Acknowledgements

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METROPOLITAN AREA PLANNING COUNCIL

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Executive Summary

The purpose of this project was to reduce municipal energy consumption and costs through the purchase and installation of light-emitting diode (LED) roadway and outdoor area lighting in cities and towns across the Commonwealth. Over the past year MAPC coordinated municipal demand and created group purchasing opportunities for LED replacements in outdoor lighting applications. In 2013, MAPC organized two group procurements for LED streetlight services by drafting and issuing an RFP and an RFQ for Streetlight Energy Management Services (EMS) pursuant to MGL Ch. 25A §11 on behalf of seven municipalities:

**EMS 1 (RFP)**
- Arlington
- Natick
- Woburn
- Chelsea

**EMS 2 (RFQ)**
- Somerville
- Sharon
- Winchester

Together, these seven communities are replacing approximately 15,000 streetlights with LEDs. These projects are expected to save approximately 4.3 million pounds or 1,969 tons of carbon dioxide equivalent emissions annually. The communities in the first procurement are currently installing LED fixtures, and the communities in the second procurement are currently contracting with the selected vendor to start the audit process.

In addition to the regional procurements, MAPC continued to provide educational and networking opportunities for municipalities through informational forums and MAPC’s Clean Energy Toolkit. Lastly, MAPC worked closely with lighting and government stakeholders to address a significant barrier to LED streetlight projects - the lack of a National Grid tariff for LED lighting.
Regional Procurements of Streetlight Energy Management Services

MAPC completed two group procurements for LED Streetlight Retrofit Energy Management Services in 2013. These two procurements included Arlington, Natick, Woburn, Chelsea, Somerville, Winchester, and Sharon. Together, the seven communities are replacing approximately 15,000 streetlights with LEDs. These projects are expected to save approximately 4.3 million pounds of carbon dioxide equivalent emissions annually. The communities in the first procurement are currently installing LED fixtures, and the communities in the second procurement are currently contracting with the selected vendor to start the audit process.

<table>
<thead>
<tr>
<th>Municipality</th>
<th>Lights Retrofitted</th>
<th>Current Energy Use (kWh)</th>
<th>Projected Energy Savings (kWh)</th>
<th>GHG Reductions (lbs CO2e)</th>
<th>GHG Reductions (tonnes CO2e)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arlington</td>
<td>2,079</td>
<td>733,358</td>
<td>413,914</td>
<td>374,592</td>
<td>170</td>
</tr>
<tr>
<td>Chelsea</td>
<td>1,622</td>
<td>970,834</td>
<td>598,706</td>
<td>541,829</td>
<td>246</td>
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<tr>
<td>Natick</td>
<td>2,364</td>
<td>897,813</td>
<td>536,189</td>
<td>485,251</td>
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</tr>
<tr>
<td>Woburn</td>
<td>1,231</td>
<td>840,071</td>
<td>567,454</td>
<td>513,546</td>
<td>233</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>14,904</strong></td>
<td><strong>8,602,038</strong></td>
<td><strong>4,796,475</strong></td>
<td><strong>4,340,810</strong></td>
<td><strong>1,969</strong></td>
</tr>
</tbody>
</table>

Table 1: Projected energy savings and GHG reductions from MAPC’s LED streetlight procurements.

For both procurements, MAPC worked with the communities to draft and issue the procurement documents for Streetlight Energy Management Services pursuant to MGL Ch. 25A §11. These were comprehensive solicitations that required respondents to demonstrate experience with identifying, planning, designing, financing, installing, owning, operating and maintaining streetlight conversions (with the intent of installing LED technology). As part of the administration of the two procurements, MAPC organized the selection processes, supported the selection committees, and provided sample contract language and documents to help the process run smoother and more efficiently. Given the success of these procurements and the level of interest expressed by other communities, MAPC plans to continue to do these types of LED streetlight projects in 2014.
LED Project Support and Education

In 2013, MAPC developed a range of educational materials to support LED streetlight retrofits.

“Energy Efficiency in Gateway Cities: A Focus on Streetlights”

June 11, 2013

In an effort to support LED streetlight projects throughout Massachusetts, MAPC partnered with the Department of Energy Resources (DOER) and the Department of Housing and Community Development (DHCD) to help Gateway Cities pursue LED streetlight projects. As part of this effort, MAPC helped organize a meeting in Westborough that brought together municipal representatives from across the state, as well as state officials, and utility representatives to discuss LED streetlight retrofits and discover opportunities to team with other communities on potential projects. See Appendix 1 for the meeting agenda.

As a result of the interest generated from this meeting, MAPC submitted an application this fall for a Community Innovation Challenge to complete LED retrofit projects in 7 Gateway Cities: Brockton, Fall River, Lawrence, Lowell, Malden, Westfield, and Chicopee. These cities are in a unique position to work together as they face similar hurdles to long-term investment. If the project is proceeds, the communities will see a combined reduction in electricity costs by $1.7 million annually, freeing up much needed capital for reinvestment in each community. If funded, this project will replace approximately 32,000 lights. These replacements have a projected savings of 15.9 million kWh and 6,111 tons of carbon dioxide equivalent emissions annually.

Clean Energy Toolkit

To increase access to information on LED technologies and the streetlight retrofit process, MAPC consolidated our LED streetlight educational materials into several easy-to-use guides on our web-based Clean Energy Toolkit, www.mapc.org/clean-energy. These guides include:

- Buy Back Streetlights from Utility (Appendix 2)
- Retrofit Streetlights with LEDs (Appendix 3)

Streetlight Buyback

MAPC continues to advise municipalities on issues that directly impact LED retrofit projects. For example, MAPC is currently helping several communities, including Hamilton, Wenham, Gloucester, and Medford, navigate the sometimes complicated process of buying back streetlights from the electric utility. This is the first step to LED streetlight retrofits and will lead to a significant reduction of greenhouse gas emissions within just a few years after retrofits are completed.
Statewide Contract FAC76

MAPC is seeing direct impacts from our work with the Massachusetts Operational Services Division (OSD), which resulted in the listing of LED lighting products on the statewide contract FAC76. This past year, several communities purchased LED fixtures off of this contract, including the Town of Amherst, which purchased approximately 850 LED fixtures in May 2013.
National Grid LED Tariff

One of the biggest challenges to LED streetlight projects in Massachusetts this past year was the lack of a LED tariff available to National Grid electric customers. Without this tariff, communities could not realize the cost savings associated with LED retrofits. To address this barrier, MAPC and 10 municipalities sent a letter to National Grid in March 2013 that requested that such a tariff be established for unmetered streetlights. See Appendix 4 for a copy of the letter. In response to this request, National Grid approved a new tariff in June that allows communities that retrofit their streetlights to LEDs to receive a reduced rate for the more efficient fixtures. The National Grid “Street and Area Lighting – Customer Owned Equipment S-5 Retail Delivery Service” tariff applies to any municipality that owns their street lights in National Grid’s jurisdiction.

