

September 16, 2013

BY HAND DELIVERY & ELECTRONIC MAIL

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

**RE: The Narragansett Electric Company d/b/a National Grid
Tariff Advice Filing for Customer-Owned Street & Area Lighting Proposal
Docket No. _____**

Dear Ms. Massaro:

National Grid¹ is submitting this tariff advice to propose a tariff for unmetered customer-owned street and area lighting in compliance with the Rhode Island Municipal Streetlight Investment Act, R.I.G.L. § 39-29-1, *et. seq.* (the “Act”) (House Bill No. 5935 Sub A). The Act, which was signed into law on July 15, 2013, requires that the Company, in consultation with the Rhode Island Office of Energy Resources (“OER”), file a tariff with the Rhode Island Public Utilities Commission (“Commission”) that provides for delivery service to municipal customers who, pursuant to the Act, elected to purchase all of the Company’s street and area lighting equipment previously leased to that municipality.² As required by the Act, the Company has consulted with the OER concerning this proposed tariff, Rate S-05, R.I.P.U.C. No. 2142. In accordance with the Act, the proposed tariff will allow municipal customers who own their own street lighting equipment to receive retail delivery service from the Company. In this filing, the Company has proposed a rate that would be billed to these customers to compensate the Company for the delivery of electricity to those customer-owned street and area lights. The Company is requesting an effective date of November 15, 2013 for the proposed tariff.³

Enclosed with this letter is one original and ten (10) copies of the proposed tariff. The Company has included in this filing pre-filed testimonies of Jeanne A. Lloyd and John E. Walter. In her testimony, Ms. Lloyd presents the proposed tariff, the services it will encompass, and the customers who would be served on the tariff. As part of the Company’s tariff proposal, Ms. Lloyd also presents the proposal to allow retail delivery service to customer-owned Light Emitting Diode

¹ The Narragansett Electric Company d/b/a National Grid (“National Grid” or the “Company”).

² The Act provides that “[t]he electric distribution company, in consultation with the office, shall file the new tariff with the public utilities commission within sixty (60) days of the effective date of this chapter and the commission shall then issue a decision within sixty (60) days after the filing to effectuate the purposes and provisions of [the Act].” R.I.G.L. § 39-29-3(1).

³ The Act provides that the Commission shall issue a decision within sixty (60) days after the filing to effectuate the purposes and provisions of [the Act].” R.I.G.L. § 39-29-3(1).

Luly E. Massaro, Commission Clerk
Customer-Owned & Area Lighting Proposal
September 16, 2013
Page 2 of 2

("LED") street lighting equipment. Finally, Ms. Lloyd describes the determination and calculation of the proposed distribution street lighting rate. In his testimony, Mr. Walter provides supporting tariff and technology research and supplemental billing factor development information relating to the Company's proposed tariff.

The Company believes that the proposed tariff satisfies the requirements of the Act, is in the best interests of its customers, and that it will allow the Company to continue providing safe, efficient, and reliable service to its municipal customers who choose to purchase the Company's street and area lighting equipment pursuant to the Act.

The Company has enclosed a draft notice that will be published in the *The Providence Journal* to notify the public of the filing. The Company will publish this notice after receiving a docket number for this filing from the Commission.

Thank you for your attention to this matter. If you have any questions regarding this filing, please contact me at (401) 784-7667.

Very truly yours,



Thomas R. Teehan

Enclosures

cc: Commissioner Marion S. Gold, Ph.D., RI Office of Energy Resources
Christopher Kearns, RI Office of Energy Resources
Steve Scialabba, RI Division
Leo Wold, Esq.

Draft Public Notice

**The Narragansett Electric Company d/b/a National Grid
Tariff Advice Filing
Customer-owned Street & Area Lighting Proposal
Docket No. _____**

Pursuant to Rule 1.9(c) of the Rules of Practice and Procedure of the Rhode Island Public Utilities Commission (the “Commission”), The Narragansett Electric Company, d/b/a National Grid (the “Company”), hereby gives notice that, on September 16, 2013, the Company filed a tariff advice to propose a tariff for unmetered customer-owned street and area lighting in compliance with the Rhode Island Municipal Streetlight Investment Act, R.I.G.L. § 39-29-1, *et. seq.* (the “Act”) (House Bill No. 5935 Sub A). The Act, which was signed into law on July 15, 2013, requires that the Company, in consultation with the Rhode Island Office of Energy Resources (“OER”), file a tariff with the Rhode Island Public Utilities Commission (“Commission”) that provides for delivery service to municipal customers who, pursuant to the Act, elected to purchase all of the Company’s street and area lighting equipment previously leased to that municipality. As required by the Act, the Company has consulted with the OER concerning this proposed tariff, Rate S-05, R.I.P.U.C. No. 2142. In accordance with the Act, the proposed tariff will allow municipal customers who own their own street lighting equipment to receive retail delivery service from the Company. In its tariff advice filing, the Company has proposed a rate that would be billed to these customers to compensate the Company for the delivery of electricity to those customer-owned street and area lights. The Act provides that the Commission shall issue a decision within sixty (60) days after the Company files its tariff proposal. Therefore, the Company has requested an effective date of November 15, 2013 for the proposed tariff.

This filing has been docketed as RIPUC. Docket No. _____. Should the Commission hold a hearing on this matter, it will publish a notice of the hearing date. A copy of this filing is on file for examination at the offices of the Commission, 89 Jefferson Boulevard, Warwick, Rhode Island. The Commission is accessible to the handicapped. Individuals requesting interpreter services for the hearing impaired must contact the Clerk of the Commission seventy-two hours in advance of the hearing.

National Grid

National Grid

The Narragansett Electric Company

Customer-owned Street & Area
Lighting Proposal

Consisting of the
Direct Testimony and Schedules of
Jeanne A. Lloyd and John E. Walter

September 16, 2013

Submitted to:
Rhode Island Public Utilities Commission
R.I.P.U.C. Docket No. _____

Submitted by:

nationalgrid

**Testimony of
Jeanne A. Lloyd**

The Narragansett Electric Company
d/b/a National Grid
R.I.P.U.C. Docket No. ____
Customer-Owned Street & Area Lighting Proposal
Witness: Jeanne A. Lloyd

PRE-FILED DIRECT TESTIMONY

OF

JEANNE A. LLOYD

September 16, 2013

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1 **I. Introduction and Qualifications**

2 **Q. Please state your full name and business address.**

3 A. My name is Jeanne A. Lloyd, and my business address is 40 Sylvan Road, Waltham,
4 Massachusetts 02451.

6 **Q. Please state your position.**

7 A. I am the Manager of Electric Pricing, New England in the Regulation and Pricing group
8 of National Grid USA Service Company, Inc. This department provides rate related
9 support to The Narragansett Electric Company d/b/a National Grid (“National Grid” or
10 “Company”).

12 **Q. Please describe your educational background and training.**

13 A. In 1980, I graduated from Bradley University in Peoria, Illinois with a Bachelor’s Degree
14 in English. In December 1982, I received a Master of Arts Degree in Economics from
15 Northern Illinois University in De Kalb, Illinois.

17 **Q. Please describe your professional experience?**

18 A. I was employed by Eastern Utilities Associates (EUA) Service Corporation in December
19 1990 as an Analyst in the Rate Department. I was promoted to Senior Rate Analyst on
20 January 1, 1993. My responsibilities included the study, analysis, and design of the retail
21 electric service rates, rate riders, and special contracts for the EUA retail companies.

1 After the merger of New England Electric System and EUA in April 2000, I joined the
2 Distribution Regulatory Services Department as a Principal Financial Analyst. I
3 assumed my present position on October 1, 2006. Prior to my employment at EUA, I
4 was on the staff of the Missouri Public Service Commission in Jefferson City, Missouri
5 in the position of research economist. My responsibilities included presenting both
6 written and oral testimony before the Missouri Commission in the areas of cost of service
7 and rate design for electric and natural gas rate proceedings.

8
9 **Q. Have you previously testified before Rhode Island Public Utilities Commission**
10 **(“Commission”)?**

11 A. Yes.

12
13 **II. Purpose of Testimony**

14 **Q. What is the purpose of your testimony?**

15 A. The purpose of my testimony is to propose a new tariff, Rate S-05, R.I.P.U.C. No. 2142,
16 under which customers who own their own streetlighting equipment can receive delivery
17 service from the Company. In conjunction, the Company is proposing a rate that would
18 be billed to these customers to compensate the Company for delivery of electricity to
19 those customer-owned street and area lights.

1 **Q. Why is the Company making this proposal?**

2 A. The Company is submitting this proposal in response to the newly enacted legislation, the
3 Rhode Island Municipal Streetlight Investment Act, R.I.G.L § 39-29-1 – 5 (the “Act”)
4 (House Bill Number. Sub A 5935). The Act allows any city or town receiving
5 streetlighting service from an electric distribution company to convert its streetlighting
6 services from the full service tariff rate to an alternative tariff rate providing for delivery
7 service by the electric distribution company. In addition, the alternative tariff rate shall
8 not include facility, support, maintenance, or accessory charges. Furthermore, any
9 municipality exercising the option to convert its streetlighting service must compensate
10 the electric distribution company for the original cost, less depreciation, less amortization,
11 of any active or inactive existing public lighting equipment owned by the electric
12 distribution company.

13
14 The proposed tariff also includes pricing provisions for customer-owned Light Emitting
15 Diode (“LED”) luminaires, as well as options for different schedules of operation.
16

17 **Q. How is your testimony organized?**

18 A. First, I will present the proposed tariff, the services it will encompass, and the customers
19 who would be served on the tariff. Then I will discuss the LED proposal as reflected in
20 the proposed tariff. Third, I will discuss the elements of the proposed tariff that satisfy
21 the Act’s requirement to allow municipal customers the ability to buy the Company’s

1 streetlighting equipment. Finally, I will describe the concept of the determination and
2 calculation of the proposed delivery-only street light rate.

3
4 **III. Tariff Proposal**

5 **Q. Please describe the proposed Rate S-05 tariff.**

6 A. The proposed Rate S-05 tariff is provided in Schedule JAL-1. Rate S-05 would be
7 available to municipal customers who, pursuant to the Act, elected to purchase all of the
8 Company's street and area lighting equipment previously leased to that municipality.
9 Under this proposed service, the Company would provide delivery service to the street
10 lights to enable their operation. Maintenance of the customer's streetlighting equipment
11 would be the responsibility of the customer.

12
13 **Q. How would customers be billed under the proposed Rate S-05?**

14 A. Currently, customers receiving service under the Company's full service tariffs, General
15 Street and Area Lighting tariff Rate S-14 and the Decorative Street and Area Lighting
16 Service tariff Rate S-06, are charged a luminaire charge which recovers not only the costs
17 for delivery of electricity over the Company's distribution system, but also the capital
18 investment and street light-specific operation and maintenance cost of providing lighting
19 service. Under Rate S-05, customers would not be assessed this luminaire charge
20 because the ownership responsibilities under Rate S-05 are different than what exists
21 today. Instead, customers would be charged a per-kWh distribution charge designed to

1 recover only the cost of delivering electricity to customer-owned lighting equipment. I
2 will describe this charge in more detail later in my testimony.

3
4 **Q. How are the rate provisions of proposed Rate S-05 structured?**

5 A. In general, the rate provisions of Rate S-05 mirror the provisions of the full service
6 counterpart, General Street and Area Lighting Rate S-14. Each of the light sources that
7 are available on Rate S-14 is also available on the proposed Rate S-05. However, unlike
8 Rate S-14, the “Rate” section of Rate S-05 does not provide for an annual fixture charge
9 for each luminaire, but rather, only indicates the annual energy usage attributable to each
10 light source. Like service provided on Rate S-14 and Rate S-06, service provided to
11 customers under Rate S-05 will be unmetered. All charges billed to Rate S-05 customers
12 will be based upon the indicated energy usage for that particular light source type.

13
14 The proposed tariff includes four different operating schedules, with each schedule
15 representing a different level of service. In addition to continuous and traditional dusk-
16 to-dawn service, which is currently provided under Rate S-14, the Company is proposing
17 two new operating schedules which allow for reduced energy consumption based upon
18 the customer’s installation and use of appropriate control technology. Annual energy
19 associated with each operating schedule is calculated based upon assumed hours of
20 operation and the light source/luminaire billable wattage. Company witness John E.

1 Walter discusses these operating schedules, the calculation of resulting operating hours,
2 and the calculation of associated annual kWh deliveries associated with each.

3
4 Finally, the proposed tariff includes a provision for service to customer-owned LED
5 luminaires, including billing determinants applicable to LED luminaires. I present the
6 LED proposal in Section IV of my testimony.

7
8 **Q. What charges will be billed to customers receiving service on Rate S-05?**

9 A. Rate S-05 customers will be billed a per kWh distribution service charge, all other
10 delivery service charges, and Standard Offer Service charges, as applicable. Schedule
11 JAL-2, Sheet 2, presents the proposed Summary of Rates tariff that identifies the various
12 retail delivery service charges that would be applicable to Rate S-05 customers based on
13 the Company's proposed distribution charge discussed later in this filing as well as the
14 currently effective retail delivery service charges.

15
16 **Q. Are there any other fees and charges applicable to this service?**

17 A. Yes. Mr. Walter will discuss other applicable fees and charges in his testimony.

18
19 **Q. What is the Company proposing as an effective date of the Rate S-05 tariff?**

1 A. The Company is proposing November 15, 2013 as the effective date of the Rate S-05
2 tariff, which complies with the Act's requirement that the Commission issue a decision
3 approving the Company's proposed tariff within sixty days of the filing.
4

5 **IV. LED Proposal**

6 **Q. Please provide more detail regarding the LED proposal contained in the proposed**
7 **Rate S-05.**

8 A. Of course. The Company is aware of its municipal customers' interest in taking
9 advantage of LED streetlighting technology as a means to lower energy usage associated
10 with the streetlighting service they receive. The Company is also aware of municipal
11 customers' goals of being more environmentally conscious in using less energy, thereby
12 decreasing overall energy demand in the region and potentially lowering their overall
13 streetlighting costs over the long term. The Company believes that the aspects of its
14 proposed tariff with respect to LED streetlighting are responsive to customers' interests
15 as well as to the requirements of the Act.
16

17 **Q. How will customers acquire LED street lights?**

18 A. Today, a customer is able to purchase, in the open market, any street or area lighting LED
19 luminaire containing a nominal wattage¹ value of up to 300 watts. The proposed Rate S-

¹ Inclusive of the total device wattage (including the driver and control).

05 will provide the customer with the efficient means to purchase and install their LED luminaire and receive delivery service from the Company.

Q. If customers can purchase any type of LED luminaire, how will the Company bill for service to these luminaires?

A. Upon receipt of customer provided technical information, the Company would assign each LED luminaire to one of six wattage ranges based upon its nominal wattage. Each wattage range specifies a billable wattage value that will be used to determine the annual kWh usage applicable to each LED luminaire. The Company would then base the monthly billing upon the annual kWh calculated for the wattage range.

The Company's proposal for utilizing wattage ranges applicable to LED luminaires is discussed further in the testimony of Mr. Walter.

V. Proposed Tariff Elements Related to Asset Purchase

Q. Please describe what customers would purchase from the Company pursuant to the Act.

A. Under the Act, customers would be allowed (and required) to purchase all of the Company's street and area lighting facilities currently being used to provide outdoor lighting service to the municipality. Not only would the customer purchase the luminaires, lamps, photocells, and brackets that is obvious in the provision of

1 streetlighting service, but they would also be required to purchase any dedicated poles
2 (and related foundations) upon which the only attached equipment is a street light,
3 conductor (wire) installed exclusively for providing streetlighting service, and
4 underground streetlighting equipment, such as conductor and conduit. Generally,
5 anything that the Company would be required to record in plant unit account (“PUC”)
6 373 in compliance with the uniform system of accounts contained in the Code of Federal
7 Regulations issued by the Federal Energy Regulatory Commission would be subject to
8 purchase.

9
10 **Q. Once a customer has made a decision to purchase the street and area lighting**
11 **equipment serving the municipality, what would occur between the customer and**
12 **the Company?**

13 A. The Act requires that the customer give the Company² sixty (60) days notice of intent to
14 purchase street and area lighting equipment serving the municipality. Once the Company
15 receives such notice, the Company will identify the inventory to be purchased by the
16 customer either through examination of current billing system records or by conducting a
17 field investigation, if necessary.

18
19 Next, the Company will calculate the sale prices of the assets that the customer will be
20 purchasing and execute an agreement of sale and license agreement. Finally, the

² Sixty days notice to the Division of Public Utilities and Carriers is also required.

1 Company will make the appropriate changes to its billing system to ensure proper billing
2 on Rate S-05.

3
4 **Q. To ensure proper billing under Rate S-05 on an ongoing basis, how will the**
5 **Company confirm that customer equipment is being billed the correct kWh based**
6 **upon the street light fixtures owned by the town?**

7 A. Under the proposed Rate S-05 tariff, the customer is required to provide the Company
8 with a complete listing of all luminaires served under this rate no less than thirty (30)
9 days following any changes to nominal wattages as those changes occur during the year.
10 In addition, the proposal requires the customer to maintain a location identification
11 reference of their existing lighting equipment, and the equipment is required to bear
12 industry standard labeling designating the equipment's wattage. The Company may
13 choose to conduct audits to confirm that customer-installed equipment is consistent with
14 the information on file with the Company.

15
16 **Q. If a customer-owned street light is not operating, how does a residential or business**
17 **customer in the community know who to call to get it fixed?**

18 A. The Company anticipates that if a community purchased the Company's street lights, the
19 municipality would notify its residents and business owners of the change. The customer
20 should also provide the Company with its contact information for residents and
21 businesses to use in reporting a street light repair request should these customers contact

1 the Company regarding a streetlight outage. However, regardless of the level of
2 communication associated with the change in ownership of street lights in a city or town,
3 the resident or business owner can call the Company, and the Company will have in its
4 records whether it owns the street light in question or if it is owned by the municipality.
5 At that time, the Company will inform the caller that the Company does not own the
6 street light, and, therefore, does not perform maintenance on the light at issue. The
7 Company would also inform the caller that it should contact the appropriate town
8 department to report the problem.

9
10 **Q. What if a customer who purchases the street and area lighting assets in the**
11 **municipality subsequently decides to terminate ownership of any or all of the**
12 **individual lights?**

13 A. If a customer decides to terminate ownership of any or all of the individual lights
14 purchased from the Company or those served on the Rate S-05, the Customer must
15 provide the Company six months advance written notice of the termination. One of two
16 things could happen at this point. The customer could relinquish ownership of the
17 streetlight equipment and the Company would assume ownership, at no cost to the
18 Company, at the Company's discretion. Alternatively, the customer must remove its
19 streetlighting equipment from the Company's distribution poles. Once the removal of
20 customer owned equipment has been completed, the Company will remove the
21 designated assets from its billing system inventory. Under either situation and if the

1 customer desires to receive streetlighting service from the Company, the customer must
2 apply for service under either Rate S-14 or Rate S-06, as applicable.
3

4 **Q. Will there be a document which governs the rights and responsibilities of the**
5 **customer and the Company pertaining to customer-owned streetlighting?**

6 A. Yes. In addition to the proposed Rate S-05 tariff, the Company will require the customer
7 to execute a license agreement that identifies, in greater detail, the rights and
8 responsibilities associated with service under the Rate S-05 tariff.
9

10 **VI. Calculation of Proposed Distribution Charge**

11 **Q. Please describe the proposed Distribution Charge.**

12 A. The Company is proposing a per-kWh Distribution Charge applicable to Rate S-05
13 customers, which is designed to recover the costs associated with the delivery of
14 electricity to customers owning and maintaining their own lighting equipment. The
15 charge reflects the recovery of costs that are similar to those recovered through the
16 Company's other rate classes' distribution and customer charges, such as the Company's
17 investment in primary and secondary distribution system infrastructure (return and
18 depreciation), distribution O&M, administrative and general costs, billing and customer
19 service costs, and all taxes, including income and property taxes. Since streetlighting
20 service is unmetered, the distribution charge does not include the costs of metering.
21

1 **Q. What is the Company proposing for the distribution charge for Rate S-05?**

2 A. The Company is proposing a distribution charge for Rate S-05 of \$0.03823 per kWh.
3 The Company is providing the calculation of the proposed charge in Schedule JAL-3.
4 The Company determined the revenue requirement associated only with the delivery of
5 electricity to outdoor lighting customers, which is generally equivalent to the revenue
6 requirement for the Company's other rate classes regarding the delivery of electricity. I
7 present this calculation below. This revenue requirement is divided by the streetlighting
8 kWh deliveries to determine the per-kWh charge applicable to Rate S-05 customers.

9
10 **Q. How did the Company determine the basis for its proposed distribution charge?**

11 A. The basis for the proposed distribution charge was the Company's allocated cost of
12 service study ("ACOSS") and revenue allocation from the Company's 2012 rate case in
13 Docket No. 4323. By adjusting the ACOSS and revenue allocation to reflect only those
14 costs that should be recovered if the Company did not own any streetlighting assets and,
15 therefore, did not incur any costs of ownership and maintenance, the Company is creating
16 a revenue requirement similar to those of its other rate classes.

17
18 **Q. Please explain how the Company revised the ACOSS and revenue allocation in**
19 **developing its proposed distribution charge.**

20 A. The starting point for this analysis was the final revenue allocation applicable to the
21 outdoor lighting rate classes of approximately \$12.0 million approved by the Commission

1 in Docket No. 4323. The revised ACOSS for distribution-only service, included as
2 Schedule JAL-4, was created by eliminating certain amounts specific to streetlighting
3 service from the Lighting class total cost of service, such as; Distribution Plant recorded
4 in PUC 373, associated depreciation reserve on these assets, depreciation expense on
5 assets recorded in PUC 373, and streetlighting O&M recorded in accounts 585 and 596,
6 plus allocated portions of rate base and expense items that cannot be identified as specific
7 to either lighting equipment or delivery service cost. The resulting Lighting Service
8 revenue requirement for distribution service is approximately \$2.5 million as presented in
9 Schedule JAL-4, page 1, line 11, column (b).
10

11 **Q. How will the customer be assessed the proposed distribution kWh charge?**

12 A. The customer will be billed this proposed per-kWh distribution charge on its monthly bill
13 generated by the Company's Customer Service System. In addition, the customer will
14 also be billed all other per-kWh factors assessed to all streetlighting customers pursuant
15 to the Company's streetlighting tariffs and Summary of Rates tariff, along with Standard
16 Offer Service, unless the customer receives its electric supply from a competitive
17 supplier.
18

19 **Q. Will the Company's distribution revenue be impacted by the replacement of existing**
20 **outdoor lighting fixtures with LED fixtures?**

21 A. Yes. Replacing existing outdoor lighting fixtures with more efficient LED lighting

1 fixtures will result in a reduction in kWh deliveries to outdoor lighting customers and,
2 consequently, a reduction in billed distribution revenue. This effect is the exact reason
3 why having a Revenue Decoupling Mechanism (“RDM”) is beneficial to the expansion
4 of energy efficiency services for the Company and its customers. A RDM removes any
5 barriers to utilities fully embracing and encouraging customers’ participation in energy
6 efficiency products and services. The operation of the Company’s RDM will capture any
7 lost revenue as a result of the operation of more efficient LED lighting fixtures. The
8 Company’s proposal in this filing is consistent with the goals of a RDM, which is to
9 enable the Company to offer energy savings solutions to customers without impacting the
10 Company’s revenue and compromising its ability to deliver safe, reliable service to its
11 customers.

12
13 **VII. Conclusion**

14 **Q. Does this conclude your testimony?**

15 **A.** Yes.

**Schedules of
Jeanne A. Lloyd**

The Narragansett Electric Company
d/b/a National Grid
R.I.P.U.C. Docket No. ____
Customer-Owned Street & Area Lighting Proposal
Witness: Jeanne A. Lloyd

Schedules of Jeanne A. Lloyd

| | |
|----------------|--|
| Schedule JAL-1 | Proposed Street and Area Lighting – Customer-Owned Equipment Rate S-05 Tariff |
| Schedule JAL-2 | Proposed Summary of Delivery Rates Tariff |
| Schedule JAL-3 | Calculation of Proposed Rate S-05 Distribution Charge |
| Schedule JAL-4 | Allocated Cost of Service Study as Revised for Customer-Owned Lighting Equipment |

The Narragansett Electric Company
d/b/a National Grid
R.I.P.U.C. Docket No. ____
Customer-Owned Street & Area Lighting Proposal
Witness: Jeanne A. Lloyd

Schedule JAL-1

Proposed Street and Area Lighting – Customer-Owned Equipment S-05 Tariffs

THE NARRAGANSETT ELECTRIC COMPANY

STREET AND AREA LIGHTING – CUSTOMER OWNED EQUIPMENT S-05
RETAIL DELIVERY SERVICE

AVAILABILITY

Street and Area Lighting Service is available under this rate to any municipal city or town, hereinafter referred to as Customer, in accordance with the qualifications and specifications set forth below and all provisions and terms as further defined in applicable license agreements.

Customers who have received service under the Company's General Street and Area Lighting Rate S-14 and have purchased street and area lighting facilities, including dedicated poles, standards, or accessories pursuant to R.I.G.L § 39-29-1 – 5, shall be served under this rate, provided that the Customer has complied with all provisions and terms of the rates and any related license agreements. Service under this rate is contingent upon the execution of a written purchase and sale agreement for the Company's designated street and area lighting facilities, and dedicated poles, standards or accessories, the completed transfer of title to the facilities from the Company to the Customer, and the execution of and compliance with associated license agreements between the Customer and the Company. Any street and area lighting additions, removals, or replacements performed by the Customer shall be served on this tariff provided the Customer is compliant with all terms and provisions of this tariff and license agreements, and written notice is provided to the Company.

Service provided under this tariff shall be unmetered. The type of service supplied and delivery service voltage shall be determined by the Company in accordance with the Company's Specifications for Electrical Installations.

Street and Area Lighting Service under this rate does not include maintenance of street and area lighting equipment owned by the Customer. The Customer shall be responsible for providing maintenance, and absent a separate written contract between the Company and the Customer, the Company shall have no obligation to maintain facilities and equipment owned by the Customer.

STREET AND AREA LIGHTING – CUSTOMER-OWNED EQUIPMENT**RATE**

The following are unmetered annual billable kWh delivered values for specific individual light source types functioning on a designated operating schedule for applicable customer-owned street and area lights. These annual billable kWh deliveries for the specified light source type/wattage and operating schedule shall be applied to customer-owned street and area lights that require annual kWh deliveries that are less than or equal to the values indicated below as determined by the Company.

1. Annual Billable kWh DeliveriesIncandescent & High Intensity Discharge (HID) Light Sources:

| <u>Light Source Type</u> | <u>Nominal Wattage</u> | <u>Billable Wattage</u> | <u>Annual Billable kWh Delivered</u> | | | |
|--------------------------|----------------------------|-----------------------------|--------------------------------------|---------------------------|----------------|-------------------|
| | | | <u>Continuous</u> | <u>Operating Schedule</u> | | |
| | | | | <u>Dusk-To-Dawn</u> | <u>Dimming</u> | <u>Part-Night</u> |
| Incandescent (INC) | 105 | 105 | 920 | 438 | 380 | 242 |
| | 205 | 205 | 1,796 | 856 | 742 | 472 |

THE NARRAGANSETT ELECTRIC COMPANY

STREET AND AREA LIGHTING – CUSTOMER-OWNED EQUIPMENT S-05
RETAIL DELIVERY SERVICE

RATE (CONTINUED)Incandescent & High Intensity Discharge (HID) Light Sources (continued):

| <u>Light Source Type</u> | <u>Nominal Wattage</u> | <u>Billable Wattage¹</u> | <u>Annual Billable kWh Delivered</u> | | | |
|----------------------------|------------------------|-------------------------------------|--------------------------------------|---------------------------|----------------|-------------------|
| | | | <u>Continuous</u> | <u>Operating Schedule</u> | | |
| | | | | <u>Dusk-To-Dawn</u> | <u>Dimming</u> | <u>Part-Night</u> |
| Mercury Vapor (MV) | 100 | 130 | 1,139 | 543 | 470 | 299 |
| | 175 | 211 | 1,848 | 881 | 763 | 486 |
| | 250 | 307 | 2,689 | 1,282 | 1,110 | 706 |
| | 400 | 477 | 4,179 | 1,991 | 1,724 | 1,098 |
| | 1,000 | 1,095 | 9,592 | 4,572 | 3,958 | 2,520 |
| Metal Halide (MH) | 400 | 451 | 3,951 | 1,883 | 1,630 | 1,038 |
| | 1,000 | 1,078 | 9,443 | 4,501 | 3,897 | 2,480 |
| High Pressure Sodium (HPS) | 50 | 61 | 534 | 255 | 221 | 140 |
| | 70 | 86 | 753 | 359 | 311 | 198 |
| | 100 | 118 | 1,034 | 493 | 427 | 272 |
| | 150 | 173 | 1,515 | 722 | 625 | 398 |
| | 250 | 304 | 2,663 | 1,269 | 1,099 | 700 |
| | 400 | 470 | 4,117 | 1,962 | 1,699 | 1,081 |

¹ Billable Wattage represents the total luminaire energy consumption including the ballast, control, and other applicable adjustments.

Solid State Lighting (SSL) Sources

| <u>Light Source Type</u> | <u>Nominal Wattage² (Range)</u> | <u>Billable Wattage</u> | <u>Annual Billable kWh Delivered</u> | | | |
|-----------------------------------|--|-------------------------|--------------------------------------|---------------------------|----------------|-------------------|
| | | | <u>Continuous</u> | <u>Operating Schedule</u> | | |
| | | | | <u>Dusk-To-Dawn</u> | <u>Dimming</u> | <u>Part-Night</u> |
| <u>Light Emitting Diode (LED)</u> | 0.1 to 50.0 | 25 | 219 | 104 | 83 | 61 |
| | 50.1 to 100.0 | 75 | 657 | 313 | 248 | 184 |
| | 100.1 to 150.0 | 125 | 1,095 | 522 | 414 | 306 |
| | 150.1 to 200.0 | 175 | 1,533 | 731 | 579 | 428 |
| | 200.1 to 250.0 | 225 | 1,971 | 939 | 745 | 551 |
| | 250.1 to 300.0 | 275 | 2,409 | 1,148 | 911 | 673 |

² LED Nominal Wattage includes the total device system wattage (LED array, driver, and control) and applicable adjustments.

2. Other Fees and Charges:

| <u>Fee or Charge Type</u> | <u>Charge Amount</u> |
|---------------------------|---|
| Lighting Service Charge | See Terms and Conditions for Distribution Service |
| Field Survey Charge | See License Agreement for Street and Area Lighting, Section 4.1 |

THE NARRAGANSETT ELECTRIC COMPANY

STREET AND AREA LIGHTING – CUSTOMER OWNED EQUIPMENT S-05
RETAIL DELIVERY SERVICE

3. Rates for Retail Delivery Service

Customers receiving delivery service under this rate shall be charged the applicable charges contained in the Summary of Retail Delivery Rates, R.I.P.U.C. No. 2095, as in effect from time to time.

