ENERGY SERVICES AGREEMENT

BY AND BETWEEN

PORT WASHINGTON UNION FREE SCHOOL DISTRICT

AND

RENU CONTRACTING & RESTORATION, INC. D/B/A RENU ENERGY SOLUTIONS

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ENERGY SERVICES AGREEMENT

BY AND BETWEEN

PORT WASHINGTON UNION FREE SCHOOL DISTRICT

AND

RENU ENERGY SOLUTIONS

THIS ENERGY SERVICES AGREEMENT ("Agreement") is entered into this 22nd day of October, 2024 ("Effective Date"), by and between Port Washington Union Free School District, having its principal place of business located at 100 Campus Drive, Port Washington, NY 11050 ("Client") and RENU Contracting & Restoration, Inc. d/b/a RENU Energy Solutions, having its principal place of business at 20 35th Street, Copiague, NY 11726 ("ESCO"). The parties to this Agreement will be collectively referred to as the "Parties" and individually as a "Party."

WHEREAS, Client wishes ESCO to perform a project ("Project") consisting of certain energy conservation services and installations (the "Scope of Services") at the Client Properties described in Attachment A (the "Property"), and ESCO wishes to perform such services;

WHEREAS, Client owns the Property; and

WHEREAS, State of New York legislation provides the authority for public school districts such as Client to contract for energy services under such terms as described in State or local regulations.

NOW, THEREFORE, in consideration of the mutual promises, covenants, representations, warranties, and agreements contained herein, and for other good valuable considerations, the receipt and sufficiency of which is hereby acknowledged, the Parties hereby agree as follows:

SECTION 1 SCOPE OF SERVICES

(a) Construction Work: The Parties' obligations hereunder are contingent upon written approval of the New York State Education Department ("NYSED") and the Client securing financing and State aid as set forth in Section 37 of this Agreement. In the event any changes in this Agreement are required in order to achieve NYSED approval of the project, the parties agree to negotiate in good faith to modify the Agreement to address the required changes. After NYSED approval has been issued for this Project and after Client has secured financing and State aid in accordance with Section 37 of this Agreement, the Client will deliver to ESCO a Notice To Proceed, substantially in the form attached to this Agreement as Attachment D. ESCO shall furnish all labor, materials and equipment and perform all work required for the completion of the Scope of Services set forth in Attachment B, including the installation of the energy conservation measures listed therein ("ECMs"), as such Scope of Services and such Attachments may be modified in accordance with this Agreement. Within ten (10) business days of ESCO's receipt of Client's Notice to Proceed, ESCO will work with Client to establish a plan to schedule the construction work (hereinafter referred to as the "Work"). The Work will be planned to minimize the interruption of the daily routine of Client's staff and building occupants except as permitted in writing by Client. ESCO will list installed ECMs on Attachment J attached hereto and made a part hereof at the time that construction is complete. Attachment J may be modified as provided for herein.

(b) Disposal: ESCO, at its cost, shall be responsible for disposal of all non-hazardous equipment and materials which are rendered useless and removed as a result of the installation of the ECMs pursuant to this Agreement. In addition, ESCO shall, at its cost, cause all lamps and PCB-contaminated ballasts, if any, which have been rendered useless and removed as a result of the installations of the ECMs to be transported and disposed of via recycling and incineration, respectively. ESCO will be responsible for removing or disposing

of any materials including hazardous materials that it uses in providing Work and for the remediation of any areas directly impacted by the release of ESCO hazardous materials. All other existing PCB-contaminated ballasts, lamps and any other hazardous substances, however, remain the responsibility of Client and ESCO shall assume no liability in connection with their removal, handling, transportation, and/or disposal. In all instances, with the only exception being those hazardous materials that Contractor brings to the site, the Client will be the "Generator" of record and sign any and all disposal documents (i.e. manifests, bills of lading, etc.) in order to document the abatement or removal of any such hazardous materials from the Project Site. Notwithstanding anything contained herein to the contrary, the Parties agree and acknowledge that should ESCO encounter any hazardous substances at the Property, after notice to Client, ESCO shall coordinate with a third-party environmental contractor for the removal of the same, at Client's sole cost and expense.

(c) ESCO shall, as needed: (1) keep the area of the Project Site in which the Work is being performed free at all times from waste materials, packing materials and other rubbish accumulated in connection with the execution of the Work by collecting and depositing said material and rubbish into dumpsters provided at designated locations by ESCO, (2) clean and remove from its own Work and from all contiguous work of others any soiling, staining, mortar, plaster, concrete, or dirt caused by the execution of the Work, (3) upon the completion of the Work in each area, perform such cleaning as may be required to leave the areas "broom clean" and (4) upon the completion of the Work, remove all of its materials and/or equipment.

(d) Asbestos: Unless explicitly and specifically identified in Attachment B, ESCO's Scope of Services is predicated on the viability of this Project without any asbestos abatement being required by ESCO. In the event that (i) ESCO encounters any friable asbestos which is in the immediate vicinity of ESCO's work, or (ii) ESCO determines that its work will result in the disturbance of asbestos material, or (iii) ESCO determines that the presence of asbestos material will impede ESCO's work, ESCO will notify Client of the same and Client will, at its cost, cause the asbestos to be promptly and properly removed, enclosed, encapsulated or otherwise abated in accordance with applicable laws and regulations, or alternatively, Client, at its cost, may provide written test reports showing that asbestos in that area has been properly removed, enclosed encapsulated or otherwise abated in accordance with applicable laws. In the event ESCO cannot determine whether any particular material does or does not contain asbestos, Client, upon ESCO's written request, will, at its cost, promptly perform tests or cause tests to be performed in order to determine whether or not such material contains asbestos and/or whether there are unacceptable levels of airborne particulate material containing asbestos or provide such a test report. Under no circumstances, shall ESCO be required to handle asbestos.

(e) Maintenance: To the extent provided for in Attachment I - "Maintenance Services," ESCO will service and maintain the equipment that is specifically identified therein, at a cost to the Client which is provided for in Section 4 and Attachments G, for the Term of this Agreement. Except for ECMs (or other equipment) which are to be maintained by ESCO, Client shall be responsible for servicing and maintaining the ECMs (and such other equipment) at its own cost.

(f) Measurement & Verification: To the extent provided for in Attachment F – "Guarantee of Energy Cost Savings" ESCO will also supply such ongoing Measurement & Verification services to the Client which may be agreed upon between the Parties at an annual fee to be set forth in Section 4 and Attachment G.

(g) Compliance With Law and Safety: This Agreement shall be governed by the law of the State of New York except where the Federal supremacy clause requires otherwise. ESCO shall comply with and obtain, at its expense, all licenses and permits required by Federal, state and local laws in connection with the installation of the ECMs. To the extent that ESCO agrees to perform operations and/or maintenance of specified ECMs or other equipment, it, or its subcontractors shall comply with and obtain, at its expense, all licenses and permits which may be required by Federal, state and local laws in connection with the operation and/or maintenance of such specified ECMs. In the event that ESCO cannot procure any such license or permit in light of a requirement that Client is required to do so, Client will procure the same.

ESCO will be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the Work and the measurement and verification services.

No drinking of alcoholic beverages, smoking, vaping or use of controlled substances is permitted on or in Client's facilities or properties. ESCO will ensure that none of its subcontractors, employees, representatives, agents, consultants and other individuals performing Work on behalf of ESECO pursuant to this Agreement, perform Work or are present at Client's facilities or properties while impaired by alcohol or any other substances. ESCO bears the responsibility of determining if its subcontractors, employees, representatives, agents and consultants and all other individuals performing Work on behalf of ESCO pursuant to this Agreement are in any way impaired and whether the safety of any person is jeopardized. Each subcontractor must provide drinking water for its own employees, representatives, agents and/or consultants.

ESCO will ensure that its employees, representatives, agents and consultants, and all of the employees, representatives, agents and consultants of ESCO's subcontractors refrain from using indecent language on or in Client's facilities or properties. Client has the right, in its sole discretion, to remove any person impaired by alcohol or any other substance or who used or is using indecent language from its facilities or properties.

Artwork or decoration found on any vehicle belonging to any person or entity performing Work pursuant to this Agreement and parked on or near a Client facility or property which contains indecent language or pictures must be covered or removed from the location. If ESCO fails to have the vehicle covered or removed, the Client may perform this obligation at ESCO's cost and ESCO will pay such cost to Client within 30 calendar days of Client's written demand therefor.

ESCO's employees, representatives, agents, consultants, and the employees, representatives, agents and consultants of ESCO's subcontractors will be required to wear photo identification at all times while on Client's property.

Each and every provision of law required to be inserted in the Agreement is deemed to have been inserted herein. In particular, among other laws, regulations, and ordinances, to the extent applicable to the Work, ESCO must fully comply with:

(i) Labor Law section 220(2) requiring that no laborer, worker or mechanic in the employ of ESCO, any subcontractor or other person doing or contracting to do all or part of the Work is permitted or required to work more than eight hours in any one calendar day or more than five days in any one week except in cases of extraordinary emergency including fire, flood or danger to life or property;

(ii) Labor Law section 220(3) requiring that the wage rate which can be paid and the supplements which can be provided to each employee of ESCO must be no less than the rates set forth by the Department of Labor. ESCO and its subcontractors must keep original payrolls or transcripts of the original payrolls and submit a transcript of the original payrolls subscribed and sworn to or affirmed as true under the penalties of perjury. The submissions must occur within 30 calendar days of the issuance of the first payroll and every 30 calendar days thereafter. The filing of payrolls by ESCO in a manner consistent with New York Labor Law 220(3-a) is a condition precedent to payment by the Client;

(iii) Labor Law section 220-e requiring that (i) in the hiring of employees for the performance of Work, no contractor, subcontractor, nor any person acting on behalf of such contractor or subcontractor, will by reason of race, creed, color, disability, sex or national origin discriminate against any citizen of the state of New York who is qualified and available to perform the work to which the employment relates; (ii) no contractor, subcontractor, nor any person on his behalf will, in any manner, discriminate against or intimidate any employee hired for the performance of Work on account of race, creed, color, disability, sex or national origin; and (iii) there may be deducted from the amount payable by the Client to ESCO pursuant to the Agreement a penalty of fifty dollars ($50.00) for each calendar day during which a person was discriminated against or intimidated in violation of Labor Law § 220-e and the Agreement may be terminated by the Client and all moneys due to ESCO may be forfeited for a second or subsequent violation of the terms or conditions of this Section of the Agreement.

(iv) Labor Law section 222-a requiring the installation, maintenance, and effective operation of appliances and methods that have been approved by the industrial board of appeals for elimination of harmful dust and stating that if the law is not complied with, this Agreement will be void.

(h) Taxes: Notwithstanding any other provision herein, Client represents that it is a governmental entity and that it will cooperate with ESCO and provide the same with appropriate documentation so that the ESCO may establish that neither it nor any lessor under the Lease shall have to pay taxes, fees and assessments or other charges of any character which may be imposed or incurred by any governmental or public authority as an incident to title to, ownership of, or operation of the ECMs or with respect to the interest component of the Lease payments which would otherwise be levied upon or in respect to said interest component of the ECMs or their operation.

(i) Non-Discrimination: ESCO agrees not to discriminate against any employee, or applicant for employment, to be employed in the performance of this Agreement, with respect to hire, tenure, terms, conditions or privileges of employment, or any matter directly or indirectly related to employment, because of age, sex, race, disability, color, religion, national origin, Vietnam era military service, ancestry, or any other protected characteristic in accordance with applicable Federal, New York State or local laws.

(j) Specifications: Prior to beginning the Work, ESCO will provide written specification of any ECMs to be installed. Client shall furnish its written approval or disapproval of each such written specification within fifteen (15) business days following its receipt of written notice by ESCO of completion of each such sample installation or the provision of such written specifications to Client. Client's approval of such specifications shall be in substantially the form of Attachment M hereto. If Client disapproves any such ECM, ESCO shall have the right to provide a substitute ECM which conforms to the applicable specifications or is equivalent to any previously approved sample by Client. Upon Client's written approval, ESCO shall revise the Attachments to reflect each substitution, subject to Client's written approval of each revised Attachment. If Client fails to approve or disapprove of any ECM(s) within fifteen (15) business days following ESCO's written notice that the written specifications are ready for inspection, it will be deemed approved by Client. If, however, Client still does not approve of any substituted ECMs or specifications, the Parties hereby agree to negotiate in good faith a mutually acceptable solution. Client shall not unreasonably withhold any approval provided for herein.

(k) Duties, Obligations and Responsibilities of ESCO:

(i) All labor furnished under this Agreement shall be competent to perform the Work. All materials and equipment provided shall be new and of suitable quality, and the Work shall reflect the requirements set forth in this Agreement. In the event this Agreement pertains to a public work contract falling under Article 8 of the Labor Law, or a building service contract governed by Article 9 thereof, ESCO and its subcontractors are prohibited from requiring or allowing their employees to work beyond the hours or days specified in said statutes, unless exceptions are permitted under the Labor Law or detailed in prevailing wage and supplement schedules issued by the State Labor Department. Furthermore, ESCO and its subcontractors shall renumerate their employees with at least the prevailing wage rate and provide or compensate for prevailing supplements, including premium rates for overtime pay, as determined by the State Labor Department in accordance with the Labor Law.

(ii) ESCO will keep the premises and the surrounding area free from accumulation of waste materials or rubbish caused by the Work at least daily and, upon completion of the Work, ESCO will remove all remaining waste materials, rubbish, tools, construction equipment, machinery, and surplus materials. If, after one business day's prior written notice, ESCO fails to keep the premises and the surrounding area free from accumulation of waste materials or rubbish or fails to remove remaining materials, rubbish, tools, construction equipment, or machinery in accordance with this Section, the Client may perform this obligation at ESCO's cost and ESCO will pay such cost to Client within thirty (30) calendar days of Clients demand therefor.

(iii) At all times relevant to this Agreement, ESCO shall permit Client or any of its representatives to enter upon the Project site to review or inspect the construction work without formality or other procedure.

(iv) ESCO will provide equipment manuals and other appropriate information regarding equipment installed hereunder to Client at or about the time of Substantial Completion.

(l) Engineering/Architectural Construction Services:

ESCO shall not perform professional services including engineering or architecture. ESCO having consulted with Client and with Client's authorization, will arrange for the design and engineering services to be performed by John A. Grillo Architect, P.C. ("Engineer") a qualified professional engineering firm whose services are included in the ECM installation costs to the Client. All costs associated with the Engineer's services in connection with this project will be the responsibility of ESCO. The work performed by the Engineer will include design and engineering services in relation to the required submissions to NYSED in order to obtain approvals. It is understood and agreed that the Engineer shall provide services in connection with the contract pursuant to the requirements set forth in the RFP.

The fees and total compensation for the Engineer will be paid by ESCO to the Engineer in accordance with the terms of the contract between ESCO and Engineer. Payment thereof being the sole responsibility of ESCO. The Engineer must remain free from any financial interest in the agreement which conflicts with the proper completion of its responsibilities pursuant to this Agreement and which conflicts with its responsibilities and duties to the Client.

ESCO will provide a copy of the contract entered into between ESCO and the Engineer to the Client for the Client's written approval ("Engineer Contract") within five (5) business days of its initial execution. The Engineer Contract will, at a minimum, include the terms and conditions set forth in Attachment N to this Agreement and made a part of this Agreement. The Engineer Contract must require that the Engineer owes its professional and contractual duty to the Client. The Engineer Contract will include third party beneficiary language in favor of the Client. The Client's written approval of the Engineer Contract will mean that the Engineer Contract fulfills the requirements of this Section of the Agreement. The Client's obligations pursuant to this Agreement are contingent upon and subject to the Client's written approval of the Engineer Contract. In the event that the Client does not approve the Engineer Contract, each Party agrees to negotiate in good faith to reach agreeable terms and conditions for the Engineer Contract. Should the Parties fail to come to agreement within three (3) calendar months of the Client's receipt of the Engineer Contract, then this Agreement will terminate with no further obligation of Client to ESCO, unless the parties agree to extend the Agreement in writing.

SECTION 2 OWNERSHIP OF ECMS

Ownership of and title to the ECMs to each Delivery and Acceptance Certificate (Attachment E-1) will automatically transfer to the Client upon both: (a) the delivery of each such Delivery and Acceptance Certificate by Client to ESCO, the execution and delivery of which shall not be unreasonably withheld or delayed, and (b) completion of all Client's payment obligations to ESCO, excluding payment obligations related to maintenance or other annual services hereunder. Subject and subordinate to any lessor's rights pursuant to any lease for this project, ESCO under this Agreement shall be entitled to all rights, benefits and remedies afforded a secured party under law with respect to the equipment installed pursuant to this Agreement, including but not limited to those under the Uniform Commercial Code, as adopted in the State of New York or any other applicable state ("Code"). ESCO shall retain such security interest in the ECMs, pursuant to this Agreement, for equipment installed hereunder until Client shall have accepted the same and title has transferred to Client. If requested by ESCO in connection therewith, Client agrees to provide to ESCO appropriate financing statements and other documents necessary in order for ESCO and/or any bank, lender or financial institution to which ESCO has assigned any interest in this Agreement, to perfect said subordinate security interest in the ECMs.

SECTION 3 FINANCIAL SERVICES

ESCO will provide cash flow statements to Client upon Client's reasonable request. In addition, ESCO shall provide Client with revised cash flow spreadsheets after the following events: (a) upon approval by NYSED of the project submission and any related revisions; (b) upon issuance of the New York State Aid report (SA4 Report) identifying the state aid allocated for the project (if applicable); and (c) upon other agreed upon changes to the Project. Prior to commencement of the Project, in the event the Project does not create positive cash flow, ESCO and Client shall agree on modifications to the Project to enable the Project to create positive cash flow or Client may terminate this Agreement. Upon NYSED approval of the Project, Client shall be responsible to obtain financing for the Project, and to comply with all laws that may be applicable related to performance contracting. In the event project financing is not obtained pursuant to Section 37, Client will be responsible to pay ESCO the Comprehensive Energy Audit ("CEA") fee of $89,250, unless both Parties agree to extend the Agreement.

SECTION 4 COMPENSATION AND PAYMENT

(a) The cost of the Project is Eight Million Seven Hundred Sixty Five Thousand Two Hundred Eighty Dollars ($8,765,280.00).

(b) A Schedule of Values is attached hereto as Attachment O and made a part of this Agreement. This Schedule of Values will (i) allocate the Project Cost to the various portions of the Work and (ii) be prepared in such form and supported by such data to substantiate its accuracy as the Engineer and Client may reasonably require._ During the period beginning on the date of delivery of the Notice to Proceed and continuing through the Date of Substantial Completion with respect to each Phase, Client will make monthly progress payments to ESCO based upon the portion of the Project completed at the end of each month, as respectively provided for in Attachment G for which payment is being made. Client shall (within thirty (30) calendar days of receipt) execute and deliver to ESCO completed forms E-1 (Attachment E-1) upon completion by ESCO of each ECM. A Final Delivery and Acceptance Certificate (Attachment E-2) shall be executed by Client upon final completion of the ECMs. Client shall not unreasonably withhold or delay the execution of any Delivery and Acceptance Certificate. For the purposes of this Agreement the term "Substantial Completion" shall mean that ESCO has provided sufficient materials and services to permit Client to operate the subject ECM and utilize the Work to obtain savings as set forth in this Agreement and that ESCO has demonstrated that the ECM is operating in a manner consistent with its manufacturer's intended use. After an on-site inspection of the Work, the Engineer will certify the date that the Work has been substantially completed by ESCO, if that is the case. The Engineer must also provide Client and ESCO, in writing, a description of all items that remain to be completed. Substantial completion is achieved when the Work required under this Agreement is substantially, but not entirely, complete and ready for its intended use and can be used pursuant to applicable federal, state local laws, rules, regulations codes and ordinances.

As a condition to the issuance of the Delivery and Acceptance Certificate Upon Substantial Completion (Attachment E-1), ESCO must: (i) conduct testing of the ECM(s) as required in this Agreement and provide a copy of the test results to Client and Engineer; (ii) provide to the Client a complete set of as-built drawings that are approved by the Engineer; (iii) provide to the Client a complete list of manuals and training sessions provided by ESCO to Client which will include a description of the manual or training provided, the date, and location where the manual or training was provided, the name of the person providing the manual or training, and the name of the person receiving the manual or training; and (iv) provide to the Client all other written documentation, licenses and software necessary for the operation of the ECM(s) or relating to the ECM(s) and their installation, including, but not limited to, equipment specifications and locations, system configurations, and sequences of operations.

Prior to the issuance of the Certificate of Substantial Completion, the Client and Engineer will provide to ESCO a punch list of items remaining to be completed by ESCO. Provided the ECMs are functioning as intended for Client's use, the Certificate of Substantial Completion shall be issued. All items within the punch list must be completed within thirty (30) calendar days of the signed Certificate of Substantial Completion, unless otherwise agreed to by the parties in writing. For the purposes of this Agreement, the terms "Final Completion" or "Final Acceptance" shall mean that ESCO has fulfilled all of its construction obligations for all

ECMs installed under this Agreement. This shall include the completion of all punch list items and the submission of all required documentation.

(c) During the month following each successive twelve (12) month period beginning with the first day of the month following the date on which the Client executes a Final Delivery and Acceptance Certificate (Attachment E-2), Client shall pay the annual maintenance and measurement and verification (M&V) service fees (collectively, the "Performance Period Fee") set forth in Attachment G.

(d) ESCO must submit Applications for Payment to the Client on the form attached hereto as Attachment O based on the percentage of the Work completed pursuant to the Schedule of Values. With each Application for Payment, ESCO must submit certified payrolls and such other documentation reasonably requested by the Engineer or Client. Within thirty (30) business days of the Client's receipt of the Application for Payment, Client will pay ESCO 95% of the value of ESCO's Work.

(e) Amounts not in dispute and not paid to ESCO on or before the due dates specified in Sections 4(a)-(d) above will accrue interest at the rate of the prime interest rate plus four (4) percent for the number of days following the due date until such time as such amount due has been paid in full.

(f) The services provided for hereunder may overlap one another. In that regard, the payments to be made by Client to ESCO with respect to one or more services shall be in addition to one another.

(g) Client may purchase an extended warranty from ESCO on all ECMs and related equipment installed under this Agreement for an amount to be mutually determined.

SECTION 5 TERM

The Term of this Agreement shall begin on the date above first written and shall end on that date which is exactly eighteen (18) years from the first day of the month following the date of execution of the Delivery and Acceptance Certificate (Attachment E-2) upon Substantial Completion of this Project by the Client, unless terminated prior to such date, as provided for in Section 12 and/or Section 14 and/or Section 32 of this Agreement. If not otherwise terminated as provided for herein, the Term of this Agreement shall terminate simultaneously with any termination of the Financing. Notwithstanding the foregoing, nothing in this Section 5 shall relieve the Client from paying amounts which accrued prior to such termination of this Agreement, when due under this Agreement.

SECTION 6 GUARANTEE OF ENERGY SAVINGS

ESCO will guarantee to the Client the amount of energy savings determined in accordance with Attachment F, "Guarantee of Energy Cost Savings".

SECTION 7 RIGHT OF ENTRY/SPACE

During the Term of this Agreement, Client shall grant ESCO, its employees, agents, and subcontractors, including any utility which provides or may provide any payment under this Agreement, access to the Property for the purpose of fulfilling ESCO's obligations under this Agreement. Client shall provide mutually satisfactory space for the installation and operation of the ECMs and shall protect such equipment in the same careful manner that Client protects its property. Additionally, Client shall provide ESCO remote electronic access to the energy management system (if required) during the Term of this Agreement. ESCO shall obey and abide by all reasonable rules of Client relative to the Property as they would directly relate to ESCO's performance of its obligations under this Agreement.

ESCO will conduct its Work during hours that are in compliance with federal, State and local laws, rules, regulations codes and ordinances. ESCO must obtain Client's written permission prior to conducting any Work during Client's non-standard business hours.

SECTION 8 CHANGES IN WORK

The quantity, quality, dimensions, type or other characteristics of the ECMs may be changed only by written consent of the Client and ESCO (and, where required by the Lease, the Lessor), via the execution of a Change Order Form (Attachment H) and the approval of NYSED. In addition, the Scope of Services may be reduced or expanded to include other significant energy efficiency measures and facilities not included within the ECMs listed on Attachment B (and, following Substantial Completion, listed on Attachment J) by the execution of such a Change Order Form and its approval by NYSED.

SECTION 9 WARRANTIES

All warranties for materials and workmanship are stipulated by ECM in Attachment B (Scope of Services). The following provisions will be in effect should any warranty language be omitted from Attachment B.

(a) ESCO warrants that the design, engineering, and installation services it performs will be performed consistent with good engineering practices and that such work is warranted to be free from defects in materials and workmanship for a period of two (2) years from the date of execution of the Delivery and Acceptance Certificate by the Client with respect to Substantial Completion. Any manufacturers' warranties which exceed this two (2) year period shall be assigned to Client to the extent allowed by the manufacturer. Except as provided above, ESCO MAKES NO WARRANTIES OR REPRESENTATIONS OF ANY KIND, WHETHER STATUTORY, WRITTEN, ORAL OR IMPLIED, INCLUDING WITHOUT LIMITATION, WARRANTIES AS TO THE VALUE, DESIGN, AND CONDITION OR FITNESS FOR USE OR PARTICULAR PURPOSE AND MERCHANTABILITY, REGARDING THE ECMs OR ANY SERVICES PROVIDED HEREUNDER.

(b) Individual ECM warranties that extend beyond the warranty defined in (a) above will transfer to the Client. ESCO will not be responsible for administering extended warranties.

(c) Client may purchase extended warranty coverage for all equipment installed under this Agreement as long as the annual cost of the project inclusive of the extended warranty coverage does not exceed the guarantees savings value should this agreement be subject to rules or laws requiring annual savings to exceed annual costs. Payment of such shall be in accordance with Section 4(d) and Attachment G.

(d) ESCO represents and warrants that: (a) it is financially solvent and experienced in and competent to perform the Work; (b) it is familiar with all federal, State, county, and local laws, regulations, and ordinances which may in any way affect the Work or those employed therein; and (c) it or its subcontractors performing the Work are holders of all licenses which are necessary to perform the Work and that said licenses will remain in effect through completion of the Work; (d) it has inspected the site and has become familiar with the conditions and operations under which the Work is to be performed; and (e) it will observe and comply with the policies, rules, and regulations of the Client which are made known to it respecting the performance of its duties (and will cause its employees to do that same), including, but not limited to, the Client's Code of Conduct; provided, however, that ESCO will determine the manner of carrying out its duties hereunder consistent with its status as an independent contractor.