With the National Grid LED tariff in place, MAPC is now working to help National Grid communities retrofit their streetlights with LED technology. However, while these communities are eager to complete LED retrofit projects, there remain uncertainties regarding the S-5 tariff that have prohibited the communities from being able to move forward with LED projects to date. This uncertainty is related to how the utility is administering their Lighting Service Fee and their requirement to install fusible links on all newly installed lights. MAPC is currently working with DOER and National Grid to resolve this uncertainty so that cities and towns within the National Grid territory can proceed with retrofit projects.
Appendix 1- “Energy Efficiency in Gateway Cities” Meeting Agenda

ENERGY EFFICIENCY IN GATEWAY CITIES
A FOCUS ON STREETLIGHTS

June 11, 2013 – 10:00 AM - 1:30 PM
Massachusetts Technology Collaborative (MTC)
75 North Drive, Westborough, MA 01581

Organized by: DHCD, Department of Energy Resources (DOER), and the Metropolitan Area Planning Council (MAPC)

AGENDA

10:00 - 10:10 Welcome & Opening Remarks
Arthur Jemison, Undersecretary, DHCD

10:10 - 10:45 Presentations on Conversion of Streetlights to LED
Kevin Galligan, Cape Light Compact
Joe Fott, City of Chelsea

10:45 - 11:00 Q&A with presenters

11:00 - 11:15 Break and transition to break-out sessions

11:15 - 12:00 Break-out sessions:

Group A: Gateway Cities with municipally-owned streetlights in NStar/National Grid/WMECO/Utility/CLC territories

Group B: Gateway Cities with municipally-leased streetlights

Group C: Gateway Cities with Municipal Light Plants for electric service

12:00 - 1:00 Report outs from Break-out sessions and Take-aways from the meeting

Light lunch will be served. Utility company representatives invited for informal discussion of energy efficiency issues and initiatives in Gateway Cities, to inform C&I Program improvements for municipalities, to be advanced per the 2013-2015 statewide Energy Efficiency Plan.
Appendix 2 – “Buy Back Streetlights from Utility” Clean Energy Toolkit
Buy Back Streetlights from Utility

In order to save energy by retrofitting streetlights with LEDs, municipalities must first own the streetlights. M.G.L. Chapter 164 Section 34A allows municipalities to purchase streetlights from their utility. It was adopted as part of the 1997 Restructuring Act.

Municipalities that purchase streetlights in order to complete an LED retrofit can see savings up to 70-80% (See the Retrofit Streetlights with LEDs strategy for more information). However, 30-60% of streetlighting costs can be saved just by purchasing streetlights from utilities. This strategy describes the process for a municipality to buy back streetlights from its utility.

Streetlight Tariffs

Streetlights (e.g., cobraheads) are not individually metered for energy consumption. Instead, they are billed based on a predetermined formula for energy consumption called a tariff for each type of fixture. The basic rate tariff is the S-1 rate, which applies to lights owned and maintained by the utility. The S-1 rate includes maintenance costs. When a municipality purchases its streetlights, it switches to a rate that does not include maintenance costs. This is where the savings associated with streetlight buyback are achieved. Tariffs will vary based on the utility.

- **For National Grid customers** – A municipality that purchases its lights under M.G.L. Chapter 164, Section 34A pays the S-5 rate, which is based on the cost of electricity delivery. National Grid has a range of other rate tariffs for streetlights, as well.

- **For NSTAR customers** – A municipality that purchases its lights pays the S-2 rate. Because the Massachusetts NSTAR territory was historically served by two separate electric companies (Commonwealth Electric and Boston Edison Company) before they were acquired by NSTAR, the rate tariffs for customers served by NSTAR can vary from town to town, as can the calculation for the purchase price of streetlights. More detailed information can be found on the NSTAR website.

Implementation Steps

The whole process of buying back streetlights can take between 90 days to 2 years, with an average of about 6 months. The law mandates 60 days to reach an agreement, and then the
Department of Public Utilities (DPU) has 60 days to make a ruling if a case reaches them (although sometimes cases take years). It is best to incur as little expense as possible before making a decision to move forward and then move quickly once that decision is made.

1. **Ask utility for a preliminary cost estimate.**

   Be clear that this is not a formal notification of intent to purchase, but simply a request for an estimate. Based on the law, once the municipality indicates that it wants to buy streetlights, it has 60 days to settle on a price. The purchase price is set on the date of notice, so the municipality will lose any depreciation that occurs if a long time is spent in deliberation after the utility is formally notified.

   - **Calculating purchase price** – The purchase price for streetlights is calculated based on the system’s net book value, which is the unamortized (e.g., depreciated) value of the streetlights minus any salvage value the utility can obtain. The depreciated value of the streetlights is calculated at the time the municipality tells its utility it wants to purchase its streetlights. Any depreciation that occurs after the day of notification will not be included in the calculation of purchase price. Standard depreciation rates are set for utilities by the DPU. NSTAR recently ramped up its depreciation rate to 13%, meaning its streetlight assets are quickly losing value.

   - **Response to utility’s purchase price** – Municipalities have the option of taking a case to the DPU if they don’t agree with the price proposed or if the utility takes more than 60 days to respond. However, these cases can sometimes take years to resolve, during which the opportunity costs of lost energy and maintenance cost savings accrue. These lost opportunity costs generally will be far greater than any savings that might be achieved by fighting over the purchase price.

2. **Calculate the basic economics of the project and decide how to proceed.**

   At this point, it may be helpful to hire a consultant or owner’s agent to facilitate the process. Based on the estimate provided, determine whether the municipality will buy all streetlights or just a subset. For example, a municipality might choose to purchase only the overhead lights, leaving any lights with underground wires for the utility to maintain. Or a municipality might choose to just purchase the lights in a certain neighborhood.

   Build a contingency amount into the project to cover the cost of repairs. When pitching to internal decision makers, be modest about the amount of potential savings the project might realize—at the end of the day, it doesn’t hurt to have excess savings, but it’s better to sell the project on its most modest projections. If an LED retrofit is planned, make sure there is a commitment to using the maintenance cost savings to pay for the purchase of LEDs. It may be possible to bid out the entire project, from acquisition to installation of the LEDs, as a performance contract through Chapter 25A, pending guidance from DOER. (For more
information on performance contracting and Chapter 25A see the Use a Performance Contract for Municipal Efficiency Projects and Procure Energy Services strategies.)

3. Notify utility of decision to purchase.
Once a municipality formally indicates to the utility that it wants to buy streetlights, this triggers a 60-day window in which the utility must submit a definite purchase price and inventory. The purchase price is set on the date of notice, so a long deliberation after the formal notification will cost the municipality depreciation.

4. Review purchase price and inventory provided by the utility.
The price sheet will include price by fixture and pole type, wattages, and quantities, and it will differentiate between overhead and underground lights. To ensure accuracy, compare the utility inventory with an inventory completed by the municipality. There are two main types of audits:

- **Basic wattage check** – This is a walk-by audit to check if poles and fixtures exist, count, and confirm their wattage. In general, a 10% audit will be sufficient to determine whether there are any major issues with the inventory provided by the utility.

