US Ignite Forum: Smart Lighting Playbook

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On December 12, 2017, US Ignite and the City of San Diego convened a one-day smart lighting workshop. Nearly 50 workshop participants, drawn from local government, industry and nonprofit organizations, examined the smart lighting deployment in San Diego and discussed best practices and lessons learned. Representatives from cities around the country, including Atlanta; Albuquerque, New Mexico; Lincoln, Nebraska; and Portland, Oregon, shared their experiences and perspectives based on their own cities' smart lighting projects.

At the workshop, participants discussed issues including:
- Procurement and financing
- Technical challenges and opportunities
- Short-term and long-term use cases.

US Ignited compiled the Smart Lighting Playbook to share highlights from the workshop materials and discussion sessions. It will stand as a go-to resource for local governments exploring smart lighting and sensor deployment projects in their own communities.

OVERVIEW OF SAN DIEGO'S SMART LIGHTING AND SENSOR DEPLOYMENT

San Diego's lighting modernization and sensor deployment project by the numbers:

- 14,000 streetlights being upgraded to LED
- 3,200 smart nodes deployed on city-owned streetlights
- Why does this matter? The project created $2.8 million in annual savings for the City of San Diego

As the project point person, David Graham's foremost recommendation to municipal leaders considering similar projects is to **start with identifying your community's goals**. Clear goals will set priorities and inform all decisions about the project's design, financing and implementation. Workshop participants emphasized that smart lighting projects can be developed, paid for, procured and implemented in various ways and that communities should develop an approach that is based on their own goals and project objectives.

WHAT IS A SMART NODE?

Smart node deployments will repurpose city-owned streetlights into networked infrastructure that creates a smart city platform for solving challenges in public safety, emergencies, gunshot detection, crime investigation, pedestrian safety, traffic, parking and more.

> " San Diego's smart lighting deployment transforms ubiquitous municipal assets into a neural network that the city of San Diego will use to advance multiple community objectives.

— **DAVID GRAHAM**
DEPUTY CHIEF OPERATING OFFICER
CITY OF SAN DIEGO

PILOT TO PROCUREMENT

San Diego's pathway to the 2017 project included two significant initial projects.:

• **2014:** Implemented an advanced control system to manage 3,000 upgraded LED streetlamps enabling city managers to dim, brighten and monitor maintenance and "up-time" remotely.
• **2016:** Piloted the deployment of the smart nodes completed in August 2016.

With the deployment, the city sought to transform the advanced controls system from a single-use light control application to a multi-application network. That 2016 pilot demonstrated successfully the benefits of the smart nodes and a multi-application network. Following that pilot, the challenge of procuring a unique city-wide lighting and sensor project fell to Lorie Cosio Azar, Energy and Sustainability Program Manager in the City of San Diego in Environmental Services Department.

At the US Ignite Forum, Azar explained that San Diego decided not to issue a Request for Proposal (RFP), but instead created a functional specification for the desired solution.

San Diego pursued separate procurements for the solution and the installation of the solution. As a general matter, San Diego pursued a "best value" approach to the procurement. In Ms. Azar's assessment, it is not appropriate to pursue a "low bid" approach in procuring such an innovative solution. San Diego shortlisted five vendors providing contracts for a certain percentage of the overall job over a certain number of years.

Residents of San Diego share what having a smart, connected city means to them.

Regarding the procurement of a smart lighting project, San Diego's recommendations to municipal leaders include:

• If you know what you want your smart lighting project to accomplish, but cannot define it as a specific product, consider developing a performance-based specification.
• Separate the procurement of the technology and the procurement of the installation of the technology.
• When scoring for responses to smart lighting installation solicitation, consider the following weighing: 60% technical and 40% cost.

David Young, Fiber Infrastructure and Right of Way Manager in Lincoln, Nebraska, shared additional recommendations for municipal leaders related to Lincoln's 2017 RFQ for a LED streetlight conversion:

• Negotiate price with equipment providers before releasing the RFP
• Select a pre-approved list of equipment providers, so that the municipality—if need be—is able to change vendors without a new procurement
• In the procurement, separate the technology from the fixtures and the labor
• To greatest extent possible, create a solicitation that allows for an apples to apples comparison between Energy Service Companies (ESCOs)

PAYING FOR THE PROJECT

David Graham explained that San Diego considered a number of different approaches to pay for the $30 million project, including:

• Public-Private Partnerships (PPPs)
• Issuing a bond
• On-bill financing

San Diego's recommendations to municipal leaders regarding paying for a Smart Lighting project:

• Consider using Housing and Urban Development's (HUD) Community Development Block Grants (CDBGs) to fund deployment of smart lighting in eligible neighborhoods.
• Consider the value of doing both LED retrofit and sensor deployment at the same time. San Diego estimates $30.8 million in cost avoidance with a reduced number of truck rolls and other installation costs.
• Identify long-term uses for five- and 10-year timeframes for the city lights. This can help ensure that as new sensors are deployed for new city services, the network backhaul and other infrastructure will not need to be upgraded as well.