(e) ESCO will perform the Work in a professional, workman-like manner. ESCO will promptly re-perform any non-conforming Work for no charge, as long as Client provides written notice of such defect to ESCO within one year following Substantial Completion or such other period identified in Attachment B. If ESCO fails to commence the correction of non-conforming Work within thirty (30) calendar days after the Client gives notice to ESCO, the Client may correct it at ESCO's cost and expense, including with respect to the costs of consultants, without relieving ESCO of its obligations hereunder. ESCO will pay Client, on demand, for the cost of such corrective work.

(f) Prior to the commencement of the Work, ESCO will be fully responsible for reviewing any and all existing warranties of equipment, fixtures and appurtenances located at the Client's facilities that are directly impacted by the Work performed under the Agreement to verify that the Work will not void any such existing

warranties. In the event that ESCO's review uncovers a potential issue, ESCO will notify the Client in writing and the parties will agree upon a resolution. Notwithstanding the foregoing, if ESCO: (a) proceeds with any Work that will impair or nullify any existing warranty; and (b) the Client has not been notified in writing of the potential issue and agreed to the performance of such work, ESCO will be fully liable for the warranty. Upon completion of the Work of the Agreement, ESCO will be fully responsible for reviewing and informing Client of all warranties that result from the Work.

SECTION 10 CLIENT ROLE AND RESPONSIBILITIES

(a) Operations: Client shall operate the equipment installed hereunder in accordance with the manufacturers' recommendations and the procedures supplied to the Client by ESCO.

(b) Maintenance: Client shall, at its expense, maintain the Property in good working order during the Term of this Agreement. Except as may otherwise be provided for in Attachment I, the Client will maintain, at Client's expense: (i) the equipment and all other components which comprise the ECMs (following the date of Substantial Completion), and (ii) all other equipment which is attached thereto and/or is integral to the proper functioning of the ECMs.

(c) Malfunctions: Client will notify ESCO within 10 business days in the event of any malfunction in the operation of the ECMs or the equipment installed hereunder.

(d) Protection of ECMs: Except in the case of emergency, Client will not remove, move, alter, turn off or otherwise significantly affect the operation of the equipment installed hereunder or the operation of the ECMs, or any individual part thereof, without the prior approval of ESCO, which approval shall not be unreasonably withheld. After receiving ESCO's approval, Client shall proceed as instructed. Client shall act reasonably to protect the ECMs from damage or injury, if, due to an emergency, it is not reasonable to notify ESCO before acting. Client agrees to protect and preserve the facility envelope and the operating condition of all ECMs, mechanical systems, and other energy consuming systems located on the Property.

(e) Measurement & Verification System: Client shall not alter, move, modify or otherwise change the measurement and verification system or any component thereof without the written consent of ESCO unless such action is in accordance with operating procedures provided by ESCO.

(f) Adjustment to Baseline: If, in ESCO's reasonable opinion, and acknowledged by Client in good faith, Client fails to reasonably protect the ECMs and/or maintain the Property in good repair and good working condition, the baseline referenced in Attachment F may be reasonably adjusted by the Parties for any increased energy usages at the Property.

(g) Changes to Property: Client will notify ESCO in writing prior to making any change to the Property that would significantly affect the energy usage at the Property, including but not limited to changes in the hours or days that the Property is occupied or operated, the number of occupants (including, but not limited to, staff and students), the activity conducted, the equipment, or the size of the Property (if possible, Client will provide this notice to ESCO at least fourteen (14) calendar days prior to the making of a change). In the event ESCO receives such notification or otherwise determines that such a change has occurred, it will make the appropriate revisions to the Attachments as mutually agreed to by the Parties or take such other action as may be provided for hereunder.

(h) Energy Usage Data: Client will make available to ESCO, on a monthly basis for the Term of this Agreement, copies of all energy bills, energy usage data, and any and all other such documentation maintained by the Client, as requested by ESCO, which is necessary for ESCO to determine and satisfy all of its obligations under this Agreement.

(i) Insurance and Risk of Loss or Damage: Without limiting any of its obligations or liabilities under this Agreement, the Client will, at its expense, provide and maintain at all times during the Term of this Agreement, sufficient insurance against the loss or theft of or damage to the ECMs related equipment and all components installed hereunder, for the full replacement value thereof.

Client shall purchase and maintain all-risk full cost replacement property insurance in form acceptable to ESCO for the duration of Project and Agreement term. The insurance shall include ESCO, its subcontractors and sub-subcontractors as additional insureds. Client shall provide ESCO with copies of said insurance coverage prior to the commencement of the Project.

Client assumes all risk of loss of or damage to the ECMs from any cause whatsoever except to the extent that such loss or damage was caused by ESCO.

If, following Client's execution of the Delivery and Acceptance Certificate to be provided upon Substantial Completion and subsequent to Client's complete payment to ESCO in accordance with Section 4(a), as that amount may then have been modified in accordance with this Agreement, any fire, flood, other casualty, or condemnation renders a majority of the Property incapable of being occupied and renders the ECMs or the equipment installed hereunder inoperable and, in the case of a casualty, the affected portion of such ECMs or equipment is not reconstructed or restored within one hundred and twenty (120) calendar days from the date of such casualty, ESCO and/or Client may terminate this Agreement by delivery of a written notice to the other Party. Upon such termination, Client shall pay ESCO any amounts, or pro-rata portions thereof, accrued under Section 4(b)-(e), Attachment G and the applicable Termination Value, if any, set forth on Attachment C or in Section 4. ESCO shall not be responsible for any savings deficiencies resulting from ECMs being rendered useless for the period of time prior to reconstruction of the ECM. The savings Guarantee will be adjusted to account for the unavailability of the ECM.

(j) Telephone/Broadband: Client is responsible for installing and maintaining either telephone lines or providing broadband access to the energy management system via Client's Local Area Network (LAN). Client is responsible for all associated costs for the energy management system's telephone lines or broadband access.

(k) Protection. Client shall at all times act reasonably to protect the ECMs from damage, theft or injury to the same extent and in the same manner in which it protects its other property.

(l) Alteration: Client agrees not to move, alter or change the ECMs in any way that causes a reduction in the level of efficiency or savings generated by any ECM or the equipment installed hereunder without obtaining ESCO's prior written approval which shall not be unreasonably withheld.

(m) Storage: ESCO shall store all materials, supplies, tools, and equipment ("Stored Materials") at the Property, within a rent-free area, in a location agreed to by the Parties. ESCO shall bear all risk of loss for the Stored Materials but only to the extent that any loss is not attributable to any act or omission of Client. Access to this storage area shall be limited to ESCO, its subcontractors, and Client-assigned personnel exclusively.

(n) Utilities: Client shall procure and pay for all energy and utility costs including, without exception, fuel for the operation of the Property.

SECTION 11 DEFAULTS BY CLIENT AND ESCO

(a) Client shall be in default under this Agreement upon the occurrence of any of the following:

(i) Client fails to pay when due any amount to be paid under this Agreement and such failure continues for a period of sixty (60) business days after notice of overdue payment is delivered by ESCO to Client;

(ii) Client fails to perform or meet any of its other required duties or obligations under this Agreement and fails to cure such failure and the effects of such failure within thirty (30) calendar days of receipt of written notice of default, unless such failures and effects cannot be completely cured within thirty (30) calendar days after said written notice, in which case a default shall exist only if Client does not commence and diligently pursue to cure such failure and effects as soon as possible;

(b) ESCO shall be in default under this Agreement upon the occurrence of the following:

(i) ESCO fails to perform or meet any of its required duties or obligations under this Agreement and fails to cure such failure or effects of such failure within thirty (30) calendar days of receipt of written notice of default, unless such failure or effects cannot be completely cured within thirty (30) calendar days after said written notice, in which case a default shall exist only if ESCO does not commence and diligently pursue to cure such failure as soon as possible.

SECTION 12 REMEDIES FOR DEFAULTS

(a) In the event that one party defaults under this Agreement, the other party, after providing notice and an opportunity to cure: may bring actions for any remedies available at law or in equity or other appropriate proceedings for the recovery of damages, (including, without exception, amounts past due), and/or bring an action in equity for specific performance.

SECTION 13 GOVERNING LAW, CHOICE OF FORUM AND WAIVER OF JURY TRIAL

This Agreement is subject to, governed by, enforced according to and construed according to the laws of the State of New York, without regard to the conflicts of laws provisions thereof. Any dispute arising under this Agreement will be litigated in a New York State Court in Nassau County, New York or the Eastern District of New York. The parties hereby consent to the jurisdiction of each such court and knowingly, voluntarily, intentionally and irrevocably waive any objection which such party may have to the laying of venue in any such court. The parties each waive trial by jury in any action concerning this Agreement.

SECTION 14 TERMINATION

Client may terminate this Agreement for any reason upon thirty (30) calendar days written notice to ESCO, provided that Client has paid to ESCO: (a) all amounts due, as set forth in Section 4 and on Attachment G (other than amounts due for future performance by ESCO). If Client wishes to terminate this Agreement by reason of any default hereunder by ESCO, Client must first provide ESCO with notice of such default, as well as afford ESCO thirty (30) calendar days to cure its default ("Cure Period"). If ESCO's default cannot reasonably be cured within the Cure Period, ESCO must begin efforts to cure the default within the Cure Period and diligently continue those efforts until the default is resolved.

SECTION 15 INSURANCE AND BONDING

(a) Without limiting any of its obligations or liabilities under this Agreement, ESCO will provide and maintain at its expense the following minimum insurance:

- Workers' Compensation and N.Y.S. Disability: Statutory Workers' Compensation (C-105.2 or U-26.3); and N.Y.S. Disability Benefits Insurance (DB-120.1) for all employees. Proof of coverage must be on the approved specific form, as required by the New York State Workers' Compensation Board. ACORD certificates are not acceptable.

- Comprehensive General Liability Insurance, including contractual liability:
  - Each Occurrence - $1,000,000
  - General Aggregate (per project basis)- $2,000,000
  - Products - Completed/Operations (each occurrence) - $2,000,000
  - Personal & Advertising Injury (any one person) - $2,000,000
  - Fire Damage (any one fire) - $300,000
  - Medical Expenses (any one person) - $10,000

- Comprehensive Automobile Liability Insurance, including owned, non-owned, borrowed and hired automotive equipment: $1,000,000 combined single limit

- Environmental Contractors Liability Insurance (to be obtained by ESCO or its subcontractors if the entity in question is performing Work relating to Hazardous Materials or ACM): With coverage for the services rendered by ESCO or its subcontractors for the Client, including, but not limited to removal, replacement, enclosure, encapsulation and/or disposal of hazardous materials, along with any related pollution events, including coverage for third-party liability claims for bodily injury, property damage and clean-up costs, and coverage for non-owned disposal sites. $2,000,000.00 per occurrence/$2,000,000.00 aggregate including products and completed operations. If a retroactive date is used, it must pre-date the inception of the Agreement. If ESCO or a subcontractor is using motor vehicles for transporting hazardous materials, the entity using the motor vehicles will provide pollution liability broadened coverage (ISO endorsement CA 9948 or equivalent) as well as proof of MCS 90.

  Coverage must extend for a period of three (3) years following Final Completion.

- Owners Contractors Protection Insurance: $2,000,000 per occurrence; $4,000,000 aggregate with the Client as the named insured.

- Builder's Risk: Must be purchased and maintained by the Client to include interest of the Client, ESCO and ESCO's subcontractors jointly. The limit must reflect the total completed value (all material and labor costs) and provide coverage for fire, lightning, explosion, extended coverage, vandalism, malicious mischief, windstorm, hail and/or flood. Coverage must remain in effect until the Client is the only entity that has an insurable interest in the property.

- Excess Insurance: $10,000,000 each occurrence and aggregate. Excess coverage must be on a follow-form basis or provide broader coverage over the general liability and automobile liability coverages.

(b) Notwithstanding any terms, conditions or provisions, in any other writing between the parties, ESCO hereby agrees to effectuate the naming of the Client as an additional insured on ESCO's insurance policies, with the exception of workers' compensation, N.Y. State disability and professional liability. Each policy naming the Client as an additional insured must:

- be an insurance policy from an insurer licensed in New York State with an A.M. Best rating of not less than "A-";

- state that ESCO's coverage is primary and non-contributory coverage for the Client, its Board, employees and volunteers including a waiver of subrogation in favor of the Client for all coverages including Workers Compensation.

(c) The Client must be listed as an additional insured by using standard or other endorsements that extend coverage to the Client for both on-going (CG 20 38 or equivalent) and products and completed operations (CG 20 37 or equivalent). The decision to accept an alternative endorsement rests solely with the Client. A completed copy of the endorsement(s) must be attached to the certificate of insurance and the certificate must state that the endorsement is being used. The certificate of insurance will reference coverage that applies to this contract by number or description. A fully completed New York Construction Certificate of Liability Insurance Addendum (ACORD 855 2014/05) must be included with the certificates of insurance. For any "Yes" answers on Items G through L on this Addendum additional details must be provided in the writing.

(d) All liability policies must be written on an occurrence basis. The commercial general liability policy must include all major divisions of coverage and be on a comprehensive basis including, but not limited to: (1) blanket contractual liability ESCO has assumed under contract (including indemnification obligations); (2) completed operations/products liability; (3) broad form property damage and loss of use; (4) explosion, collapse and underground ("XC&U" perils), where applicable; (5) premises; and (6) operations.

(e) ESCO hereby indemnifies and holds harmless the Client for any applicable deductibles and self-insured retentions, all of which are the sole responsibility of ESCO, to the extent not covered by the applicable policy.

(f) ESCO acknowledges that failure to obtain the foregoing insurance on behalf of the Client constitutes a material breach of this Agreement and subjects ESCO to liability for damages, indemnification and all other legal remedies available to the Client. ESCO must provide the Client with the required proof of insurance prior to the commencement of Work or use of Client facilities. The failure of the Client to object to the contents of the certificate or the absence of same will not be deemed a waiver of any and all rights held by the Client.

(g) ESCO must require all subcontractors to carry similar insurance coverages and limits of liability as set forth herein and adjusted to the nature of subcontractors' operations and submit same to the Client for written approval prior to start of any Work. Notwithstanding any other terms, conditions or provisions, ESCO must require each subcontractor, pursuant to a written agreement, that the subcontractor effectuate the naming of the Client as an additional insured on the subcontractor's insurance policies, with the exception of workers' compensation and N.Y. State disability insurance. Client must be listed as an additional insured on any subcontractor policy by using standard or other endorsements that extend coverage to the Client for both on-going and completed operations. The decision to accept an endorsement rests solely with the Client. ESCO must submit to Client for Client's approval a completed copy of the endorsement(s) and the certificates of insurance and the certificates must state that the endorsement is being used.

(h) Payment and Performance Bond. ESCO shall within seven (7) calendar days of execution of this Agreement, deliver to the Client Performance and Payment Bonds in a sum equal to the contract price with sureties satisfactory to the Client, conditioned upon the faithful performance by ESCO, for the implementation of the ECMs as it may be from time to time modified by Change Orders, such bonds to be in such form and otherwise to contain such provisions as are reasonably satisfactory to the Client. ESCO shall deliver to Client the Payment and Performance Bond prior to commencement of construction of any work in respect of this Agreement. The Payment and Performance Bonds required hereunder shall expire upon Final Acceptance of all ECMs required under this Agreement (including any applicable two year warranty period), and shall not secure any energy savings, measurement and verification obligations or maintenance/service obligations, which may be guaranteed by ESCO under this Agreement.

SECTION 16 INDEMNIFICATION AND LIMIT OF LIABILITY

(a) To the fullest extent permitted by law, each Party (hereinafter referred to as the "Indemnifying Party") agrees to defend, indemnify and hold harmless the other Party from and against any and all claims for damages sustained by third parties arising by reason of bodily injury or damage to third party property caused by the Indemnifying Party's willful misconduct or negligent physical acts (or the willful misconduct or negligent physical acts of any entity under the control, responsibility or direction of the Indemnifying Party). In no event, however, shall the Indemnifying Party be obligated to indemnify the other Party to the extent that any injury or damage is caused by the negligence of the other Party or any entity for which the other Party is legally responsible.

(b) To the fullest extent permitted by law, ESCO shall be solely responsible for and shall indemnify and hold harmless the Client, its officers, members of the Board of Education, employees, and agents (the "Indemnified Parties") from and against any and all liabilities, losses, costs, expenses (including, without limitation, reasonable attorneys' fees and disbursements) and damages ("Losses"), arising out of or in connection with any acts or omissions of ESCO or a ESCO Agent, regardless of whether taken pursuant to or authorized by this Agreement and regardless of whether due to negligence, fault, or default, including Losses in connection with any threatened investigation, litigation or other proceeding or preparing a defense to or prosecuting the same; provided, however, that ESCO shall not be responsible for that portion, if any, of a Loss that is caused by the negligence or wrongful act of the Client.

(c) ESCO shall, upon the Client's demand and at the Client's direction, promptly and diligently defend, at ESCO's own risk and expense, any and all suits, actions, or proceedings which may be brought or instituted against one or more Indemnified Parties for which ESCO is responsible under this Section and ESCO shall pay and satisfy any judgment, decree, loss or settlement in connection therewith.

(d) ESCO shall, and shall cause ESCO Agents to, cooperate with the Client in connection with the

investigation, defense or prosecution of any action, suit or proceeding in connection with this Agreement including the acts or omissions of ESCO and/or a ESCO Agent in connection with this Agreement.

(e) The provisions of this Section shall survive expiration or sooner termination of this Agreement.

SECTION 17 AGREEMENT INTERPRETATION AND PERFORMANCE

The interpretation and performance of this Agreement, and the interpretation and enforcement of the rights of the Parties hereunder, shall be in accordance with and controlled by the laws of the State of New York, except where the Federal supremacy clause requires otherwise. In the event of any ambiguity or conflict in meaning, the terms of this Agreement shall not be construed against the drafting Party based upon that Party's having drafted this Agreement.

SECTION 18 PRIVILEGED AND PROPRIETARY INFORMATION

ESCO's systems, means, cost, and methodologies of evaluating, implementing, accomplishing and determining energy savings and the terms of the Agreement for this Project is considered by ESCO as privileged and proprietary information. The New York State Freedom of Information Law, Public Officers Law, Article 6 ("FOIL"), provides for public access to information. Public Officers Law § 87(2)(d) provides that the Client may deny access to records or portions thereof that are "trade secrets or are submitted to an agency by a commercial enterprise or derived from information obtained by a commercial enterprise and which if disclosed would cause substantial injury to the competitive position of the subject enterprise." Information that ESCO believes is a trade secret or would cause substantial injury to the competitive position of the ESCO if disclosed, should be labeled "Confidential" or "Proprietary" on each page at the time of submittal to Client. This information should include a written request to except it from disclosure, including a written statement of the reasons why the information should be excepted. The designation of information by ESCO as "confidential" or "proprietary" does not guarantee that it is, in fact, confidential or proprietary or that the information will not be released by the Client in response to a FOIL request.

When any request for disclosure of information that is labeled Confidential or Proprietary by ESCO is made under FOIL, Client will provide prompt verbal and written notice to ESCO such that ESCO will have the opportunity to timely object under FOIL should it desire to object to such disclosure of that information in whole or in part. In the event that Client is required to make a filing with any agency or other governmental body, which includes such information, Client shall notify ESCO and cooperate with ESCO in order to seek confidential treatment of such information included within any such filing or, if all such information cannot be protected from disclosure, to request that Client be permitted to redact portions of such information, as ESCO may designate, from that portion of said filing which is to be made available to the public.

SECTION 19 SEVERABILITY

In the event that any clause or provision of this Agreement or any part thereof shall be declared invalid by any court having jurisdiction, such invalidity shall not affect the validity or enforceability of the remaining portions of this Agreement.

SECTION 20 ASSIGNMENTS AND SUBCONTRACTING

(a) ESCO may elect to use subcontractors in meeting its obligations pursuant to this Agreement. Client will approve all subcontractors and outside professionals in advance in writing, which approval will not be unreasonably withheld or delayed.

(b) Client shall not assign, transfer, or otherwise dispose of this Agreement, the ECMs, or any interest therein, or sublet or lend the ECMs or permit the ECMs to be used by anyone other than Client and Client's employees without the prior express written consent of ESCO (or, if applicable, the Lessor) such consent not to be unreasonably withheld. If Client transfers ownership or its interest in the Property, Client shall require the new party acquiring ownership of the Property to assume Client's obligations hereunder, pursuant to an assignment and assumption agreement, subject to ESCO's approval; otherwise, this Agreement will terminate

as provided for in Section 14.

(c) ESCO shall not assign this Agreement in whole or in part to any other party without first obtaining the consent of Client, which consent shall not be unreasonably withheld.

SECTION 21 DELAYS

If ESCO is delayed in the performance of the Work by causes beyond its control, including but not limited to, a Force Majeure condition, ESCO shall provide written notice to Client of the existence, extent of, and reason for such delays and their potential impacts. ESCO agrees to make a claim only for additional costs attributable to delay in the performance of this Agreement necessarily extending the time for completion of the Work, occasioned solely by any act or omission to act of Client such as: (i) unreasonable delays attributable to the review of shop drawings, the issuance of change orders, or the cumulative impact of change orders that were not brought about by any act or omission of ESCO; (ii) the unavailability of the project site caused by acts or omissions of Client, except for acts or omissions of the Client that were beyond the Client's control; and (iii) differing project site conditions or environmental hazards that were neither known nor reasonably ascertainable by the ESCO on a pre-bid inspection of the project site or review of the bid documents or other publicly available sources, that are not ordinarily encountered in the project site's geographical area or neighborhood or in the type of Work to be performed, and that were constructively known, but not disclosed by the Client. ESCO agrees that in the event of any such other delay, it shall only make a claim for an adjustment of the project schedule.

SECTION 22 WAIVER

The failure of either Party to require compliance with any provision of this Agreement shall not affect that Party's right to later enforce the same. It is agreed that the waiver by either Party of performance of any other terms of this Agreement or of any breach thereof will not be held or deemed to be a waiver by that Party of any subsequent failure to perform the same or any other term or condition of this Agreement or any breach thereof.

SECTION 23 FORCE MAJEURE

(a) If either Party shall be unable to carry out any part of its obligations under this Agreement due to causes beyond its control ("Force Majeure"), including but not limited to an act of God, strikes, lockouts or other industrial disturbances, acts of public enemies, orders or restraints of any kind of the government of the United States or any state or any of their departments, agencies, or officials, or any other civil governmental, transportation delays, military or judicial authority, war, blockage, insurrection, riot, sudden action of the elements, pandemic, fire, explosion, flood, earthquake, storms, drought, landslide, or explosion or nuclear emergency, this Agreement shall remain in effect but the affected Party's obligations shall be suspended for a period equal to the disabling circumstances, provided that:

(i) the non-performing Party gives the other Party prompt written notice describing the particulars of the Force Majeure, including but not limited to the nature of the occurrence and its expected duration, and continues to furnish timely regular reports with respect thereto during the period of Force Majeure;

(ii) the suspension of performance is of no greater scope and of no longer duration than is required by the Force Majeure;

(iii) no obligations of either Party that arose before the Force Majeure causing the suspension of performance are excused as a result of the Force Majeure;

(iv) the non-performing Party uses reasonable efforts to remedy its inability to perform; and

(v) the Term of this Agreement, at ESCO's option, shall be extended for a period

equal to the number of days that the Force Majeure prevented the non-performing Party from performing.

(b) Any decision by Client to close or change the use of the facilities or ECMs at the Property shall not constitute a Force Majeure excusing Client's performance under this Agreement unless the decision was the result of a Force Majeure event.

SECTION 24 CONTRACT DOCUMENTS

(a) Upon execution of this Agreement by both Parties, this Agreement and its Attachments will constitute the entire Agreement between the Parties relating to the subject matter hereof, and supersedes all proposals, previous agreements, discussions, correspondences, and all other communications, whether oral or written, between the Parties relating to the subject matter of this Agreement.

(b) Headings are for the convenience of reference only and are not to be construed as a part of the Agreement.

(c) This Agreement may not be modified or amended except in writing signed by the Parties.

(d) This Agreement may be executed simultaneously in two (2) or more counterparts, each of which shall be deemed an original but all of which together shall constitute one and the same instrument.

SECTION 25 NOTICES

All notices and other communication under this Agreement (other than regularly scheduled payments) shall be deemed properly given upon receipt if delivered in person or sent by electronic facsimile with regular mail follow-up or sent by overnight delivery service or sent by registered mail, return receipt requested and postage prepaid, addressed as follows:

To: Client
Port Washington Union Free School District
100 Campus Drive
Port Washington, NY 11050
Attention: Kathleen Manuel

With a copy to:

Bond, Schoeneck & King PLLC
225 Old Country Road
Melville, New York 11747-2719

To ESCO:
RENU Energy Solutions
20 35th Street
Copiague, NY 11726
Attention: Robert Ragozine

Either Party may change such address from time to time by written notice to the other Party.

SECTION 26 RECORDS

ESCO shall establish and maintain complete and accurate books, records, documents and other evidence (Records) directly pertinent to performance under this Agreement. The Records shall be kept for the balance of the calendar year in which they were made and for six (6) years after final payment. The State Comptroller, the Attorney General, the Commissioner of Education, and any other person or entity authorized to conduct an examination, as well as the agency or agencies involved in this contract, shall have access to

the Records during normal business hours at an office of the ESCO within the State of New York or, if no such office is available, at a mutually agreeable and reasonable venue within the State, for the term specified above for the purposes of inspection, auditing and copying.

ESCO will provide services and maintain records, logs and reports in accordance with all applicable laws, regulations and requirements of NYSED and the New York State Department of Labor in force during the term of this Agreement. ESCO must provide Client with a copy of any reports, tests, evaluations or observations that are prepared in connection with the Agreement. The Client will have the right to examine any or all records or accounts maintained by ESCO in connection with the Agreement.

SECTION 27 REPRESENTATIONS AND WARRANTIES

Each Party warrants and represents to the other that:

(a) It has all requisite power, authority, licenses, permits, and franchises, corporate or otherwise, to execute and deliver this Agreement and perform its obligations hereunder, subject to the approval of the Commissioner of Education;

(b) Its execution, delivery, and performance of this Agreement have been duly authorized by, or are in accordance with, as to ESCO, its organic instruments and, as to Client, by all requisite municipal, board, or other action and are not in breach of any applicable law, code or regulation; this Agreement has been duly executed and delivered by the signatories so authorized, and constitutes each Party's legal, valid and binding obligation;

(c) Its execution, delivery, and performance of this Agreement shall not result in a breach or violation of, or constitute a default under, any agreement, lease or instrument to which it is a party or by which it or its properties may be bound or affected; and

(d) It has not received any notice, nor to the best of its knowledge is there pending or threatened any notice of any violation of any applicable laws, ordinances, regulations, rules, decrees, awards, permits or orders which would materially adversely affect its ability to perform hereunder.

(e) The persons executing this Agreement are fully authorized by law to do so.