- **GIS survey** – The most accurate inventory is a submeter-level GIS survey. It is also the most labor-intensive and expensive.

If lights are discovered that were not included in the inventory, the utility can bill the municipality for unpaid back charges. On the other hand, if it is discovered that the utility is billing the municipality for lights that don’t exist, it is entitled to ask for a refund. If the utility believes an error was made in the municipality’s inventory, it can have a separate, comprehensive audit completed at the municipality’s expense.

5. Decide how to finance the purchase.
Options include:

- **Tax-exempt municipal lease financing** – This is the recommended method for paying for these projects up front, as it doesn’t affect municipal bond rating or debt levy.

- **Performance contract under Chapter 25A** – With this method, guaranteed energy savings from a retrofit can be dedicated to debt service each year.

- **Bonds** – General obligation bonds and Qualified Energy Conservation Bonds (QECBs) are appropriate for projects with substantial up-front costs.

- **Operating expenses** – If other energy projects have already been set up in the municipality and are generating savings, a case can be made to appropriate those savings for further energy efficiency improvements.

3 | Last updated September 11, 2013. For the most up-to-date information and additional resources, visit [http://www.mapc.org/clean-energy](http://www.mapc.org/clean-energy).
• **Capital projects** – An LED streetlight retrofit can be undertaken as a separate capital project, with a line item in the municipality’s budget.

• **Utility incentives** – Incentives will vary based on the utility. NSTAR provides an incentive for LED streetlight retrofits of up to $0.25 per kWh saved.

• **Grants** – Green Communities funds can potentially be used to cover the costs of acquisition, if acquisition costs are included as part of an overall funding request for LED streetlight retrofits. However, round 1 Green Communities funds can’t be used to pay for streetlight retrofits. A municipality will have to wait for its next round of competitive grant awards to apply for any funding related to streetlight retrofits. (For more information, see the [Receive Green Communities Designation](#) strategy.)

6. **Competitively procure a maintenance contract.**

Once a municipality purchases their streetlights, it is on the hook for maintenance. The majority of communities opt to competitively bid out maintenance services to an outside contractor, although a few have chosen to do the work in-house. According to [M.G.L. Chapter 141 Section 7](#), streetlight replacement does not require the supervision of a licensed contractor; only a bucket truck license is needed. The cost of maintenance typically runs $1.00-$1.20 per fixture per month.

### In-House Maintenance – Newton, Maynard, and Lexington

While most municipalities contract out for maintenance of municipally owned streetlights, multiple options are available for in-house maintenance. Newton contracted with the Wellesley Municipal Light Department for maintenance services for a time. Maynard used the savings they achieved from purchasing their streetlights to buy a bucket truck that could be used for maintaining the lights. Lexington replaces bulbs and photocells in-house, but brings in a contractor for anything that might expose staff to live wires.

• **Labor laws** – Always be clear on what types of labor need to be compensated at prevailing wage in a solicitation for a maintenance contract.

• **Storm repair** – Generally, maintenance contracts include a five-day turnaround clause for storm repair. In extreme cases when the pole is damaged as well as the fixture, the utility company will need to repair the pole before the contractor can repair the fixture.

• **Approximate failure rates** – Typically, failure rates systemwide for NSTAR are 18-19%. In coastal communities, anticipated failure rates can come closer to 25%. Coastal communities should always make sure any streetlights they install have demonstrated resiliency to humidity and salt.

• **Warranties** – If the municipality chooses an outside contractor, determine what level of risk is it is comfortable with. If the maintenance company holds 100% of the risk, the

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Last updated September 11, 2013. For the most up-to-date information and additional resources, visit [http://www.mapc.org/clean-energy](http://www.mapc.org/clean-energy).
municipality will pay a higher monthly cost. If the municipality assumes some of the risk, then there will be lower costs in years when fewer incidents occur.

**Case Study – City of Somerville**

Somerville purchased 100% of their streetlights after a long (two-year) deliberation process. This meant that by the time they made the decision to purchase, the system had completely depreciated; however, they also lost out on cost and energy savings during this time.

- **Audit** - Staff completed a preliminary audit with support from consultant George Woodbury. They audited 10% of lights by doing a walkby to compare against NSTAR’s records, making sure fixtures were where they were supposed to be and were the correct wattage.

- **Purchase price** – Somerville received a purchase price from NSTAR, but it had concerns about purchasing the system as-is, as there were a number of deferred repairs that NSTAR hadn’t yet addressed. The 311 “report an outage” line in Somerville meant the city had good records on the condition of the system. For some time, the city tried to convince utility representatives to make repairs before it purchased the assets. However, NSTAR was reluctant to fix lights with expensive underground repairs when they were about to sell the system.

- **Maintenance** - In the end, Somerville decided to go forward with streetlight buybacks. They built in a contingency to the project such that they would be able to address the backlog of repairs on their own. They competitively bid out a maintenance contract, which RepublicITS won. They were able to negotiate an arrangement by which residents could still call the 311 line to report outages.

**References**

- “Municipal Street Lighting Service.” Massachusetts General Laws, Chapter 164, Section 34A. https://malegislature.gov/Laws/GeneralLaws/PartI/TitleXXII/Chapter164/Section34A
Appendix 3 – “Retrofit Streetlights with LEDs”
Clean Energy Toolkit
Retrofit Streetlights with LEDs

Street lighting constitutes a significant portion of municipal energy consumption and expenditures. By buying back streetlights from their utility provider, converting to energy-efficient fixtures, and procuring products and services in bulk, municipalities can achieve energy and financial savings. For many municipalities considering upgrades to their street lighting system, LEDs have become a viable option. In addition to its environmental and economic benefits, undergoing a system-wide conversion can provide an opportunity for a municipality to standardize certain fixture types and styles, which can help create a unified aesthetic appearance or signature statement for a community. The benefits of LED lighting include:

- Decreased energy consumption and costs
- Reduced maintenance costs due to longer life
- Visible commitment to efficiency
- Improved safety through enhanced visibility
- Decreased light trespass and pollution
- Instant-on
- Opportunity for programmable controls
- No mercury, lead, or other known disposable hazards

This guide outlines the planning process for a conversion to exterior LED lighting systems, describes options for implementing projects, and summarizes available resources for cities and towns. It includes the following sections:

- Developing a Scope of Work
- Street Lighting Design and Fixture Selection
- Project Implementation, Procurement, and Financing
- Glossary of Lighting Terminology and Common Fixture Types
- Additional Resources
Developing a Scope of Work

There are a variety of ways in which a municipality can convert its street lighting system to LEDs, and the most appropriate will vary based on the municipality's individual scope of work. The following is a general guideline for approaching the process.

