State of Rhode Island Public Utilities Commission

Review of the Customer-owned Street & Area Lighting Proposal in compliance with the RI Municipal Streetlight Investment Act, R.I.G.L. § 39-29-1, et. seq.

Docket No. 4442

EXHIBIT A

Pre-Filed Testimony of

Daniel T. Carrigg

October 30, 2013

I. Introduction and Qualifications

Q. Please state your name and business address.

A. My name is Dan Carrigg and my business address is 152 Robinson Street, Wakefield, Rhode Island 02879.

Q. By whom are you employed and in what capacity?

A. I am the principal of Belenus LLC. My firm was engaged by the Washington County Regional Planning Council to investigate existing costs and inventories of streetlights in the county and examine the legal and regulatory structures that govern other jurisdictions, specifically jurisdictions that have experience with municipal ownership.

Q. Please describe your educational background and training.

A. In 2006 I graduated from the University of Rhode Island with a Bachelor of Arts degree in political science and German. In 2008 I graduated from the University of Rhode Island with a masters degree in political science. I am currently working towards candidacy to a Doctor of Philosophy degree in political science at Brown University.

Q. Please describe your professional experience.

A. From 2007 to 2009 I was the Project Administrator for Rhode Island's Experimental Program to Stimulate Competitive Research. From 2009 to 2011 I was Chief of Program Development at the Rhode Island Office of Energy Resources. From 2011 to 2012 I was Deputy Director at the Rhode Island Office of the Attorney General.

II. Purpose of Testimony

Q. What is the purpose of your testimony in this docket?

A. My testimony addresses comparative analysis of public utilities regulation for street lighting and its application in Rhode Island.

Q. How is your testimony organized?

A. In Section III, I examine the Company's calculation of annual energy consumption of each light source category for this unmetered service and the Company's proposed operating schedules. In Section IV, I examine the Company's proposed miscellaneous fees and charges applicable to the S-5 service. In Section V, I examine issues related to the municipal purchase of streetlights.

III. Determination of Annual Energy Consumption

Q. How does the Company determine annual energy consumption for the S-5 rate?

A. The company determines annual energy consumption based on a table of available lighting technologies, nominal wattages, billable wattages, and operating schedules. The company proposes four (4) operating schedules for the S-5 tariff, namely continuous, dusk-to-dawn, dimming, and part light.

Q. Do you find the types of light sources available under the proposed rate adequate?

A. Yes.

Q. Do you find the hours of operation schedule adequate?

A. Partially. The company's calculated monthly hours of darkness for the dusk-to-dawn operating schedule (4,175 annual burn hours) are adequate. The company's proposed hours of operation schedule for the dimming and part-light schedules is based on an arbitrary value of just over 5 average hours of dimmed or de-powered streetlights per evening (1,874 annual burn hours). Greater flexibility on dimming and part night schedules would not cause undo administrative burden or require a costly update to existing billing software.

Q. Do you find the method by which the company proposes to determine energy consumption for billing adequate?

A. Yes.

Q. Do you find the method by which the company proposes to apply the hours of operation schedules to energy consumption figures or billing adequate?

A. Partially. The method is consistent for the continuous, dusk-to-dawn, and part light schedules. The method is inconsistent for the dimming schedule. According to the testimony of John E. Walter, the dimming operating schedule proposes that the annual dusk to dawn figure of 4,175 burn hours be divided into 2,301 hours at full energy consumption and 1,874 hours at 70% energy consumption. (Testimony of John Walter pg. 10 line 11 and page 12 line 4) This represents an energy reduction of 30% for 1,874 hours and an energy reduction of 13.4% compared to standard full power dusk to dawn operation. The Company proposes to calculate the kilowatt-hour consumption of lights under the dimming operating schedule by simply reducing these 1,874 burn hours by 30% (multiplying 1,874 by 70%). The testimony figures that 70% of 1,874 is approximately 1,314 hours. 70% of 1,874 is in fact approximately 1,312 hours. Furthermore, when one attempts to calculate the figures for the proposed rate tariff provided in JAL-1 sheet 2,

one finds that even the figure of 1,314 hours was not used to obtain the Annual Billable kWh Delivered Operating Schedule for each light source under the dimming operating schedule. A figure close to 1,314 hours was used to calculate the figures for Incandescent, Mercury Vapor, Metal Halide, and High Pressure Sodium Lights. A figure of approximately 1,031 hours was used for Light Emitting Diodes (LEDs). Put simply, the company's testimony and proposed dimming operating schedule for all light sources except LEDs calculates 1,874 hours at 70% energy consumption. This represents a 13.4% energy reduction overall. The proposed dimming operating schedule for LEDs calculates 1,874 hours at 55% energy consumption. This represents an energy reduction of 45% during the dimming period, and a 20.2% energy reduction overall. This inconsistency is detailed in Figure 1.

Q. What should be done to resolve this inconsistency?

A. If it is indeed necessary for the company to allow only one dimming operating schedule, it should calculate 1,874 hours at 50% energy consumption for a total of 937 burn hours during the annual dimming period. This was the quantity the company originally proposed to the Office of Energy Resources. At 50% energy levels, dimming will more effectively reduce both energy use and expenditures for municipalities during the evening dimming periods compared to 70% energy levels. The 70% energy level figure is arbitrary. This fact is made even more clear by the company's proposed Annual Billable kWh Delivered Operating Schedule (JAL-1, sheet 2), which uses a 70% figure for some light sources and a 55% figure for others. Furthermore, the testimony of John E. Walter found that, "the company observed that lighting levels can be reduced by as much as half when activity is significantly reduced." Therefore, a 50% energy level for the dimming operating schedule for all light sources proposed is warranted.

Q. Why did you select a 50% energy reduction value for the dimming period?

A. According to John E. Walter, "The Company was unable to identify any utility tariffs which specify dimming criteria for unmetered lighting applications." (Testimony of John Walter page 11 line 13) While this may be true for the United States, extensive schedules for exactly this purpose are in place in the United Kingdom (See Figure 2). Dimming schedules for unmetered service allow for several "dimming events" to occur in combination throughout a night, either on a time switch or on photoelectric control units. If in the interest of parsimony for billing and administration only one dimming schedule is to be allowed, then a wide range of safety and energy and cost savings options offered by control systems will not be available to municipalities in Rhode Island.