RATE ADJUSTMENT PROVISIONS

Transmission Service Charge Adjustment

The prices under this rate as set forth under “Monthly Charge” may be adjusted from time to time in the manner described in the Company’s Transmission Service Cost Adjustment Provision.

Transition Charge Adjustment

The prices under this rate as set forth under “Monthly Charge” may be adjusted from time to time in the manner described in the Company’s Non-Bypassable Transition Charge Adjustment Provision.

Standard Offer Adjustment

All Customers served on this rate must pay any charges required pursuant to the terms of the Company’s Standard Offer Adjustment Provision, whether or not the Customer is taking or has taken Standard Offer Service.

Energy Efficiency Programs

The amount determined under the preceding provisions shall be adjusted in accordance with the Company’s Energy Efficiency Program Provision as from time to time effective in accordance with law.

Infrastructure, Safety and Reliability Provision

The amount determined under the preceding provisions shall be adjusted in accordance with the Company’s Infrastructure, Safety and Reliability Provision as from time to time effective in accordance with law.

Customer Credit Provision

The amount determined under the preceding provisions shall be adjusted in accordance with the Company’s Customer Credit Provision as from time to time effective in accordance with law.

LIHEAP Enhancement Plan Provision

The amount determined under the preceding provisions shall be adjusted in accordance with the Company’s LIHEAP Enhancement Plan Provision as from time to time effective in accordance with law.

Revenue Decoupling Mechanism Provision

The amount determined under the preceding provisions shall be adjusted in accordance with the Company’s Revenue Decoupling Mechanism Provision as from time to time effective in accordance with law.

THE NARRAGANSETT ELECTRIC COMPANY

STREET AND AREA LIGHTING – CUSTOMER OWNED EQUIPMENT S-05
RETAIL DELIVERY SERVICE

Net Metering Provision and Qualifying Facilities Power Purchase Rate

The amount determined under the preceding provisions shall be adjusted in accordance with the Company's Net Metering Provision and Qualifying Facilities Power Purchase Rate as from time to time effective in accordance with law.

Pension Adjustment Mechanism Provision

The amount determined under the preceding provisions shall be adjusted in accordance with the Company's Pension Adjustment Mechanism Provision as from time to time effective in accordance with law.

STANDARD OFFER SERVICE

Any Customer served under this rate who is eligible for Standard Offer Service shall receive such service pursuant to the Standard Offer Service tariff.

GROSS EARNINGS TAX

A Rhode Island Gross Earnings Tax adjustment will be applied to the charges determined above in accordance with Rhode Island General Laws.

DETERMINATION OF MONTHLY BILL

The monthly bill will be based on the following:

1. ENERGY CHARGES

The Energy Charges for customer-owned street and area lighting are determined by multiplying the current energy rates by the aggregation of Billable kWh Delivered for each light per billing period.

The monthly billable kWh delivered shall be determined by allocating the Annual Billable kWh Delivered to each month based upon the Monthly Operating Hour Equivalents for lights and Operating Schedule as shown below. Applicable to lights under each Operating Schedule, the sum of the monthly billable kWh delivered for each light equals the annual billable kWh delivered in this tariff. Each month's daily kWh amount is determined from the monthly amount by dividing the monthly kWh by the number of days in the month. The daily kWh amount is multiplied by the actual number of days for each month during the billing period as measured from the prior billing date to the current billing date, and then multiplied by the energy charges per kWh.

Hours of Operation

The Customer's street and area lighting may be operated for the hours and at the light level of the Customer's choice. However, for billing purposes all individual street and area lighting sources will be billed on an applicable Operating Schedule based upon the nature of the street and area lighting services as follows:

1. Continuous – Street and area lights operate continuously each day of the year, a total of approximately 8,760 hours each year.
2. Dusk-To-Dawn – Street and area lights operate daily at full energy requirements from approximately one-half hour after sunset until approximately one-half hour before sunrise, a total of no greater than 4,175 hours each year.

THE NARRAGANSETT ELECTRIC COMPANY

STREET AND AREA LIGHTING – CUSTOMER OWNED EQUIPMENT S-05**RETAIL DELIVERY SERVICE**Hours of Operation (continued)

3. Dimming – Street and area lights operate daily at full energy consumption from approximately one-half hour after sunset until a time equal to the mid-point of the previous Dusk-To-Dawn service period, then an assumed 30% reduction in wattage and energy requirements for a period of reduced light output not to exceed five and one-half hours, as necessary, at which time returning to full energy requirements until approximately one-half hour before sunrise, determined to be a total of 2,301 hours at full energy requirements and 1,874 hours at reduced energy requirements, respectively, for a total annual hourly equivalent of no greater than 3,615 hours each year.
4. Part-Night – Street and area lights operate daily from approximately one-half hour after sunset then turn off at a time equal to the mid-point of the previous Dusk-To-Dawn service period and, as necessary, turn back on five and one-half hours later until approximately one-half hour before sunrise, a total of no greater than 2,301 hours each year.

Customers requesting a change in Hours of Operation of a light due to installation or removal of a control device will be required to provide the estimated annual operating hours and energy reduction conditions it anticipates that the control device will provide as defined by the manufacturer's specifications. The Company will assign the Customer to the appropriate Operating Schedule based upon the Customer's light source type, billable wattage and expected annual operating hours.

Monthly Operating Hour Equivalents

The Monthly Operating Hour Equivalents provided below represents the equivalent time of full energy deliveries to an individual light following the defined Hours of Operation defined above:

Table of Monthly Operating Hour Equivalents (Hrs)

| <u>Month</u> | <u>Days</u> | <u>Operating Schedule</u> | | | |
|--------------|-------------|---------------------------|---------------------|----------------|-------------------|
| | | <u>Continuous</u> | <u>Dusk-To-Dawn</u> | <u>Dimming</u> | <u>Part-Night</u> |
| January | 31 | 744 | 442 | 386 | 266 |
| February | 28 | 672 | 367 | 319 | 211 |
| March | 31 | 744 | 363 | 312 | 192 |
| April | 30 | 720 | 309 | 263 | 154 |
| May | 31 | 744 | 280 | 240 | 141 |
| June | 30 | 720 | 251 | 217 | 127 |
| July | 31 | 744 | 267 | 232 | 137 |
| August | 31 | 744 | 301 | 259 | 153 |
| September | 30 | 720 | 338 | 286 | 172 |
| October | 31 | 744 | 392 | 339 | 220 |
| November | 30 | 720 | 418 | 365 | 250 |
| December | 31 | 744 | 447 | 397 | 278 |
| Annual | 365 | 8,760 | 4,175 | 3,615 | 2,301 |

2. OTHER FEES AND CHARGES

Individual charges for specific Customer requested services will be identified as adjustments on the bill. The representation of applicable fees associated with specific agreements, or license terms and conditions between the Customer and the Company will be imposed according to the agreements, licenses, or as specified in the Terms and Conditions for Distribution Service and presented as adjustments on the Customer's bill.

THE NARRAGANSETT ELECTRIC COMPANY

STREET AND AREA LIGHTING – CUSTOMER OWNED EQUIPMENT S-05
RETAIL DELIVERY SERVICE

LIABILITY AND INDEMNIFICATION

The Customer has the responsibilities and obligations associated with luminaire and support or accessory ownership and maintenance of the street and area lighting facilities served under this tariff. The Customer assumes all liability and shall indemnify the Company for all damages, claims, and liabilities associated with the ownership, maintenance, and operation or failure of operation of the street and area lighting facilities, and the Company shall have the right to require the Customer to show proof of insurance and/or a bond naming the Company as beneficiary to assure such indemnification and assumption of liability is effective. Under no circumstance shall the Company have the obligation to maintain facilities and equipment sold to or owned by the Customer absent the execution of a separate agreement for maintenance. All facilities and equipment purchased by a Customer pursuant to R.I.G.L § 39-29-1 – 5, shall be on an AS IS basis without any warranties, whether express or implied.

INVENTORY OF LIGHTS

The Customer shall be responsible for reporting to the Company the quantity, type of light source, Operating Schedule, type of luminaires by location, and the applicable Customer identification reference for all lights that are operating at any time. The Customer shall provide the Company with a complete listing of all luminaires served under this rate no less than thirty (30) days following any changes to this listing as those changes occur during the year. Such reporting is necessary to ensure that the Company bills the Customer accurately for the cost of distribution, transmission, transition, energy efficiency, and any other applicable delivery service charges and, where appropriate, Standard Offer Service. The Company may perform random confirmation of operating lights in a municipality to ensure the accuracy of such reports. If the Customer fails to meet the referenced reporting requirements or the identification of unreported lights by the Company, the Company will have the right to terminate service under this tariff and require the Customer to obtain service under an applicable metered service.

TERMINATION OF SERVICE

If a Customer that has purchased designated Company street and area lighting facilities subsequently chooses to terminate the service provided by the Company under this tariff and relinquish and surrender its ownership of street and area lighting equipment served on this tariff, the Customer must provide six months advance written notice of such termination and request surrender. Upon providing notification and within the same six-month time period, the Customer shall remove all its street and area lighting equipment from Company-owned poles unless the Company, at its sole option, chooses to assume from the Customer ownership of any or all of the street and area lighting equipment previously owned by the Customer and informs the Customer of such intent to assume ownership. Upon termination of service under this tariff, the Customer will accept service under the appropriate tariff. If the Company agrees to take ownership, the Customer shall transfer to the Company the ownership of designated street and area lights, poles, standards and/or accessories previously owned by the Customer at the time of termination at no cost to the Company and the Company shall operate and maintain the street and area lighting equipment as part of its street and area lighting system under the appropriate Company-Owned street and area lighting tariff. The Customer shall be responsible for payment of any tax liability resulting from the transfer of ownership, and any costs incurred by the Company to inspect designated street and area lights, poles, standards and/or accessories to ensure compliance with the Company's standards. Under no circumstances will the Company accept transfer of ownership of any street and area lights, poles, standards or accessories that do not conform to the Company's standards.

Upon removal of the customer's street and area lighting equipment from Company-owned poles, the Company shall update its billing inventory to cease billing the Customer for that equipment under this rate.

THE NARRAGANSETT ELECTRIC COMPANY

STREET AND AREA LIGHTING – CUSTOMER OWNED EQUIPMENT S-05
RETAIL DELIVERY SERVICE

TERMS AND CONDITIONS

The Company's Terms and Conditions in effect from time to time, where applicable hereto and not inconsistent with any specific provisions hereof, are a part of this rate.

Effective: November 15, 2013

The Narragansett Electric Company
d/b/a National Grid
R.I.P.U.C. Docket No. ____
Customer-Owned Street & Area Lighting Proposal
Witness: Jeanne A. Lloyd

Schedule JAL-2

Proposed Summary of Delivery Rates Tariff

THE NARRAGANSETT ELECTRIC COMPANY
Summary of Retail Delivery Rates

| Rate | Charge Description | Distribution Charge | Operating & Maintenance Exp Charge | O&M Reconciliation Factor | CapEx Factor | CapEx Reconciliation Factor | RDM Adj Factor | Pension Adjustment Factor | Billing Distribution Charge | Net Metering Charge | Long-Term Contracting | Renewable Energy Distribution Charge | LIHEAP Enhancement Charge | Base Transmission Charge | Transmission Adjustment | Uncollectible Factor | Total Transmission Charge | Base Transition Charge | Transition Charge Adj | Total Transition Charge | Energy Efficiency Program Charge | Total Delivery Charges |
|---|--|---|--|---------------------------|---------------------|-----------------------------|--------------------|---------------------------|---|---------------------|-----------------------|--------------------------------------|---------------------------|--------------------------|-------------------------|----------------------|---------------------------|------------------------|-----------------------|-------------------------|----------------------------------|--|
| A-16 Basic Residential Rate R.I.P.U.C. No. 2100 | Customer Charge kWh Charge Effective Date | \$5.00 \$0.3664 2/1/13 | \$0.0190 4/1/13 | \$0.0002 10/1/12 | \$0.0000 4/1/13 | \$0.0000 4/1/13 | \$0.0000 7/1/13 | \$0.0000 2/1/13 | \$5.00 \$0.03812 2/1/13 | \$0.00005 4/1/13 | \$0.00003 7/1/13 | \$0.00002 7/1/13 | \$0.83 1/1/13 | \$0.00142 4/1/13 | (\$0.00128) 4/1/13 | \$0.00025 4/1/13 | \$0.02036 4/1/13 | \$0.00142 4/1/13 | \$0.00020 4/1/13 | \$0.00162 4/1/13 | \$0.00906 2/1/13 | \$5.83 \$0.06918 2/1/13 |
| A-60 Low Income Rate R.I.P.U.C. No. 2101 | Customer Charge kWh Charge Effective Date | \$0.0217 \$0.02310 2/1/13 | \$0.0190 4/1/13 | \$0.0002 10/1/12 | \$0.0000 4/1/13 | \$0.0000 4/1/13 | \$0.0000 7/1/13 | \$0.0000 2/1/13 | \$0.00 \$0.02465 2/1/13 | \$0.00005 4/1/13 | \$0.00003 7/1/13 | \$0.00002 7/1/13 | \$0.83 1/1/13 | \$0.00142 4/1/13 | (\$0.00128) 4/1/13 | \$0.00025 4/1/13 | \$0.02036 4/1/13 | \$0.00142 4/1/13 | \$0.00020 4/1/13 | \$0.00162 4/1/13 | \$0.00906 2/1/13 | \$0.83 \$0.05571 2/1/13 |
| B-32 Large Demand Back-up Service Rate R.I.P.U.C. No. 2137 | Customer Charge Backup Demand Charge - in excess of 200 kW kW Charge - in excess of 200 kW kW Charge (all kW) kWh Charge High Voltage Delivery Discount High Voltage Delivery Add'l Discount (115KV) Second Feeder Service Second Feeder Service - Add'l Transformer High Voltage Metering Discount Effective Date | \$825.00 \$0.19 \$3.70 \$0.00551 (\$0.42) (\$2.75) \$2.75 \$0.42 -1.0% 4/1/13 | \$0.57 \$0.00 \$0.00 \$0.0090 4/1/13 | \$0.0002 10/1/12 | \$0.0000 10/1/12 | \$0.0000 10/1/12 | \$0.0000 7/1/13 | \$0.0000 2/1/13 | \$825.00 \$0.76 \$3.70 \$0.00999 (\$0.42) (\$2.75) \$2.75 \$0.42 -1.0% 4/1/13 | \$0.00005 4/1/13 | \$0.00003 7/1/13 | \$0.00002 7/1/13 | \$0.83 1/1/13 | \$0.00142 4/1/13 | \$0.00056 4/1/13 | \$0.00021 4/1/13 | \$0.00842 4/1/13 | \$0.00142 4/1/13 | \$0.00020 4/1/13 | \$0.00162 4/1/13 | \$0.00906 2/1/13 | \$825.83 \$0.76 \$3.70 \$3.23 (\$0.42) (\$2.75) \$2.75 \$0.42 -1.0% 2/1/13 |
| B-62 Optional Large Demand Back-up Service Rate R.I.P.U.C. No. 2138 | Customer Charge Backup Demand Charge kW Charge (all kW) kWh Charge High Voltage Delivery Discount High Voltage Delivery Add'l Discount (115KV) Second Feeder Service Second Feeder Service - Add'l Transformer High Voltage Metering Discount Effective Date | \$17,000.00 \$0.01 \$2.99 \$0.00000 (\$0.42) (\$2.75) \$2.75 \$0.42 -1.0% 4/1/13 | \$0.32 \$0.32 \$0.00000 4/1/13 | \$0.0002 10/1/12 | \$0.0000 10/1/12 | \$0.0000 10/1/12 | \$0.0000 7/1/13 | \$0.0000 2/1/13 | \$17,000.00 \$0.33 \$3.31 \$0.00042 (\$0.42) (\$2.75) \$2.75 \$0.42 -1.0% 4/1/13 | \$0.00005 4/1/13 | \$0.00003 7/1/13 | \$0.00002 7/1/13 | \$0.83 1/1/13 | \$0.00142 4/1/13 | \$0.00032 4/1/13 | \$0.00018 4/1/13 | \$0.00710 4/1/13 | \$0.00142 4/1/13 | \$0.00020 4/1/13 | \$0.00162 4/1/13 | \$0.00906 2/1/13 | \$17,000.83 \$0.33 \$3.31 \$3.23 (\$0.42) (\$2.75) \$2.75 \$0.42 -1.0% 2/1/13 |
| C-06 Small C&I Rate R.I.P.U.C. No. 2104 | Customer Charge kWh Charge Additional Minimum Charge (per kVA in excess of 25 kVA) Effective Date | \$10.00 \$0.03253 \$1.85 2/1/13 | \$0.0213 4/1/13 | \$0.0002 10/1/12 | \$0.0000 10/1/12 | \$0.0000 10/1/12 | \$0.0000 7/1/13 | \$0.0000 2/1/13 | \$10.00 \$6.00 \$0.03424 \$1.85 4/1/13 | \$0.00005 4/1/13 | \$0.00003 7/1/13 | \$0.00002 7/1/13 | \$0.83 1/1/13 | \$0.00142 4/1/13 | \$0.00029 4/1/13 | \$0.00027 4/1/13 | \$0.02204 4/1/13 | \$0.00142 4/1/13 | \$0.00020 4/1/13 | \$0.00162 4/1/13 | \$0.00906 2/1/13 | \$10.83 \$6.83 \$0.06698 \$1.85 2/1/13 |
| G-02 General C&I Rate R.I.P.U.C. No. 2139 | Customer Charge kW > 10 Charge CHP Minimum Demand Charge (effective 1/1/13) kW Charge kWh Charge High Voltage Delivery Discount High Voltage Metering Discount Effective Date | \$135.00 \$4.85 \$4.85 \$0.00468 (\$0.42) -1.0% 2/1/13 | \$0.0146 4/1/13 | \$0.0002 10/1/12 | \$0.0000 10/1/12 | \$0.0000 10/1/12 | \$0.0000 7/1/13 | \$0.0000 2/1/13 | \$135.00 \$4.85 \$4.85 \$0.00569 (\$0.42) -1.0% 4/1/13 | \$0.00005 4/1/13 | \$0.00003 7/1/13 | \$0.00002 7/1/13 | \$0.83 1/1/13 | \$0.00142 4/1/13 | \$0.00061 4/1/13 | \$0.00021 4/1/13 | \$0.00716 4/1/13 | \$0.00142 4/1/13 | \$0.00020 4/1/13 | \$0.00162 4/1/13 | \$0.00906 2/1/13 | \$135.83 \$4.85 \$4.85 \$2.89 \$0.02355 (\$0.42) -1.0% 2/1/13 |

Taxes and other rate clauses apply as usual and will appear on customer bills as applicable.

Column Descriptions:

- A - C, per retail delivery tariffs R.I.P.U.C. Nos. 2100, 2101, 2104, 2108 through 2112, 2137 through 2141
- D - G, per Infrastructure, Safety and Reliability Provision, R.I.P.U.C. No. 2118
- H, per Revenue Decoupling Mechanism Provision, R.I.P.U.C. No. 2073
- I, per Pension Adjustment Mechanism Provision, R.I.P.U.C. No. 2119
- J, Col C+ Col D+ Col E+ Col F + Col G + Col H + Col I
- K, per Net Metering Provision, R.I.P.U.C. No. 2099
- L, per Long-Term Contracting for Renewable Energy Recovery Provision, R.I.P.U.C. No. 2125 & 2127
- M, Col K+ Col L
- N, per LIHEAP Enhancement Plan Provision, R.I.P.U.C. No. 2079
- O - Q, per Transmission Cost Adjustment Provision, R.I.P.U.C. No. 2115
- R, Col O+ Col P + Col Q
- S, - T, per Non-Bypassable Transition Adjustment Provision, R.I.P.U.C. No. 1188
- U, Col S+ Col T
- V, per Energy Efficiency Program Provision, R.I.P.U.C. No. 2114, also includes \$0.00030 per kWh Renewable Energy Charge per R.I.G.L. §39-2-12
- W, Col H- Col M+ Col N+ Col R + Col U + Col V

Effective: 11/15/2013
(Replacing R.I.P.U.C. No. 2095 effective 04/01/13)
Issued: 09/16/2013

THE NARRAGANSETT ELECTRIC COMPANY
Summary of Retail Delivery Rates

| Rate | Charge Description | Distribution Charge | Operating & Maintenance Expense Charge | O&M Reconciliation Factor | CapEx Factor | CapEx Charge | RDM Adj Factor | Pension Adjustment Factor | Billing Distribution Charge | Net Metering Charge | Long-Term Contracting | Renewable Energy Distribution Charge | LIHEAP Enhancement Charge | Base Transmission Charge | Base Charge | Transmission Adjustment | Transmission Uncollectible Factor | Total Charge | Transition Charge Adj | Total Transition Charge | Energy Efficiency Program Charge | Total Delivery Charges |
|---|--|---------------------|--|---------------------------|--------------|--------------|----------------|---------------------------|-----------------------------|---------------------|-----------------------|--------------------------------------|---------------------------|--------------------------|-------------|-------------------------|-----------------------------------|--------------|-----------------------|-------------------------|----------------------------------|------------------------|
| G-32 Large Demand Rate R.I.P.U.C. No. 2140 | A Customer Charge Large Demand Rate - in excess of 200 kW R.I.P.U.C. No. 2140 kW Charge CHP Minimum Demand Charge (effective 1/1/13) kW Charge High Voltage Delivery Discount (115KV) Second Feeder Service Second Feeder Service - Addtl Transformer High Voltage Metering Discount Effective Date | \$825.00 | | | | | | | \$825.00 | | | | | | | | | | | | | |
| | | \$3.70 | | | | \$0.00 | | | \$3.70 | | | | | | | | | | | | | |
| | | \$3.70 | | | | \$0.00 | | | \$3.70 | | | | | | | | | | | | | |
| | | \$0.00551 | | | | \$0.00000 | | | \$0.0099 | | | | | | | | | | | | | |
| | | \$0.42 | | | | \$0.00000 | | | \$0.0099 | | | | | | | | | | | | | |
| | | \$2.75 | | | | \$0.00000 | | | \$0.0099 | | | | | | | | | | | | | |
| G-62 Optional Large Demand Rate R.I.P.U.C. No. 2141 | B Customer Charge Large Demand Rate - in excess of 200 kW R.I.P.U.C. No. 2141 kW Charge CHP Minimum Demand Charge (effective 1/1/13) kW Charge High Voltage Delivery Discount (115KV) Second Feeder Service Second Feeder Service - Addtl Transformer High Voltage Metering Discount Effective Date | \$17,000.00 | | | | | | | \$17,000.00 | | | | | | | | | | | | | |
| | | \$2.99 | | | | \$0.00 | | | \$2.99 | | | | | | | | | | | | | |
| | | \$2.99 | | | | \$0.00 | | | \$2.99 | | | | | | | | | | | | | |
| | | \$0.00000 | | | | \$0.00000 | | | \$0.00000 | | | | | | | | | | | | | |
| | | \$0.42 | | | | \$0.00000 | | | \$0.00000 | | | | | | | | | | | | | |
| | | \$2.75 | | | | \$0.00000 | | | \$0.00000 | | | | | | | | | | | | | |
| X-01 Electric Propulsion Rate R.I.P.U.C. No. 2108 | C Customer Charge Electric Propulsion Rate - in excess of 200 kW R.I.P.U.C. No. 2108 kW Charge CHP Minimum Demand Charge (effective 1/1/13) kW Charge High Voltage Delivery Discount (115KV) Second Feeder Service Second Feeder Service - Addtl Transformer High Voltage Metering Discount Effective Date | \$16,500.00 | | | | | | | \$16,500.00 | | | | | | | | | | | | | |
| | | \$0.00 | | | | \$0.00 | | | \$0.00 | | | | | | | | | | | | | |
| | | \$0.01600 | | | | \$0.00000 | | | \$0.01705 | | | | | | | | | | | | | |
| | | \$0.00000 | | | | \$0.00000 | | | \$0.00000 | | | | | | | | | | | | | |
| | | \$0.42 | | | | \$0.00000 | | | \$0.00000 | | | | | | | | | | | | | |
| | | \$2.75 | | | | \$0.00000 | | | \$0.00000 | | | | | | | | | | | | | |
| M-1 Station Power Delivery & Reliability Service Rate R.I.P.U.C. No. 2109 | D Customer Charge Station Power Delivery & Reliability Service Rate - in excess of 200 kW R.I.P.U.C. No. 2109 kW Charge CHP Minimum Demand Charge (effective 1/1/13) kW Charge High Voltage Delivery Discount (115KV) Second Feeder Service Second Feeder Service - Addtl Transformer High Voltage Metering Discount Effective Date | \$3,959.09 | | | | | | | \$3,959.09 | | | | | | | | | | | | | |
| | | \$0.00 | | | | \$0.00 | | | \$0.00 | | | | | | | | | | | | | |
| | | \$0.00 | | | | \$0.00 | | | \$0.00 | | | | | | | | | | | | | |
| | | \$0.00000 | | | | \$0.00000 | | | \$0.00000 | | | | | | | | | | | | | |
| | | \$0.42 | | | | \$0.00000 | | | \$0.00000 | | | | | | | | | | | | | |
| | | \$2.75 | | | | \$0.00000 | | | \$0.00000 | | | | | | | | | | | | | |
| S-05 Customer-owned Lighting Equipment R.I.P.U.C. No. 2142 | E Customer Charge Customer-owned Lighting Equipment - in excess of 200 kW R.I.P.U.C. No. 2142 kW Charge CHP Minimum Demand Charge (effective 1/1/13) kW Charge High Voltage Delivery Discount (115KV) Second Feeder Service Second Feeder Service - Addtl Transformer High Voltage Metering Discount Effective Date | \$0.03823 | | | | | | | \$0.03823 | | | | | | | | | | | | | |
| | | \$0.01338 | | | | \$0.00000 | | | \$0.01338 | | | | | | | | | | | | | |
| | | \$0.01338 | | | | \$0.00000 | | | \$0.01338 | | | | | | | | | | | | | |
| | | \$0.00000 | | | | \$0.00000 | | | \$0.00000 | | | | | | | | | | | | | |
| | | \$0.42 | | | | \$0.00000 | | | \$0.00000 | | | | | | | | | | | | | |
| | | \$2.75 | | | | \$0.00000 | | | \$0.00000 | | | | | | | | | | | | | |
| S-06 Decorative Street and Area Lighting Service R.I.P.U.C. No. 2110 | F Customer Charge Decorative Street and Area Lighting Service - in excess of 200 kW R.I.P.U.C. No. 2110 kW Charge CHP Minimum Demand Charge (effective 1/1/13) kW Charge High Voltage Delivery Discount (115KV) Second Feeder Service Second Feeder Service - Addtl Transformer High Voltage Metering Discount Effective Date | \$0.03823 | | | | | | | \$0.03823 | | | | | | | | | | | | | |
| | | \$0.01338 | | | | \$0.00000 | | | \$0.01338 | | | | | | | | | | | | | |
| | | \$0.01338 | | | | \$0.00000 | | | \$0.01338 | | | | | | | | | | | | | |
| | | \$0.00000 | | | | \$0.00000 | | | \$0.00000 | | | | | | | | | | | | | |
| | | \$0.42 | | | | \$0.00000 | | | \$0.00000 | | | | | | | | | | | | | |
| | | \$2.75 | | | | \$0.00000 | | | \$0.00000 | | | | | | | | | | | | | |
| S-14 General Street and Area Lighting Service R.I.P.U.C. No. 2112 | G Customer Charge General Street and Area Lighting Service - in excess of 200 kW R.I.P.U.C. No. 2112 kW Charge CHP Minimum Demand Charge (effective 1/1/13) kW Charge High Voltage Delivery Discount (115KV) Second Feeder Service Second Feeder Service - Addtl Transformer High Voltage Metering Discount Effective Date | \$0.03823 | | | | | | | \$0.03823 | | | | | | | | | | | | | |
| | | \$0.01338 | | | | \$0.00000 | | | \$0.01338 | | | | | | | | | | | | | |
| | | \$0.01338 | | | | \$0.00000 | | | \$0.01338 | | | | | | | | | | | | | |
| | | \$0.00000 | | | | \$0.00000 | | | \$0.00000 | | | | | | | | | | | | | |
| | | \$0.42 | | | | \$0.00000 | | | \$0.00000 | | | | | | | | | | | | | |
| | | \$2.75 | | | | \$0.00000 | | | \$0.00000 | | | | | | | | | | | | | |

Taxes and other rate clauses apply as usual and will appear on customer bills as applicable.

