STATE OF RHODE ISLAND AND PROVIDENCE PLANTATIONS
PUBLIC UTILITIES COMMISSION

In the Matter of:

Docket No. 4513	Establishment of Pilot Metering Program for Municipal-Owned Streetlights

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PRISM AND THE RI LEAGUE OF CITIES AND TOWNS
REPLY TO
THE RHODE ISLAND DIVISION OF PUBLIC UTILITIES'
DATA REQUESTS SET IV

January 25, 2019

The RI League of Cities and Towns (League) and the Partnership for Rhode Island Streetlight Management (PRISM) reply to the Division of Public Utilities fourth set of data requests as follows.

R-IV-1. Mr. White discusses in his September 12, 2018 Pre-Filed Testimony on pages 28, 29, 33 and 35 the issue of certified testing lab and certified agency and independent certifying agency. Provide all published industry standards which require a certified testing lab or certifying agency for meter testing per ANSI C12.20.

Response:

The relevant section on page 28 seems to be in response to the question: ***Q. What action do you propose?***

The specific sentence in the testimony is this:

> *"This initiative should proceed assuming that meters provide good data because they are certified to ANSI C12.20 by an independent certifying agency."*

It is not clear what exactly on page 29 is referred to, but the testimony restates that

> "*Certificates from a certifying agency should be given appropriate deference. That does not mean that the utility should simply accept whatever data the nodes produce; the quality of any batch of deliverables can certainly be challenged using a small test sample.*"

Beginning on page 31 is the appendix, which contains rebuttal points that are not organized in response to any particular question. On appendix page 33, the discussion is intended to convey several key points:

> *"My recommendation, in reading the remainder of the report, is to consider only those issues related to the original directive Point 1, meter accuracy. It is the only part of the directive that has been addressed with any rigor."*

In summary, the points are that: 1) the report does not meet the goals originally set out here and in the predecessor docket, as described elsewhere in detail in the testimony, and 2) the report mixes science with business positioning, and only the science is useful for the ratepayers. Also on appendix page 33, the NGRID report is quoted:

> *"ANSI industry accepted protocols must be available to qualify ... integrated circuit meters."* (quote from NGRID report)

And the testimony responds that:

> *"ANSI C12.20 is the standard in question and has been applied to integrated circuit meters. After this report was released, CIMCON meters were tested by a certifying agency, which confirmed that CIMCON's design meets ANSI C12.20 as tested."*

The utility has set the standard ("*ANSI industry accepted protocols"*) and CIMCON has shown that node metering can meet ANSI C12.20, which is the currently accepted industry method.

On appendix page 35, the NGRID report is again quoted:

> *"[...] industry standards are needed to establish accepted testing protocols to support the utility industry's required definition of revenue grade metering [...]"*

And my testimony responds:

> *Industry standard ANSI C12.20 exists for this very purpose.*

The question is whether node metering has been shown to meet the existing industry standard, or in the alternative, has been shown not to meet the standard. CIMCON's certifications are evidence that CIMCON equipment can meet the standard. CIMCON equipment has been independently certified by a nationally recognized testing lab. ANSI C12.20 has been applied to integrated circuit meters. After this report was released, CIMCON meters were tested by a certifying agency, which confirmed that CIMCON's design meets ANSI C12.20 as tested. The utility has set the standard ("*ANSI industry accepted protocols"*) and CIMCON has shown that node metering can meet ANSI C12.20, which is the currently accepted industry method. Industry standard ANSI C12.20 exists to establish accepted testing protocols to support the utility industry's required definition of revenue grade metering, to qualify integrated circuit meters, to establish accepted testing protocols to support the utility industry's required definition of revenue grade metering. CIMCON's certifications are evidence that node metering can meet ANSI C12.20.

R-IV-2. Provide a copy of specifications for the latest node technology units referenced by Mr. White in his September 12, 2018 Pre-Filed Testimony, including a power one-line diagram showing the metering, control circuits and photo cell circuits.

