

# Chicago Smart Lighting Project *Implementation Model*

## Organization Type

Public / Non-profit Partnership

## Barrier

Assessing and prioritizing municipal outdoor lighting modernization opportunities, including LED retrofits, infrastructure repairs, lighting management systems, and more, to develop an economically viable and financially prudent project.

## Solution

Close collaboration between a non-profit organization, a municipality, subject matter experts, and industry professionals resulted in a feasible project vision and a collaborative competitive procurement process.

## Outcome

The realistic project vision with clearly defined project objectives and requirements, coupled with a competitive procurement process maximized short- and long-term project benefits while remaining within the project budget.

## Implementation Model

A Model for Developing and Managing the Procurement of a Complex Street Lighting Modernization Project

### OVERVIEW

The City of Chicago, IL, (City) with a population of ~2,700,000, is the largest city in the Midwest and comprises roughly 234 square miles. The City estimates that it manages 353,000 existing outdoor lighting fixtures; this estimate includes street lights on residential and arterial streets, and lighting for viaducts, alleyways, and approximately 20,000 lights illuminating Chicago Park District (CPD) pathways. The vast majority of existing Chicago's fixtures, (~92%), are high-pressure sodium (HPS); 38% of CPD fixtures are HPS. LED represents less than 2% of the overall existing inventory. Cobrahead type fixtures are by far the most common type (~75%), and are used to light a variety of lighting contexts. The City also utilizes a wide assortment of ornamental fixture types that have been deployed over the years in conjunction with individualized neighborhood and business district streetscape designs.

The City of Chicago and the Park District own, operate, and maintain most of the outdoor lighting infrastructure. The noted exceptions are City-owned alley lights which are mounted on wooden power poles owned by the local electric utility, Commonwealth Edison (ComEd). Most of the steel light poles were installed in the 1950s and 60s. There currently is a mix of underground and overhead wiring providing electricity to different types of pole configurations. A portion of this legacy infrastructure

has been replaced over the last 15 years, but maintenance of the aging infrastructure remains an ongoing challenge as the City does its best to address reliability concerns within budget constraints.

The Chicago Infrastructure Trust (Trust), a non-profit organization whose mission is to catalyze public infrastructure projects, is currently working with the Office of Mayor Rahm Emanuel and multiple City departments, including but not limited to the Department of Transportation (CDOT), the Department of Innovation and Technology (DOIT), Fleet & Facility Management (2FM), Office of Emergency Management and Communications (EMC), as well as CPD to upgrade the City's street lighting infrastructure to LED technology.

While the City hopes to eventually convert all street lights to LED fixtures, due to financial constraints, the 2016-2017 procurement process focused on:

- replacement of approximately 270,000 of the City's high pressure sodium fixtures to LEDs,
- targeted infrastructure stabilization repairs, and
- deployment of a lighting management system enabling real-time monitoring and control of the fixtures, and to support future smart city applications.

## PLAYBOOK

### POLICIES

To assure success, Chicago's Smart Lighting project required, and will continue to require, the long-term collaboration and buy-in of several key City departments. The Trust was selected to champion the project due to their ability to liaise effectively across City departments, design and oversee a complicated multi-phase procurement process, and maintain momentum. The project fits well within the Trust's purpose "to assist the people of the City of Chicago, the City government and its sister agencies in providing alternative financing and project delivery options for transformative infrastructure projects."<sup>1</sup>

The City's plans for street lighting improvements are not only driven by the desire to achieve a more reliable and higher-quality lighting, improve safety and quality-of-life in Chicago's diverse neighborhoods and improve the City's responsiveness to outages, but also by the City's sustainability goals. Like many U.S. cities, Chicago has convened a Sustainability Council, chaired by Mayor Rahm Emanuel and made up of many of the City's key department leaders. This Council guides the goals and actions designed to make the City "healthier, more livable, and more prosperous." In 2012, building on the 2008 *Chicago Climate Action Plan* that stressed the importance of a reduction in energy use, the Mayor launched a three-year *Sustainable Chicago 2015* plan.

<sup>1</sup> <http://chicagoinfrastructure.org/about/how-it-works/>.