SECTION 28 INDEPENDENT CONTRACTOR

ESCO is engaged by Client only for the purpose and to the extent set forth in this Agreement and its relation to Client shall, during the period of the engagement and service hereunder, be that of an independent contractor. ESCO shall not be considered under this provision of the Agreement, or otherwise, as having an employee status or as being entitled to participate in any plans, arrangements or collective bargaining agreements by Client pertaining to, or in connection with any salary, term or condition of employment, health insurance, workers compensation insurance, unemployment insurance or similar benefits as provided for regular employees.

Nothing in this Section shall be deemed to be a waiver of the Client of the right to use its property. Client and ESCO are independent of one another and shall have no other relationship relating to or arising out of this Agreement. Neither Party shall have or hold itself out as having the right or authority to bind or create liability for the other by its intentional or negligent act or omission, or to make any contract or otherwise assume any obligation or responsibility in the name of or on behalf of the other Party.

It is understood and agreed that ESCO, its employees, agents, subcontractors and employees of such agents and subcontractors, shall adhere to Client’s policies with respect to conduct on Client property as well as any and all federal, state, and local laws, rules, ordinances, Client policies and procedures applicable to construction projects on Client premises.

SECTION 29 ADDITIONAL REPRESENTATIONS AND WARRANTIES OF CLIENT

Client hereby warrants and represents to ESCO that:

(a) Client presently intends to continue to use the Property in a manner reasonably similar to its present use, and will properly maintain all equipment and building systems in accordance with the manufacturer's specifications;

(b) Client does not presently contemplate any changes to the electrical and thermal consumption characteristics of the Property as these existed during the base period except as may have been disclosed to ESCO by Client in writing prior to the execution of this Agreement, or those changes deemed necessary as a result of ESCO's discovery of concealed or unknown physical conditions while performing its Work hereunder at the Property;

(c) Client has provided, and will continue to provide ESCO with all records heretofore requested by ESCO and, in that regard, ESCO acknowledges that it has received base period data from Client which appears to be complete as of the date of this Agreement, and that the information set forth therein is, and all information in other records to be subsequently provided pursuant to this Agreement shall be, true and accurate in all material respects except as may be disclosed by Client in writing;

(d) Client has not entered into any contracts or agreements for the Property with persons or entities other than ESCO regarding the provision of the energy services referenced herein.

(e) Any material change in population or other design parameter that materially impacts consumption will be disclosed to ESCO within thirty (30) business days. The impact on energy savings calculations will be mutually agreed upon by ESCO and Client at the time a change is determined.

(f) In the event of renovations or construction at any Facility listed in this Agreement, Client agrees to provide and install sub-metering equipment to enable calculations to allow ESCO to adjust the Savings Guarantee.

SECTION 30 ABSENCE OF FRAUD OR COLLUSION

In accordance with Section 139-d of the State Finance Law and/or Section 103 of the General Municipal Law, if this agreement was awarded based upon the submission of bids, ESCO warrants, by its execution of this Agreement, that no official or employee of Client has any pecuniary interest in this Agreement or in the expected profits to arise here from, and that this Agreement is made in good faith without fraud or collusion with any other person involved in the bidding process.

SECTION 31 NEGLIGENT/WRONGFUL ACTS

Intentionally Omitted.

SECTION 32 FURTHER DOCUMENTS AND EVENTS

The Parties shall execute and deliver all documents and perform all further acts that may be reasonably necessary to effectuate the provisions of this Agreement, in that regard, it being understood and agreed that ESCO covenants and agrees to execute or procure the execution of all documents reasonably required to release any lien held by ESCO or its assignees upon the termination of this Agreement and payment of all amounts required to be paid by Client to ESCO, pursuant to this Agreement, including but not limited to the Termination Value, if any. It being further agreed and understood that Client agrees to execute all documents which may be reasonably required by an entity which provides funds for any financing contemplated herein and to cooperate with ESCO in obtaining such funds.

It is further understood that Client agrees to execute all documents which may be reasonably required

to obtain all licenses, permits and governmental approvals required by ESCO for installation and operation of the ECMs. ESCO's obligations hereunder are also subject to obtaining any such licenses, permits and governmental approvals.

SECTION 33 NON-APPROPRIATION

Pursuant to NYS Energy Law § 9-103, this Agreement shall be deemed executory only to the extent of the monies appropriated and available for the purpose of the Agreement, and no liability on account therefore shall be incurred beyond the amount of such monies. It is understood that neither this Agreement nor any representation by any public employee or officer creates any legal or moral obligation to request, appropriate or make available monies for the purpose of the Agreement.

SECTION 34 THIRD-PARTY BENEFICIARIES

Except as may be specifically provided for in this Agreement, the Parties hereto do not intend to create any rights for, or grant any remedies to, any third-party beneficiary of this Agreement.

SECTION 35 NOTIFICATIONS OF GOVERNMENTAL ACTION - OCCUPATIONAL SAFETY AND HEALTH

The Parties agree to notify each other as promptly as is reasonably possible upon becoming aware of an inspection under, or any alleged violation of, the Occupational Safety and Health Act or any other provision of Federal, State or Local law, relating in any way to the undertakings of either Party under this Agreement.

SECTION 36 REFERENCES

Unless otherwise stated all references to a particular Attachment or to Attachments herein are to the referenced Attachment or Attachments which are attached to this Agreement and all such referenced Attachments are incorporated by reference within this Agreement. All references herein to a Section shall refer to a Section of this Agreement unless this Agreement specifically provides otherwise.

SECTION 37 APPROVAL

ESCO and Client acknowledge that this Agreement is subject to 8 NYCRR 155.20 and, as such, requires the approval of the Commissioner of Education of the State of New York. This Agreement shall not executory until NYSED approval is obtained. In addition, this Agreement shall not be executory until Client has secured state aid at the current projected level and has secured project financing, with the terms and conditions of financing and/or other means of payment acceptable to the Client in its sole discretion. In the event approval of said financing or other means of payment has not been secured by the Client within one (1) year after NYSED approval, and Client has made good faith efforts to security financing, then this Agreement will terminate with no further obligation of Client to ESCO or any other party, unless the parties agree to the extend the Agreement in writing. Upon obtaining project financing, Client shall issue a Notice to Proceed to ESCO. Prior to NYSED approval, it shall be ESCO's sole responsibility to validate each ECM with Client and gain their final approval of the savings numbers as outlined herein. ESCO shall forward a copy of the specifications to Client's attorney for review and approval prior to sending to NYSED.

Notwithstanding the above, should any portion of this agreement fail to be approved by NYSED, or, if the Scope of Work contained in this agreement is not approved by NYSED in its entirety, Client may, at its sole discretion, elect to terminate this agreement. ESCO shall have no remedy at law or in equity for such termination.

SECTION 38 IRAN DIVESTMENT ACT OF 2012

By signing this Agreement, each person and each person signing on behalf of any other party certifies, and in the case of a joint bid or partnership each party thereto certifies as to its/his/her own

organization, under penalty of perjury, that to the best of its/his/her knowledge and belief that each person is not on the list created pursuant New York State Finance Law § 165-a(3)(b).

IN WITNESS WHEREOF, the duly authorized officers or representatives of the Parties have set their hand on the date first written above with the intent to be legally bound.

Port Washington UFSD

Signature

Adam Smith, President, Board of Education
Print Name and Title

10/22/2024
Date

RENU Energy Solutions

Signature

ROBERT RAGOZINE, VP ENERGY SOLUTIONS
Print Name and Title

10/24/24
Date

ATTACHMENTS

ATTACHMENT A - PROPERTY DESCRIPTION

ATTACHMENT B - SCOPE OF SERVICES

ATTACHMENT C – FINANCING DOCUMENTS

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ATTACHMENT M - FORM OF CLIENT'S APPROVAL OF SAMPLE OR SPECIFICATIONS

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ATTACHMENT O - SCHEDULE OF VALUES AND APPLICATION FOR PAYMENT

ATTACHMENT P - FINAL WAIVER OF LIEN FORMS

ATTACHMENT A

PROPERTY DESCRIPTION

Table A.1 Properties

Building Name	Address
Paul D. Schreiber High School	101 Campus Drive, Port Washington, NY 11050
Carrie P. Weber Middle School	52 Campus Drive, Port Washington, NY 11050
Administration Building	100 Campus Drive, Port Washington, NY 11050
John Philip Sousa Elementary School	101 Sands Point Road, Port Washington, NY 11050
Guggenheim Elementary School	38 Poplar Place, Port Washington, NY 11050
South Salem Elementary School	10 Newbury Road, Port Washington, NY 11050
John J. Daly Elementary School	36 Rockwood Avenue, Port Washington, NY 11050
Administrative Annex	90 Avenue C, Port Washington, NY 11050
Manorhaven Elementary School	12 Morewood Oaks, Port Washington, NY 11050

ATTACHMENT B

SCOPE OF SERVICES

DESCRIPTION OF THE ENERGY CONSERVATION MEASURES
AND THE EQUIPMENT

Table B.1 summarizes the ECMs to be included in this project.

Table B.1 ECM Summary

ECM #	ECM
1	LED Lighting Upgrades and Controls
2	Solar Rooftop
3	Pipe and Valve Insulation
4	Plug Load Controls
5	Building Envelope Improvements
6	Ceiling Replacements and Lighting
7	Condensate Pump Skid

ECM 1: New LED Lighting and Lighting Controls

Below is a summary of the buildings receiving new LED lighting upgrades.

School Name	Lighting
Paul D. Schreiber H.S.	X
Carrie P. Weber M.S.	X
Administration Building	X
John Philip Sousa E.S.	X
Guggenheim E.S.	X
South Salem E.S.	X
John J. Daly E.S.	X
Manorhaven E.S.	-

Scope of Work:

This ECM involves the replacement of non-LED fixtures with new LED lighting to conserve energy and improve the quality of the lighting. The detail of the areas being affected by this ECM are in the Line by Line Spreadsheet (LXL) in the CEA in Attachment L.

ECM 2: Solar Rooftop

Below is a summary of the buildings receiving new solar rooftop systems.

Location	Module Quantity	Size in kW (DC)	Est. Annual kWh Production
Paul D. Schreiber H.S.	1,322	641.2	815,008
Carrie P. Weber M.S.	-	-	-
Administration Building	-	-	-
John Philip Sousa E.S.	663	321.6	414,393
Guggenheim E.S.	805	397.8	497,698
South Salem E.S.	418	202.7	264,938
John J. Daly E.S.	311	150.8	197,253
Manorhaven E.S.	525	254.6	328,052
Total	**4,044**	**1,968.7**	**2,517,343**

Scope of Work:

Schreiber High School
-Install (1,322) Hanwha Q Peak DUO XL Solar Panels
-Install (17) Sunny Tri-Power DC-AC Inverters
-Furnish and Install Rooftop Solar as per Helioscope design included in the CEA.

Sousa Elementary School
-Install (663) Hanwha Q Peak DUO XL Solar Panels
-Install (7) Sunny Tri-Power DC-AC Inverters
-Furnish and Install Rooftop Solar as per Helioscope design included in the CEA.

Guggenheim Elementary School
-Install (805) Hanwha Q Peak DUO XL Solar Panels
-Install (7) Sunny Tri-Power DC-AC Inverters
-Furnish and Install Rooftop Solar as per Helioscope design included in the CEA.

South Salem Elementary School
-Install (418) Hanwha Q Peak DUO XL Solar Panels
-Install (4) Sunny Tri-Power DC-AC Inverters
-Furnish and Install Rooftop Solar as per Helioscope design included in the CEA.

Daly Elementary School
-Install (311) Hanwha Q Peak DUO XL Solar Panels
-Install (2) Sunny Tri-Power DC-AC Inverters
-Furnish and Install Rooftop Solar as per Helioscope design included in the CEA.

Manorhaven Elementary School
-Install (525) Hanwha Q Peak DUO XL Solar Panels
-Install (6) Sunny Tri-Power DC-AC Inverters
-Furnish and Install Rooftop Solar as per Helioscope design included in the CEA.

- All wiring to meet the requirements of the 2020 National Electrical Code.
- Solar modules to be Bankable Quality 480 or higher
- Inverter(s) to be Bankable Quality 480/208 volt Inverters
- Install web-based Monitoring System/ Internet services are by other
- Furnish and install As-Built drawings
- Inverter 10-year Manufacturer’s warranty
- 1-year parts and labor warranty.
- 1-year Maintenance program.
- Port Washington to provide 2 IP addresses at each location for remote monitoring
- PSEGLI Coordination
- Commissioning of system and start up report upon close out
- Restoration of areas disturbed by this contract
- Underwriters Certificate
- Provide P.E. stamp rooftop ballast calculations.
- Provide P.E. stamp interconnection electrical design and NYSED Submission.
- PSEG interconnection application filings
- Roofing Slip Sheets for Solar Racking System only
- Solar Racking engineering drawings PE Stamped.
- Rapid Shut Down Device or 3307 UL Certification
- Tree pruning.
- CESIR Study fee, if necessary.

Exclusions:
- Roofing structural certification of capacity for additional load.
- Roofing warranty requirements other than slip sheets.
- Electrical building incoming service upgrades.

ECM 3: Pipe and Valve Insulation

Below is a summary of the building receiving new pipe and valve insulation.

School Name	Pipe and Valve Insulation
Paul D. Schreiber H.S.	-
Carrie P. Weber M.S.	X
Administration Building	-
John Philip Sousa E.S.	-
Guggenheim E.S.	-
South Salem E.S.	-
John J. Daly E.S.	-
Manorhaven E.S.	-

Scope of Work:

Install Pipe & Valve Insulation on both the Hot Water and Domestic Hot Water piping in the Weber Middle School Cafeteria. A total of (1,749) linear feet of mineral fiber insulation will be installed in the space shown in chart below.

Building & Location	System	Insulation Sizing	Insulation Material	Footage
Weber Middle School - Café	Hot Water	3/4" x 1 1/2"	Mineral Fiber	42'
Weber Middle School - Café	Hot Water	1"x 1 1/2"	Mineral Fiber	252'
Weber Middle School - Café	Hot Water	1 1/4" x 1 1/2"	Mineral Fiber	84'
Weber Middle School - Café	Hot Water	1 1/2" x 1 1/2"	Mineral Fiber	75'
Weber Middle School - Café	Hot Water	2" x 2"	Mineral Fiber	261'
Weber Middle School - Café	Hot Water	2 1/2" x 2"	Mineral Fiber	45'
Weber Middle School - Café	Hot Water	3" x 2"	Mineral Fiber	201'
Weber Middle School - Café	Domestic Hot Water	3/4" x 1"	Mineral Fiber	90'
Weber Middle School - Café	Domestic Hot Water	1" x 1"	Mineral Fiber	90'
Weber Middle School - Café	Domestic Hot Water	1 1/4" x 1"	Mineral Fiber	165'
Weber Middle School - Café	Domestic Hot Water	2" x 1"	Mineral Fiber	204'
Weber Middle School - Café	Domestic Hot Water	2 1/2" x 1"	Mineral Fiber	165'
Weber Middle School - Café	Domestic Hot Water	3" x 1"	Mineral Fiber	75'

ECM 4: Plug Load Controls

Below is a summary of the buildings receiving new plug load controllers and the number of pieces of equipment being controlled.

School Name	Plug Load Controllers
Paul D. Schreiber H.S.	154
Carrie P. Weber M.S.	176
Administration Building	9
John Philip Sousa E.S.	79
Guggenheim E.S.	91
South Salem E.S.	43
John J. Daly E.S.	67
Manorhaven E.S.	97
Total	**716**

Scope of Work:

Install plug load controls on (716) electronic devices across eight buildings throughout the district, such as projectors, printers, and copiers. The plug load controls will be installed to automatically turn off electronic devices or put them in standby mode. The details of plug load controller installation locations are referenced in the CEA in Attachment L.

ECM 5: Building Envelope Improvements

Below is a summary of the buildings receiving building envelope improvements and the pieces of equipment being improved.

PORT WASHINGTON UFSD, NY
BUILDING ENVELOPE WORK SUMMARY

Task	Admin Building 1	Admin Building 2	Daly ES	Guggenheim ES	Manorhaven ES	Schreiber HS	Sousa ES	South Salem ES	Weber MS	Total Quantity
Building Envelope Improvement										
Buck Frame Air Sealing (LF)			145	23						168
Door - Install Jamb Spacer (Units)			1					9		10
Door Weather Striping - Doubles (Units)	1		14	22	15	25	7	13	23	120
Door Weather Stripping - Singles (Units)	3	1	2	2	3	18	8	3	15	55
Overhang Air Sealing (LF)								428		428
Overhang Air Sealing (SF)							63	10		73
Overhead Door Weather Stripping (Units)		2		1		1				4
Roll-Up Door Weather Stripping (Units)	3					2	1			6
Roof-Wall Intersection Air Sealing (LF)	109		566	751	496	650	1,330			3,902

Scope of Work:

1. Supply and install weather stripping around doors and attic access hatches.
2. Provide tenting over attic pipes to bring pipes into thermal envelope of attic.
3. Supply and install flat insulation in attics at South Salem Elementary and Weber Middle School on under-insulated surfaces.
4. Seal buck frame area at Daly and Guggenheim Elementary Schools.
5. Seal overhang areas that extend over exterior walls Sousa and South Salem Elementary Schools.
6. Remove existing weather stripping and replace with commercial-grade weather stripping on overhead and/or roll-up doors at Schreiber High School, Guggenheim & Sousa Elementary Schools, and the Administration building.
7. Seal roof-wall intersections to prevent air infiltration at Schreiber High School, Daly, Guggenheim, Manorhaven, and Sousa Elementary Schools, and the Administration building.
8. Details of the Building Envelope Improvements are referenced in the CEA in Attachment L.

ECM 6: Ceiling Replacements and Lighting

Below is a summary of the buildings and areas receiving new ceilings and lighting.

School Name	Ceiling Replacement
Paul D. Schreiber H.S.	-
Carrie P. Weber M.S.	-
Administration Building	X
John Philip Sousa E.S.	X
Guggenheim E.S.	-
South Salem E.S.	-
John J. Daly E.S.	-
Manorhaven E.S.	X

Scope of Work:

This measure includes upgrading ceilings throughout Manorhaven and Sousa Elementary corridors. The Administration building will get its existing ceilings replaced throughout the space. ESCO will be removing existing non-plaster ceilings and installing new 2x2 drop ceilings to give the spaces highlighted above with a fresh and modern look. Included will be the supply and installation of new 2x2 recessed LED lights. The details of new ceiling replacement installation locations are referenced in the CEA in Attachment L.

1. Removal of existing drop ceilings and light fixtures.
2. Temporary removal of existing alarms, speakers, etc.
3. Provide temporary lighting during construction.
4. Furnish & Install New 2x2 Maxlite 16W LED recessed light fixtures.
5. Install New 2x2 drop ceiling CertainTeed HHF-457 HNRC with reinstallation of existing alarms, speakers, and low voltage devices.

ECM 7: Condensate Pump Skid

Below is a summary of the building where the condensate pump and tanks will be replaced.

School Name	Condensate Pump Skid
Paul D. Schreiber H.S.	X
Carrie P. Weber M.S.	-
Administration Building	-
John Philip Sousa E.S.	-
Guggenheim E.S.	-
South Salem E.S.	-
John J. Daly E.S.	-
Manorhaven E.S.	-

Scope of Work:

This measure includes replacing the condensate return system located in the Schreiber High School boiler room.

1. Removal of existing tank and pumps.
2. Install new SHIPCO Duplex Stainless Steel vacuum condensate tank.
3. Provide startup and commissioning of new tank.

ATTACHMENT C

FINANCING DOCUMENTS

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ATTACHMENT D

NOTICE TO PROCEED

Robert Ragozine
RENU Energy Solutions
20 35th Street
Copiague, NY 11726

Subject: Notice to Proceed

Dear Mr. Ragozine:

In accordance with Section 1(a) of the Energy Services Agreement by and between Port Washington Union Free School District ("Client") and RENU Contracting & Restoration, Inc. D/B/A/ RENU Energy Solutions ("ESCO")dated __ _____, 2024, the Client hereby submits to ESCO this **Notice to Proceed** in relation to the Scope of Services defined in the aforementioned Agreement, for Client, dated _ _____, 2024.

Sincerely,

PORT WASHINGTON UFSD

_____ Date:_____
Signature

_____
Print Name and Title

ATTACHMENT E-1

DELIVERY AND ACCEPTANCE CERTIFICATE UPON SUBSTANTIAL COMPLETION

Port Washington Union Free School District ("Client") hereby acknowledges the Work required for the Energy Efficiency Measure (the "ECMs") described in the applicable Attachment B to the Energy Services Agreement between Client and RENU Contracting & Restoration, Inc. D/B/A/ RENU Energy Solutions ("ESCO") is substantially complete. The punch list items set forth on the attached punch list must be completed by ESCO within thirty (30) calendar days of its receipt of this certificate, unless otherwise agreed to by the parties in writing.

Substantial Completion Date:

ECM:

Date Accepted by Client: _____

Accepted By: **Port Washington UFSD**

_____
Signature

_____
Name and Title

Accepted By: **John A Grillo Architects**

_____
Signature and Date

_____
Name and Title

Accepted By: **RENU Energy Solutions**

_____
Signature

_____
Name and Title

Note: ECMs to which this Delivery and Acceptance Certificate relates is attached hereto as Schedule E-1.

ATTACHMENT E-2

FINAL DELIVERY AND ACCEPTANCE CERTIFICATE
FINAL ACCEPTANCE OF PROJECT

Port Washinton Union Free School District ("Client") hereby acknowledges Final Acceptance of all Work described in Attachment B to the Energy Services Agreement (the "Agreement") between Client and RENU Contracting & Restoration, Inc. D/B/A/ RENU Energy Solutions ("ESCO"). The date of Final Acceptance is the date certified by the Client and Client's architect that the Work has been installed, functionally tested and is in accordance with the Contract Documents, so that the Client has possession of the Work and can use it for its intended use. Client hereby accepts the ECMs listed hereto after full inspection thereof as satisfactory for all purposes of the Agreement. Client agrees to make the required payment(s) to ESCO as set forth in Section 4 and Attachment G of the Agreement.

Date Accepted by Client:_____

Amount Certified by Client:_____

Accepted By: **Port Washington UFSD**

_____
Signature

_____
Name and Title

Accepted By: **John A Grillo Architects**

_____
Signature and Date

_____
Name and Title

Accepted By: **RENU Energy Solutions**

_____
Signature

_____
Name and Title

Note: ECMs to which this Delivery and Acceptance Certificate relates is attached hereto.

ATTACHMENT F

GUARANTEE OF ENERGY COST SAVINGS

1. DEFINITIONS

When used in this Agreement, the following capitalized words shall have the meaning ascribed to them below:

"Baseline Period" is the period of time that defines the Baseline Usage and is representative of the facilities operations, consumption, and usage that is used as the benchmark for determining cost avoidance.

"Baseline Usage" is the calculated energy usage of the Facilities prior to the implementation of the ECMs.

"Baseline Demand" is the calculated energy demand of a piece of equipment or a site prior to the implementation of the ECMs. Baseline physical conditions, such as equipment counts, nameplate data, and control strategies, will typically be determined through building occupancy, energy end-use survey and plug load surveys of the Facilities.

"Cumulation of Savings." The Guaranteed Savings in each Guarantee Period are considered satisfied if the Savings for such Guarantee Period equals or exceeds the Guaranteed Savings for such Guarantee Period.

"Energy and Operational Cost Avoidance Guarantee Practices" are those practices identified in The Schedule of Savings, intended to achieve avoided costs in energy and/or operating expenses.

"Energy Costs" may include the cost of electricity and fuels to operate HVAC equipment, cogeneration system, facility mechanical and lighting systems, and energy management systems, and the cost of water and sewer usage, as applicable.

"ECM" the Energy Conservation Measure (ECM) is the installation of equipment or systems, or modification of equipment or systems as described in Attachment B.

"Excess Savings" is energy savings in excess of the Guaranteed Savings.

"Facilities" shall mean those described in Attachment A.

"First Guarantee Period" is defined as the period beginning on the first (1st) day of the month following the date of full execution of the Final Delivery and Acceptance Certificate (Attachment E-2) and ending on the day prior to the first (1st) twelve-month anniversary thereof.

"Guarantee Period" is defined as the First Guarantee Period and each of the successive twelve (12) month periods commencing on the anniversary of the commencement of the First Guarantee Period throughout the entire Guarantee Term of this Agreement.

"Guaranteed Savings" is defined as the amount of avoided Energy and Operational Costs guaranteed to the Client in each Guarantee Period. Savings will be determined in accordance with the methodology(s), operating parameters, formulas, and constants as described below and/or defined in the Measurement & Verification Plan and/or additional methodologies defined by ESCO that may be negotiated with Client at any time. Actual savings reduction in utility bills may vary for reasons outside of ESCO's control including but not limited to: changes in energy and other utility rates and tariffs, changes in Client operating schedules and usage patterns, changes in Client loads due to addition or reductions in energy and water consuming devices, changes in weather, impacts due to the operations of ECMs, impacts due to the maintenance of ECMs maintained by Client, and additions to and/or reduction in facility space usage. For the purposes of calculating any shortfalls or excesses of Verified Savings versus Guaranteed Savings, the Measurement & Verification Plan will be utilized.

"Guaranteed Savings Report" is defined as the process and report for determining the Verified Savings in each Guarantee Period and reconciling it to the Guaranteed Savings in the same Guarantee Period.

"IPMVP" shall mean the International Performance Measurement and Verification Protocol and its Measurement and Verification Guidelines for energy savings performance contract projects. The IPMVP guidelines classify measurement & verification approaches as Option A, Option B, Option C, and Option D.

"Measurement and Verification Plan" (M&V Plan) is defined as the plan providing details on how the Guarantee Savings will be verified.

"Operational Costs" shall include the cost of operating and maintaining the Facilities, such as, but not limited to, the cost of inside and outside labor to repair and maintain Covered Systems and Equipment, the cost of custodial supplies, the cost of replacement parts, the cost of deferred maintenance, the cost of lamp and ballast disposal, and the cost of new capital equipment as defined for each ECM in Section 4, Schedule of Values.

"Savings During Construction" is defined as the energy and operational savings that are realized during the construction of the Work, and prior to Substantial Completion of the Project. Savings during construction accrue to the benefit of the Client and may not be applied to any Savings Shortfalls.

"Savings Shortfalls" is defined as the Savings in any Guarantee Period that is less than the Guaranteed Savings required for that Guarantee Period. ESCO shall, at Client's option, either compensate Client the amount of any such shortfall, limited by the value of the guarantee, or provide to Client additional products or services within thirty (30) calendar days. Resulting compensation shall be ESCO's sole liability for any shortfall in the Guaranteed Savings.

"Substantial Completion" is the stage in the progress of the Work when the designated portion of the Work is sufficiently complete in accordance with the Agreement.

"Term" shall commence on the on the first (1st) day of the month following the date of full execution of the Final Delivery and Acceptance Certificate (Attachment E-2) and shall terminate at the end of 18 years unless terminated earlier as provided for herein.

