HINCKLEY ALLEN

50 Kennedy Plaza, Suite 1500
Providence, RI 02903-2319
p: 401-274-2000 f: 401-277-9600
hinckleyallen.com

Adam M. Ramos
aramos@hinckleyallen.com
Direct Dial: 401-457-5164

March 23, 2015

Via Electronic Mail and Hand Delivery

Luly E. Massaro, Commission Clerk
Rhode Island Public Utilities Commission
89 Jefferson Boulevard
Warwick, Rhode Island 02888

Re: Docket No. 4513 – Revised Street Light Metering Pilot Proposal

Dear Ms. Massaro:

Enclosed for filing in the above-referenced matter are an original and nine (9) copies of The Narragansett Electric Company d/b/a National Grid's (National Grid or the Company) Revised Street Light Metering Pilot Proposal.

This filing is the result of several weeks of discussions and negotiations between the Company, the Rhode Island League of Cities and Towns (the League), the Washington County Regional Planning Council (WCRPC), the Rhode Island Office of Energy Resources (OER), the Rhode Island Department of Transportation (DOT), and the Rhode Island Division of Public Utilities and Carriers (the Division) (collectively, the Parties). After the Company filed its original proposal with the Rhode Island Public Utilities Commission (PUC) on October 23, 2014, and the League and WCRPC objected to that proposal, OER raised the possibility of incorporating a pilot project it was involved in with DOT for the installation of light emitting diode (LED) street lights into the Company's pilot as a means of reducing the cost and duration of the pilot. After OER made that suggestion, the Parties agreed to meet and discuss whether incorporating the OER/DOT pilot might make it possible to develop a revised pilot upon which all the Parties could agree. The Parties met on January 7, 2015 to discuss this possibility and agreed that reaching agreement appeared possible. Accordingly, the Parties agreed to meet further and to seek additional time from the PUC to work to develop and agreed-upon, revised pilot.

Following that meeting, National Grid developed a list of the critical issues that needed to be addressed in the pilot and circulated it to the other Parties. After a conference call to discuss that list of issues, the Parties agreed that it seemed likely that they would be able to negotiate an agreed-upon filing. Accordingly, the parties jointly sent a request to the PUC to postpone the

scheduled hearing in this docket to allow additional time for negotiations. That request asked for an extension until February 13, 2015 for the submission of a revised pilot proposal. As the Parties continued to work to negotiate a revised pilot proposal, it became apparent that the time period originally requested was insufficient, and the Parties jointly requested a subsequent extension of time until March 23, 2015 to file the revised pilot. At the time the Parties made this request, the Parties also reached agreement on a schedule to ensure sufficient time for all Parties to meaningfully review and respond to each of the other Parties' positions and proposals for revisions.

The enclosed Revised Street Light Metering Pilot Proposal is the result of these extensive discussions and negotiations. Through this process, the Company carefully considered all the input and positions of the other Parties, while also carefully assessing what needs to be accomplished through the pilot to satisfy the PUC's expectations for the pilot and for the Company to gather the necessary information from the pilot to implement a street light metering program, if warranted, at the conclusion of the pilot. As a result, this Revised Street Light Metering Pilot Proposal reflects significant changes that substantially reduce the cost and duration of the pilot, while also maintaining its integrity. In particular, the budget for the pilot is reduced from more than $3 million to only $441,000. Additionally, whereas the original pilot proposal called for a schedule lasting as long as 64 weeks, the revised pilot schedule anticipates completing the pilot in 53 weeks. Moreover, whereas the original proposal required the participation of four different municipal customers, the revised pilot requires the participation of only one municipal customer.

Although the Parties are in agreement on much of the revised pilot, it is the Company's understanding that the League, WCRPC, and OER remain in disagreement on two aspects of the pilot: (1) the inclusion of a municipal customer in the pilot, and (2) the method of cost recovery. The Company understands the position of the League, WCRPC, and OER on these aspects of the pilot; however, the Company maintains that these aspects of the pilot as reflected in this revised filing are critical to maintain the integrity of the pilot. Specifically, the Company must field test the street light metering technology in a municipal environment in Rhode Island to gather information about how the technology works in the varied topographical and environmental conditions presented in a municipality (*i.e.*, rural, urban, tree-covered, etc.), and to assess how the technology performs when the network is stressed in such an environment. The Company has carefully considered alternate proposals for how the Company might be able to obtain the information it needs through other means and has determined that there is no adequate substitute for gaining the experience of actually operating the technology in a municipality.

Although the pilot has changed significantly from the Company's original filing, the Joint Pre-Filed Direct Testimony of John E. Walter, Jeanne A. Lloyd, Jeffrey P. Martin, and Larry G. Durante, filed by the Company on December 10, 2014, supports this Revised Street Light Metering Pilot Proposal, generally (even though some of the particulars discussed in that testimony are no longer part of the pilot). In particular, pages 19-24 include the reasons described above as to why a municipal installation is critical to the pilot. If it would assist the

PUC, the Company can prepare additional testimony in support of this Revised Street Light Metering Pilot Proposal.

Thank you for your attention to this filing. If you have any questions, please feel free to contact me at (401) 457-5164.

Very truly yours,

Adam M. Ramos

AMR:cw
Enclosures

cc: Docket No. 4513 Service List (electronically only)

Docket No. 4513 - National Grid – Streetlight Metering Pilot Proposal
Service List updated 10/30/14

Name/Address	E-mail Distribution	Phone
Raquel Webster, Esq. Thomas Teehan, Esq. National Grid 280 Melrose Street Providence, RI 02907	Thomas.teehan@nationalgrid.com celia.obrien@nationalgrid.com Joanne.scanlon@nationalgrid.com Jeanne.lloyd@nationalgrid.com John.walter@nationalgrid.com Raquel.Webster@nationalgrid.com	781-907-2121 401-784-7288
Leo Wold, Esq. Dept. of Attorney General 150 South Main St. Providence, RI 02903	Lwold@riag.ri.gov Jmunoz@riag.ri.gov dmacrae@riag.ri.gov john.spirito@dpuc.ri.gov James.lanni@dpuc.ri.gov joseph.shilling@dpuc.ri.gov Al.contente@dpuc.ri.gov Steve.scialabba@dpuc.ri.gov	401-274-4400 Ext. 2218
Richard Hahn LaCapra Associates One Washington Mall, 9th floor Boston, MA 02108	rhahn@lacapra.com	
Seth H. Handy, Esq. (for RILCT / WCRPC) HANDY LAW, LLC 42 Weybosset Street Providence, RI 02903	seth@handylawllc.com	401-626-4839
Dan Beardsley, Executive Director RI League of Cities and Towns (RILCT) One State St., Suite 502 Providence, RI 02908	dan@rileague.org peder@rileague.org	401-272-3434
Jeff Broadhead, Executive Director Washington County Regional Planning Council (WCRPC) 344 Main St., Suite 202 Wakefield, RI 02879	jb@wcrpc.org	401-792-9900
Chris Kearns, Chief Program Development RI Office of Energy Resources (OER) One Capitol Hill, 4th Fl. Providence, RI 02808	Christopher.Kearns@energy.ri.gov Marion.Gold@energy.ri.gov Nicholas.Ucci@energy.ri.gov Danny.Musher@energy.ri.gov	401-574-9113
Daniel W. Majcher, Esq. (for OER) RI Dept. of Administration Division of Legal Services One Capitol Hill, 4th Fl. Providence, RI 02908	Daniel.majcher@doa.ri.gov	401-222-8880
R. Daniel Prentiss, P.C. (for EERMC) Prentiss Law Firm One Turks Head Place, Suite 380 Providence, RI 02903	dan@prentisslaw.com	401-824-5150
S. Paul Ryan (EERMC)	spryan@eplaw.necoxmail.com	401-289-0184

File an original & 10 copies w/: Luly E. Massaro, Commission Clerk Public Utilities Commission 89 Jefferson Blvd. Warwick, RI 02888	Luly.massaro@puc.ri.gov	401-780-2017
	Cynthia.WilsonFrias@puc.ri.gov	
	Todd.bianco@puc.ri.gov	
	Alan.nault@puc.ri.gov	

The Narragansett Electric Company
d/b/a National Grid

Revised Street Light Metering Pilot Proposal

March 23, 2015

Submitted to:

Rhode Island Public Utilities Commission
RIPUC Docket No. 4513

Submitted by:

nationalgrid

TABLE OF CONTENTS

Abbreviations **1**
Executive Summary **2**
1. Introduction **5**
2. Scope **5**
2.2 Stage 1 – Phase 1: Laboratory Testing 6
2.3 Stage 1 – Phase 2: Field Testing 6
2.4 Stage 2 – Phase 1: Information System Integration Study 6
2.5 Stage 2 – Phase 2: Metered/Unmetered Bill Comparison 7
3. Meter Technology Overview **7**
3.1. Company Standard Meters 7
3.2 Network-Controlled Nodes 7
3.2.1 Sunrise Technology OpenGrid Light Control Node 8
3.2.2 SELC External CMS Module 8
3.2.3 Cimcon Model iSLC-3100 Controller 8
4. Network Application Overview **8**
4.1 Network Security 10
5. Meter Testing **12**
5.1 Revenue Grade Meter Accuracy 12
5.2 Industry Testing Standards 12
5.3 Sample Population 12
5.4 Existing Company Meters 12
6. Metering Pilot Logistics **13**
6.1 Municipal Questionnaire 13
6.2 Municipal Qualifications 13
6.3 Independent Consultant Partnership 13
6.4 Test Location Orientation 14
6.5 Testing Plan 14
7. Methodology **15**
7.1 Stage 1 Phase 1 – Laboratory Testing 15
7.1.1 Individual Device Testing 15
7.1.2 Networked Device Testing 15
7.2 Stage 1 Phase 2 – Field Testing 15
7.2.1 Test Location 1 – DOT Pilot Phase 1 16
7.2.2 Test Location 2 – DOT Pilot Phase 2 16
7.2.3 Test Location 3 – DOT Pilot Phase 3 16
7.2.4 Test Location 4 – Participating Municipality 17
8. Monitoring Plan **19**
8.1 Meter Read Retrieval 19
8.2 Node Failure Modes 19
8.3 Application Software 19
8.4 Stage 2 Phase 1 – Information System Integration Study 19

