Response to

RFI No. 2017-0001

Smart Streetlights

Prepared for

City of Pittsburgh

Office of Management and Budget

April 10, 2017

AMERESCO

Green • Clean • Sustainable

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Smart Streetlights

Presented by
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April 10, 2017

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Pittsburgh, PA 15219

R.E: Ameresco Proposal Response to City of Pittsburgh Request for Information (RFI): Smart Streetlights (RFI No. 2017-0001)

Mr. Simpson,

Ameresco is pleased to submit this proposal that will provide the City of Pittsburgh with the Smart Streetlighting solution it desires. In accordance with RFI specifications, please find enclosed one (1) original and five (5) printed copies of Ameresco's response; and one (1) electronic copy in PDF format

Ameresco is a U.S. based, publicly traded company (NYSE: AMRC) that has the financial stability and strength to serve as the City's ESCO partner for the long term. We have designed and implemented over $5 billion of energy projects over our 30-year history, having been awarded more than 650 Guaranteed Energy Saving Act ("GESA") type projects across North America. Ameresco brings tremendous depth of expertise and experience of a U.S. Dept. of Energy (DOE) pre-qualified and NAESCO accredited Energy Services Company (ESCO) with the added strengths and skills of a proven energy asset developer, owner, and operator. As one of the largest independent Energy Solutions Providers in the country, Ameresco has designed/built customized Combined Heat and Power (CHP or "Cogen") and solar PV solutions throughout North America that are currently generating over 300 MWe of clean energy for our clients. Our team consists of highly qualified professional engineers and construction managers with decades of GESA industry experience, and who have direct working knowledge and understanding of how to successfully deliver quality solutions on a not-to-interfere basis within our client's facilities. As a result, our proposed GESA solutions consist of energy conservation measures ("ECMs") that have demonstrated history of successful performance serving other GESA type clients.

Ameresco, Inc. is a Corporation, incorporated in the State of Delaware, and one of the largest independent Energy Services Companies (ESCO) and Energy Solutions Providers (ESP) in North America. Our core business is providing turnkey, Guaranteed Energy Savings Act ("GESA") type contract services and solutions to public institutions like the City of Pittsburgh. Ameresco is headquartered in Framingham, MA, and has 70 offices located across the United States, Canada, and United Kingdom, including local regional offices located in Exton, PA, Philadelphia, PA, Columbus, OH, Wilmington, DE, and Cumberland, MD. Mailing addresses for each of Ameresco's PA Regional offices are listed below. Mr. Fritz Feiten (National Director - LED Lighting & Smart City Solutions), and Mr. Jon Zeller (Sr. Account Executive), from the Ameresco Exton, PA office, are the designated Ameresco points-of-contact for this project, authorized to provide any clarification required by the City regarding our proposal. On behalf of Ameresco, Inc., Inc., Mr. Michael J. Daigneault, Vice President – East

Region, is hereby listed as the designated Ameresco representative authorized to conduct any/all final contract negotiations and executions with the City of Pittsburgh. Complete contact information for each representative can be found below.

Ameresco acknowledges receipt of RFI Questions & Answers issued (March 28, 2017).

Ameresco acknowledges that this response may be considered public information in accordance with the Commonwealth of Pennsylvania Right to Know Laws as described in Section 5 of the City's RFI document. Ameresco has no relationship or knowledge of, or contact with any official or employee of the City of Pittsburgh.

We pledge the very best of our talented staff, whose dedication to City's Smart Streetlighting project will ensure its success. We look forward to your favorable review of our proposal and welcome the opportunity to discuss it with you further. We thank you in advance for your time and energy in reviewing our submittal.