If the Commission should find that one single regime for lighting controls meets the purposes of the Municipal Streetlight Investment Act, then a single dimming rate of 50% of original energy and lumens would be preferable to 70%. Mr. Walter testified that "Additional research did not identify any municipality that has adopted large scale dimming applications." (Testimony of John Walter page 11 line 15) Large jurisdictions such as Surry, Southampton, and Suffolk UK have recently moved to a 50% dimming regime for residential roads (See Figure 3). It should be noted that Surry is only dimming to 80% of original energy and lumens on streets designated as "main roads." Having a similar option for Rhode Island where two separate levels of dimming are offered would allow energy use reductions on main roads, where 50% dimming may be deemed unsafe, whilst still providing energy and cost savings of a 50% reduction on side streets and in residential areas.

Q. Please describe the energy usage reduction associated with your proposed 50% dimming operating schedule.

A. In accordance with the Company's general hours of operation for operating schedules, the 50% Dimming operating schedule would be based upon 3,238 hours of operation annually as compared to the 4,175 hours annually for the Dusk-to-Dawn schedule and 3,615 hours of operation annually for the company's proposed 30% energy reduction Dimming operating schedule (See Figure 3).

IV: Other Fees And Charges

Q. Do you find the Company's fees under the proposal for customer obligations after the purchase of Company assets reasonable?

A. No. The costs of the requirements appear excessive. The requirement to install fuses on each and every light will be expensive in and of itself. The requirement that municipalities pay both a $130 de-energize lighting services fee and a $130 re-energize lighting services fee each time one performs routine maintenance before a fuse can be installed is especially onerous. These fees greatly exceed the cost of the actual physical plant they relate to.

On page 21, starting with line 15, the Testimony of John E. Walter describes the Company charging two separate lighting services fees for each required fuse installation. If one assumes that this $260 fee will apply to each and every light before it can be brought into compliance with obligations under these terms, then the lighting services fees alone could amount to more than three times the net book value of the total street lighting plant statewide. Put simply, this proposal might imply a cost of well over twenty million dollars in fees to comply with Company-imposed obligations related to the purchase of a seven million dollar streetlight system.

This figure does not even take into account expenses related to the requirement for "immediate" removal of company property tags and affixing of municipal property tags, which

could take time to perform on thousands of lights. Safety is a paramount concern. But it defies belief that the existing streetlight system is so unsafe, and the transfer of lights to municipalities so confusing, that it requires tens of millions of dollars in fees for safety upgrades and immediate tagging in order for qualified personnel to simply perform routine maintenance.

V: Issues Related to the Municipal Purchase of Streetlights

Q. Do you find the Company's proposal for random field auditing to observe luminaire labeling adequate?

A. Partially. Page 18, line 22 of Mr. Walter's testimony refers to the company observing: "industry standard labeling" for the purposes of random field auditing of luminaires. It would appear that Mr. Walter is referring to standard 3" NEMA label stickers that indicate light source by color and wattage by number (See Figure 5). NEMA label stickers should be sufficient for identification of luminaires, and no additional costs for labeling should be required. Inventory purchased from the Company should already bear standard NEMA labels that confirm light type and wattage at time of purchase. Municipalities should not be penalized for failing to affix industry-standard labels on active property purchased from the company in the case that such labels were not previously affixed per industry standards.

Q. Has National Grid produced an adequate inventory and price calculation to enable the municipalities to accurately assess a reasonable price for the lighting equipment?

A. No. National Grid has presented substantial information about its inventory and price calculation in response to RI League & WCRPC 1-1 and PUC 1-7, but that information remains incomplete and incoherent. The Act requires using the original price less depreciation to

calculate price, and in its price calculations National Grid does use those parameters. However, the listed equipment is highly generalized, such as "all brackets put into service in each year," each municipality has one listing, and the quantity of items in the listing is not specified. This is convenient for National Grid and may, indeed, provide an accurate way for them to price the streetlight system. However, there is no way for the municipal customer to verify the price proposed by the Company either by comparing it to the inventory or by their own, expensive field survey. In addition, the information is provided in pdf form and, therefore, is not portable for analysis.

National Grid has provided an inventory separately from the pricing mechanism, and it is provided in Excel form. It was received too late for the Municipalities to ground check all of the towns data. The inventory contains the location and identification information requested, but cannot be tied to the pricing information to verify prices. I looked at two small towns to try to match the data sets. For Exeter, the price schedule says the Town must pay $195 for its streetlight system and the detail has 40 entries by year, indicating an unknown number of lights. The inventory shows 14 entries, indicating seven streetlights. Yet the Town of Exeter claims to pay no streetlight invoices to National Grid.

For the town of Richmond, the Inventory shows only four entries. Two are "turned off permanent" lamps—one a luminaire and one a 250 W HPS streetlight lamp - and these have the same geocode location, so it is reasonable to assume they are one streetlight that the town has requested be turned off permanently. The other two have no geocodes so cannot be located, are labeled "active," and since one is a lamp and one a luminaire and they are on the same pole, one could reasonably conclude they are one light. The "Grouped City or Town" for these two items is "Richmond," but the "Tax Area Name-City, Town, Village, District" is labeled "S KENYON T

CHARLESTOWN," which leads us to assume they are in Charlestown. These are the only Inventory listings for Richmond.

The Pricing information for Richmond tells a different story. It includes fifty-four separate entries, with varying "sum of values" for each. One bracket entry has a sum of values of $7,127.12, while the bracket entry for the following year is only $467.40. This indicates a different number of brackets, but that cannot be confirmed from the information provided.

The inventory and pricing information is confused and confusing.