"Termination Value" refers to the amount specified in Attachment C.

"Verified Savings" is defined as the summation of avoided Energy and Operational Costs as determined by the Measurement & Verification Plan for the Facilities in each Guarantee Period as a result of the ECMs provided by ESCO.

2. SAVINGS DOCUMENTATION

2.1 Savings Documentation. ESCO will provide Client with a Guarantee Savings Report after each Guarantee Period within sixty (60) calendar days. Client will assist ESCO in generating the savings report by providing ESCO with access to relevant records relating to such Energy and Operating Costs. Client will also assist ESCO by permitting access to any energy billing information, maintenance records, drawings, or other data deemed necessary by ESCO to generate the said report. Data and calculations utilized by ESCO in the preparation of its Guaranteed Savings Report will be made available to Client, along with such explanations and clarifications as Client may reasonably request.

2.2 Acceptance of Guaranteed Savings Report. At the end of each Guarantee Period, Client will have forty-five (45) calendar days to review the Guaranteed Savings Report and provide written notice to ESCO of non-acceptance of the Guaranteed Savings Report for that Guarantee Year. Failure to provide written notice within forty-five (45) calendar days of the receipt of the Guarantee Savings Report shall constitute the deemed acceptance of the Report and its findings by the Client.

2.3 Activities and Events Adversely Impacting Savings. Client must promptly notify ESCO of any activities known to Client, which adversely impacts ESCO's ability to realize the Guaranteed Savings and ESCO shall be

entitled to reduce the Guaranteed Savings by the amount of any such adverse impact to the extent that such adverse impact is beyond ESCO's reasonable control.

2.4 Guarantee Adjustment. ESCO's Guaranteed Savings obligations under this Agreement are contingent upon: (1) Client following the operations and maintenance requirements for the ECMs in accordance with the Agreement; (2) no material alterations or additions being made by the Client without prior notice and written agreement of the Parties unless otherwise permitted by this Agreement; (3) Client sending all current utility bills to ESCO within thirty (30) calendar days after receipt of written demand by ESCO; and (4) ESCO'S ability to render services not being impaired by circumstances beyond its control. To the extent that the Client defaults or fails to perform fully any of its obligations under this Agreement, ESCO may, subject to the Client's agreement, adjust the Guaranteed Savings obligation; provided, however, that no adjustment hereunder shall be effective unless ESCO has first provided the Client with written notice of Client's default(s) or failure(s) to perform and Client has failed to cure its default(s) and failure(s) to perform within thirty (30) calendar days after receipt of such notice.

In addition, if any Facility or portion of a Facility is closed or its use is suspended or discontinued, the Guaranteed Savings associated with the ECMs for that Facility shall be considered to be achieved, and the Guaranteed Savings for the Project will be adjusted accordingly.

2.5 Guaranteed Savings and M&V Services. If the Guaranteed Savings are achieved during the last year of the term of the M&V Services, it shall be assumed that the Guaranteed Savings will be achieved during the remaining term of the Agreement. If there is a Savings Shortfall in any year, ESCO shall, at Client's option and agreement, either compensate Client the amount of any such shortfall, limited by the value of the guarantee, or provide to Client additional products or services within thirty (30) calendar days.

If the Guaranteed Savings are achieved during the last year of the term of the M&V Services, it shall be assumed that the Guaranteed Savings will be achieved during the remainder of the term of the Agreement. The term of the M&V Services shall be five (5) years from the date of Substantial Completion.

If there is a Savings Shortfall during the last year of the term of M&V Services, the Client shall allow ESCO access to the Facilities to conduct repairs or make adjustments to the equipment as necessary to resolve the cause of the Savings Shortfall. If, after ESCO has had a reasonable opportunity to make repairs or adjustments as may be necessary, there is still a Savings Shortfall, then ESCO must pay the amount of the Shortfall to the Client during each year of the remainder of the Guarantee Term in annual installments.

2.6 Excess Savings. Excess Savings shall be carried forward in any year of the term of M&V services, except the last year of the term of M&V services and will be applied to any Savings Shortfall that exists in any year of the term of M&V services, except the last year of the term of M&V services. If, during the last year of the term of M&V services, there are any Excess Savings that exist from prior years, those Excess Savings will not be applied to any Savings Shortfall that exists, will not be carried forward and will accrue to the benefit of the Client.

3. GUARANTEED SAVINGS SUMMARY

The following tables list the amount of Guaranteed Savings resulting from the ECMs to be installed by ESCO, including the annual escalation rates indicated in the RFP and shown in Tabled F.5.

Table F.1. Guaranteed Savings by ECM

ECM	Electric (kWh)	Electric Demand (kW)	Natural Gas (Therms)	Guaranteed Energy Savings Year 0
1 – LED Lighting Upgrade	90,345	27.1	0	$17,614
2 – Solar Rooftop	2,517,342	0	0	$394,454
3 – Pipe and Valve Insulation	0	0	1,548	$1,788
4 – Plug Load Controls	90,303	0	0	$14,271
5 - Building Envelope Improvements	26,730	0	15,543	$22,169
6 – Ceiling Replacements	0	0	0	0
7 – Condensate Pump Skid	0	0	0	0
Total	**2,724,720**	**27.1**	**17,091**	**$450,296**

Table F.2 Guaranteed Savings by Year

Year	Cost Savings
1	$461,553
2	$473,091
3	$484,919
4	$497,042
5	$509,468
6	$522,204
7	$535,259
8	$548,641
9	$562,357
10	$576,416
11	$590,826
12	$605,597
13	$620,737
14	$636,255
15	$652,162
16	$668,466
17	$685,177
18	$702,307
Total	**$10,332,477**

Table F.3. Energy Savings per Building

Building	Electric Total $ Savings	Natural Gas Total $ Savings
Schreiber High School	$131,615	$2,993
Weber Middle School	$23,483	$3,180
Administration Building	$369	$942
Sousa Elementary	$64,255	$4,202
Guggenheim Elementary	$74,542	$2,992
Salem Elementary	$47,667	$1,789
Daly Elementary	$37,434	$1,599
Manorhaven Elementary	$51,199	$2,035
District Wide	**$430,564**	**$19,732**

4. Baseline Electrical and Natural Gas Usage Data and Rates

The base utility rates used for calculating annual cost savings are presented in Table F.4. These rates will be escalated annually utilizing the rates indicated in Table F.5 and applied to the ECM savings at each facility to determine annual cost savings for each guarantee period. The escalated utility rates will be compared to actual utility rates during each year of the Guarantee Period, and the higher of the floor values or the actual utility rates in effect will be used to determine the Guaranteed Savings. Utility bills analyzed during periods February 2022 – February 2023 for Electric and March 2022 – March 2023 for Natural Gas.

Table F.4 Baseline Electrical and Natural Gas Usage Table

Building	Dem and kW	kW Cost	Electrical kWh Usage	Unblended kWh Cost	Total Electric Cost	Gas Usage Therms	Total Gas Cost	Cost/ Therm
Schreiber High School	7,412	$72,398	1,621,800	$0.161	$261,780	129,179	$149,149	$1.15
Weber Middle School	6,433	$62,836	1,407,600	$0.161	$227,205	104,940	$123,369	$1.18
Administration Building	140	$1,366	30,600	$0.161	$4,939	6,528	$11,230	$1.72
Sousa Elementary	2,183	$20,953	361,600	$0.186	$67,413	41,581	$51,158	$1.23
Guggenheim Elementary	2,505	$28,487	442,249	$0.176	$77,625	40,356	$49,808	$1.23
Salem Elementary	1,646	$21,362	393,900	$0.176	$69,234	30,771	$40,359	$1.31
Daly Elementary	2,755	$30,593	512,640	$0.172	$87,997	34,089	$43,605	$1.28
Manorhaven Elementary	1,140	$23,359	338,960	$0.159	$53,731	26,098	$33,884	$1.30
District Wide	**24,214**	**$261,353**	**5,109,349**	**$0.166**	**$849,925**	**413,542**	**$502,563**	**$1.22**

4.1 **Annual Utility Rate Escalation Rate.** The following table shows annual escalation of the utility rates to be used for calculating energy cost savings. The utility rates will increase by the following percentages each year over the rates in the prior year beginning in Year 1.

Table F.5 Annual Escalation

Utility	Electricity $/kWh	Natural Gas $/Therm
Annual	**2.5%**	**2.5%**

5. MEASUREMENT AND VERIFICATION SERVICES

5.1 ESCO and the Client agree that the Verified Savings by ECM will be determined using the following Measurement & Verification plans further described in this section. Through this plan, the guaranteed savings generated by the ECMs installed in the Facilities will be validated. The M&V methodologies proposed for these ECMs are based on the International Performance Measurement and Verification Protocol (IPMVP). The objective of the plan is to quantify the actual electrical and fossil fuel and compare those to the specific Baseline Usage for each Facility, the difference of which is the Verified Savings.

During the term of the Agreement, ESCO will make adjustments to energy savings due to changes in building occupancy, weather data, and utility rate schedules, etc. The unit costs of energy will be applied to the energy savings calculated by this M&V plan. Current utility cost will be used as a basis for determining the unit cost, with floor and ceiling prices set by baseline rate information, presented herein this Attachment.

There are four guarantee options that may be used to measure and verify the performance of a particular energy conservation measure. Each one is described below.

5.1.1 Option A – Retrofit Isolation: Key Parameter Measurement

Energy savings is determined by field measurement of the key parameters affecting the energy use of the system(s) to which an improvement measure was applied separate from the energy use of the rest of the facility. Measurement frequency ranges from short-term to continuous, depending on the expected variations in the measured parameter, and the length of the reporting period.

Measurement of key parameters means that those parameters not selected for field measurement will be estimated. Estimates can be based on historical data, manufacturer's specifications, or engineering judgment. Documentation of the source or justification of the estimated parameter will be described in the M&V plan in the Agreement. Energy savings is determined through engineering calculations of the baseline and post-retrofit energy used based on the combination of measured and estimated parameters, along with any routine adjustments.

5.1.2 Option B – Retrofit Isolation: All Parameter Measurement

Like Option A, energy savings is determined by field measurement of the energy use of the systems to which an improvement measure was applied separate from the energy use of the rest of the facility. However, all of the key parameters affecting energy use are measured; there are no estimated parameters used for Option B. Measurement frequency ranges from short-term to continuous, depending on the expected variations in the savings and the length of the reporting period. Energy savings is determined through engineering calculations of the baseline and post-retrofit energy used based on the measured parameters, along with any routine adjustments.

5.1.3 Option C – Whole Building Metering/Utility Bill Comparisons

Option C involves the use of utility meters or whole building sub-meters to assess the energy performance of a total building. Option C assesses the impact of any type of improvement measure, but not individually if more than one is applied to an energy meter. This option determines the collective savings of all improvement measures applied to the part of the facility monitored by the energy meter. In addition, since whole building meters are used, savings reported under Option C include the impact of any other change made in facility energy use (positive or negative).

Option C may be used in cases where there is a high degree of interaction between installed improvement measures or between improvement measures and the rest of the building or the isolation and measurement of individual improvement measures is difficult or too costly.

This Option is intended for projects where savings are expected to be large enough to be discernable from the random or unexplained energy variations that are normally found at the level of the whole facility meter. The larger the savings, or the smaller the unexplained variations in the baseline, the easier it will be to identify savings. In addition, the longer the period of savings analysis after installing the improvement measure, the less significant is the impact of short-term unexplained variations. Typically, savings should be more than 20% of the baseline energy use if they are to be separated from the noise in the baseline data.

Periodic inspections should be made of all equipment and operations in the facility after the improvement measure installation. These inspections will identify changes from baseline conditions or intended operations. Accounting for changes (other than those caused by the improvement measures) is the major challenge associated with Option C, particularly when savings are to be monitored for long periods. Savings are calculated through analysis of whole facility utility meter or sub-meter data using techniques from simple comparison to regression analysis.

5.1.4 Option D – Calibrated Simulation

Option D involves the use of computer simulation software to predict energy use, most often in cases where baseline data does not exist. Such simulation models must be calibrated so that it predicts an energy use and demand pattern that reasonably matches actual utility consumption and demand data from either the base-year or a post-retrofit year. Option D may be used to assess the performance of all improvement measures in a facility, akin to Option C. However, different from Option C, multiple runs of the simulation in Option D allow estimates of the savings attributable to each improvement measure within a multiple improvement measure project.

Option D may also be used to assess just the performance of individual systems within a facility, akin to Option A and B. In this case, the system's energy use must be isolated from that of the rest of the facility by appropriate meters. Savings are calculated using energy use simulation models, calibrated with hourly or monthly utility billing data and/or end-use metering.

5.2 As part of the M&V Services, ESCO will monitor the M&V data for the ECMs and produce an annual report for Client that will outline the Project's performance as well as an accounting of the energy savings achieved. ESCO will review Client-supplied utility bill information and incorporate such information into the annual report. ESCO shall communicate performance-related issues to Client to either confirm the ECMs are performing as intended, or to address deficiencies and the causes of the deficiencies.

5.3 M&V Descriptions. The following matrix summarizes the M&V Plan with detailed plan descriptions for each ECM.

Table F.6 Measurement and Verification Description

ECM Description	Measurement and Verification Method – Summary	Detail of M&V Methodology
ECM-1 LED Lighting and Lighting Controls **ECM-6 Ceiling Replacement and Lighting** **M&V Option: A**	Key Parameters	Lighting fixture power consumption, operating hours.
	Baseline	Measure a sample of fixture wattages pre-installation. Determine operating hours through stipulated values. Baseline shall be generated using Energy calculations.
	Post-Installation	Measure a sample of fixture wattages one time post-installation. Operating hours remain the same as baseline, except for adjustment due to implementation of lighting controls. Lighting controls are to be verified for on/off and/or dimming capability and timing.
	Performance Period	Annual visual inspection of a sample set of lighting fixtures and controls to ensure the integrity of the fixtures and controls and confirm that the ECM still has the potential to perform as specified.
ECM-2 Solar Rooftop **M&V Option: B**	Key Parameters	System name plate DC rating, array tilt, array azimuth, DC to AC conversion efficiency, hours and intensity of solar radiation, annual kWh generation.
	Baseline	Baseline electrical energy is equivalent to the portion of the facility electrical load to be offset by the PV system electrical generation. PV system generation shall be calculated using the FEMP ENABLE IGA Tool, which is linked with the Helioscope tool.
	Post-Installation	Verify that proposed PV system has been implemented and is operating as intended. Instantaneous array performance to be compared against designed system output through measurement of solar insolation, module temperature and inverter output. Post installation savings is

		determined from the same baseline calculation modified for the as-built condition of the PV system.
	Performance Period	Annual on-site inspections of PV equipment for ongoing verification that the system is in place, operational and that guaranteed electrical generation is sustainable. Energy generation is continuously metered by the PV system's revenue grade meter. All metered generation is reported as verified savings.
ECM-3 Pipe & Valve Insulation **ECM-7 Condensate Pump Skid** **M&V Option: C**	Key Parameters	Weather, temperature setting, heating & cooling system efficiency.
	Baseline	Stipulated weather values, derived from detailed simulation modeling. The model shall account for air flow. The model shall be adjusted to the specific site conditions.
	Post-Installation	Month-by-month annual whole building energy simulation model calibrated against whole building metered data for electricity and natural gas used in the buildings.
	Performance Period	Annual on-site inspections of equipment for ongoing verification. Baseline Adjustment should be made based on cooling and heating load and operating hours.
ECM-4 Plug Load Controls **M&V Option: A**	Key Parameters	Device wattage, number of BERTs and scheduled ON hours.
	Baseline	Reported operation from facility staff was used to establish baseline operation and equipment stipulated wattage. savings shall be generated using Energy calculations.
	Post-Installation	A sample of equipment being controlled will be monitored for two-week period.
	Performance Period	Annual on-site inspections of equipment for ongoing verification that energy control

		strategies are in place and sustainable.
ECM-5 Building Envelope Improvements **M&V Option: C**	Key Parameters	Weather, heating, and cooling system efficiency.
	Baseline	Stipulated weather values, derived from detailed simulation modeling. The model shall account for air flow. The model shall be adjusted to the specific site conditions.
	Post-Installation	Month-by-month annual whole building energy simulation model calibrated against whole building metered data for electricity and natural gas used in the buildings.
	Performance Period	Annual on-site inspections of equipment for ongoing verification. Baseline Adjustment should be made based on cooling and heating load and operating hours.

5.3 M&V Plan by ECM

5.3.1 ECM 1- LED Lighting Upgrades

The M&V plan for the lighting efficiency retrofit throughout Port Washington UFSD will follow M&V Option A. The Option A approach will be used to quantify energy consumption savings associated with the lighting equipment upgrades and annual verify that the measure continues to operate and perform as specified in the Final Proposal.

The M&V Plan for this retrofit assumes:

- Operating hours will be measured before the retrofit. The hours for the lighting fixtures will be the same before and after the equipment retrofit for the purpose of energy savings calculations.
- All fixtures installed will not be measured, an effective IPMVP recommended sampling method will be used. Lighting fixture types that account for greater than 10% of the total fixtures installed will be sampled. Lighting fixtures will be separated to homogenous groups and sampled to achieve ±10% precision with 90% confidence with an assumed 0.50 coefficient of variance.
- Interactive effects on heating and cooling equipment from the lighting retrofit will not be considered.

Overview of Baseline and Savings Calculations
The baseline energy consumption was documented through accurate accounting of all existing lighting equipment within the scope of the project during the CEA. A room-by-room inventory of fixture counts, types, and circuits was made. Fixture powers will be measured based on a sample of the most common fixture types. For less common fixture types, fixture power will be based on manufacturer's data.

Typical lighting hours for facility spaces were obtained from the typical hours of operation, categorized in "usage groups" and input into the CEA lighting tool. Further, run-time meters were installed that showed actual run hours to be in line with the estimates. Each of the room-by-room equipment entries within the CEA tool are assigned an appropriate usage group representative of the number of hours that piece of equipment is expected to operate. In instances where lighting controls are deployed, the CEA tool adjusts the post-retrofit operating hours by a factor appropriate for the control technology. The established post-retrofit operating hours will be held constant as annual operating hours during the performance period.

Post Installation and Performance Period Activities
Upon project completion, an as-built inventory of post-installation lighting fixtures will be supplied, including the lighting ballasts and lamps installed, and lighting illumination levels (foot-candles) in each area. Savings predictions will be corrected based on as-built data and will be reported in the Post-Installation Report. Fixture power will be measured in a manner identical to that for the baseline fixtures. Sample sizes for measurements and procedures are described. These measurements will be used to calculate actual expected energy savings and will be detailed in the Post-Installation Report. The initial lighting power consumption will be assessed and detailed in a breakdown by location and the type of fixtures used. This breakdown of kilowatts (kW) will serve as the basis for calculating energy savings before the retrofit. ESCO will also take actual measurements of the pre-retrofit kilowatt usage to confirm the accuracy of the breakdown by location. Additionally, ESCO will measure the illumination levels in selected areas to gain insight into the current lighting conditions.

The M&V team will quality check the line by line and take photographs for documentation.

Measuring Equipment: True-RMS Wattmeter (kW measurement) and HOBO loggers for Logging Operating Hours.

Energy Savings Calculations and Methodology
After completion of the field survey RENU compiled the audit data, field measurements and operating hours data. Details of existing fixture types, quantities, wattages and operating hours were generated. Based on RENU's retrofit strategy, proposed retrofit equipment is applied against the room-by-room equipment entries within the CEA tool. The CEA tool then calculates the energy and cost savings by comparing the baseline and post installation energy consumption at the designated energy rate. The energy calculations can be found in the CEA document under the lighting ECM.

Table F.7 - ECM 1 Savings Summary

Description	Electric Savings kWh	Electric Demand Savings (kW)
LED Lighting Upgrades	**90,345**	**27.1**

5.3.2 ECM 2 - Solar Rooftop

The M&V Plan for the Solar Photovoltaic (PV) installations throughout the Port Washington UFSD will follow M&V Option B. The Option B approach will be used to quantify the energy savings associated with the Solar PV installation and annually verify that the measure continues to operate and perform as specified.

The M&V plan for this ECM assumes:

- The annual solar radiation as utilized in the calculation of the annual electrical generation of the PV array will be assumed to represent a typical meteorological year (TMY) and will be held constant during the performance period for the purpose of energy generation calculations.
- PV Module Performance and inverter efficiencies are based on manufacturer's data.
- An annual verification of the measure will be performed to document that the PV system remains installed and performing as specified in the CEA.
- An annual collection of the generated electrical output from the PV system will be performed and recorded as verified savings.

Option B will be used in the verification of solar production (kWh) output for this project. The verification of savings will be done by sub-meters and/or system control platform, with an overall measurement uncertainty of +- 10% at each system location. This means any M&V result within 10% of the guaranteed level is deemed to meet the guarantee. The above variability is recommended, as the panel's output is dependent on solar insolation, and independent variable.

For Solar energy production (kWh):
For this ECM, once the system is installed and operational, RENU will collect the electric generation data. Measurement and Verification shall be performed using utility grade sub-meters and or the System software (HELIOSCOPE) platform for each building. If electric generation data is not available or any part of the PV system is not operational for more than 15 days during each guarantee year then the guarantee year solar data from TMY3, 10km Grid (40.85 - 73.75), NREL (Prospector, NY) will be used, and a model will be generated using the latest version of Helioscope to calculate the PV system production.

Overview of Baseline and Savings Calculations:
Given that the solar PV system is not installed at present, the energy baseline is considered to be the maximum potential annual output of the array. The baseline energy was established through collection of various data parameters including:

- Geographic location of array
- DC system size (name plate rating)
- DC-to-AC derate factors
- Array type (fixed, tracking, etc)
- Array tilt, azimuth

The data collected is used within the proposal to generate baseline energy generation for the PV system.

Post Installation and Performance Period Activities:

- Inspections of the renewable energy system to ensure proper operation and maximum performance.
- Submeter the renewable energy source to verify energy production and savings.
- The general approach for calculating energy savings from renewable energy projects is the Net energy generation (the total kWh generation from the PV system).
- Solar capacity generation will decrease by 0.4% per guaranteed year of kWh production beginning in year.

- Excess solar production credits will be transferred to designated accounts, as per PSEGLI guidelines and current Value of Distributed Energy Rate (VDER).

Solar Transfer	Electricity $/kWh
District-Wide	**.105**

The approach involves directly measuring the energy output from the system and quantifying any additional costs incurred or savings realized. This approach is suitable for PV, as the measurement concept assumes that energy (electrical) produced by the renewable system is used at the project site and displaces energy that would have been provided by an existing source. Savings are determined by measuring the net amount of energy produced by the renewable system and used at the project site valued at prescribed utility rates. This approach eliminates the need for a baseline.

When an onsite net metering approach is used, meter(s) will typically show the measure's gross output (in kW and kWh) and credits from the local utility. The goal with this method is usually to measure net generation delivered to the project site. Metering, interconnection (including safety provisions), reporting, and other related issues are to be in accordance with current electrical standards and the requirements of the servicing electric utility. For every guaranteed year, the calculation of energy savings from solar kWh production involves multiplying the solar production for the guaranteed year by the utility rate specified for that year in along with any applicable escalation as per Table F.5.

The effectiveness of the proposed PV system in generating kWh is directly influenced by solar isolation, which encompasses factors like cloud cover and other uncontrollable variables, even over short intervals, typically around 30 minutes.

Solar system availability: In estimating the guarantee for the proposed PV systems, ESCO assumes that the PV system undergoes proper maintenance, and timely corrective actions are taken to ensure consistent system availability. If the PV system experiences adverse impacts during any given period, including but not limited to issues with the availability of generated electrical energy (kWh), Client and ESCO will consider the guarantee for that period is met.

Energy Savings Calculations and Methodology
The HELIOSCOPE design tool has been used to determine the energy production and cost savings of the grid-connected photovoltaic (PV) energy systems by creating hour-by-hour performance simulations that provide calculated monthly and annual energy production in kilowatts and energy value. This HELIOSCOPE energy calculation can be found in the CEA document under Solar Rooftop ECM. Users select a geographic location of the PV installation and establish system parameters for size, electric cost, array type, tilt angle, and azimuth angle. Using typical meteorological year weather data for the selected location, the Helioscope calculator determines the solar radiation incident of the PV array and the PV cell temperature for each hour of the year. The DC energy for each hour is calculated from the PV system DC rating and the incident solar radiation and then corrected for the PV cell temperature. The AC energy for each hour is calculated by multiplying the DC energy by the overall DC-to-AC derate factor and adjusting for inverter efficiency as a function of load. Hourly values of AC energy are then summed to calculate monthly and annual AC energy production.

Table F.8 - ECM 2 Savings Summary

Description	Electric Savings kWh
Solar - Rooftop	**2,517,342**

5.3.3 ECM 3 – Pipe and Valve Insulation

The M&V Plan for the Pipe & Valve Insulation upgrades at Weber Middle School will follow M&V Option C. The Option C approach will be used to quantify the energy savings associated with the pipe & valve insulation and verify that the measure continues to operate and perform as specified in the Final Proposal. Pipe & valve insulation assessment evaluates existing pipe & valve distribution for missing and degraded insulation. Our assessments identify locations of thermal losses.

Overview of Baseline and Savings Calculations
The Baseline was validated by verifying the linear feet and area contributing to heat loss. Accepted engineering principles were used for Baseline and Post-Installation calculations. Baseline energy use is affected by weather patterns, building loads, and pipe & valve deficiencies.

The data collected during the Feasibility Study and CEA was input into calculations to create the Baseline to determine the performance of the building envelope improvements.

Post Installation and Performance Period Activities
The Post-Installation performance factors are heating system efficiencies and thermal integrity of pipe & valve insulation. The intent of Performance Period verification activities is to ensure that the heat loss experienced by the piping prior to implementing this ECM has been reduced as a result of various building envelope improvements. The intent is also to ensure that the pipe & valve insulation improvements are being properly maintained. The savings from this measure will impact the building gas consumption and by utilizing Option C the bill analysis will be run to indicate the savings occurred from this measure.

Energy Savings Calculations and Methodology
A linear foot/temperature difference calculation method was used to estimate the savings associated with improving the building's insulation characteristics and reducing the building's unwanted infiltration. The energy calculations can be found in the CEA document under the Pipe and Valve Insulation ECM.

Table F.9 – ECM 3 Savings Summary

Description	Electric Savings kWh	Natural Gas Savings (Therms)
Pipe and Valve Insulation	**201,246**	**1,548**

5.3.4 ECM 4 – Plug Load Controls

The primary intent of the M&V plan Option A for Plug Load Control is to verify and quantify the energy savings achieved by automatically turning off or putting electronic devices in standby mode when they are not in use.

Plug load controllers are used to shut down plug loads during times of low or no occupancy. ESCO will document the completed scope and savings will be based upon the measured field variable of wattage.