1. **Conduct preliminary research and build the business case for retrofits.**

   In order to build the case for implementing an LED streetlight retrofit project to both residents and municipal officials, research into the following areas is helpful. The Massachusetts Department of Energy Resources, vendors on the state contract, and the Illuminating Engineering Society (IES) can aid such research.

   - **Lighting terminology and technology** – Refer to the [Glossary](#) later in this guide for an overview of lighting terminology and technology.

   - **Streetlight ownership status and inventory** – Figure out what streetlights the municipality owns and if there are plans to purchase streetlights from the utility. (See the [Buy Back Streetlights from Utility](#) strategy for more information on how to buy back lights.)

   - **Metered, decorative, or outdoor area lights inventory** – Figure out if the municipality has any decorative/metered lights and whether it wants to replace them.

   - **Case studies** – Interview other municipalities that have already completed LED streetlight retrofits to obtain anecdotal information on the potential for savings. Case studies and fact sheets are also available from the [Municipal Solid-State Street Lighting Consortium](#).

   - **Maintenance costs** – While there are up-front costs associated with fixture replacement and installation, keep in mind that maintenance costs are generally reduced due to LED bulbs’ longer life span.

   - **Procurement pathways** – Decide whether the municipality will purchase the fixtures or procure design, installation, and maintenance services. Identify in-house capacity for these various components and proceed accordingly with the required procurement processes.

   - **Utility incentives** – NSTAR and National Grid are offer lighting retrofit incentives via the Mass Save program. Contact your utility lighting program coordinator to learn more.

   - **Tariff changes** – Both NSTAR and National Grid have developed tariffs specifically for LED lights. Be mindful of what rate any new LED streetlights would be on to ensure that any potential cost savings are accurately depicted.

   - **Calculating savings for different lights** – There are currently viable LED replacements for a wide variety of lights in addition to traditional cobrahead streetlights, including decorative pole lights, parking lot lights, flood lights, and wallpacks. The process for
receiving utility incentives and recouping energy cost savings is different for streetlights and these other lighting types due to the fact that streetlights are billed for electricity based on a tariff calculation and the other lighting types are billed based on actual metered consumption.

- **Streetlights** – Streetlights (e.g., cobraheads) are not individually metered for energy consumption. Instead, they are billed based on a predetermined formula for energy consumption called a tariff. Utility incentives for replacements of these types of fixtures are calculated based on estimated kWh savings and are currently determined on a case-by-case basis. Municipal utility tariffs and incentives will vary based on the utility. NSTAR is able to calculate a change in power consumption by comparing the existing fixture with the proposed replacement. National Grid has a tariff for LED technologies that approximates reductions in energy consumption using 50-watt brackets.

- **Metered lights** – Individually metered lights, such as decorative post-to fixtures, parking lot lights, flood lights, and walllighters are not subject to tariff issues. Municipalities can replace these immediately, and this may be the preferred course of action to become familiar with LED lights. The incentives for these fixtures are prescriptive (i.e., predetermined based on the fixture), but fixtures must have an Energy Star rating and/or be on the Design Lighting Consortium list of qualified products.

2. **Hold kick-off meeting and form project team.**

Completing an LED street lighting retrofit project will require support from multiple departments, and a well-balanced project team can be helpful to cultivate and maintain buy-in throughout the course of the project. Once a municipality has identified an interest in pursuing LED streetlight retrofits, it should hold a kick-off meeting to discuss the potential project scope with key stakeholders. These can include staff from the following departments, who should be invited to discuss their role in any potential project and to address any questions and concerns upfront:

- **Public Works** will need to be involved in providing information on existing street lighting infrastructure (condition/age, fixture type, maintenance requirements), as well as overseeing actual project construction.

- **Engineering** will need to be involved in assessing the feasibility of proposed retrofits.

- **Planning/Community Development** will need to be involved in classifying streets/neighborhoods, identifying desired/appropriate lighting levels, and collecting public input on pilot programs.

- **Administration/Finance** will need to be involved in securing funding/financing for projects and approving final budgets and contracts.
• **General Counsel** will also need to approve contracts and should be engaged early on, particularly if they are unfamiliar with the procurement and contracting methods chosen (e.g., contracting for energy management services pursuant to M.G.L. 25A requirements).

• **Procurement** will need to be involved in identifying the appropriate procurement pathway for materials and labor, and putting projects out to bid.

• **Energy Committee and/or Staff**, if applicable, can be tasked with coordinating project team, summarizing research, and filling in staffing gaps as needed.

• **Public Safety** representatives may want to be engaged in this, conversation as well.

Key decision points to be discussed with the project team and at the kick-off meeting include:

• Will there be a pilot program? At what stage in the project? How will the information be used?

• Will the energy committee interview vendors on the state contract and bring back a report to present to the city council/board of selectmen?

• Who will decide the best procurement pathway?

• Will a lighting consultant be hired?

• Is funding available or is there support for a financing option?

• Will fixtures and labor be procured separately? What about design work?

• Should decorative/metered lights be included?

• Is there an interest in having controls or renewable energy backups?

3. **Prepare project scope and budget.**

   The specific parameters of the project will determine the funding needed.

   • Establish whether the entire lighting system is being retrofitted or just a small section, based on availability of funds.

   • Develop desired performance specifications for all of the streetlights that retrofits are planned for, based on the street lighting energy audit and/or improvement guidelines.

   • Ensure that the LED lights being considered have an adequate warranty that covers the product for a sufficient period of time (e.g., 10 years). Good warranties span a significant portion of the lifetime of the lights and will cover not just the LED components but the driver and photocell, as well.

   • Decide on the controls for the LED technologies. The types of controls (basic photocells, motion sensors, dimmers, advanced panels) depend on the amount of flexibility desired for the different types of LED light uses. For example, a combination of motion sensors and dimmers could be implemented in parking garages, while solar-powered cells could be useful in emergency situations and grid outages.
• With a complete specifications list in place, identify which procurement mechanism is most appropriate. Refer to the Project Implementation, Procurement, and Financing section of this document for more information.

Street Lighting Design and Fixture Selection

This section of the guide was developed thanks to Paul Lutkevich, Vice President, Technical Director, Parsons Brinckerhoff.

The following are important factors to consider in choosing fixtures for an LED street lighting conversion.

Fixture

• **Equivalency** – When considering replacement fixtures for a street lighting system the aim is often finding “equivalent” fixtures to the existing ones that consume less power. This approach is relatively simple but assumes that the existing fixtures provide appropriate light levels. It also relies on judgments of equivalencies made by simply using source wattages and not required photometric performance. When evaluating proper replacement fixtures, some typical streets should be evaluated by comparing the LED fixtures under consideration with current lighting recommendations. This comparison can simply be done by performing lighting calculations for these streets showing expected results. These calculations can be performed by a lighting engineer or often can be provided by the lighting fixture manufacturer of the chosen product.