Response:

Specifications for CIMCON products are available at

https://www.cimconlighting.com/resources

A one-line diagram can be provided as part of a project proposal to ensure the highest quality deliverables, but in this context it will serve only to obfuscate the key issues around node metering, which are not electrical.

R-IV-3. Mr. White states in his September 12, 2018 Pre-Filed Testimony on page 10, line 18 "Aggregation of data from a streetlight fleet is something that CIMCON specializes in…"

a. Please describe how this aggregation could be implemented, including data collection, aggregation, and incorporation into existing billing systems.
b. When did CIMCON recognize the Company was not incorporation streetlight aggregation in the Company's testing process?
c. How did CIMCON communicate their recommendations to the Company, re: incorporating light aggregation into the testing process? What was the Company's response to your recommendations?

Response:

a. A streetlight Central Management System (CMS) is connected to each node meter through a low-power mesh network. Each node in the mesh can communicate with its neighbors, and messages are passed through the mesh until the message reaches a "gateway" which is connected directly to the internet and thereby to the CMS. Each node in the mesh knows something about its neighbors and uses that information to optimize the routing of the message to the internet.

   Nodes can report different bits of data on the status of the streetlight. The most important, as we have been discussing, is the accumulated energy usage of the streetlight system (light, LED driver, and any other loads). The node can also report the current status of the light on/off, the current draw of the luminaire, and report edge case exceptions when, for example, the light is on/off in conflict with the planned schedule or most recent on/off command.

   In terms of collection and aggregation, the CMS already performs collection and aggregation functions. Those functions are not theoretical things that "could be developed;" they exist today.

   With regard to incorporation into existing billing systems, CIMCON CMS (called LightingGale) provides a secure web service for reporting data to other systems. This communication layer uses the same Transport Layer Security and security certificate scheme (PKI, Public key Infrastructure) as used by other secure commercial and financial web applications.

   The CMS is not a static bundle of functions, but is adaptable to meet the requirements of all our stakeholders. For example, there will be other edge cases where a node has not reported as expected; there are several reasonable actions that could be taken. One might estimate the energy use based on last known status, or

assume the light is on unless an update is received. These are all normal deployment activities and not fear-inducing and show-stopping unknowns.

It should be noted that these edge cases are not new problems created by LED lighting or node metering. These edge cases have always existed, but the technology has not been there to address them, and so the inefficiencies (day burners, burnouts, poorly optimized schedules) have been tolerated.

b. Mr. White discovered the lack of aggregation only when reviewing the NGRID report.

c. Mr. White is not aware that CIMCON influenced the testing plan in any way.

R-IV-4. Regarding page 14, line 10 of Mr. White's September 12, 2018 Pre-Filed Testimony, please provide details about the "…3) Operational efficiencies of the type successfully deployed by Georgia Power and Florida Power & Light…" What are the specific operational efficiencies and what are their costs and benefits? Also, does Mr. White contend the utility commissions in either Florida or Georgia have approved customers owning the retail revenue meters?

Response:

On the first question, please refer to our responses to question R-III-13, which addresses this issue of operational efficiencies.

As for the second question, Mr. White does not believe that his testimony makes any claims about the official acts of the Georgia or Florida utility commissions.

R-IV-5. Regarding page 17, line 9 of Mr. White's September 12, 2018 Pre-Filed Testimony, please list and describe the "Meter accuracy" errors you refer to.

Response:

This testimony responded to the question: ***Q. What is your own analysis of potential errors in the billing process?***

In this section, Mr. White listed seven types of uncertainty that exist in the system, and meter accuracy was just one of the seven. There more than seven (temperature sensitivity comes to mind) but these seven are clearly implicated in this exercise.

In this context, "meter accuracy" is simply the difference between the meter reading and the unknowable ground truth. Because it is carefully analyzed, meter accuracy has become one small uncertainty among several other larger or unmeasured ones.

R-IV-6. Regarding page 20, lines 6-8 of Mr. White's September 12, 2018 Pre-Filed Testimony, could the tariff buckets be adjusted to normalize and minimize the errors referred to? How would the cost to adjust the tariff buckets compare to the cost of deploying node metering and National Grid's cost to modify communication and billing systems?