Overview of baseline and Savings Calculations
The activities include:

- Confirm that the actual energy consumption aligns with the projected energy savings by utilizing plug load data loggers at a percentage of the loads.
- Validate that plug load control measures effectively reduce energy use by managing and optimizing equipment and appliances.
- Ensure that the installation meets or exceeds relevant energy efficiency standards and guidelines.

Post Installation and Performance Period Activities

- Installation and commissioning of plug load control devices and network communication system, quantity of post device installation to be verified against as-builts.
- Post-installation data collection will be collected using the manufacture monitoring network software. This measuring period will collect usage data for a period of two weeks. This measured data will be used to evaluate savings.
- Periodic inspections to ensure the continued operation and optimization of plug load control systems.

Overview of Savings Calculations

Savings calculation methods for Plug Load Control often involve the comparison of pre-installation and post-installation energy consumption data. Key steps include:

Calculating energy consumption before and after control measures are implemented, taking into account factors like equipment schedules and occupancy patterns. The energy calculations can be found in the CEA document under the Plug Load ECM.

Table F.10 – ECM 4 Savings Summary

Description	Electric Savings kWh
Plug Load Controls	**90,303**

5.3.5 ECM 5 – Building Envelope Improvements

The M&V Plan for the Building Envelope upgrades throughout the Port Washington UFSD will follow M&V Option C. The Option C approach will be used to quantify the energy savings associated with the building envelope and verify that the measure continues to operate and perform as specified in the Final Proposal. Building envelope assessment evaluates sides of the building, including the attics/roofs, walls, and floors and all of intersections connecting the building's assemblies. Our assessments identify locations of air leakage losses and thermal transfer – the two primary modes of energy loss in buildings.

Cooling and heating loss (or gain in the case of any system) resulting from inadequate insulation can be mitigated by both reinforcing insulation and implementing air barriers to minimize air leakage. ESCO will record the finalized scope of work, and the savings will be determined based on the measured field variables such as the length and thickness of insulation, as well as the materials used for air sealing.

Overview of Baseline and Savings Calculations

The Baseline was validated by verifying the linear feet and area contributing to infiltration. Accepted engineering principles were used for Baseline and Post-Installation calculations. Baseline energy use is affected by weather patterns, building loads, and building envelope deficiencies. The data collected was inputted into a calculator to create the baselines to determine the performance of the building envelope improvements.

Post Installation and Performance Period Activities

The Post-Installation performance factors are heating system efficiencies and thermal integrity of windows, doors, roofs, and wall insulation. The intent of Performance Period verification activities is to ensure that the infiltration experienced in the building prior to implementing this ECM has been reduced as a result of various building envelope improvements. The savings from this measure will impact the building gas consumption and by utilizing the Option C bill analysis will be run to indicate the savings occurred from this measure. The intent is also to ensure that the building envelope improvements are being properly maintained.

Energy Savings Calculations and Methodology
An engineering tool was developed to calculate the baseline and savings for this ECM. This calculation method was used to calculate the savings associated with improving the building's insulation characteristics and reducing the building's unwanted infiltration. The energy calculations can be found in the CEA document under the weatherization ECM.

Table F.11 – ECM 5 Savings Summary

Description	Electric Savings kWh
Building Envelope Improvements	**3,363**

5.3.6 ECM 6 – Ceiling Replacement and Lighting

Option A as per ECM 1.

5.3.7 ECM 7 – Condensate Pump Skid

Option C.

ATTACHMENT G

CONTRACT COST AND ANNUAL SERVICES

PAYMENT TERMS

1. The Project Cost is $8,347,887. The Engineering/Architect fee for the Project is $417,394. The Total Project Cost for the Project is $8,765,281.

Table G.1 – Project Cost Breakout

ECM Description	Project Cost	Federal Tax Incentive
LED Lighting and Controls	$196,042	$0
Solar - Rooftop	$7,046,798	$1,944,464
Pipe and Valve Insulation	$37,356	$0
Plug Load Controls	$156,563	$0
Building Envelope Improvements	$252,533	$0
Ceiling Replacements and Lighting	$554,268	$0
Condensate Pump Skid	$104,326	$0
Project Sub-Total	$8,347,886	$1,944,464
Architect Fees	$417,394	-
Project Total	$8,765,280	

2. Client agrees to pay ESCO and ESCO shall invoice Client as follows:
   a) 20% of the Total Project Cost shall be due and payable within thirty (30) calendar days of transmission of Client's Notice to Proceed ("Mobilization Payment").
   b) The balance of the Total Project Cost will be invoiced on a monthly basis based on the percentage of the Work completed and accepted by Client and the Engineer.
   c) Client will hold back five percent (5%) of the Mobilization Payment and each subsequent progress payment until Substantial Completion when fifty percent (50%) of the retainage will be released to ESCO. The balance of the retainage will be paid within thirty (30) calendar days of Final Completion. Neither final payment nor any remaining retained percentage will be come due until ESCO submits to the Client duly execute Final Waivers of Lien in the form attached hereto as Attachment ___ and a two-year maintenance bond(s) form and substance satisfactory to the Client, in the Client's sole discretion.
   d) M&V Services for years 1-5 are included in the Total Project Cost. Additional years of M&V Services will be invoiced separately based on the Schedule in Table G.3.

3. Maintenance Fee:
   Maintenance is not included in this Project.

Table G.2 – Annual Maintenance Fee

Year	Fee
1	$0
2	$0
3	$0
4	$0
5	$0
6	$0
7	$0
8	$0
9	$0
10	$0
11	$0
12	$0
13	$0
14	$0
15	$0
16	$0
17	$0
18	$0
Total	**$0**

4. Measurement & Verification Services Fee:

ESCO shall provide, and has included costs for, M&V Services, for a period of five (5) years. Client agrees that if for any reason it a) cancels the M&V Services; b) fails to timely pay for the M&V Services within sixty (60) days or receipt of the invoice from ESCO; c) cancels, terminates or breaches this Agreement; d) or fails to enable or allow ESCO to perform the Work as agreed to, the Energy Savings Guarantee shall terminate and ESCO will have no further obligation under this Agreement.

Client may elect to continue the M&V Services so long as it agrees to pay the M&V Services Fee shown in Table G.3.

Table G.3 – Annual M&V Services Fee

Year	Fee
1	$0
2	$0
3	$0
4	$0
5	$0
6	$92,500
7	$92,500

Year	Fee
8	$92,500
9	$92,500
10	$92,500
11	$92,500
12	$92,500
13	$92,500
14	$92,500
15	$92,500
16	$92,500
17	$92,500
18	$92,500
Total	$1,202,500

5. Performance Period Fee:
The annual performance period fee shall be the sum of the Maintenance Fee and the Measurement and Verification Fee. Client agrees to pay the following Performance Period Fees.

Table G.4 – Performance Period Fee

Year	Fee
1	$0
2	$0
3	$0
4	$0
5	$0
6	$92,500
7	$92,500
8	$92,500
9	$92,500
10	$92,500
11	$92,500
12	$92,500
13	$92,500
14	$92,500
15	$92,500
16	$92,500
17	$92,500
18	$92,500
Total	$1,202,500

6. Payments for Architectural/Engineering Services

ESCO shall pay the Engineer $417,394, as approved by NYSED and financed by the Owner for the energy project. Accordingly, ESCO shall be responsible for making payments for Architectural/Engineering services directly to the Architect as set forth herein. ESCO will make payments to the Architect according to Engineer Contract.

ATTACHMENT H

CHANGE ORDER FORM

(Request & Agreement for Change in Plans and/or Specifications and/or Contract)

Change Request No. _____

Client:_____

Department:_____

Project No._____ Contract No._____ Site:_____

Title:_____

I. REQUEST Date:_____

(a) Requested by_____ Of_____

(b) Description of change _____
_____

II. ESCO's AGREEMENT

For all costs involved in this change including extensions of time herein requested ESCO proposes to perform the work described in accordance with the provisions of the subject Agreement and certifies that the attached cost data is accurate, complete and current, and mathematically correct.

Payment shall be made on the basis of:

If necessary, attach detailed estimates and breakdown for above in accordance with change order instruction. A claim for work performed under protest may be submitted in writing.

An extension of contract time of _____ calendar days to _____ is requested.

ESCO_____ by_____ Date:_____

CLIENT APPROVAL: Date:_____

Client:

By:

Title:

Contract Award	$_____
Previous Additions	$_____
Previous Deductions	$_____
Net Total	$_____
This Change	$_____
Total	$_____

ATTACHMENT I

MAINTENANCE SERVICES

Maintenance services provided by ESCO are limited to annual oversight activities as described in the M&V Plan. Oversight activities are limited to annual confirmation that the Client continues to operate, maintain, and repair the ECMs in a manner consistent with contract requirements to ensure the persistence of guarantees savings over the term of the Project. ESCO shall submit an annual report for the first five (5) years of the Agreement indicating the results of its maintenance oversight functions.

ATTACHMENT J

ESCO INSTALLED EQUIPMENT

ESCO will provide Client with two (2) copies of As-Built and warranty information for the Work.

ATTACHMENT K

STANDARDS OF SERVICE

The Standards of Service documents equipment operating characteristics for the purpose of developing baseline energy use and energy efficient upgrade profiles.

Lighting Systems:
Standards of Service for lighting systems are defined as the footcandle (fc) at the work surface by the new lighting and/or other equipment to be affected by the ECMs. The pre-construction fc levels and equipment schedules are used in the development and calibration of the system baseline energy use model/analysis. The post-construction fc levels and equipment schedules are used in the development of the system energy use model/analysis, and the associated savings.

Mechanical Systems:
Standards of Service for mechanical systems are defined as the temperature settings and equipment schedules for buildings, zones, and/or other equipment to be affected by the ECMs. The pre-construction temperature settings and equipment schedules are used in the development and calibration of the system baseline energy use model/analysis. The post-construction temperature settings and equipment schedules are used in the development of the system energy use model/analysis, and the associated savings.

The following Attachments K-1 and K-2 document the Standards of Service for the lighting and mechanical upgrades.

ATTACHMENT K-1

A. DISTRICT WIDE OCCUPANCY SCHEDULE

Table K.1 - Number of Occupied Hours Between

Building	Midnight-8AM	8AM-6PM	6PM-Midnight
Paul D. Schreiber H.S.	2	10	3
Carrie P. Weber M.S.	2	10	0
Administration Building	1	9	0
Elementary Schools	2	10	0

Table K.2 – Occupied/Unoccupied Status of Buildings

Building	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Paul D. Schreiber H.S.	Occupied	Occupied	Occupied	Occupied	Occupied	Occupied	Unoccupied
Carrie P. Weber M.S.	Occupied	Occupied	Occupied	Occupied	Occupied	Unoccupied	Unoccupied
Administration Building	Occupied	Occupied	Occupied	Occupied	Occupied	Unoccupied	Unoccupied
Elementary Schools	Occupied	Occupied	Occupied	Occupied	Occupied	Unoccupied	Unoccupied

If Client is unable to meet these Standards of Service for any reason, Client and ESCO shall mutually agree upon an appropriate adjustment to energy savings.

B. LIGHTING STANDARDS OF SERVICE

As per NYSED Manual of Planning Standards 2022, the following average maintained Standards of Service and comfort shall apply:

Table K.3 – Lighting Standards of Service

Building	Description	Hours Per Year	Existing FC	Proposed FC
Paul D. Schreiber H.S.	Classrooms	2,000	30	30
Paul D. Schreiber H.S.	Offices	3,000	30	30
Paul D. Schreiber H.S.	Hallways	3,000	10	10
Paul D. Schreiber H.S.	Gym	3,000	20	20
Paul D. Schreiber H.S	Non-instructional student space	2,000	10	10
Paul D. Schreiber H.S.	Exterior	Dusk to Dawn	1	1

Carrie P. Weber M.S.	Classrooms	2,000	30	30
Carrie P. Weber M.S.	Offices	3,000	30	30
Carrie P. Weber M.S.	Hallways	3,000	10	10
Carrie P. Weber M.S.	Gym	3,000	20	20
Carrie P. Weber M.S.	Non-instructional student space	2,000	10	10
Carrie P. Weber M.S.	Exterior	Dusk to Dawn	1	1
Administration Building	Offices	3,000	30	30
Elementary Schools	Classrooms	2,000	30	30
Elementary Schools	Offices	2,000	30	30
Elementary Schools	Hallways	3,000	10	10
Elementary Schools	Gym	3,000	20	20
Elementary Schools	Non-instructional student space	2,000	10	10
Elementary Schools	Exterior	Dusk to Dawn	1	1

C. MECHANICAL STANDARDS OF SERVICE

As per ASHRAE Standard 55 2017 Guidelines, the following average maintained standards of service and comfort shall apply:

K.4 – Mechanical Standards of Service Summer Setpoints

Building	Existing Occupied	Existing Unoccupied
Paul D. Schreiber H.S.	72-78	80
Carrie P. Weber M.S.	72-78	80
Administration Building	72-78	80
Elementary Schools	72-78	80

K.5 – Mechanical Standards of Service Winter Setpoints

Building	Existing Occupied	Existing Unoccupied
Paul D. Schreiber H.S.	68-74	55
Carrie P. Weber M.S.	68-74	55
Administration Building	68-74	55
Elementary Schools	68-74	55

If Client is unable to meet these Standards of Service for any reason, Client and ESCO shall mutually agree upon an appropriate adjustment to energy savings.

ATTACHMENT L

COMPREHENSIVE ENERGY AUDIT

The Comprehensive Energy Audit (CEA) dated April 30, 2024 is attached hereto to this Agreement.

(***See Attached***)

RENU ENERGY SOLUTIONS

A DIVISION OF RENU CONTRACTING RESTORATION

Port Washington School District

COMPREHENSIVE ENERGY AUDIT

Port Washington, NY

April 30, 2024

renuny.com

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Section 1. Executive Summary

1.1 Overview

RENU is pleased to submit this Comprehensive Energy Audit (CEA) for the Port Washington Union Free School District. The purpose of this CEA is to assess the energy performance of (1) High School, (1) Middle School, (5) Elementary Schools and (1) Administration Building and identify energy conservation measures (ECM) that could reduce operating costs and improve energy efficiency. The CEA was conducted in accordance with industry-standard procedures and guidelines and includes a comprehensive analysis of the buildings energy systems, utility bills, and energy usage patterns.

The structure of our Comprehensive Energy Audit aims to demonstrate compliance with the New York EPC law in a clear manner, while also presenting information in an organized format that enables the best path forward in the implementation of an Energy Performance Contract (EPC). Overall, the Comprehensive Energy Audit for the entire Port Washington School District provides a comprehensive analysis of the building's energy performance, identified cost-effective energy conservation measures, and provided a detailed financial analysis to assist the Port Washington School District Board of Education in making informed decisions about implementing these measures. By implementing the recommended measures, the buildings can significantly reduce energy consumption, lower operating costs, and improve energy efficiency.

ECM Summary Table	ECM 1	ECM 2	ECM 3	ECM 4	ECM 5	ECM 6	ECM 7
Building	Lighting	Solar	Pipe and Valve Insulation	Plug Load Controls	Weatherization	Ceiling Replacements	Pump Skid
Schreiber H.S.	X	X		X	X		X
Weber M.S.	X		X	X	X		
Admin. Bldg.	X			X	X	X	
Sousa E.S.	X	X		X	X	X	
Guggenheim E.S.	X	X		X	X		
Salem E.S.	X	X		X	X		
Daly E.S.	X	X		X	X		
Manorhaven E.S.		X		X	X	X	

1.2 Benefits

RENU has evaluated various energy-saving measures to develop the CEA. Based on the findings, several energy conservation measures were identified that could reduce energy consumption and operating costs. The measures evaluated included but were not limited to upgrades to the building's HVAC systems, lighting upgrades, enhanced controls, installation of rooftop and carport photovoltaic systems, and improvements to the building envelope. Each measure was evaluated based on its potential energy savings, capital cost, and payback period.

1.3 Simple Payback Table

RENU ENERGY SOLUTIONS
A DIVISION OF RENU CONTRACTING RESTORATION

ECM #	Energy Conservation Measure "ECM" Description	Total Installed Cost	Rebates/ Financial Incentives	Net Installed Cost	Total Annual Energy Savings kWh	Total Annual Energy Savings kW	Total Annual Energy Savings Therms	Total Annual Energy Savings $	Annual O&M Savings	Simple Payback (Years)	Guaranteed Annual Energy Savings	Simple Payback (Years) - Guar Savings	Simple Payback w/State Aid
1	Lighting Upgrades and Controls	$196,042	$0	$196,042	90,345	27	0	$18,541	$250	10.43	$17,614	11.13	9.88
2	Solar - Rooftop	$7,046,798	$1,944,464	$5,102,333	2,517,342	0	0	$415,215	$0	12.29	$394,454	12.94	10.35
3	Pipe & Valve Insulation	$37,356	$0	$37,356	0	0	1,548	$1,882	$0	19.85	$1,788	20.90	16.72
4	Plug Load Controls	$156,563	$0	$156,563	90,303	0	0	$15,022	$0	10.42	$14,271	10.97	8.78
5	Building Envelope Improvements	$252,533	$0	$252,533	26,730	0	15,543	$23,335	$0	10.82	$22,169	11.39	9.11
6	Ceiling Replacement & Lighting	$554,268	$0	$554,268	0	0	0	$0	$0	0.00	$0	0.00	0.00
7	Condensate Pump Skid	$104,326	$0	$104,326	0	0	0	$0	$0	0.00	$0	0.00	0.00
	Architect Fees:	$417,394											
	Without 20% State Aid	$8,765,280	$1,944,464	$6,299,095	2,724,720	27	17,091	$473,995	$250	13.28	$450,295	13.99	11.14
	With 20% State Aid			$5,019,831									

Section 2. Building Overview

This Comprehensive Energy Audit (CEA) addresses the following facilities:

Building	Address	Square Footage
Paul D. Schreiber High School	101 Campus Drive	269,199
Carrie P. Weber Middle School	52 Campus Drive	305,821
Administration Building	100 Campus Drive	4,450
John Philip Sousa Elementary	101 Sands Point Road	83,000
Guggenheim Elementary	38 Poplar Place	67,500
South Salem Elementary	10 Newbury Road	55,000
John J. Daly Elementary	36 Rockwood Ave	81,564
Manorhaven Elementary	12 Morewood Oaks Drive	52,570
Total		919,104

2.1 Facility Descriptions

2.1.1 Paul D. Schreiber High School

Background Information



Schreiber High School is located at 101 Campus Drive, Port Washington, New York. This 269,199 ft^2 facility was originally built in 1953 and remains in fair condition. The High School consists of three (3) floors of classroom space, office space, two (2) gymnasiums, an auditorium, library/media center, a cafeteria, a kitchen, locker rooms and a fitness center.

Building Occupancy

Occupancy of the building is approximately 1,612 students with a staff of 155 people.

Hours of Operation

- Monday through Friday (School Hours) – 8:05 am to 3:05 pm
- Monday through Friday (Whole Building) 6:00 am to 11:00 pm (students/staff)
- Saturday and Sunday (Gyms, Auditorium, Health Center and some Classrooms) 7:00 am to 5:00 pm

Building Envelope





The building is constructed of steel columns with a brick façade. The building has flat roofs, some of which were recently replaced, and others scheduled to be replaced in the next two years. The building has double pane operable windows with metal frames and interior shades. The exterior doors are typically metal with glass panes and metal frames. Corridor areas have large double pane fixed windows with metal frames. The exterior doors have either missing or worn weather-stripping materials which show signs of excessive infiltration. The building envelope has deficiencies and contributes to a significant amount of air infiltration.

Lighting

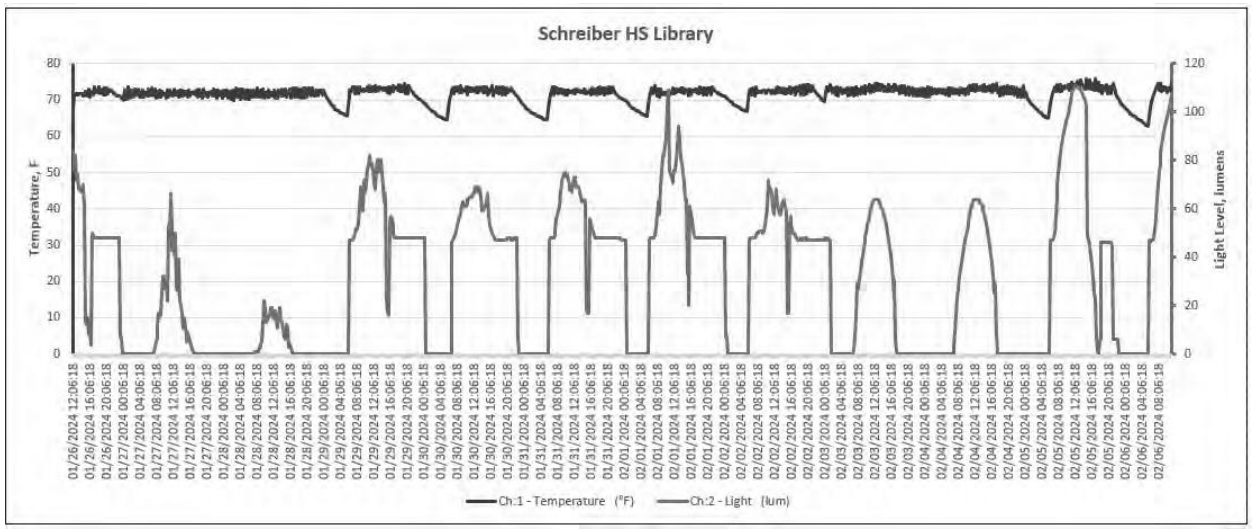
The High School lighting has been upgraded to LED, with a few minor exceptions. There are existing round downlights that have compact fluorescent lamps in them that should be replaced with new LED downlights (not re-lamped with LED bulbs). There is an old, exterior building-mounted High Pressure Sodium fixture that is visible from the parking lot and is noted by its orange-yellow light. This should be replaced with a new LED fixture.

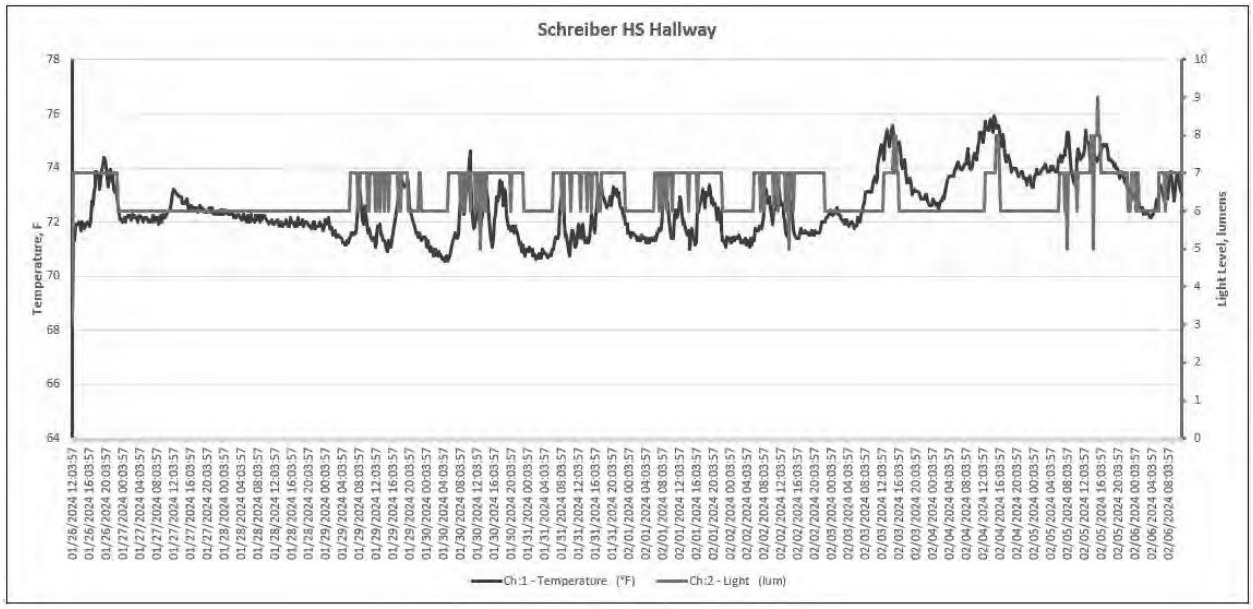


Lighting Controls:

The lighting in individual rooms is occupancy based and uses daylight harvesting sensors in certain areas. Typical classrooms are equipped with bi-level switching where 2 or 3 lamps may operate at a time.

RENU installed Light/Temperature datalogging meters in the High School Library and a hallway to gain better understanding of the building's trends throughout the day and week. The following graphs show the data from January 26th to February 6, 2024. The cycling of the lighting appears to coincide with occupied hours for both students/faculty and custodial crews


Schreiber HS Library
Temperature, F
Light Level, lumens
Ch:1 - Temperature (°F)
Ch:2 - Light (lum)


Schreiber HS Hallway
Temperature, F
Light Level, lumens
Ch:1 - Temperature (°F)
Ch:2 - Light (lum)

Motors

The HVAC systems that serve the building utilize fan and pump motors which are generally in good condition and of standard to high efficiency. These systems include self-contained exhaust fan motors, pump motors and supply/return fan motors. All motors in excess of 3 horsepower either currently utilize a variable frequency drive or were analyzed for retrofit.



Renewable Energy Systems

The High School has a small, 10 kW fixed-tilt photovoltaic system which provides renewable energy for the building. The system consists of 36 panels which produce an approximate 12,556 kWh of energy per year. The system was installed as part of the previous Energy Performance Contract with another ESCO.



Mechanical Systems

HVAC Systems and Equipment:

Most non-specialty classrooms throughout the High School have a unit ventilator which supplies heating and ventilation, with a window-mounted air conditioner to supply conditioned air in the summer months. None of the unit ventilators have cooling capabilities.

Packaged Rooftop Units (RTUs) and Air Handling Units (AHUs) mainly serve the auditorium, gymnasiums, media center and other specialty rooms. Some of the RTUs have DX cooling capabilities while others are strictly heating and ventilation for their respective rooms.

The cafeteria is currently served by a brand new 20-ton LG VRF system paired with energy recovery ventilators (ERVs) which provide exhaust and outside air duty for the cafeteria as per code.