TABLE OF CONTENTS

8.4.1 Network System – Functional Assessment Summary 20
8.4.1.1 Meter Data Services (MDS) Interface 20
8.4.1.2 Geospatial Information System (GIS) Interface 20
8.4.1.3 Meter Inventory System Interface 20
8.4.1.4 Customer Service System – Outdoor Lighting Interface 21
8.4.1.4.1 Inventory Record Interface – Meter/GPS Information 21
8.4.1.4.2 Investigation Order Interface – Operation Problems 21
8.4.2 Customer Service System – Billing 21
8.4.2.1 Interface Requirements 21
8.4.2.2 Default Meter Data 21
8.4.3 Ancillary Control Functionality 21
8.5 Stage 2 Phase 2 – Metered & Unmetered Bill Comparison 21
9. Pilot Cost Recovery 22
10. Pilot Schedule 23
11. Pilot Cost Estimate 24
Attachments 25
Attachment A – Municipal Survey Questionnaire 26
Attachment B – Rules Prescribing Standards for Electric Utilities 33
Figures 39
Figure 1 - Sunrise Technology OpenGrid Light Control Node 40
Figure 2 - SELC External Control Module 41
Figure 3 - Cimcon Model iSLC-3100 Controller 43
Figure 4 – Cimcon Lighting Network 45
Figure 5 – Silver Spring Network, Inc. 46
Figure 6 – DOT Pilot Phase 1 (I 295 / Rt 44 – Exit 7 Smithfield) 47
Figure 7 – DOT Pilot Phase 2 (I-295 / Rt 146 North & South Project) 48
Figure 8 – DOT Pilot Phase 3 (Park & Ride Locations) 49

Abbreviations

AMR	Automated Meter Reading
ANSI	American National Standards Institute
CMS	Central Management System
CSS	Customer Service System
DC	Direct Current
ERT	Encoder Receiver Transmitter
FTP	File Transfer Protocol
GIS	Geodetic Information System
GPS	Geographical Positioning System
HID	High Intensity Discharge
HPS	High Pressure Sodium
IC	Integrated Circuit
ID	Identification
IDM	Interval Data Message
IEEE	Institute of Electrical and Electronics Engineers
IP	Internet Protocol
IPv6	Internet Protocol version 6
IS	Information Systems
ISO	International Organization for Standardization
JMS	Java Message Service
LED	Light Emitting Diode
MDMS	Meter Data Management System
MDS	Meter Data Services
MIS	Meter Inventory System
MOU	Memorandum Of Understanding
OSI	Open Systems Interconnection model
PKI	Public Key Infrastructure
PNNL	Pacific Northwest National Laboratory
PUC	(Rhode Island) Public Utilities Commission
RF	Radio Frequency
SCM	Standard Consumption Message packet format
SCP	Secure Copy Protocol
SFTP	Secure File Transfer Protocol
SSN	Silver Springs Network, Inc.
TESCO	The Eastern Specialty Company

Executive Summary

The Narragansett Electric Company d/b/a National Grid (National Grid or the Company) proposes a pilot study to evaluate new metering technology for its compatibility with street lighting applications. Currently, the Company offers street lighting as an unmetered service that relies on fixed operating schedules and industry-standard light source wattage ratings to determine energy consumption.

The pilot will review the accuracy and capabilities of various integrated circuit (IC) meter technologies available for street lights. Metering technology for street lights may be helpful in providing utilities with actual time-of-use energy consumption and municipalities and other street light customers with greater information for operational decision-making. The question is whether the added information is sufficiently valued by customers and accurate enough from a metering perspective. The pilot will provide experience that can address these issues for both the street lighting customers and the Company.

The Company will test the capability of various IC meter technologies by comparing actual field measurements against a sample group in a controlled environment. The Company intends to accomplish the following tasks with the metering pilot:

1. Verify the meter manufacturer's test results;
2. Confirm the operational performance of the meters as presented by the manufacturers through testing by National Grid in a controlled environment using appropriate sample sizes of each meter (~6 units of each manufacturer's meter type/grade);
3. During the testing referred to in No. 2 above, National Grid will also evaluate the technical and communication capabilities of each meter associated with their respective communication networks;
4. The aggregate of all IC meters to be field tested (~2000 units) will be an appropriate sample quantity to provide results that meet established industry testing standards.

The pilot will field test the various IC meter technologies on light emitting diode (LED) outdoor lighting equipment. The tests will establish a baseline of energy consumption data relative to recognized operating schedules. Laboratory and field testing of network-controlled IC meter technology will determine meter accuracy and reliability during both laboratory simulations and actual field operating conditions. The laboratory and field testing will use communication networks to gauge the opportunities and complexities that result from the use of this infrastructure to manage remote street light metering. The Company will assess information systems capabilities to determine the changes that would be required to integrate this network-controlled IC meter technology with the Company's existing computer systems.

In addition, the Company will conduct a comparison of meter data from the field pilot and the Company's present unmetered tariff energy consumption calculation model. This evaluation will provide findings necessary for the Company to determine the relative accuracy of the present unmetered energy calculation approach. A simulated billing calculation will provide the comparative analysis. The Company's billing system will not be altered during the pilot because one of the purposes of the pilot is to determine what changes the Company would have to make to its data management and billing systems to accommodate the unique remote street light metering applications.

The Company proposes to partner with the Rhode Island Department of Transportation (DOT) for a majority of the field testing portion of the pilot. Field testing will utilize street lighting infrastructure and network-control applications that are currently being evaluated in three separate DOT pilots. The Company will monitor and assess the independent IC meter technology performance, communication network operation, and related data transmission functionality of the networked intelligent wireless street lighting control equipment installed as a part of the DOT pilots. Additionally, the Company will collaborate with a single municipal customer that meets specific criteria as further described in Section 6 below to participate as part of field testing.

Throughout the laboratory and field testing stage of the pilot, the Company proposes to investigate similar utility managed network-controlled street lighting infrastructure applications and associated testing programs to expand its research base and further qualify test results. Several noteworthy system trials presently occurring are associated with San Diego Gas & Electric, Florida Power & Light, Georgia Power, Commonwealth Edison, Pacific Gas & Electric and Baltimore Gas & Electric. The Company anticipates that this effort will assist to validate key findings and/or concerns and will provide potential time/cost savings.

The Company expects that the pilot will require a minimum 12-month period. In an effort to accelerate the overall pilot schedule, several phases of the testing plan are proposed to be performed concurrently. The laboratory testing is proposed to occur while field measurements are obtained from operational DOT infrastructure applications. For equipment acquired for the pilot, field testing is scheduled to last approximately six months following the laboratory-controlled vetting process. The Company proposes the use of various street lighting applications within a single municipality to address specific physical and/or operational conditions which are not present in the DOT applications. However, the use of a selected municipal street lighting system may incur excessive processing time to facilitate appropriate ownership and infrastructure changes. Should the resultant equipment testing time be insufficient to achieve reliable/reproducible results, the municipal field testing phase of the pilot may be restructured to consider available alternatives. Through the pilot, the Company will evaluate whether the equipment procured and installed specifically for the pilot should remain in service at the end of the pilot period. A longer test could help the Company understand the potential reliability of networked intelligent wireless street lighting control equipment while it is

in service. Continuation of the pilot would be subject to the Rhode Island Public Utilities Commission's (PUC) approval and agreement by participating partners. At the conclusion of the pilot, equipment associated with field testing will be removed and replaced with equipment originally in service prior to the pilot unless pre-approved provisions or agreements are established. The Company will recover all costs it incurs in the performance of the pilot.

As directed by the PUC, the pilot does not address who will own the networked intelligent wireless street lighting control equipment, the integrated IC meter technology and/or all components of the communication network system for street lighting applications at the conclusion of this pilot. Nothing in this pilot should be construed to address those ownership questions. The ownership of any referenced equipment and systems to be used in the proposed pilot testing program is provided only to clarify responsibilities and related cost and asset transactions during the pilot.

1. Introduction

In Docket No. 4513, the PUC ordered the Company to perform a street light metering pilot to assess, among other things, the accuracy of metering for street lights. The Company proposes to evaluate several IC meters from different manufacturers, operating on individual network-control platforms, to assess the quality and reliability of the metered energy consumption measurements and the means by which the meter read information is communicated and received for billing applications. These individual networked wireless intelligent street lighting controls, each having integrated IC meter technology, will be referred to as "nodes" or "devices" throughout the remainder of the proposal except when specifically referencing the metering aspect. In those instances, the Company uses the term "IC meter."

In conducting the pilot, the Company will assess and compare network communications technology and its associated interface requirements with existing meter data management and billing systems. The Company will use the meter data obtained through field testing to analyze existing unmetered energy consumption calculation models that are currently used for street light billing.

The Company will collaborate with the DOT and one municipal customer, which will participate in the pilot relative to the installation of the nodes in diversified applications. The Company will obtain additional information from the pilot participants through interviews and discussions to obtain a mutual understanding of the roles and responsibilities of all involved parties throughout all phases of the pilot. These pilot participants will be required to sign a Memorandum of Understanding (MOU) to establish and/or clarify the expectations and obligations of all parties.

2. Scope

The proposed pilot has two defined stages. Each stage includes specific phases that focus on the following principal studies: Stage 1 - Phase 1: IC meter laboratory verification testing; Stage 1 – Phase 2: IC meter and communication network field application testing; Stage 2 – Phase 1: impact assessment of information system integration; and Stage 2 – Phase 2: comparative analysis of metered and unmetered energy consumption computations. The Company expects that the pilot will last approximately 12 months.

2.1 Project Start-Up

The Company will initially establish the project's management team, facilitate the procurement of materials and equipment required for the pilot and will finalize the required agreements with vendors, consultants, and the partners participating in the pilot.

2.2 Stage 1 – Phase 1: Laboratory Testing

Upon receipt of the required meter equipment from all represented manufacturers, the Company will begin the laboratory testing of the designated quantity of devices in compliance with industry meter testing standards. During laboratory testing, a complete technical evaluation of these devices will also be performed. This testing program will also include an end-to-end performance examination of the various network communication platforms to assess the complexities and limitations of each element of the integrated system prior to field testing.

2.3 Stage 1 – Phase 2: Field Testing

The Company proposes four independent field application deployments. During IC meter laboratory testing, the Company will begin facilitating the receipt of energy consumption data from the in-service DOT pilot projects. Additionally, the Company will start establishing the remaining DOT Park & Ride locations at several areas across the state and the individual municipal field testing applications. The initial development of this testing phase includes the field application engineering and network communication design work in collaboration with the respective lighting infrastructure partners and the participating network communication vendors. Following the establishment of the communication networks and successful commissioning of the tested devices, full scale field testing of the systems and devices will occur. Each of the four applications will expose the devices and communication network systems to diverse functional and/or operational characteristics. The Company proposes to stress test and evaluate the various qualified devices and examine the communication network infrastructure's performance in each field application. During field testing, the participating customers will have the opportunity to use the network capabilities of the remote-control technology to alter the operating schedule and light output characteristics of the luminaires in alignment with their desired lighting applications. The Company will use the meter data acquired during field testing to assess the reliability and accuracy of the IC meters during actual operational conditions.

2.4 Stage 2 – Phase 1: Information System Integration Study

Stage 2 of the pilot studies the information system and billing-related impacts associated with adopting the IC meter technology and the networked communication application. In Stage 2, Phase 1 of the pilot, the Company will use the information obtained from field testing to identify the requirements necessary to scope the information system interfaces so that all data transmission and/or systems are compatible with the appropriate Company data management and billing systems. This assessment will evaluate the data management of the communication network providers' central management system (CMS), the Company's meter data management system (MDMS), and the outdoor lighting management system and customer service system (CSS) for the billing application. The evaluation will include strategies to address data security and resolve corrupt or missing data.