VI: Conclusion

Q. Does this conclude your testimony?

A. Yes

Figure 1: Inconsistent Energy Reductions for Dimming Operating Schedule Proposed by the Company in JAL-1

Light Source	Nominal Wattage	Billable Wattage	kWh Continuous	kWh Dusk-To-Dawn	kWh Dimming	kWh Part-Night	**Total Dimming Energy Reduction***
Mercury Vapor	100	130	1,139	543	470	299	**13.44%**
	175	211	1,848	881	763	486	**13.39%**
	250	307	2,689	1,282	1,110	706	**13.42%**
	400	477	4,179	1,991	1,724	1,098	**13.41%**
	1,000	1,095	9,592	4,572	3,958	2,520	**13.43%**
Metal Halide	400	451	3,951	1,883	1,630	1,038	**13.44%**
	1,000	1,078	9,443	4,501	3,897	2,480	**13.42%**
High Pressure Sodium	50	61	534	255	221	140	**13.33%**
	70	86	753	359	311	198	**13.37%**
	100	118	1,034	493	427	272	**13.39%**
	150	173	1,515	722	625	398	**13.43%**
	250	304	2,663	1,269	1,099	700	**13.40%**
	400	470	4,117	1,962	1,699	1,081	**13.40%**
Light Emitting Diode	50	25	219	104	83	61	**20.19%**
	150	125	1,095	522	414	306	**20.69%**
	250	225	1,971	939	745	551	**20.66%**

* Total Dimming Energy Reduction is calculated by taking the value: [1-(kWh Dimming / kWh Dusk-To-Dawn)]

Figure 2: Unmetered Service Regimes for Street and Traffic Lighting in the United Kingdom

Regime		London	Lux On	Lux Off	Intermediate Off	Intermediate On	Switch On	Switch Off	Switch Class	Category	Status	Default Switch Regime	Effective From Date
001	Continuous - No switching - 24 Hour Burning	8766							F	A	P		4/1/96
030	Manually switched e.g. school patrol X lights	300							F	D	P		4/1/96
031	School Crossing Patrol Flashers (360 hours per year)	360							F	D	P		4/1/96
032	School Crossing Patrol Flashers (450 hours per year)	450							F	D	P		4/1/96
033	School Crossing Patrol Flashers (500 hours per year)	500							F	D	P		4/1/96
034	School Crossing Patrol Flashers (483 hours per year)	483							F	D	P		1/5/09
036	School Crossing Patrol Flashers (231 hours per year)	231							F	D	P		1/5/09
078	Part Time Traffic Signals	728							F	D	P		3/3/09
079	Part Time Traffic Signals	2236							F	D	P		3/3/09
100	Infra Red Photo Detector (Generic)	5394	102	102					P	B	P		4/5/11
200	Dusk to Dawn	3917							V	B	P		4/1/96
201	Dawn to Dusk	4849							V	D	P		4/1/96
205	Offset Dusk to Offset Dawn	4100							V	B	P		4/1/96
206	Offset Dusk (10 min) to Offset Dawn (11 min)	4152							V	B	P		4/5/11
207	Offset Dusk (3 min) to Offset Dawn (3 min)	4244							V	B	P		4/5/11
208	Offset Dusk (8 min) to Offset Dawn (8 min)	4183							V	B	P		4/5/11
210	Sunset to Sunrise	4283							V	B	P		4/1/96
219	Dusk to 21.00	862						21	V	C	P		11/16/11
220	Dusk to 22.00	1228						22	V	C	P		4/1/96
221	Dusk to 23.00	1594						23	V	C	P		4/1/96
222	Dusk to 23.30	1776						23.3	V	C	P		4/1/96

223	Dusk to 24.00	1959			24	V	C	P	4/1/96
224	Dusk to 01.00	2324			1	V	C	P	4/1/96
235	Dusk to 22.00 / 04.30 to Dawn	1648	22	4.3		V	C	P	4/1/96
236	Dusk to 22.00 / 05.30 to Dawn	1445	22	5.3		V	C	P	4/1/96
237	Dusk to 22.00 / 06.30 to Dawn	1304	22	6.3		V	C	P	4/1/96
240	Dusk to 23.00 / 04.30 to Dawn	2014	23	4.3		V	C	P	4/1/96
241	Dusk to 23.00 / 05.30 to Dawn	1810	23	5.3		V	C	P	4/1/96
242	Dusk to 23.00 / 06.30 to Dawn	1670	23	6.3		V	C	P	4/1/96
245	Dusk to 23.30 / 04.30 to Dawn	2196	23.3	4.3		V	C	P	4/1/96
246	Dusk to 23.30 / 05.30 to Dawn	1993	23.3	5.3		V	C	P	4/1/96
247	Dusk to 23.30 / 06.30 to Dawn	1852	23.3	6.3		V	C	P	4/1/96
250	Dusk to 24.00 / 04.30 to Dawn	2379	24	4.3		V	C	P	4/1/96
251	Dusk to 24.00 / 05.30 to Dawn	2175	24	5.3		V	C	P	4/1/96
252	Dusk to 24.00 / 06.30 to Dawn	2035	24	6.3		V	C	P	4/1/96
253	Dusk to 24.00 / 06.45 to Dawn	2009	24	6.45		V	C	P	4/1/96
255	Dusk to 01.00 / 04.30 to Dawn	2744	1	4.3		V	C	P	4/1/96
256	Dusk to 01.00 / 05.30 to Dawn	2541	1	5.3		V	C	P	4/1/96
257	Dusk to 01.00 / 06.30 to Dawn	2400	1	6.3		V	C	P	4/1/96
258	Dusk to 24.00 / 05.00 to Dawn	2269	24	5		V	C	P	4/1/96
259	Dusk to 01.00 / 05.00 to Dawn	2634	1	5		V	C	P	12/1/09
270	Offset Dusk to 22.00	1320			22	V	C	P	4/1/96
271	Offset Dusk to 23.00	1685			23	V	C	P	4/1/96
272	Offset Dusk to 23.30	1868			23.3	V	C	P	4/1/96
273	Offset Dusk to 24.00	2050			24	V	C	P	4/1/96
274	Offset Dusk to 01.00	2415			1	V	C	P	4/1/96
280	Offset Dusk to 22.00 / 04.30 to Offset Dawn	1801	22	4.3		V	C	P	4/1/96
281	Offset Dusk to 22.00 / 05.30 to Offset Dawn	1581	22	5.3		V	C	P	4/1/96
282	Offset Dusk to 22.00 / 06.30 to Offset Dawn	1425	22	6.3		V	C	P	4/1/96
285	Offset Dusk to 23.00 / 04.30 to Offset Dawn	2166	23	4.3		V	C	P	4/1/96
286	Offset Dusk to 23.00 / 05.30 to Offset Dawn	1946	23	5.3		V	C	P	4/1/96