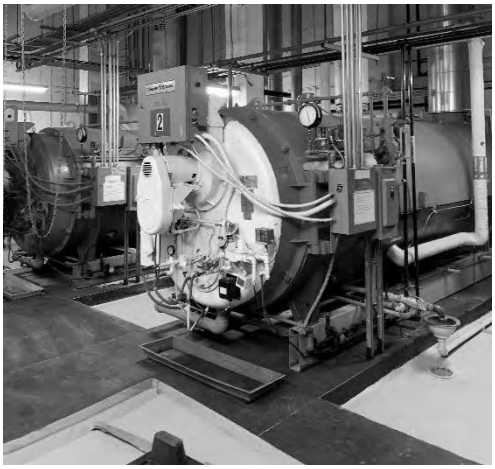


Small office areas, electric/server closets and other small spaces with special cooling requirements have ductless mini-splits that provide cooling and/or heat pump duty. There are (18) mini-split condensers from various brands and manufactured dates, ranging in size from 1-2.5 tons.



Steam & Hot Water Systems (Steam & Domestic Hot Water)

The building is heated primarily by (3) Cleaver-Brooks 6,277 MBH dual-fuel steam boilers which produce steam that goes to finned-tube radiation, AHUs, and (82) unit ventilators throughout the building. The steam is then condensed back into water, which is circulated back to the boilers via multiple condensate pump systems. The steam boilers were installed in 1991 and appear to be in good condition.



The existing domestic hot water system consists of (1) 399 MBH, 100-gallon gas-fired water heater installed in 2018 and (1) 199 MBH, 100-gallon gas-fired water heater installed in 2020. A 100-gallon storage tank is used to store the hot water before being sent out to the rest of the building. There is also a semi-instantaneous steam-to-hot water heat exchanger from 2020 which provides alternative heating source during the heating season and can provide a much greater volume of hot water. However, this system has yet to be brought online. A concern with this system is the overall heating efficiency of the domestic hot water will be less than 72% (80% boiler efficiency x 90% heat exchanger efficiency = 72% system efficiency). Replacing the current non-condensing water heater with a condensing water heater would provide an overall efficiency upgrade of over 20% from the steam to hot water heater.

High School Boilers

Designation	System Quantity	Location	Floor/ Serves	Manufacturer	Model/ Make	Date	Efficiency	Capacity
Steam Boiler	3	Boiler Room	Entire Building	Cleaver-Brooks	CBW 200-150	1991	80%	6,277 (MBH)
DHW	1	Boiler Room	Entire Building	Rheem	GHE100S U-400A	2018	95%	399.9 (MBH)
DHW	1	Boiler Room	Entire Building	American Standard	D100-199AS	2020	82.6%	199 (MBH)

Building Controls (HVAC Controls)

The building has a Johnson Controls building management system (BMS). All major mechanical equipment is tied into this system. The system is equipped with global temperature set points and are over-ridden in certain areas where complaints are made.



Each area of the building (A through G) has a different operating schedule which is tailored to the use of the area and temperature set points are set back for both the heating and cooling seasons. There are temperature sensors throughout the rooms of the buildings which communicate back for each associated heating hot water valve within each unit ventilator. 68 degrees is the global temperature set point where some were locally overridden to 60 or 70 degrees. There are existing outdoor air temperature sensors and CO2 sensors. It should be noted in the Library that based on the data logging equipment RENU installed, there does not appear to be a weekend temperature setback incorporated in the Building Management System.

Kitchen Equipment



The kitchen utilizes both electric and gas cooking equipment. Various types of refrigeration equipment are present.

The kitchen exhaust hoods have new DDC controls to start and stop the fan based upon weekly occupancy schedule integrated into the BMS. Kitchen personnel are able to override this and operate the fan in unoccupied times, by using a local timer mounted on the wall.

Plug Loads

Office equipment is regularly left in the 'on' state at all times, allowing the individual machines to revert to the 'Sleep' mode based on an internal timer. This measure will plug the office equipment into a networkable device that will allow for scheduling of the plugged in equipment.



VendingMiser controls allow for vending machines to be controlled based upon occupancy. It allows the machine to turn off during off-hours to conserve energy, and "wake up" when it senses movement in the room. RENU observed that in the Cafeteria, there were (10) vending machines which had these controls installed as part of the previous EPC. However, it was discovered that none of the machines were properly connected to their controllers and that an additional vending machine exists that requires an additional controller. All of the occupancy sensors and controllers were seemingly thrown behind the vending machines.

It is RENU's understanding that a wall had been put up in the cafeteria recently and that the vending machines were moved from their previous location. It is possible that the VendingMiser Controllers were not properly reinstalled when the machines were relocated.

RENU observed to following plug load technologies, a total of 154 devices:

Device Type:	Quantity:
Projector	54
Smartboard	2
Charging Cart	5
Small Printer	0
Medium Printer	42
Large Printer/Copier (110 only)	0
TV/LCD/Smart TV	0
Soda Vending Machine	1
Air Scrubber	18
H/C Water Dispenser	3
Water Fountain (plug on outside)	0
AC - 220 (not to be more than 20 amps)	29
AC - 110 20 amps	0
AC - 110 15 amps	0
Electric Hot Water Heater	0
Other Device not listed above	0

2.1.2 Carrie P. Weber Middle School

Background Information



Carrie P. Weber Middle School is located at 52 Campus Drive Port Washington, New York. This 305,821 ft^2 facility was originally built in 1927 and remains in good condition. The Middle School consists of three (3) floors of classroom space, office space, two (2) gymnasiums, an auditorium, library/media center, a cafeteria, a kitchen and locker rooms.

Building Occupancy

Approximate enrollment is 1,200 students with a staff of 124 people.

Hours of Operation

- Monday through Friday (School Hours) – 8:00 am to 3:10 pm
- Monday through Friday (Whole Building) 6:00 am to 11:00 pm (students/staff)
- Saturday and Sunday (Gyms, Auditorium, Health Center and some Classrooms) 7:00 am to 5:00 pm

Building Envelope





The building is constructed of steel columns with a brick façade. The building has flat and pitched roofs which appear to be in good condition. The building has double pane operable windows with metal frames and interior shades. The exterior doors are typically metal with glass panes and metal frames. Corridor areas have large double pane fixed windows with metal frames. The exterior doors have either missing or worn weather-stripping materials which show signs of excessive infiltration. The building envelope has deficiencies and contributes to air infiltration.

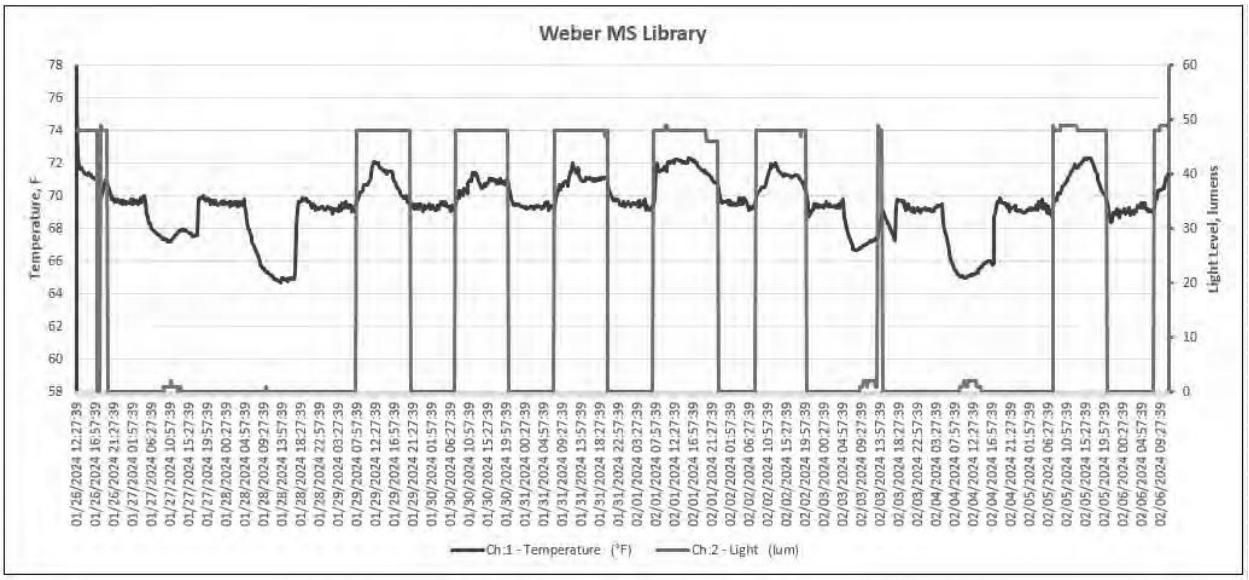
Lighting

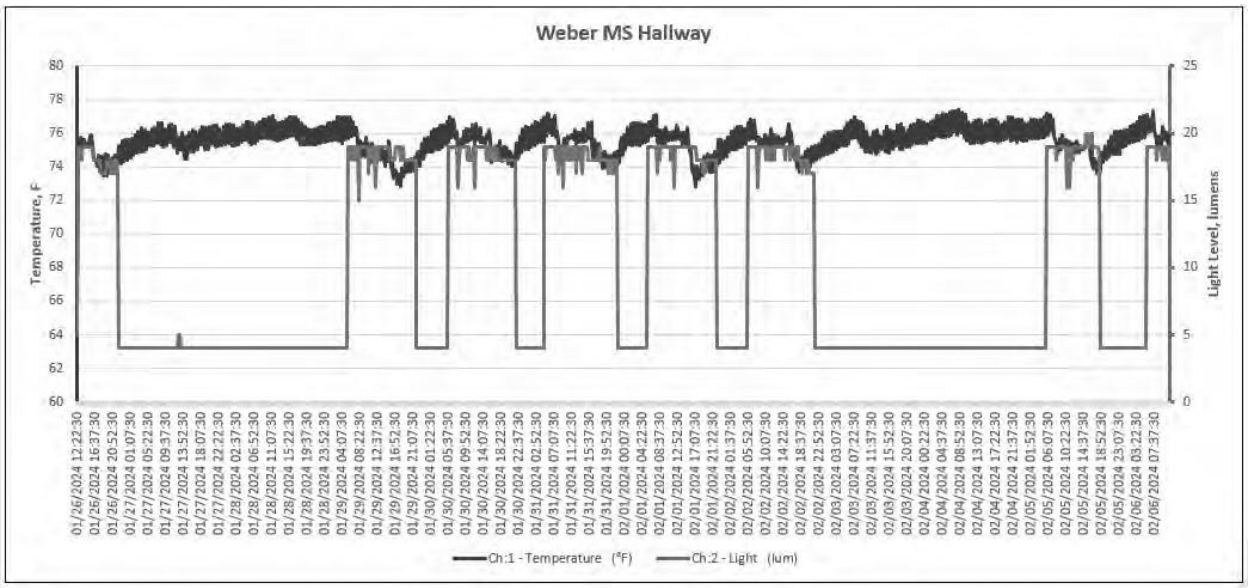
The Middle School lighting has been upgraded to LED, with a few exceptions. The two gyms were not upgraded, which totals (38) high bay fixtures, which are either induction or Metal Halide. Both gyms are currently underlit and would benefit from the installation of LED high bay/gym fixtures with occupancy and dimming controls.

Lighting Controls:

The lighting in individual rooms is manually controlled via wall switches or occupancy based sensors. Typical classrooms are equipped with bi-level switching where 2 or 3 lamps may operate at a time.

RENU installed Light/Temperature datalogging meters in the Middle School Library and a hallway to gain better understanding of the building's trends throughout the day and week. The following graphs show the data from January 26th to February 6, 2024. The cycling of the lighting appears to coincide with occupied hours for both students/faculty and custodial crews.





Motors

The HVAC systems that serve the building utilize fan and pump motors which are generally in good condition and of standard to high efficiency. These systems include exhaust fan motors, pump motors and supply fan motors. All motors in excess of 5 horsepower either currently utilize a variable frequency drive or were analyzed for retrofit.



Renewable Energy Systems

The Middle School does not currently have any source of renewable energy systems installed.

Mechanical Systems

HVAC Systems and Equipment:



The building is heated by a steam boiler system and cooled by both chilled water and DX systems. This is an efficient system as it provides central generation of heating to the distributed systems. The new section air handlers are served by the chiller. Some components of the major units serving the main gymnasium require frequent maintenance. For the purposes of this report, the efficiencies were de-rated for the existing equipment.

Hot Water Systems (Heating Hot Water & Domestic Hot Water)



The building is heated primarily by (3) Cleaver-Brooks 8,369 MBH, 6,277 MBH and 4,134 MBH dual-fuel steam boilers which produce steam that goes to finned-tube radiation, AHUs and (63) unit ventilators throughout the building. The steam is then condensed back into water, which is circulated back to the boilers via (3) 1-HP feedwater pumps. The steam boilers were installed in 1989 and are in relatively good condition.

The existing domestic hot water system consists of (1) 250 MBH, 100-gallon gas-fired water heater installed in 2022. A 100-gallon storage tank is used to store the hot water before being sent out to the rest of the building. There is also a semi-instantaneous steam-to-hot water heat exchanger from 2019 which provides alternative generation of domestic hot water when the boilers are operational.

Middle School Boilers

Designation	System Quantity	Location	Floor/ Serves	Manufacturer	Model/ Make	Date	Efficiency	Capacity
Boiler	1	Boiler Room	Entire Building	Cleaver Brooks	CBW 200-200	1989	80%	8369 (MBH)
Boiler	1	Boiler Room	Entire Building	Cleaver Brooks	CBW 200-100	1989	80%	4134 (MBH)
Boiler	1	Boiler Room	Entire Building	Cleaver Brooks	CBW 200-150	1989	80%	6277 (MBH)
DHW	1	Boiler Room	Entire Building	Bradford White	D100L25 03A	2022	80%	250 (MBH)

Building Controls (HVAC Controls)



The building has a Johnson Controls building management system (BMS). All major mechanical equipment is tied into this system. The system is equipped with global temperature set points and are over-ridden in certain areas where complaints are made. Each area of the building has a different operating schedule which is tailored to the use of the area and temperature set points are set back for both the heating and cooling seasons. There are temperature sensors throughout the rooms of the buildings which communicate back for each associated heating hot water valve within each unit ventilator. 68 degrees is the global temperature set point where some were locally overridden to 60 or 70 degrees. There are existing outdoor air temperature sensors and CO2 sensors. Of note in the Library data, the weekend temperature setback sequence incorporated in the Building Management System appears to mimic the weekday sequence instead of maintaining a lower setpoint for the entire weekend (1/27-1/28).

Kitchen Equipment

The kitchen utilizes both electric and gas cooking equipment. Various types of refrigeration equipment are present.

Plug Loads

Office equipment is regularly left in the ‘on’ state at all times allowing the individual machine to revert to the ‘Sleep’ mode based on an internal timer. This measure will plug the office equipment into a networkable device that will allow for scheduling of the plugged in equipment.

RENU observed to following plug load technologies, a total of 176 devices:

Device Type:	Quantity:
Projector	69
Smartboard	1
Projector/Smartboard Combo	0
Air Scrubber	24
Charging Cart	0
Small Printer	0
Medium Printer	53
Large Printer/Copier (110 only)	0
TV/LCD/Smart TV	0
Snack Vending	0
Soda Vending	0
Lg Coffeemaker (Bunn)	0
H/C Water Dispenser	5
Water Fountain (plug on outside)	0
AC - 220 (not to be more than 20 amps)	23
AC - 110 20 amps	0
AC - 110 15 amps	1
Electric Hot Water Heater	0
Other Device not listed above	0





2.1.3 Administration Building

Background Information



The Port Washington Administration building is located at 100 Campus Drive, Port Washington, New York. This 4,450 ft^2 facility was originally built in 1952 and remains in fair condition. The building consists of (1) floor of office space for the administration and various warehouse/maintenance garage spaces.

Building Occupancy

Approximate occupancy is a staff of 25 people.

Hours of Operation

- Monday through Friday (Whole Building) 6:00 am to 5:00 pm

Building Envelope





The building is constructed of composite walls with a brick façade. The main building has a flat roof which appears to be in good condition. The external maintenance buildings are steel with metal siding and flat, sloped roofs. The main building has double pane operable windows with metal frames and interior shades. The exterior doors are typically metal with glass panes and metal frames. The exterior doors have either missing or worn weather-stripping materials which show signs of excessive infiltration. The building envelope has deficiencies and contributes to a significant amount of air infiltration.

Lighting

The building is primarily lit by LED fixtures with a few minor exceptions.



Lighting Controls:

The lighting in individual rooms is manually controlled via wall switches or occupancy based sensors.

Motors

The HVAC systems that serve the building utilize fan and pump motors which are generally in good condition and of standard to high efficiency. These systems include exhaust fan motors, pump motors and supply fan motors. All motors in excess of 3 horsepower either currently utilize a variable frequency drive or were analyzed for retrofit.



Renewable Energy Systems

The Administration building does not currently have any source of renewable energy systems installed.

Mechanical Systems

HVAC Systems and Equipment:

The office section of the building is primarily served by (3) 5-ton AHUs with their own associated outdoor condenser. The units provide the necessary cooling and ventilation needs for the office space. The perimeter office spaces are also served by finned-tube radiation. (4) 1/6-HP pumps circulate hot water throughout the building.



The garage areas are served by hot-water unit heaters which receive their hot water from the boiler plant. There is also a brand new, used-fuel oil burner that was installed as part of the previous EPC which utilizes used-fuel from maintenance equipment to heat the main garage area, in order to reduce the demand on the boiler plant.

Hot Water Systems (Heating Hot Water & Domestic Hot Water)



The building is supplied heating hot water by two (2) Weil-McLain 1,010 MBH gas-fired non-condensing boilers which are in good condition. The hot-water boilers have Intellidyne fuel-use economizers installed.

The building's domestic hot water is supplied by (1) Bradford White 40-gallon, gas fired 40 MBH domestic water heater from 2020.

Admin Building Boilers

Designation	System Quantity	Location	Floor/ Serves	Manufacturer	Model/ Make	Date	Efficiency	Capacity
Boiler	2	Boiler Room	Entire Building	Weil-McLain	88-488	-	84%	1,010 (MBH)
DHW	1	Boiler Room	Entire Building	Bradford White	RG240T6 N	2020	80%	40 (MBH)

Building Controls (HVAC Controls)

The building has a Johnson Controls building management system (BMS). There are (3) three network thermostats that monitor, trend, alarm, and provide optimal start/stop features.

Kitchen Equipment

The administration building does not have a commercial kitchen, instead having a small break room with a residential-style refrigerator, toaster oven, microwave oven and coffee maker.



Plug Loads

Office equipment is regularly left in the 'on' state at all times allowing the individual machine to revert to the 'Sleep' mode based on an internal timer. This measure will plug the office equipment into a networkable device that will allow for scheduling of the plugged in equipment.

RENU observed to following significant plug load technologies, a total of 9 devices:

Device Type:	Quantity:
Medium Printers	7
Large Printer/Copier	0
AC - 220 (not to be more than 20 amps)	1
Computers	0
Snack Vending	0
Soda Vending	0
Coffeemaker	0
Microwave/Toaster Oven	0
Water Fountain (plug on outside)	0
Electric Hot Water Heater	0
AC - 110	1



2.1.4 John Philip Sousa Elementary

Background Information



John Philip Sousa Elementary School is located at 101 Sands Point Road, Port Washington, New York. This 83,000 ft^2 facility was originally built in 1956 and remains in fair condition. The Elementary School consists of two (2) floors of classroom space, office space, a gymnasium, an auditorium, library/media center, a cafeteria, and a kitchen. The auditorium is currently not in use.

Building Occupancy

Approximate enrollment is 520 students with a staff of 46 people.

Hours of Operation

- Monday through Friday (Whole Building) 6:00 am to 6:00 pm (students/staff)
- Saturday and Sunday (Gyms, Auditorium, Health Center and some Classrooms) 7:00 am to 5:00 pm

Building Envelope





The building is constructed of steel columns with a brick façade. The building has flat roofs which appear in good condition. The building has double pane operable windows with metal frames and interior shades. The exterior doors are typically metal with glass panes and metal frames. Corridor areas have large double pane fixed windows with metal frames. The exterior doors have either missing or worn weather-stripping materials which show signs of excessive infiltration. The building envelope has deficiencies and contributes to a significant amount of air infiltration.

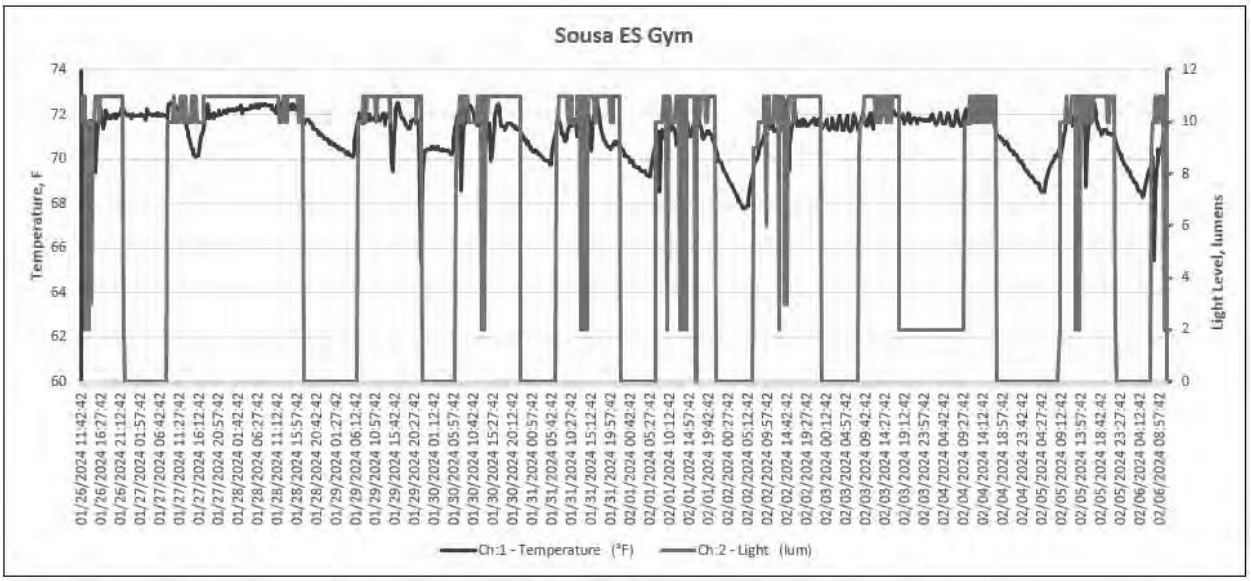
Lighting

The building has been upgraded to LED, with a few minor exceptions. Specifically, the Gym has (12) 2x4 6-light T8 fluorescent fixtures with a cage guard that should be replaced with new high bay LED fixtures with built-in occupancy sensors.

Lighting Controls:

The lighting in individual rooms is manually controlled via wall switches or occupancy based sensors. Typical classrooms are equipped with bi-level switching where 2 or 3 lamps may operate at a time.

RENU installed Light/Temperature datalogging meters in the school's gym to gain better understanding of the building's trends throughout the day and week. The following graphs show the data from January 26th to February 6, 2024. The cycling of the lighting appears to coincide with occupied hours for both students/faculty and custodial crews. Of note in the Gym data, there does not appear to be a weekend temperature setback incorporated in the Building Management System.



Motors

The HVAC systems that serve the building utilize fan and pump motors which are generally in good condition and of standard to high efficiency. These systems include exhaust fan motors, pump motors and supply fan motors. All motors in excess of 5 horsepower either currently utilize a variable frequency drive or were analyzed for retrofit.



Renewable Energy Systems

Sousa Elementary School does not have any sources of renewable energy.

Mechanical Systems

HVAC Systems and Equipment:

The building is heated by a hot water boiler system. This is an efficient system as it utilizes the hot water distribution to terminal AHUs. There are (4) four main AHU/Fans that serve the Auditorium, Library, and Gym (2 units). For the purposes of this report, the efficiencies were de-rated for the existing equipment.



Hot Water Systems (Heating Hot Water & Domestic Hot Water)



The building is heated primarily by (2) Cleaver Brooks 6,277 MBH dual-fuel boilers which produce hot water that goes to finned-tube radiation, AHUs and (30) unit ventilators throughout the building. The hot water boilers were installed in 1990 and are in good condition. The boilers are equipped with Intellidyne Fuel Use Economizers.

The heating hot water is primarily pumped throughout the building with (2) 7.5-HP pumps. The pumps are equipped with VFDs.

The existing domestic hot water system consists of (2) 199.9 MBH, 100-gallon gas-fired water heater installed in 2009 and 2016.

Sousa Boilers

Designation	System Quantity	Location	Floor/ Serves	Manufacturer	Model/ Make	Date	Efficiency	Capacity
Boiler	2	Boiler Room	Entire Building	Cleaver Brooks	CBW 200-150	1990	80%	6277 (MBH)
DHW	1	Boiler Room	Entire Building	Bradford White	D100L1 993N	2016	80%	199 (MBH)
DHW	1	Boiler Room	Entire Building	A.O. Smith	BTR200-118	2009	80%	199 (MBH)

Building Controls (HVAC Controls)

The building has a Johnson Controls building management system (BMS). All major mechanical equipment is tied into this system. The system is equipped with zone temperature set points and are over-ridden in certain areas where complaints are made. There are temperature sensors throughout the zones of the buildings which communicate back for each associated heating hot water valve within each unit ventilator. Key components of the BMS are an array of trends/alarms, optimal start/stop for major equipment, start/stop/alarm of the boilers.

Kitchen Equipment

The kitchen utilizes both electric and gas cooking equipment. Various types of refrigeration equipment are present.

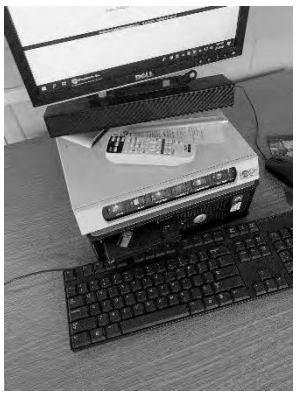
Plug Loads

Office equipment is regularly left in the 'on' state at all times allowing the individual machine to revert to the 'Sleep' mode based on an internal timer. This measure will plug the office equipment into a networkable device that will allow for scheduling of the plugged in equipment.

RENU observed to following plug load technologies, a total of 79 devices:

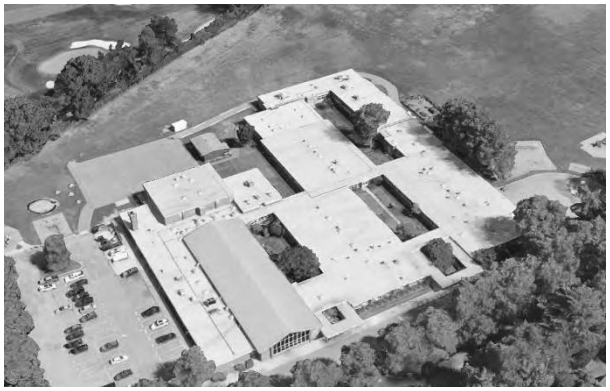
Device Type:	Quantity:
Projector	29
Smartboard	0
Projector/Smartboard Combo	0
Air Scrubber	3
Charging Cart	3
Small Printer	0
Medium Printer	21
Large Printer/Copier (110 only)	0
TV/LCD/Smart TV	0
Snack Vending	0
Soda Vending	1
Lg Coffeemaker (Bunn)	0
H/C Water Dispenser	0
Water Fountain (plug on outside)	0
AC - 220 (not to be more than 20 amps)	22
AC - 110 20 amps	0
AC - 110 15 amps	0
Electric Hot Water Heater	0
Other Device not listed above	0





2.1.5 Guggenheim Elementary

Background Information



Guggenheim Elementary School is located at 38 Poplar Place, Port Washington, New York. This 67,500 ft^2 facility was originally built in 1962 and remains in fair condition. Guggenheim Elementary School consists of one (1) floor of classroom space, office space, a gymnasium, an auditorium/cafeteria, a library/media center, a music room and a kitchen.