2.5 Stage 2 – Phase 2: Metered/Unmetered Bill Comparison

After the Company gathers the IC meter energy consumption data during established operating conditions of specific lights, Stage 2, Phase 2 of the pilot will provide the Company the ability to perform comparative analyses of this IC meter data to the Company's existing unmetered energy consumption calculations. This assessment will further investigate the value of implementing and utilizing this metering technology and communication system to achieve more accurate billing. The Company will prepare a final report of the results of the pilot within approximately three months of the conclusion of Stage 2, Phase 2.

In the event the PUC directive modifies the pilot proposal as filed by the Company, the Company will provide a revised cost estimate and schedule. The Company proposes that all costs associated with this pilot will be recovered through a fully reconcilable mechanism from customers receiving service under the Company's outdoor lighting Rates: S-05, S-06, S-10, and S-14.

3. Meter Technology Overview

3.1. Company Standard Meters

Currently, the Company uses solid state integrated circuit (IC) electricity meters that are equipped with encoder receiver transmitter (ERT) radios for automated meter reading (AMR). The ERT produces a modulated radio signal that operates in an unlicensed band to transmit meter data over a short range. The Company retrieves the metered data through a meter data collection device installed in a Company vehicle. The protocol uses multiple access methods to avoid interference with other nearby meters and issues each individual meter's data in standard consumption message (SCM) format. SCM messaging contains single, cumulative meter reading values with the 'ERT ID', and additional 'checksum' and 'tamper flags' attributes.

The Company uses both new manufactured solid state meters and older electromechanical retrofit meters. Therefore, the Company works with four meter manufacturers that have ERT modules. Although some models of these ERTs support Interval Data Message (IDM) transmission, a fixed network is required to use such models. As such, the Company does not collect Interval Data from an AMR meter.

3.2 Network-Controlled Nodes

The nodes the Company will use in the pilot provide the means to apply a solid state IC energy consumption metering solution at a location immediately preceding the device that consumes the electrical energy. This meter technology is integrated within the intelligent wireless street light control device, which includes a wireless IPv6, IEEE 802.15.4g

communication platform dedicated to the individual network communication service provider and all the supplemental components required to facilitate ancillary control of the lighting equipment in a single operational assembly.

The single-phase multifunction IC meter that is utilized within the available network-controlled nodes (and which are only compatible with the proposed network providers) may be unique to a specific manufacturer. Therefore, the Company proposes to use and test several compatible nodes that include IC meter devices from different manufacturers. All IC meter equipment the Company receives from manufacturers must comply with applicable industry standards, including but not limited to ANSI C12.20-2010[1]. In addition, manufacturers will be required to submit supplemental qualifying independent laboratory test reports for each IC meter component.

These network-ready street light control devices use Direct Current (DC) voltage to operate the light sensor and provide secure wireless communications to the network. Additionally, these devices are capable of electric system diagnostics and independent lighting management applications such as standard dusk-to-dawn operations, variable dimming, and override commands. Below, the Company has identified the individual node products that it plans to use during this pilot.

3.2.1 Sunrise Technology OpenGrid Light Control Node
Technical specifications are provided in Figure 1.

3.2.2 SELC External CMS Module
Technical specifications are provided in Figure 2.

3.2.3 Cimcon Model iSLC-3100 Controller
Technical specifications are provided in Figure 3.

4. Network Application Overview

For the purpose of the pilot, the Company will use and evaluate two network communication platform providers. The network provider supporting the first two DOT pilot phases is Cimcon Lighting, Inc. (Cimcon). The other network provider that is proposed for the third DOT pilot phase and within the individual customer application is Silver Spring Networks, Inc. (SSN). The DOT pilot phases are identified in Section 6.4 below. These predetermined service providers will expedite the technology selection process so that the Company can meet the anticipated pilot schedule and deployment parameters. Each network provider uses a proprietary communication platform that supports an open protocol to utilize various end-point

[1] American National Standards Institute, Electricity Meters; 2.0% and 0.5% Accuracy Classes.

network-controlled device manufacturers. This open protocol will enable the Company to test several network IC meter devices, which are compatible with each of the two communication networks. Each network will also provide the Company with the communication and software tools necessary to manage and assess the meter data the Company will use for the comparative billing assessment. The Company has provided a summary of technical specifications of these individual networks in Figures 4 and 5.

The individual networks provide high performance wireless mesh communication technology. Utilizing true mesh architecture, each device can act as a relay for the other, resulting in a radio frequency (RF) mesh that is self-forming and self-healing. This network approach simplifies installation, improves network resilience, and reduces maintenance relating to communication issues.

A mesh architecture significantly reduces the volume of additional infrastructure equipment required to enable two-way communication to all lighting control devices. Each network uses "access points" or "gateways" (gateway) to support the collection and management of data from up to 5,000 nodes per gateway. These gateways are strategically located on utility infrastructure to communicate with the "Head End" software through the most appropriate backhaul communication channel – usually cellular or ethernet. Unlike concentrators utilized by other network providers, these are IPv6 routers that reduce response time and the likelihood of configuration errors and improve overall network reliability.

The installation of each node automatically establishes the two best mesh communication routes and validates these routes on a regular basis. This multi-signal routing reinforces the mesh network by automatically reconfiguring during incidents of localized power outages, individual damaged poles, or other obstruction interference.

The proposed networks are an open Ipv6 platform that is standards-compatible across each proprietary communication network, based on the layered approach to networking defined by the Open Systems Interconnection (OSI) model. Vendors offer various network-compatible products that leverage the value of the system while adding to the sustainability of the mesh application. The ANSI standards-based control nodes can be used universally with the majority of luminaire manufacturers, provided that each node contains the appropriate communication network platform.

During the pilot, the Company proposes to use an existing contractual service agreement between DOT and Cimcon, and also to establish a separate relationship with Cimcon through an MOU for this pilot. This multiple-party collaborative approach will maximize the utilization of the existing DOT-sponsored Cimcon network, including any required end-to-end network support, professional services related to data acquisition, transmission and end-user training associated with the proprietary "LightingGale" centralized Streetlight Management System.

The Company also proposes an independent contract between the Company and SSN to provide and deploy a network that is complete with all hardware, software, and support services for locations within the DOT pilot's Phase 3 (see Section 6.4 below) and an individual municipal testing application. This solution will support approximately 400 Company-provided nodes with integrated SSN communication technology. SSN will design, own, and manage the end-to-end network, except the individual devices. This contract will include all professional services related to project management, field design, field network deployment support, network acceptance testing, and end-user training. The "StreetLight Vision" Central Management System (CMS) and the SSN Software Suite will support the network.

These proposed network service providers will provide endpoint monitoring, management and reporting, network management, and remote firmware upgrades. The DOT and individual municipal customer that participates in field testing will maintain specific access and secure privileges to the individual street light data management systems to manage and monitor the network-controlled street lights in their respective footprint. The Company encourages each participant to use the street lighting control functionality of these networks to diversify the scheduled operation of the street lights to vary the energy consumption that will be measured by the associated IC meters.

4.1 Network Security

Due to issues relating to security breaches, networks are often subject to security threats, which include malicious operation of interconnected remote devices and/or data transmission or storage corruption. Therefore, pilot participants must recognize that security is a moving target. As new products are introduced to the market, people who seek to breach security are offered new and more powerful tools to exploit weaknesses. The proposed networks will be evaluated regarding their architectural approach to security, which has been integrated throughout their respective hardware, software, and transaction processing and data communications.

During the pilot, National Grid is attempting to provide both a reliable and secure solution by carefully choosing diverse technologies, processes, and approaches with adequate security measures. However, National Grid recognizes that its limited exposure and selection opportunity during the pilot will create challenges with choosing a solution that is effective, efficient, and easy to adopt. Therefore, National Grid will place great emphasis on technologies that demonstrate best practices and a high degree of architectural discipline.

A key element to the Company's implementation of the pilot and maintenance of Information Systems' (IS) security is the existing IS Security Policies and Standards at National Grid. These standards are based on many factors, including current and planned network structures, information and control flows, potential security risks, and available technical security solutions. During the pilot, the Company will evaluate the following security issues:

- Availability: avoid denial of service
- Integrity: avoid unauthorized modification
- Confidentiality: avoid disclosure
- Authenticity: avoid spoofing/forgery
- Access control: avoid unauthorized usage
- Audit ability: avoid hiding
- Accountability: avoid denial of responsibility
- Third- party protection: avoid attacks on others
- Segmentation: limiting the scope of attacks on the solution
- Quality of Service: Maintaining a reasonable latency and throughput

National Grid's approach to IS security is the onion approach, also known as "defense in depth." The inner layers, or zones, of a network, where communication interactions have been designed to flow freely between nodes, are referred to as trusted. Trusted network zones are kept small and independent. They are physically protected by limiting physical access to computers, network equipment, and network cables. In addition, through physical means, trusted network zones are limited to authorized persons. As a practice, when connecting a trusted network zone to an outer network zones, additional layers of security measures are applied, isolating the network zones from each other and providing additional security for the network as a whole.

National Grid uses firewalls, gateways, and proxies to control network traffic between zones of different security levels and filter out any undesirable or dangerous material. Traffic that is allowed to pass between zones is limited to what is absolutely necessary because each type of service call or information exchange translates into a possible route that an intruder may exploit.

These security mechanisms not only include defensive and preventive means, but are also used as a means for detection and reaction. By continuously monitoring a system for intrusion attempts, security personnel are alerted to potential threats and take suitable actions, such as isolating an inner network zone from outer zones. Additionally, the network leverages standard IP-based security technologies, which have been developed collectively by the best security firms across the world and are proven to be highly scalable and hardened over decades of worldwide use against a broad range of attacks.

The proposed network's baseline security capabilities include all functions to authenticate (who and what is allowed onto the system), authorize (given your role, what can you do), and encrypt (prevent snooping of content) communications across the mesh system, and maintain the highest level of availability. These capabilities span from the applications in the back office to each device in the field. Hardware-based mechanisms are leveraged to promote the security and acceleration of these functions including the use of Public Key Infrastructure (PKI) for its security certificates.

5. Meter Testing

5.1 Revenue Grade Meter Accuracy

At a minimum, the acceptable revenue-grade meter accuracy will comply with the Rhode Island Division of Public Utilities and Carriers' (Division) Rules Prescribing Standards for Electric Utilities (Division Standards). *See* Attachment B. In general, minimum meter accuracy will be established at 98.0% (2.0% error), as defined in the Division Standards. The Company also proposes to evaluate a small quantity of available devices providing revenue grade meter accuracy of 99.5% (0.5% error). The Company will test all devices to evaluate the manufacturers' established accuracy levels, as referenced with current independent laboratory reports of each product in addition to what is published within product specification literature.

5.2 Industry Testing Standards

The IC meters will be tested in accordance with industry-accepted ANSI C12.20 standards and as additionally defined in the Division Standards. Although specific testing and quality standards for this form of revenue grade IC meter device continue to be developed, the Company will use the referenced ANSI standards and testing protocols that are used for existing revenue grade metering to best accommodate the devices and the anticipated applications.