287	Offset Dusk to 23.00 / 06.30 to Offset Dawn	1790	23	6.3		V	C	P	4/1/96
290	Offset Dusk to 23.30 / 04.30 to Offset Dawn	2349	23.3	4.3		V	C	P	4/1/96
291	Offset Dusk to 23.30 / 05.30 to Offset Dawn	2129	23.3	5.3		V	C	P	4/1/96
292	Offset Dusk to 23.30 / 06.30 to Offset Dawn	1973	23.3	6.3		V	C	P	4/1/96
295	Offset Dusk to 24.00 / 04.30 to Offset Dawn	2531	24	4.3		V	C	P	4/1/96
296	Offset Dusk to 24.00 / 05.30 to Offset Dawn	2312	24	5.3		V	C	P	4/1/96
297	Offset Dusk to 24.00 / 06.30 to Offset Dawn	2155	24	6.3		V	C	P	4/1/96
300	Offset Dusk to 01.00 / 04.30 to Offset Dawn	2897	1	4.3		V	C	P	4/1/96
301	Offset Dusk to 01.00 / 05.30 to Offset Dawn	2677	1	5.3		V	C	P	4/1/96
302	Offset Dusk to 01.00 / 06.30 to Offset Dawn	2521	1	6.3		V	C	P	4/1/96
310	Sunset to 01.00 / 05.00 to Sunrise	2927	1	5		V	C	P	4/1/96
311	Offset Dusk to 01.00 / 05.30 to Dawn	2632	1	5.3		V	C	P	4/1/96
312	Offset Dusk to 01.00 / 06.30 to Dawn	2491	1	6.3		V	C	P	4/1/96
313	Offset Dusk to 24.00 / 05.30 to Offset Dawn	2267	24	5.3		V	C	P	4/1/96
320	Sunset to 22.00	1411			22	V	C	P	4/1/96
321	Sunset to 23.00	1776			23	V	C	P	4/1/96
322	Sunset to 23.30	1959			23.3	V	C	P	4/1/96
323	Sunset to 24.00	2141			24	V	C	P	4/1/96
324	Sunset to 01.00	2507			1	V	C	P	4/1/96
330	Sunset to 22.00 / 04.30 to Sunrise	1958	22	4.3		V	C	P	4/1/96
331	Sunset to 22.00 / 05.30 to Sunrise	1721	22	5.3		V	C	P	4/1/96
332	Sunset to 22.00 / 06.30 to Sunrise	1549	22	6.3		V	C	P	4/1/96
335	Sunset to 23.00 / 04.30 to Sunrise	2323	23	4.3		V	C	P	4/1/96
336	Sunset to 23.00 / 05.30 to Sunrise	2086	23	5.3		V	C	P	4/1/96
337	Sunset to 23.00 / 06.30 to Sunrise	1915	23	6.3		V	C	P	4/1/96
340	Sunset to 23.30 / 04.30 to Sunrise	2505	23.3	4.3		V	C	P	4/1/96
341	Sunset to 23.30 / 05.30 to Sunrise	2269	23.3	5.3		V	C	P	4/1/96
342	Sunset to 23.30 / 06.30 to Sunrise	2097	23.3	6.3		V	C	P	4/1/96
345	Sunset to 24.00 / 04.30 to Sunrise	2688	24	4.3		V	C	P	4/1/96
346	Sunset to 24.00 / 05.30 to Sunrise	2452	24	5.3		V	C	P	4/1/96

347	Sunset to 24.00 / 06.30 to Sunrise	2280			24	6.3			V	C	P	4/1/96
348	Sunset to 24.00 / 06.45 to Sunrise	2247			24	6.45			V	C	P	4/1/96
349	Sunset to 24.00 / 05.00 to Sunrise	2562			24	5			V	C	P	4/1/96
350	Sunset to 01.00 / 04.30 to Sunrise	3053			1	4.3			V	C	P	4/1/96
351	Sunset to 01.00 / 05.30 to Sunrise	2817			1	5.3			V	C	P	4/1/96
352	Sunset to 01.00 / 06.30 to Sunrise	2645			1	6.3			V	C	P	4/1/96
362	Sunset to 24.00 / 06.45 to Dawn	2192			24	6.45			V	C	P	4/1/96
363	Dusk to 24.00 / 06.45 to Sunrise	2064			24	6.45			V	C	P	4/1/96
364	Offset Dusk to 24.00 / 06.45 to Offset Dawn	2126			24	6.45			V	C	P	4/1/96
365	Offset Dusk to 24.00 / 05.00 to Dawn	2360			24	5			V	C	P	4/1/96
366	Sunset to 24.00 / 05.00 to Dawn	2452			24	5			V	C	P	4/1/96
367	Dusk to 24.00 / 05.00 to Sunrise	2379			24	5			V	C	P	4/1/96
368	Dusk to 24.00 / 05.30 to Sunrise	2269			24	5.3			V	C	P	4/1/96
369	Dusk to 24.00 / 06.30 to Sunrise	2097			24	6.3			V	C	P	4/1/96
370	Sunset to Dawn	4100							V	B	P	4/1/96
371	06.00 to 10.30 / 16.00 to midnight	4566			10.3	16	6	24	F	C	P	4/1/96
372	07.00 to midnight	6209					7	24	F	D	P	7/1/08
373	07.00 to 20.00	4748							F	D	P	9/23/08
374	08.00 to 18.00	3653							F	D	P	9/23/08
375	16:00 to midnight	2922							F	C	P	1/9/09
376	16.30 to 01.00	3105							F	C	P	2/23/09
377	16.30 to 07.00	5296							F	B	P	2/23/09
380	Dusk to Sunrise	4100							V	B	P	4/1/96
381	05:00 to 01:00	7305					5	1	P	D	P	12/1/09
411	Thermal PEC 55/110	4208	55	110					P	B	P	207 4/5/11
412	Thermal PEC 55/138	4234	55	138					P	B	P	207 4/5/11
413	Thermal PEC 55/165	4252	55	165					P	B	P	207 4/5/11
421	Thermal PEC 70/140	4249	70	140					P	B	P	207 4/5/11
422	Thermal PEC 70/175	4266	70	175					P	B	P	210 4/5/11
423	Thermal PEC 70/210	4266	70	210					P	B	P	210 4/5/11