Building Occupancy

Approximate enrollment is 497 students with a staff of 54 people.

Hours of Operation

- Monday through Friday (Whole Building) 6:00 am to 6:00 pm (students/staff)
- Saturday and Sunday (Gyms, Auditorium, Health Center and some Classrooms) 7:00 am to 5:00 pm

Building Envelope



The building is constructed of steel columns with a brick façade. The building has flat roofs which appear in good condition. The building has double pane operable windows with metal frames and interior shades. The exterior doors are typically metal with glass panes and metal frames. Corridor areas have large double pane fixed windows with metal frames. The exterior doors have either missing or worn weather-stripping materials which show signs of excessive infiltration. The building envelope has deficiencies and contributes to a significant amount of air infiltration.

Lighting

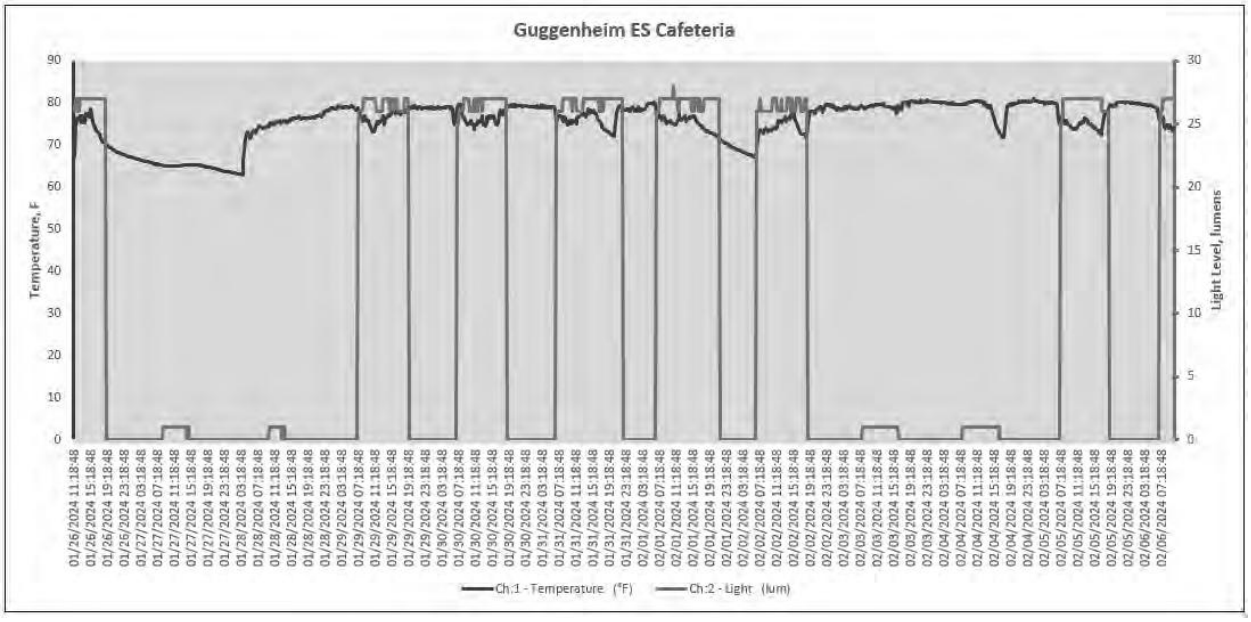
The building is primarily lit by fixtures which contain LED tubes. However, the library has not been completely upgraded to LED. Additionally, the gym has a mix of fixtures that were upgraded with LED tubes and fixtures that are still T12 fluorescent fixtures.

Lighting Controls:

The lighting in individual rooms are manually controlled via wall switches or occupancy based sensors. Typical classrooms are equipped with bi-level switching where 2 or 3 lamps may operate at a time.

RENU installed Light/Temperature datalogging meters in the school gym and cafeteria to gain better understanding of the building's trends throughout the day and week. The following graphs show the data from January 26th to February 6, 2024. The cycling of the lighting appears to coincide with occupied hours for both students/faculty and custodial crews. Of note in the cafeteria data, there does not appear to be a weekend temperature setback incorporated in the Building Management System (2/3-2/4).





Motors

The HVAC systems that serve the building utilize fan and pump motors which are generally in good condition and of standard to high efficiency. These systems include self-contained exhaust fan motors, pump motors and supply fan motors. All motors in excess of 3 horsepower either currently utilize a variable frequency drive or were analyzed for retrofit.



Renewable Energy Systems

Guggenheim Elementary School does not have any sources of renewable energy.

Mechanical Systems

HVAC Systems and Equipment:

Most non-specialty classrooms throughout the elementary school have a unit ventilator which supplies heating and ventilation, with a window-mounted air conditioner to supply conditioned air in the summer months. None of the unit ventilators have cooling capabilities.



Packaged Rooftop units (RTUs) and Air Handling Units (AHUs) mainly serve the cafetorium, gymnasium, media center and other specialty rooms. There was a recent building addition to Guggenheim in 2018. This entire section has (4) of its own RTUs as well as (2) VRF systems with ERVs to serve the spaces.

Small office areas, electric/server closets and other small spaces with special cooling requirements have ductless mini-split systems that provide cooling and/or heat pump duty. There are (17) mini-split condensers from various brands and manufactured dates, ranging in size from 0.75-2.5 tons.

Hot Water Systems (Heating Hot Water & Domestic Hot Water)



The building is heated primarily by (2) Burnham 3,348 MBH dual-fuel boilers which produce hot water that goes to finned-tube radiation, AHUs and (39) unit ventilators throughout the building. The hot water boilers were installed in 1991 and are in good condition.

The hot water is pumped throughout the building with (5) 2-HP each pumps, with an additional (2) 1.5-HP pumps added for the 2018 addition of the building.

The building is supplied with domestic hot water by one (1) gas-fired 199.9 MBH domestic hot water heater.

Guggenheim Boilers

Designation	System Quantity	Location	Floor/ Serves	Manufacturer	Model/ Make	Date	Efficiency	Capacity
Boiler	2	Boiler Room	Entire Building	Burnham	3W-100-50	1991	80%	3348 (MBH)
DHW	1	Boiler Room	Entire Building	Bradford White	D80T1993N	2014	80%	199.9 (MBH)

Building Controls (HVAC Controls)

The building has a Johnson Controls building management system (BMS). All major mechanical equipment is tied into this system. The system is equipped with zone temperature set points and are over-ridden in certain areas where complaints are made. There are temperature sensors throughout the zones of the buildings which communicate back for each associated heating hot water valve within each unit ventilator. Key components of the BMS are an array of trends/alarms, optimal start/stop for major equipment, start/stop/alarm of the boilers.

Kitchen Equipment



The kitchen utilizes both electric and gas cooking equipment. Various types of refrigeration equipment are present.

The kitchen exhaust hoods have new DDC controls to start and stop the fan based upon weekly occupancy schedule integrated into the BMS. Kitchen personnel are able to override this and operate the fan in unoccupied times, by using a local timer mounted on the wall.

Plug Loads

Office equipment is regularly left in the ‘on’ state at all times allowing the individual machine to revert to the ‘Sleep’ mode based on an internal timer. This measure will

plug the office equipment into a networkable device that will allow for scheduling of the plugged in equipment.

RENU observed to following plug load technologies, a total of 91 devices:

Device Type:	Quantity:
Projector	34
Smartboard	0
Projector/Smartboard Combo	0
Air Scrubber	11
Charging Cart	4
Small Printer	0
Medium Printer	19
Large Printer/Copier (110 only)	0
TV/LCD/Smart TV	0
Snack Vending	0
Soda Vending	1
Lg Coffeemaker (Bunn)	0
H/C Water Dispenser	2
Water Fountain (plug on outside)	0
AC - 220 (not to be more than 20 amps)	20
AC - 110 20 amps	0
AC - 110 15 amps	0
Electric Hot Water Heater	0
Other Device not listed above	0





2.1.6 South Salem Elementary

Background Information



South Salem Elementary School is located at 10 Newbury Road, Port Washington, New York. This 55,000 ft^2 facility was originally built in 1951 and remains in fair condition. South Salem Elementary School consists of two (2) floors of classroom space, office space, a gymnasium, a library/media center, a cafeteria, and a kitchen.

Building Occupancy

Approximate enrollment is 426 students with a staff of 39 people.

Hours of Operation

- Monday through Friday (Whole Building) 6:00 am to 6:00 pm (students/staff)

- Saturday and Sunday (Gyms, Auditorium, Health Center and some Classrooms) 7:00 am to 5:00 pm

Building Envelope





The building is constructed of steel columns with a brick façade. The building has flat roofs which appear in good condition. The building has double pane operable windows with metal frames and interior shades. The exterior doors are typically metal with glass panes and metal frames. Corridor areas have large double pane fixed windows with metal frames. The exterior doors have either missing or worn weather-stripping materials which show signs of excessive infiltration. The building envelope has deficiencies and contributes to a significant amount of air infiltration.

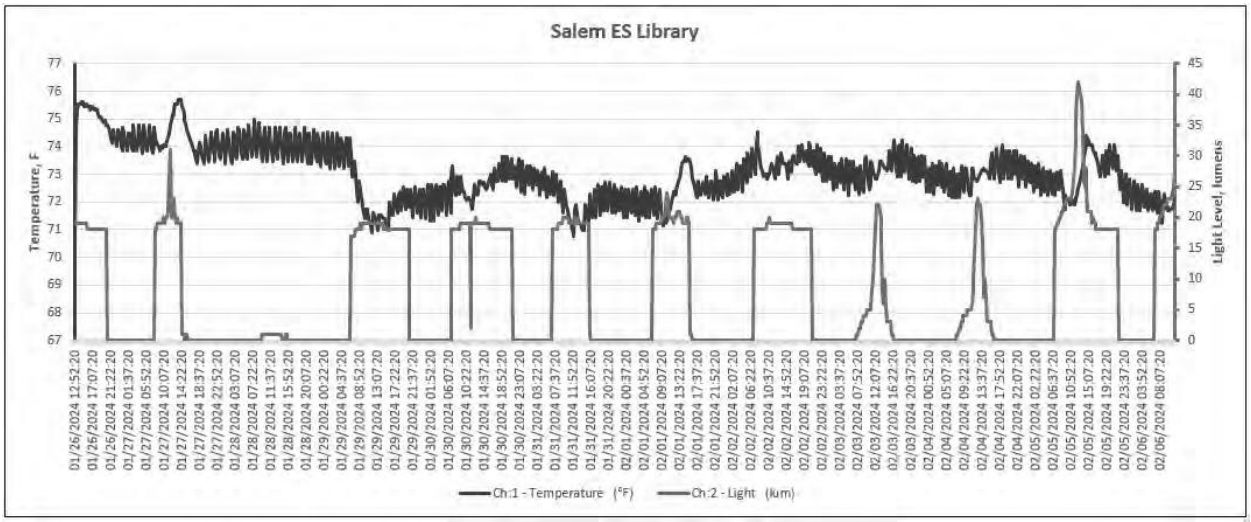
Lighting

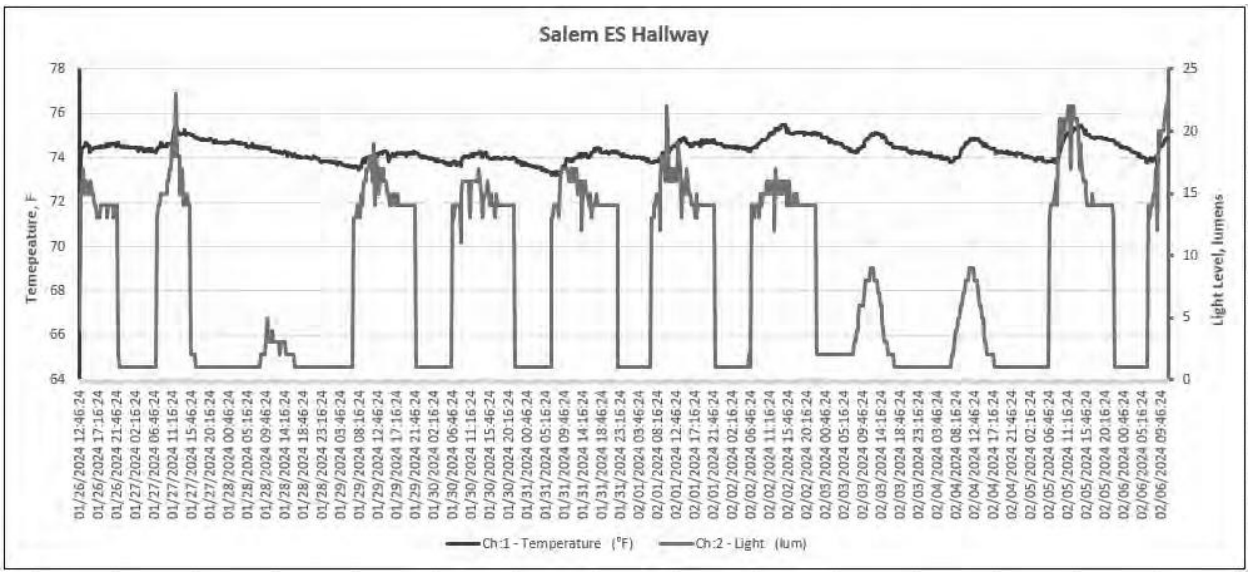
The building is primarily lit by LED fixtures. However, there were several areas noted throughout the building that require upgrade from fluorescent. These areas include the Library, Music Room, and (2) hallways.

Lighting Controls:

The lighting in individual rooms is manually controlled via wall switches or occupancy based sensors. Typical classrooms are equipped with bi-level switching where 2 or 3 lamps may operate at a time.

RENU installed Light/Temperature datalogging meters in the school's library and a hallway to gain better understanding of the building's trends throughout the day and week. The following graphs show the data from January 26th to February 6, 2024. The cycling of the lighting appears to coincide with occupied hours for both students/faculty and custodial crews. Of note in the Library data, there does not appear to be a weekend temperature setback incorporated in the Building Management System (1/27-1/28 & 2/3-2/4).





Motors

The HVAC systems that serve the building utilize fan and pump motors which are generally in good condition and of standard to high efficiency. These systems include exhaust fan motors, pump motors and supply fan motors. All motors in excess of 3 horsepower either currently utilize a variable frequency drive or were analyzed for retrofit.



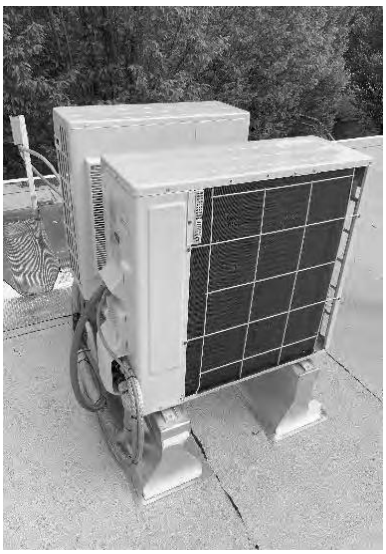
Renewable Energy Systems

South Salem Elementary School does not have any sources of renewable energy.

Mechanical Systems

HVAC Systems and Equipment:

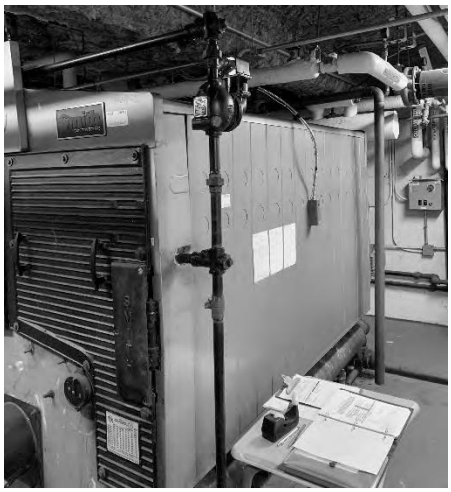
Most non-specialty classrooms throughout the elementary school have a unit ventilator which supplies heating and ventilation, with a window-mounted air conditioner to supply conditioned air in the summer months. None of the unit ventilators have cooling capabilities.



Packaged Rooftop units (RTUs) and Air Handling Units (AHUs) mainly serve the Faculty Lounge, Gym, Library and other specialty rooms.

Small office areas, electric/server closets and other small spaces with special cooling requirements have ductless mini-split system that provide cooling and/or heat pump duty. There are (7) mini-split condensers from various brands and manufactured dates, ranging in size from 0.75-2.75 tons.

Hot Water Systems (Heating Hot Water & Domestic Hot Water)



The building is heated primarily by (2) HB Smith 6,825 MBH dual-fuel boilers which produce hot water that goes to finned-tube radiation, AHUs and (30) unit ventilators throughout the building. The hot water boilers were installed in 2001 and are in good condition.

The hot water is pumped throughout the building with (2) 7.5-HP pumps and (2) 5-HP pumps. The pumps are not currently on VFDs.

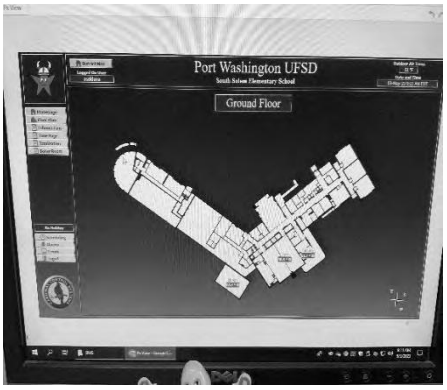
The existing domestic hot water system consists of (2) 199.9 MBH, 140-gallon gas-fired water heater installed in 2004.

Salem Boilers

Designation	System Quantity	Location	Floor/ Serves	Manufacturer	Model/ Make	Date	Efficiency	Capacity
Boiler	2	Boiler Room	Entire Building	HB Smith	4500A - W-16	2001	80%	6,825 (MBH)
DHW	2	Boiler Room	Entire Building	A.O. Smith	BTP140-199000	2003	80%	199 (MBH)

Building Controls (HVAC Controls)

The building has a Johnson Controls building management system (BMS). All major mechanical equipment is tied into this system. The system is equipped with zone temperature set points and are over-ridden in certain areas where complaints are made. There are temperature sensors throughout the zones of the buildings which communicate back for each associated heating hot water valve within each unit ventilator. Key components of the BMS are an array of trends/alarms, optimal start/stop for major equipment, start/stop/alarm of the boilers.



Kitchen Equipment

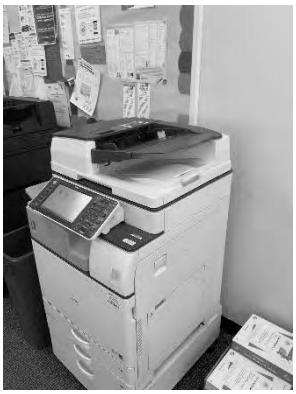
The kitchen utilizes both electric and gas cooking equipment. Various types of refrigeration equipment are present.

Plug Loads

Office equipment is regularly left in the 'on' state at all times allowing the individual machine to revert to the 'Sleep' mode based on an internal timer. This measure will plug the office equipment into a networkable device that will allow for scheduling of the plugged in equipment.

RENU observed to following plug load technologies, a total of 43 devices:

Device Type:	Quantity:
Projector	15
Smartboard	0
Projector/Smartboard Combo	0
Air Scrubber	1
Charging Cart	1
Small Printer	0
Medium Printer	14
Large Printer/Copier (110 only)	0
TV/LCD/Smart TV	0
Snack Vending	0
Soda Vending	0
Lg Coffeemaker (Bunn)	0
H/C Water Dispenser	0
Water Fountain (plug on outside)	0
AC - 220 (not to be more than 20 amps)	12
AC - 110 20 amps	0
AC - 110 15 amps	0
Electric Hot Water Heater	0
Other Device not listed above	0





2.1.7 John J. Daly Elementary

Background Information



John J. Daly Elementary School is located at 36 Rockwood Ave, Port Washington, New York. This 81,564 ft^2 facility was originally built in 1927 and remains in good condition. Daly Elementary School consists of two (2) floors of classroom space, office space, a gymnasium, an auditorium, library, a cafeteria, a kitchen, and a health center. The administration annex also occupies space within the building. The District is in the process of constructing a brand new wing.

Building Occupancy

Approximate enrollment is 478 students with a staff of 40 people.

Hours of Operation

- Monday through Friday (Whole Building) 6:00 am to 6:00 pm (students/staff)
- Saturday and Sunday (Gyms, Auditorium, and some Classrooms) 7:00 am to 5:00 pm

Building Envelope





The building is constructed of steel columns with a brick façade. The building has flat roofs which appear in good condition. The building has double pane operable windows with metal frames and interior shades. The exterior doors are typically metal with glass panes and metal frames. Corridor areas have large double pane fixed windows with metal frames. The exterior doors have either missing or worn weather-stripping materials which show signs of excessive infiltration. The building envelope has deficiencies and contributes to a significant amount of air infiltration.

Lighting

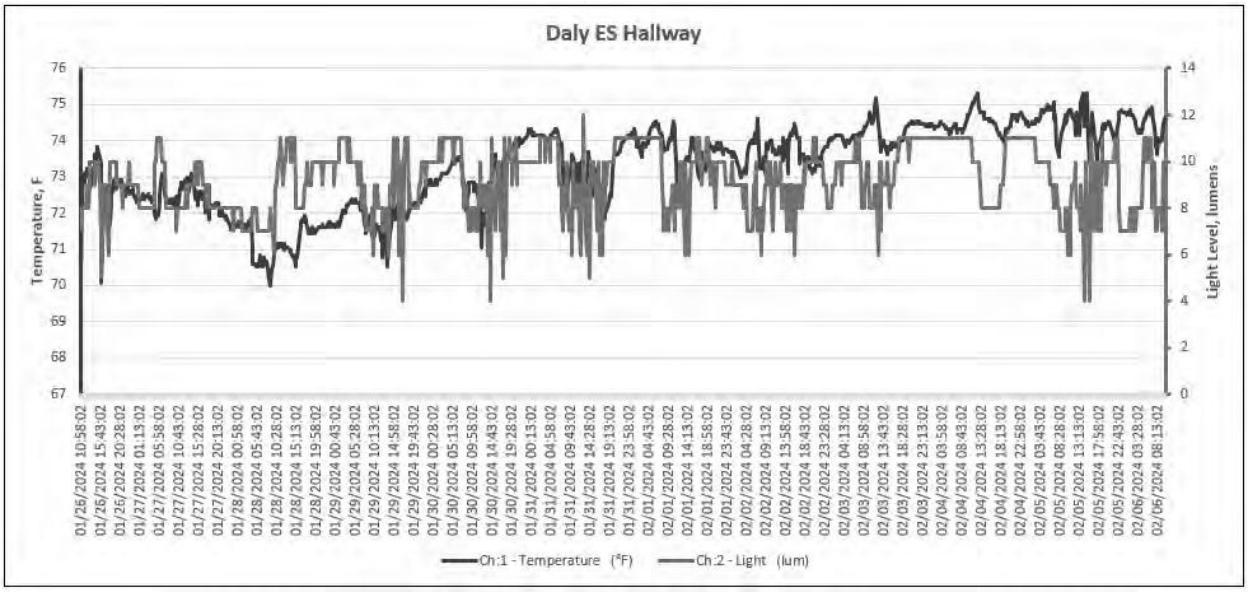
The lighting in this building has been upgraded to LED, with a few minor exceptions. There are existing round downlights that have compact fluorescent lamps in them that should be upgraded to LED.



Lighting Controls:

The lighting in individual rooms is manually controlled via wall switches or occupancy based sensors. Typical classrooms are equipped with bi-level switching where 2 or 3 lamps may operate at a time.

RENU installed Light/Temperature datalogging meters in the school's hallway to gain better understanding of the building's trends throughout the day and week. The following graphs show the data from January 26th to February 6, 2024.



Motors

The HVAC systems that serve the building utilize fan and pump motors which are generally in good condition and of standard to high efficiency. These systems include self-contained exhaust fan motors, pump motors and supply fan motors. All motors in excess of 5 horsepower either currently utilize a variable frequency drive or were analyzed for retrofit.



Renewable Energy Systems

Daly Elementary School does not currently have any source of renewable energy systems installed.

Mechanical Systems

HVAC Systems and Equipment:

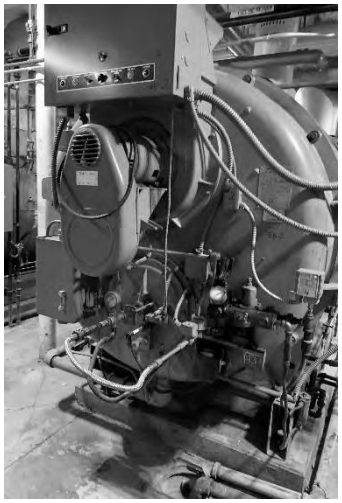


Most non-specialty classrooms throughout the elementary school have a unit ventilator which supplies heating and ventilation, with a window-mounted air conditioner to supply conditioned air in the summer months. None of the unit ventilators have cooling capabilities.

Packaged Rooftop units (RTUs) and Air Handling Units (AHUs) mainly serve the Faculty Lounge, Gym, Library and other specialty rooms.

Small office areas, electric/server closets and other small spaces with special cooling requirements have ductless mini-split systems that provide cooling and/or heat pump duty. There are (7) mini-split condensers from various brands and manufactured dates, ranging in size from 0.75-2.75 tons.

Hot Water Systems (Heating Hot Water & Domestic Hot Water)





The building is heated primarily by (2) Cleaver-Brooks 5,230 MBH dual-fuel steam boilers and one (1) Burnham 3,348 MBH steam boiler which produces steam that goes to finned-tube radiation, AHUs and (38) unit ventilators throughout the building. The steam is then condensed back into water, which is circulated back to the boilers via (4) 3/4-HP feedwater pumps. The steam boilers were installed in 1990 and are in good condition.

The existing domestic hot water system consists of (1) 76 MBH, 75-gallon gas-fired water heater installed in 2003 and (1) 76 MBH, 75-gallon gas-fired water heater installed in 2020.