5.3 Sample Population

The minimum quantity of devices to be tested will be compliant with Division Standards or as otherwise specified in ANSI Z1.9 (Acceptance by Accuracy) standards defining the minimum acceptable testing population, whichever is more rigorous. At this time, the Company plans to use three node vendors to provide the products for the pilot. Each vendor is to provide devices meeting both the 2% and 0.5% accuracy levels. Approximate sample sizes for each manufacturer's accuracy level device is six for the individual testing and 50+ for the meter farm test application. Unless determined to be defective, these devices will be deployed in the field testing applications.

5.4 Existing Company Meters

The standard AMR meters pre-existing or planned to be installed as part of the various DOT pilots provide an opportunity for supplemental comparative energy consumption measurements. The Company will not conduct selective testing of these existing Company-standard AMR meters during the pilot. These meters will provide aggregate energy consumption values for all the operating street lights associated with each respective metered circuit within the DOT pilots.

6. Metering Pilot Logistics

6.1 Municipal Questionnaire

In connection with the pilot, the Company developed and issued an 18-question survey that focused on key, high level municipal street lighting issues. *See* Attachment A. The purpose of the questionnaire was to obtain a better understanding of each municipality's preferences concerning street lights and metering, and their future plans relating to the street light service they currently received from the Company. On October 6, 2014, the Company sent the questionnaire to various municipal leaders and critical services personnel. In the cover letter to the survey, the Company explained the potential benefits of the pilot. The main goal of the survey was to assist the Company with identifying the potential municipalities that could participate in the pilot. On or about November 5, 2014, the Company compiled the municipal customer feedback from the questionnaire. Originally, the Company's plan was to follow-up with selected municipalities to provide a clearer understanding of each selected municipality's expectations, including their interest and participation level in the pilot. However, based upon the limited quality of the questionnaire responses, the Company proposes to select candidate municipalities for consideration through current information received from the RI League of Cities and Towns, Washington County Regional Planning Council and the RI Office of Energy Resources. Following in-depth discussions with these candidate municipalities, a single municipality will be selected that can best support the goals of the pilot within the established cost and schedule parameters. In the event that one municipality cannot satisfy the field testing application criteria, other municipalities may be considered to participate in order to achieve the stated testing objectives. The Company will execute an MOU with the selected participating municipality(ies) to confirm the understanding and responsibilities of each party during the pilot.

6.2 Municipal Qualifications

The requirements for municipal participation in the survey are interdependent, and the Company will evaluate these requirements accordingly. In addition, the Company will consider other logistical factors such as geography, topography, and varied street lighting applications. The municipality's availability and commitment of resources to facilitate the street light infrastructure required to support the pilot is mandatory.

6.3 Independent Consultant Partnership

In addition to the relationships between the Company, the DOT, the participating municipality, and the two network-communication service providers, other partnerships may be established to facilitate the pilot. The Company proposes to partner with several consultants to provide expertise and neutral, independent oversight of key elements of the pilot. The Company plans to use the services of The Eastern Specialty Company (TESCO) to provide consultation on the Stage 1 Phase 1 (IC meter test program development, execution, and oversight). TESCO is a

recognized industry leader in meter test equipment for metering systems having provided expert consultation services on the subject since 1904. The Company also proposes to use the technical knowledge and research capabilities of the Pacific Northwest National Laboratory (PNNL) to provide independent consultation, supervision, and oversight of the pilot's Stage 1 Phase 1 and Phase 2 (meter testing). PNNL will serve as a technical resource to assist with milestone progress reporting and provide independent verification of the final project report.

6.4 Test Location Orientation

The Company proposes to partner with the DOT to use established or proposed street lighting infrastructure required to facilitate field testing of the network communication systems and devices. These DOT-designated test locations are referenced as:

- DOT Pilot Phase 1 – I-295 / Rt 44 – Exit 7 Smithfield
- DOT Pilot Phase 2 – I-295 / Rt 146 – North & South Projects
- DOT Pilot Phase 3 – Park & Ride Locations

These individual DOT pilot test locations are illustrated in Figures 6-8.

The Company proposes to select a municipal partner for specific physical, topographic, and/or other unique characteristics to perform additional field testing. The focus of this testing is to stress the capabilities of the network communication system relative to mesh integrity and data transmission reliability in the varied environments within the municipality (e.g., urban, rural, tree-covered, physical barriers, etc.) that differ from the interstate environments of the DOT pilot locations.

6.5 Testing Plan

The Company will manage the laboratory testing of the IC meter devices in compliance with established industry standards and protocols. A sample size of approximately 6 units each will be tested in accordance with ANSI Standard Z1.4 of each manufacturer's IC meter device to ensure compliance with ANSI C12.20. The Company will not perform laboratory testing of the standard AMR meters that may be associated with the pilot. These meters will have been prequalified as part of the Company's established meter commissioning process. In addition, as part of the Company's "Pick for Test" sampling program, the Company has annually reported these meter families to the PUC. Following assurance of ANSI C12.20 compliance, a "meter farm" controlled testing model will be used to test the network and interoperability of the devices including the transmission reliability of IC meter data. Finally, for the duration of the pilot, the successful candidate technologies will be field tested in a real world environment and the corresponding data analyzed in relation with Company meter data collection and billing systems.

7. Methodology

7.1 Stage 1 Phase 1 – Laboratory Testing

The laboratory testing of the IC meter devices will be in compliance with the latest industry standards. This testing will qualify various meter operating characteristics (e.g., accuracy, reliability, etc.) and validate the manufacturers' published performance results. Functional performance of the network-control system will also be evaluated with a focus on the interoperability with the Company's data management and billing systems.

7.1.1 Individual Device Testing

The Company proposes to employ TESCO to perform IC meter device testing in compliance with ANSI C12.20-2010 industry standards. These individual IC meter device tests will be performed on random samples of each of the three manufacturer's IC meter components as identified in Section 3.2. The proposed sampling quantity of 6 devices of each of the 2 meter accuracy levels from each of the 3 manufacturers will strive to comply with ANSI Z1.4 unless pilot specified resource limitations restrict conformance. The Company also will comply with ANSI Z540 Standard Laboratory Practices regarding all testing instrumentation and will ensure that test results conform to National Institute of Standards and Technology (NIST) requirements.

7.1.2 Networked Device Testing

TESCO will establish a functional "meter farm" environment to facilitate an end-to-end test program for the independent IC meters operating on unique communications networks. The sample of IC meters to be tested within this meter farm environment will be consistent with recommended industry practice as defined in ANSI Z1.4 unless pilot specified resource limitations restrict conformance. The Company will ensure that the systems under test will remain separate and unaffected by a compatible live system. The end-to-end test system will incorporate all components in a test environment to eliminate as many effects as possible that may impact field testing. In addition, the Company will perform testing prescribed by IEEE 519-1992 to assess the impact of the power inverter technologies used in these street light technologies.

7.2 Stage 1 Phase 2 – Field Testing

The devices will be deployed in designated areas corresponding with lighting infrastructure at the DOT pilot sites and within the geography of the individual municipal

partner. The Company proposes that these devices be strategically located to address specific street lighting illumination needs. In general, field testing will attempt to utilize areas that will effectively test the full spectrum of operations and functionality of the devices and associated communication networks. This testing is anticipated to include, but not be limited to, high volume traffic / high conflict areas, high speed / low conflict areas, commercial business districts, general urban areas, general suburban residential, and rural (individual intersection) areas. These locations will support the testing of the devices and network systems under various physical conditions to determine their limitations and reliability. These locations also have unique illumination requirements that allow the DOT and the participating municipality to utilize the network-controlled operating device to independently manage the localized illumination levels and operating schedule.

7.2.1 Test Location 1 – DOT Pilot Phase 1 (I-295 / Rte. 44, Exit 7 - Smithfield)

This location is a standard cloverleaf interchange providing ingress and egress off a limited access interstate highway to a state roadway as illustrated on Figure 6. The site provides a defined area within which there are two dedicated electric circuits to manage 154 underground-sourced LED street lights. Each circuit is constructed with a primary AMR ERT meter at the source. The DOT pilot for this location consists of testing four luminaire manufacturers within the defined space of each of the four cloverleaf ramps. DOT has commissioned the use of Cimcon as the designated communication network provider at this location and deployed the Cimcon device on each luminaire.

7.2.2 Test Location 2 – DOT Pilot Phase 2 (I-295 / Rte. 146, North & South Projects)

This proposed test area incorporates multiple general locations which define a significant linear profile of DOT highway involving 1,559 street lights. The DOT pilot is subdivided into two general zones representing North and South application areas. As noted on Figure 7, the quantities of street lights within each North and South zone are 783 and 776, respectively. DOT has commissioned the use of Cimcon as the designated communication network provider and will utilize Cimcon devices for all locations within DOT pilot Phase 2 area. The physical logistics of these locations promote the testing of the network mesh and/or gateway applications relative to information transmission between concentrated sites.

7.2.3 Test Location 3 – DOT Pilot Phase 3 (Park & Ride Locations)

This proposed test application incorporates ten distinct geographic locations having a total of 92 lights as detailed on Figure 8. These individual locations

represent unique islands or groups of street lights for the purpose of field testing. The Company proposes to collaborate with the DOT to commission SSN as the communication network provider for these test locations during the pilot. Additionally, the Company proposes to utilize a proportionate share of each of the two accuracy levels of the three IC meter device manufacturers previously identified which are appropriately configured to communicate with the SSN system. The individual location applications provide the DOT an opportunity to uniquely manage the lighting operation at each site. This portfolio of different operating schedules provides the Company with a greater variation of energy consumption data to evaluate IC meter performance. Each of these DOT sites will have lighting infrastructure constructed with an AMR ERT meter installed at the source of the lighting circuit. In addition to the testing of different IC meter manufacturers, the separation of sites will also test the limitations of the mesh network and/or gateway applications of the SSN system within an assumed "rural" application.

7.2.4 Test Location 4 – Participating Municipality (Various Locations)

This proposed test application would use the street lighting infrastructure within a specific municipality. The selection and participation of the municipality requires the timely solutions to key process issues associated with the transition of ownership of the existing street lighting system and the anticipated procurement/installation of new energy efficient street lighting technology. However, in recognition of the aforementioned transition process and as necessary to progress this phase of the pilot, the Company will make reasonable efforts to work with the municipality to address the transaction process and acquisition of the desired street lighting infrastructure to facilitate the achievement of the pilot objectives.

In the event all parties agree that the transaction process and subsequent infrastructure conversion is incompatible with the pilot for any reason(s), the Company and municipality would reach agreement on one of the following alternatives. Whereas the aforementioned conditions exist and there is mutual agreement regarding the applicable locations within the municipality to achieve the defined test objectives, the Company would procure and install LED lighting equipment in the test locations. The equipment procured by the Company is to be consistent with, but may not be identical to, the planned street lighting equipment proposed for future conversion by the municipality. In this manner, the Company can evaluate the performance of specific LED lighting equipment meeting Company specifications. The Company will utilize this lighting equipment in conjunction with the Company supported SSN system to perform the desired meter and communication network testing. The municipality will maintain

complete control of the lighting operations and schedule during the testing. During the pilot, the Company proposes to bill the municipality for the energy consumed by this equipment based upon usage under an applicable tariff. At the conclusion of the pilot, and based upon the aforementioned mutual agreement, the municipality would either: (a) acquire ownership of the Company owned/installed LED street lighting equipment at the installed cost, or (b) the Company replaces the LED street lighting equipment with the original equipment in-service prior to the pilot.