Sincerely,

AMERESCO

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Project Overview

Ameresco, Inc. (NYSE: AMRC) is a leading, independent provider of energy efficiency, infrastructure upgrades and renewable energy solutions for customers throughout North America. Our capabilities include large smart city infrastructure projects such as that contemplated by this RFI. For example, Ameresco was recently selected for the Chicago Smart Lighting Project. The largest project of its kind in the United States, the Chicago project will convert more than 270,000 street lights to LED, deploy a city-wide "umbrella network" to communicate with and manage street lights and other smart city end points, integrate the street light management systems with the City's 311 and 911 systems, and make infrastructure stabilization repairs, including replacement of a significant portion of the City's legacy street light poles, conduit and wiring.

For the Chicago project Ameresco teamed with Current, Powered by GE, Philips, and Leotek (luminaires); Silver Spring Networks, Streetlight.Vision, and SELC (network and street light management); and a variety of local firms, including John Burns Construction (luminaire and control installation and infrastructure stabilization), Uturn Data Solutions (311 and 911 integration), and Lyons View (assembly of Current cobra head luminaires and retrofitting of decorative acorn coach lights). As the prime contractor, Ameresco is responsible for the entire project, providing design, engineering, project management, commissioning, and other services.

In our view there is no single vendor or solution that can achieve all of Pittsburgh's smart city objectives. Rather, these objectives are best met by a group of infrastructure and technology providers working together collaboratively and managed by a single responsible entity. This approach enables the provision of "best of breed" smart city solutions that address a variety of needs while at the same time following the dictum of "touch once", "dig once" to reduce costs and minimize public right of way disruption.

For this RFI response we will describe how the combination of Ameresco, Silver Spring Networks, Streetlight.Vision, SELC, Crown Castle International Corporation, AT&T and Current can collaborate to meet many of Pittsburgh's smart city needs, including:

- An LED street light conversion that maximizes energy savings while reducing over-lighting and other issues that can result in poor public acceptance
- Deployment of a low cost, city-wide network to provide communication for the management of street lights and other smart city applications
- Implementation of the Streetlight.Vision central management system for management and control of street lights and other smart city end points, and metering of street light energy use.
- Free to the City deployment of shared, neutral host small cell and fiber-optic infrastructure that will generate ongoing revenue to the City

- Deployment of AT&T's wireless network, global IP backbone network, collaboration tools and Current's Intelligent Node infrastructure to provide additional integrated smart city solutions

The development and deployment of these solutions and systems must be tightly coordinated to reduce installation costs and "touch once", "dig once". Designing and replacing (if needed) street light poles to provide current and future small cell wireless capacity and connectivity (fiber, power) will increase the efficient and effective use of scarce capital resources.

LED Street Light Conversion:

One of the key objectives expressed in the RFI is the conversion of some 35,000 street lights to LED. The City expects to generate savings of 60-80% from the conversion, using the savings to pay for the conversion through an Energy Savings Performance Contract (ESPC). Ameresco is one of the largest providers of ESPCs in North America, is accredited by the National Association of Energy Services Companies (NAESCO), and pre-qualified by the Pennsylvania Treasury Department's PennSEF program.

Our comprehensive approach to LED street light conversions includes:

- asset auditing and condition assessment,
- lighting design and engineering,
- procurement and installation of LED luminaires, control systems, and smart city solutions,
- long term operation and maintenance services, and
- financing services, from municipal leases to P3 structures

Over the past five years Ameresco has emerged as a leader in the design and implementation of turnkey LED street light solutions, with thirty-four projects representing nearly 500,000 street lights installed, in construction or awarded to date. We have proven expertise in designing and implementing street light conversions that both deliver outsized energy savings and eliminate over-lighting and other issues that have generated resident complaints in some cities.

For example, Ameresco's conversion of 20,000 street lights for the City of Tucson reduces energy consumption by 75%, not including additional control-based energy savings, and will reduce maintenance costs by some 80%. The project was designed in close cooperation with the local astronomy community, a major local economic driver, and utilizes 3000K luminaires to minimize light emitted in the blue spectrum, which can contribute to light pollution and has been associated with negative health effects by the American Medical Association. The end result of this effort is an energy efficient LED lighting system that emits some 20% less blue spectrum than the HPS system it replaces.