The third goal of the 2015 *Sustainable Chicago Action Agenda* is to “improve citywide energy efficiency by 5%.” Among the key actions listed to achieve this goal is the plan to “Include energy efficient technologies in all street lighting replacements”.<sup>2</sup> The 2013 progress report highlights the success of partner organizations’ sustainability efforts, including Shedd Aquarium’s “replacement of 75% of [its] lights with high efficiency LEDs” and cites progress towards the goal of “include[ing] energy efficient technologies in all street lighting replacements” in 2014, with further achievement reported in 2015.<sup>3</sup>

Chicago’s plans for LED retrofits also align with national energy efficiency policy efforts. In early 2014, following the publication of the third *U.S. National Climate Assessment*, and supported by plans outlined in the 2013 national *Climate Action Plan*, the White House announced the development of the Outdoor Lighting Accelerator (OLA). The OLA is part of the broader Better Buildings Accelerator program supported by the Better Building Initiative (BBI). Its purpose is to engage with dozens of municipalities “to accelerate the adoption and use of high efficiency outdoor lighting in the public sector.”<sup>4</sup> Originally aimed at converting 500,000 outdoor lights, in 2015, President Obama tripled the goal to replace 1.5 Million fixtures by 2016. Cities like Chicago played a crucial role in helping to meet these national goals, as well as developing best practices for system-wide street lighting replacements.

## PROCESS

**Information Gathering** – Prior to the initiation of the Smart Lighting project, a limited number of LED fixtures were installed in Chicago. Therefore, the City and Trust sought technical assistance from a variety experts to guide their project scope development and procurement plans. To this end, Midwest Energy Efficiency Alliance (MEEA) partnered with the Trust and City from 2015-2017 to provide ongoing technical assistance and access to national resources.

Through focused technical assistance, MEEA and its partners at the U.S. Department of Energy (DOE) and Pacific Northwest National Laboratories (PNNL), helped the Trust and various City Department representatives better understand the LED street lighting and Lighting Management System technologies available, as well as best practices with respect to specifying, installing, and managing these resources. Special consideration was also given to assessing the potential for revenue-generating and cost-saving smart city initiatives (e.g., smart parking management) and joint-value creating opportunities (e.g., a shared network to transfer street lighting and utility data) that would leverage a pole-mounted, city-wide network.

**Barrier Identification** – As the Trust and the City considered various retrofit plans, a number of key barriers emerged. These included:

<sup>2</sup> <http://www.cityofchicago.org/content/dam/city/progs/env/SustainableChicago2015.pdf>

<sup>3</sup> <http://www.cityofchicago.org/content/dam/city/progs/env/SustainableChicago2015.pdf>

<sup>4</sup> [https://www4.eere.energy.gov/challenge/sites/default/files/uploaded-files/BBChallenge-HighPerformance-OutdoorLighting-FactSheet\\_1.29.15.pdf](https://www4.eere.energy.gov/challenge/sites/default/files/uploaded-files/BBChallenge-HighPerformance-OutdoorLighting-FactSheet_1.29.15.pdf)

- *Limited access to information about large-scale LED conversion best practices.* The LED retrofit scope-development process presented many auxiliary opportunities (e.g., infrastructure upgrades, fiber optic cabling, renewable energy integration, electric vehicle (EV) plug-in, security cameras, and many more). To vet these opportunities against the goals of maximizing public benefit while exceeding budget constraints, the team needed to engage experts, members of industry, and representatives of other cities. This led to a robust information-gathering effort, including interviews with a variety of cities that previously completed LED street lighting retrofits (e.g., New York, Boston, Los Angeles, and Philadelphia).
- *Limited access to financing for the street lighting project.* The Mayor tasked the Trust with delivering a financially feasible project that would ensure the City maintained ownership of all street lighting infrastructure. To this end, the team assessed expected energy-savings, estimated the cost of each potential element of the project scope, and determined whether state, federal, or foundation grants; federal loans; or other supplemental financing mechanisms could lead to a justifiable business case for this much needed large scale modernization that would not burden Chicago taxpayers.
- *Aging infrastructure.* In some cases, Chicago's aging street lighting infrastructure (e.g., poles and wiring) requires targeted stabilization repairs to support the new, longer-lasting LED fixtures and to power the network needed for the City's planned lighting management system. The team built the estimated costs for such repairs into the project scope.
- *Diverse stakeholders.* The groups with a stake in the City's street lighting plans include Aldermen in 50 distinct Wards that control a portion of the infrastructure spending within the City; groups such as the International Dark Sky Association (IDA); and the residents and businesses of Chicago who would be individually and collectively impacted by the project. The needs of these stakeholders required the team to develop an inclusive process and to specify inclusion of a community engagement and public relations plan in the Smart Lighting project scope.
- *Public concern about a potential connection between blue wavelength light and human health.* In large part due to the American Medical Association's June 2016 LED street lighting guidance document, advocacy by the IDA and coverage by local media, some Chicago residents expressed concern about the potential impacts of LED street lighting on human health. This required the team to engage topic experts to learn about the latest research, respond to media requests for information, maintain a flexible scope to adapt to public concern, and build information resources to help the public and media better understand the science behind human responses to LED street lighting.