Customer Descriptions:

- A. - C. per retail delivery tariffs
- D. - G. per Infrastructure, Safety and Reliability Provision, R.I.P.U.C. No. 2118
- H. per Revenue Decoupling Mechanism Provision, R.I.P.U.C. No. 2073
- I. per Pension Adjustment Mechanism Provision, R.I.P.U.C. No. 2119
- J. Col C+ Col D+ Col E+ Col F + Col G + Col H + Col I
- K. per Net Metering Provision, R.I.P.U.C. No. 2099

L. per Long-Term Contracting for Renewable Energy Recovery Provision, R.I.P.U.C. No. 2125 & 2127

M. Col K+ Col L

N. per LIHEAP Enhancement Plan Provision, R.I.P.U.C. No. 2079

O. - Q. per Transmission Cost Adjustment Provision, R.I.P.U.C. No. 2115

R. Col O+ Col P + Col Q

S. - T. per Non-Bypassable Transition Adjustment Provision, R.I.P.U.C. No. 1188

U. Col S+ Col T

V. per Energy Efficiency Program Provision, R.I.P.U.C. No. 2114, also includes \$0.00030 per kWh Renewable Energy Charge per R.L.G.L. §39-2-1.2

W. Col J+ Col M+ Col N+ Col R + Col U + C

Effective: 11/15/2013
Issued: 09/16/2013
(Replacing R.I.P.U.C. No. 2095 effective 04/01/13)

THE NARRAGANSETT ELECTRIC COMPANY
Summary of Retail Delivery Rates

| Rate | A | Charge Description B | Distribution Charge C | | | |
|---|---|--|-----------------------------|-----------------------------|-----------------------------|-------------------------|
| Rate S-06 <i>Decorative Street and Area Lighting Service</i> R.I.P.U.C. No. 2110 | | <u>Fixture Charges</u> | <u>Full Service</u> S-06 | <u>Full Service</u> S-10 | <u>Full Service</u> S-14 | <u>Temp-off</u> S-14 |
| Rate S-10 <i>Limited Service - Private Lighting</i> R.I.P.U.C. No. 2111 | | <u>Luminaires</u> | | | | |
| | | <u>Incandescent</u> | n/a | \$77.43 | \$77.43 | \$46.46 |
| | | Roadway LUM INC RWY 105W | n/a | n/a | \$77.43 | \$46.46 |
| | | LUM INC RWY 205W (S-14 Only) | | | | |
| | | <u>Mercury Vapor</u> | | | | |
| | | Roadway LUM MV RWY 100W | n/a | \$78.06 | \$78.06 | \$46.84 |
| | | LUM MV RWY 175W | n/a | \$78.06 | \$78.06 | \$46.84 |
| | | LUM MV RWY 250W (S-14 Only) | n/a | n/a | \$120.39 | \$72.23 |
| | | LUM MV RWY 400W | n/a | \$163.46 | \$163.46 | \$98.08 |
| | | LUM MV RWY 1000W | n/a | \$163.46 | \$163.46 | \$98.08 |
| | | Post-top LUM MV POST 175W (S-14 Only) | n/a | n/a | \$156.80 | \$94.08 |
| | | Flood LUM MV FLD 400W | n/a | \$181.37 | \$181.37 | \$108.82 |
| | | LUM MV FLD 1000W | n/a | \$181.37 | \$181.37 | \$108.82 |
| | | <u>Sodium Vapor</u> | | | | |
| | | Roadway LUM HPS RWY 50W | n/a | \$77.43 | \$77.43 | \$46.46 |
| | | LUM HPS RWY 70W | n/a | \$76.91 | \$76.91 | \$46.15 |
| | | LUM HPS RWY 100W | n/a | \$78.06 | \$78.06 | \$46.84 |
| | | LUM HPS RWY 150W | n/a | \$78.58 | \$78.58 | \$47.15 |
| | | LUM HPS RWY 250W | n/a | \$120.39 | \$120.39 | \$72.23 |
| | | LUM HPS RWY 400W | n/a | \$163.46 | \$163.46 | \$98.08 |
| | | Flood LUM HPS FLD 250W | n/a | \$146.11 | \$146.11 | \$87.67 |
| | | LUM HPS FLD 400W | n/a | \$181.37 | \$181.37 | \$108.82 |
| | | Post-top LUM HPS POST 50W | n/a | \$155.49 | \$155.49 | \$93.29 |
| | | LUM HPS POST 100W | n/a | \$156.80 | \$156.80 | \$94.08 |
| | | WALL HPS 250W 24HR | n/a | \$172.21 | \$172.21 | \$103.33 |
| | | SHOEBBOX - LUM HPS REC 100W-C1 | n/a | \$98.99 | n/a | n/a |
| | | <u>Metal Halide</u> | | | | |
| | | Flood LUM MH FLD 400W | n/a | \$181.37 | \$181.37 | \$108.82 |
| | | LUM MH FLD 1000W | n/a | \$181.37 | \$181.37 | \$108.82 |
| | | <u>Decorative</u> | | | | |
| | | DEC HPS TR 50W | \$155.49 | n/a | n/a | n/a |
| | | DEC HPS TR 100W | \$156.80 | n/a | n/a | n/a |
| | | DEC HPS AG 50W | \$292.34 | n/a | n/a | n/a |
| | | DEC HPS AG 100W | \$280.77 | n/a | n/a | n/a |
| | | DEC HPS WL 50W | \$325.35 | n/a | n/a | n/a |
| | | DEC HPS WL 100W | \$325.30 | n/a | n/a | n/a |
| | | DEC HPS TR-TW 50W | \$506.29 | n/a | n/a | n/a |
| | | DEC HPS TR-TW 100W | \$509.46 | n/a | n/a | n/a |
| | | DEC HPS AG-TW 50W | \$693.84 | n/a | n/a | n/a |
| | | DEC HPS AG-TW 100W | \$670.71 | n/a | n/a | n/a |
| | | DEC HPS WL-TW 50W | \$759.87 | n/a | n/a | n/a |
| | | DEC HPS WL-TW 100W | \$759.77 | n/a | n/a | n/a |
| | | <u>Standards</u> | | | | |
| | | POLE-WOOD | n/a | \$133.71 | \$133.71 | \$133.71 |
| | | POLE FIBER PT EMB <2.5' w/out foundation | n/a | \$260.22 | \$260.22 | \$260.22 |
| | | POLE FIBER RWY <2.5' w/ foundation | n/a | \$424.14 | \$424.14 | \$424.14 |
| | | POLE FIBER RWY ≈ 25' w/ foundation | n/a | \$473.53 | \$473.53 | \$473.53 |
| | | POLE METAL EMBEDDED (S-14 Only) | n/a | n/a | \$405.16 | \$405.16 |
| | | POLE METAL ≈ 25FT (with foundation) | n/a | \$484.72 | \$484.72 | \$484.72 |
| | | DEC VILL PT/FDN | \$566.70 | n/a | n/a | n/a |
| | | DEC WASH PT/FDN | \$575.78 | n/a | n/a | n/a |
| <i>Taxes and other rate clauses apply as usual and will appear on customer bills as applicable.</i> | | | 2/1/13 | 2/1/13 | 2/1/13 | 2/1/13 |

Column Descriptions:Effective:
11/15/2013
(Replacing R.I.P.U.C. No. 2095 effective 04/01/13)
Issued:
09/16/2013

A. - C. per retail delivery tariffs R.I.P.U.C. Nos. 2110 through 2112

The Narragansett Electric Company
d/b/a National Grid
R.I.P.U.C. Docket No. ____
Customer-Owned Street & Area Lighting Proposal
Witness: Jeanne A. Lloyd

Schedule JAL-3

Calculation of Proposed Rate S-05 Distribution Charge

The Narragansett Electric Company

Calculation of Distribution kWh Charge Applicable to Rate S-05 Customer-Owned Street & Area Lighting

Line No.

| | | |
|---|--|-------------|
| 1 | Lighting Service Revenue Requirement excluding lighting equipment | \$2,509,000 |
| 2 | Annual kWh Deliveries | 65,617,055 |
| 3 | Proposed Distribution kWh Charge Applicable to Rate S-05 Customer-Owned Street & Area Lighting | \$0.03823 |

Line Descriptions:

- 1 per Schedule JAL-4, page 1, line 11, column (c)
- 2 per R.I.P.U.C. Docket No. 4323, Compliance Attachment 3D (Schedule JAL-4), Page 13, Column (h), Lines 19 and 20
- 3 Line 1 ÷ Line 2, truncated to five decimal places

The Narragansett Electric Company
d/b/a National Grid
R.I.P.U.C. Docket No. ____
Customer-Owned Street & Area Lighting Proposal
Witness: Jeanne A. Lloyd

Schedule JAL-4

Allocated Cost of Service Study as Revised for Customer-Owned Lighting Equipment

The Narragansett Electric Company
RESULTS OF ALLOCATED COST OF SERVICE STUDY AND REVENUE ALLOCATION

| Line | Lighting - Total | Lighting - Delivery Service Only | Lighting (excl. lighting equip. and O&M) |
|---|------------------|--|--|
| | (a) | (b) | (c) |
| SECTION 1. SUMMARY OF RESULTS OF ALLOCATED COST OF SERVICE STUDY | | | |
| 1 Rate Base | \$29,287 | \$4,193 | \$25,094 |
| 2 Compliance Rate of Return | 7.17% | 7.17% | 7.17% |
| 3 Return on Rate Base | \$2,100 | \$301 | \$1,799 |
| 4 Operating Expenses (not including income taxes) | \$12,073 | \$1,997 | \$10,076 |
| 5 Income Taxes | \$766 | \$110 | \$656 |
| 6 Total Distribution Revenue Requirement | \$14,938 | \$2,407 | \$11,875 |
| 7 less: Other revenue | \$274 | \$274 | \$0 |
| 8 Distribution Rate Revenue Requirement | \$14,664 | \$2,133 | \$11,875 |
| 9 A-60 Subsidy | \$376 | \$376 | \$0 |
| 10 Apply Cap on Increase | -\$3,066 | \$0 | -\$3,066 |
| 11 Total Revenue Requirement | \$11,974 | \$2,509 | \$8,809 |

Column Notes:

- Col (a): Col (b) +Col (c)
Col (b): Pages 2 through 4, Col (b)
Col (c): Pages 2 through 4, Col (c)

Line Notes:

- (1) Page 2, Line 38
(2) per RIPUC Docket No. 4323 Compliance Attachment 3A, page 7 line 162
(3) Line 1 x Line 2
(4) Page 4, Line 94
(5) Line 3 x 36.46 %
(6) Line 3 + Line 4 + Line 5
(7) RIPUC Docket No. 4323 Compliance Attachment 3B, page 1 line 11 plus line 50 for lighting class
(8) Line 6 - Line 7
(9) per RIPUC Docket No. 4323 Compliance Attachment 3B, page 1 line 30
(10) per RIPUC Docket No. 4323 Compliance Attachment 3B, page 1 line 42
(11) Line 8 + Line 9 + Line 10

The Narragansett Electric Company
Class Allocated Cost of Service Study

Class Allocations - Total (in 000s)

REVISED FOR CUSTOMER-OWNED LIGHTING EQUIPMENT

| Line No. | FERC Account | FERC Acct No. | Lighting - Total (a) | Lighting - Delivery Service Only (b) | Lighting (lighting equip. and O&M) (c) |
|----------------------------------|------------------------------------|------------------|-------------------------|--|--|
| ELECTRIC PLANT IN SERVICE | | | | | |
| 1 | Production Plant | 303 | \$27 | \$27 | \$0 |
| 2 | Transmission Plant | | \$27 | \$27 | \$0 |
| TRANSMISSION PLANT | | | | | |
| 3 | Transmission Plant | 350-359 | \$0 | \$0 | \$0 |
| 4 | Transmission Plant | 361 | \$0 | \$0 | \$0 |
| 5 | Transmission Plant | 350-359 | \$0 | \$0 | \$0 |
| DISTRIBUTION PLANT | | | | | |
| 6 | Land and Land Rights | 360 | \$80 | \$80 | \$0 |
| 7 | Structures and Improvements | 361 | \$64 | \$64 | \$0 |
| 8 | Station Equipment | 362 | \$1,385 | \$1,385 | \$0 |
| 9 | Poles, Towers and Fixtures | 364 | \$1,819 | \$1,819 | \$0 |
| 10 | Overhead Conductors and Devices | 365 | \$2,282 | \$2,282 | \$0 |
| 11 | Underground Conduit | 366 | \$537 | \$537 | \$0 |
| 12 | Underground Conductors & Devices | 367 | \$1,150 | \$1,150 | \$0 |
| 13 | Line Transformers | 368 | \$1,545 | \$1,545 | \$0 |
| 14 | Services | 369 | | \$0 | \$0 |
| 15 | Meters | 370 | | \$0 | \$0 |
| 16 | Installations on Customer Premises | 371 | | \$0 | \$0 |
| 17 | Street Lighting & Signal Systems | 373 | \$53,261 | \$0 | \$53,261 |
| 18 | Plant Additions | 374 | \$3,749 | \$534 | \$3,215 |
| 19 | Distribution Plant | 360-374 | \$65,872 | \$9,396 | \$56,476 |
| GENERAL PLANT | | | | | |
| 20 | | | | | |
| 21 | General Plant | 398 | \$3,932 | \$403 | \$3,529 |
| 22 | General Plant | 389-399 | \$3,932 | \$403 | \$3,529 |
| 23 | TOTAL UTILITY PLANT | | \$69,831 | \$9,826 | \$60,005 |
| DEPRECIATION RESERVE | | | | | |
| 24 | | | | | |
| 25 | Production Plant | 108 | \$0 | \$0 | \$0 |
| 26 | Distribution Plant | 108 | \$28,534 | \$4,071 | \$24,463 |
| 27 | General Plant | 108 | \$3,097 | \$317 | \$2,780 |
| 28 | Depreciation Reserve | 108 | \$31,631 | \$4,388 | \$27,243 |
| OTHER RATE BASE ITEMS | | | | | |
| 29 | Property Held for Future Use | 131 | \$0 | \$0 | \$0 |
| 30 | Less: CIAC | 131 | (\$5) | (\$1) | (\$4) |
| 31 | Materials and Supplies | 131 | \$347 | \$50 | \$297 |
| 32 | Loss on Reacquired Debt | 131 | \$415 | \$59 | \$356 |
| 33 | Cash Working Capital | 255 | \$310 | \$53 | \$257 |
| 34 | Accumulated Deferred FIT | 0 | (\$9,722) | (\$1,368) | (\$8,354) |
| 35 | Customer Deposits | 154 | (\$2) | (\$2) | \$0 |
| 36 | Injuries and Damages Reserve | 131 | (\$256) | (\$36) | (\$220) |
| 37 | Other Rate Base | 131-283 | (\$8,913) | (\$1,245) | (\$7,668) |
| 38 | TOTAL RATE BASE | | \$29,287 | \$4,193 | \$25,094 |

**The Narragansett Electric Company
Class Allocated Cost of Service Study****Class Allocations - Total (in 000s)****REVISED FOR CUSTOMER-OWNED LIGHTING EQUIPMENT**

| Line No. | FERC Account | FERC Acct No. | Lighting - Total (a) | Lighting - Delivery Service Only (b) | Lighting (lighting equip. and O&M) (c) |
|---|---------------------------------|------------------|-------------------------|--|--|
| OPERATING AND MAINTENANCE EXPENSES | | | | | |
| DISTRIBUTION EXPENSE | | | | | |
| 39 | Purchased Power- Borderline | 555.111 | \$0 | \$0 | \$0 |
| 40 | Dist Oper-Supervision & Eng | 580 | \$83 | \$7 | \$76 |
| 41 | Dist Oper-Load Dispatching | 581 | \$17 | \$17 | \$0 |
| 42 | Dist Oper-Substations | 582 | \$9 | \$9 | \$0 |
| 43 | Dist Oper-Overhead Lines | 583 | \$19 | \$19 | \$0 |
| 44 | Dist Oper-Underground Lines | 584 | \$9 | \$9 | \$0 |
| 45 | Dist Oper-Outdoor Lighting | 585 | \$349 | \$0 | \$349 |
| 46 | Dist Oper-Electric Meters | 586 | \$0 | \$0 | \$0 |
| 47 | Dist Oper-Customer Installation | 587 | \$12 | \$12 | \$0 |
| 48 | Dist Oper-Misc Expenses | 588 | \$656 | \$54 | \$602 |
| 49 | Dist Oper-Rents | 589 | \$7 | \$1 | \$6 |
| 50 | Dist Maint-Supervision & Eng | 590 | \$6 | \$1 | \$5 |
| 51 | Dist Maint-Structures | 591 | \$0 | \$0 | \$0 |
| 52 | Dist Maint-Substations | 592 | \$15 | \$15 | \$0 |
| 53 | Dist Maint-Overhead Lines | 593 | \$106 | \$106 | \$0 |
| 54 | Dist Maint-Underground Lines | 594 | \$3 | \$3 | \$0 |
| 55 | Dist Maint-Line Transformers | 595 | \$2 | \$2 | \$0 |
| 56 | Dist Maint-Outdoor Lighting | 596 | \$1,374 | \$0 | \$1,374 |
| 57 | Dist Maint-Electric Meters | 597 | \$0 | \$0 | \$0 |
| 58 | Oper. & Maint. Exp. | 500-599 | \$2,667 | \$255 | \$2,412 |
| CUSTOMER ACCOUNTS AND SERVICE | | | | | |
| 59 | Cust Acct-Supervision | 901 | \$5 | \$5 | \$0 |
| 60 | Cust Acct-Meter Reading Exp | 902 | \$0 | \$0 | \$0 |
| 61 | Cust Records & Collection | 903 | \$132 | \$132 | \$0 |
| 62 | Uncollectible Accounts | 904 | \$172 | \$172 | \$0 |
| 63 | Commodity Costs/Trans Uncoll | 0 | \$0 | \$0 | \$0 |
| 64 | Cust Acct-Misc Expenses | 905 | \$1 | \$1 | \$0 |
| 65 | Customer Accts. Exp. | 901-905 | \$310 | \$310 | \$0 |
| 66 | Cust Service-Supervision | 907 | \$0 | \$0 | \$0 |
| 67 | Cust Assistance Expenses | 908 | \$8 | \$8 | \$0 |
| 68 | Cust Service-Misc Expenses | 910 | \$8 | \$8 | \$0 |
| 69 | Demo & Selling Exp | 912 | \$6 | \$6 | \$0 |
| 70 | Customer Service Exp. | 907-912 | \$22 | \$22 | \$0 |
| 71 | Customer Accts. & Serv. Exp. | 901-919 | \$332 | \$332 | \$0 |
| ADMINISTRATIVE AND GENERAL | | | | | |
| 72 | A&G-Salaries | 920 | \$907 | \$93 | \$814 |
| 73 | A&G-Office Supplies | 921 | \$789 | \$81 | \$708 |
| 74 | A&G-Outside Services Employed | 923 | \$201 | \$21 | \$180 |
| 75 | Property Insurance | 924 | \$6 | \$1 | \$5 |
| 76 | Injuries & Damages Insurance | 925 | \$294 | \$42 | \$252 |
| 77 | Employee Pensions & Benefits | 926 | \$1,608 | \$165 | \$1,443 |
| 78 | Franchise Requirements | 927 | (\$7) | (\$6) | (\$1) |
| 79 | Regulatory Comm Expenses | 928 | \$289 | \$257 | \$32 |
| 80 | Miscellaneous General Expenses | 930 | \$18 | \$16 | \$2 |
| 81 | Rents | 931 | \$546 | \$56 | \$490 |
| 82 | Maintenance of general plant | 935 | \$18 | \$2 | \$16 |
| 83 | Donations | 426 | \$21 | \$19 | \$2 |
| 84 | Admin & Genl. Exp. | 920-935 | \$4,690 | \$747 | \$3,943 |
| 85 | Total Operating Expenses | | \$7,689 | \$1,334 | \$6,355 |

The Narragansett Electric Company
Class Allocated Cost of Service Study

Class Allocations - Total (in 000s)

REVISED FOR CUSTOMER-OWNED LIGHTING EQUIPMENT

| Line No. | FERC Account | FERC Acct No. | Lighting - Total (a) | Lighting - Delivery Service Only (b) | Lighting (lighting equip. and O&M) (c) |
|-----------------------------|--------------------------------|------------------|-------------------------|--|--|
| DEPRECIATION EXPENSE | | | | | |
| 86 | Depreciation Expense | 403 | \$2,387 | \$336 | \$2,051 |
| 87 | Depreciation Expense | | \$2,387 | \$336 | \$2,051 |
| TAXES and OTHER | | | | | |
| GENERAL TAXES | | | | | |
| 88 | Municipal tax | 408.14 | \$1,599 | \$225 | \$1,374 |
| 89 | Payroll tax | 408.11 | \$268 | \$27 | \$241 |
| 90 | Other tax | 408.17 | \$64 | \$9 | \$55 |
| 91 | General Taxes | | \$1,931 | \$261 | \$1,670 |
| OTHER | | | | | |
| 92 | Incremental Uncollectibles | 0 | \$66 | \$66 | \$0 |
| 93 | Other | | \$66 | \$66 | \$0 |
| 94 | Total Operating Expense | | \$12,073 | \$1,997 | \$10,076 |

Column Notes:

Col (a): Compliance Attachment 3A, R.I.P.U.C. Docket No. 4323

Col (b): Col (a) - Col (c)

Col (c): Compliance Attachment 3A, R.I.P.U.C. Docket No. 4323, Pages 34 through 38, for Lighting Service Class

**Testimony of
John E. Walter**

The Narragansett Electric Company
d/b/a National Grid
R.I.P.U.C. Docket No. ____
Customer-Owned Street & Area Lighting Proposal
Witness: John E. Walter

PRE-FILED DIRECT TESTIMONY

OF

JOHN E. WALTER

September 16, 2013

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VI. Issues Related to Customer Purchase of Lighting Assets 19

VII. Conclusion..... 22

1 **I. Introduction and Qualifications**

2 **Q. Please state your full name and business address.**

3 A. My name is John E. Walter, and my business address is 144 Kensington Avenue, Buffalo,
4 New York 14214.

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

7 A. I am a Principal Engineer in the Outdoor Lighting & Attachments Group of National Grid
8 USA Service Company, Inc., including The Narragansett Electric Company d/b/a
9 National Grid. Throughout this testimony, I will refer to National Grid USA as “National
10 Grid”. For purposes of clarity, where I intend to refer to The Narragansett Electric
11 Company, I will refer to it as the “Company”.

13 **Q. Please describe your educational background and training.**

14 A. In 1979, I graduated from Clarkson College of Technology, (presently Clarkson
15 University), located in Potsdam, New York with a Bachelor of Science degree in Civil
16 and Environmental Engineering. In 1981, I graduated from Clarkson College of
17 Technology with a Masters of Science degree in Civil and Environmental Engineering. I
18 received a Masters in Business Administration degree from the State University of New
19 York at Buffalo in 1996. I am a registered professional engineer in the State of New
20 York.

1 **Q. Please describe your professional experience?**

2 A. From 1981-1983, I provided civil, structural and geotechnical engineering and project
3 management services to D'Appolonia Consulting Engineers, Pittsburgh, PA. From 1983-
4 1990, I provided these same services to Niagara Mohawk Power Corporation, Syracuse,
5 NY. In 1990, I transferred to the position of Manager of Construction, Inspection, and
6 Street Lighting in the Operations organization of Niagara Mohawk Power Corporation's
7 Western Division, (Buffalo, NY), and had managerial responsibilities of all field
8 construction and maintenance associated within these work groups. I held this
9 management position from 1990-1999. In 1999, I took the position of Director Outdoor
10 Lighting for Niagara Mohawk Power Corporation, and was responsible for all outdoor
11 lighting business related functions. In 2002, following the merger of Niagara Mohawk
12 Power Corporation and National Grid, I became the Director of Outdoor Lighting – NY.
13 In 2008, I became Manager of Outdoor Lighting and was responsible for all policies,
14 procedures, information systems, and regulatory issues associated with the outdoor
15 lighting business in National Grid's New England and upstate New York service
16 territories. In 2011, I transitioned to my current role as Principal Engineer, providing
17 technical expertise in support of all outdoor lighting business, regulatory, and information
18 systems related matters.

1 **Q. Have you previously testified before the Rhode Island Public Utilities Commission**
2 **(“Commission”) or any other regulatory commission?**

3 A. Yes. In 2009, I provided pre-filed testimony in R.I.P.U.C Docket No. 4065, the
4 Company’s 2009 electric rate case proceeding before the Commission. In 2009, I also
5 provided pre-filed and witness testimony related to the 2009 rate case for Massachusetts
6 Electric Company and Nantucket Electric Company before the Massachusetts
7 Department of Public Utilities (Docket No. 09-39). During the period between 2000 and
8 2004, I provided testimony before the New York Public Service Commission regarding
9 several proceedings associated with three cases that were consolidated (Docket Nos. 99-
10 E-0387, 00-E-0934 and 00-E-0935). In 2010, I provided pre-filed testimony in the
11 electric rate case for Niagara Mohawk Power Corporation before the New York Public
12 Service Commission (Docket No. 10-E-0050). In 2010/2011, I provided testimony in the
13 outdoor lighting case before the New Hampshire Public Utilities Commission for
14 National Grid’s former affiliate, Granite State Electric Company (Docket No. DE-10-
15 326). In all the above proceedings, my testimony related to the outdoor lighting business
16 of the respective companies.

17
18 **II. Purpose of Testimony**

19 **Q. What is the purpose of your testimony?**

20 A. The purpose of my testimony is to provide supporting tariff and technology research and
21 supplemental billing factor development information relating to the Company’s proposed

1 Customer Owned Street & Area Lighting Rate (S-05), as presented by Company Witness
2 Jeanne A. Lloyd.
3

4 **Q. How is your testimony organized?**

5 A. In section III, I explain the calculation of annual energy consumption of each light source
6 category specific to each of the Company's proposed operating schedules. In section IV,
7 I discuss the Company's proposal for billing customer-owned Light Emitting Diode
8 ("LED") technology. In section V, I describe the proposed miscellaneous fees and
9 charges applicable to customers receiving Rate S-05 service. Finally, in section VI, I
10 discuss issues related to the customer's right to purchase Company lighting assets, which
11 is allowed pursuant to the Rhode Island Municipal Streetlight Investment Act, R.I.G.L. §
12 39-29-1 – 5 (the "Act") (House Bill No. 5935 Sub A).
13

14 **III. Determination of Annual Energy Consumption**

15 **Q. Please describe the process for determining the annual energy consumption used for**
16 **billing purposes for Rate S-05.**

17 A. Annual energy consumption, which serves as the basis for billing all energy charges
18 applicable to Rate S-05 customers, is based upon each available type of light source and a
19 pre-determined hours of operation schedule. The proposed hours of operation for each
20 light source category vary according to four separate operating schedules, referenced as
21 continuous, dusk-to-dawn, dimming, and part-night.

1 **Q. How did the Company select the types of light sources that will be available under**
2 **the proposed rate?**

3 A. The proposed sources of light types include the light source offerings available under the
4 Company's existing street and area lighting tariffs – the Decorative Street and Area
5 Lighting Service Rate S-06 and the General Street and Area Lighting Rate S-14, as these
6 lights represent the street and area lighting assets that will be available for acquisition by
7 municipal customers consistent with the Act. In addition, an LED light source offering is
8 also included in the proposed tariff. This new offering is discussed in detail later in
9 section IV of my testimony.

10
11 **Q. What is the hours of operation schedule?**

12 A The hours of operation schedule defines several approximate annual operating hour
13 values which represent upper bound operating time limitations required to determine
14 unmetered energy consumption of individual lights.

15
16 **Q. How were the values in the hours of operation determined?**

17 A. The hours of operation limitations for individual lights were established to represent
18 unique annual schedules designating established daily on/off times and specific periods
19 of reduced energy consumption to cause light output dimming. These independent
20 schedules were arbitrarily developed based upon reasonably priced common control
21 technology readily available to the customer. The schedules are proposed as rational

1 operating time applications which reasonably segment the possible annual hours of
2 operation limitations of an individual light. These schedules provide the limiting
3 threshold time value of energy usage of the light, often referred to as “burning hours”.
4

5 **Q. How are the hours of operation schedules used to determine energy consumption for**
6 **billing?**

7 A. The hours of operation of an individual light are determined and compared to the hours of
8 operation schedule. The hours of operation schedule representing the closest threshold
9 limitation that is not less than the actual equivalent hours of the individual light is
10 applied. This hour of operation schedule is used in conjunction with the assigned billable
11 wattage for the individual light source receiving service to determine the total energy to
12 be billed during a respective billing period.
13

14 **Q. Briefly describe the current operating schedules used to determine the hours of**
15 **operation for street and area lighting reflected in the Company’s existing street and**
16 **area lighting rates.**

17 A. All current street and area lights are in operation from approximately one-half hour after
18 sunset until approximately one-half hour before sunrise (Dusk-To-Dawn) except for those
19 lights operating continuously, such as certain underpass lights (Continuous).

1 **Q. Please describe the Company’s proposed operating schedules used to determine the**
2 **hours of operation for Rate S-05?**

3 A. In addition to the traditional dusk-to-dawn and continuous operation schedules discussed
4 above, the Company is proposing two new non-traditional operating schedules, Dimming
5 and Part-Night, to meet the requirements of the Act and to promote cost savings through
6 energy savings. The two additional schedules individually address a separate on-off
7 cycle and incorporate a reduced energy consumption period to address customer-desired
8 dimming conditions to establish the respective annual hours of operation. Therefore, the
9 proposed four operating schedules and corresponding annual hours of operation for Rate
10 S-05 are:

- 11 1. Continuous – Street and area lights operate continuously each day of the year at
12 full energy consumption, a total of approximately 8,760 hours each year.
- 13 2. Dusk-To-Dawn – Street and area lights operate daily at full energy consumption
14 from approximately one-half hour after sunset until approximately one-half hour
15 before sunrise, a total of no greater than 4,175 hours each year.
- 16 3. Dimming – Street and area lights operate daily at full energy consumption from
17 approximately one-half hour after sunset until the midpoint of the Dusk-To-Dawn
18 schedule, and then operate at 70% of the full energy consumption value to yield
19 reduced light output for a duration not to exceed five and one-half hours, at which
20 time returning to full energy consumption until approximately one-half hour
21 before sunrise. This schedule results in a total of no greater than 2,301 hours at
22 full energy consumption and 1,874 hours at 30% reduced energy consumption, or
23 approximately 1,314 full energy consumption equivalent hours, respectively each
24 year. Therefore, the total full energy consumption operating hour equivalent is to
25 be no greater than 3,615 hours each year.
- 26
- 27

- 1 4. Part-Night – Street and area lights operate daily at full energy consumption from
2 approximately one-half hour after sunset, turn off at the midpoint of the Dusk-To-
3 Dawn schedule, and turn back on at full energy consumption five and one-half
4 hours later until approximately one-half hour before sunrise, a total of no greater
5 than 2,301 hours each year.
6

7 **Q. How are street and area lights able to operate at different operating schedules?**

8 A. The actual hours of operation of an individual light are established through the use of a
9 control device. Control devices offer numerous options to manage the on-off operation
10 and dimming capability of a light. As an unmetered offering, the Company's proposed
11 hours of operation schedule corresponds to four separate limitation thresholds based upon
12 operating schedules providing reasonable energy consumption profiles for billing
13 purposes. Within these schedules the customer can define independent operating
14 conditions per individual light.
15

16 **Q. How did the Company determine the two new proposed operating schedules?**

17 A. The Company investigated market available street light controls that provide a wide
18 range of operating schedules and dimming options. The Company selected operating
19 schedules that are reproducible by a majority of reasonably valued, quality control
20 devices which are marketed by reputable manufacturers.
21

22 **Q. How did the Company determine the operating hours for each operating schedule?**

23 A. The Company used U.S. Naval Observatory, Astronomical Applications Department

1 (USNO) information specific to the Providence, Rhode Island geographic location (W07°
2 26', N41° 49') in conjunction with the functional criteria of the selected control device to
3 determine the operating conditions of a light on a daily basis. This information is
4 provided in Schedule JEW-1.

5
6 **Q. Why is the Company proposing the Part-Night and Dimming operating schedules?**

7 A. The Company recognizes customer demand for cost savings initiatives associated with
8 outdoor lighting service. These operating schedules promote cost savings through the
9 elimination or reduction of energy consumption of the light during the off cycle occurring
10 each night during periods of low traffic volume and/or pedestrian activity. The energy
11 savings, in aggregate, also provides a positive environmental impact through reduced sky
12 glow and potential power plant carbon emission reduction. Additionally, both operating
13 schedules promote conditions as specified in the Act.