• **Expected life and performance** – LED fixtures are very different from currently used lamp technologies. The key in achieving system performance and expected life from LED fixtures is heat management. Heat is managed by the fixture design as well as the rating of the LEDs used and the current at which they are operated. For example, an LED that is operated at a higher drive current and having a higher output will lead to a less-efficient and shorter-lived LED and driver. When evaluating LED fixtures, refer to the following test reports:
  - **LM-79 Electrical and Photometric Measurements of Solid-State Lighting Products** – This report gives the photometric performance of the fixture under consideration.
  - **LM-80 Measuring Lumen Maintenance of LED Light Sources** – This report gives the expected life of the LEDs based on the lumen depreciation of the source.

• **Color** – Various products use LEDs that produce various shades of “white” light. The color is a function of the phosphor coating used on the LEDs. The color is defined in terms of correlated color temperature (CCT). Street lighting fixtures are typically in the range of 4,000K and 5,700K. To an observer, the high CCT sources will appear “cooler” with more blue content to the source, while the lower CCT sources will have a “warmer” appearance with more “red” content. Color preference is subjective, and many users decide on sources with a CCT of between 4,000K and 5,000K.
• **Construction** – Material and construction is indicative of the expected life of the fixture. Reviewing available test reports for the fixture can offer an idea of the quality of construction. Tests which should be available for review include salt spray or salt fog testing, vibration testing, and the IP testing report, which rates the Ingress Protection of the fixture against solids and liquids. An IP designation typically uses two digits to identify the amount of protection a fixture has, with higher numbers noting greater protection. Roadway fixtures are typically rated an IP65 (with the 6 meaning totally protected against dust and the 5 meaning that it is protected against low pressure jets of water from all directions – limited ingress). Many fixture are also rated IP66, showing increased protection against liquid ingress and should be considered. Surge suppression is an important option for solid-state devices like LEDs, and many fixtures can provide surge suppression of up to 10 kV. The fixture warranty can also give some indication of the construction. Most LED streetlights are available with at least a five-year warranty, with some offering a ten-year warranty. The terms of the warranty are important to review, as some include labor, other just parts, as well as other coverage limitations.

• **Optical Control** – Optical control is an important factor to consider, particularly relating to lighting trespass, sky glow, and glare. Lighting calculations will quantify these impacts for the fixture under consideration. Another means is the BUG rating system developed by the IES. This system classifies the amount of Backlight, Uplight, and Glare they produce. The higher the BUG rating, the more of each of these items they produce. The correct BUG rating for an installation depends on many factors. Typically, ratings of B2-U1-G2 have been found to be acceptable.

• **Style and Finish** – LED fixtures come in various styles, ranging from contemporary to utilitarian to period reproduction styles. Before selecting a style, evaluate higher-volume streets like a downtown area and decide whether a unifying style or color may assist in creating an image or place within the community. The investment in a lighting retrofit can provide benefits beyond energy and maintenance savings and should be considered as part of the community planning and development process.

**Area to be Illuminated**

The lighting criteria used for street lighting is a compilation of standards and research from IES, the Federal Highway Administration (FHWA), the Transportation Association of Canada (TAC), the International Commission on Illumination (CIE), and the British Institute of Lighting Engineers (ILE). Specific documents include:

- IES TM-11 Light Trespass: Research, Results and Recommendations
Street lighting design is typically based on luminance-based design criteria for the roadway and horizontal and vertical illuminance criteria for the adjacent sidewalk area. Veiling luminance criteria are also included to limit the amount of disability glare generated by the lighting system.

The following definitions are excerpted from IES RP-8 Standard Practice for Roadway Lighting.

**Roadways**

- **Major** – That part of the roadway system that serves as the principal network for through-traffic flow. The routes connect areas of principal traffic generation and important rural roadways leaving the city. These routes are often known as arterials,” “thoroughfares,” or “preferentials.” They are sometimes subdivided into primary and secondary; however, such distinctions are not necessary in roadway lighting.

- **Collector** – Roadways servicing traffic between major and local streets. These are streets used mainly for traffic movements within residential, commercial, and industrial areas. They do not handle long, through trips. Collector streets may be used for truck or bus movements and give direct service to abutting properties.

- **Local** – Local streets are used primarily...
for direct access to residential, commercial, industrial, or other abutting property. They make up a large percentage of the total street system, but carry a small proportion of vehicular traffic.

- **Pedestrian areas**
  - **High** – Areas with significant numbers of pedestrians expected to be on the sidewalks or crossing the streets during darkness. Examples are downtown retail areas and near theaters, concert halls, stadiums, and transit terminals. (Over 100 pedestrians per hour in a typical block on both sides of the street)
  - **Medium** – Areas where lesser numbers of pedestrians utilize the streets at night. Typical are downtown office areas, blocks with libraries, apartments, neighborhood shopping, industrial, older city areas, and streets with transit lines. (11 to 100 pedestrians per hour in a typical block on both sides of the street)
  - **Low** – Areas with very low volumes of night pedestrian usage. These can occur in any of the cited roadway classifications but may be typified by suburban single family streets, very low density residential developments, and rural or semi-rural areas. (10 or fewer pedestrians per hour in a typical block on both sides of the street)

The recommended lighting levels for street lighting are:

<table>
<thead>
<tr>
<th>Road and Area Classification</th>
<th>Road</th>
<th>Pedestrian</th>
<th>Avg. Lumin. (cd/m²)</th>
<th>Max Uniform. Ratio</th>
<th>Max Uniform. Ratio</th>
<th>Max Veiling Lumin. Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Lₐvg</td>
<td>Lₐvg/Lₘₐₚ</td>
<td>Lₘₐₓ/Lₘₐₚ</td>
<td>Lᵥₘₜₙₓ/Lₐᵥₜ₉</td>
</tr>
<tr>
<td>Major</td>
<td></td>
<td>High</td>
<td>1.2</td>
<td>3.0</td>
<td>5.0</td>
<td>0.3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Medium</td>
<td>0.9</td>
<td>3.0</td>
<td>5.0</td>
<td>0.3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Low</td>
<td>0.6</td>
<td>3.5</td>
<td>6.0</td>
<td>0.3</td>
</tr>
<tr>
<td>Collector</td>
<td></td>
<td>High</td>
<td>0.8</td>
<td>3.0</td>
<td>5.0</td>
<td>0.4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Medium</td>
<td>0.6</td>
<td>3.5</td>
<td>6.0</td>
<td>0.4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Low</td>
<td>0.4</td>
<td>4.0</td>
<td>8.0</td>
<td>0.4</td>
</tr>
<tr>
<td>Local</td>
<td></td>
<td>High</td>
<td>0.6</td>
<td>6.0</td>
<td>10.0</td>
<td>0.4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Medium</td>
<td>0.5</td>
<td>6.0</td>
<td>10.0</td>
<td>0.4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Low</td>
<td>0.3</td>
<td>6.0</td>
<td>10.0</td>
<td>0.4</td>
</tr>
</tbody>
</table>

- **Pedestrian areas and bikeways** – When the roadway includes a bikeway or a sidewalk, additional lighting recommendations are given by the IES to allow for reliable detection of pedestrians and cyclists by a motorist, as well as allowing facial recognition and a sense of
security for the pedestrian. These areas are described by the total expected pedestrian volumes.