The acquisition proposal (a) described above proposes the Company transfer the billing of these street light locations to the applicable S-05 tariff after the asset transfer. The agreement would also address the SSN devices procured and tested by the Company within the purchase/transfer transaction. It is to be understood that any costs associated with this municipal testing phase which are not addressed in the equipment acquisition cost by the municipality are to be recovered as a cost of the pilot.

The replacement proposal (b) described above proposes that the Company incur the capital cost of the equipment and utilize the equipment for alternate purposes by the Company. However, all other associated installation and removal costs would be attributed to the pilot. Following re-installation of the original lighting equipment, billing will be restored to the applicable street lighting tariff.

The Company desires to deploy the two accuracy grade IC meters from the three manufacturers and utilize the SSN system within the participating municipality. The deployment will occur within specific geographic areas selected for their physical conditions which promote conflict or interference with the operation of the communication network. The Company plans to use approximately 300 IC meters within several geographic areas which have the potential to cause negative impacts upon the system, such as obstructed mesh communications due to buildings or vegetation interference. Additionally, the participating municipality will have the opportunity to create different operating schedules for each application area during the pilot.

Should all the desired test conditions not be available within a single municipality, the Company proposes to use alternate solutions in an effort to achieve the desired field testing application of this phase. These alternates may include, but not be limited to, the use of multiple municipalities having the necessary testing attributes or a suitable application within the Company's other service territories.

8. Monitoring Plan

8.1 Meter Read Retrieval

During the pilot, the Company will acquire meter read information using the preferred transmission and data capture methodology of the network service provider. The Company will use the communication channels consistent with each device. For the purpose of promoting further meter data comparison and assessment, the Company may obtain AMR ERT meter data from the existing metered street lighting circuits during the course of the pilot where available. The IC meter data will be obtained through the respective Cimcon and SSN networks and provided as requested through the use of each networks' metering head-end system.

8.2 Node Failure Modes

Various device failure conditions will be simulated to experience the automation and/or timeliness of the resolution. Failure modes that impact the meter data information will be assessed for the appropriate identification and/or resolution during data capture and transmission.

8.3 Application Software

The Company requires the use of the network communication providers' end use software to manage the access of all energy consumption metering measurements while the DOT and participating municipality will require similar access for the independent operation of the street lights. Access to the network-control software by all parties will be through a secure, proprietary communication channel as provided by each network service provider. The Company will only monitor and assess all the functional control applications provided by these software applications.

8.4 Stage 2 Phase 1 – Information System Integration Study

One requirement of the pilot is to evaluate the network capabilities for street lighting control and the impact on metering. In addition, the Company will assess the information system compatibility and interface requirements. The purpose of these studies is to provide the technical detail, estimated costs, and development timelines necessary to support the adoption, deployment, and integration of a street lighting network-control system which is independent of street light and network ownership. During the pilot, Cimcon and SSN network solution architects must be available to work with the Company's IS resources to scope the integration efforts required to fully assimilate the metering head-end system for meter data transmission with the Company's back-office applications.

Based on (a) the nature, scope, and limited time requirements of the pilot, (b) the undefined long-term ownership strategy, and (c) the cost associated with IS integration applications, the Company is not planning to program or integrate any information systems during the pilot. The full deployment of a network system(s) would require the integration of the metering head-end system and its data transmission with the Meter Data Management System (MDMS) in addition to various other back-office applications to fully address all aspects of customer billing.

During the pilot, the Cimcon and SSN metering head-end systems will provide a periodic file export detailing the metering data, which will allow the Company the ability to manage and manipulate that data for testing and shadow billing purposes. Both Cimcon and SSN have stated that their respective metering head-end systems have been successfully integrated with many MDMSs including the AMR meter applications utilized by the Company. It is further understood that both Cimcon's and SSN's typical integration method is via Web Services for control and retrieving small data sets. Large data sets (meter reads as an example) are normally delivered via JMS or other standard file transfer protocols (FTP, SCP, and SFTP are some examples).

8.4.1 Network System – Functional Assessment Summary

The automation of data transfer from the network CMS will require an assessment of interface requirements during the pilot. The Company will study the following information systems:

8.4.1.1 Meter Data Services (MDS) Interface
Evaluate the requirements necessary to facilitate the meter data and asset data alignment of accumulated meter data with the correct billing account and individual location-based facilities.

8.4.1.2 Geospatial Information System (GIS) Interface
If the nodes that are deployed for field testing have available Global Positioning System (GPS) coordinates, the IS requirements to automate the use of the individual node GPS coordinates will be assessed. These coordinates support the quality assurance location verification information on land-based mapping against the individual location based facilities inventory to further define the billing application.

8.4.1.3 Meter Inventory System Interface
Assess the requirements necessary to facilitate the recording and control of unique meter identification of these devices (or the IC meter) for the compliance of meter testing requirements.

8.4.1.4 Customer Service System – Outdoor Lighting Interface

8.4.1.4.1 Inventory Record Interface – Meter/GPS Information
Identify the modifications necessary to adopt a meter data repository to the existing street lighting asset inventory model. Identify the requirements necessary to facilitate the transfer of meter identification information and GPS coordinates to the location record repository.

8.4.1.4.2 Investigation Order Interface – Operation Problems
Evaluate the interface requirements necessary to automate the transfer of operational diagnostic information to initiate appropriate shadow Investigation Order creation to facilitate applicable outage repair and/or maintenance orders. Assess the necessary requirements to facilitate the retention of the diagnostic report in the 'History' file.

8.4.2 Customer Service System – Billing

8.4.2.1 Interface Requirements
Identify, scope and estimate the requirements to interface meter data information from the MDMS to a new repository for a new rate class billing application.

8.4.2.2 Default Meter Data
Assess the development requirements for default meter data estimation functionality to address data gaps, missed reads, dropped reads, etc.

8.4.3 Ancillary Control Functionality

Investigate and assess the additional functionality and benefits provided by a wireless network-control device including light source outage detection, under/over voltage detection, stray voltage detection, asset management, and the various maintenance functions including end of lamp life prediction and distribution circuit outage notification.

8.5 Stage 2 Phase 2 – Metered & Unmetered Bill Comparison

The Company proposes to perform a comparative assessment of customer billing as determined by the Company's Rate S-05 unmetered usage model and the actual energy consumption obtained from IC meters for the same defined street lighting operating schedules.

The actual-to-estimated energy consumption comparison will provide an approximate magnitude of the difference between unmetered estimated energy consumption and actual meter readings for the different lighting sources, their actual wattages, and operation schedules.

9. Pilot Cost Recovery

The Company proposes to recover all pilot costs through a fully reconciling cost recovery surcharge applicable to all customers on Rate S-05, S-06, S-10 and S-14. The surcharge will be calculated to recover the estimated pilot costs over a two-year period with reconciliation of actual expense and revenue at the end of the two-year period. Any over or under recovery of expense will be refunded to or recovered from customers over a subsequent 12-month period. The surcharge will be a per luminaire surcharge provided that the Company can implement a per luminaire charge for little or no incremental cost. Otherwise, the Company proposes that the surcharge be a per kWh charge.

10. Pilot Schedule

The Narragansett Electric Company
Docket 4513
Street Light Meter Pilot Schedule

Task Function	Week 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53
Regulatory Approval																																																					
Project Management Initiation																																																					
DOT MOU Agreement Development																																																				
Cimcon MOU Agreement Development																																																				
SSN Contract Development																																																				
Municipality MOU Agreement Development																																																				
PNNL MOU Agreement Development																																																				
TESC Services Contract Development																																																				
Municipal Participation Meetings																																																				
TESC Services Agreement Execution																																																				
SSN Services Contract Execution																																																				
Cimcon Services MOU Execution																																																				
PNNL MOU Agreement Execution																																																				
Cimcon Network CMS Access/Training																																																				
SSN CMS Access/Training																																																				
SSN Network Equipment Delivery																																																				
Meter Node Procurement/Delivery																																																				
Municipal Selection Process																																																				
Municipal MOU Agreement Execution																																																				
STAGE 1 - Phase 1 Laboratory Testing																																																				
Meter Node Test Samples Shipped - TESC																																																				
Manufacturer Meter Qualification Test Data Review																																																				
Laboratory Meter Set-up & Testing																																																				
Meter Farm System Set-Up																																																				
Meter Farm Testing																																																				
STAGE 1 - Phase 2 Field Application Testing																																																			
DOT Phase 1 - Exit 7																																																			
Collect & Monitor ERT Meter Data																																																			
Collect & Monitor IC Meter Performance Data																																																			
DOT Phase 2 - I 295																																																			
Collect & Monitor ERT Meter Data																																																			
Collect & Monitor IC Meter Performance Data																																																			
DOT Phase 3 - Park & Ride																																																			
SSN Communication Network Engineering																																																			
SSN / Control Device Installation																																																			
Collect & Monitor ERT Meter Data																																																			
Collect & Monitor IC Meter Performance Data																																																			
Municipal Test Sites																																																			
Municipal SL System Acquisition Process																																																			
Municipal Purchase Approval																																																			
Municipal Lighting Study Design																																																			
Municipal SL Equipment Bid Process																																																			
Municipal SL Service Contract Bid Process																																																			
SSN Communication Network Engineering																																																			
Municipal SL Equipment Contract Approval																																																			
Municipal SL Service Contract Approval																																																			
Municipal SL Equipment Procurement & Delivery																																																			
SSN Network Deployment																																																			
Municipal SL Equipment Installation																																																			
Meter Node Deployment																																																			
Communication Network Commissioning																																																			
Collect & Monitor IC Meter Performance Data																																																			
STAGE 2 - Phase 1 IS Interface Assessment																																																			
Network / Security Data Interface Assessment																																																				
MDMS Interface Assessment																																																				
CMS Interface Assessment																																																				
Billing System Interface Assessment																																																			
STAGE 2 - Phase 2 Comparative Billing Analysis																																																			
Assemble Comparative Meter Data																																																			
Meter/Unmeter Billing Analysis																																																			
PILOT CLOSURE																																																			
Summary Documentation - Develop Final Report																																																			
Pilot Decommissioning / Equipment Removal																																																			

11. Pilot Cost Estimate

The following table provides an estimate of costs to implement the pilot as identified in this proposal.