14
15 **Q. What are the proposed operating criteria under the Part-Night schedule option?**

16 A. Under the proposed Part-Night operating schedule, the light would be in operation on a
17 partial basis whereby it would turn on at approximately one-half hour after sunset (dusk)
18 and operate for a period equal to the midpoint of the prior night's dusk-to-dawn cycle at
19 which time the light will turn off, remaining off for a period of five and one-half hours, at
20 which time it will turn on if ambient light conditions are less than observed at dusk until
21 approximately one-half hour before sunrise (dawn).

1 **Q. Why is the Company proposing a Part-Night operating schedule that will turn lights**
2 **back on prior to dawn?**

3 A. During certain periods of the year when dawn occurs later in the morning, early morning
4 commuter traffic, school buses, and waiting school-age children create a high potential
5 for vehicle - pedestrian conflict in a dark environment. The proposed Part-Night
6 operating schedule reduces this potential conflict by operating the lights at full lumen
7 output during the calendar months when it remains dark longer during the morning hours.

8
9 **Q. Please describe the energy usage reduction associated with the Part-Night operating**
10 **schedule option.**

11 A. The determination of energy charges per light source would be based upon 2,301 hours of
12 operation annually for the Part-Night operating schedule as compared to 4,175 hours
13 annually for the Dusk-To-Dawn operating schedule. The difference between the two
14 operating schedules represents the time savings associated with the Part-Night off cycle.
15 The actual energy savings is dependant upon the light source's billable wattage. The
16 table containing the monthly operating hour equivalent values for each operating
17 schedule is included in Schedule JEW-2.

18
19 **Q. What are the proposed operating criteria for the Dimming operating schedule?**

20 A. Under the proposed Dimming operating schedule, the light would be in operation similar
21 to the Part-Night schedule except that the control will reduce the energy consumption of

1 the light source causing it to reduce the light output or “dim” during the middle of the
2 night rather than turning the light off. For the purpose of determining energy
3 consumption, the Company has designated the energy reduction as 30%. This dim period
4 is estimated to be five and one-half hours, at which time the light will resume full light
5 output at full energy consumption if ambient light conditions are less than observed at
6 dusk until approximately one-half hour before sunrise (dawn).

7
8 **Q. Why did the Company select a 30% energy reduction value for the dimming**
9 **period?**

10 A. The Company researched recommended industry guidelines and standards associated
11 with lighting levels during periods of normal and reduced traffic and pedestrian activity.
12 In general, the Company observed that lighting levels can be reduced by as much as half
13 when activity is significantly reduced. The Company was also unable to identify any
14 utility tariffs which specify fixed dimming criteria for unmetered street lighting
15 applications. Additional research did not identify any municipality that has adopted large
16 scale dimming applications. However, the Company identified several trial or pilot
17 projects that use varied light reduction levels corresponding to unique energy savings
18 values dependant upon the energy reduction or dimming rate, the application period, and
19 light source. The Company’s proposed Dimming operating schedule reflects a
20 reasonable energy reduction measure for the purpose of determining the energy
21 consumption between Dusk-To-Dawn and Part-Night operation.

1 **Q. Please describe the energy usage reduction associated with the Dimming operating**
2 **schedule.**

3 A. The determination of energy charges for the Dimming operating schedule per light would
4 be based upon 3,615 hours of operation annually as compared to 4,175 hours annually for
5 the Dusk-To-Dawn operating schedule. The hours represented by the Dimming operating
6 schedule reflect an hourly equivalent for the purposes of billing determination. Similar to
7 the Part-Night operating schedule, the actual energy cost savings is dependant upon the
8 light source billable wattage. The table containing the monthly operating hour equivalent
9 values for each operating schedule is included in Schedule JEW-2.

10
11 **Q. What are operating hour equivalents?**

12 A. The Company uses “hour equivalents” which equal the time a light would operate at
13 100% energy consumption. This conversion is necessary to determine hours of operation
14 for lights utilizing the Dimming operating schedule. The proposed Dimming operating
15 schedule utilizes the energy reduction rate of 30%. Therefore, the actual energy
16 consumption is 70% of the full energy consumption level over the established dimming
17 cycle period. The hour equivalent is determined by multiplying the dimming period time
18 (hours) by the reduced energy consumption percentage as a decimal. As an example, five
19 hours of operation at 70% energy consumption equals a three and one-half hour
20 equivalent (at 100% energy consumption).

21

1 **Q. Why are operating hour equivalents being proposed?**

2 A. The Company requires the representation of operating time to be equivalent of full
3 energy consumption (100%) to facilitate the billing of energy charges.
4

5 **Q. Did the Company consider other operating schedules in addition to the two new**
6 **ones proposed?**

7 A. Yes. However, it is necessary to strike a balance between the number of pricing options
8 made available to customers and the administrative costs of providing those options. The
9 proposed non-traditional operating schedules comply with the requirements of the Act to
10 include options for street lighting controls, and are intended to provide the customer with
11 options that promote reasonable lighting level reduction choices and associated energy
12 cost savings. In addition, the Company believes that the administration of the proposed
13 limited number of operating schedules in addition to the traditional schedules for the
14 prospective population of customer-owned street and area lights is manageable without
15 incurring excessive costs.
16

17 **Q. What limitations does the proposed customer-owned street and area lighting service**
18 **have?**

19 A. The Company's proposal balances the constraints of an unmetered service requiring static
20 billing determinants with the complexities associated with developing lighting
21 technologies, variable energy consumption modes, and flexible operating schedules.

1 Therefore, the variable lighting technologies and usage conditions available to the
2 customer will be limited to the listed light sources, the static operating schedule profiles,
3 and a fixed energy consumption reduction associated with dimming.
4

5 **Q. How will the Company's proposal affect customers' light source choices and**
6 **monthly bills?**

7 A. The customer will be limited to taking advantage of only those light source types
8 identified by the proposed Rate S-05. Additionally, customer-defined operating
9 schedules and/or dimming conditions other than what is proposed by the Company will
10 result in the customer being over or under charged for the actual energy delivered.
11

12 **Q. How will the Company address other light sources or the adoption of new lighting**
13 **technologies?**

14 A. Based upon sufficient customer demand and a reasonable level of industry
15 standardization, additional lighting sources including new lighting technologies can be
16 added to the proposed tariff by including their respective billable wattages through a
17 subsequent filing. Conversely, in the future, the Company could propose to remove from
18 the tariff obsolete lighting technologies that customers no longer use.

1 **IV. Proposal for Customer-Owned LED Equipment Service**

2 **Q. Please summarize the Company's proposal for LED service in this filing?**

3 A. As discussed by Ms. Lloyd in her testimony, customers have expressed an interest in
4 LED street and area lighting. With the Company's proposal of Rate S-05 that would
5 provide delivery service to customer-owned lighting equipment, the Company has
6 included an accepted rate structure for customer-owned LED equipment in the proposed
7 S-05 tariff.

8
9 **Q. Why is the LED light source annual energy use included in the proposed S-05 Rate**
10 **different from the other light source types?**

11 A. The Company recognizes the ongoing development of LED technology resulting in
12 continual efficiency gains, the lack of product standardization within the industry, and the
13 system wattage values of customer-owned equipment are constantly changing.
14 Therefore, the Company proposes the use of moderate wattage ranges to normalize these
15 variables. In addition, the number of moderate ranges proposed is intended to minimize
16 the administrative burden to the customer and the Company related to the notification,
17 tracking, and inventory records associated with these technology and equipment changes.

18
19 **Q. How did the Company choose the proposed wattage ranges?**

20 A. The Company performed an assessment of the few existing utility LED tariffs to identify
21 the various rate models in use for LED luminaires. A summary of the LED tariffs

1 observed and those specific to customer-owned equipment are provided in Schedule
2 JEW- 3. The Company also performed a technical performance data review from a
3 sampling of over 1,400 LED products available in the market, which is shown in
4 Schedule JEW- 4. Based on that information, and balancing the desire to create a billing
5 structure that was not overly complex to administer and that recognized both the vast
6 range of wattages of LED equipment available in the market and the rapidly changing
7 nature of that market, the Company determined that it was reasonable to divide the
8 available products into six different wattage ranges.

9
10 **Q. How did the Company determine the billable wattage value for each of the wattage**
11 **ranges?**

12 A. The billable wattage value the Company proposes to use for LED lights is the midpoint
13 of each wattage range. The mid-point of the range was chosen, rather than averaging the
14 wattage values of the LED products falling within the range, because it generally yielded
15 a somewhat lower wattage amount, thereby providing some recognition of the continually
16 improving efficacy and efficiency performance of LED technology. The calculation of
17 each wattage range's kWh is provided in Schedule JEW-5.

1 **Q. Did the Company consider other solutions to minimize the difference between the**
2 **actual wattage of LED equipment and the billable wattage assigned to them under**
3 **the Company's proposal?**

4 A. Yes. The Company evaluated other rate model concepts that use smaller wattage ranges
5 as well as those that used other billing determinants to establish the billable wattage
6 values.

7
8 **Q. Why did the Company decide not to use any of these alternate approaches?**

9 A. The use of narrow wattage ranges or exact rate models for extremely diverse customer-
10 owned equipment promotes inaccuracies in inventory records, billing criteria, installation
11 or equipment modification notification, and an excessive quantity of operational use
12 schedules. The Company also considered utilizing other billing determinants (e.g.,
13 lumens, color temperature, drive current, etc.). However, the added task of conversion to
14 an energy measurement and the unfamiliar nature of the calculation to the customer made
15 the process counterproductive. Additionally, the information required to verify billing
16 determinant accuracy on each item of customer owned equipment would not be readily
17 available through simple visual inspection of the equipment or the affixed wattage label.

1 **Q. Over the long term, how will the Company confirm that customer equipment is**
2 **being billed under the correct assigned wattage value?**

3 A. The Company may perform random field auditing to observe the industry standard
4 labeling of each luminaire. However, the label only designates the type of light source
5 (LED, HPS, etc.) and the wattage. It will not depict the individual light's operating
6 schedule.

7
8 **V. Other Fees and Charges**

9 **Q. Please describe the other fees and charges applicable to Rate S-05 customers.**

10 A. The Company is including the following Lighting Service Charge for customers
11 receiving service in the S-05 tariff:

12 Lighting Service Charge – As defined in the Terms and Conditions for
13 Distribution Service, Section 18, the Lighting Service Charge is an existing
14 charge for the Company's unmetered street lighting rates. It may be assessed for
15 Company services rendered in response to a customer request in support of the
16 customer's equipment but unrelated to the performance of the Company's
17 facilities. In relation to the S-05 Rate, the Company is proposing to assess the
18 charge when energizing, re-energizing, or de-energizing the customer's street and
19 area lighting equipment.
20

21 Additionally, other charges contained within the License Agreements may be applicable
22 to customers requesting additional lights or relocation of existing lights:

- 23 1. Field Survey Charge – A field survey may be performed when a customer
24 requests a new lighting attachment, a material change of existing customer-owned
25 lighting equipment attached to Company facilities, or the facilitation of service
26 from an underground distribution service source. The Field Survey Charge
27 compensates the Company for expenses incurred during the site visit to determine

1 the feasibility of the attachment or the underground service connection to the
2 Company's distribution system.

- 3
4 2. Make Ready Charges – The Company proposes that a customer should be
5 responsible to all impacted parties for costs incurred to facilitate a lighting
6 attachment, provide appropriate service and/or perform tasks specifically
7 associated with customer-owned lighting equipment or for its operation in
8 accordance with Company policies, procedures and standards.
9

10 **VI. Issues Related to Customer Purchase of Lighting Assets**

11 **Q. What are the customer's obligations after the purchase of the Company's assets?**

12 A. The customer must immediately remove the Company's identification tags currently
13 affixed to each asset and replace them with information markings denoting ownership by
14 the customer. The customer shall also institute a program to install individual separation
15 and demarcation equipment for each luminaire.
16

17 **Q. What issues occur with the ownership and operation of street lighting by the**
18 **Customer?**

19 A. The Company has identified various safety, operation and maintenance, system
20 separation and demarcation, administration, communication, and notification issues
21 associated with customer ownership of street lighting.

1 **Q. How does the Company propose to address the concerns related to these various**
2 **issues.**

3 A. The Company will require the customer to execute a License Agreement which will
4 address the roles and responsibilities of both parties relative to the identified issues.
5

6 **Q. What safety related issues are of concern to the Company?**

7 A. For the safety of the workers representing both the customer and the Company and for
8 the general welfare of the public, the Company believes it is imperative for the customer
9 to comply with all terms and conditions of the License Agreements. The customer must
10 comply with critical electrical safety requirements related to fusing, grounding, system
11 separation, appropriate equipment demarcation, maintaining minimum clearance
12 distances and the avoidance of contact with all distribution and transmission facilities.
13

14 **Q. What other safety concerns does the Company have?**

15 A. The transfer of Company street lighting assets to the customer will be based upon “where
16 is” and “as is” conditions, as certain street lighting installations conforming to older
17 standards but not causing problems for Company workers may not meet the minimum
18 requirements established for the customer’s workers. This condition may require the
19 customer to incur specific make-ready costs to facilitate the proper and safe operation and
20 installation of the street lighting equipment.

1 **Q. Please describe the other issues the Company presents regarding customer**
2 **ownership of street lighting equipment.**

3 A. The customer must provide timely and accurate communications and notifications
4 relative to lighting equipment changes for the Company to maintain an accurate inventory
5 record in order to provide proper energy usage billing per the proposed Rate S-05. A
6 timely and accurate inventory shall also minimize the cost and time associated with
7 Company operating crews responding to service orders on customer-owned equipment.
8

9 **Q. How can compliance with the terms and conditions of the various agreements**
10 **benefit the customer?**

11 A. The License Agreements will provide the customer with operating guidelines. For
12 example, the customer's installation and use of individual street light fuse devices to
13 facilitate separation from the distribution system will minimize the customer from
14 incurring the Lighting Service Charge for each de-energize and re-energize required
15 when performing routine maintenance. Until the customer has installed a fuse device, it
16 will be necessary for the Company to disconnect (or de-energize) the customer's light
17 from the Company's distribution system in order to perform work safely. Once the

1 customer's workers have completed work on the customer's equipment, the Company
2 will reconnect (or re-energize) the customer's light. As stated previously, the Lighting
3 Service Charge will allow the Company to recover its costs to perform this work.
4

5 **VII. Conclusion**

6 **Q. Does this conclude your testimony?**

7 **A. Yes.**

**Schedules of
John E. Walter**

Schedules of John E. Walter

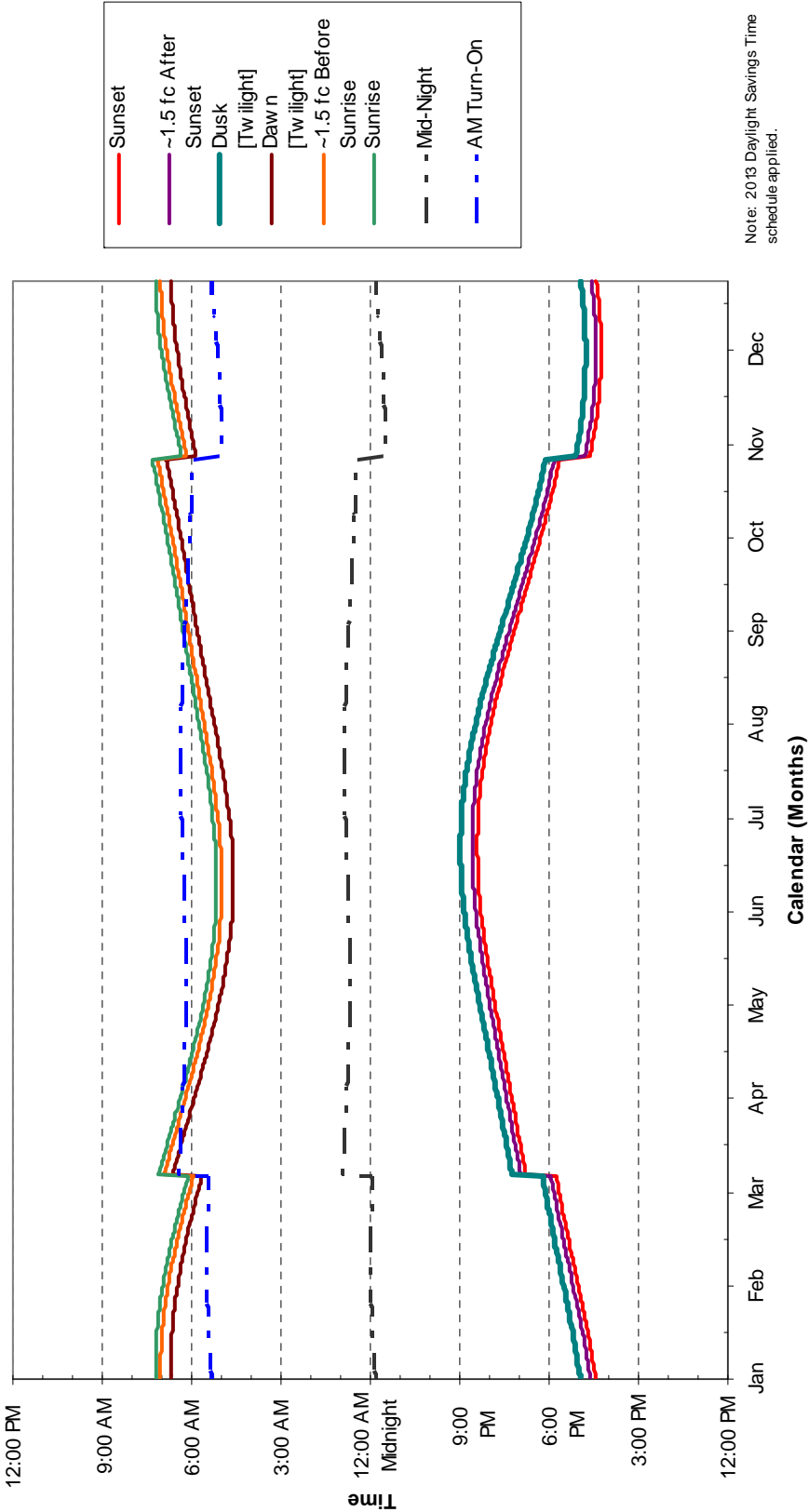
| | |
|----------------|---|
| Schedule JEW-1 | Daily Astronomical Data for Providence, Rhode Island |
| Schedule JEW-2 | Operating Hour Equivalent Table |
| Schedule JEW-3 | Industry Tariff Review Summary |
| Schedule JEW-4 | LED Luminaire Operational Performance Data Summary |
| Schedule JEW-5 | LED Light Source Energy Consumption (kWh) Determination |

The Narragansett Electric Company
d/b/a National Grid
R.I.P.U.C. Docket No. ____
Customer-Owned Street & Area Lighting Proposal
Witness: John E. Walter

Schedule JEW-1

Daily Astronomical Data for Providence, Rhode Island

Annual Operating Time Schedule
(Providence, Rhode Island)



Reference:
Astronomical Applications Department, U.S. Naval Observatory, Washington, D.C. 20392-5420
Eastern Standard Time with Day-Light Saving Time

Monthly Operating Time Schedule

Providence, Rhode Island
Location W071°26', N41°49'
2013 Calendar Year

| Month | Day | AM Turn-On | Twilight Dawn | ~1.5 fc Before Sunrise | Sunrise | Sunset | ~1.5 fc After Sunset | Twilight Dusk | Mid-Night |
|-------|-----|------------|---------------|------------------------|---------|--------|----------------------|---------------|-----------|
| | | (Time) | (Time) | (Time) | (Time) | (Time) | (Time) | (Time) | (Time) |
| Jan | 1 | 5:19 | 6:42 | 7:02 | 7:13 | 16:26 | 16:36 | 16:57 | 23:49 |
| Jan | 2 | 5:20 | 6:42 | 7:02 | 7:13 | 16:27 | 16:37 | 16:58 | 23:50 |
| Jan | 3 | 5:20 | 6:42 | 7:02 | 7:13 | 16:28 | 16:38 | 16:59 | 23:50 |
| Jan | 4 | 5:21 | 6:42 | 7:02 | 7:13 | 16:29 | 16:39 | 17:00 | 23:51 |
| Jan | 5 | 5:21 | 6:42 | 7:02 | 7:13 | 16:30 | 16:40 | 17:01 | 23:51 |
| Jan | 6 | 5:22 | 6:42 | 7:02 | 7:13 | 16:31 | 16:41 | 17:02 | 23:52 |
| Jan | 7 | 5:22 | 6:42 | 7:02 | 7:13 | 16:32 | 16:42 | 17:03 | 23:52 |
| Jan | 8 | 5:23 | 6:42 | 7:02 | 7:13 | 16:33 | 16:43 | 17:04 | 23:53 |
| Jan | 9 | 5:23 | 6:42 | 7:02 | 7:13 | 16:34 | 16:44 | 17:05 | 23:53 |
| Jan | 10 | 5:23 | 6:41 | 7:01 | 7:12 | 16:35 | 16:45 | 17:06 | 23:53 |
| Jan | 11 | 5:24 | 6:41 | 7:01 | 7:12 | 16:36 | 16:46 | 17:07 | 23:54 |
| Jan | 12 | 5:24 | 6:41 | 7:01 | 7:12 | 16:37 | 16:47 | 17:08 | 23:54 |
| Jan | 13 | 5:24 | 6:41 | 7:00 | 7:11 | 16:38 | 16:48 | 17:09 | 23:54 |
| Jan | 14 | 5:25 | 6:40 | 7:00 | 7:11 | 16:39 | 16:49 | 17:10 | 23:55 |
| Jan | 15 | 5:25 | 6:40 | 7:00 | 7:11 | 16:40 | 16:50 | 17:11 | 23:55 |
| Jan | 16 | 5:25 | 6:40 | 6:59 | 7:10 | 16:41 | 16:51 | 17:12 | 23:55 |
| Jan | 17 | 5:26 | 6:39 | 6:59 | 7:10 | 16:43 | 16:53 | 17:13 | 23:56 |
| Jan | 18 | 5:26 | 6:39 | 6:58 | 7:09 | 16:44 | 16:54 | 17:14 | 23:56 |
| Jan | 19 | 5:26 | 6:38 | 6:57 | 7:08 | 16:45 | 16:55 | 17:15 | 23:56 |
| Jan | 20 | 5:26 | 6:38 | 6:57 | 7:08 | 16:46 | 16:56 | 17:17 | 23:56 |
| Jan | 21 | 5:27 | 6:37 | 6:56 | 7:07 | 16:47 | 16:57 | 17:18 | 23:57 |
| Jan | 22 | 5:27 | 6:36 | 6:56 | 7:07 | 16:49 | 16:59 | 17:19 | 23:57 |
| Jan | 23 | 5:27 | 6:36 | 6:55 | 7:06 | 16:50 | 17:00 | 17:20 | 23:57 |
| Jan | 24 | 5:27 | 6:35 | 6:54 | 7:05 | 16:51 | 17:01 | 17:21 | 23:57 |
| Jan | 25 | 5:27 | 6:34 | 6:53 | 7:04 | 16:52 | 17:02 | 17:22 | 23:57 |
| Jan | 26 | 5:28 | 6:34 | 6:52 | 7:03 | 16:54 | 17:04 | 17:24 | 23:58 |
| Jan | 27 | 5:28 | 6:33 | 6:52 | 7:03 | 16:55 | 17:05 | 17:25 | 23:58 |
| Jan | 28 | 5:28 | 6:32 | 6:51 | 7:02 | 16:56 | 17:06 | 17:26 | 23:58 |
| Jan | 29 | 5:29 | 6:31 | 6:50 | 7:01 | 16:58 | 17:08 | 17:27 | 23:59 |
| Jan | 30 | 5:29 | 6:30 | 6:49 | 7:00 | 16:59 | 17:09 | 17:28 | 23:59 |
| Jan | 31 | 5:29 | 6:29 | 6:48 | 6:59 | 17:00 | 17:10 | 17:30 | 23:59 |

Reference:

Astronomical Applications Department, U.S. Naval Observatory, Washington, D.C. 20392-5420
Eastern Standard Time with Day-Light Saving Time

Monthly Operating Time Schedule

Providence, Rhode Island
Location W071°26', N41°49'
2013 Calendar Year

| Month | Day | AM Turn-On | Twilight Dawn | ~1.5 fc Before Sunrise | Sunrise | Sunset | ~1.5 fc After Sunset | Twilight Dusk | Mid-Night |
|-------|-----|------------|---------------|------------------------|---------|--------|----------------------|---------------|-----------|
| | | (Time) | (Time) | (Time) | (Time) | (Time) | (Time) | (Time) | (Time) |
| Feb | 1 | 5:29 | 6:28 | 6:47 | 6:58 | 17:01 | 17:11 | 17:31 | 23:59 |
| Feb | 2 | 5:29 | 6:27 | 6:46 | 6:57 | 17:03 | 17:13 | 17:32 | 23:59 |
| Feb | 3 | 5:29 | 6:26 | 6:45 | 6:56 | 17:04 | 17:14 | 17:33 | 23:59 |
| Feb | 4 | 5:29 | 6:25 | 6:44 | 6:55 | 17:05 | 17:15 | 17:34 | 23:59 |
| Feb | 5 | 5:29 | 6:24 | 6:43 | 6:54 | 17:06 | 17:16 | 17:36 | 23:59 |
| Feb | 6 | 5:29 | 6:23 | 6:41 | 6:52 | 17:08 | 17:18 | 17:37 | 23:59 |
| Feb | 7 | 5:29 | 6:22 | 6:40 | 6:51 | 17:09 | 17:19 | 17:38 | 23:59 |
| Feb | 8 | 5:29 | 6:21 | 6:39 | 6:50 | 17:10 | 17:20 | 17:39 | 23:59 |
| Feb | 9 | 5:29 | 6:20 | 6:38 | 6:49 | 17:12 | 17:22 | 17:41 | 23:59 |
| Feb | 10 | 5:29 | 6:19 | 6:37 | 6:48 | 17:13 | 17:23 | 17:42 | 23:59 |
| Feb | 11 | 5:29 | 6:18 | 6:35 | 6:46 | 17:14 | 17:24 | 17:43 | 23:59 |
| Feb | 12 | 5:29 | 6:16 | 6:34 | 6:45 | 17:15 | 17:25 | 17:44 | 23:59 |
| Feb | 13 | 5:29 | 6:15 | 6:33 | 6:44 | 17:17 | 17:27 | 17:45 | 23:59 |
| Feb | 14 | 5:29 | 6:14 | 6:31 | 6:42 | 17:18 | 17:28 | 17:47 | 23:59 |
| Feb | 15 | 5:29 | 6:12 | 6:30 | 6:41 | 17:19 | 17:29 | 17:48 | 23:59 |
| Feb | 16 | 5:29 | 6:11 | 6:29 | 6:40 | 17:20 | 17:30 | 17:49 | 23:59 |
| Feb | 17 | 5:29 | 6:10 | 6:27 | 6:38 | 17:22 | 17:32 | 17:50 | 23:59 |
| Feb | 18 | 5:29 | 6:08 | 6:26 | 6:37 | 17:23 | 17:33 | 17:51 | 23:59 |
| Feb | 19 | 5:29 | 6:07 | 6:24 | 6:35 | 17:24 | 17:34 | 17:53 | 23:59 |
| Feb | 20 | 5:29 | 6:06 | 6:23 | 6:34 | 17:25 | 17:35 | 17:54 | 23:59 |
| Feb | 21 | 5:29 | 6:04 | 6:22 | 6:33 | 17:27 | 17:37 | 17:55 | 23:59 |
| Feb | 22 | 5:29 | 6:03 | 6:20 | 6:31 | 17:28 | 17:38 | 17:56 | 23:59 |
| Feb | 23 | 5:28 | 6:01 | 6:19 | 6:30 | 17:29 | 17:39 | 17:57 | 23:58 |
| Feb | 24 | 5:28 | 6:00 | 6:17 | 6:28 | 17:30 | 17:40 | 17:58 | 23:58 |
| Feb | 25 | 5:28 | 5:58 | 6:15 | 6:26 | 17:32 | 17:42 | 18:00 | 23:58 |
| Feb | 26 | 5:28 | 5:57 | 6:14 | 6:25 | 17:33 | 17:43 | 18:01 | 23:58 |
| Feb | 27 | 5:28 | 5:55 | 6:12 | 6:23 | 17:34 | 17:44 | 18:02 | 23:58 |
| Feb | 28 | 5:27 | 5:54 | 6:11 | 6:22 | 17:35 | 17:45 | 18:03 | 23:57 |

Reference:

Astronomical Applications Department, U.S. Naval Observatory, Washington, D.C. 20392-5420
Eastern Standard Time with Day-Light Saving Time