- **High pedestrian conflict area** – High pedestrian conflict areas are going to be those with mixed commercial and residential use. Typical streets that would fall into this classification would be main streets through a city or town center where there is fairly dense development. A typical city or town would have very few areas of high pedestrian use.

The recommended values for high pedestrian conflict areas are:

<table>
<thead>
<tr>
<th>Maintained Illuminance Values for Walkways</th>
</tr>
</thead>
<tbody>
<tr>
<td>E_H</td>
</tr>
<tr>
<td>------</td>
</tr>
<tr>
<td>Mixed Vehicle and Pedestrian</td>
</tr>
<tr>
<td>Pedestrian Only</td>
</tr>
</tbody>
</table>

* Horizontal only

E_H - average horizontal illuminance at pavement
E_Vmin - minimum vertical illuminance at 1.5m above pavement

- **Medium pedestrian conflict areas** – Intermediate areas have moderate night pedestrian activities. These areas may typically be those near community facilities such as libraries and recreation centers. Safety for the pedestrians and providing guidance to primary travel ways, are key elements in the design of a lighting system in these areas. These values do not consider areas with increased crime and vandalism.

The recommended values for medium pedestrian conflict areas are:

<table>
<thead>
<tr>
<th>Maintained Illuminance Values for Walkways</th>
</tr>
</thead>
<tbody>
<tr>
<td>E_H</td>
</tr>
<tr>
<td>------</td>
</tr>
<tr>
<td>Pedestrian Areas</td>
</tr>
</tbody>
</table>

* Horizontal only
- **Low pedestrian conflict areas** – The lighting system in residential areas may allow both driver and pedestrian to visually orient in the environment, detect obstacles, identify other pedestrians, read street signs, and recognize landmarks. Table 7 includes recommended illuminance values. These values do not consider areas with increased crime and vandalism.

The recommended values for low pedestrian conflict areas are:

<table>
<thead>
<tr>
<th>Maintained Illuminance Values for Walkways</th>
<th>( E_H ) (lux/( fc ))</th>
<th>( E_{V_{\text{min}}} ) (lux/( fc ))</th>
<th>( \frac{E_{\text{avg}}}{E_{\text{min}}}^* )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Density Residential</td>
<td>3.0/0.3</td>
<td>0.8/0.08</td>
<td>6.0</td>
</tr>
<tr>
<td>Medium Density Residential</td>
<td>4.0/0.4</td>
<td>1.0/0.1</td>
<td>4.0</td>
</tr>
</tbody>
</table>

*Horizontal only

- **Crosswalks** – An extensive study was conducted by the FHWA and VTTI concerning the lighting of crosswalks. The information is based on static and dynamic experiments performed at the Virginia Tech Transportation Institute and documented in FHWA-HRT-08-052, available at NTIS under publication number PB2008-106431. The finding and recommendations of the study are:
  - A vertical illuminance level of 20 lx measured at 1.5 m (5 ft) from the road surface allowed drivers to detect pedestrians in midblock crosswalks at adequate distances under rural conditions.
  - A higher level of vertical illuminance may be required for crosswalks when there is a possibility of continuous glare from opposing vehicles, the crosswalk is located in an area with high ambient light levels, or the crosswalk is located at a lighted intersection.
  - The fixture selected will influence the best mounting location and height with respect to the crosswalk.
  - The vertical illuminance level that allowed drivers to detect pedestrians at adequate distances was the same for HPS and MH sources; however, MH or other white light sources may provide better facial recognition and comfort for pedestrians.
For lighting of crosswalks, poles should be placed on the approach side of mid-block crosswalks and crosswalks located at intersections. The lighting level in the crosswalk should be equivalent to 20 lux vertical. This can generally be accomplished by placing the pole 0.7 x mounting heights before the crosswalk (e.g., for a 30’ pole the placement should be 0.7 x 30 = 21’ before the center of the crosswalk).

- **Intersections** – Intersections should be illuminated to the sum of the intersecting streets. The area within the intersection that is required to meet these elevated levels is defined by the area in the center of the intersection to the location of the stop bars at each intersecting street.

The recommended values for intersections are:

<table>
<thead>
<tr>
<th>Functional Classification</th>
<th>Average Maintained Illumination at Pavement by Pedestrian Area Classification in Lux/fc</th>
<th>$E_{\text{avg}}/E_{\text{min}}$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>High</td>
<td>Medium</td>
</tr>
<tr>
<td>Major/Major</td>
<td>34.0/3.4</td>
<td>26.0/2.6</td>
</tr>
<tr>
<td>Major/Collector</td>
<td>29.0/2.9</td>
<td>22.0/2.2</td>
</tr>
<tr>
<td>Major/Local</td>
<td>26.0/2.6</td>
<td>20.0/2.0</td>
</tr>
<tr>
<td>Collector/Collector</td>
<td>24.0/2.4</td>
<td>18.0/1.8</td>
</tr>
<tr>
<td>Collector/Local</td>
<td>21.0/2.1</td>
<td>16.0/1.6</td>
</tr>
<tr>
<td>Local/Local</td>
<td>18.0/1.8</td>
<td>14.0/1.4</td>
</tr>
</tbody>
</table>
**Project Implementation, Procurement, and Financing**

After establishing a clear project scope, cost, and timeline, the implementation phase can begin in earnest. It is helpful to maintain a checklist of tasks, responsibilities, and milestones to ensure that all aspects of the project are progressing as required. Some important components to consider are:

- Design/audit work
- LED fixtures: types, purchase costs
- Installation labor
- Maintenance and performance verification
- Submission for utility for incentives

**Procurement Options**

Municipalities in Massachusetts can use a collective procurement model to purchase fixtures, as well as design and installation services. (See the [Procure Energy Services](http://www.mapc.org/clean-energy) strategy for more information.)

Fixtures-only purchases can be made from the statewide contract, FAC76: Maintenance, Repair and Operations (MRO) Products, Supplies and Equipment, Category 6: LED Street and Roadway Lighting.