For our Tucson design we developed a comprehensive GIS street light asset database that includes the characteristics of each pole and luminaire as well as data associated with their lighting context, such as street classification, pedestrian conflict level, lane numeration, road geometry, and

pavement reflectance. This enabled a more granular design that uses the most appropriate LED luminaire for each lighting context. In addition to increasing energy savings, it reduces or eliminates over lighting, and light trespass. Combined with lower color temperature luminaires, it has been shown to facilitate LED conversion designs that are readily accepted by the public.

The Q&A released by the City as part of the RFI process indicates the City intends to use its own crews to install new LED street lights. We recommend the City reconsider this approach, as it will likely result in a much longer installation period due to the City's more limited crew resources in comparison to those available in the private sector. Ameresco often uses multiple installation sub-contractors to accelerate the installation process and enable our customers to realize the energy savings and other benefits of LED street lighting as rapidly as possible.

We recommend Current's high performance Evolve LED street light luminaires for cobra head replacements. They offer very high efficacy (lumens of light output per watt of energy consumed), use recessed LEDs and high quality optics to reduce glare and put light where it is needed with excellent uniformity, and have a flat glass lens to reduce dirt depreciation (as indicated by a recent IES report). For decorative street lights, new luminaires or high quality LED retrofit kits may be appropriate.

LED Street Light Management Recommendations

When considering the networking requirements for a centralized street light management system, the core need is a system that can provide secure, economical, pervasive, city-wide connectivity with moderate bandwidth requirements. In addition, networks designed to manage a variety of end-points, including street lights, are preferred over standalone street light management systems that do not offer a path to other smart city applications.

Silver Spring Networks is one of the largest providers of network platforms for critical infrastructure, controlling more than 25 million end points, transforming energy grids for utilities around the world and providing an Internet of Things (IoT) network for cities that is highly reliable and secure. The Silver Spring solution only requires one gateway device per 5K-10K endpoints and is highly adept at routing around obstacles such as buildings or hills. The Silver Spring gateways can be connected to the cloud via fiber, Ethernet or cellular and the location of the gateways on streetlight poles is highly flexible.

For Pittsburgh we recommend Silver Spring's Starfish platform, a Network-as-a-Service or NaaS solution that provides a highly reliable and secure low to medium bandwidth IPV6 mesh network that that can be deployed city-wide at low cost to connect street lights and other end points while also offering edge computing and an ecosystem of third-party applications and end-point devices.

With the Silver Spring network Street lights are managed with their StreetLight.Vision (SLV) central management system. Delivered as a Software-as-a-Service (SaaS), it is the de-facto standard for the smart streetlight market, in use by more than 500 cities around the world. SLV provides command, control (ON, OFF and stepless dimming), monitoring, alerting and many other features to manage street lights and other devices within a single web user interface. SLV supports a wide range of smart city devices, such as electrical vehicle charging stations, traffic cameras, environmental sensors, and more through its Open Smart City Protocol,.

Shared, Neutral-host Small Cell and Fiber Infrastructure

Following on the theme of "touch once, dig once", we recommend that the City consider the deployment of shared, neutral host small cell and fiber-optic infrastructure concurrently with the LED street light conversion. Working with Crown Castle, Ameresco can coordinate and manage the installation of this infrastructure with the LED street light conversion. The small cell infrastructure can be deployed using specialized street light poles that hide the equipment and connect to fiber that is currently available or installed by Crown Castle.

With approximately 40,000 towers and 18,000 small cell nodes supported by approximately 26,500 miles of fiber, Crown Castle is the nation's largest provider of shared wireless infrastructure with a significant presence in the top 100 US markets. Crown Castle's customers include all of the major wireless service providers (AT&T, Verizon, Sprint, T-Mobile), Federal, State and Local government, utility companies, backhaul providers, broadcasters, machine to machine operators and a variety of non-traditional customers.