Response:

Page 20 lines 6-8 read:

There is a potential for large errors built in to the population model embedded in the tariff; those errors are realized if the deployed fleet does not match the model. Node metering eliminates this class of error.

a. *could the tariff buckets be adjusted to normalize and minimize the errors referred to?*

Response:

Not without continuous addition of new information. Documenting the initial inventory is required to establish a baseline. Note that an inventory is different from a sample; an inventory is a complete accounting of the fleet.

With that information, it is possible to eliminate the tariff buckets entirely and simply take the fleet average. That will start out accurately.

The problem with is that the fleet is not static. Replacements get made, either individually or as part of a sectional upgrade, and the fleet diverges from the initial inventory. Efforts to manually keep the fleet average accurate will inevitably prove futile as the continuous information proves to be discontinuous. Day burners and burnouts are still not addressed.

Both fleet rot (day burners and burnouts) and information rot (stale fleet average calculations) are prone to occur in this system.

Fortunately, a continuous source of accurate information is available with node metering. In this case again, the tariff buckets can be eliminated entirely and replaced with accurate measurements.

b. *How would the cost to adjust the tariff buckets compare to the cost of deploying node metering and National Grid's cost to modify communication and billing systems?*

Response:

We cannot address the costs incurred by changes to internal utility business processes.

R-IV-7. Regarding page 21, lines 1-2 of Mr. White's September 12, 2018 Pre-Filed Testimony, please explain why "… the schedules must light during many times when the light is not required…" Additionally, please include the basis for determining lighting requirements as well as quantifying how many times this occurs.

Response:

Taking the second part first, and for purposes of the streetlighting discussion rather than lighting in general, lighting is generally required when people are nearby and need it. If no people are nearby, or there are people nearby but they do not need the light, then the light is not required.

Furthermore, if people are nearby who do need or desire light, and yet they remain illuminated, then light has become pollution. In this case the light is not only not required, it is contraindicated and an eyesore.

Returning to the first part of the question, why *"the schedules must light during many times when the light is not required,"* this will occur whenever the lights are on and nobody is nearby.

R-IV-8. Regarding page 21, lines 8-14 of Mr. White's September 12, 2018 Pre-Filed Testimony, could the "…assumed schedule in the tariff's billing model" be adjusted to normalize and minimize these errors?

Response:

Page 21 lines 8-14 read:

> *If photocells are used, there is an additional mismatch between the photocell's control behavior and the assumed schedule in the tariff's billing model. This mismatch results in 2 additional uncertainties; 1) photocell operation will be affected by the weather (overcast or sunny at the shoulders of the day), and 2) there will be variability from one photocell to another. Fifteen minutes weather-related difference in a 12-hour schedule results in 30 minutes of uncertainty in each 24 hours, or just over 2%.*

It is certainly possible to develop an inventory and use that as a baseline for billing. I refer the reader to question R-IV-6a for a discussion of adapting the tariff buckets to maintain a match with the deployed streetlight fleet.

This photocell population inventory will be much more difficult to develop than a luminaire population inventory. The variability of the photocell product will need to be measured under controlled circumstances (to establish fleet variability) and again after deployment (to extract the site variability component).

The straightforward way to account for photocell variability is to measure the energy usage directly and report that, rather than create a model that will evolve separately from reality.

R-IV-9. Regarding page 30, lines 11-16 of Mr. White's September 12, 2018 Pre-Filed Testimony, please describe the system that can be calibrated "…to more closely approach the theoretical performance of the embedded integrated circuit meter." Was this system made available to the Company for the pilot?

Response:

Page 30 lines 11-16 read:

> *CIMCON will review our calibration method, and if feasible, will implement a multipoint calibration scheme with piecewise linear interpolation. That will allow our system to more closely approach the theoretical performance of the embedded integrated circuit meter.*
>
> *The use of small, distributed and varying loads has increased; the use of small, distributed meters is an obvious response, and CIMCON intends to be at the forefront of that industrial change.*

The system provided for the pilot project used a single point of calibration. Multipoint calibration was not available at that time.