Some purchases of lighting fixtures in this contract fall under the requirements of statutes governing building and public works construction (M.G.L. chapter 149 and chapter 30 section 39M, respectively). The following table explains how those statutes apply to the contract, based on the ordering option and project type:

<table>
<thead>
<tr>
<th>Project type</th>
<th>Order/Project Size Limit Under the Contract</th>
<th>Applicable Procurement Law for Projects Above Order/Project Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fixtures for projects using municipal staff</td>
<td>No limit</td>
<td>N/A</td>
</tr>
<tr>
<td>Fixtures for multiple projects using hired labor (installation procured separately)</td>
<td>No limit</td>
<td>N/A</td>
</tr>
<tr>
<td>Fixtures for a single project using hired labor (installation procured separately)</td>
<td>$10,000</td>
<td>M.G.L. Chapter 30 Section 39M*</td>
</tr>
<tr>
<td>Fixtures and installation procured together</td>
<td>$10,000</td>
<td>M.G.L. Chapter 149 or Chapter 30 Section 39M*</td>
</tr>
</tbody>
</table>

* Consult the Inspector General’s Office for guidance on the application of the construction statutes referenced above.
If a municipality intends to install fixtures in multiple locations, the following guidance will apply:

- If the work is going to be performed in phases and potentially by multiple installers (e.g., when installers are allowed to bid on portions of the work, even if one wins everything), municipalities may consider each phase/portion of the total scope of work to be a separate project. The contract does not impose a limit on the purchase of fixtures for multiple projects, as long as the fixtures are not required to be installed by “manufacturer certified” contractors. Municipalities may order all the fixtures at once and stock them or they may schedule separate deliveries for each project under the same purchase order.

- If the work in all the locations is going to be performed at the same time and is expected to be awarded to only one installer, it should be considered one project. The contract limits purchases of fixtures for such single projects with hired labor to $10,000.

- If the project falls under the category of “Purchase of Construction Materials without Labor,” or if design and/or installation labor will be secured in addition to the fixtures themselves, the following options are available:
  - Bid out the project separately under M.G.L. ch. 30, sec. 39M
  - Projects under $100,000 can be contracted through the utilities and their preferred vendors pursuant to M.G.L. ch. 25A, sec. 14
  - Projects over $100,000 can be competitively bid pursuant to ch. 25A sec. 11c or 11i as streetlight energy management services (EMS) solicitations that include design, audit, and installation work. MAPC can help with group procurements for EMS.

When crafting a solicitation for streetlight EMS and evaluating responses, consider some of the following questions:

- In the Management Capabilities and Project Experience categories, consider:
  - What type of experience does the respondent have working with municipal street lighting systems, particularly in the Northeast and specifically in Massachusetts?
  - How many years has the respondent been engaged in providing energy efficiency, street lighting, and performance contracting services?
  - How many full-time personnel does the respondent employ?
  - Do the respondent’s maintenance and installation employees have any accreditations or pre-qualifications? (Note: All work must be performed by personnel having the minimum qualifications of MA Licensed Electricians and Journeyman Lineman certified as IMSA Roadway Lighting Level I technicians or higher, and be paid prevailing wages.)
  - What scope of services (auditing, design, construction, monitoring, operations, maintenance, training, financing, etc.) does the respondent offer? In particular:
Does the respondent offer services to upgrade the following: street lighting, controls, underground feeds, overhead feeds, foundations, pole placement, series circuits, parallel circuits, emergency response, call center operations, and other street lighting systems?

What is the respondent’s general knowledge of latest street lighting technologies and associated life cycle costs?

What is the respondent’s general ability and approach to help with financing and secure low rates?

What is the respondent’s general ability to secure insurance policies?

Does the respondent operate a 24-hour call service with a toll-free number answered at all times by a person to receive outage reports with the capability for real-time work order dispatching for emergency calls? If so, for how long has it been in operation?

In the Experience and Project References category, consider:

- Which of the respondent’s past project experiences involve systems similar in type, size, or scope to the system described in the technical appendices, and/or in locations with similar geography or climate to municipalities in Massachusetts?
- Is the respondent able to provide lease purchase financing?
- What are the respondent’s existing street lighting maintenance contracts like?
- Does the respondent have knowledge of utility tariffs, available incentives and rebates, and application processes?
- What are the respondent’s relationships with lighting fixture, controls, and other related technology suppliers?
- What are the respondent’s staff capabilities in terms of conducting technical analysis, engineering design, construction management, construction, training, and post-contract monitoring?

In the Project Approach category, consider:

- What scope of services (auditing, design, construction, monitoring, operations, maintenance, training, financing, etc.) is the respondent proposing? What is the respondent’s approach to auditing streetlights and determining light output?
- What equipment modifications, installations, or replacements does the respondent recommend? What are the potential energy saving opportunities? Does the respondent propose any special features, renewable technologies, advanced technologies, or any additional special features or services?
- Does the respondent have facilities management and maintenance personnel to coordinate construction and avoid conflicts with other ongoing or scheduled projects?
- Will the respondent use subcontractors, and if so, in what nature?
- What is the proposed project schedule?
- What is the commissioning and utility coordination process?
- Does the respondent assume all responsibility for proper handling, storage and disposal of environmentally sensitive equipment?
- What equipment ownership model does the respondent propose? What is the respondent’s proposed service responsibility?
- What is the nature and term of typical warranties that the respondent recommends?

- In the Pricing Methodology categories, consider:
  - What is the estimated cost per fixture or per municipality to compete a Technical Street Light Energy Audit?
  - What is the proposed cost per fixture?
  - Has the respondent accurately calculated utility rebates and incentives?
  - What are the proposed installation costs?

**Financing Options**

A variety of options are available for the project team to consider for financing the project:

- **Tax-exempt municipal lease financing** – This is the recommended method for paying for LED projects upfront, as it doesn’t affect municipal bond rating or debt levy.

- **Performance contract under ch. 25A** – With this method, guaranteed energy savings can be dedicated to debt service each year.

- **Bonds** – General obligation bonds and Qualified Energy Conservation Bonds (QECBs) are appropriate for projects with substantial up-front costs.

- **Operating funds** – If other energy projects have already been set up in the municipality and are generating savings, a case can be made to appropriate those savings for further energy efficiency improvements.

- **Capital projects** – An LED streetlight retrofit can be undertaken as a separate capital project, with a line item in the municipality’s budget.

- **Grants** – Green Communities funds can potentially be used to cover the costs of acquisition, if acquisition costs are included as part of an overall funding request for LED streetlight
retrofits. However, round 1 Green Communities funds can’t be used to pay for streetlight retrofits. A municipality will have to wait for its next round of competitive grant awards to apply for any funding related to streetlight retrofits.

**Glossary**

**Lighting Terminology**

- **Correlated Color Temperature (CCT)** indicates how “warm” or “cool” the light a particular lighting technology generates is. CCT is measured in Kelvin (K). A higher value (>5,000K) indicates a “cooler”/bluer light color; a lower value (<4,500K) indicates a “warmer”/more orange light color.

- **Color Rendering Index (CRI)** indicates the light’s ability to render colors across the spectrum. It is represented by a number between 1 and 100, where 100 is the full spectrum of visible light equivalent to the sun.

- **Illuminance** indicates the light intensity on a surface per unit area. It is measured in foot-candles (fc). 1 fc = 1 lumen/square foot.

- **Kilowatt-hours (kWh)** is a measurement of energy. It is calculated by multiplying the power draw (wattage) of a device by the amount of time for which it is drawing power (e.g., a 100W light bulb that is on for 10 hours uses 100 x 10 = 1,000 watt-hours = 1 kWh).

- **Uniformity** describes how evenly light is distributed across an area.