431	Thermal PEC 100/200	4293	100	200	P	B	P	210	4/5/11
432	Thermal PEC 100/250	4293	100	250	P	B	P	210	4/5/11
433	Thermal PEC 100/300	4293	100	300	P	B	P	210	4/5/11
510	Dimmed from 19:00 to 06:00 - Bright	557	70	35	V	B	P		10/5/10
510	Dimmed from 19:00 to 06:00 - Dim	3596	70	35	V	B	P		10/5/10
511	Dimmed from 19:00 to 07:00 -Bright	349	55	28	V	B	P		12/19/12
511	Dimmed from 19:00 to 07:00 - Dim	3784	55	28	V	B	P		12/19/12
512	Dimmed from 19:00 to Dawn - Bright	363	70	35	V	B	P		10/5/10
512	Dimmed from 19:00 to Dawn - Dim	3790	70	35	V	B	P		10/5/10
513	Dimmed from 19:00 to 07:00 - Bright	369	70	35	V	B	P		12/19/12
513	Dimmed from 19:00 to 07:00 - Dim	3784	70	35	V	B	P		12/19/12
514	Dimmed from 20:00 to 06:00 - Bright	816	70	35	V	B	P		10/5/10
514	Dimmed from 20:00 to 06:00 - Dim	3337	70	35	V	B	P		10/5/10
515	Dimmed from 20:30 to 05:30 (GMT) - Bright - 35/18 lux	1038	35	18	V	B	P		6/19/13
515	Dimmed from 20:30 to 05:30 (GMT) - Dim - 35/18 lux	3068	35	18	V	B	P		6/19/13
516	Dimmed from 20:00 to Dawn - Bright	622	70	35	V	B	P		10/5/10
516	Dimmed from 20:00 to Dawn - Dim	3531	70	35	V	B	P		10/5/10
518	Dimmed from 21:00 to 06:00 - Bright	1159	70	35	V	B	P		10/5/10
518	Dimmed from 21:00 to 06:00 - Dim	2994	70	35	V	B	P		10/5/10
520	Dimmed from 21:00 to Dawn - Bright	964	70	35	V	B	P		10/5/10
520	Dimmed from 21:00 to Dawn - Dim	3189	70	35	V	B	P		10/5/10
522	Dimmed from 22:00 to 06:00 - Bright	1524	70	35	V	B	P		10/5/10
522	Dimmed from 22:00 to 06:00 - Dim	2629	70	35	V	B	P		10/5/10
523	Dimmed from 22:00 to 06:30 (GMT) - Bright - 55/28	1443	55	28	V	B	P		5/15/13
523	Dimmed from 22:00 to 06:30 (GMT) - Dim - 55/28	2690	55	28	V	B	P		5/15/13
524	Dimmed from 22:00 to Dawn - Bright	1329	70	35	V	B	P		10/5/10
524	Dimmed from 22:00 to Dawn - Dim	2824	70	35	V	B	P		10/5/10
526	Dimmed from 23:00 to 06:00 - Bright	1889	70	35	V	B	P		10/5/10
526	Dimmed from 23:00 to 06:00 - Dim	2264	70	35	V	B	P		10/5/10
528	Dimmed from 23:00 to Dawn - Bright	1694	70	35	V	B	P		10/5/10

528	Dimmed from 23:00 to Dawn - Dim	2459	70	35	V	B	P	10/5/10
530	Dimmed from 00:00 to 05:00 - Bright	2450	70	35	V	B	P	10/5/10
530	Dimmed from 00:00 to 05:00 - Dim	1703	70	35	V	B	P	10/5/10
532	Dimmed from 00:00 to 06:00 - Bright	2254	70	35	V	B	P	10/5/10
532	Dimmed from 00:00 to 06:00 - Dim	1899	70	35	V	B	P	10/5/10
533	Dimmed from 22:00 to 06:00 (GMT) - Bright - 55/28	1516	55	28	P	B	P	9/18/13
533	Dimmed from 22:00 to 06:00 (GMT) - Dim - 55/28	2617	55	28	P	B	P	9/18/13
534	Dimmed from 00:00 to Dawn - Bright	2059	70	35	V	B	P	10/5/10
534	Dimmed from 00:00 to Dawn - Dim	2094	70	35	V	B	P	10/5/10
535	Dimming from 00:00 to 06:00 (GMT) - Bright - 35/18	2227	35	18	V	B	P	10/16/13
535	Dimming from 00:00 to 06:00 (GMT) - Dim - 35/18	1879	35	18	V	B	P	10/16/13
536	Dimmed from 01:00 to 05:00 - Bright	2815	70	35	V	B	P	10/5/10
536	Dimmed from 01:00 to 05:00 - Dim	1338	70	35	V	B	P	10/5/10
538	Dimmed from 01:00 to 06:00 - Bright	2619	70	35	V	B	P	10/5/10
538	Dimmed from 01:00 to 06:00 - Dim	1534	70	35	V	B	P	10/5/10
540	Dimmed from 01:00 to Dawn - Bright	2424	70	35	V	B	P	10/5/10
540	Dimmed from 01:00 to Dawn - Dim	1729	70	35	V	B	P	10/5/10
542	Dimmed from 22:00 to 05:30 - Bright	1519	70	35	V	B	P	6/15/11
542	Dimmed from 22:00 to 05:30 - Dim	2634	70	35	V	B	P	6/15/11
560	Dimming from 19:00 to 06:00 (Clock) - Bright	517	70	35	V	B	P	1/4/11
560	Dimming from 19:00 to 06:00 (Clock) - Dim	3636	70	35	V	B	P	1/4/11
561	Dimming from 20:00 to 06:00 (Clock) - Bright - 35/18	671	35	18	V	B	P	7/17/13
561	Dimming from 20:00 to 06:00 (Clock) - Dim - 35/18	3435	35	18	V	B	P	7/17/13
562	Dimming from 19:00 to Dawn (Clock) - Bright	302	70	35	V	B	P	1/4/11
562	Dimming from 19:00 to Dawn (Clock) - Dim	3851	70	35	V	B	P	1/4/11
564	Dimming from 20:00 to 06:00 (Clock) - Bright	714	70	35	V	B	P	1/4/11
564	Dimming from 20:00 to 06:00 (Clock) - Dim	3439	70	35	V	B	P	1/4/11
565	Dimming from 20:00 to 06:00 (Clock) - Bright - 55/28	698	55	28	V	B	P	7/17/13
565	Dimming from 20:00 to 06:00 (Clock) - Dim - 55/28	3435	55	28	V	B	P	7/17/13
566	Dimming from 20:00 to Dawn (Clock) - Bright	499	70	35	V	B	P	1/4/11