Crown Castle specializes in shared, neutral-host infrastructure and fully supports Pittsburgh's vision for shared capacity on its infrastructure. The possibilities for sharing cross Crown's entire customer base, enabling the City to benefit from revenue opportunities from wireless service providers, content and technology companies. Further, in considering the City's long-term vision it is important to plan for future capacity for enhanced applications desired for the City's own use.

Crown is uniquely positioned to collaborate with Ameresco and the City. They are local and have existing assets that can be utilized for shared capacity, including towers, small cells and fiber. Crown can further review City asset locations and assist in determining where there are potential wireless needs. Designing and replacing (if needed) streetlights with the necessary future capacity and connectivity (fiber, power) increases the efficient and effective use of scarce capital resources. The foundational infrastructure that Crown delivers to its customers on a daily basis is the backbone that drives Smart Communities.

AT&T and Current

AT&T established an exclusive partnership with Current earlier this year to redefine smart cities for the digital age. This agreement brings together two global leaders with a singular focus to drive and support the successful transformation of today's cities into smart cities. The highlights of this partnership include the following:

- AT&T is the exclusive reseller of Current's intelligent sensor nodes in the US and Mexico;
- Utilizing the AT&T Smart Cities framework, Current brings end-to-end software and hardware solutions to connect cities to the Industrial Internet; and
- AT&T and Current are already working together with the Cities of San Diego and Atlanta to transform existing street lighting into a connected digital infrastructure.

AT&T's smart cities solutions are built around the AT&T Control Center, a cloud-based Internet of Things (IoT) service platform that facilitates centralized mobile device management. AT&T Control Center helps manage mobile devices across multiple mobile network operator (MNO) networks. The solution has these key technology features:

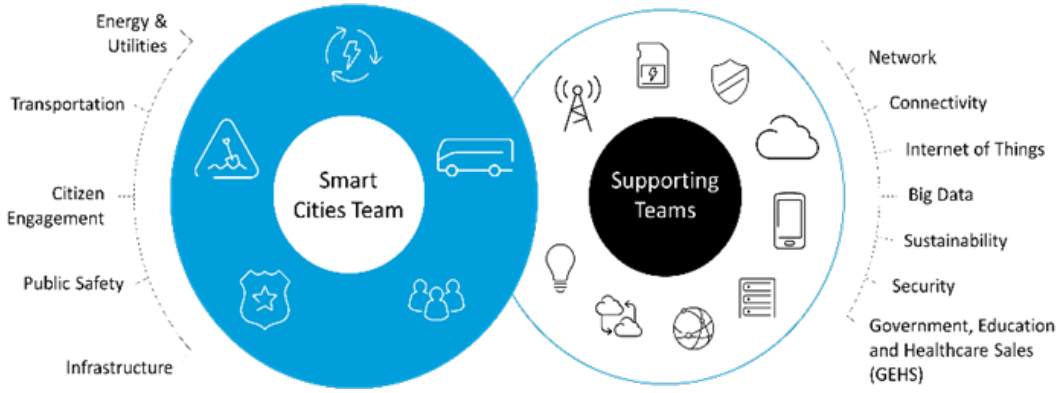
- AT&T Wireless Network— the nation's most reliable 4G LTE network with the most powerful LTE signal and fewest dropped calls.
- Global IP Backbone Network—carries more than 100 petabytes of data traffic on an average business day, and is one of the world's most advanced and powerful IP backbones, carrying a full range of IP-based services, including wireless data, business video, data and voice services, Internet access, and other services. It also incorporates Multiprotocol Label Switching (MPLS), which supports a full range of applications over a single IP network infrastructure with the highest levels of service quality.
- Collaboration Tools—allows customers to set process requirements, customize policies, and help enable distributors and customers to manage connected devices, making it easier to launch new services and devices with preset rules and policies.

AT&T is uniquely structured and equipped to address Pittsburgh's smart city needs, bringing deep functional expertise and the ability to pair seamlessly with Ameresco and other firmss with complementary expertise and capabilities. As a communications and IoT leader, AT&T has the experience and skills to assist in the deployment of the integrated smart city solutions contemplated in this RFI response.