The Narragansett Electric Company
Street Light Metering Pilot Proposal
Docket No. 4513
Cost Estimate

Task Function	Labor	Materials	Contract	SubTotal	Comments
Corporate					
Project Management	$85,000			$85,000	Project Performance, Budget, Schedule, Reporting, Vendor Mgmt.
Administrative & General	$25,000			$25,000	Legal, Procurement, Clerical, Expenses
Pacific Northwest National Laboratories (PNNL)			$0	$0	
				$110,000	
Stage 1 - Phase 1					
Individual Meter Testing - TESCO			$86,000	$86,000	Priliminary Vendor Quote
Meter Farm Testing - TESCO			Included		
				$86,000	
Stage 1 - Phase 2					
DOT Phase 1 (Exit 7)			$0	$0	DOT Project
DOT Phase 2 (I-295)			$0	$0	DOT Project
Dot Phase 3 (Park & Ride)		$15,000	$61,500	$76,500	DOT Project - Company provides SSN (Vendor Quote)
Installation	$7,200	$4,200		$11,400	Company installs device and gateways
Removal	$5,400			$5,400	Company replaces device/removes gateways
Cimcon Network Services			$0	$0	MOU Agreement - DOT Contract
RI Municipality (TBD - Single)		$45,000	$18,500	$63,500	Municipal Purchase & Conversion, Company Provides SSN (Vender Quote)
Installation	$22,800	$800		$23,600	Company installs device and gateways
Removal	$14,600			$14,600	Company replaces device/removes gateways
				$195,000	
Stage 2 - Phase 1					
Information Systems Studies	$45,000			$45,000	Company/Contractor IS Services
				$45,000	
Stage 2 - Phase 2					
Billing Comparation Study	$5,000			$5,000	Company Regulatory Billing
				$5,000	
	$210,000	**$65,000**	**$166,000**		
			Pilot Total	**$441,000**	

Attachments

Attachment A – Municipal Survey Questionnaire – October 2014

Attachment B – Division Rules Prescribing Standard for Electric Utilities

Attachment A – Municipal Survey Questionnaire

Streetlight Metering Pilot Questionnaire – October 2014

Narragansett Electric Company[2] is requesting that you complete a brief questionnaire by clicking on the link below.

Completion of the survey will allow the Company to gather data concerning your community's interest in the metering pilot and metering technology described below. **Please complete this survey no later than Friday, October 10th**, so your responses may be used in formation of the pilot.

The Rhode Island Public Utilities Commission ("PUC") recently approved the Company's tariff for Customer-Owned Street and Area Lighting – S-05 (the "Tariff").The Tariff was filed in compliance with the Municipal Streetlights Investment Act, R.I.G.L. § 39-30-1, which allows a city or town to purchase the streetlight system from the Company.

After approving the Tariff, the PUC opened Docket No. 4513 for the Company to perform a pilot for the metering of streetlights owned either by the Company or a municipality. Therefore, National Grid will propose a limited pilot to assess the application and accuracy of metering technologies associated with street lighting energy consumption ("metering pilot"). This metering pilot will provide relevant data for all parties to determine whether the use of meters for streetlights is appropriate at this time. The metering pilot will also help the Company develop strategies for the use of meters for streetlights in the future.

Although the majority of streetlight installations have historically been unmetered and billed on a fixed calculation, there is new technology available that may make the use of meters now viable for streetlights. The metering pilot will propose that testing of the technology utilized in the metering pilot take place in both a controlled laboratory condition and in various physical environments.

In general, the metering pilot will propose the installation of various meter technologies on existing and high efficiency street lighting equipment, operated under controlled conditions and schedules. The pilot will use existing industry, and regulatory-approved revenue-grade meter technology (such as the meter used for your residence) to establish baseline energy consumption information. Representative samples of the newer metering technology, including any associated networking and communication requirements, will be deployed and tested under the same operating conditions as the standard meter technology. The results will be compared against the

[2]The Narragansett Electric Company d/b/a National Grid ("National Grid" or the "Company").

baseline information and provide additional comparison to the conventional and approved unmetered bill calculation model. Further testing of the advanced meter technologies will analyze the accuracy, reliability, quality, and security of the meter data collection, and transmission of the metered data to the Company's billing systems.

Thank you in advance for your time and attention. Please contact your National Grid Community Manager for any additional information regarding this matter.
A list of Community Managers is included for your convenience.

Attachment A – Municipal Survey Questionnaire

1. Would you like for your municipality to be considered for participation in National Grid's metering pilot project?

___ Yes
___ No
___ Don't know

2. National Grid's metering pilot provides the opportunity for municipalities to assess both the quality of newer lighting technologies and the application of varied operating schedules and conditions. Would you like your municipality to participate in a lighting quality study?

___ Yes
___ No
___ Don't know

3. Would you be willing to have your municipality participate in a lighting quality study connected to the metering pilot with municipal contribution for labor, product and/or financial resource support?

___ Yes
___ No
___ Don't know

4. If you purchase your lights, you may have more options in managing your lighting system than have previously been available. Please select the 3 most important factors when you make decisions about outdoor lighting issues for your municipality:

___ Public welfare (safety / security)
___ Liability (risk avoidance)
___ Actual energy consumption (metered)
___ Energy efficiency
___ Light performance (design)
___ Compliance with industry codes/standards
___ Product options/procurement
___ Cost
___ Aesthetics
___ Maintenance
___ Outage reporting

Attachment A – Municipal Survey Questionnaire

___ Technology
___ Lighting controls
___ Dark Sky compliance
___ Other, please specify:

5. How familiar are you regarding the following electric street lighting system issues? Please use the following scale: 1-Very Familiar; 2-Somewhat Familiar; 3-Neither Familiar, Nor Unfamiliar; 4-Somewhat Unfamiliar; 5-Not Familiar At All

___ Safety requirements
___ Industry and utility codes &standards
___ Lighting design criteria
___ Present lighting technologies
___ Electrical lighting system components
___ Lighting operation and maintenance
___ Lighting infrastructure construction and maintenance

6. How familiar are you regarding the following new lighting sources and control technologies associated with street lighting? Please use the following scale: 1-Very Familiar; 2-Somewhat Familiar; 3-Neither Familiar Nor Unfamiliar; 4-Somewhat Unfamiliar; 5-Not Familiar At All

___ Solid State Lighting (such as Light Emitting Diode, (LED))
___ Lighting metric standards
___ Human health effects of lighting
___ Physiological and vision effects
___ Adaptive operating controls and schedules
___ Communication networks
___ Meter standards and testing

7. How likely would you be to reduce light output or turn off streetlights during the night in your municipality if it resulted in overall cost savings?

___ Very likely
___ Somewhat likely
___ Neither likely nor unlikely
___ Not very likely
___ Not at all likely

Attachment A – Municipal Survey Questionnaire

8. Does your municipality currently have customer-owned street lights attached to a conventional electric meter (similar to that on a residential or commercial building)?

___ Yes
___ No
___ Don't know

9. Approximately how many metered streetlights do you have in your municipality?

10. Are you familiar with the Rhode Island General Law § 39-30-1, the Municipal Streetlights Investment Act, which allows a city or town to purchase the streetlight system from the electric utility?

___ Very familiar
___ Somewhat familiar
___ Neither familiar nor unfamiliar
___ Somewhat unfamiliar
___ Not familiar at all

11. What is your municipality's plan regarding purchasing the utility street lighting system as allowed under R.I.G.L. § 39-30-1?

___ Planning to purchase the system within a year
___ Planning to purchase the system within the next two (2) years
___ Planning to purchase the system within the next three (3) years
___ Evaluating the opportunity to purchase
___ Not planning to purchase the system within the next 3 years

12. *Programmer note: Only ask of those who plan to purchase utility streetlight system.* Which technology do you intend to install when you purchase the utility streetlight system? (Select all that apply.)

___ LED
___ Induction
___ Plasma
___ Other technology (specify)
___ I will evaluate all appropriate technologies

Attachment A – Municipal Survey Questionnaire

___ I do not plan to change the existing lighting equipment

13. *Programmer note: Only ask of those who plan to purchase utility streetlight system.* How soon after the transfer of ownership do you expect the conversion to be completed?

___ Months

14. *Programmer note: Only ask of those who plan to purchase utility streetlight system.* Many of the new street lighting technologies can accommodate dimming, with some having instant on/off capability. How likely are you to use these features in your municipality to save energy?

___ Very likely
___Somewhat likely
___ Neither likely nor unlikely
___ Somewhat unlikely
___ Not at all likely

15. *Programmer note: Only ask of those interested in a lighting quality study.* Which of the following would you like to have included in a lighting quality study? (Select all that apply)

___ Part-Night operation (on/off)
___ Dimming operation
___ Motion Sensor operation
___ Illumination level monitoring
___ Illumination pattern monitoring
___ Lighting layout design
___ Color temperature assessment
___ Drive current evaluation
___ Public feedback instruments
___ Visual assessment

16. *Programmer note: Only ask of those that chose to include Visual assessment in lighting quality study.* Which of the following visual assessment aspects would you like to have included in a lighting quality study? (Select all that apply)

___ Light level - visual acuity
___ Clear condition
___ Wet condition

Attachment A – Municipal Survey Questionnaire

___ Snow condition
___ Glare assessment
___ Shadow assessment
___ Color recognition
___ Contrast assessment
___ Physiological assessment (safety/security)

17. Is there another subject or issue that your municipality would like included in the metering pilot not mentioned in the questionnaire?

COMPLETED BY:

Name:
Title:
Municipality:
Email address:

Attachment B – Rules Prescribing Standards for Electric Utilities

Rules Prescribing Standards for Electric Utilities

STATE OF RHODE ISLAND AND PROVIDENCE PLANTATIONS
DIVISION OF PUBLIC UTILITIES AND CARRIERS

RULES PRESCRIBING STANDARDS FOR ELECTRIC UTILITIES

Date of Public Notice: June 18, 2004

Date of Public Hearing: July 26, 2004

Effective Date: September 21, 2004

The following rules and regulations, after due notice and an opportunity for hearing, are hereby adopted and filed with the Secretary of State this 1st day of September, 2004, to become effective twenty (20) days after filing, in accordance with the provisions of R.I.G.L. §42-35-4 and §39-3-33 (1990 Reenactment).

These rules and regulations supersede the Rules Prescribing Standards for Electric Utilities that have been in effect since May 1995.

Date September 1, 2004

Thomas F. Ahern, Administrator

Attachment B – Division Rules Prescribing Standards for Electric Utilities

RULES PRESCRIBING STANDARDS FOR ELECTRIC UTILITIES

I. APPLICATION OF RULES

A. These rules shall apply to every public utility as hereinafter defined doing business as such, or authorized to do so, within the State of Rhode Island.
B. These rules shall be amended or repealed, and applications therefore shall be made, in accordance with provisions of Title 42, Chapter 35 of the General Laws of 1956 entitled "Administrative Procedures".