Monthly Operating Time Schedule

Providence, Rhode Island
Location W071°26', N41°49'
2013 Calendar Year

| Month | Day | AM Turn-On | Twilight Dawn | ~1.5 fc Before Sunrise | Sunrise | Sunset | ~1.5 fc After Sunset | Twilight Dusk | Mid-Night |
|-------|-----|------------|---------------|------------------------|---------|--------|----------------------|---------------|-----------|
| | | (Time) | (Time) | (Time) | (Time) | (Time) | (Time) | (Time) | (Time) |
| Mar | 1 | 5:27 | 5:52 | 6:09 | 6:20 | 17:36 | 17:46 | 18:04 | 23:57 |
| Mar | 2 | 5:27 | 5:51 | 6:08 | 6:19 | 17:38 | 17:48 | 18:05 | 23:57 |
| Mar | 3 | 5:27 | 5:49 | 6:06 | 6:17 | 17:39 | 17:49 | 18:07 | 23:57 |
| Mar | 4 | 5:27 | 5:48 | 6:04 | 6:15 | 17:40 | 17:50 | 18:08 | 23:57 |
| Mar | 5 | 5:26 | 5:46 | 6:03 | 6:14 | 17:41 | 17:51 | 18:09 | 23:56 |
| Mar | 6 | 5:26 | 5:44 | 6:01 | 6:12 | 17:42 | 17:52 | 18:10 | 23:56 |
| Mar | 7 | 5:26 | 5:43 | 6:00 | 6:11 | 17:43 | 17:53 | 18:11 | 23:56 |
| Mar | 8 | 5:26 | 5:41 | 5:58 | 6:09 | 17:45 | 17:55 | 18:12 | 23:56 |
| Mar | 9 | 5:26 | 5:40 | 5:56 | 6:07 | 17:46 | 17:56 | 18:13 | 23:56 |
| Mar | 10 | 6:25 | 6:38 | 6:55 | 7:06 | 18:47 | 18:57 | 19:15 | 0:55 |
| Mar | 11 | 6:25 | 6:36 | 6:53 | 7:04 | 18:48 | 18:58 | 19:16 | 0:55 |
| Mar | 12 | 6:25 | 6:35 | 6:51 | 7:02 | 18:49 | 18:59 | 19:17 | 0:55 |
| Mar | 13 | 6:24 | 6:33 | 6:50 | 7:01 | 18:50 | 19:00 | 19:18 | 0:54 |
| Mar | 14 | 6:24 | 6:31 | 6:48 | 6:59 | 18:51 | 19:01 | 19:19 | 0:54 |
| Mar | 15 | 6:24 | 6:29 | 6:46 | 6:57 | 18:53 | 19:03 | 19:20 | 0:54 |
| Mar | 16 | 6:24 | 6:28 | 6:45 | 6:56 | 18:54 | 19:04 | 19:21 | 0:54 |
| Mar | 17 | 6:23 | 6:26 | 6:43 | 6:54 | 18:55 | 19:05 | 19:23 | 0:53 |
| Mar | 18 | 6:23 | 6:24 | 6:41 | 6:52 | 18:56 | 19:06 | 19:24 | 0:53 |
| Mar | 19 | 6:23 | 6:23 | 6:39 | 6:50 | 18:57 | 19:07 | 19:25 | 0:53 |
| Mar | 20 | 6:22 | 6:21 | 6:38 | 6:49 | 18:58 | 19:08 | 19:26 | 0:52 |
| Mar | 21 | 6:22 | 6:19 | 6:36 | 6:47 | 18:59 | 19:09 | 19:27 | 0:52 |
| Mar | 22 | 6:22 | 6:17 | 6:34 | 6:45 | 19:00 | 19:10 | 19:28 | 0:52 |
| Mar | 23 | 6:22 | 6:16 | 6:33 | 6:44 | 19:02 | 19:12 | 19:29 | 0:52 |
| Mar | 24 | 6:21 | 6:14 | 6:31 | 6:42 | 19:03 | 19:13 | 19:31 | 0:51 |
| Mar | 25 | 6:21 | 6:12 | 6:29 | 6:40 | 19:04 | 19:14 | 19:32 | 0:51 |
| Mar | 26 | 6:21 | 6:11 | 6:27 | 6:38 | 19:05 | 19:15 | 19:33 | 0:51 |
| Mar | 27 | 6:20 | 6:09 | 6:26 | 6:37 | 19:06 | 19:16 | 19:34 | 0:50 |
| Mar | 28 | 6:20 | 6:07 | 6:24 | 6:35 | 19:07 | 19:17 | 19:35 | 0:50 |
| Mar | 29 | 6:20 | 6:05 | 6:22 | 6:33 | 19:08 | 19:18 | 19:36 | 0:50 |
| Mar | 30 | 6:19 | 6:04 | 6:21 | 6:32 | 19:09 | 19:19 | 19:37 | 0:49 |
| Mar | 31 | 6:19 | 6:02 | 6:19 | 6:30 | 19:10 | 19:20 | 19:38 | 0:49 |

Reference:

Astronomical Applications Department, U.S. Naval Observatory, Washington, D.C. 20392-5420
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2013 Calendar Year

| Month | Day | AM Turn-On | Twilight Dawn | ~1.5 fc Before Sunrise | Sunrise | Sunset | ~1.5 fc After Sunset | Twilight Dusk | Mid-Night |
|-------|-----|------------|---------------|------------------------|---------|--------|----------------------|---------------|-----------|
| | | (Time) | (Time) | (Time) | (Time) | (Time) | (Time) | (Time) | (Time) |
| Apr | 1 | 6:19 | 6:00 | 6:17 | 6:28 | 19:11 | 19:21 | 19:40 | 0:49 |
| Apr | 2 | 6:19 | 5:58 | 6:16 | 6:27 | 19:13 | 19:23 | 19:41 | 0:49 |
| Apr | 3 | 6:18 | 5:57 | 6:14 | 6:25 | 19:14 | 19:24 | 19:42 | 0:48 |
| Apr | 4 | 6:18 | 5:55 | 6:12 | 6:23 | 19:15 | 19:25 | 19:43 | 0:48 |
| Apr | 5 | 6:18 | 5:53 | 6:10 | 6:21 | 19:16 | 19:26 | 19:44 | 0:48 |
| Apr | 6 | 6:17 | 5:52 | 6:09 | 6:20 | 19:17 | 19:27 | 19:45 | 0:47 |
| Apr | 7 | 6:17 | 5:50 | 6:07 | 6:18 | 19:18 | 19:28 | 19:47 | 0:47 |
| Apr | 8 | 6:17 | 5:48 | 6:06 | 6:17 | 19:19 | 19:29 | 19:48 | 0:47 |
| Apr | 9 | 6:16 | 5:46 | 6:04 | 6:15 | 19:20 | 19:30 | 19:49 | 0:46 |
| Apr | 10 | 6:16 | 5:45 | 6:02 | 6:13 | 19:21 | 19:31 | 19:50 | 0:46 |
| Apr | 11 | 6:16 | 5:43 | 6:01 | 6:12 | 19:22 | 19:32 | 19:51 | 0:46 |
| Apr | 12 | 6:16 | 5:41 | 5:59 | 6:10 | 19:24 | 19:34 | 19:52 | 0:46 |
| Apr | 13 | 6:16 | 5:40 | 5:57 | 6:08 | 19:25 | 19:35 | 19:54 | 0:46 |
| Apr | 14 | 6:15 | 5:38 | 5:56 | 6:07 | 19:26 | 19:36 | 19:55 | 0:45 |
| Apr | 15 | 6:15 | 5:36 | 5:54 | 6:05 | 19:27 | 19:37 | 19:56 | 0:45 |
| Apr | 16 | 6:15 | 5:35 | 5:53 | 6:04 | 19:28 | 19:38 | 19:57 | 0:45 |
| Apr | 17 | 6:15 | 5:33 | 5:51 | 6:02 | 19:29 | 19:39 | 19:58 | 0:45 |
| Apr | 18 | 6:14 | 5:31 | 5:50 | 6:01 | 19:30 | 19:40 | 19:59 | 0:44 |
| Apr | 19 | 6:14 | 5:30 | 5:48 | 5:59 | 19:31 | 19:41 | 20:01 | 0:44 |
| Apr | 20 | 6:14 | 5:28 | 5:46 | 5:57 | 19:32 | 19:42 | 20:02 | 0:44 |
| Apr | 21 | 6:14 | 5:27 | 5:45 | 5:56 | 19:33 | 19:43 | 20:03 | 0:44 |
| Apr | 22 | 6:14 | 5:25 | 5:44 | 5:55 | 19:35 | 19:45 | 20:04 | 0:44 |
| Apr | 23 | 6:14 | 5:23 | 5:42 | 5:53 | 19:36 | 19:46 | 20:05 | 0:44 |
| Apr | 24 | 6:13 | 5:22 | 5:41 | 5:52 | 19:37 | 19:47 | 20:07 | 0:43 |
| Apr | 25 | 6:13 | 5:20 | 5:39 | 5:50 | 19:38 | 19:48 | 20:08 | 0:43 |
| Apr | 26 | 6:13 | 5:19 | 5:38 | 5:49 | 19:39 | 19:49 | 20:09 | 0:43 |
| Apr | 27 | 6:13 | 5:17 | 5:36 | 5:47 | 19:40 | 19:50 | 20:10 | 0:43 |
| Apr | 28 | 6:13 | 5:16 | 5:35 | 5:46 | 19:41 | 19:51 | 20:11 | 0:43 |
| Apr | 29 | 6:12 | 5:14 | 5:34 | 5:45 | 19:42 | 19:52 | 20:12 | 0:42 |
| Apr | 30 | 6:12 | 5:13 | 5:32 | 5:43 | 19:43 | 19:53 | 20:14 | 0:42 |

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Astronomical Applications Department, U.S. Naval Observatory, Washington, D.C. 20392-5420
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|-------|-----|------------|---------------|------------------------|---------|--------|----------------------|---------------|-----------|
| | | (Time) | (Time) | (Time) | (Time) | (Time) | (Time) | (Time) | (Time) |
| May | 1 | 6:12 | 5:11 | 5:31 | 5:42 | 19:44 | 19:54 | 20:15 | 0:42 |
| May | 2 | 6:12 | 5:10 | 5:30 | 5:41 | 19:45 | 19:55 | 20:16 | 0:42 |
| May | 3 | 6:12 | 5:09 | 5:28 | 5:39 | 19:47 | 19:57 | 20:17 | 0:42 |
| May | 4 | 6:12 | 5:07 | 5:27 | 5:38 | 19:48 | 19:58 | 20:18 | 0:42 |
| May | 5 | 6:12 | 5:06 | 5:26 | 5:37 | 19:49 | 19:59 | 20:20 | 0:42 |
| May | 6 | 6:12 | 5:05 | 5:24 | 5:35 | 19:50 | 20:00 | 20:21 | 0:42 |
| May | 7 | 6:12 | 5:03 | 5:23 | 5:34 | 19:51 | 20:01 | 20:22 | 0:42 |
| May | 8 | 6:12 | 5:02 | 5:22 | 5:33 | 19:52 | 20:02 | 20:23 | 0:42 |
| May | 9 | 6:12 | 5:01 | 5:21 | 5:32 | 19:53 | 20:03 | 20:24 | 0:42 |
| May | 10 | 6:12 | 5:00 | 5:20 | 5:31 | 19:54 | 20:04 | 20:25 | 0:42 |
| May | 11 | 6:12 | 4:58 | 5:19 | 5:30 | 19:55 | 20:05 | 20:27 | 0:42 |
| May | 12 | 6:12 | 4:57 | 5:18 | 5:29 | 19:56 | 20:06 | 20:28 | 0:42 |
| May | 13 | 6:12 | 4:56 | 5:17 | 5:28 | 19:57 | 20:07 | 20:29 | 0:42 |
| May | 14 | 6:12 | 4:55 | 5:16 | 5:27 | 19:58 | 20:08 | 20:30 | 0:42 |
| May | 15 | 6:12 | 4:54 | 5:15 | 5:26 | 19:59 | 20:09 | 20:31 | 0:42 |
| May | 16 | 6:12 | 4:53 | 5:14 | 5:25 | 20:00 | 20:10 | 20:32 | 0:42 |
| May | 17 | 6:12 | 4:52 | 5:13 | 5:24 | 20:01 | 20:11 | 20:33 | 0:42 |
| May | 18 | 6:12 | 4:51 | 5:12 | 5:23 | 20:02 | 20:12 | 20:34 | 0:42 |
| May | 19 | 6:12 | 4:50 | 5:11 | 5:22 | 20:03 | 20:13 | 20:36 | 0:42 |
| May | 20 | 6:12 | 4:49 | 5:10 | 5:21 | 20:04 | 20:14 | 20:37 | 0:42 |
| May | 21 | 6:12 | 4:48 | 5:09 | 5:20 | 20:05 | 20:15 | 20:38 | 0:42 |
| May | 22 | 6:12 | 4:47 | 5:08 | 5:19 | 20:06 | 20:16 | 20:39 | 0:42 |
| May | 23 | 6:12 | 4:46 | 5:08 | 5:19 | 20:07 | 20:17 | 20:40 | 0:42 |
| May | 24 | 6:12 | 4:45 | 5:07 | 5:18 | 20:08 | 20:18 | 20:41 | 0:42 |
| May | 25 | 6:12 | 4:44 | 5:06 | 5:17 | 20:09 | 20:19 | 20:42 | 0:42 |
| May | 26 | 6:13 | 4:44 | 5:05 | 5:16 | 20:10 | 20:20 | 20:43 | 0:43 |
| May | 27 | 6:12 | 4:43 | 5:05 | 5:16 | 20:10 | 20:20 | 20:44 | 0:42 |
| May | 28 | 6:13 | 4:42 | 5:04 | 5:15 | 20:11 | 20:21 | 20:44 | 0:43 |
| May | 29 | 6:13 | 4:41 | 5:04 | 5:15 | 20:12 | 20:22 | 20:45 | 0:43 |
| May | 30 | 6:13 | 4:41 | 5:03 | 5:14 | 20:13 | 20:23 | 20:46 | 0:43 |
| May | 31 | 6:13 | 4:40 | 5:03 | 5:14 | 20:14 | 20:24 | 20:47 | 0:43 |

Reference:

Astronomical Applications Department, U.S. Naval Observatory, Washington, D.C. 20392-5420
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2013 Calendar Year

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|-------|-----|------------|---------------|------------------------|---------|--------|----------------------|---------------|-----------|
| | | (Time) | (Time) | (Time) | (Time) | (Time) | (Time) | (Time) | (Time) |
| Jun | 1 | 6:13 | 4:40 | 5:02 | 5:13 | 20:14 | 20:24 | 20:48 | 0:43 |
| Jun | 2 | 6:13 | 4:39 | 5:02 | 5:13 | 20:15 | 20:25 | 20:49 | 0:43 |
| Jun | 3 | 6:14 | 4:39 | 5:01 | 5:12 | 20:16 | 20:26 | 20:50 | 0:44 |
| Jun | 4 | 6:14 | 4:38 | 5:01 | 5:12 | 20:17 | 20:27 | 20:50 | 0:44 |
| Jun | 5 | 6:14 | 4:38 | 5:01 | 5:12 | 20:17 | 20:27 | 20:51 | 0:44 |
| Jun | 6 | 6:14 | 4:37 | 5:00 | 5:11 | 20:18 | 20:28 | 20:52 | 0:44 |
| Jun | 7 | 6:14 | 4:37 | 5:00 | 5:11 | 20:18 | 20:28 | 20:52 | 0:44 |
| Jun | 8 | 6:15 | 4:37 | 5:00 | 5:11 | 20:19 | 20:29 | 20:53 | 0:45 |
| Jun | 9 | 6:15 | 4:37 | 5:00 | 5:11 | 20:20 | 20:30 | 20:54 | 0:45 |
| Jun | 10 | 6:15 | 4:36 | 4:59 | 5:10 | 20:20 | 20:30 | 20:54 | 0:45 |
| Jun | 11 | 6:15 | 4:36 | 4:59 | 5:10 | 20:21 | 20:31 | 20:55 | 0:45 |
| Jun | 12 | 6:15 | 4:36 | 4:59 | 5:10 | 20:21 | 20:31 | 20:55 | 0:45 |
| Jun | 13 | 6:16 | 4:36 | 4:59 | 5:10 | 20:22 | 20:32 | 20:56 | 0:46 |
| Jun | 14 | 6:16 | 4:36 | 4:59 | 5:10 | 20:22 | 20:32 | 20:56 | 0:46 |
| Jun | 15 | 6:16 | 4:36 | 4:59 | 5:10 | 20:22 | 20:32 | 20:57 | 0:46 |
| Jun | 16 | 6:16 | 4:36 | 4:59 | 5:10 | 20:23 | 20:33 | 20:57 | 0:46 |
| Jun | 17 | 6:16 | 4:36 | 4:59 | 5:10 | 20:23 | 20:33 | 20:58 | 0:46 |
| Jun | 18 | 6:17 | 4:36 | 4:59 | 5:10 | 20:23 | 20:33 | 20:58 | 0:47 |
| Jun | 19 | 6:17 | 4:36 | 5:00 | 5:11 | 20:24 | 20:34 | 20:58 | 0:47 |
| Jun | 20 | 6:17 | 4:36 | 5:00 | 5:11 | 20:24 | 20:34 | 20:58 | 0:47 |
| Jun | 21 | 6:17 | 4:37 | 5:00 | 5:11 | 20:24 | 20:34 | 20:59 | 0:47 |
| Jun | 22 | 6:17 | 4:37 | 5:00 | 5:11 | 20:24 | 20:34 | 20:59 | 0:47 |
| Jun | 23 | 6:18 | 4:37 | 5:00 | 5:11 | 20:24 | 20:34 | 20:59 | 0:48 |
| Jun | 24 | 6:18 | 4:37 | 5:01 | 5:12 | 20:25 | 20:35 | 20:59 | 0:48 |
| Jun | 25 | 6:18 | 4:38 | 5:01 | 5:12 | 20:25 | 20:35 | 20:59 | 0:48 |
| Jun | 26 | 6:19 | 4:38 | 5:01 | 5:12 | 20:25 | 20:35 | 20:59 | 0:49 |
| Jun | 27 | 6:19 | 4:39 | 5:02 | 5:13 | 20:25 | 20:35 | 20:59 | 0:49 |
| Jun | 28 | 6:19 | 4:39 | 5:02 | 5:13 | 20:25 | 20:35 | 20:59 | 0:49 |
| Jun | 29 | 6:19 | 4:39 | 5:03 | 5:14 | 20:25 | 20:35 | 20:59 | 0:49 |
| Jun | 30 | 6:20 | 4:40 | 5:03 | 5:14 | 20:25 | 20:35 | 20:59 | 0:50 |

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|-------|-----|------------|---------------|------------------------|---------|--------|----------------------|---------------|-----------|
| | | (Time) | (Time) | (Time) | (Time) | (Time) | (Time) | (Time) | (Time) |
| Jul | 1 | 6:19 | 4:41 | 5:04 | 5:15 | 20:24 | 20:34 | 20:58 | 0:49 |
| Jul | 2 | 6:20 | 4:41 | 5:04 | 5:15 | 20:24 | 20:34 | 20:58 | 0:50 |
| Jul | 3 | 6:20 | 4:42 | 5:05 | 5:16 | 20:24 | 20:34 | 20:58 | 0:50 |
| Jul | 4 | 6:20 | 4:42 | 5:05 | 5:16 | 20:24 | 20:34 | 20:58 | 0:50 |
| Jul | 5 | 6:20 | 4:43 | 5:06 | 5:17 | 20:23 | 20:33 | 20:57 | 0:50 |
| Jul | 6 | 6:20 | 4:44 | 5:07 | 5:18 | 20:23 | 20:33 | 20:57 | 0:50 |
| Jul | 7 | 6:21 | 4:44 | 5:07 | 5:18 | 20:23 | 20:33 | 20:57 | 0:51 |
| Jul | 8 | 6:21 | 4:45 | 5:08 | 5:19 | 20:22 | 20:32 | 20:56 | 0:51 |
| Jul | 9 | 6:21 | 4:46 | 5:09 | 5:20 | 20:22 | 20:32 | 20:56 | 0:51 |
| Jul | 10 | 6:21 | 4:47 | 5:09 | 5:20 | 20:22 | 20:32 | 20:55 | 0:51 |
| Jul | 11 | 6:21 | 4:48 | 5:10 | 5:21 | 20:21 | 20:31 | 20:55 | 0:51 |
| Jul | 12 | 6:21 | 4:48 | 5:11 | 5:22 | 20:21 | 20:31 | 20:54 | 0:52 |
| Jul | 13 | 6:21 | 4:49 | 5:12 | 5:23 | 20:20 | 20:30 | 20:53 | 0:51 |
| Jul | 14 | 6:21 | 4:50 | 5:12 | 5:23 | 20:19 | 20:29 | 20:53 | 0:51 |
| Jul | 15 | 6:22 | 4:51 | 5:13 | 5:24 | 20:19 | 20:29 | 20:52 | 0:52 |
| Jul | 16 | 6:22 | 4:52 | 5:14 | 5:25 | 20:18 | 20:28 | 20:51 | 0:52 |
| Jul | 17 | 6:22 | 4:53 | 5:15 | 5:26 | 20:17 | 20:27 | 20:50 | 0:52 |
| Jul | 18 | 6:22 | 4:54 | 5:16 | 5:27 | 20:17 | 20:27 | 20:50 | 0:52 |
| Jul | 19 | 6:22 | 4:55 | 5:17 | 5:28 | 20:16 | 20:26 | 20:49 | 0:52 |
| Jul | 20 | 6:22 | 4:56 | 5:17 | 5:28 | 20:15 | 20:25 | 20:48 | 0:52 |
| Jul | 21 | 6:22 | 4:57 | 5:18 | 5:29 | 20:14 | 20:24 | 20:47 | 0:52 |
| Jul | 22 | 6:22 | 4:58 | 5:19 | 5:30 | 20:14 | 20:24 | 20:46 | 0:52 |
| Jul | 23 | 6:22 | 4:59 | 5:20 | 5:31 | 20:13 | 20:23 | 20:45 | 0:52 |
| Jul | 24 | 6:22 | 5:00 | 5:21 | 5:32 | 20:12 | 20:22 | 20:44 | 0:52 |
| Jul | 25 | 6:22 | 5:01 | 5:22 | 5:33 | 20:11 | 20:21 | 20:43 | 0:52 |
| Jul | 26 | 6:22 | 5:02 | 5:23 | 5:34 | 20:10 | 20:20 | 20:42 | 0:52 |
| Jul | 27 | 6:22 | 5:03 | 5:24 | 5:35 | 20:09 | 20:19 | 20:41 | 0:52 |
| Jul | 28 | 6:22 | 5:04 | 5:25 | 5:36 | 20:08 | 20:18 | 20:40 | 0:52 |
| Jul | 29 | 6:22 | 5:05 | 5:26 | 5:37 | 20:07 | 20:17 | 20:39 | 0:52 |
| Jul | 30 | 6:22 | 5:06 | 5:27 | 5:38 | 20:06 | 20:16 | 20:37 | 0:52 |
| Jul | 31 | 6:22 | 5:07 | 5:28 | 5:39 | 20:05 | 20:15 | 20:36 | 0:52 |

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|-------|-----|------------|---------------|------------------------|---------|--------|----------------------|---------------|-----------|
| | | (Time) | (Time) | (Time) | (Time) | (Time) | (Time) | (Time) | (Time) |
| Aug | 1 | 6:22 | 5:08 | 5:29 | 5:40 | 20:04 | 20:14 | 20:35 | 0:52 |
| Aug | 2 | 6:22 | 5:09 | 5:30 | 5:41 | 20:02 | 20:12 | 20:34 | 0:52 |
| Aug | 3 | 6:22 | 5:11 | 5:31 | 5:42 | 20:01 | 20:11 | 20:32 | 0:52 |
| Aug | 4 | 6:22 | 5:12 | 5:32 | 5:43 | 20:00 | 20:10 | 20:31 | 0:52 |
| Aug | 5 | 6:22 | 5:13 | 5:33 | 5:44 | 19:59 | 20:09 | 20:30 | 0:52 |
| Aug | 6 | 6:22 | 5:14 | 5:34 | 5:45 | 19:58 | 20:08 | 20:28 | 0:52 |
| Aug | 7 | 6:21 | 5:15 | 5:35 | 5:46 | 19:56 | 20:06 | 20:27 | 0:51 |
| Aug | 8 | 6:21 | 5:16 | 5:36 | 5:47 | 19:55 | 20:05 | 20:26 | 0:51 |
| Aug | 9 | 6:21 | 5:17 | 5:37 | 5:48 | 19:54 | 20:04 | 20:24 | 0:51 |
| Aug | 10 | 6:21 | 5:18 | 5:38 | 5:49 | 19:52 | 20:02 | 20:23 | 0:51 |
| Aug | 11 | 6:21 | 5:20 | 5:39 | 5:50 | 19:51 | 20:01 | 20:21 | 0:51 |
| Aug | 12 | 6:21 | 5:21 | 5:40 | 5:51 | 19:50 | 20:00 | 20:20 | 0:51 |
| Aug | 13 | 6:20 | 5:22 | 5:41 | 5:52 | 19:48 | 19:58 | 20:18 | 0:50 |
| Aug | 14 | 6:20 | 5:23 | 5:42 | 5:53 | 19:47 | 19:57 | 20:17 | 0:50 |
| Aug | 15 | 6:20 | 5:24 | 5:43 | 5:54 | 19:45 | 19:55 | 20:15 | 0:50 |
| Aug | 16 | 6:20 | 5:25 | 5:44 | 5:55 | 19:44 | 19:54 | 20:14 | 0:50 |
| Aug | 17 | 6:19 | 5:26 | 5:45 | 5:56 | 19:42 | 19:52 | 20:12 | 0:49 |
| Aug | 18 | 6:19 | 5:28 | 5:46 | 5:57 | 19:41 | 19:51 | 20:11 | 0:49 |
| Aug | 19 | 6:19 | 5:29 | 5:47 | 5:58 | 19:39 | 19:49 | 20:09 | 0:49 |
| Aug | 20 | 6:19 | 5:30 | 5:48 | 5:59 | 19:38 | 19:48 | 20:07 | 0:49 |
| Aug | 21 | 6:18 | 5:31 | 5:49 | 6:00 | 19:36 | 19:46 | 20:06 | 0:48 |
| Aug | 22 | 6:18 | 5:32 | 5:50 | 6:01 | 19:35 | 19:45 | 20:04 | 0:48 |
| Aug | 23 | 6:18 | 5:33 | 5:51 | 6:02 | 19:33 | 19:43 | 20:02 | 0:48 |
| Aug | 24 | 6:18 | 5:34 | 5:52 | 6:03 | 19:32 | 19:42 | 20:01 | 0:48 |
| Aug | 25 | 6:18 | 5:35 | 5:54 | 6:05 | 19:30 | 19:40 | 19:59 | 0:48 |
| Aug | 26 | 6:18 | 5:36 | 5:55 | 6:06 | 19:29 | 19:39 | 19:58 | 0:48 |
| Aug | 27 | 6:17 | 5:38 | 5:56 | 6:07 | 19:27 | 19:37 | 19:56 | 0:47 |
| Aug | 28 | 6:17 | 5:39 | 5:57 | 6:08 | 19:25 | 19:35 | 19:54 | 0:47 |
| Aug | 29 | 6:17 | 5:40 | 5:58 | 6:09 | 19:24 | 19:34 | 19:52 | 0:47 |
| Aug | 30 | 6:16 | 5:41 | 5:59 | 6:10 | 19:22 | 19:32 | 19:51 | 0:46 |
| Aug | 31 | 6:16 | 5:42 | 6:00 | 6:11 | 19:20 | 19:30 | 19:49 | 0:46 |

Reference:

Astronomical Applications Department, U.S. Naval Observatory, Washington, D.C. 20392-5420
Eastern Standard Time with Day-Light Saving Time

Monthly Operating Time Schedule

Providence, Rhode Island
Location W071°26', N41°49'
2013 Calendar Year

| Month | Day | AM Turn-On | Twilight Dawn | ~1.5 fc Before Sunrise | Sunrise | Sunset | ~1.5 fc After Sunset | Twilight Dusk | Mid-Night |
|-------|-----|------------|---------------|------------------------|---------|--------|----------------------|---------------|-----------|
| | | (Time) | (Time) | (Time) | (Time) | (Time) | (Time) | (Time) | (Time) |
| Sep | 1 | 6:16 | 5:43 | 6:01 | 6:12 | 19:19 | 19:29 | 19:47 | 0:46 |
| Sep | 2 | 6:15 | 5:44 | 6:02 | 6:13 | 19:17 | 19:27 | 19:46 | 0:45 |
| Sep | 3 | 6:15 | 5:45 | 6:03 | 6:14 | 19:15 | 19:25 | 19:44 | 0:45 |
| Sep | 4 | 6:15 | 5:46 | 6:04 | 6:15 | 19:14 | 19:24 | 19:42 | 0:45 |
| Sep | 5 | 6:14 | 5:47 | 6:05 | 6:16 | 19:12 | 19:22 | 19:40 | 0:44 |
| Sep | 6 | 6:14 | 5:49 | 6:06 | 6:17 | 19:10 | 19:20 | 19:39 | 0:44 |
| Sep | 7 | 6:14 | 5:50 | 6:07 | 6:18 | 19:09 | 19:19 | 19:37 | 0:44 |
| Sep | 8 | 6:13 | 5:51 | 6:08 | 6:19 | 19:07 | 19:17 | 19:35 | 0:43 |
| Sep | 9 | 6:13 | 5:52 | 6:09 | 6:20 | 19:05 | 19:15 | 19:33 | 0:43 |
| Sep | 10 | 6:12 | 5:53 | 6:10 | 6:21 | 19:03 | 19:13 | 19:32 | 0:42 |
| Sep | 11 | 6:12 | 5:54 | 6:11 | 6:22 | 19:02 | 19:12 | 19:30 | 0:42 |
| Sep | 12 | 6:12 | 5:55 | 6:12 | 6:23 | 19:00 | 19:10 | 19:28 | 0:42 |
| Sep | 13 | 6:11 | 5:56 | 6:13 | 6:24 | 18:58 | 19:08 | 19:26 | 0:41 |
| Sep | 14 | 6:11 | 5:57 | 6:14 | 6:25 | 18:57 | 19:07 | 19:24 | 0:41 |
| Sep | 15 | 6:11 | 5:58 | 6:15 | 6:26 | 18:55 | 19:05 | 19:23 | 0:41 |
| Sep | 16 | 6:10 | 5:59 | 6:16 | 6:27 | 18:53 | 19:03 | 19:21 | 0:40 |
| Sep | 17 | 6:10 | 6:00 | 6:17 | 6:28 | 18:51 | 19:01 | 19:19 | 0:40 |
| Sep | 18 | 6:10 | 6:01 | 6:18 | 6:29 | 18:50 | 19:00 | 19:17 | 0:40 |
| Sep | 19 | 6:09 | 6:02 | 6:19 | 6:30 | 18:48 | 18:58 | 19:16 | 0:39 |
| Sep | 20 | 6:09 | 6:03 | 6:20 | 6:31 | 18:46 | 18:56 | 19:14 | 0:39 |
| Sep | 21 | 6:08 | 6:04 | 6:21 | 6:32 | 18:44 | 18:54 | 19:12 | 0:38 |
| Sep | 22 | 6:08 | 6:06 | 6:22 | 6:33 | 18:43 | 18:53 | 19:10 | 0:38 |
| Sep | 23 | 6:08 | 6:07 | 6:23 | 6:34 | 18:41 | 18:51 | 19:09 | 0:38 |
| Sep | 24 | 6:07 | 6:08 | 6:24 | 6:35 | 18:39 | 18:49 | 19:07 | 0:37 |
| Sep | 25 | 6:07 | 6:09 | 6:25 | 6:36 | 18:37 | 18:47 | 19:05 | 0:37 |
| Sep | 26 | 6:07 | 6:10 | 6:27 | 6:38 | 18:36 | 18:46 | 19:03 | 0:37 |
| Sep | 27 | 6:07 | 6:11 | 6:28 | 6:39 | 18:34 | 18:44 | 19:02 | 0:37 |
| Sep | 28 | 6:06 | 6:12 | 6:29 | 6:40 | 18:32 | 18:42 | 19:00 | 0:36 |
| Sep | 29 | 6:06 | 6:13 | 6:30 | 6:41 | 18:30 | 18:40 | 18:58 | 0:36 |
| Sep | 30 | 6:06 | 6:14 | 6:31 | 6:42 | 18:29 | 18:39 | 18:56 | 0:36 |

Reference:

Astronomical Applications Department, U.S. Naval Observatory, Washington, D.C. 20392-5420
Eastern Standard Time with Day-Light Saving Time