Here are some of the key resources that AT&T brings to the team:

- Smart Cites Framework: AT&T has the resources, ecosystem alliances, networks, platforms, analytics capabilities, and people with deep IoT experience to execute the strategy of bringing to life truly connected communities and cities – in transportation, utilities, infrastructure, public safety and citizen engagement.
- Connectivity: AT&T is the preeminent global telecommunications company. Their portfolio of connectivity solutions includes all the connectivity choices needed for a dynamic smart city deployment, including cellular, microwave, satellite and wireline solutions, supplemented by an industry leading roadmap for next generation technology (e.g. low-power wireless connectivity, Ethernet and on-demand cloud solutions).
- Security: AT&T's deep expertise in security design and incident response and their collaborative ecosystem enable integrated security solutions that help customers detect and minimize threats quickly and efficiently.
- Government Solutions Team: To ultimately bring these groups together AT&T has dedicated teams designated for a particular city's mission and objectives in mind when approaching potential solutions. This team has the knowledge and power to bring in the appropriate AT&T partner when and where needed.

The following graphic presents an internal structure developed and tested through the AT&T Spotlight City programs.



AT&T Smart Cities has successfully vetted many companies and technologies to select a best of breed ecosystem of solutions capable of meeting the needs of our many Spotlight Smart Cities which include but is not limited to Charlotte, New York, Chicago, Dallas, Miami-Dade and Portland. AT&T has cultivated strategic relationships with the right companies with the right technology to deliver holistic solutions to these cities.

Deployment Plan

The most appropriate deployment plan will depend on the City's objectives and the specific solutions selected. The LED street light conversion and Silver Spring umbrella network should be completed together to minimize installation and commissioning costs (and touch each pole once). If small cell and fiber solutions are included, this will likely require the installation of specialized small cell street light poles and should be closely coordinated with the LED street light conversion.

The development of specific smart city applications that utilize these and other assets will clearly benefit from an initial pilot and thorough testing and development prior to large scale deployment. That said, the experience Ameresco, Silver Spring, Current and AT&T have gained vetting smart city technologies in other cities can speed the process of selecting and testing smart city applications for Pittsburgh.

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Technical Specifications

Given the page limitations of this RFI response, we have provided a high level overview. Regarding the correlated color temperature (CCT) of the LED luminaires, we recommend 3000K CCT or less. Without commenting on the scientific merits of the blue spectrum health concerns raised by the AMA and others, in our experience lower CCT LED luminaires are more readily accepted by the public. Although some luminaire efficacy is sacrificed by the use of lower CCT luminaires, the reduction in efficacy has and will continue to shrink as chip manufacturers respond to the general trend towards lower CCT luminaires.

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Operational Considerations

The GE luminaires we recommend have a 10 year warranty and an L-70 of 100,000 hours or more (L-70 is the point at which the luminaire's lumen output is expected to have depreciated 30%, a point at which it would be replaced as it will no longer be meeting light level requirements). This equates to an expected life in excess of 20 years based on annual dusk to dawn operation of 4200 hours per year. The useful life can be extended by using control-based techniques such as dimming or constant lumen output or CLO. CLO involves dimming the luminaires the amount of the light loss factor in the early years of their use and then ramping their output up in response to dirt and lumen depreciation.

The control nodes for the Silver Spring Network are also warrantied for 10 years.

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Business Model

The City's share of the revenue generated by Crown will depend on a variety of factors.

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Evaluation

Again, given the page constraints associ ated with this RFI response we have provided only a high level overview of our recommendations. Should the City move forward with an RFQ or RFP, we recommend that proposed LED conversion solutions be evaluated based on their ability to meet the City's specification, including light level requirements, and lifecycle cost analysis that includes the initial cost of the luminaires and the cost to operate them over time, including both energy costs and maintenance costs (including required cleaning schedule to maintain lumen output).

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Cover Letter

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