EVSE Innovation: Streetlight Charging in City Right-of-Way

Area of Interest 3e: Multi-Unit Dwelling and Curbside Residential Charging Infrastructure Innovations

Technical Contact

Sara Lamprise

Program Coordinator, Metropolitan Energy Center

Ph: (913) 777 9800, sara@metroenergy.org

Business Contact

Kelly M. Gilbert

Executive Director and Pre-Award Manager, Metropolitan Energy Center

Ph: (816) 812 9772, kelly@metroenergy.org

Team Member Organizations

Kansas City Regional Clean Cities Coalition, Metropolitan Energy Center, Kansas City, MO

Energy Solutions Hub, Metropolitan Energy Center, Kansas City, MO

Missouri University of Science and Technology, Rolla, MO

Mid-America Regional Council, Kansas City, MO

Parking Division, Department of Public Works, City of Kansas City, MO

Kansas City Power & Light, Kansas City, MO

Konnectronix, Waukegan, IL and/or LilyPad EV, Kansas City, MO

National Lab, tbd

Additional Funder, tbd

TECHNOLOGY DESCRIPTION

Project Summary

We envision a network of EVSE charging stations paired with street lighting, providing an on-street charging solution across Kansas City. We plan to develop a feasibility analysis of pairing EVSE charging infrastructure with street lighting in various on-street locations in Kansas City. The analysis will detail costs and other challenges associated with providing streetlight charging and will provide recommendations on how best to address those challenges. Additionally, the analysis will factor in the need for equity and anticipate issues specific to streetlight charging access in lower income neighborhoods. The analysis will be supplemented by decision support tools, in the form of predictive modeling, to analyze diffusion rates and optimal charging locations. Lessons learned and best practices will assist other urban regions in the U.S. to develop their own feasibility analyses.

Problem Statement

On-street deployment of EVSE presents several challenges, including costs, permitting, and issues of equity. Kansas City Public Works, for example, is concerned about installing traditional EVSE on-street because of maintenance concerns, as well as prohibitive capital and construction costs associated with facilitating grid access. In relatively privileged parts of town, where capital costs are less of a concern, the Permitting Office is fielding questions from business owners about the process for permitting and approving the installation of charging stations in the city right-of-way (i.e. on-street). For lower income neighborhoods, installing traditional EVSE on-street remains cost-prohibitive, exacerbating existing equity concerns related to EV access.

KCMO City Engineers and Divisions of Permitting, Public Works and Parking are intrigued by deployments in Europe of charging paired with street lighting and would like to study its feasibility in Kansas City. This solution has the potential to decrease installation costs because it taps in to existing grid infrastructure, rather than requiring trenching or digging up sidewalks to lay line. It is more aesthetic than stand-alone infrastructure. Because it uses slower charging, it does not cause electrical usage spikes during hours of peak demand. And because of the lower upfront costs, it offers the City a more viable option for providing on-street charging to drivers in low-income neighborhoods.

However, this solution comes with its own challenges. These challenges can be grouped into five main concerns: 1) determining location and the logistical integration of charging infrastructure into the existing grid network, 2) calculating and securing projected installation and maintenance costs, 3) ensuring equitable access in lower income neighborhoods, 4) identifying permitting and right-of-way requirements, and 5) determining billing logistics for electricity use.

We aim to confront these challenges through systematic, replicable feasibility analysis based on deployments across Europe and Los Angeles, CA, as well as concerns unique to Kansas City.

Proposed Solution

We propose a systematic, replicable feasibility analysis of the suitability of pairing EVSE infrastructure with streetlight charging. Our analysis will focus on Kansas City, but will produce

a method of analysis that can be used by other municipalities. Our analysis will focus on addressing the five main concerns with streetlight charging: 1) logistical integration of charging infrastructure into the existing grid network, including how to account for the increased load, 2) projected installation and maintenance costs, 3) ensuring equitable access in lower income neighborhoods, including on/near multi-family dwelling units (MFDU), 4) permitting and right-of-way requirements likely to be encountered, and 5) tracking and monetizing electricity use.

We propose to integrate the feasibility analysis with transportation system operation and management modeling. We will model overall travel demand and driving behaviors in order to anticipate how many streetlight charging stations we would need. The model would be based on results of an initial survey and would assume a certain percentage of market penetration (e.g. 5, 10, or 20 percent). Our predictive model would incorporate certain limitations, such as the elimination of potential charging locations due to logistics (for example, if parking at that location would obstruct traffic flow).

The model could be updated with incoming adoption data describing the diffusion of the innovation process. Diffusion is influenced by numerous factors, including peer adoption rates, regular travel patterns, and socio-economic conditions. As data filters in, the model could be calibrated to better predict the number of adopters and suggest ways to further promote adoption technologies. Results of the diffusion model, combined with the data on eligibility and suitability of certain locations, would indicate where streetlight charging stations should be optimally located.

There is significant interest in the results of a feasibility analysis, for reasons mentioned above. Additionally, a city-led buildout of streetlight EVSE would support existing legislative initiatives, including Kansas City's Renewable Energy Now Resolution, which calls for "equity for energy efficiency and EVs in disadvantaged neighborhoods," and Mid-America Regional Council's Complete Streets Policy, which is part of the Kansas City region's current Metropolitan Transportation Plan, *Transportation Outlook 2040*.

Leveraging Advances in Infrastructure Innovations

Streetlight charging has been deployed across Europe through companies such as Ubitricity, with great success. The company's infrastructure connects to city street lamps, turning them into charging stations by installing a socket (called the SimpleSocket). When used together with the SmartCable and plugged into an electric vehicle, the setup allows for immediate charging and billing.

Billing is done through a box on the SmartCable that acts as a mobile phone and built-in electricity meter. The box communicates with the server to activate charging from the light pole then transmits the usage data back to the server. This data can be analyzed for usage patterns and help determine viable future locations.

Streetlight charging has also been deployed in Los Angeles through ebee, a company similar to Ubitricity. In Los Angeles, like in some European cities, the electric load was balanced by switching all streetlights to LED. Load balancing is a particularly attractive solution and

increases buy-in from utility companies, who have not seen a significant increase in electricity usage since 2010 and are looking for ways to maintain demand while increasing efficiency.

Ultimately, the impact of this study would be to enable efficient decision-making by municipalities and other impacted stakeholders through creation of decision support tools based in predictive modeling founded on real data sets. Lessons learned and best practices will assist other urban regions in the U.S. to develop their own feasibility analyses.

Multidisciplinary Team

Our team consists of researchers, entrepreneurs, and decision makers from a Tier I research university, a DOE lab, a Clean Cities Coalition, an electric utility, a city government, and a startup company active in electric vehicle technology implementation. The multidisciplinary team will be led by Kelly M. Gilbert of Metropolitan Energy Center, who has experience leading projects funded by various federal agencies, including multiple EPA and DOE grants. Dr. Xianbiao Hu of the University of Missouri has extensive experience in transportation big data analytics and intelligent transportation systems. Sherri McIntyre, Kansas City Director of Public Works and Assistant City Manager, will provide data on parking, usage patterns and permitting, as well as steer activities within City of Kansas City. Larry Kinder of LilyPad EV (Jon Hipchen of Konnectronix) will provide technical infrastructure and pricing expertise. Wendy Marine of Kansas City Power & Light will provide insight into load balancing and grid concerns. Sara Lamprise, with MEC's Energy Solutions Hub, will gather data on concerns of MFDU residents. The study itself will be designed and analyzed by a National Laboratory, to be determined, while the data itself will be collected and modeled by the rest of the project team.