Monthly Operating Time Schedule

Providence, Rhode Island
Location W071°26', N41°49'
2013 Calendar Year

| Month | Day | AM Turn-On | Twilight Dawn | ~1.5 fc Before Sunrise | Sunrise | Sunset | ~1.5 fc After Sunset | Twilight Dusk | Mid-Night |
|-------|-----|------------|---------------|------------------------|---------|--------|----------------------|---------------|-----------|
| | | (Time) | (Time) | (Time) | (Time) | (Time) | (Time) | (Time) | (Time) |
| Oct | 1 | 6:05 | 6:15 | 6:32 | 6:43 | 18:27 | 18:37 | 18:55 | 0:35 |
| Oct | 2 | 6:05 | 6:16 | 6:33 | 6:44 | 18:25 | 18:35 | 18:53 | 0:35 |
| Oct | 3 | 6:05 | 6:17 | 6:34 | 6:45 | 18:24 | 18:34 | 18:51 | 0:35 |
| Oct | 4 | 6:04 | 6:18 | 6:35 | 6:46 | 18:22 | 18:32 | 18:50 | 0:34 |
| Oct | 5 | 6:04 | 6:19 | 6:36 | 6:47 | 18:20 | 18:30 | 18:48 | 0:34 |
| Oct | 6 | 6:04 | 6:20 | 6:37 | 6:48 | 18:19 | 18:29 | 18:46 | 0:34 |
| Oct | 7 | 6:03 | 6:21 | 6:38 | 6:49 | 18:17 | 18:27 | 18:45 | 0:33 |
| Oct | 8 | 6:03 | 6:23 | 6:39 | 6:50 | 18:15 | 18:25 | 18:43 | 0:33 |
| Oct | 9 | 6:03 | 6:24 | 6:41 | 6:52 | 18:14 | 18:24 | 18:41 | 0:33 |
| Oct | 10 | 6:03 | 6:25 | 6:42 | 6:53 | 18:12 | 18:22 | 18:40 | 0:33 |
| Oct | 11 | 6:02 | 6:26 | 6:43 | 6:54 | 18:10 | 18:20 | 18:38 | 0:32 |
| Oct | 12 | 6:02 | 6:27 | 6:44 | 6:55 | 18:09 | 18:19 | 18:37 | 0:32 |
| Oct | 13 | 6:02 | 6:28 | 6:45 | 6:56 | 18:07 | 18:17 | 18:35 | 0:32 |
| Oct | 14 | 6:02 | 6:29 | 6:46 | 6:57 | 18:06 | 18:16 | 18:34 | 0:32 |
| Oct | 15 | 6:01 | 6:30 | 6:47 | 6:58 | 18:04 | 18:14 | 18:32 | 0:31 |
| Oct | 16 | 6:01 | 6:31 | 6:48 | 6:59 | 18:02 | 18:12 | 18:30 | 0:31 |
| Oct | 17 | 6:01 | 6:32 | 6:50 | 7:01 | 18:01 | 18:11 | 18:29 | 0:31 |
| Oct | 18 | 6:01 | 6:33 | 6:51 | 7:02 | 17:59 | 18:09 | 18:27 | 0:31 |
| Oct | 19 | 6:01 | 6:35 | 6:52 | 7:03 | 17:58 | 18:08 | 18:26 | 0:31 |
| Oct | 20 | 6:00 | 6:36 | 6:53 | 7:04 | 17:56 | 18:06 | 18:25 | 0:30 |
| Oct | 21 | 6:00 | 6:37 | 6:54 | 7:05 | 17:55 | 18:05 | 18:23 | 0:30 |
| Oct | 22 | 6:00 | 6:38 | 6:55 | 7:06 | 17:53 | 18:03 | 18:22 | 0:30 |
| Oct | 23 | 6:00 | 6:39 | 6:57 | 7:08 | 17:52 | 18:02 | 18:20 | 0:30 |
| Oct | 24 | 6:00 | 6:40 | 6:58 | 7:09 | 17:50 | 18:00 | 18:19 | 0:30 |
| Oct | 25 | 6:00 | 6:41 | 6:59 | 7:10 | 17:49 | 17:59 | 18:18 | 0:30 |
| Oct | 26 | 6:00 | 6:42 | 7:00 | 7:11 | 17:48 | 17:58 | 18:16 | 0:30 |
| Oct | 27 | 5:59 | 6:44 | 7:01 | 7:12 | 17:46 | 17:56 | 18:15 | 0:29 |
| Oct | 28 | 6:00 | 6:45 | 7:02 | 7:13 | 17:45 | 17:55 | 18:14 | 0:30 |
| Oct | 29 | 6:00 | 6:46 | 7:04 | 7:15 | 17:44 | 17:54 | 18:12 | 0:30 |
| Oct | 30 | 5:59 | 6:47 | 7:05 | 7:16 | 17:42 | 17:52 | 18:11 | 0:29 |
| Oct | 31 | 5:59 | 6:48 | 7:06 | 7:17 | 17:41 | 17:51 | 18:10 | 0:29 |

Reference:

Astronomical Applications Department, U.S. Naval Observatory, Washington, D.C. 20392-5420
Eastern Standard Time with Day-Light Saving Time

Monthly Operating Time Schedule

Providence, Rhode Island
Location W071°26', N41°49'
2013 Calendar Year

| Month | Day | AM Turn-On | Twilight Dawn | ~1.5 fc Before Sunrise | Sunrise | Sunset | ~1.5 fc After Sunset | Twilight Dusk | Mid-Night |
|-------|-----|------------|---------------|------------------------|---------|--------|----------------------|---------------|-----------|
| | | (Time) | (Time) | (Time) | (Time) | (Time) | (Time) | (Time) | (Time) |
| Nov | 1 | 6:00 | 6:49 | 7:07 | 7:18 | 17:40 | 17:50 | 18:09 | 0:30 |
| Nov | 2 | 6:00 | 6:51 | 7:09 | 7:20 | 17:39 | 17:49 | 18:08 | 0:30 |
| Nov | 3 | 4:59 | 6:52 | 6:10 | 6:21 | 16:37 | 16:47 | 17:06 | 23:29 |
| Nov | 4 | 4:59 | 5:53 | 6:11 | 6:22 | 16:36 | 16:46 | 17:05 | 23:29 |
| Nov | 5 | 4:59 | 5:54 | 6:12 | 6:23 | 16:35 | 16:45 | 17:04 | 23:29 |
| Nov | 6 | 5:00 | 5:55 | 6:13 | 6:24 | 16:34 | 16:44 | 17:03 | 23:30 |
| Nov | 7 | 5:00 | 5:56 | 6:15 | 6:26 | 16:33 | 16:43 | 17:02 | 23:30 |
| Nov | 8 | 5:00 | 5:57 | 6:16 | 6:27 | 16:32 | 16:42 | 17:01 | 23:30 |
| Nov | 9 | 5:00 | 5:59 | 6:17 | 6:28 | 16:31 | 16:41 | 17:00 | 23:30 |
| Nov | 10 | 5:00 | 6:00 | 6:18 | 6:29 | 16:30 | 16:40 | 16:59 | 23:30 |
| Nov | 11 | 5:00 | 6:01 | 6:20 | 6:31 | 16:29 | 16:39 | 16:58 | 23:30 |
| Nov | 12 | 5:00 | 6:02 | 6:21 | 6:32 | 16:28 | 16:38 | 16:57 | 23:30 |
| Nov | 13 | 5:00 | 6:03 | 6:22 | 6:33 | 16:27 | 16:37 | 16:56 | 23:30 |
| Nov | 14 | 5:00 | 6:04 | 6:23 | 6:34 | 16:26 | 16:36 | 16:56 | 23:30 |
| Nov | 15 | 5:01 | 6:05 | 6:24 | 6:35 | 16:25 | 16:35 | 16:55 | 23:31 |
| Nov | 16 | 5:01 | 6:07 | 6:26 | 6:37 | 16:24 | 16:34 | 16:54 | 23:31 |
| Nov | 17 | 5:01 | 6:08 | 6:27 | 6:38 | 16:23 | 16:33 | 16:53 | 23:31 |
| Nov | 18 | 5:01 | 6:09 | 6:28 | 6:39 | 16:22 | 16:32 | 16:53 | 23:31 |
| Nov | 19 | 5:01 | 6:10 | 6:29 | 6:40 | 16:22 | 16:32 | 16:52 | 23:31 |
| Nov | 20 | 5:02 | 6:11 | 6:30 | 6:41 | 16:21 | 16:31 | 16:51 | 23:32 |
| Nov | 21 | 5:02 | 6:12 | 6:32 | 6:43 | 16:20 | 16:30 | 16:51 | 23:32 |
| Nov | 22 | 5:02 | 6:13 | 6:33 | 6:44 | 16:20 | 16:30 | 16:50 | 23:32 |
| Nov | 23 | 5:02 | 6:14 | 6:34 | 6:45 | 16:19 | 16:29 | 16:50 | 23:32 |
| Nov | 24 | 5:03 | 6:16 | 6:35 | 6:46 | 16:19 | 16:29 | 16:49 | 23:33 |
| Nov | 25 | 5:03 | 6:17 | 6:36 | 6:47 | 16:18 | 16:28 | 16:49 | 23:33 |
| Nov | 26 | 5:04 | 6:18 | 6:37 | 6:48 | 16:18 | 16:28 | 16:48 | 23:34 |
| Nov | 27 | 5:04 | 6:19 | 6:39 | 6:50 | 16:17 | 16:27 | 16:48 | 23:34 |
| Nov | 28 | 5:04 | 6:20 | 6:40 | 6:51 | 16:17 | 16:27 | 16:48 | 23:34 |
| Nov | 29 | 5:04 | 6:21 | 6:41 | 6:52 | 16:16 | 16:26 | 16:47 | 23:34 |
| Nov | 30 | 5:05 | 6:22 | 6:42 | 6:53 | 16:16 | 16:26 | 16:47 | 23:35 |

Reference:

Astronomical Applications Department, U.S. Naval Observatory, Washington, D.C. 20392-5420
Eastern Standard Time with Day-Light Saving Time

Monthly Operating Time Schedule

Providence, Rhode Island
Location W071°26', N41°49'
2013 Calendar Year

| Month | Day | AM Turn-On | Twilight Dawn | ~1.5 fc Before Sunrise | Sunrise | Sunset | ~1.5 fc After Sunset | Twilight Dusk | Mid-Night |
|-------|-----|------------|---------------|------------------------|---------|--------|----------------------|---------------|-----------|
| | | (Time) | (Time) | (Time) | (Time) | (Time) | (Time) | (Time) | (Time) |
| Dec | 1 | 5:05 | 6:23 | 6:43 | 6:54 | 16:16 | 16:26 | 16:47 | 23:35 |
| Dec | 2 | 5:05 | 6:24 | 6:44 | 6:55 | 16:15 | 16:25 | 16:47 | 23:35 |
| Dec | 3 | 5:06 | 6:25 | 6:45 | 6:56 | 16:15 | 16:25 | 16:46 | 23:36 |
| Dec | 4 | 5:06 | 6:26 | 6:46 | 6:57 | 16:15 | 16:25 | 16:46 | 23:36 |
| Dec | 5 | 5:07 | 6:27 | 6:47 | 6:58 | 16:15 | 16:25 | 16:46 | 23:37 |
| Dec | 6 | 5:07 | 6:28 | 6:48 | 6:59 | 16:15 | 16:25 | 16:46 | 23:37 |
| Dec | 7 | 5:08 | 6:28 | 6:49 | 7:00 | 16:15 | 16:25 | 16:46 | 23:38 |
| Dec | 8 | 5:08 | 6:29 | 6:50 | 7:01 | 16:15 | 16:25 | 16:46 | 23:38 |
| Dec | 9 | 5:08 | 6:30 | 6:51 | 7:02 | 16:15 | 16:25 | 16:46 | 23:38 |
| Dec | 10 | 5:09 | 6:31 | 6:51 | 7:02 | 16:15 | 16:25 | 16:46 | 23:39 |
| Dec | 11 | 5:09 | 6:32 | 6:52 | 7:03 | 16:15 | 16:25 | 16:46 | 23:39 |
| Dec | 12 | 5:10 | 6:33 | 6:53 | 7:04 | 16:15 | 16:25 | 16:47 | 23:40 |
| Dec | 13 | 5:10 | 6:33 | 6:54 | 7:05 | 16:15 | 16:25 | 16:47 | 23:40 |
| Dec | 14 | 5:10 | 6:34 | 6:55 | 7:06 | 16:15 | 16:25 | 16:47 | 23:40 |
| Dec | 15 | 5:11 | 6:35 | 6:55 | 7:06 | 16:16 | 16:26 | 16:47 | 23:41 |
| Dec | 16 | 5:12 | 6:35 | 6:56 | 7:07 | 16:16 | 16:26 | 16:48 | 23:42 |
| Dec | 17 | 5:12 | 6:36 | 6:57 | 7:08 | 16:16 | 16:26 | 16:48 | 23:42 |
| Dec | 18 | 5:13 | 6:37 | 6:57 | 7:08 | 16:17 | 16:27 | 16:48 | 23:43 |
| Dec | 19 | 5:13 | 6:37 | 6:58 | 7:09 | 16:17 | 16:27 | 16:49 | 23:43 |
| Dec | 20 | 5:14 | 6:38 | 6:58 | 7:09 | 16:18 | 16:28 | 16:49 | 23:44 |
| Dec | 21 | 5:14 | 6:38 | 6:59 | 7:10 | 16:18 | 16:28 | 16:50 | 23:44 |
| Dec | 22 | 5:15 | 6:39 | 6:59 | 7:10 | 16:19 | 16:29 | 16:50 | 23:45 |
| Dec | 23 | 5:15 | 6:39 | 7:00 | 7:11 | 16:19 | 16:29 | 16:51 | 23:45 |
| Dec | 24 | 5:16 | 6:40 | 7:00 | 7:11 | 16:20 | 16:30 | 16:51 | 23:46 |
| Dec | 25 | 5:16 | 6:40 | 7:01 | 7:12 | 16:20 | 16:30 | 16:52 | 23:46 |
| Dec | 26 | 5:16 | 6:40 | 7:01 | 7:12 | 16:21 | 16:31 | 16:53 | 23:46 |
| Dec | 27 | 5:17 | 6:41 | 7:01 | 7:12 | 16:22 | 16:32 | 16:53 | 23:47 |
| Dec | 28 | 5:17 | 6:41 | 7:02 | 7:13 | 16:22 | 16:32 | 16:54 | 23:47 |
| Dec | 29 | 5:18 | 6:41 | 7:02 | 7:13 | 16:23 | 16:33 | 16:55 | 23:48 |
| Dec | 30 | 5:18 | 6:41 | 7:02 | 7:13 | 16:24 | 16:34 | 16:56 | 23:48 |
| Dec | 31 | 5:19 | 6:42 | 7:02 | 7:13 | 16:25 | 16:35 | 16:56 | 23:49 |

Reference:

Astronomical Applications Department, U.S. Naval Observatory, Washington, D.C. 20392-5420
Eastern Standard Time with Day-Light Saving Time

The Narragansett Electric Company
d/b/a National Grid
R.I.P.U.C. Docket No. ____
Customer-Owned Street & Area Lighting Proposal
Witness: John E. Walter

Schedule JEW-2

Operating Hour Equivalent Table

Operating Hour Equivalent Table

Providence, Rhode Island
Location W071°26', N41°49'
2013 Calendar Year

Operating Hour Equivalents¹ (Hrs) Operating Schedule

| <u>Month</u> | <u>Days</u> | <u>Continuous</u> | <u>Dusk-To-Dawn</u> | <u>Dimming²</u> | <u>Part-Night</u> |
|--------------|-------------|-------------------|---------------------|----------------------------|-------------------|
| January | 31 | 744 | 437 | 386 | 266 |
| February | 28 | 672 | 365 | 319 | 211 |
| March | 31 | 744 | 363 | 312 | 192 |
| April | 30 | 720 | 309 | 263 | 154 |
| May | 31 | 744 | 282 | 240 | 141 |
| June | 30 | 720 | 255 | 217 | 127 |
| July | 31 | 744 | 272 | 232 | 137 |
| August | 31 | 744 | 305 | 259 | 153 |
| September | 30 | 720 | 335 | 286 | 172 |
| October | 31 | 744 | 390 | 339 | 220 |
| November | 30 | 720 | 414 | 365 | 250 |
| December | 31 | 744 | 448 | 397 | 278 |
| Annual | 365 | 8,760 | 4,175 | 3,615 | 2,301 |

Footnote:

1. Operating Hour Equivalents are approximate and have been rounded to whole numbers.
2. Dimming Equivalent Hours (per month) at 70% energy consumption equals:
Part-Night + [(Dusk-To-Dawn – Part-Night) x 70%]

Reference:

Astronomical Applications Department, U.S. Naval Observatory, Washington, D.C. 20392-5420
Eastern Standard Time with Day-Light Saving Time

Operating Hour Equivalent Table Supporting Reference Data

Providence, Rhode Island
Location W071°26', N41°49'
2013 Calendar Year

| Month | Day | Dusk-To-Dawn [Twilight] (Hours) | Dusk-To-Dawn Operating Schedule [~1.5 fc On/Off] (Hours) | Sunset-To-Sunrise (Hours) | Time After AM Turn-On (Hours) | Part-Night Operating (Hours) | Part-Night Off Period (Hours) |
|-------|-----|---------------------------------------|--|------------------------------|-------------------------------------|------------------------------------|-------------------------------------|
| | | (Decimal) | (Decimal) | (Decimal) | (Decimal) | (Decimal) | (Decimal) |
| Jan | 1 | 13.77 | 14.45 | 14.80 | 1.72 | 8.93 | 5.52 |
| Jan | 2 | 13.75 | 14.43 | 14.78 | 1.71 | 8.92 | 5.52 |
| Jan | 3 | 13.73 | 14.42 | 14.77 | 1.70 | 8.90 | 5.52 |
| Jan | 4 | 13.72 | 14.40 | 14.75 | 1.69 | 8.88 | 5.52 |
| Jan | 5 | 13.70 | 14.38 | 14.73 | 1.68 | 8.87 | 5.52 |
| Jan | 6 | 13.68 | 14.37 | 14.72 | 1.68 | 8.85 | 5.52 |
| Jan | 7 | 13.67 | 14.35 | 14.70 | 1.67 | 8.83 | 5.52 |
| Jan | 8 | 13.65 | 14.33 | 14.68 | 1.66 | 8.82 | 5.52 |
| Jan | 9 | 13.63 | 14.32 | 14.67 | 1.66 | 8.80 | 5.52 |
| Jan | 10 | 13.60 | 14.28 | 14.63 | 1.63 | 8.77 | 5.52 |
| Jan | 11 | 13.58 | 14.27 | 14.62 | 1.63 | 8.75 | 5.52 |
| Jan | 12 | 13.57 | 14.25 | 14.60 | 1.63 | 8.73 | 5.52 |
| Jan | 13 | 13.55 | 14.22 | 14.57 | 1.60 | 8.70 | 5.52 |
| Jan | 14 | 13.52 | 14.20 | 14.55 | 1.59 | 8.68 | 5.52 |
| Jan | 15 | 13.50 | 14.18 | 14.53 | 1.59 | 8.67 | 5.52 |
| Jan | 16 | 13.48 | 14.15 | 14.50 | 1.57 | 8.63 | 5.52 |
| Jan | 17 | 13.45 | 14.13 | 14.48 | 1.56 | 8.60 | 5.53 |
| Jan | 18 | 13.43 | 14.08 | 14.43 | 1.54 | 8.57 | 5.52 |
| Jan | 19 | 13.40 | 14.05 | 14.40 | 1.52 | 8.53 | 5.52 |
| Jan | 20 | 13.38 | 14.03 | 14.38 | 1.52 | 8.52 | 5.52 |
| Jan | 21 | 13.33 | 14.00 | 14.35 | 1.49 | 8.48 | 5.52 |
| Jan | 22 | 13.30 | 13.98 | 14.33 | 1.48 | 8.45 | 5.53 |
| Jan | 23 | 13.28 | 13.93 | 14.28 | 1.47 | 8.42 | 5.52 |
| Jan | 24 | 13.25 | 13.90 | 14.25 | 1.45 | 8.38 | 5.52 |
| Jan | 25 | 13.22 | 13.87 | 14.22 | 1.43 | 8.35 | 5.52 |
| Jan | 26 | 13.20 | 13.83 | 14.18 | 1.40 | 8.30 | 5.53 |
| Jan | 27 | 13.15 | 13.80 | 14.15 | 1.40 | 8.28 | 5.52 |
| Jan | 28 | 13.12 | 13.77 | 14.12 | 1.38 | 8.25 | 5.52 |
| Jan | 29 | 13.08 | 13.73 | 14.08 | 1.36 | 8.20 | 5.53 |
| Jan | 30 | 13.05 | 13.68 | 14.03 | 1.34 | 8.17 | 5.52 |
| Jan | 31 | 13.02 | 13.65 | 14.00 | 1.33 | 8.13 | 5.52 |
| | | | 437.45 | | | 266.37 | 171.08 |

Reference:

Astronomical Applications Department, U.S. Naval Observatory, Washington, D.C. 20392-5420
Eastern Standard Time with Day-Light Saving Time

Operating Hour Equivalent Table Supporting Reference Data

Providence, Rhode Island
Location W071°26', N41°49'
2013 Calendar Year

| Month | Day | Dusk-To-Dawn [Twilight] (Hours) | Dusk-To-Dawn Operating Schedule [~1.5 fc On/Off] (Hours) | Sunset-To-Sunrise (Hours) | Time After AM Turn-On (Hours) | Part-Night Operating (Hours) | Part-Night Off Period (Hours) |
|-------|-----|---------------------------------------|--|------------------------------|-------------------------------------|------------------------------------|-------------------------------------|
| | | (Decimal) | (Decimal) | (Decimal) | (Decimal) | (Decimal) | (Decimal) |
| Feb | 1 | 12.97 | 13.62 | 13.97 | 1.31 | 8.10 | 5.52 |
| Feb | 2 | 12.93 | 13.58 | 13.93 | 1.28 | 8.05 | 5.53 |
| Feb | 3 | 12.90 | 13.53 | 13.88 | 1.27 | 8.02 | 5.52 |
| Feb | 4 | 12.87 | 13.50 | 13.85 | 1.25 | 7.98 | 5.52 |
| Feb | 5 | 12.83 | 13.47 | 13.82 | 1.24 | 7.95 | 5.52 |
| Feb | 6 | 12.78 | 13.42 | 13.77 | 1.20 | 7.88 | 5.53 |
| Feb | 7 | 12.75 | 13.37 | 13.72 | 1.18 | 7.85 | 5.52 |
| Feb | 8 | 12.72 | 13.33 | 13.68 | 1.17 | 7.82 | 5.52 |
| Feb | 9 | 12.68 | 13.30 | 13.65 | 1.14 | 7.77 | 5.53 |
| Feb | 10 | 12.63 | 13.25 | 13.60 | 1.13 | 7.73 | 5.52 |
| Feb | 11 | 12.60 | 13.20 | 13.55 | 1.10 | 7.68 | 5.52 |
| Feb | 12 | 12.55 | 13.17 | 13.52 | 1.08 | 7.65 | 5.52 |
| Feb | 13 | 12.52 | 13.13 | 13.48 | 1.07 | 7.60 | 5.53 |
| Feb | 14 | 12.48 | 13.07 | 13.42 | 1.03 | 7.55 | 5.52 |
| Feb | 15 | 12.42 | 13.03 | 13.38 | 1.02 | 7.52 | 5.52 |
| Feb | 16 | 12.38 | 13.00 | 13.35 | 1.01 | 7.48 | 5.52 |
| Feb | 17 | 12.35 | 12.95 | 13.30 | 0.97 | 7.42 | 5.53 |
| Feb | 18 | 12.30 | 12.90 | 13.25 | 0.96 | 7.38 | 5.52 |
| Feb | 19 | 12.27 | 12.85 | 13.20 | 0.92 | 7.33 | 5.52 |
| Feb | 20 | 12.22 | 12.82 | 13.17 | 0.91 | 7.30 | 5.52 |
| Feb | 21 | 12.17 | 12.78 | 13.13 | 0.89 | 7.25 | 5.53 |
| Feb | 22 | 12.13 | 12.72 | 13.07 | 0.86 | 7.20 | 5.52 |
| Feb | 23 | 12.08 | 12.68 | 13.03 | 0.85 | 7.17 | 5.52 |
| Feb | 24 | 12.05 | 12.63 | 12.98 | 0.82 | 7.12 | 5.52 |
| Feb | 25 | 12.00 | 12.58 | 12.93 | 0.78 | 7.05 | 5.53 |
| Feb | 26 | 11.95 | 12.53 | 12.88 | 0.78 | 7.02 | 5.52 |
| Feb | 27 | 11.90 | 12.48 | 12.83 | 0.74 | 6.97 | 5.52 |
| Feb | 28 | 11.87 | 12.45 | 12.80 | 0.73 | 6.93 | 5.52 |
| | | | 365.35 | | | 210.77 | 154.58 |

Reference:

Astronomical Applications Department, U.S. Naval Observatory, Washington, D.C. 20392-5420
Eastern Standard Time with Day-Light Saving Time

Operating Hour Equivalent Table Supporting Reference Data

Providence, Rhode Island
Location W071°26', N41°49'
2013 Calendar Year

| Month | Day | Dusk-To-Dawn [Twilight] (Hours) | Dusk-To-Dawn Operating Schedule [~1.5 fc On/Off] (Hours) | Sunset-To-Sunrise (Hours) | Time After AM Turn-On (Hours) | Part-Night Operating (Hours) | Part-Night Off Period (Hours) |
|-------|-----|---------------------------------------|--|------------------------------|-------------------------------------|------------------------------------|-------------------------------------|
| | | (Decimal) | (Decimal) | (Decimal) | (Decimal) | (Decimal) | (Decimal) |
| Mar | 1 | 11.82 | 12.40 | 12.75 | 0.70 | 6.88 | 5.52 |
| Mar | 2 | 11.78 | 12.37 | 12.72 | 0.68 | 6.83 | 5.53 |
| Mar | 3 | 11.73 | 12.30 | 12.65 | 0.66 | 6.78 | 5.52 |
| Mar | 4 | 11.68 | 12.25 | 12.60 | 0.62 | 6.73 | 5.52 |
| Mar | 5 | 11.63 | 12.22 | 12.57 | 0.62 | 6.70 | 5.52 |
| Mar | 6 | 11.58 | 12.17 | 12.52 | 0.58 | 6.65 | 5.52 |
| Mar | 7 | 11.55 | 12.13 | 12.48 | 0.58 | 6.62 | 5.52 |
| Mar | 8 | 11.50 | 12.08 | 12.43 | 0.54 | 6.55 | 5.53 |
| Mar | 9 | 11.47 | 12.02 | 12.37 | 0.51 | 6.50 | 5.52 |
| Mar | 10 | 11.42 | 11.98 | 12.33 | 0.50 | 6.47 | 5.52 |
| Mar | 11 | 11.35 | 11.93 | 12.28 | 0.47 | 6.42 | 5.52 |
| Mar | 12 | 11.32 | 11.88 | 12.23 | 0.44 | 6.37 | 5.52 |
| Mar | 13 | 11.27 | 11.85 | 12.20 | 0.43 | 6.33 | 5.52 |
| Mar | 14 | 11.22 | 11.80 | 12.15 | 0.41 | 6.28 | 5.52 |
| Mar | 15 | 11.17 | 11.75 | 12.10 | 0.37 | 6.22 | 5.53 |
| Mar | 16 | 11.13 | 11.70 | 12.05 | 0.36 | 6.18 | 5.52 |
| Mar | 17 | 11.08 | 11.65 | 12.00 | 0.33 | 6.13 | 5.52 |
| Mar | 18 | 11.02 | 11.60 | 11.95 | 0.31 | 6.08 | 5.52 |
| Mar | 19 | 10.98 | 11.55 | 11.90 | 0.28 | 6.03 | 5.52 |
| Mar | 20 | 10.93 | 11.52 | 11.87 | 0.27 | 6.00 | 5.52 |
| Mar | 21 | 10.88 | 11.47 | 11.82 | 0.24 | 5.95 | 5.52 |
| Mar | 22 | 10.83 | 11.42 | 11.77 | 0.21 | 5.90 | 5.52 |
| Mar | 23 | 10.80 | 11.38 | 11.73 | 0.19 | 5.85 | 5.53 |
| Mar | 24 | 10.75 | 11.32 | 11.67 | 0.17 | 5.80 | 5.52 |
| Mar | 25 | 10.68 | 11.27 | 11.62 | 0.14 | 5.75 | 5.52 |
| Mar | 26 | 10.65 | 11.22 | 11.57 | 0.11 | 5.70 | 5.52 |
| Mar | 27 | 10.60 | 11.18 | 11.53 | 0.10 | 5.67 | 5.52 |
| Mar | 28 | 10.55 | 11.13 | 11.48 | 0.07 | 5.62 | 5.52 |
| Mar | 29 | 10.50 | 11.08 | 11.43 | 0.04 | 5.57 | 5.52 |
| Mar | 30 | 10.47 | 11.05 | 11.40 | 0.03 | 5.53 | 5.52 |
| Mar | 31 | 10.42 | 11.00 | 11.35 | 0.01 | 5.48 | 5.52 |
| | | | 362.67 | | | 191.58 | 171.08 |

Reference:

Astronomical Applications Department, U.S. Naval Observatory, Washington, D.C. 20392-5420
Eastern Standard Time with Day-Light Saving Time