566	Dimming from 20:00 to Dawn (Clock) - Dim	3654	70	35	V	B	P	1/4/11
568	Dimming from 21:00 to 06:00 (Clock) - Bright	962	70	35	V	B	P	1/4/11
568	Dimming from 21:00 to 06:00 (Clock) - Dim	3191	70	35	V	B	P	1/4/11
570	Dimming from 21:00 to Dawn (Clock) - Bright	747	70	35	V	B	P	1/4/11
570	Dimming from 21:00 to Dawn (Clock) - Dim	3406	70	35	V	B	P	1/4/11
572	Dimming from 22:00 to 06:00 (Clock) - Bright	1289	70	35	V	B	P	1/4/11
572	Dimming from 22:00 to 06:00 (Clock) - Dim	2864	70	35	V	B	P	1/4/11
574	Dimming from 22:00 to Dawn (Clock) - Bright	1074	70	35	V	B	P	1/4/11
574	Dimming from 22:00 to Dawn (Clock) - Dim	3079	70	35	V	B	P	1/4/11
576	Dimming from 23:00 to 06:00 (Clock) - Bright	1654	70	35	V	B	P	1/4/11
576	Dimming from 23:00 to 06:00 (Clock) - Dim	2499	70	35	V	B	P	1/4/11
578	Dimming from 23:00 to Dawn (Clock) - Bright	1439	70	35	V	B	P	1/4/11
578	Dimming from 23:00 to Dawn (Clock) - Dim	2714	70	35	V	B	P	1/4/11
580	Dimming from 24:00 to 05:00 (Clock) - Bright	2182	70	35	V	B	P	1/4/11
580	Dimming from 24:00 to 05:00 (Clock) - Dim	1971	70	35	V	B	P	1/4/11
582	Dimming from 24:00 to 06:00 (Clock) - Bright	2019	70	35	V	B	P	1/4/11
582	Dimming from 24:00 to 06:00 (Clock) - Dim	2134	70	35	V	B	P	1/4/11
584	Dimming from 24:00 to Dawn (Clock) - Bright	1804	70	35	V	B	P	1/4/11
584	Dimming from 24:00 to Dawn (Clock) - Dim	2349	70	35	V	B	P	1/4/11
586	Dimming from 01:00 to 05:00 (Clock) - Bright	2547	70	35	V	B	P	1/4/11
586	Dimming from 01:00 to 05:00 (Clock) - Dim	1606	70	35	V	B	P	1/4/11
588	Dimming from 01:00 to 06:00 (Clock) - Bright	2384	70	35	V	B	P	1/4/11
588	Dimming from 01:00 to 06:00 (Clock) - Dim	1769	70	35	V	B	P	1/4/11
589	Dimming from 00:00 to 05:00 (Clock) - Bright	2330	55	28	V	B	P	6/19/13
589	Dimming from 00:00 to 05:00 (Clock) - Dim	1803	55	28	V	B	P	6/19/13
590	Dimming from 01:00 to Dawn (Clock) - Bright	2169	70	35	V	B	P	1/4/11
590	Dimming from 01:00 to Dawn (Clock) - Dim	1984	70	35	V	B	P	1/4/11
591	Dimming from 21:00 to 06:00 (Clock) - Bright - 55/36	1146	55	36	V	B	P	4/18/12
591	Dimming from 21:00 to 06:00 (Clock) - Dim - 55/36	2994	55	36	V	B	P	4/18/12
592	Dimming from 21:00 to 06:00 (Clock) - Bright - 35/18	1112	35	18	V	B	P	4/18/12