II. DEFINITIONS

A. The term "Division" means the Rhode Island Division of Public Utilities and Carriers.
B. The term "Administrator" means Public Utility Administrator of the Division of Public Utilities and Carriers.
C. The term "public utility" shall mean and apply to every corporation, company, person, association of persons, their lessees, trustees, or receivers appointed to any court whatsoever, that now or hereafter may own, lease, operate, manage or control any electric plant or equipment or any part of any electric plant or equipment, within this State, for the production, transmission, delivery or furnishing of electricity, light, heat or power, either directly or indirectly, to or for the public.
D. The term "electric plant" shall mean all real estate, fixtures, equipment and personal property owned, controlled, operated or managed in connection with or to facilitate the production, generation, transmission, delivery or furnishing of electric energy.
E. The term "customer" shall mean and apply to every corporation, company, person, association of persons, their lessees, trustees or receivers appointed by any court whatsoever, that now or hereafter may be supplied with electric service by any public utility as herein defined.
F. The term "service" shall mean, in its broadest and most inclusive sense, the furnishing of electricity to a customer by a public utility.
G. The term "meter", without other qualification, shall mean a device or appliance for the measurement of electrical quantities to be used as a basis for determining charges by a public utility for furnishing or rendering electric service to a customer.
H. The term "creep" means the motion of the rotor of a meter with normal operating voltage applied and the load terminals open-circuited.

Attachment B – Division Rules Prescribing Standards for Electric Utilities

III. SERVICE PROVISIONS

A. Filing of Rates Schedules.

Schedules showing all rates, tolls and charges by a public utility shall be filed and kept open to public inspection in accordance with the provisions of Title 39, Chapter 3, Section 10 of the General Laws of 1956.

B. Application for Service.

An Applicant desiring service under a public utility's filed rate schedules may be required to make application in writing, in accordance with the forms prescribed by the public utility.

C. Information to Customers - Rate Selection.

1. Each public utility shall, upon request, provide a customer with such information and assistance as is necessary to enable the customer to secure the most advantageous rate or rates. Further, each utility shall inform the applicant of any service connection and/or installation charge to be applied to the bill. Each customer shall be responsible for selecting, and taking service at the most advantageous rate or rates.
2. Each public utility shall, upon request, explain to a customer the method of reading meters and how the billing is calculated.
3. Where special charges for construction, maintenance, replacement costs, expenses or overtime work are not specifically set forth in a utility's tariff, the utility shall, before performing non-emergency work, provide the applicant or customer with an estimate of charges to be levied, in writing if requested.
4. In addition, the utility shall make available free information concerning the utility's programs, services, rights and responsibilities, and complaint procedures for the general public.

D. Deposits.

1. A public utility, as security for prompt payment of a customer's indebtedness to it, may require a cash deposit or other collateral satisfactory to it before rendering, or as a condition of continuing to render service to such customer. This deposit shall not be more than the estimated bill for two times the normal billing period. Interest shall be paid on deposits held six (6) months or more in accordance with applicable rate schedules or the terms and conditions of the public utility. Deposits, plus accrued interest thereon, less any amount due the public utility, will be refunded upon termination of service. When a deposit is applied against an account that has been

Attachment B – Division Rules Prescribing Standards for Electric Utilities

terminated, interest shall cease to be accumulated on the balance at the date of termination.

E. Meter Reading and Bill Forms.

1. The metering equipment for each service shall be such as to register the number of kilowatt-hours (kwh) delivered during any period, and to the extent applicable, the number of Kilo-Var Hours (KvarH) and the Kilowatt (Kw) and Kilo-Volt Amperes (Kva) demand.
2. All service meters shall be read at regular intervals and on the corresponding day of each meter reading period insofar as practicable within regularly scheduled work days.
3. Bills shall be rendered at regular intervals and shall show the date of the current meter reading and the amount or quantity of service for the billing period; and shall also show any applicable discount or penalty date.
4. Each public utility shall keep an accurate account of all charges for service billed each customer and shall maintain records showing information from which each bill rendered may be readily computed.

F. Customer Complaints.

1. Each public utility shall make a full and prompt investigation of customer complaints made either directly or through the Division. A record of complaints received, other than those of a minor nature shall be kept for at least two years and shall show the name and address of the complainant, the date and character of the complaint and the disposition thereof.
2. Each public utility shall endeavor to keep its appointments. In the event cancellation of appointment is unavoidable, every reasonable effort should be made to promptly notify the customer.
3. During an abnormal service outage the utility shall make reasonable efforts to inform the general public about the areas affected, the progress of service restoration, and anticipated restoration schedules when available. Information for the general public shall be made through advisories to the news media. Business offices shall make similar information available to callers, using appropriate communications systems.

G. Change in Character of Service.

1. If a change in character of service to a customer is brought about for the convenience or benefit of the public utility, the public utility shall pay such part of the cost of changing the equipment of the customer affected as shall be

Attachment B – Division Rules Prescribing Standards for Electric Utilities

determined by mutual agreement. An equitable settlement would normally be on the following basis: Payment by the public utility to the customer of:
a) The cost of the customer's electrical utilization and equipment that is made obsolete, less proper allowance for depreciation.
b) The cost of installing the new equipment and removing the old, less the salvage value of such equipment as the customer retains.
c) The cost of making the necessary change in customer's wiring.

H. Discontinuance of Service

1. By Customer: A customer shall be required to give at least twenty four (24) hour notice of its intention to discontinue service in accordance with the provisions of the applicable rate or terms and conditions of service and shall be responsible for all charges until expiration of such notice period.
2. By the Public Utility:
a) Non-Payment of Bills. In accordance with the provisions of the applicable rate or terms and conditions of service, a public utility may require that bills be paid within a specified time after presentation. On and after thirty (30) days from the date of presentation service may be discontinued for non-payment provided written notice to the customer has been deposited in the U.S. mail at least ten (10) days prior to the date of discontinuance. In lieu of the discontinuance, or upon reconnection, the public utility may require payments at less than monthly intervals. If service is discontinued for non-payment, the public utility may make a reasonable charge for reconnection. Service must not be discontinued on a Friday, a Saturday, or the day before a holiday.

b) For Violation of Rules: No public utility shall discontinue service to a customer for violation of any rule unless it shall first have deposited in the U.S. mail written notice to the customer at least ten (10) days prior to the date of discontinuance advising the customer of the particular rule that has been violated, except that service may be discontinued immediately when continuance of the service would endanger life or property, or when ordered to do so by any governmental agency or official having jurisdiction.

c) For Fraudulent Use of Service: A public utility may discontinue service without notice whenever a fraudulent use of the service by the customer is detected.

Attachment B – Division Rules Prescribing Standards for Electric Utilities

IV. QUALITY OF ELECTRIC SERVICE

A. Standard Frequency - The standard frequency for alternating current distribution systems shall be sixty (60) Hertz, with permissible variations not exceeding maximum and minimum values of 60.3 and 59.7 Hertz.

B. Service Voltage - The following service voltage standards shall be maintained at the point where the electrical system of the supplier and the electrical system of the user are connected.

Table I [These values are ANSI C84.1 (1989). Values shall change if ANSI adopts new standards.] Established Standard Service Voltage	**Minimum Voltage**	**Maximum Voltage**	**Type of Service**
120	114	126	Single Phase
120/240	114/228	126/252	Single or Polyphase
208Y/120	197Y/114	218Y/126	Single or Polyphase
240	228	252	Single or Polyphase
480Y/277	456Y/263	504Y/291	Single or Polyphase
480	456	504	Single or Polyphase
600	570	630	Single or Polyphase
2400	2340	2520	Single or Polyphase
4160Y/2400	4050Y/2340	4370Y/2520	Single or Polyphase
12470Y/7200	12160Y/7020	13090Y/7560	Single or Polyphase

Figures

Figure 1 - Sunrise Technology OpenGrid Light Control Node

Figure 2 - SELC External Control Module

Figure 3 – Cimcon Model iSLC-3100 Controller

Figure 4 – Cimcon Lighting Network

Figure 5 - Silver Spring Network, Inc

Figure 6 – DOT Pilot Phase 1 (I-295 / Rt 44 - Exit 7 Smithfield)

Figure 7 – DOT Pilot Phase 2 (I-295 / Rt 146 - North & South Projects)

Figure 8 – DOT Pilot Phase 3 (Park & Ride Locations)

Figure 1 - Sunrise Technology OpenGrid Light Control Node

Technical Specifications

Voltage input: 105 – 305 VAC
Load rating: 15,000 + operation at 1,000W/1800VA
Surge Protection: 380 Joule MOV
Housing: UV stabilized impact resistant polycarbonate
Operating temperature: -30°C to +70°C
Humidity: 0% to 95%, non-condensing
Base: High temperature polycarbarbonate
Contact blades: Meets ANSI C136.10 (3-prong), ANSI C136.41 (Dimming)
Gasket: Cross linked polyethylene
Photosensor: Encapsulated phototransistor
Energy Metrology: 1% accuracy
Metrology Manufacturer: Analog Devices, Inc.

Figure 2 - SELC External Control Module

Technical Specifications

Metering Accuracy: 1% VRMS, IRMS, Watts.
Metering Range: 90 - 320VAC , 10A RMS (48 – 62)Hz Standard Unit.
430 – 530VAC , 5A RMS (48 – 62)Hz High Voltage version.
Metrology Manufacturer: ST Microelectronics
Turn ON Light Level: 1.5fc (Other levels available on request)
Housing Material: UV Stabilized Polycarbonate
Enclosure Sealing: IP67
Dimensions: 3.54in (90mm) Diameter- 3.43in (87mm)
Switch Ratio (OFF:ON) Ratios: 1.5:1 (Also available - 1:1, 2:1, 0.5:1)
Guarantee: 5 years*
Rated Load: 1800VA 3 x 400W
Maximum Load Current: 10 Amps

Operating Temperature Range: -40˚C to +70˚C (-40˚F to +158˚F)

Circuit Power Consumption: <2Watts Avg Power @120 VAC

Manufacturing Standard: EN ISO 9001:2008

Photo Control designed to: Applicable parts of BS5972;

Satisfy the following standards: EMC EN55015, EN61547 EN61000-3-2,EN61000-3-3, UL773 ,CSA C22.2

Operating Voltage: 105 – 305V (50/60Hz) Standard Unit, 480VAC high voltage version will also be available to special order

Options for controlling LED driver: DALI or 0-10VDC

Energy metrology: 1% accuracy, with per day, per hour, or per minute records and robust utility billing integration

Figure 3 - Cimcon Model iSLC-3100 Controller

Technical Specifications

Controller: Powerful 16bit Microcontroller
Real Time Clock: Battery Backed RTC
Storage Memory: 32Kbytes
Power Metering: Parameters Measured – Voltage, Current, Power Factor, Frequency, KW and KWh
Metrology Manufacturer: Cirrus Logic
Switching Capacity: 120V/240V/277V AC, 15 Amp Max
Power Supply: Universal AC input 85V-264V, 50/60Hz (277V AC option available)
Radio Communication: 2.4 GHz, IEEE 802.15.4
RF Data Rate: 250 kbps
Transmit Rate: +18 dBm
Receiver Sensitivity: -102 dBm
Network Type: Self-forming mesh network

Network Fault Tolerance: Self-healing mesh
Hardware: CSMA-CA Mechanism
Open Field Range: 5000 ft/1.5 km
Data Protection: 128 bit AES encryption
RF Transceiver Certifications: United States (FCC), Canada (IC) and Europe (ETSI)

Dimming Interface:

