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U.S. DEPARTMENT OF ENERGY

October 6, 2015

Chronicle of a City's LED Street Lighting Conversion

The City of Portland, OR, is midway through the process of converting its street lighting from high-pressure sodium (HPS) to LED. Such large-scale conversions are rarely simple matters, and a new GATEWAY report identifies some of the challenges Portland has encountered in the process and describes how they were addressed. The Portland Bureau of Transportation (PBOT) was an early investigator of LED street lighting and one of the first public agencies to join DOE's Municipal Solid-State Street Lighting Consortium, so Portland's experiences — backed as they were by careful research and expert advice — can be especially helpful to other cities that are implementing or considering their own lighting transitions.

Portland has just over 55,000 streetlights, which are maintained by PBOT. In the early 1980s, the city purchased from Portland General Electric (PGE, an investor-owned utility) all of the streetlight fixtures and mast arms Portland didn't already own, along with most of the existing streetlight-only (SLO) poles. However, roughly 38,000 poles played dual roles by also supporting distribution wiring or other utility or communications equipment, and were therefore retained by PGE. In addition, about 4,400 SLO poles owned by PGE and another 1,600 owned by the city were more practically maintained by the utility, due to their proximity to high-voltage circuitry or equipment. Over the next few decades, PGE continued to maintain about 44,000 poles and the city-owned fixtures installed on them, leaving about 11,000 SLO poles and luminaires that were owned and maintained by Portland.

In 2010, Portland joined with several nearby cities and agencies to get the Oregon Public Utilities Commission to require PGE to incorporate LEDs into its rate structure. At the time, PGE offered three tariff options:

- *Option A:* The utility owned and maintained the equipment.
- *Option B:* The city owned but the utility maintained the equipment.
- *Option C:* The city owned and maintained all fixtures, poles, mastheads, and wiring, and billing was for energy only.

PGE agreed to offer an LED tariff in 2012, but simultaneously eliminated Option B lights from its portfolio for any customer installing energy-efficient LEDs. Under the new LED tariff, customers wanting LEDs could either convert to Option A, selling the assets and renting them back, or they could convert to Option C, purchasing all remaining components (poles, fixtures, mast arms, and circuit wiring) and subsequently maintaining the entire system themselves.

Re-lamping HPS streetlights had been traditionally scheduled in Portland on a five-year cycle or as emergency outages otherwise dictated. However, the LED products were expected to require much less maintenance than the conventional HPS system and, therefore, to offer significant maintenance savings. Given that PBOT had maintained 11,000 Option C streetlights for decades, taking over the maintenance of the additional Option B streetlights seemed relatively straightforward. PBOT ultimately reconfirmed that the city was better off owning its street lighting system, and Portland approved the purchase of the remaining components from PGE, along with the separate financing of the additional purchase and installation of LED products.

Issues raised during subsequent negotiations delayed the project's planned rollout by more than two years, however. Ultimately, PBOT issued its initial Phase I luminaire specification in April 2013 to replace the approximately 45,000 cobrahead fixtures mounted on utility poles with LEDs, followed by the Phase II luminaire specification for ornamental post-top fixtures in March 2015.

Initial public response to the LED streetlights has been largely positive, although there has been some limited reaction to the comparatively "cooler" light. As expected, the brighter appearance of the LEDs led to a few initial requests to lower illumination levels, as well as to some concerns about glare and light trespass. The luminaires selected by PBOT for the cobrahead replacements offer three output levels: 3,000 lumens (29W), 4,100 lumens (42W), or 5,000 lumens (54W). Based on initial feedback from residents, PBOT has adopted the lowest output level for all residential units going forward. The corresponding power level represents a 75% reduction in power use over the HPS products being replaced.

Collector and arterial roadways in Portland previously employed 150W to 400W nominal HPS cobrahead luminaires, which are being replaced with LED products ranging from 63W to 180W power use. Overall, the average power reduction amounts to about 64%. Crews installing the lights are pleased with the ease of installation and report that each luminaire replacement requires only about 15 minutes. Thus far, out-of-the-box failure rates and other operating issues typically associated with new installations have been very low, with a warranty return rate of just over 0.5%, in line with LED experiences elsewhere.

Projected dollar savings from the completed conversion exceed $2 million per year and are expected to repay the total $18.5 million investment in the upgraded system within about eight years. Beyond that point, continued savings will be used

for system maintenance and put into a capital replacement fund for poles and circuits and the next round of luminaire replacements.

The process of upgrading Portland's streetlights to LED was more complicated and lengthy than PBOT originally envisioned, with a number of issues and circumstances arising that increased the cost as well as the time to complete. Overall, however, the city and its residents are pleased with the results. For more details about this project, see the full report.

As always, if you have questions or comments, you can reach us at postings@akoyaonline.com.