R-IV-10. Regarding page 38, line 1 of Mr. White's September 12, 2018 Pre-Filed Testimony, "Using aggregated data was certainly an option, but the Utility chose not to take it." Did CIMCON offer to provide this aggregate data to the Company? How did the Company respond?

Response:

This aggregate data is available to customers using our centralized management system for lighting. The metering pilot itself was not a systems approach (as evidenced by the withdrawal of commitment to assess changes to billing procedures), but a device test. So yes, the CIMCON LightingGale CMS was available for use in a metering systems assessment, but was not used in the metering device assessment performed by the Company.

R-IV-11. Regarding page 41, lines 5-8 of Mr. White's September 12, 2018 Pre-Filed Testimony, are there industry standards for testing and certifying the accuracy and applicability of "…aggregation [that] could be done by the lighting control system…"? Has the CIMCON aggregation system been certified to these standards?

Response:

I am not aware of specific specifications for aggregated measurements as opposed to individual discrete measurements. It does not appear to me that such a specification is needed. ANSI C12.20 provides thorough guidance on meter accuracy, whether or not the meter reading is from a single device or a sum from a collection of devices.

Where aggregation brings edge cases that individuals devices do not bring (primarily this will be partially missing information), some technical policy is required to address these. These policies are not difficult to develop; it is necessary only to identify the edge case and codify the system behavior in those few cases.

Some anecdotes were presented in the report regarding missing expected messages from the node meter. These cases are normal in the field, and it is only necessary to respond reasonably, and not necessary to obtain 99.999% uptime 24x7 error-free communication from the cloud to every streetlight. The utility does not provide that level of service today and should not be expected to provide it in the future.

R-IV-12. What is the expected functional life of the NLC for metering purposes? How does the life of the NLC compare to traditional utility meters?

In CIMCON's experience with new installations, the LED driver will fail before any other item. That is primarily because it is subject to power supply ripple, which produces life-shortening side effects in the LED driver internal components.

That said, CIMCON can offer up to a 10-year warranty for our products.

I am not familiar with MTBF rates for "traditional" meters, but in personal experience they never fail. They are also built for centralized metering of large loads, with significant economic consequences in case of failure.

The calculus is a bit different with aggregations of small loads. A single meter failure can be detected and reported, while at the same time having a small but compensable contribution to the total error. So the failure of a single node meter in a fleet has a small, easily detected effect which can also be easily compensated for.

R-IV-13. If the municipality owns the NLC metering device:
a. What would the process for providing the metered data be with the utility?
b. How would the NLC metering device be identified for a particular light or location?
c. What would the process of communicating replacement of an NLC device be with the utility?

Response:

a. CIMCON's LightingGale CMS can provide the data through a secure web service using public key infrastructure (PKI) authentication.

b. These devices have built in GPS locational devices and can report their unique IP address using the above-mentioned software. CIMCON's nodes are available with GPS. Asset management data can also be included in the CMS to associate node serial numbers, light or pole numbers etc. Each node also has its own reportable serial number. Node locations are plotted on a map-based interface and light status is indicated by icons on the map.

c. When a device is replaced due to failure or taken out of service for accuracy testing, the replacement device information and security certificates are entered into the software by the installer. The new device would then appear in the central management software.

If for some reason the device was installed without the proper procedure, it may join the network and announce itself (if communication security certificates are correct), or an "expected but missing" alarm may be raised in the central management software. In no case will the light operate without either regular energy reporting or an alarm to report a defective node.

In cases where nodes lose connectivity temporarily, the meter reading is updated on next contact. All the energy used is measured and reported.

In contrast, the present process requires towns to pay for a light whether it is working or not. Until someone reports an outage it is treated as if it were fully functioning. Same thing with day burners.

CIMCON has an established returned material and warranty process. Spares can be quickly provided or prepositioned.

ALL OF THE FOREGOING RESPONSES WERE PROVIDED BY MR. WHITE WITH MR. WOODBURY CONTRIBUTING TO THE RESPONSE ON R-IV-13.