At the US Ignite Forum on December 12, there was notable consensus among participating municipal leaders that streetlight modernization is something that all cities should consider. The question should not be should a city do it, but is instead how a city should do it.

The city determined it wanted to retain ownership of the city's assets (i.e. the streetlights), and wanted to own and control the data collected by the network. In the end, San Diego selected a low-cost financing option. GE Capital loaned the city $30 million, which the city will pay back via energy savings created by the LED retrofits. The payback period is 13 years.

COST SAVINGS AND ENHANCED COLLABORATION BETWEEN MUNICIPAL DEPARTMENTS

An important element of the City of San Diego's decision to install a platform that can accommodate multiple applications (as opposed to adding single-purpose solutions) was a cost savings analysis conducted by the city. As illustrated below, the City of San Diego estimates that deploying the IoT platform will mean that it can avoid future costs totaling $30.8 million.

DEPARTMENT	COST AVOIDANCE INFASTRUCTURE ITEM	CAPEX + 5 YEAR OPEX
Traffic	Inductive Loop Surveillance at Intersection	1,581,743
Traffic	Passive Acoustic Sensor at Intersection	954,185
Public Safety	CCTV Video Camera	10,261,703
Public Safety	Pedestrian Detection Infared	67,481
Environmental	Environmental Sensing Station (Weather Station)	454, 264
Public Safety	Portable Speed Monitoring System	168,283
Traffic	Rail Crossing Trapped Vehicle Detector	705,777
Parking	In-Ground Parking Sensor	12,852,000
Public Safety	Shot Spotter	3,780,488
	TOTAL	**30,825,923**

In addition to the efficiencies created by installing a multipurpose IoT platform, David Graham, San Diego's Deputy Chief Operating Officer, emphasized that the repurposed infrastructure is helping break down silos within city government and is facilitating cross-departmental communication.

To sustain the IoT network beyond the costs of the initial deployment, municipal departments will opt in to the network of smart nodes (including the data collected by the smart nodes, the capabilities of the applications and ability to propose deploying new applications) and will contribute to a fund that will support network operation and maintenance. Collaboration between municipal departments is, in effect, built in to the sustainability plan for San Diego's smart node network.

CITY OF ATLANTA AND GEORGIA POWER SMART LIGHTING PILOT PROJECT

The relatively high price of electricity in San Diego means that cost savings from LED upgrades can finance San Diego's large-scale sensor deployment. At the US Ignite Forum, the City of Atlanta and Georgia Power discussed their Public-Private Partnership. Despite energy costs much lower than in San Diego—Georgia's average price per kilowatt was 9.59 cents in 2016, compared to California's 15.23 kWh, per the U.S. Energy Information Administration—Atlanta and Georgia Power are each paying for 100 smart nodes (a total of 200) to be deployed on Georgia Power's streetlight poles throughout the City of Atlanta.

Along with the smart nodes, the one-year pilot will include the deployment of four selected applications for gunshot detection, video sharing with public safety, parking optimization and active dimming of streetlights.

Additionally, in smaller communities throughout Georgia, Georgia Power will be sponsoring a series of Smart City workshops and a competition, called the Georgia Smart Communities Challenge. This competition is an effort to foster innovation amongst small and medium sized communities. Participating communities will submit proposals and selected communities will receive grants and technical assistance.

According to Christine Primmer, Strategic Manager for Georgia Power Smart Cities, the one-year pilot will allow Georgia Power to evaluate business case for the applications and use cases. That Georgia Power—a subsidiary of the second largest utility in the United States—is exploring the sustainability of transforming lighting infrastructure introduces the exciting idea that new revenue sources created by new applications and use cases might drive both greater top-line value and the deployment of at-scale smart city IoT deployments.

New applications driving new revenue? James Benson from Current by GE discussed an intriguing application that is made possible by smart node deployments like the one in San Diego and is expected to generate revenue. In cases of automobile accidents, the application provides insurance companies with video footage collected by the deployed smart nodes. Insurance companies that expend considerable resources investigating auto accidents would value the data.

POLICY AND TECHNICAL CONSIDERATIONS

The City of San Diego and workshop participants discussed at length the data management requirements and policy considerations (including privacy and security) related to a smart lighting sensor deployment. Maksim Pecherskiy, San Diego's Chief Data Officer, fielded questions such as:

Q How do you avoid spending on data collection systems for data that is not useful?
A Rather than focus on a data strategy, we focus on the city's strategy. The City of San Diego identifies existing challenges and prioritizes which ones we need to solve. We can then apply the data that is currently available and the holes we need to fill conserving our resources on what matters most.

Q Does each department in San Diego have data analysts or are they centralized in a single department?
A Each municipal department has their own data analysts and/or management personnel.

Q Recognizing that there are many innovative projects, how do you fail without political damage?
A You have to be willing to test and fail in order to know what will work. A willing test bed, San Diego's approach has been to test, try, experiment and repeat until we get it right before a large-scale deployment, keeping the failures in control before being rolled out.

A number of US Ignite Forum participants, including Kehav Gupta from San Jose's Office of Civic Innovation and Digital Strategy, recommended that municipalities not attempt to create a comprehensive policy framework before IoT deployment and instead recommended moving toward deployment and policy at the same time.