Operating Hour Equivalent Table Supporting Reference Data

Providence, Rhode Island
Location W071°26', N41°49'
2013 Calendar Year

| Month | Day | Dusk-To-Dawn [Twilight] (Hours) | Dusk-To-Dawn Operating Schedule [~1.5 fc On/Off] (Hours) | Sunset-To-Sunrise (Hours) | Time After AM Turn-On (Hours) | Part-Night Operating (Hours) | Part-Night Off Period (Hours) |
|-------|-----|---------------------------------------|--|------------------------------|-------------------------------------|------------------------------------|-------------------------------------|
| | | (Decimal) | (Decimal) | (Decimal) | (Decimal) | (Decimal) | (Decimal) |
| Apr | 1 | 10.37 | 10.95 | 11.30 | 0.00 | 5.46 | 5.49 |
| Apr | 2 | 10.30 | 10.92 | 11.27 | 0.00 | 5.43 | 5.49 |
| Apr | 3 | 10.27 | 10.85 | 11.20 | 0.00 | 5.40 | 5.45 |
| Apr | 4 | 10.22 | 10.80 | 11.15 | 0.00 | 5.38 | 5.43 |
| Apr | 5 | 10.17 | 10.75 | 11.10 | 0.00 | 5.36 | 5.39 |
| Apr | 6 | 10.13 | 10.72 | 11.07 | 0.00 | 5.33 | 5.38 |
| Apr | 7 | 10.08 | 10.67 | 11.02 | 0.00 | 5.32 | 5.35 |
| Apr | 8 | 10.02 | 10.63 | 10.98 | 0.00 | 5.29 | 5.34 |
| Apr | 9 | 9.97 | 10.58 | 10.93 | 0.00 | 5.27 | 5.32 |
| Apr | 10 | 9.93 | 10.53 | 10.88 | 0.00 | 5.25 | 5.28 |
| Apr | 11 | 9.88 | 10.50 | 10.85 | 0.00 | 5.23 | 5.28 |
| Apr | 12 | 9.83 | 10.45 | 10.80 | 0.00 | 5.19 | 5.26 |
| Apr | 13 | 9.80 | 10.38 | 10.73 | 0.00 | 5.18 | 5.21 |
| Apr | 14 | 9.73 | 10.35 | 10.70 | 0.00 | 5.15 | 5.20 |
| Apr | 15 | 9.68 | 10.30 | 10.65 | 0.00 | 5.13 | 5.17 |
| Apr | 16 | 9.65 | 10.27 | 10.62 | 0.00 | 5.11 | 5.16 |
| Apr | 17 | 9.60 | 10.22 | 10.57 | 0.00 | 5.09 | 5.13 |
| Apr | 18 | 9.55 | 10.18 | 10.53 | 0.00 | 5.07 | 5.12 |
| Apr | 19 | 9.52 | 10.13 | 10.48 | 0.00 | 5.04 | 5.09 |
| Apr | 20 | 9.45 | 10.08 | 10.43 | 0.00 | 5.03 | 5.06 |
| Apr | 21 | 9.42 | 10.05 | 10.40 | 0.00 | 5.01 | 5.04 |
| Apr | 22 | 9.37 | 10.02 | 10.37 | 0.00 | 4.98 | 5.04 |
| Apr | 23 | 9.32 | 9.95 | 10.30 | 0.00 | 4.96 | 4.99 |
| Apr | 24 | 9.28 | 9.92 | 10.27 | 0.00 | 4.93 | 4.98 |
| Apr | 25 | 9.22 | 9.87 | 10.22 | 0.00 | 4.92 | 4.95 |
| Apr | 26 | 9.18 | 9.83 | 10.18 | 0.00 | 4.89 | 4.94 |
| Apr | 27 | 9.13 | 9.78 | 10.13 | 0.00 | 4.88 | 4.91 |
| Apr | 28 | 9.10 | 9.75 | 10.10 | 0.00 | 4.86 | 4.89 |
| Apr | 29 | 9.05 | 9.72 | 10.07 | 0.00 | 4.83 | 4.88 |
| Apr | 30 | 9.02 | 9.67 | 10.02 | 0.00 | 4.82 | 4.85 |
| | | | 308.82 | | | 153.75 | 155.07 |

Reference:

Astronomical Applications Department, U.S. Naval Observatory, Washington, D.C. 20392-5420
Eastern Standard Time with Day-Light Saving Time

Operating Hour Equivalent Table Supporting Reference Data

Providence, Rhode Island
Location W071°26', N41°49'
2013 Calendar Year

| Month | Day | Dusk-To-Dawn [Twilight] (Hours) | Dusk-To-Dawn Operating Schedule [~1.5 fc On/Off] (Hours) | Sunset-To-Sunrise (Hours) | Time After AM Turn-On (Hours) | Part-Night Operating (Hours) | Part-Night Off Period (Hours) |
|-------|-----|---------------------------------------|--|------------------------------|-------------------------------------|------------------------------------|-------------------------------------|
| | | (Decimal) | (Decimal) | (Decimal) | (Decimal) | (Decimal) | (Decimal) |
| May | 1 | 8.95 | 9.63 | 9.98 | 0.00 | 4.80 | 4.83 |
| May | 2 | 8.92 | 9.60 | 9.95 | 0.00 | 4.78 | 4.83 |
| May | 3 | 8.88 | 9.55 | 9.90 | 0.00 | 4.75 | 4.80 |
| May | 4 | 8.83 | 9.50 | 9.85 | 0.00 | 4.73 | 4.77 |
| May | 5 | 8.80 | 9.47 | 9.82 | 0.00 | 4.71 | 4.76 |
| May | 6 | 8.75 | 9.42 | 9.77 | 0.00 | 4.69 | 4.73 |
| May | 7 | 8.70 | 9.38 | 9.73 | 0.00 | 4.68 | 4.71 |
| May | 8 | 8.67 | 9.35 | 9.70 | 0.00 | 4.66 | 4.69 |
| May | 9 | 8.63 | 9.32 | 9.67 | 0.00 | 4.64 | 4.68 |
| May | 10 | 8.60 | 9.28 | 9.63 | 0.00 | 4.63 | 4.66 |
| May | 11 | 8.55 | 9.25 | 9.60 | 0.00 | 4.61 | 4.64 |
| May | 12 | 8.50 | 9.22 | 9.57 | 0.00 | 4.59 | 4.63 |
| May | 13 | 8.47 | 9.18 | 9.53 | 0.00 | 4.58 | 4.61 |
| May | 14 | 8.43 | 9.15 | 9.50 | 0.00 | 4.56 | 4.59 |
| May | 15 | 8.40 | 9.12 | 9.47 | 0.00 | 4.54 | 4.58 |
| May | 16 | 8.37 | 9.08 | 9.43 | 0.00 | 4.53 | 4.56 |
| May | 17 | 8.33 | 9.05 | 9.40 | 0.00 | 4.51 | 4.54 |
| May | 18 | 8.30 | 9.02 | 9.37 | 0.00 | 4.49 | 4.53 |
| May | 19 | 8.27 | 8.98 | 9.33 | 0.00 | 4.48 | 4.51 |
| May | 20 | 8.22 | 8.95 | 9.30 | 0.00 | 4.46 | 4.49 |
| May | 21 | 8.18 | 8.92 | 9.27 | 0.00 | 4.44 | 4.48 |
| May | 22 | 8.15 | 8.88 | 9.23 | 0.00 | 4.43 | 4.45 |
| May | 23 | 8.12 | 8.87 | 9.22 | 0.00 | 4.42 | 4.45 |
| May | 24 | 8.08 | 8.83 | 9.18 | 0.00 | 4.40 | 4.43 |
| May | 25 | 8.05 | 8.80 | 9.15 | 0.00 | 4.38 | 4.42 |
| May | 26 | 8.03 | 8.77 | 9.12 | 0.00 | 4.38 | 4.39 |
| May | 27 | 8.00 | 8.75 | 9.10 | 0.00 | 4.37 | 4.38 |
| May | 28 | 7.97 | 8.73 | 9.08 | 0.00 | 4.36 | 4.38 |
| May | 29 | 7.95 | 8.72 | 9.07 | 0.00 | 4.34 | 4.38 |
| May | 30 | 7.93 | 8.68 | 9.03 | 0.00 | 4.33 | 4.35 |
| May | 31 | 7.90 | 8.67 | 9.02 | 0.00 | 4.32 | 4.35 |
| | | | 282.12 | | | 140.56 | 141.56 |

Reference:

Astronomical Applications Department, U.S. Naval Observatory, Washington, D.C. 20392-5420
Eastern Standard Time with Day-Light Saving Time

Operating Hour Equivalent Table Supporting Reference Data

Providence, Rhode Island
Location W071°26', N41°49'
2013 Calendar Year

| Month | Day | Dusk-To-Dawn [Twilight] (Hours) | Dusk-To-Dawn Operating Schedule [~1.5 fc On/Off] (Hours) | Sunset-To-Sunrise (Hours) | Time After AM Turn-On (Hours) | Part-Night Operating (Hours) | Part-Night Off Period (Hours) |
|-------|-----|---------------------------------------|--|------------------------------|-------------------------------------|------------------------------------|-------------------------------------|
| | | (Decimal) | (Decimal) | (Decimal) | (Decimal) | (Decimal) | (Decimal) |
| Jun | 1 | 7.9 | 8.6 | 9.0 | 0.0 | 4.3 | 4.3 |
| Jun | 2 | 7.9 | 8.6 | 9.0 | 0.0 | 4.3 | 4.3 |
| Jun | 3 | 7.8 | 8.6 | 9.0 | 0.0 | 4.3 | 4.3 |
| Jun | 4 | 7.8 | 8.6 | 8.9 | 0.0 | 4.3 | 4.3 |
| Jun | 5 | 7.8 | 8.6 | 8.9 | 0.0 | 4.3 | 4.3 |
| Jun | 6 | 7.8 | 8.6 | 8.9 | 0.0 | 4.3 | 4.3 |
| Jun | 7 | 7.8 | 8.5 | 8.9 | 0.0 | 4.3 | 4.3 |
| Jun | 8 | 7.8 | 8.5 | 8.9 | 0.0 | 4.3 | 4.3 |
| Jun | 9 | 7.7 | 8.5 | 8.9 | 0.0 | 4.2 | 4.3 |
| Jun | 10 | 7.7 | 8.5 | 8.8 | 0.0 | 4.2 | 4.2 |
| Jun | 11 | 7.7 | 8.5 | 8.8 | 0.0 | 4.2 | 4.3 |
| Jun | 12 | 7.7 | 8.5 | 8.8 | 0.0 | 4.2 | 4.2 |
| Jun | 13 | 7.7 | 8.5 | 8.8 | 0.0 | 4.2 | 4.2 |
| Jun | 14 | 7.7 | 8.5 | 8.8 | 0.0 | 4.2 | 4.2 |
| Jun | 15 | 7.7 | 8.5 | 8.8 | 0.0 | 4.2 | 4.2 |
| Jun | 16 | 7.7 | 8.5 | 8.8 | 0.0 | 4.2 | 4.2 |
| Jun | 17 | 7.7 | 8.4 | 8.8 | 0.0 | 4.2 | 4.2 |
| Jun | 18 | 7.6 | 8.4 | 8.8 | 0.0 | 4.2 | 4.2 |
| Jun | 19 | 7.6 | 8.5 | 8.8 | 0.0 | 4.2 | 4.2 |
| Jun | 20 | 7.6 | 8.4 | 8.8 | 0.0 | 4.2 | 4.2 |
| Jun | 21 | 7.7 | 8.4 | 8.8 | 0.0 | 4.2 | 4.2 |
| Jun | 22 | 7.6 | 8.4 | 8.8 | 0.0 | 4.2 | 4.2 |
| Jun | 23 | 7.6 | 8.4 | 8.8 | 0.0 | 4.2 | 4.2 |
| Jun | 24 | 7.6 | 8.5 | 8.8 | 0.0 | 4.2 | 4.2 |
| Jun | 25 | 7.7 | 8.4 | 8.8 | 0.0 | 4.2 | 4.2 |
| Jun | 26 | 7.7 | 8.4 | 8.8 | 0.0 | 4.2 | 4.2 |
| Jun | 27 | 7.7 | 8.5 | 8.8 | 0.0 | 4.2 | 4.2 |
| Jun | 28 | 7.7 | 8.5 | 8.8 | 0.0 | 4.2 | 4.2 |
| Jun | 29 | 7.7 | 8.5 | 8.8 | 0.0 | 4.2 | 4.2 |
| Jun | 30 | 7.7 | 8.5 | 8.8 | 0.0 | 4.2 | 4.2 |
| | | | 254.6 | | | 127.2 | 127.4 |

Reference:

Astronomical Applications Department, U.S. Naval Observatory, Washington, D.C. 20392-5420
Eastern Standard Time with Day-Light Saving Time

Operating Hour Equivalent Table Supporting Reference Data

Providence, Rhode Island
Location W071°26', N41°49'
2013 Calendar Year

| Month | Day | Dusk-To-Dawn [Twilight] (Hours) | Dusk-To-Dawn Operating Schedule [~1.5 fc On/Off] (Hours) | Sunset-To-Sunrise (Hours) | Time After AM Turn-On (Hours) | Part-Night Operating (Hours) | Part-Night Off Period (Hours) |
|-------|-----|---------------------------------------|--|------------------------------|-------------------------------------|------------------------------------|-------------------------------------|
| | | (Decimal) | (Decimal) | (Decimal) | (Decimal) | (Decimal) | (Decimal) |
| Jul | 1 | 7.7 | 8.5 | 8.8 | 0.0 | 4.3 | 4.2 |
| Jul | 2 | 7.7 | 8.5 | 8.9 | 0.0 | 4.3 | 4.2 |
| Jul | 3 | 7.7 | 8.5 | 8.9 | 0.0 | 4.3 | 4.3 |
| Jul | 4 | 7.7 | 8.5 | 8.9 | 0.0 | 4.3 | 4.3 |
| Jul | 5 | 7.8 | 8.5 | 8.9 | 0.0 | 4.3 | 4.3 |
| Jul | 6 | 7.8 | 8.6 | 8.9 | 0.0 | 4.3 | 4.3 |
| Jul | 7 | 7.8 | 8.6 | 8.9 | 0.0 | 4.3 | 4.3 |
| Jul | 8 | 7.8 | 8.6 | 8.9 | 0.0 | 4.3 | 4.3 |
| Jul | 9 | 7.8 | 8.6 | 9.0 | 0.0 | 4.3 | 4.3 |
| Jul | 10 | 7.9 | 8.6 | 9.0 | 0.0 | 4.3 | 4.3 |
| Jul | 11 | 7.9 | 8.6 | 9.0 | 0.0 | 4.3 | 4.3 |
| Jul | 12 | 7.9 | 8.7 | 9.0 | 0.0 | 4.3 | 4.3 |
| Jul | 13 | 7.9 | 8.7 | 9.0 | 0.0 | 4.4 | 4.3 |
| Jul | 14 | 8.0 | 8.7 | 9.1 | 0.0 | 4.4 | 4.3 |
| Jul | 15 | 8.0 | 8.7 | 9.1 | 0.0 | 4.4 | 4.4 |
| Jul | 16 | 8.0 | 8.8 | 9.1 | 0.0 | 4.4 | 4.4 |
| Jul | 17 | 8.0 | 8.8 | 9.1 | 0.0 | 4.4 | 4.4 |
| Jul | 18 | 8.1 | 8.8 | 9.2 | 0.0 | 4.4 | 4.4 |
| Jul | 19 | 8.1 | 8.8 | 9.2 | 0.0 | 4.4 | 4.4 |
| Jul | 20 | 8.1 | 8.9 | 9.2 | 0.0 | 4.4 | 4.4 |
| Jul | 21 | 8.2 | 8.9 | 9.2 | 0.0 | 4.5 | 4.4 |
| Jul | 22 | 8.2 | 8.9 | 9.3 | 0.0 | 4.5 | 4.5 |
| Jul | 23 | 8.2 | 8.9 | 9.3 | 0.0 | 4.5 | 4.5 |
| Jul | 24 | 8.3 | 9.0 | 9.3 | 0.0 | 4.5 | 4.5 |
| Jul | 25 | 8.3 | 9.0 | 9.4 | 0.0 | 4.5 | 4.5 |
| Jul | 26 | 8.3 | 9.0 | 9.4 | 0.0 | 4.5 | 4.5 |
| Jul | 27 | 8.4 | 9.1 | 9.4 | 0.0 | 4.6 | 4.5 |
| Jul | 28 | 8.4 | 9.1 | 9.5 | 0.0 | 4.6 | 4.5 |
| Jul | 29 | 8.4 | 9.1 | 9.5 | 0.0 | 4.6 | 4.6 |
| Jul | 30 | 8.5 | 9.2 | 9.5 | 0.0 | 4.6 | 4.6 |
| Jul | 31 | 8.5 | 9.2 | 9.6 | 0.0 | 4.6 | 4.6 |
| | | | 272.4 | | | 136.6 | 135.8 |

Reference:

Astronomical Applications Department, U.S. Naval Observatory, Washington, D.C. 20392-5420
Eastern Standard Time with Day-Light Saving Time

Operating Hour Equivalent Table Supporting Reference Data

Providence, Rhode Island
Location W071°26', N41°49'
2013 Calendar Year

| Month | Day | Dusk-To-Dawn [Twilight] (Hours) | Dusk-To-Dawn Operating Schedule [~1.5 fc On/Off] (Hours) | Sunset-To-Sunrise (Hours) | Time After AM Turn-On (Hours) | Part-Night Operating (Hours) | Part-Night Off Period (Hours) |
|-------|-----|---------------------------------------|--|------------------------------|-------------------------------------|------------------------------------|-------------------------------------|
| | | (Decimal) | (Decimal) | (Decimal) | (Decimal) | (Decimal) | (Decimal) |
| Aug | 1 | 8.5 | 9.2 | 9.6 | 0.0 | 4.6 | 4.6 |
| Aug | 2 | 8.6 | 9.3 | 9.6 | 0.0 | 4.7 | 4.6 |
| Aug | 3 | 8.6 | 9.3 | 9.7 | 0.0 | 4.7 | 4.6 |
| Aug | 4 | 8.7 | 9.4 | 9.7 | 0.0 | 4.7 | 4.7 |
| Aug | 5 | 8.7 | 9.4 | 9.7 | 0.0 | 4.7 | 4.7 |
| Aug | 6 | 8.7 | 9.4 | 9.8 | 0.0 | 4.7 | 4.7 |
| Aug | 7 | 8.8 | 9.5 | 9.8 | 0.0 | 4.8 | 4.7 |
| Aug | 8 | 8.8 | 9.5 | 9.9 | 0.0 | 4.8 | 4.7 |
| Aug | 9 | 8.9 | 9.5 | 9.9 | 0.0 | 4.8 | 4.8 |
| Aug | 10 | 8.9 | 9.6 | 9.9 | 0.0 | 4.8 | 4.8 |
| Aug | 11 | 9.0 | 9.6 | 10.0 | 0.0 | 4.8 | 4.8 |
| Aug | 12 | 9.0 | 9.7 | 10.0 | 0.0 | 4.8 | 4.8 |
| Aug | 13 | 9.0 | 9.7 | 10.0 | 0.0 | 4.9 | 4.8 |
| Aug | 14 | 9.1 | 9.7 | 10.1 | 0.0 | 4.9 | 4.9 |
| Aug | 15 | 9.1 | 9.8 | 10.1 | 0.0 | 4.9 | 4.9 |
| Aug | 16 | 9.2 | 9.8 | 10.2 | 0.0 | 4.9 | 4.9 |
| Aug | 17 | 9.2 | 9.9 | 10.2 | 0.0 | 5.0 | 4.9 |
| Aug | 18 | 9.3 | 9.9 | 10.3 | 0.0 | 5.0 | 4.9 |
| Aug | 19 | 9.3 | 9.9 | 10.3 | 0.0 | 5.0 | 4.9 |
| Aug | 20 | 9.4 | 10.0 | 10.3 | 0.0 | 5.0 | 5.0 |
| Aug | 21 | 9.4 | 10.0 | 10.4 | 0.0 | 5.0 | 5.0 |
| Aug | 22 | 9.4 | 10.1 | 10.4 | 0.0 | 5.1 | 5.0 |
| Aug | 23 | 9.5 | 10.1 | 10.5 | 0.0 | 5.1 | 5.0 |
| Aug | 24 | 9.5 | 10.2 | 10.5 | 0.0 | 5.1 | 5.1 |
| Aug | 25 | 9.6 | 10.2 | 10.6 | 0.0 | 5.1 | 5.1 |
| Aug | 26 | 9.6 | 10.3 | 10.6 | 0.0 | 5.1 | 5.1 |
| Aug | 27 | 9.7 | 10.3 | 10.6 | 0.0 | 5.2 | 5.1 |
| Aug | 28 | 9.7 | 10.3 | 10.7 | 0.0 | 5.2 | 5.1 |
| Aug | 29 | 9.8 | 10.4 | 10.7 | 0.0 | 5.2 | 5.2 |
| Aug | 30 | 9.8 | 10.4 | 10.8 | 0.0 | 5.2 | 5.2 |
| Aug | 31 | 9.9 | 10.5 | 10.8 | 0.0 | 5.3 | 5.2 |
| | | | 304.6 | | | 153.0 | 151.7 |

Reference:

Astronomical Applications Department, U.S. Naval Observatory, Washington, D.C. 20392-5420
Eastern Standard Time with Day-Light Saving Time

Operating Hour Equivalent Table Supporting Reference Data

Providence, Rhode Island
Location W071°26', N41°49'
2013 Calendar Year

| Month | Day | Dusk-To-Dawn [Twilight] (Hours) | Dusk-To-Dawn Operating Schedule [~1.5 fc On/Off] (Hours) | Sunset-To-Sunrise (Hours) | Time After AM Turn-On (Hours) | Part-Night Operating (Hours) | Part-Night Off Period (Hours) |
|-------|-----|---------------------------------------|--|------------------------------|-------------------------------------|------------------------------------|-------------------------------------|
| | | (Decimal) | (Decimal) | (Decimal) | (Decimal) | (Decimal) | (Decimal) |
| Sep | 1 | 9.9 | 10.5 | 10.9 | 0.0 | 5.3 | 5.2 |
| Sep | 2 | 10.0 | 10.6 | 10.9 | 0.0 | 5.3 | 5.3 |
| Sep | 3 | 10.0 | 10.6 | 11.0 | 0.0 | 5.3 | 5.3 |
| Sep | 4 | 10.0 | 10.7 | 11.0 | 0.0 | 5.3 | 5.3 |
| Sep | 5 | 10.1 | 10.7 | 11.0 | 0.0 | 5.4 | 5.3 |
| Sep | 6 | 10.2 | 10.7 | 11.1 | 0.0 | 5.4 | 5.3 |
| Sep | 7 | 10.2 | 10.8 | 11.1 | 0.0 | 5.4 | 5.4 |
| Sep | 8 | 10.2 | 10.8 | 11.2 | 0.0 | 5.4 | 5.4 |
| Sep | 9 | 10.3 | 10.9 | 11.2 | 0.0 | 5.5 | 5.4 |
| Sep | 10 | 10.3 | 10.9 | 11.3 | 0.0 | 5.5 | 5.4 |
| Sep | 11 | 10.4 | 11.0 | 11.3 | 0.0 | 5.5 | 5.5 |
| Sep | 12 | 10.4 | 11.0 | 11.4 | 0.0 | 5.5 | 5.5 |
| Sep | 13 | 10.5 | 11.1 | 11.4 | 0.0 | 5.6 | 5.5 |
| Sep | 14 | 10.5 | 11.1 | 11.5 | 0.1 | 5.6 | 5.5 |
| Sep | 15 | 10.6 | 11.1 | 11.5 | 0.1 | 5.7 | 5.5 |
| Sep | 16 | 10.6 | 11.2 | 11.5 | 0.1 | 5.7 | 5.5 |
| Sep | 17 | 10.7 | 11.2 | 11.6 | 0.1 | 5.8 | 5.5 |
| Sep | 18 | 10.7 | 11.3 | 11.6 | 0.1 | 5.8 | 5.5 |
| Sep | 19 | 10.8 | 11.3 | 11.7 | 0.2 | 5.9 | 5.5 |
| Sep | 20 | 10.8 | 11.4 | 11.7 | 0.2 | 5.9 | 5.5 |
| Sep | 21 | 10.8 | 11.4 | 11.8 | 0.2 | 6.0 | 5.5 |
| Sep | 22 | 10.9 | 11.5 | 11.8 | 0.2 | 6.0 | 5.5 |
| Sep | 23 | 11.0 | 11.5 | 11.9 | 0.3 | 6.0 | 5.5 |
| Sep | 24 | 11.0 | 11.6 | 11.9 | 0.3 | 6.1 | 5.5 |
| Sep | 25 | 11.0 | 11.6 | 12.0 | 0.3 | 6.1 | 5.5 |
| Sep | 26 | 11.1 | 11.7 | 12.0 | 0.3 | 6.2 | 5.5 |
| Sep | 27 | 11.1 | 11.7 | 12.1 | 0.4 | 6.2 | 5.5 |
| Sep | 28 | 11.2 | 11.8 | 12.1 | 0.4 | 6.3 | 5.5 |
| Sep | 29 | 11.2 | 11.8 | 12.2 | 0.4 | 6.3 | 5.5 |
| Sep | 30 | 11.3 | 11.9 | 12.2 | 0.4 | 6.4 | 5.5 |
| | | | 335.1 | | | 172.3 | 162.8 |

Reference:

Astronomical Applications Department, U.S. Naval Observatory, Washington, D.C. 20392-5420
Eastern Standard Time with Day-Light Saving Time

Operating Hour Equivalent Table Supporting Reference Data

Providence, Rhode Island
Location W071°26', N41°49'
2013 Calendar Year

| Month | Day | Dusk-To-Dawn [Twilight] (Hours) | Dusk-To-Dawn Operating Schedule [~1.5 fc On/Off] (Hours) | Sunset-To-Sunrise (Hours) | Time After AM Turn-On (Hours) | Part-Night Operating (Hours) | Part-Night Off Period (Hours) |
|-------|-----|---------------------------------------|--|------------------------------|-------------------------------------|------------------------------------|-------------------------------------|
| | | (Decimal) | (Decimal) | (Decimal) | (Decimal) | (Decimal) | (Decimal) |
| Oct | 1 | 11.3 | 11.9 | 12.2 | 0.4 | 6.4 | 5.5 |
| Oct | 2 | 11.4 | 11.9 | 12.3 | 0.5 | 6.5 | 5.5 |
| Oct | 3 | 11.4 | 12.0 | 12.3 | 0.5 | 6.5 | 5.5 |
| Oct | 4 | 11.5 | 12.0 | 12.4 | 0.5 | 6.6 | 5.5 |
| Oct | 5 | 11.5 | 12.1 | 12.4 | 0.5 | 6.6 | 5.5 |
| Oct | 6 | 11.5 | 12.1 | 12.5 | 0.6 | 6.6 | 5.5 |
| Oct | 7 | 11.6 | 12.2 | 12.5 | 0.6 | 6.7 | 5.5 |
| Oct | 8 | 11.6 | 12.2 | 12.6 | 0.6 | 6.7 | 5.5 |
| Oct | 9 | 11.7 | 12.3 | 12.6 | 0.6 | 6.8 | 5.5 |
| Oct | 10 | 11.7 | 12.3 | 12.7 | 0.7 | 6.8 | 5.5 |
| Oct | 11 | 11.8 | 12.4 | 12.7 | 0.7 | 6.9 | 5.5 |
| Oct | 12 | 11.8 | 12.4 | 12.8 | 0.7 | 6.9 | 5.5 |
| Oct | 13 | 11.9 | 12.4 | 12.8 | 0.7 | 7.0 | 5.5 |
| Oct | 14 | 11.9 | 12.5 | 12.8 | 0.7 | 7.0 | 5.5 |
| Oct | 15 | 11.9 | 12.5 | 12.9 | 0.8 | 7.1 | 5.5 |
| Oct | 16 | 12.0 | 12.6 | 12.9 | 0.8 | 7.1 | 5.5 |
| Oct | 17 | 12.0 | 12.6 | 13.0 | 0.8 | 7.2 | 5.5 |
| Oct | 18 | 12.1 | 12.7 | 13.0 | 0.8 | 7.2 | 5.5 |
| Oct | 19 | 12.1 | 12.7 | 13.1 | 0.9 | 7.2 | 5.5 |
| Oct | 20 | 12.2 | 12.8 | 13.1 | 0.9 | 7.3 | 5.5 |
| Oct | 21 | 12.2 | 12.8 | 13.2 | 0.9 | 7.3 | 5.5 |
| Oct | 22 | 12.3 | 12.8 | 13.2 | 0.9 | 7.4 | 5.5 |
| Oct | 23 | 12.3 | 12.9 | 13.3 | 1.0 | 7.4 | 5.5 |
| Oct | 24 | 12.3 | 12.9 | 13.3 | 1.0 | 7.5 | 5.5 |
| Oct | 25 | 12.4 | 13.0 | 13.3 | 1.0 | 7.5 | 5.5 |
| Oct | 26 | 12.4 | 13.0 | 13.4 | 1.0 | 7.5 | 5.5 |
| Oct | 27 | 12.5 | 13.1 | 13.4 | 1.0 | 7.6 | 5.5 |
| Oct | 28 | 12.5 | 13.1 | 13.5 | 1.0 | 7.6 | 5.5 |
| Oct | 29 | 12.5 | 13.2 | 13.5 | 1.1 | 7.7 | 5.5 |
| Oct | 30 | 12.6 | 13.2 | 13.5 | 1.1 | 7.7 | 5.5 |
| Oct | 31 | 12.6 | 13.2 | 13.6 | 1.1 | 7.8 | 5.5 |
| | | | 389.6 | | | 219.9 | 169.7 |

Reference:

Astronomical Applications Department, U.S. Naval Observatory, Washington, D.C. 20392-5420
Eastern Standard Time with Day-Light Saving Time

Operating Hour Equivalent Table Supporting Reference Data

Providence, Rhode Island
Location W071°26', N41°49'
2013 Calendar Year

| Month | Day | Dusk-To-Dawn [Twilight] (Hours) | Dusk-To-Dawn Operating Schedule [~1.5 fc On/Off] (Hours) | Sunset-To-Sunrise (Hours) | Time After AM Turn-On (Hours) | Part-Night Operating (Hours) | Part-Night Off Period (Hours) |
|-------|-----|---------------------------------------|--|------------------------------|-------------------------------------|------------------------------------|-------------------------------------|
| | | (Decimal) | (Decimal) | (Decimal) | (Decimal) | (Decimal) | (Decimal) |
| Nov | 1 | 12.7 | 13.3 | 13.6 | 1.1 | 7.8 | 5.5 |
| Nov | 2 | 12.7 | 13.3 | 13.7 | 1.2 | 7.8 | 5.5 |
| Nov | 3 | 12.7 | 13.4 | 13.7 | 1.2 | 7.9 | 5.5 |
| Nov | 4 | 12.8 | 13.4 | 13.8 | 1.2 | 7.9 | 5.5 |
| Nov | 5 | 12.8 | 13.4 | 13.8 | 1.2 | 8.0 | 5.5 |
| Nov | 6 | 12.9 | 13.5 | 13.8 | 1.2 | 8.0 | 5.5 |
| Nov | 7 | 12.9 | 13.5 | 13.9 | 1.3 | 8.0 | 5.5 |
| Nov | 8 | 12.9 | 13.6 | 13.9 | 1.3 | 8.1 | 5.5 |
| Nov | 9 | 13.0 | 13.6 | 13.9 | 1.3 | 8.1 | 5.5 |
| Nov | 10 | 13.0 | 13.6 | 14.0 | 1.3 | 8.1 | 5.5 |
| Nov | 11 | 13.0 | 13.7 | 14.0 | 1.3 | 8.2 | 5.5 |
| Nov | 12 | 13.1 | 13.7 | 14.1 | 1.4 | 8.2 | 5.5 |
| Nov | 13 | 13.1 | 13.7 | 14.1 | 1.4 | 8.3 | 5.5 |
| Nov | 14 | 13.1 | 13.8 | 14.1 | 1.4 | 8.3 | 5.5 |
| Nov | 15 | 13.2 | 13.8 | 14.2 | 1.4 | 8.3 | 5.5 |
| Nov | 16 | 13.2 | 13.9 | 14.2 | 1.4 | 8.4 | 5.5 |
| Nov | 17 | 13.2 | 13.9 | 14.2 | 1.4 | 8.4 | 5.5 |
| Nov | 18 | 13.3 | 13.9 | 14.3 | 1.5 | 8.4 | 5.5 |
| Nov | 19 | 13.3 | 14.0 | 14.3 | 1.5 | 8.5 | 5.5 |
| Nov | 20 | 13.3 | 14.0 | 14.3 | 1.5 | 8.5 | 5.5 |
| Nov | 21 | 13.4 | 14.0 | 14.4 | 1.5 | 8.5 | 5.5 |
| Nov | 22 | 13.4 | 14.1 | 14.4 | 1.5 | 8.6 | 5.5 |
| Nov | 23 | 13.4 | 14.1 | 14.4 | 1.5 | 8.6 | 5.5 |
| Nov | 24 | 13.4 | 14.1 | 14.5 | 1.5 | 8.6 | 5.5 |
| Nov | 25 | 13.5 | 14.1 | 14.5 | 1.6 | 8.6 | 5.5 |
| Nov | 26 | 13.5 | 14.2 | 14.5 | 1.6 | 8.7 | 5.5 |
| Nov | 27 | 13.5 | 14.2 | 14.5 | 1.6 | 8.7 | 5.5 |
| Nov | 28 | 13.5 | 14.2 | 14.6 | 1.6 | 8.7 | 5.5 |
| Nov | 29 | 13.6 | 14.2 | 14.6 | 1.6 | 8.8 | 5.5 |
| Nov | 30 | 13.6 | 14.3 | 14.6 | 1.6 | 8.8 | 5.5 |
| | | | 414.1 | | | 249.6 | 164.6 |