592	Dimming from 21:00 to 06:00 (Clock) - Dim - 35/18	2994	35	18			V	B	P		4/18/12
593	Dimming from 21:00 to 06:00 (Clock) - Bright - 20/20	1100	20	20			V	B	P		4/18/12
593	Dimming from 21:00 to 06:00 (Clock) - Dim - 20/20	2994	20	20			V	B	P		4/18/12
594	Dimming from 00:00 to 06:00 (Clock) - Bright - 55/36	2241	55	36			V	B	P		4/18/12
594	Dimming from 00:00 to 06:00 (Clock) - Dim - 55/36	1899	55	36			V	B	P		4/18/12
595	Dimming from 00:00 to 06:00 (Clock) - Bright - 35/18	2207	35	18			V	B	P		4/18/12
595	Dimming from 00:00 to 06:00 (Clock) - Dim - 35/18	1899	35	18			V	B	P		4/18/12
596	Dimming from 00:00 to 06:00 (Clock) - Bright - 20/20	2195	20	20			V	B	P		4/18/12
596	Dimming from 00:00 to 06:00 (Clock) - Dim - 20/20	1899	20	20			V	B	P		4/18/12
597	Dimming from 00:00 to 05:30 (Clock) - Bright - 35/18	2273	35	18			V	B	P		1/16/13
597	Dimming from 00:00 to 05:30 (Clock) - Dim - 35/18	1833	35	18			V	B	P		1/16/13
598	Dimming from 22:00 to 06:00 (Clock) - Bright 35/18	1289	35	18			P	B	P		3/20/13
598	Dimming from 22:00 to 06:00 (Clock) - Dim 35/18	2817	35	18			P	B	P		3/20/13
599	Dimming from 22:00 to 06:30 (Clock) - Bright - 35 / 18	1369	35	18			P	B	P		2/20/13
599	Dimming from 22:00 to 06:30 (Clock) - Dim - 35 / 18	2737	35	18			P	B	P		2/20/13
611	Hybrid PEC 55/28	4133	55	28			P	B	P	206	4/5/11
612	Hybrid PEC 55/55	4158	55	55			P	B	P	206	4/5/11
613	Hybrid PEC 55/83	4183	55	83			P	B	P	208	4/5/11
621	Hybrid PEC 70/35	4153	70	35			P	B	P	206	4/5/11
622	Hybrid PEC 70/70	4185	70	70			P	B	P	208	4/5/11
623	Hybrid PEC 70/105	4217	70	105			P	B	P	207	4/5/11
624	Hybrid PEC 70/50	4167	70	50			P	B	P	206	4/5/11
631	Hybrid PEC 100/50	4194	100	50			P	B	P	208	4/5/11
632	Hybrid PEC 100/100	4240	100	100			P	B	P	207	4/5/11
633	Hybrid PEC 100/150	4286	100	150			P	B	P	210	4/5/11
711	PEC Dusk to 24.00 / 05.00 to Dawn 55 lux	2330	55		24	5	P	C	P	365	10/5/10
712	PEC Dusk to 24.00 / 05.30 to Dawn 55 lux	2221	55		24	5.3	P	C	P	346	10/5/10
713	PEC Dusk to 24.00 / 06.00 to Dawn 55 lux	2126	55		24	6	P	C	P	347	10/5/10
714	PEC Dusk to 24.00 / 06.30 to Dawn 55 lux	2047	55		24	6.3	P	C	P	347	10/5/10
715	PEC Dusk to 00:00 / 05:30 to PEC Dawn Clock 55 Lux	2193	55	28	24	5.3	P		P	346	10/16/13

721	PEC Dusk to 24.00 / 05.00 to Dawn	70 lux	2350	70		24	5		P	C	P	365	10/5/10
722	PEC Dusk to 24.00 / 05.30 to Dawn	70 lux	2241	70		24	5.3		P	C	P	346	10/5/10
723	PEC Dusk to 24.00 / 06.00 to Dawn	70 lux	2146	70		24	6		P	C	P	347	10/5/10
724	PEC Dusk to 24.00 / 06.30 to Dawn	70 lux	2067	70		24	6.3		P	C	P	347	10/5/10
725	PEC Dusk to 01.00 / 05.00 to Dawn	70 lux	2806	70		1	5		P	C	C	351	10/5/10
731	PEC Dusk to 24.00 / 05.00 to Dawn	100 lux	2391	100		24	5		P	C	P	365	10/5/10
732	PEC Dusk to 24.00 / 05.30 to Dawn	100 lux	2282	100		24	5.3		P	C	P	346	10/5/10
733	PEC Dusk to 24.00 / 06.00 to Dawn	100 lux	2187	100		24	6		P	C	P	347	10/5/10
734	PEC Dusk to 24.00 / 06.30 to Dawn	100 lux	2108	100		24	6.3		P	C	P	347	10/5/10
741	PEC Dusk to 24.00 / 05.00 to Dawn	120 lux	2419	120		24	5		P	C	P	365	10/5/10
742	PEC Dusk to 24.00 / 05.30 to Dawn	120 lux	2310	120		24	5.3		P	C	P	346	10/5/10
743	PEC Dusk to 24.00 / 06.00 to Dawn	120 lux	2215	120		24	6		P	C	P	347	10/5/10
744	PEC Dusk to 24.00 / 06.30 to Dawn	120 lux	2136	120		24	6.3		P	C	P	347	10/5/10
749	PEC Dusk to 24:00 - GMT - 70 Lux		1848	70				0	P	C	P	323	9/18/13
750	PEC Dusk to 24.30	70 lux	2030	70				0.3	P	C	P	323	10/5/10
751	PEC Dusk to 24:00 / 5:00 to PEC Dawn Clock 70 lux		2331	70	35	24	5		P	C	P	365	3/2/11
752	PEC Dusk to 01:00 / 5:00 to PEC Dawn Clock 70 lux		2696	70	35	1	5		P	C	P	350	3/2/11
753	PEC Dusk to 02:00 / 5:00 to PEC Dawn Clock 70 lux		3061	70	35	2	5		P	C	P	350	3/2/11
754	PEC Dusk to 24:00 / 5:00 to PEC Dawn Clock 55 lux		2311	55	28	24	5		P	C	P	365	3/2/11
755	PEC Dusk to 01:00 / 5:00 to PEC Dawn Clock 55 lux		2676	55	28	1	5		P	C	P	350	3/2/11
756	PEC Dusk to 02:00 / 5:00 to PEC Dawn Clock 55 lux		3041	55	28	2	5		P	C	P	350	3/2/11
757	PEC Dusk to 24.00 / 06.00 to PEC Dawn Clock 55 lux		2042	55	28	0	6		P	C	P	346	11/6/11
758	PEC Dusk to 01:00 / 6:00 to PEC Dawn Clock 70 lux		2432	70	35	1	6		P	C	P	351	3/20/13
759	PEC Dusk to 00:30 / 05:30 to PEC Dawn Clock 55 Lux		2375	55	28	24.3	5.3		P	C	P	346	5/15/13
760	PEC Dusk to 19:00 / 06:00 to Dawn	35 lux	549	35	18	19	6		P	C	P	237	3/20/13
761	PEC Dusk to 24.00 / 05.00 to Dawn	35 lux	2303	35	18	24	5		P	C	P	365	1/4/11
762	PEC Dusk to 24.00 / 05.30 to Dawn	35 lux	2194	35	18	24	5.3		P	C	P	346	1/4/11
763	PEC Dusk to 24.00 / 06.00 to Dawn	35 lux	2099	35	18	24	6		P	C	P	346	1/4/11
764	PEC Dusk to 24.00 / 06.30 to Dawn	35 lux	2022	35	18	24	6.3		P	C	P	347	1/4/11
770	PEC Dusk to 24:00 / 4:30 to PEC Dawn Clock 35 lux		2463	35	18	24	4.3		P	C	P	345	3/2/11