App providers demonstrated solving specific department challenges, and the ecosystem of app continues to grow. Here are examples in each segment:

TRANSPORTATION

Smart nodes will collect data that will enable next generation transportation solutions including multimodal options, mobility as a service, and connected vehicles.

PTV Group collects traffic volumes and speeds and enables real-time traffic management with adaptive signal controls.

StreetLight Data constructs precise patterns and modes of pedestrian and vehicle movement through the urban environment.

PARKING

City of San Diego expects parking enforcement revenue to increase by 15%, totaling $4.5 million of additional annual revenue.

CivicSmart uses computer vision analytics so that parking enforcement is more efficient and provides cities with a better understanding of parking utilization.

INRIX ParkME provides a comprehensive view of all parking options, including on-street parking availability based on the real-time node data.

PUBLIC SAFETY

Access to video will enhance situational awareness for law enforcers and first responders.

Genetec and Milestone sends video data to a video management system. Events of interest can trigger actionable alerts. Edge storage enables storage of high-resolution video and images on demand.

ShotSpotter delivers real-time gunfire detection data (including location information and maps), enabling real-time response.

ENVIRONMENTAL + URBAN DEVELOPMENT

New data streams will help the City of San Diego make informed decisions related to urban development and environmental issues.

BreezeoMeter provides real-time, localized environmental quality estimates based on input from sensors and advanced analytics.

CityZenith live-stream sensor data into the workflow of building projects throughout a city.

CITIZEN ENGAGEMENT

Open and interoperable APIs with real-time ubiquitous node data enhance the citizen engagement to build a smarter and safer community.

CivicConnect makes it easy for citizens, visitors, and city workers to explore, access, and service a city or region's civic resources, assets, and services based on the historical and real-time node data.

Connecthings improves quality of life with enhanced mobility and local commerce with ubiquitous pedestrian, traffic, and parking data from the node.

TECHNICAL/POLICY CONSIDERATIONS:

There are still questions to consider when it comes to smart leading, and we're calling on you for help in solving them. As municipal leaders around the country consider smart lighting IoT deployments, workshop participants identified these technical and policy considerations that have yet to be answered:

- What are the warranty and monthly maintenance costs for the nodes?
- Is the video fidelity and algorithmic accuracy sufficient to support certain applications (e.g. Vision 2020 solutions)?
- Is there a project deployment advantage in exploring coordination of the smart lighting/IoT deployments in tandem with the 5G/small-cell deployments that are beginning in many communities?
- Is data that municipalities collect on the edge computing networks a public record?

Call for Example Service Level Agreements (SLAs). Anne Hill of the Portland Department of Transportation, along with other workshop participants, felt that it would be valuable to review Service Level Agreements (SLAs) that municipalities have negotiated with their smart lighting sensor deployment partners. Municipal representatives with SLA examples to share, please send them to William.Maguire@us-ignite.org and we will add links to this Playbook.

RESOURCES LINKS TO MUNICIPAL SMART LIGHTING PROCUREMENTS

Atlanta, GA: http://procurement.atlantaga.gov/fc-9888-smart-lighting-project/

Washington, DC: https://op3.dc.gov/sites/default/files/dc/sites/op3/release_content/attachments/2017.06.21%20Smart%20Lighting%20RFQ%20Press%20Release%20Final.pdf

Pittsburgh, PA: https://procurement.pittsburghpa.gov/beacon/opportunities/243

Cleveland, OH: http://www.cleveland-oh.gov/node/11345

San Jose, CA: https://www.sanjoseca.gov/index.aspx?NID=4742&PREVIEW=YES

Great Neck, NY: http://www.greatneckvillage.org/Great-Neck_Smart%20Controls-RFP_%2017-NY-P-0471-C.pdf

Lincoln, NE: https://drive.google.com/open?id=1tyGN3EhPhS4J9BNlDuye2Og-qpvVP7x-

San Jose, CA: http://www.sanjoseca.gov/ledrfp

OTHER APPLICABLE RESOURCES:

Ohio State University—City Case Studies:

https://kb.osu.edu/dspace/bitstream/handle/1811/80672/ENRAEDE4567_StreetLightingCSA_sp2017.pdf?sequence=1

Four European Smart City Strategies: http://redfame.com/journal/index.php/ijsss/article/viewFile/1364/1446

Navigant Research Report overview: https://www.ioti.com/smart-buildings/report-commercial-iot-lighting-market-heating

Rocky Mountain Institute, Carbon Free Cities Report: https://www.rmi.org/carbonfreecities_electricity/

UC-Davis report: http://cltc.ucdavis.edu/sites/default/files/files/publication/2015-lighting-technology-overview-apr-2016.pdf

EU report: http://lightingmetropolis.com/wp-content/uploads/2017/10/LM_IIIEE_LEDs-light-the-future_full.pdf

Northeast Energy Efficiency Partnerships: http://www.neep.org/sites/default/files/resources/ResLightingBriefFinal_0.pdf