Reference:

Astronomical Applications Department, U.S. Naval Observatory, Washington, D.C. 20392-5420
Eastern Standard Time with Day-Light Saving Time

Operating Hour Equivalent Table Supporting Reference Data

Providence, Rhode Island
Location W071°26', N41°49'
2013 Calendar Year

| Month | Day | Dusk-To-Dawn [Twilight] (Hours) | Dusk-To-Dawn Operating Schedule [~1.5 fc On/Off] (Hours) | Sunset-To-Sunrise (Hours) | Time After AM Turn-On (Hours) | Part-Night Operating (Hours) | Part-Night Off Period (Hours) |
|-------|-----|---------------------------------------|--|------------------------------|-------------------------------------|------------------------------------|-------------------------------------|
| | | (Decimal) | (Decimal) | (Decimal) | (Decimal) | (Decimal) | (Decimal) |
| Dec | 1 | 13.6 | 14.3 | 14.6 | 1.6 | 8.8 | 5.5 |
| Dec | 2 | 13.6 | 14.3 | 14.7 | 1.7 | 8.8 | 5.5 |
| Dec | 3 | 13.6 | 14.3 | 14.7 | 1.7 | 8.8 | 5.5 |
| Dec | 4 | 13.7 | 14.4 | 14.7 | 1.7 | 8.9 | 5.5 |
| Dec | 5 | 13.7 | 14.4 | 14.7 | 1.7 | 8.9 | 5.5 |
| Dec | 6 | 13.7 | 14.4 | 14.7 | 1.7 | 8.9 | 5.5 |
| Dec | 7 | 13.7 | 14.4 | 14.8 | 1.7 | 8.9 | 5.5 |
| Dec | 8 | 13.7 | 14.4 | 14.8 | 1.7 | 8.9 | 5.5 |
| Dec | 9 | 13.7 | 14.4 | 14.8 | 1.7 | 8.9 | 5.5 |
| Dec | 10 | 13.8 | 14.4 | 14.8 | 1.7 | 8.9 | 5.5 |
| Dec | 11 | 13.8 | 14.5 | 14.8 | 1.7 | 9.0 | 5.5 |
| Dec | 12 | 13.8 | 14.5 | 14.8 | 1.7 | 9.0 | 5.5 |
| Dec | 13 | 13.8 | 14.5 | 14.8 | 1.7 | 9.0 | 5.5 |
| Dec | 14 | 13.8 | 14.5 | 14.9 | 1.8 | 9.0 | 5.5 |
| Dec | 15 | 13.8 | 14.5 | 14.9 | 1.7 | 9.0 | 5.5 |
| Dec | 16 | 13.8 | 14.5 | 14.9 | 1.7 | 9.0 | 5.5 |
| Dec | 17 | 13.8 | 14.5 | 14.9 | 1.8 | 9.0 | 5.5 |
| Dec | 18 | 13.8 | 14.5 | 14.9 | 1.7 | 9.0 | 5.5 |
| Dec | 19 | 13.8 | 14.5 | 14.9 | 1.8 | 9.0 | 5.5 |
| Dec | 20 | 13.8 | 14.5 | 14.9 | 1.7 | 9.0 | 5.5 |
| Dec | 21 | 13.8 | 14.5 | 14.9 | 1.8 | 9.0 | 5.5 |
| Dec | 22 | 13.8 | 14.5 | 14.9 | 1.7 | 9.0 | 5.5 |
| Dec | 23 | 13.8 | 14.5 | 14.9 | 1.8 | 9.0 | 5.5 |
| Dec | 24 | 13.8 | 14.5 | 14.9 | 1.7 | 9.0 | 5.5 |
| Dec | 25 | 13.8 | 14.5 | 14.9 | 1.8 | 9.0 | 5.5 |
| Dec | 26 | 13.8 | 14.5 | 14.9 | 1.8 | 9.0 | 5.5 |
| Dec | 27 | 13.8 | 14.5 | 14.9 | 1.7 | 9.0 | 5.5 |
| Dec | 28 | 13.8 | 14.5 | 14.9 | 1.8 | 9.0 | 5.5 |
| Dec | 29 | 13.8 | 14.5 | 14.9 | 1.7 | 9.0 | 5.5 |
| Dec | 30 | 13.8 | 14.5 | 14.8 | 1.7 | 9.0 | 5.5 |
| Dec | 31 | 13.8 | 14.5 | 14.8 | 1.7 | 9.0 | 5.5 |
| | | | 448.2 | | | 277.6 | 170.7 |

Reference:

Astronomical Applications Department, U.S. Naval Observatory, Washington, D.C. 20392-5420
Eastern Standard Time with Day-Light Saving Time

The Narragansett Electric Company
d/b/a National Grid
R.I.P.U.C. Docket No. ____
Customer-Owned Street & Area Lighting Proposal
Witness: John E. Walter

Schedule JEW-3

Industry Tariff Review

Industry Tariff Review
(Summary)

| No. | State | Utility Companies | LED Service Classifications |
|-------|-------|-------------------|-----------------------------|
| 1 | AR | 1 | |
| 2 | AZ | 1 | 1 |
| 3 | CA | 2 | 3 |
| 4 | CO | 1 | |
| 5 | CT | 1 | |
| 6 | FL | 2 | |
| 7 | IN | 2 | 2 |
| 8 | KY | 2 | |
| 9 | LA | 1 | |
| 10 | MD | 1 | |
| 11 | ME | 1 | |
| 12 | MI | 5 | 7 |
| 13 | MN | 1 | |
| 14 | NC | 2 | 3 |
| 15 | ND | 1 | |
| 16 | NJ | 1 | 3 |
| 17 | NM | 1 | |
| 18 | NY | 5 | 5 |
| 19 | OH | 2 | |
| 20 | OK | 1 | 4 |
| 21 | OR | 1 | |
| 22 | SC | 1 | |
| 23 | SD | 1 | |
| 24 | TN | 1 | |
| 25 | TX | 3 | 1 |
| 26 | VA | 1 | |
| 27 | VT | 5 | |
| 28 | WI | 2 | 1 |
| 29 | WV | 1 | |
| Total | | 49 | 30 |

Industry Tariff Review
(Range Model Details)

| State | Company | Asset Ownership | Specific Units | Range Increment | Unmetered Rate | General Comments |
|-------|---------------------------------------|-----------------|----------------|-----------------|----------------|--|
| CA | Southern California Edison | Company Owned | 5 | 5W | X | Tariff LS-1 Lighting-Street and Highway-Unmetered, Sheet 49435-E, pgs 1-12 RATES: LED Roadway - 52W, 67W, 90W, 145W, 155W SPECIAL CONDITIONS: LED - (Range 0-400W) |
| CA | Southern California Edison | Customer Owned | | 5W | X | Tariff LS-2 Street & Highway Lighting, U 338-E, pgs 1-15 SPECIAL CONDITIONS: LED Lamps- (Range 0-400W) |
| CA | Pacific Gas & Electric | Customer Owned | | 5W | X | Tariff LS-2 Street & Highway Lighting, U 39, pgs 1-16 SPECIAL CONDITIONS: LED Lamps- (Range 0-400W) |
| NY | Central Hudson Gas & Electric Company | Customer Owned | 3 | 10W | X | Tariff PSC No. 15, SC-8, Public Street and Highway Lighting, Leaf No. 221. The annual kWh and annual charges for Light Emitting Diode (LED) fixtures applicable under this Schedule will be shown on a statement filed with the Public Service Commission apart from this Schedule. |

Industry Tariff Review
(Details)

| State | Company | Asset Ownership | Specific Units | Range | Contract | kWh Unmetered Rate | Metered Rate | General Comments |
|-------|--------------------------------|--------------------------------|----------------|-------|----------|--------------------|--------------|---|
| AZ | Arizona Public Service Company | Company Owned & Customer Owned | 7 | | | X | | Tariff E-47 Dusk To Dawn Lighting Service, E-47 |
| CA | Southern California Edison | Company Owned | | | | NA | | Tariff OL-1 Outdoor Area Lighting Service, Sheet 49445-E |
| | | Company Owned | 5 | 5W | | X | | Tariff LS-1 Lighting-Street and Highway-Unmetered, Sheet 49435-E |
| | | Customer Owned | | 5W | | X | | Tariff LS-2 Street & Highway Lighting, U 338-E |
| CA | Pacific Gas & Electric | Company Owned | | | | | | Tariff LS-1 Street and Highway Lighting, U 39 |
| | | Customer Owned | | 5W | | X | | Tariff LS-2 Street & Highway Lighting, U 39 |
| | | Company Owned | | | | NA | NA | Tariff OL - Outdoor Lighting, Sheet No. 19. |
| IN | Indiana Michigan Power Company | Company Owned | | | | NA | NA | Tariff TOL - Timed Outdoor Lighting, Sheet No. 20. |
| | | Company Owned | | | | NA | NA | Tariff SLS - Street Lighting Service, Sheet No. 21. |
| | | Company Owned | | | | NA | NA | Tariff ECLS - Energy Conservation Lighting Service, Sheet No. 22. |
| | | Customer Owned | | | | NA | NA | Tariff SLC - Street Lighting-Customer Owned System, Sheet No. 23. |

| State | Company | Asset Ownership | Specific Units | Range | Contract | kWh Unmetered Rate | Metered Rate | General Comments |
|-------|-----------------------------------|-----------------|----------------|-------|----------|--------------------|--------------|---|
| | | Customer Owned | | | | | X | Tariff SLCM - Street Lighting-Customer Owned System - Metered, Sheet No. 24.. |
| | | Customer Owned | 1 | | | X | | Tariff WF-SL - Fort Wayne Street Lighting, Sheet No. 25-1. |
| MI | Indiana Michigan Power Company | Company Owned | 1 | | | X | | Tariff OSL - Outdoor Security Lighting, Sheet No. D46. |
| | | Company Owned | | | | NA | NA | Tariff SLS - Streetlighting Service, Sheet No. D-50. Closed Offering |
| | | Customer Owned | 3 | | | X | | Tariff SLC - Streetlighting Customer Owned, Sheet No. D-53. |
| | | Customer Owned | 3 | | | X | | Tariff ECLS - Energy Conservation Lighting Service, Sheet No. D-56. |
| | | Customer Owned | | | | | X | Tariff SLCM - Streetlighting-Customer Owned Metered System, Sheet No. D-60. |
| MI | Detroit Edison | Company Owned | | | X | X | | Tariff MPSC-10, D-49, Municipal Street Lighting |
| MI | Northern States Power Corporation | Customer Owned | | | | X | | Tariff MSL-2, Non-Metered LED Street Lighting, Area Lighting, Traffic Signal Service, Sheet No. D-36.5. |
| MI | Wisconsin Electric Power Company | Company Owned | | | X | X | | Tariff PSC No 3, LED Street Lighting Service Rate LED1, Sheet No. D-42.01. |

| State | Company | Asset Ownership | Specific Units | Range | Contract | kWh Unmetered Rate | Metered Rate | General Comments |
|-------|---|--------------------------------|----------------|-------|----------|--------------------|--------------|---|
| NC | Duke Energy | Company Owned | | | X | NA | NA | Tariff No 4, Schedule GL, Governmental Lighting Service, Leaf No. 33. |
| | | Company Owned | | | X | X | | Tariff No. 4, Schedule NL, Nonstandard Lighting Service (Pilot), Leaf No. 35. |
| | | Company Owned | | | | NA | NA | Tariff No 4, Schedule PL, Street and Public Lighting Service, Leaf No. 34. |
| NC | Carolina Power & Light Company | Company Owned | 4 | | X | X | | Tariff ALS-17, Area Lighting Service, Sheet Nos. 1-6. |
| | | Customer Owned | | | | NA | NA | Tariff Regulations, Street Lighting Service Regulations, Sheet Nos. 1-4. |
| | | Company Owned & Customer Owned | 4 | | X | X | | Tariff SLS-17, Street Lighting Service, Sheet No. 22. |
| NJ | Public Service Electric and Gas Company | Company Owned | | | X | X | | Tariff 15, Schedule BPL, Body Politic Lighting Service, Sheet No. 180. |
| | | Customer Owned | | | X | X | | Tariff 15, Schedule BPL-POF, Body Politic Lighting Service From Publicly Owned Facilities, Sheet No. 195. |
| NJ | Public Service Electric and Gas Company | Company Owned | | | X | X | | Tariff 15, Schedule PSAL, Private Street and Area Lighting Service, Sheet No. 203. |
| NY | Rochester Gas & Electric | Company Owned | | | | NA | NA | Tariff PSC No. 18, SC-1, Street Lighting Service, Leaf No. 25. |

The Narragansett Electric Company
d/b/a National Grid
R.I.P.U.C. Docket No. _____
Customer-Owned Street & Area Lighting Proposal
Schedule JEW-3
Page 6 of 8

| State | Company | Asset Ownership | Specific Units | Range | Contract | kWh Unmetered Rate | Metered Rate | General Comments |
|-------|---------------------------------------|-----------------|----------------|-------|----------|--------------------|--------------|--|
| | | Customer Owned | | | | NA | NA | Tariff PSC No. 18, SC-2, Street Lighting Service - Customer Owned Equipment, Leaf No. 37. |
| NY | Central Hudson Gas & Electric Company | Customer Owned | | 10w | | X | | Tariff PSC No. 15, SC-8, Public Street and Highway Lighting, Leaf No. 221. |
| | | Company Owned | | | | NA | NA | Tariff PSC No. 15, SC-4, Area Lighting Service, Leaf No. 204. |
| NY | New York State Electric & Gas Company | Company Owned | | | | NA | NA | Tariff PSC No. 120, SC-5, Outdoor Lighting Service, Leaf Nos. 180-202. |
| | | Company Owned | | | | NA | NA | Tariff PSC No. 121, SC-1, Street Lighting Service - w/ Contributory Provisions, Leaf Nos. 185-25. |
| | | Company Owned | | | | NA | NA | Tariff PSC No. 121, SC-2, Street Lighting Service - Energy and Limited Maintenance, Leaf Nos. 26-38. |
| | | Company Owned | | | | NA | NA | Tariff PSC No. 121, SC-3, Standard Street Lighting Service, Leaf Nos. 39-61. |
| | | Customer Owned | | | | NA | NA | Tariff PSC No. 121, SC-4, Street Lighting Service - Energy Only, Leaf Nos. 62-67. |
| NY | Orange and Rockland | Company Owned | 2 | | | X | | Tariff PSC No. 3, SC-4, Public Street Lighting - Company Owned, Leaf No. 281. |

| State | Company | Asset Ownership | Specific Units | Range | Contract | kWh Unmetered Rate | Metered Rate | General Comments |
|-------|------------------------------------|-----------------|----------------|-------|----------|--------------------|--------------|--|
| OK | Public Service Company of Oklahoma | Customer Owned | | | | X | | Tariff PSC No. 3, SC-6, Public Street Lighting - Customer Owned, Leaf No. 293. |
| | | Company Owned | 2 | | | X | | Tariff PSC No. 3, SC-16, Private Area Lighting, Leaf No. 329 |
| | | Customer Owned | | | | X | | Tariff PSC No. 10, SC-6, Public and Private Street Lighting, Leaf No. 415. |
| | | Customer Owned | | | | X | | Tariff Sheet No. 30-2B - Municipal Lighting Service (MSL), RATES C. |
| | | Customer Owned | | | | | X | Tariff Sheet No. 30-5B - Municipal Lighting Service (MSL). |
| | | Customer Owned | | | | | X | Tariff Sheet No. 31-3B - Governmental Street Lighting Service (GSL). |
| | | Company Owned | | | | NA | NA | Tariff Sheet No. 41-1B - Security Lighting (SL). |
| | | Company Owned | | | | NA | NA | Tariff Sheet No. 42-1B - Non-Roadway Lighting (NL). |
| | | Customer Owned | | | | | X | Tariff Sheet No. 43-1B - Recreational Lighting (RL). |
| TX | Oncor | Customer Owned | | | | X | | Tariff Section 6.1.1.1.8 - Lighting Service. |
| WI | Wisconsin Electric Power Company | Company Owned | | | | NA | NA | Tariff Schedule S-1, Automatic Protective Lighting, Sheet No. E-41 |

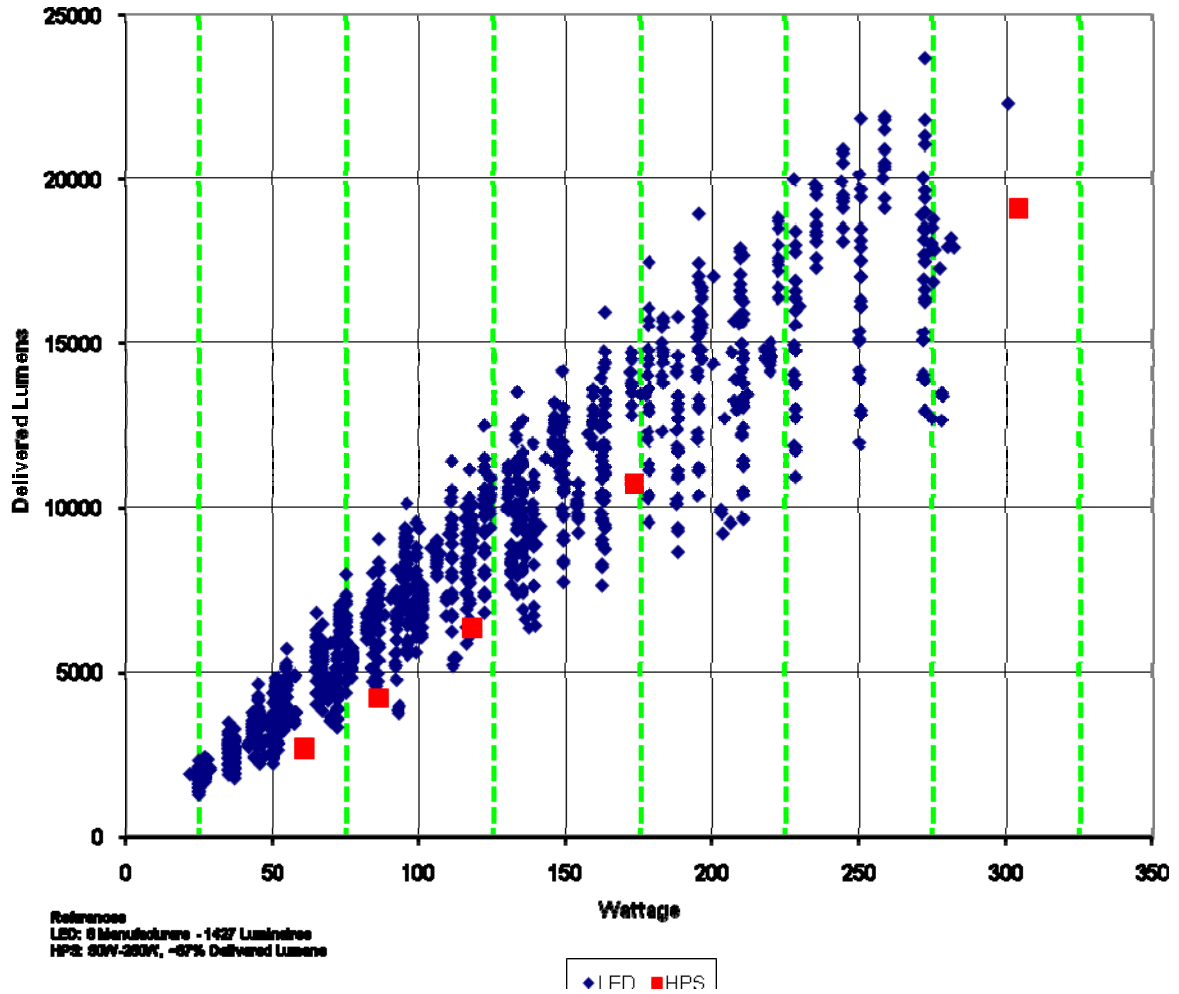
| State | Company | Asset Ownership | Specific Units | Range | Contract | kWh Unmetered Rate | Metered Rate | General Comments |
|-------|---------|--------------------------|----------------|-------|----------|--------------------|--------------|--|
| | | Company Owned | | | | NA | NA | Tariff Schedule MS-2, Street Lighting System Service, Sheet No. E-44. |
| | | Customer Owned | | | | NA | NA | Tariff Schedule MS-3, Customer Owned Street Lighting Service, Sheet No. E-45. |
| | | Customer Owned | | | | NA | NA | Tariff Schedule MS-4, Customer Owned Street Lighting Service, Sheet No. E-47. |
| | | Customer Owned | | | | NA | NA | Tariff Schedule MS-4.2, Company Owned Ornamental Street Lighting Service, Sheet No. E-49. |
| | | Company & Customer Owned | | | | NA | NA | Tariff Schedule MS-5, Street Lighting Service, Sheet No. E-50. |
| | | Company Owned | | | | NA | NA | Tariff Schedule MS-6, Underground Area Lighting Service, Sheet No. E-52. |
| | | Customer Owned | | | | | X | Tariff Schedule MS-7, Street Lighting Service - Customer Owned - Metered, Sheet No. E52.5. |

The Narragansett Electric Company
d/b/a National Grid
R.I.P.U.C. Docket No. ____
Customer-Owned Street & Area Lighting Proposal
Witness: John E. Walter

Schedule JEW-4

LED Luminaire Operational Performance Data Summary

LED Luminaire Operational Performance Data Summary



The Narragansett Electric Company
d/b/a National Grid
R.I.P.U.C. Docket No. ____
Customer-Owned Street & Area Lighting Proposal
Witness: John E. Walter

Schedule JEW-5

LED Light Source Energy Consumption (kWh) Determination

LED Light Source Energy Consumption (kWh) Determination

| Nominal Wattage Range | Range Midpoint | Billable Wattage | Annual Energy Consumption (kWh) ¹ | | | |
|--------------------------|-------------------|---------------------|--|--|-------------------------------------|--|
| | | | Operation Schedule | | | |
| | | | Continuous ¹ 8,760 (Hrs) | Dusk-To-Dawn ¹ 4,175 (Hrs) | Dimming ¹ 3,615 (Hrs) | Part-Night ¹ 2,301 (Hrs) |
| (a) | (b) | (c) | (d) | (e) | (f) | (g) |
| 0.1 to 50.0 | 25 | 25 | 219 | 104 | 90 | 58 |
| 50.1 to 100.0 | 75 | 75 | 657 | 313 | 271 | 173 |
| 100.1 to 150.0 | 125 | 125 | 1,095 | 522 | 452 | 288 |
| 150.1 to 200.0 | 175 | 175 | 1,533 | 731 | 632 | 403 |
| 200.1 to 250.0 | 225 | 225 | 1,971 | 939 | 813 | 518 |
| 250.1 to 300.0 | 275 | 275 | 2,409 | 1,148 | 993 | 633 |

- (a) Nominal wattage is the total (system) wattage of the entire LED device, inclusive of the driver (based upon designated current rating), control device, color temperature and environment temperature adjustment factor.
- (b) The midpoint of the nominal wattage range is the basis for the proposed LED billable wattage.
- (c) Equal to column (b)
- (d) LED lights operated at full energy consumption continuously each day of the year, a total of approximately 8,760 hours annually.
- (e) LED lights operated daily at full energy consumption from approximately one-half hour after sunset until approximately one-half hour before sunrise, a total of approximately 4,175 hours annually.
- (f) LED lights operated daily at full energy consumption from approximately one-half hour after sunset until approximately one-half hour before sunrise, except for a five and one-half (5½) hour dimming period during which energy consumption is reduced to seventy percent (70%) of full energy consumption, approximately 3,615 equivalent hours at full energy consumption annually.
- (g) LED lights operated daily at full energy consumption from approximately one-half hour after sunset until approximately one-half hour before sunrise, except for a five and one-half (5½) hour off period during which only control device energy is consumed, approximately 2,301 equivalent hours at full energy consumption annually.

Footnote

1. Annual Operating Hour Equivalents are approximate and have been rounded to whole numbers.

LED Light Source Energy Consumption (kWh) Determination

| Nominal Wattage Range | Sample Count | Sample Group Average Wattage | Range Midpoint | Annual Hours of Operation Equivalent | Sample Average Wattage Annual Energy (kWh) | Midpoint Wattage Annual Energy (kWh) | Difference Between Sample Average and Midpoint (kWh) |
|--|-----------------|---------------------------------------|-------------------|---|---|--|---|
| (a) | (b) | (c) | (d) | (e) | (f) | (g) | (h) |
| Continuous Operating Schedule | | | | | | | |
| 0.1 to 50.0 | 225 | 37 | 25 | 8,760 | 72,927 | 49,275 | 23,652 |
| 50.1 to 100.0 | 500 | 74 | 75 | 8,760 | 324,120 | 328,500 | -4,380 |
| 100.1 to 150.0 | 321 | 126 | 125 | 8,760 | 354,307 | 351,495 | 2,812 |
| 150.1 to 200.0 | 184 | 176 | 175 | 8,760 | 283,684 | 282,072 | 1611.84 |
| 200.1 to 250.0 | 139 | 226 | 225 | 8,760 | 275,187 | 273,969 | 1217.64 |
| 250.1 to 300.0 | 58 | 271 | 275 | 8,760 | 137,690 | 139,722 | -2032.32 |
| Sum | 1,427 | | | | 1,447,914 | 1,425,033 | 22,881 |
| Dusk-To-Dawn Operating Schedule | | | | | | | |
| 0.1 to 50.0 | 225 | 37 | 25 | 4,175 | 34,757 | 23,484 | 11,273 |
| 50.1 to 100.0 | 500 | 74 | 75 | 4,175 | 154,475 | 156,563 | -2,088 |
| 100.1 to 150.0 | 321 | 126 | 125 | 4,175 | 168,862 | 167,522 | 1,340 |
| 150.1 to 200.0 | 184 | 176 | 175 | 4,175 | 135,203 | 134,435 | 768 |
| 200.1 to 250.0 | 139 | 226 | 225 | 4,175 | 131,153 | 130,573 | 580 |
| 250.1 to 300.0 | 58 | 271 | 275 | 4,175 | 65,623 | 66,591 | -968 |
| Sum | 1,427 | | | | 690,073 | 679,168 | 10,905 |
| Dimming Operating Schedule | | | | | | | |
| 0.1 to 50.0 | 225 | 37 | 25 | 3,615 | 30,095 | 20,334 | 9,761 |
| 50.1 to 100.0 | 500 | 74 | 75 | 3,615 | 133,755 | 135,563 | -1,808 |
| 100.1 to 150.0 | 321 | 126 | 125 | 3,615 | 146,212 | 145,052 | 1,160 |
| 150.1 to 200.0 | 184 | 176 | 175 | 3,615 | 117,068 | 116,403 | 665 |
| 200.1 to 250.0 | 139 | 226 | 225 | 3,615 | 113,562 | 113,059 | 502 |
| 250.1 to 300.0 | 58 | 271 | 275 | 3,615 | 56,821 | 57,659 | -839 |
| Sum | 1,427 | | | | 597,513 | 588,070 | 9,442 |
| Part-Night Operating Schedule | | | | | | | |
| 0.1 to 50.0 | 225 | 37 | 25 | 2,301 | 19,156 | 12,943 | 6,213 |
| 50.1 to 100.0 | 500 | 74 | 75 | 2,301 | 85,137 | 86,288 | -1,151 |
| 100.1 to 150.0 | 321 | 126 | 125 | 2,301 | 93,066 | 92,328 | 739 |
| 150.1 to 200.0 | 184 | 176 | 175 | 2,301 | 74,516 | 74,092 | 423 |
| 200.1 to 250.0 | 139 | 226 | 225 | 2,301 | 72,284 | 71,964 | 320 |
| 250.1 to 300.0 | 58 | 271 | 275 | 2,301 | 36,167 | 36,701 | -534 |
| Sum | 1,427 | | | | 380,325 | 374,315 | 6,010 |

- (a) Nominal wattage represents the total system wattage of the entire LED device, inclusive of the driver (based upon designated current rating), control device, color temperature and environment temperature adjustment factor.
- (b) The quantity of randomly selected LED luminaires available in the marketplace sampled by the Company, as of March 2012.

- (c) The average (statistical mean) wattage of the LED luminaires in the sample, within the wattage range listed.
- (d) The midpoint of the nominal wattage range is the basis for the proposed billable wattage.
- (e) The approximate annual hours of operation equivalent schedule. Values have been rounded to represent whole numbers.
- (f) Equal to column (b) times column (c) times column (e), divided by 1,000. The total annual energy (kWh) consumed by all sample luminaires using the average sample wattage for the designated operating schedule.
- (g) Equal to column (b) times column (d) times column (e), divided by 1,000. The total annual energy (kWh) consumed by all sample luminaires using the range midpoint wattage for the designated operating schedule.
- (h) Equal to column (f) minus column (g). The total annual energy (kWh) consumption difference by all sample luminaires between the average sample wattage and the range midpoint wattage for the designated operating schedule.