771	PEC Dusk to 24:00 / 4:30 to PEC Dawn Clock 55 lux	2491	55	28	24	4.3		P	C	P	345	3/2/11
772	PEC Dusk to 24:00 / 5:00 to PEC Dawn Clock 20 lux	2278	20	20	24	5		P	C	P	346	12/19/12
806	Electronic PEC 20/20	4094	20	20				P	B	P	205	4/5/11
807	Electronic PEC 35/35	4121	35	35				P	B	P	205	4/5/11
808	Electronic PEC 35/18	4106	35	18				P	B	P	205	4/5/11
809	Electronic PEC 40/60	4149	40	60				P	B	P	206	4/5/11
810	Electronic PEC 40/20	4112	40	20				P	B	P	205	4/5/11
811	Electronic PEC 55/28	4133	55	28				P	B	P	206	4/5/11
812	Electronic PEC 55/55	4158	55	55				P	B	P	206	4/5/11
813	Electronic PEC 55/83	4183	55	83				P	B	P	208	4/5/11
821	Electronic PEC 70/35	4153	70	35				P	B	P	206	4/5/11
822	Electronic PEC 70/70	4185	70	70				P	B	P	208	4/5/11
823	Electronic PEC 70/135	4244	70	135				P	B	P	207	4/5/11
824	Electronic PEC 70/140	4249	70	140				P	B	P	207	4/5/11
825	Electronic PEC 70/50	4167	70	50				P	B	P	208	4/5/11
826	Electronic PEC 70/55	4171	70	55				P	B	P	208	4/5/11
831	Electronic PEC 100/50	4194	100	50				P	B	P	208	4/5/11
832	Electronic PEC 100/100	4240	100	100				P	B	P	207	4/5/11
833	Electronic PEC 100/150	4286	100	150				P	B	P	210	4/5/11
834	Electronic PEC 100/200	4293	100	200				P	B	P	210	4/5/11
998	CMS Controlled - Continous Burning							V	HH	P	001	9/26/08
999	CMS Controlled - Switched Equipment							V	HH	P	205	9/26/08
A01	Multi-Level Static Dimming	2984	70	35					B	P		6/21/12
A02	Multi-Level Static Dimming	1792	70	35					B	P		7/18/12
A03	Multi-Level Static Dimming	2142	70	35					B	P		7/18/12
A04	Multi-Level Static Dimming	3117	70	35					B	P		1/16/13
A05	Multi-Level Static Dimming	3099	70	35					B	P		1/16/13
A06	Multi-Level Static Dimming	3006	70	35					B	P		5/15/13
A08	Multi-Level Static Dimming	1518	70	35					B	P		6/19/13
D01	Multi-Level Static Dimming - 35/18	2779	35	18				P	B	P		7/17/13

D02	Multi-Level Static Dimming - 35/18	2238	35	18	P	B	P	7/17/13
D03	Multi-Level Static Dimming - 35/18	2955	35	18		B	P	7/17/13
D04	Multi-Level Static Dimming -35/18	1966	35	18	P	B	P	9/18/13

*More details about unmetered service standards implemented for the UK by Elexon are available at:
http://www.elexon.co.uk/reference/technical-operations/unmetered-supplies/charge-codes-and-switch-regimes/

**Elexon implements the rules and governance arrangements for electricity balancing and settlement in Great Britain:
http://www.nationalgrid.com/uk/Electricity/Codes/elexon/

***A copy of this table is available at:
http://www.elexon.co.uk/wp-content/uploads/2013/10/operational_information_switch_regime_spreadsheet_v3.5.xls

Figure 3: Examples of Other Jurisdictions Using Unmetered Dimming Control Technologies

Locality	Population	Energy and Lumen Reduction on Main Roads	Energy and Lumen Reduction on Residential and Side Streets	More Information
Surry, UK	1,135,500	20%	50%	http://tinyurl.com/kxqnkey
Suffolk, UK	730,100	Varies based on night of the week and safety concerns.	50%	http://tinyurl.com/p6fcpwh
Southampton, UK	239,700	50% (Plus 25% between dusk and midnight and 5am and dawn)	50% (Plus 25% between dusk and midnight and 5am and dawn)	http://tinyurl.com/m7butv2

Figure 4: Comparison of Billable Hours and Energy Savings Under Various Dimming Energy Reduction Percentages

	"Dusk to Dawn" Operating Schedule	"Part Night" Operating Schedule (Lights are powered off for part of each night)	"Dimming" Operating Schedule by 30% during Part-Night Period (Proposed by the Company)	"Dimming" Operating Schedule by 45% during Part-Night Period (Proposed in JAL-1, Sheet 2 for LED Only)	"Dimming" Operating Schedule by 50% during Part-Night Period. (Proposed in this Testimony)	Time Period for Which Lights May Not Be Shut Off or Dimmed Regardless of Operating Schedule
Total Annual Billable Hours Under Each Operating Schedule	4,175	2,301	3,613	3,332	3,238	*Not Applicable*
Total Annual Energy Savings Under Each Operating Schedule	0%	44.9%	13.4%	20.2%	22.4%	*Not Applicable*
Total Annual Hours During Which Category Applies	4,175	1,874	1,312 (30% reduction in 1,874 figure from part night schedule)	1,031 (45% reduction in 1,874 figure from part night schedule)	937 (50% reduction in 1,874 figure from part night schedule)	2,301

Figure 5: NEMA Standard Stickers Illustrated from National Grid Luminaire Rental Brochure