- **Useful life** is used for measuring LED fixture lifetimes. It is generally defined as the estimated time at which LED light output will depreciate to 70% of its initial rating.

**Common Fixture Types**

- **Incandescent lights** are the most out-dated and least efficient street lighting technology available, although utilities currently maintain a tariff for incandescent lights.

- **Mercury vapor (MV) lights** replaced incandescents in the ’50s and continue to be a widely used technology today. Nonetheless, most Massachusetts cities and towns have replaced them with alternative technologies that are more efficient.

- **High-pressure sodium (HPS) lights** are the most commonly used technology by municipalities today. A typical 150W HPS fixture:
  - Draws approximately 183W of power
  - Has a CCT of 2,000K
  - Has a CRI of 22

(Note: Low-pressure sodium lighting is also used on rare occasions. It is more efficient but the color rendering is worse than HPS.)
• **Metal halide (MH) lights** are also a commonly used lighting source. This lighting technology emits a very bright white to bluish light. The color of these lamps tends to shift over time. It is not uncommon to find a row of identical MH fixtures with each emitting slightly different color light. A typical 175W MH fixture:
  - Draws approximately 208W of power
  - Has a CCT of 4,000K
  - Has a CRI of 65

• **Induction lighting** transfers electric power via electromagnetic fields, rather than electric connections (electrodes). It is a more efficient method of transforming electric power into light. Induction lamps are also referred to as electrode-less lamps. Current technology of induction lighting provides a much higher color temperate and yields a cooler/bluer light than HPS lamps.

• **Light-emitting diode (LED), a.k.a. solid-state lighting**, creates a new potential for energy-efficient lighting. This technology can provide directional light emission and has a longer life than conventional light sources. In comparison to HPS and MH technologies, LEDs are also improving more rapidly in terms of color quality, optical design, thermal management, and cost. A typical LED fixture:
  - Draws 150W of power
  - Has a CCT of 6,000K
  - Has a CRI of 75

<table>
<thead>
<tr>
<th>Comparison of HPS and LED Outdoor Fixtures for Demonstration Site</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td><strong>Existing 70W HPS Fixture</strong></td>
</tr>
<tr>
<td>Total power draw</td>
</tr>
<tr>
<td>Average illuminance levels</td>
</tr>
<tr>
<td>Maximum illuminance</td>
</tr>
<tr>
<td>Minimum illuminance*</td>
</tr>
<tr>
<td>Max/Min Ratio (uniformity)</td>
</tr>
<tr>
<td>Energy consumption per fixtures***</td>
</tr>
<tr>
<td>Energy savings per fixture</td>
</tr>
</tbody>
</table>

Table from US DOE “LED Application Series: Outdoor Area Lighting”
* Lowest measured or modeled for each fixture. IESNA guidelines call for at least 0.5 fc.
** Modeled results.
*** Energy consumption for the HPS system is based on manufacturer-rated power levels for lamps and ballasts, for the 3-bar LED unit on laboratory power measurements, and for the 2-bar unit on manufacturer-rated power levels, all multiplied by 4,380 hours per year.
Additional Resources

March 11, 2013

Marcy Reed, President
National Grid USA
40 Sylvan Road
Waltham, MA 02451

Dear Ms. Reed:

We are writing to respectfully request that National Grid file a rate tariff for unmetered streetlights with the Massachusetts Department of Public Utilities that includes LED luminaires, and additionally establish an incentive program for LED streetlights based on the potential for energy savings that they represent. As part of our commitment to leading the way in environmental sustainability by investing in energy efficiency in our municipal infrastructure, we are eager to move forward with energy-efficient LED street light retrofit projects. However, since National Grid offers neither a rate tariff nor an energy efficiency incentive for LED streetlights, it is currently impossible to capture the energy cost savings associated with installing these more-efficient fixtures, rendering our projects economically unviable. In order to ensure the success of these and other projects, it is crucial that National Grid align its policies and incentives with the efforts of local municipalities.

Recent retrofits in other Massachusetts communities have been successful at achieving significant savings. The City of Boston will save over $2.8 million annually as a result of the LED streetlight conversions completed in 2012. Smaller communities can also achieve significant savings: the four communities of Arlington, Chelsea, Natick and Woburn—all served by NSTAR—together expect to save around two million kWh and over $300,000 annually as a result of a retrofit project of more than 5,000 fixtures currently underway. Especially during times like now when municipal budgets are so tight, these types of savings can make large impacts on municipal operations, including continuing other energy efficiency efforts.

The 2013-2015 Joint Statewide Three-Year Electric and Gas Energy Efficiency Plan filed by the eight Program Administrators, including National Grid, calls for an electric savings target of 2.5% of electric sales each year over the three-year term. Part of the Commercial & Industrial Retrofit Program described in the plan for implementing these targets includes evaluating and launching major retrofit initiatives for municipally-owned streetlights (p. 168). Our communities are prepared to undertake such initiatives upon removal of key barriers, namely, the lack of an LED rate tariff and incentive for retrofits of unmetered lights. These retrofit initiatives can result in not only electricity savings that support National Grid in meeting these targets, but also in reduced maintenance costs across the board due to the greater longevity of LED luminaires.
As National Grid moves forward with its rigorous product evaluation, engineering analysis, and the other requirements that we appreciate are necessary to implement a rate tariff and incentive program for LED streetlights, we would be glad to work together and support this work with findings through a pilot/demonstration effort. A pilot tariff and incentive amount could be used to enable implementation of LED streetlight upgrades for the streetlights we own in our communities, the results of which we hope could be used to launch widespread similar efforts upon adoption of a statewide rate tariff and incentive program.

Thank you for your consideration of this issue. We look forward to working with you in the future. Should you wish to discuss this issue further, please contact Helen Aki, Clean Energy Program Coordinator at the Metropolitan Area Planning Council (MAPC), at 617-933-0714.

Sincerely,

Mayor William F. Scanlon
City of Beverly

Jeffrey Nutting
Town Administrator
Town of Franklin

Mayor Carolyn A. Kirk
City of Gloucester

Mayor Gary Christensen
City of Malden

Mayor Robert Dolan
City of Melrose

Mayor Thomas P. Koch
City of Quincy

Mayor Kimberly Driscoll
City of Salem

Thomas G. Younger
Town Manager
Town of Swampscott

Mark Andrews
Town Administrator
Town of Wenham

James M. McKenna
Town Manager
Town of Winthrop

Marc D. Draisen
Executive Director
Metropolitan Area Planning Council

CC:
Carol White, Director, Program Strategy – Massachusetts Customer and Business Strategy, National Grid
Paula Roseen, Lead Analyst, Outdoor Lighting, National Grid
David Cash, Commissioner, Massachusetts Department of Public Utilities
Mark Sylvia, Commissioner, Massachusetts Department of Energy Resources
Meg Lusardi, Director of Green Communities, Massachusetts Department of Energy Resources
Senator Benjamin Downing
Representative Robert DeLeo