The resulting project scope needed to address these and more barriers in order to be successful.

**Procurement Process** – The Trust and City established the following procurement plan whose overarching goal was to define a clear and achievable project scope and

procure the necessary services and technology through an open, fair, competitive, inclusive, process the resulted in a project that balanced multiple goals:

- RFI: The Trust released an RFI to solicit information from industry experts regarding possible city-wide solutions, innovative partnerships, and/or financing opportunities. Information collected through proposals and subsequent interviews informed the project scope and helped inform the assumptions underlying the initial economic modeling.
- RFQ: The Trust next released a Request for Qualifications (RFQ) to gather further information on available technology and vendors. This process established a shortlist of qualified potential prime contractors who would be responsible for the delivery of the comprehensive project scope including: project management overseeing an asset condition assessment, LED conversion, infrastructure stabilization, and lighting management system deployment.
- RFP: Finally, the Trust released a Request for Proposals (RFP) to select a single successful and qualified bidder to proceed to contract negotiations. At the time of this Implementation Model's publication, the selection process is concluding.

## OUTREACH

MEEA's primary points of contact within the City included Trust staff and various City departmental leaders. MEEA also leveraged the expertise of PNNL staff over the course of the project; Jason Tuenge, Michael Poplawski, and Bruce Kinzey from PNNL were instrumental in advising the best practices related to fixture selection, lighting management systems, and the connection between lighting and human health.

## TOOLS & RESOURCES

The following tools were used or created over the course of Chicago's Smart Lighting project

- Procurement Documents
- MEEA Street Lighting Toolkit
- The U.S. DOE Municipal Solid-State Street Lighting Consortium (MSSLC)
- Better Buildings Initiative: Outdoor Lighting Accelerator (OLA)
- U.S. DOE Outdoor Lighting Resources Webpage

## OUTCOMES

There are three primary activities associated with the Smart Lighting project:

1. targeted infrastructure stabilization repairs,
2. replacement of ~270,000 HPS fixtures with efficient LED fixtures equipped with networking technology, and
3. deployment of a city-wide lighting management system.

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Given the scale of the City of Chicago's street lighting infrastructure, successful completion of these activities will significantly contribute to U.S. DOE's Outdoor Lighting Accelerator Goal of replacing 1.5 Million street lighting fixtures with LEDs.

## MEASURING SUCCESS

Chicago's success will be measured by the following short-term anticipated outcomes:

- Save energy – the estimated annual energy savings are 181,679,358 kWh.
- Save money – the estimated annual energy cost savings are approximately \$9.3 million.
- Streamline operations – one of the primary goals of the lighting system is to streamline and automate the process of maintaining the City's street lighting, including reducing the frequency, backlog, and duration of outages; accessing real-time information about the lighting system; and integrating with the City's 311 system to automate work orders.
- Enhance public safety – improving nighttime visibility and safety for Chicago residents, travelers and businesses.
- Support the Chicago economy – creating jobs and supporting the City's goals to bring increased manufacturing within the City limits will ensure opportunities for diverse businesses.

Success may also be measured by the following long-term outcomes:

- Successful deployment of future "smart city" applications on the street lighting network.
- Conversion of the remaining street lighting infrastructure to LED.

## TOOLS

The following tools were used or created over the course of Chicago's Smart Lighting project

### Procurement Documents

- **Type of Tool:** RFI, RFQ, and RFP
- Procurement documents (e.g., materials related to Chicago's RFI, RFP, and RFQ) are available for review online.

### MEEA Street Lighting Toolkit

- **Type of Tool:** Informational webpages
- MEEA created a LED Street Lighting Toolkit serving as an annotated bibliography of key resources that will help Midwestern cities and utilities advance their LED street lighting replacement plans. These resources are coalesced around the following themes: general guidance; technology guidance; control systems; financing and financial analysis; case studies; and a lighting terminology glossary.

### The U.S. DOE Municipal Solid-State Street Lighting Consortium (MSSLC)

- **Type of Tool:** Consortium
- U.S. DOE administers the MSSLC to help cities and organizations conduct retrofits of LED street and area lighting products.

### Better Buildings Initiative: Outdoor Lighting Accelerator (OLA)

- **Type of Tool:** Accelerator Program
- An accelerator program providing municipalities with resources and case studies of peer cities who are also upgrading their streetlights to LEDs.

### U.S. DOE Outdoor Lighting Resources Webpage

- **Type of Tool:** Webpage
- This webpage includes a broad range of resources, including publications, interactive tools, sample specifications, lighting market reports, webinars and much more.