Analog Dimming (0-10V DC)
Maximum Current: 10mA
Protection: Output Short Circuit protection
PWM Dimming (10V p-p, 400HZ)
Maximum Current: 10mA (Sink)

Optional Features: Provision for two Digital Inputs and one Analog Input that can be used for motion based lighting controls, adaptive lighting or advanced lighting controls

Surge Protection: 320 Joule (12,000 Amps)

Enclosure:

Outdoor – CIMCON offers various options to accommodate different lighting fixtures requirements for different enclosure dimensions.
Material: Polycarbonate (other options available)
Installation: NEMA TwistLock

Operating Conditions: -20C to +70C / -4 F to +158 F (-40 C option available)
20% to 90% Rh non-condensing

Figure 4 – Cimcon Lighting Network

Technical Specifications

General:
Processor: 32bit ARM9 running at 250MHz
Real Time Clock: Battery backed RTC
Radio Characteristics: 2.4GHz, IEEE 802.15.4
Data Rate: 250kbps
Transmit Power: +19 dBm
Receiver Sensitivity: -103 dBm
Transmission Interval: 10 seconds or more
Network Type: Self-forming mesh network
Network Fault Tolerance: Self-healing mesh
Hardware: CSMA-CA Mechanism
Open Field Range: 5000 ft/1.5km
Data Protection: 128 bit AES encryption
RF Transceiver Certifications: United States (FCC), Canada (IC) and Europe (ETSI)
GSM Characteristics: Quad band 850/900/1800/1900 MHz
GPRS multi-slot class 10
GPRS coding scheme CS-1 to 4
Packet data up to 85.6K bps
Circuit-switched data up to 14,400 bps transparent and non-transparent
External antenna required
Storage Memory: 256MB XNAND Flash
Power: Universal AC input 85-264 VAC, 50/60HZ
Ports: Ethernet 10/100 Base-T, RS-232, USV2 480Mbit/s Host (2) / Device (1)
Operating Conditions: -20^{o}C to +70^{o}C / -4^{o}F to +158^{o}F (-40^{o}C option available), 20% to 90% Rh non-condensing

Figure 5 – Silver Spring Network, Inc.

Technical Specifications

General:

IPv6 transport
50 to 300 kbps data rates
Full, two-way communications
One-watt transmitter
Frequency Hopping Spread Spectrum (FHSS)
Multi-layer security policy enforcement and monitoring
Automatic data routing with self-configuration, auto-healing and redundant uplinks
Dynamic network discovery and self healing
Continuous neighbor monitoring and route calculation
Over-the-air configuration and firmware upgrades

Platform Processor: ARM 7
RAM: 8 MB
Flash: 16 MB
NAN Network Data rate: 50 to 300 kbps
Frequency range: 902 – 928 MHz
Spread spectrum: Frequency hopping
Transmitter output: 27 – 30 dBm (1 W)
Receiver sensitivity: -98 dBm for 10% PER
Protocol: IEEE 802.15.4g
Security Addressing: IPv6
Encryption: Advanced Encryption Standard (AES-128 or AES-256)
Security: Secure Hash Algorithm 256-bit (SHA-256) and RSA-1024 or ECC-256
Key storage: Secure NVRAM with tamper detection and key erasure

Figure 6 – DOT Pilot Phase 1 (I 295 / Rt 44 – Exit 7 Smithfield)

Details

154 total LED luminaires
NE Cloverleaf – 41 (American Electric Lighting luminaires)
SE Cloverleaf – 36 (Leotek luminaires)
SW Cloverleaf – 39 (General Electric luminaires)
NW Cloverleaf – 38 (Cree luminaires)

2 AMR ERT Meter Installations
Infrastructure installation completed December, 2014.

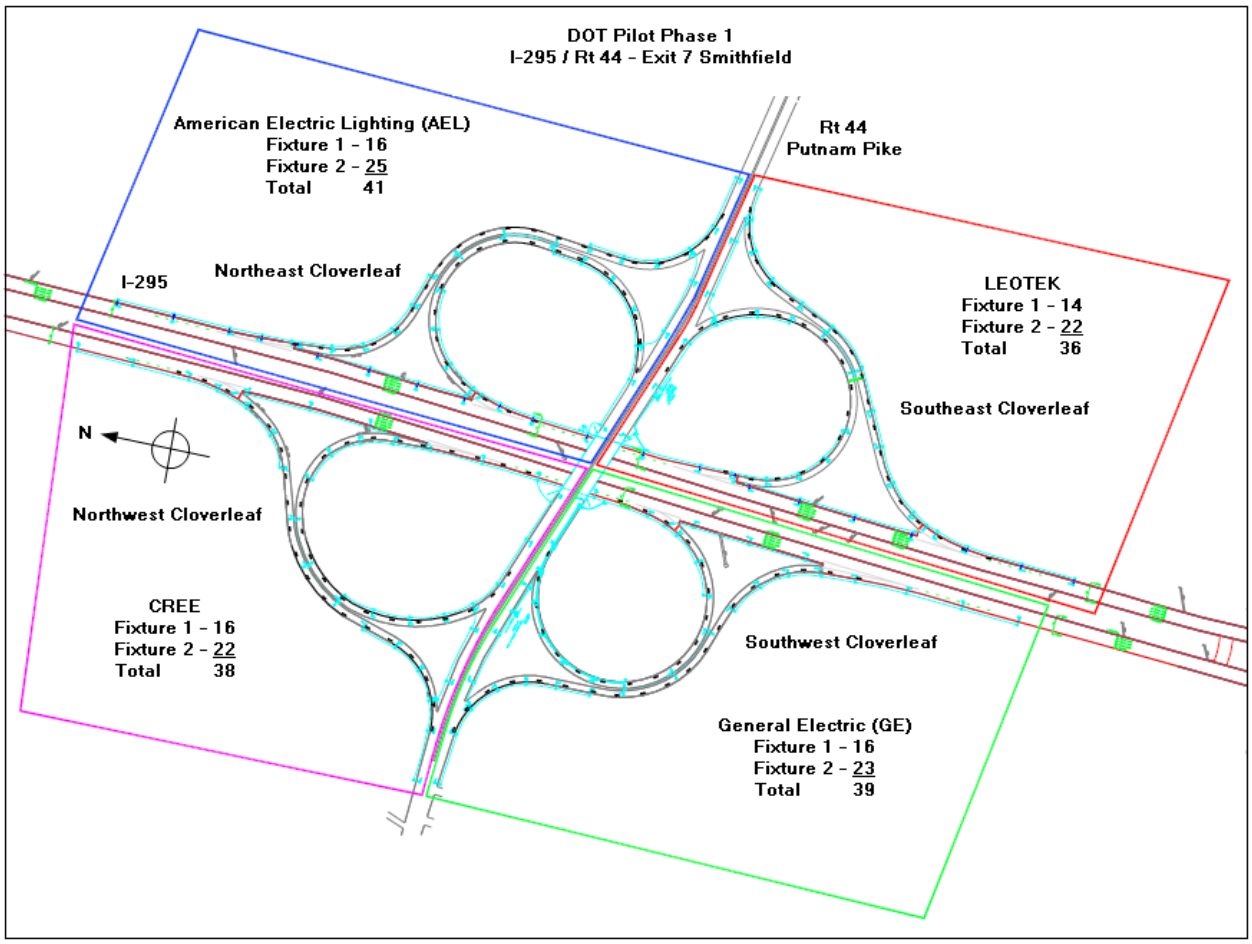

Figure 7 – DOT Pilot Phase 2 (I-295 / Rt 146 North & South Project)

Details

Total 1559: North Project -783 / South Project 776

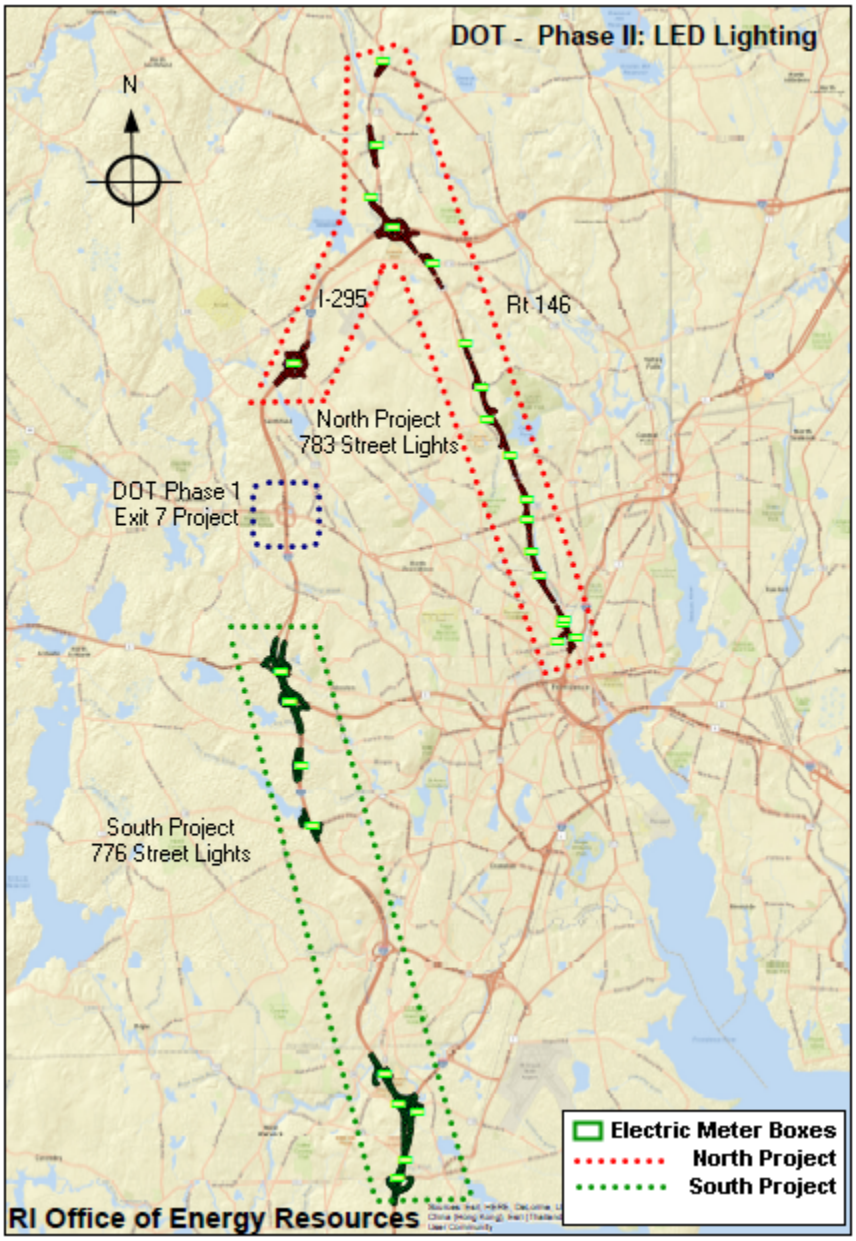

Figure 8 – DOT Pilot Phase 3 (Park & Ride Locations)

Details

10 Park & Ride locations: 92 total lights