Daly Boilers

Designation	System Quantity	Location	Floor/ Serves	Manufacturer	Model/ Make	Date	Efficiency	Capacity
Boiler	2	Boiler Room	Entire Building	Cleaver Brooks	CB-200-125	1990	80%	5,230 (MBH)
Boiler	1	Boiler Room	Entire Building	Burnham	5L-80-50	2003	80%	3,348 (MBH)
DHW	1	Boiler Room	Entire Building	American Standard	75-76-AS	2003	80%	75 (MBH)
DHW	1	Boiler Room	Entire Building	Bradford White	RG275H5 N	2020	80%	75 (MBH)

Building Controls (HVAC Controls)



The building has a Johnson Controls building management system (BMS). All major mechanical equipment is tied into this system. The system is equipped with zone temperature set points and are over-ridden in certain areas where complaints are made. There are temperature sensors throughout the zones of the buildings which communicate back for each associated heating hot water valve within each unit ventilator. Key components of the BMS are an array of trends/alarms, optimal start/stop for major equipment, start/stop/alarm of the boilers.

Kitchen Equipment

The kitchen utilizes both electric and gas cooking equipment. Various types of refrigeration equipment are present.

Plug Load

Office equipment is regularly left in the ‘on’ state at all times allowing the individual machine to revert to the ‘Sleep’ mode based on an internal timer. This measure will plug the office equipment into a networkable device that will allow for scheduling of the plugged in equipment.

RENU observed to following plug load technologies, a total of 67 devices:

Device Type:	Quantity:
Projector	29
Smartboard	0
Projector/Smartboard Combo	0
Air Scrubber	3
Charging Cart	3
Small Printer	0
Medium Printer	14
Large Printer/Copier (110 only)	0
TV/LCD/Smart TV	0
Snack Vending	0
Soda Vending	0
Lg Coffeemaker (Bunn)	0
H/C Water Dispenser	3
Water Fountain (plug on outside)	0
AC - 220 (not to be more than 20 amps)	15
AC - 110 20 amps	0
AC - 110 15 amps	0
Electric Hot Water Heater	0
Other Device not listed above	0





2.1.8 Manorhaven Elementary

Background Information



Manorhaven Elementary School is located at 12 Morewood Oaks Drive, Port Washington, New York. This 52,570 ft^2 facility was originally built in 1951 and remains in fair condition. Manorhaven Elementary School consists of one (1) floor of classroom space, office space, a gymnasium, a cafetorium, a library, a kitchen, and multi-purpose rooms.

Building Occupancy

Approximate enrollment is 458 students with a staff of 51 people.

Hours of Operation

- Monday through Friday (Whole Building) 6:00 am to 6:00 pm (students/staff)
- Saturday and Sunday (Gym and some Classrooms) 7:00 am to 5:00 pm

Building Envelope





The building is constructed of steel columns with a brick façade. The building has flat and pitched roofs which appear in good condition. The building has double pane operable windows with metal frames and interior shades. The exterior doors are typically metal with glass panes and metal frames. Corridor areas have large double pane fixed windows with metal frames. The exterior doors have either missing or worn weather-stripping materials which show signs of excessive infiltration. The building envelope has deficiencies and contributes to a significant amount of air infiltration.

Lighting

The building is upgraded to LED lighting throughout.



Lighting Controls:

The lighting in individual rooms is manually controlled via wall switches or occupancy based sensors. Typical classrooms are equipped with bi-level switching where 2 or 3 lamps may operate at a time.

Motors

The HVAC systems that serve the building utilize fan and pump motors which are generally in good condition and of standard to high efficiency. These systems include self-contained, exhaust fan motors, pump motors and supply fan motors. All motors in excess of 3 horsepower either currently utilize a variable frequency drive or were analyzed for retrofit. The existing 10-HP heating hot water pumps P-1 and P-2 are already equipped with VFDs.



Renewable Energy Systems

Manorhaven Elementary School does not currently have any source of renewable energy systems installed.

Mechanical Systems

HVAC Systems and Equipment:

Most non-specialty classrooms throughout the elementary school have a unit ventilator which supplies heating and ventilation, with a window-mounted air conditioner to supply conditioned air in the summer months. None of the unit ventilators have cooling capabilities.



Packaged Rooftop units (RTUs) and Air Handling Units (AHUs) mainly serve the Music Room, Gym, and other specialty rooms.

Small office areas, electric/server closets and other small spaces with special cooling requirements have ductless mini-split systems that provide cooling and/or heat pump duty. There are (12) mini-split condensers from various brands and manufactured dates, ranging in size from 0.75-2.75 tons.

Hot Water Systems (Heating Hot Water & Domestic Hot Water)



The building is heated primarily by (2) Cleaver-Brooks 3360 MBH dual-fuel hot water boilers which produce hot water that goes to finned-tube radiation, AHUs and (47) unit ventilators throughout the building. The boilers were installed in 1994 and are in good condition.

The heating hot water is recirculated throughout the school via (2) 10-HP feedwater pumps.

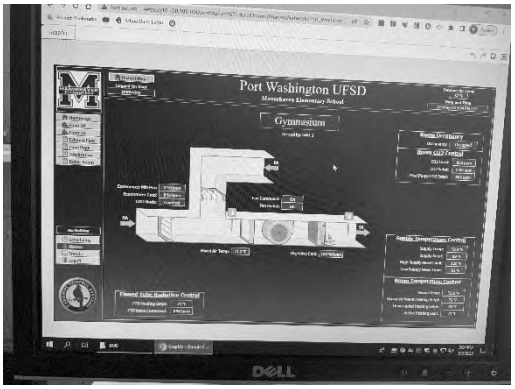
The existing domestic hot water system consists of (1) 199.9 MBH, 80-gallon gas-fired water heater installed in 2014.

Manorhaven Boilers

Designation	System Quantity	Location	Floor/ Serves	Manufacturer	Model/ Make	Date	Efficiency	Capacity
Boiler	2	Boiler Room	Entire Building	Cleaver-Brooks	CB-200-80-30HW	1994	80%	3360 (MBH)
DHW	1	Boiler Room	Entire Building	Bradford-White	D80T1993N	2014	80%	80 Gal

Building Controls (HVAC Controls)

The building has a Johnson Controls building management system (BMS). All major mechanical equipment is tied into this system. The system is equipped with zone temperature set points and are over-ridden in certain areas where complaints are made. There are temperature sensors throughout the zones of the buildings which communicate back for each associated heating hot water valve within each unit ventilator. Key components of the BMS are an array of trends/alarms, optimal start/stop for major equipment, start/stop/alarm of the boilers.



Kitchen Equipment

The kitchen utilizes both electric and gas cooking equipment. Various types of refrigeration equipment are present.

Plug Loads

Office equipment is regularly left in the 'on' state at all times allowing the individual machine to revert to the 'Sleep' mode based on an internal timer. This measure will plug the office equipment into a networkable device that will allow for scheduling of the plugged in equipment.

RENU observed to following plug load technologies, a total of 97 devices:

Device Type:	Quantity:
Projector	35
Smartboard	0
Projector/Smartboard Combo	0
Air Scrubber	18
Charging Cart	0
Small Printer	0
Medium Printer	17
Large Printer/Copier (110 only)	0
TV/LCD/Smart TV	0
Snack Vending	0
Soda Vending	1
Lg Coffeemaker (Bunn)	0
H/C Water Dispenser	3
Water Fountain (plug on outside)	0
AC - 220 (not to be more than 20 amps)	23
AC - 110 20 amps	0
AC - 110 15 amps	0
Electric Hot Water Heater	0
Other Device not listed above	0





Section 3. Utility Analysis

3.1 Utility Baseline

3.1.1 Electric

Electrical energy is provided to Port Washington Union Free School District from PSE&G Long Island. The electric utility measures consumption in kilowatt-hours (kWh). One kWh usage is equivalent to 1,000 watts running for one hour.

The primary electric rate used by the buildings at Port Washington Union Free School District Schools, is Rate 285 – Primary, Commercial, Large, Multiple Periods and Rate 281 – Secondary, Commercial, Large General Use.

Note – The electric bill for Schreiber High School, Weber Middle School, and the Administration Building are combined on the same meter through PSEG. For the purpose of this analysis, the buildings were rationed based on their size and equipment base as far as their consumption and demand.

3.1.2 Natural Gas

Port Washington Union Free School District Schools have natural gas transported and delivered by National Grid. The District entered into a 48-month fixed price supply contract at $0.66/therm that began in the Summer of 2023. The gas utility measures consumption in cubic feet x 100 (CCF) and converts the quantity into therms of energy. The district buildings fall under the Rate 170 – Gas Non-Residential Heating or Rate 250 - Gas Non-Residential General Use structure for natural gas.

Table 3.1.1 Total 12 Month Utility Consumption for the District

				Electric							Natural Gas			
Building ID	Building Name	Building Area (ft^2)	Building Population	Annual kW	Total kW $	Annual kWh	Total kWh $	$/kW	$/kWh	$/kWh (Blended)	Usage (th)	Total ($)	$/Unit	Total ($)
1	Paul D. Schreiber High School	269,199	1,770	7,412	$72,398	1,621,800	$261,780	$9.77	$0.161	$0.21	129,179	$149,149	$ 1.15	$483,327.26
2	Carrie P. Weber Middle School	305,821	1,325	6,433	$62,836	1,407,600	$227,205	$9.77	$0.161	$0.21	104,940	$123,369	$ 1.18	$413,409.87
3	Administration Building	4,450	25	140	$1,366	30,600	$4,939	$9.77	$0.161	$0.21	6,528	$11,230	$ 1.72	$17,534.96
4	John Philip Sousa Elementary	83,000	566	2,183	$20,953	361,600	$67,413	$9.60	$0.186	$0.24	41,581	$51,158	$ 1.23	$139,524.64
5	Guggenheim Elementary	67,500	551	2,505	$28,487	442,249	$77,625	$11.37	$0.176	$0.24	40,356	$49,808	$ 1.23	$155,918.98
6	South Salem Elementary	55,000	465	1,646	$21,362	393,900	$69,234	$12.98	$0.176	$0.23	30,771	$40,359	$ 1.31	$130,954.73
7	John J. Daly Elementary	81564	518	2,755	$30,593	512,640	$87,997	$11.10	$0.172	$0.23	34,089.00	$43,605	$ 1.28	$162,195.55
8	Manorhaven Elementary	52570	509	1,140	$23,359	338,960	$53,731	$20.50	$0.159	$0.23	26,098.00	$33,884	$ 1.30	$110,974.24
9	District-wide	-	-					$10.79	$0.166	$0.22			$ 1.22	
10	Solar Transfer	-	-					-	$0.105	-			$ -	
Total		919,104	5,729	**24,214**	**$261,353**	**5,109,349**	**$849,925**	**$10.79**	**$0.17**	**$0.22**	**413,542**	**$502,563**	**$ 1.22**	**$1,613,840**

The rates used to calculate the $ savings were verified through the gas billing structure that national gas utility uses to bill the clients according to the tables below for the gas service structure by national grid.

Table 3.1.2

Effective September 1, 2021

nationalgrid

Rate Code to Gas Service Class Conversion Table

Long Island NY

If your bill says Rate Code...	then your Service Class is...	and your Sub-Classification is...
120 - Non-Heating - General	SC1 Residential Service	1A
130 - Non-Heating - Water Heating		1A
140 - Heating - Space Heating		1B
150 - Distributed Generation		1DG
120R - Energy Affordability Program Non-Heating - General		1AR
130R - Energy Affordability Program Non-Heating - Water Heating		1AR
140R - Energy Affordability Program Heating - Space Heating		1BR
250 - Non-Heating - General	SC2 Non-Residential Service	2A
160 - Non-Heating - Water Heating		2A
170 - Heating - Space Heating		2B
152 - Water Heating	SC 3 Multiple-Dwelling Service	3A
151 - Heating		3B

Table 3.1.3

Effective April 1, 2023

nationalgrid

Gas Delivery Charges

Long Island, NY

Service Class	Volume	Rate
SC 1A, 5-1A Residential Non-Heating Service	First 3 therms or less	$19.7500
	Next 47 therms	$1.6275
	Excess of 50 therms	$0.3971
SC 1B, 5-1B Residential Heating Service	First 3 therms or less	$21.6600
	Next 47 therms	$1.3528
	Excess of 50 therms	$0.3185
SC 1AR, 5-1AR Residential Non-Heating Service, Energy Affordability Program*	First 3 therms or less	$19.7500
	Next 47 therms	$1.6275
	Excess of 50 therms	$0.3971
SC 1BR, 5-1BR Residential Heating Service, Energy Affordability Program*	First 3 therms or less	$21.6600
	Next 47 therms	$1.3528
	Excess of 50 therms	$0.3185
SC 1-DG Distributed Generation	First 3 therms or less	$33.0400
	Excess of 3 therms	$0.1786
SC 2A, 5-2A Non-Residential Non-Heating Service	First 3 therms or less	$37.6600
	Next 87 therms	$1.8441
	Next 2,910 therms	$0.3739
	Excess of 3,000 therms	$0.2404
SC 2B, 5-2B Non-Residential Heating Service	First 3 therms or less	$37.6600
	Next 87 therms	$1.8428
	Next 2,910 therms	$0.4627
	Excess of 3,000 therms	$0.3194

For the billing period of 2022 - 2023, the Port Washington school district used 5,109,349 kWh, 24,214 kW of peak demand electricity and 413,542 therms of natural gas. This results in site energy use intensity (EUI) of 81.80 kBtu/sq. foot.

Table 3.1.4

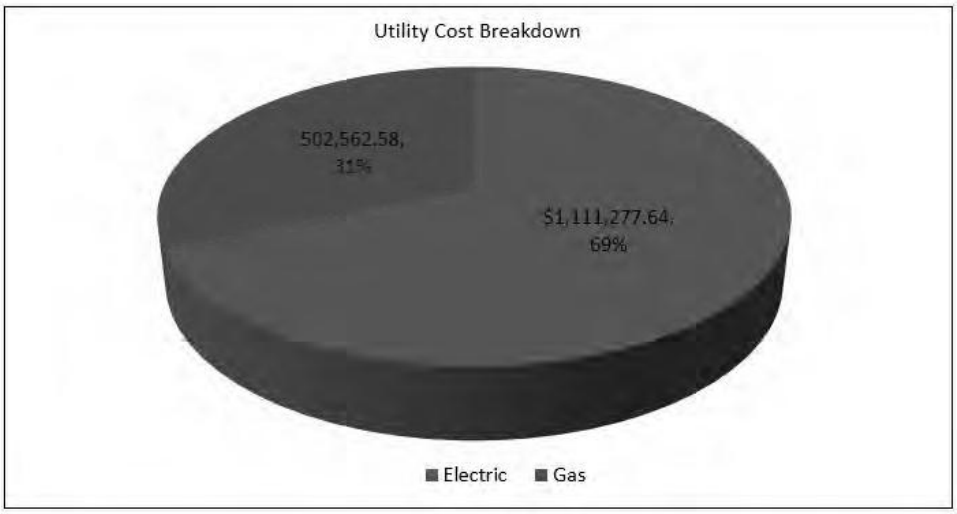
			Electric				Natural Gas		
Building #	Building Name	Area (ft²)	Annual Usage (kWh)	KBTU	KBTU/SF	$/ft²	Therms	Kbtu	Kbtu/SF
1	Schreiber High School	269,199	1,621,800	5,533,582	18.1	$1.09	129,179.00	12,915,316.42	47.98
2	Weber Middle School	305,821	1,407,600	4,802,731	17.8	$1.08	104,940.00	10,491,901.20	34.31
3	Guggenheim Elementary School	67,500	442,249	1,508,954	22.4	$1.57	40,356.00	4,034,792.88	59.77
4	Sousa Elementary School	81,000	361,600	1,233,779	15.2	$1.09	41,581.00	4,157,268.38	51.32
5	Admin Building	4,450	30,600	104,407	23.5	$1.42	6,528.00	652,669.44	146.67
6	Manorhaven Elementary	51,030	338,960	1,156,532	22.7	$1.51	26,098.00	2,609,278.04	51.13
7	South Salem Elementary	55,000	393,900	1,343,987	24.4	$1.65	30,771.00	3,076,484.58	55.94
8	Daly Elementary	81,564	512,640	1,749,128	21.4	$1.45	34,089.00	3,408,218.22	41.79
	TOTAL	-	5,109,349	17,433,099	166		413,542	41,345,929	489

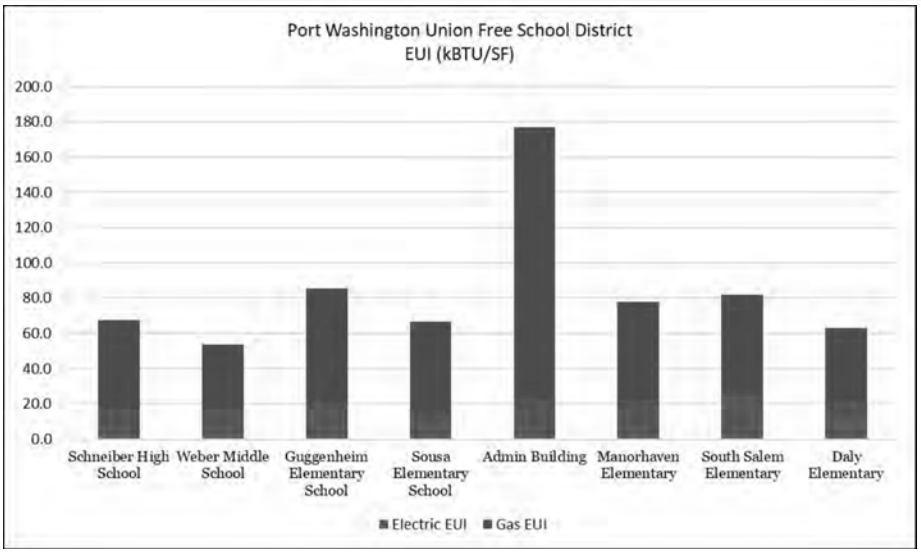
Table 3.1.5

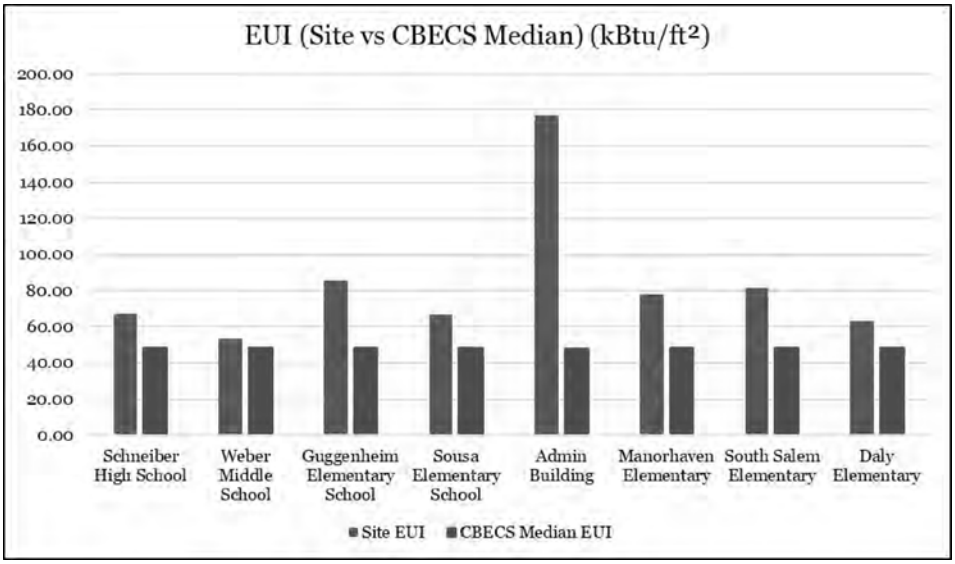
				Electric Account Details				
Building #	Building Name	Area (ft²)	Population	Electric Account #	Electric Meter #	Distribution Company	Supply Company	Rate Schedule
1	Schreiber High School	269,199	1,770	5323097301	80339126	PSEGLI	PSEGLI	Rate 285
2	Weber Middle School	305,821	1,325	5323097301	80339126	PSEGLI	PSEGLI	Rate 285
3	Guggenheim Elementary School	67,500	551	5324272001	80352103	PSEGLI	PSEGLI	Rate 285
4	Sousa Elementary School	81,000	566	5328821000	803452963	PSEGLI	PSEGLI	Rate 285
5	Admin Building	4,450	25	5323097301	80339126	PSEGLI	PSEGLI	Rate 285
6	Manorhaven Elementary	51,030	509	5328826000	80345207	PSEGLI	PSEGLI	Rate 281
7	South Salem Elementary	55,000	465	5320947000	96744819	PSEGLI	PSEGLI	Rate 285
8	Daly Elementary	81,564	518	5324370000	80345262	PSEGLI	PSEGLI	Rate 285
9	High School, Middle School, Admin Bldg.	0		5323097301	80339126	PSEGLI	PSEGLI	Rate 285

Table 3.1.6

Natural Gas Account Details				
Natural Gas Account #	Natural Gas Meter #	Distribution Company	Supply Company	Rate Schedule
15139-76005/ 29533-15003	06588269/04624603	National Grid	National Grid	Rate 170
04857-01004/ 17120-89007/89895-63008	01309597/06056862/ 01155486	National Grid	National Grid	Rate 170
77423-82008/ 42885-40003	01209477/01208327	National Grid	National Grid	Rate 170/ Rate 250
02939-93003/81085-17002	01247228/05452484	National Grid	National Grid	Rate 170/ Rate 250
41980-59008/ 54433-52006	04653190/04582227	National Grid	National Grid	Rate 170
93544-01003/06693-76005	01282465/01337375	National Grid	National Grid	Rate 170/ Rate 250
76477-89005/15139-37008	04875058/05237528	National Grid	National Grid	Rate-170
06035-75006/43115-79007	01309964/04926662	National Grid	National Grid	Rate 170


Utility Cost Breakdown
502,562.58, 31%
$1,111,277.64, 69%
Electric
Gas


Port Washington Union Free School District
EUI (kBTU/SF)
200.0
180.0
160.0
140.0
120.0
100.0
80.0
60.0
40.0
20.0
0.0
Schneiber High School
Weber Middle School
Guggenheim Elementary School
Sousa Elementary School
Admin Building
Manorhaven Elementary
South Salem Elementary
Daly Elementary
Electric EUI
Gas EUI


EUI (Site vs CBECS Median) (kBtu/ft²)
200.00
180.00
160.00
140.00
120.00
100.00
80.00
60.00
40.00
20.00
0.00
Schneiber High School
Weber Middle School
Guggenheim Elementary School
Sousa Elementary School
Admin Building
Manorhaven Elementary
South Salem Elementary
Daly Elementary
Site EUI
CBECS Median EUI

3.2 Marginal Rates

For the purposes of determining how energy conservation measures will affect the utility bill, it is important to understand what portions of the cost can be saved. In general, there are costs associated with utility bills that are fixed and independent of usage, such as the monthly meter charge. For example, in the case of a monthly meter charge, this charge often exists even if the energy usage were zero. An energy conservation measure often cannot produce a cost savings on this portion of the bill. The utility rate structure has to, therefore, be analyzed to determine what portion of the bill a cost savings can be produced using a specific energy conservation measure. The blended average utility rate is the total cost divided by the total energy units. The effective rate is the portion of the bill effected by energy saving or the applied energy conservation measure.

The utility rates identified below were used for purposes of calculating the dollar effect of the energy conservation measures.

3.2.1 Electric

Table 3.2.1

Building	$/kWh
Paul D. Schreiber High School	0.16
Carrie P. Weber Middle School	0.16
Administration Building	0.16
John Philip Sousa Elementary	0.19
Guggenheim Elementary	0.18
South Salem Elementary	0.18
John J. Daly Elementary	0.17
Manorhaven Elementary	0.16
District-wide Average	0.17

The effective supply kWh rate is the most recent in the baseline period. The effective transport $/kWh and $/kW demand rates are based on the most recent utility tariff rates as of 2/1/23. The total effective $/kWh rate is the summation of the supply and transport effective rates.

3.2.2 Natural Gas

Due to the complex nature and variablity of the gas rates which includes demand and balancing charges in the tarriff rates, the blended average unit cost is consided the effective rate for savings calculations. In cases where more than one account/meter serves a school the total average of all combined accouts is used unless the accout is not significant, for instance where the account exists but delivers no natual gas on a regular basis or uses a very small amount relative to the other accounts.

Table 3.2.2

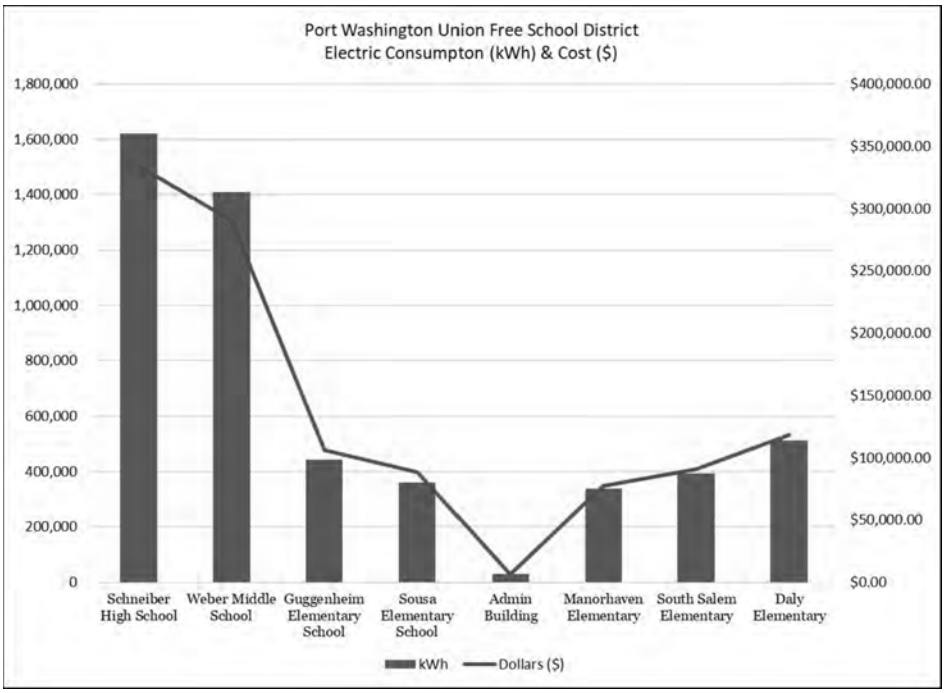
Building	$/therm
Paul D. Schreiber High School	1.11
Carrie P. Weber Middle School	1.13
Administration Building	1.66
John Philip Sousa Elementary	1.18
Guggenheim Elementary	1.18
South Salem Elementary	1.24
John J. Daly Elementary	1.22
Manorhaven Elementary	1.24
District-wide Average	1.24

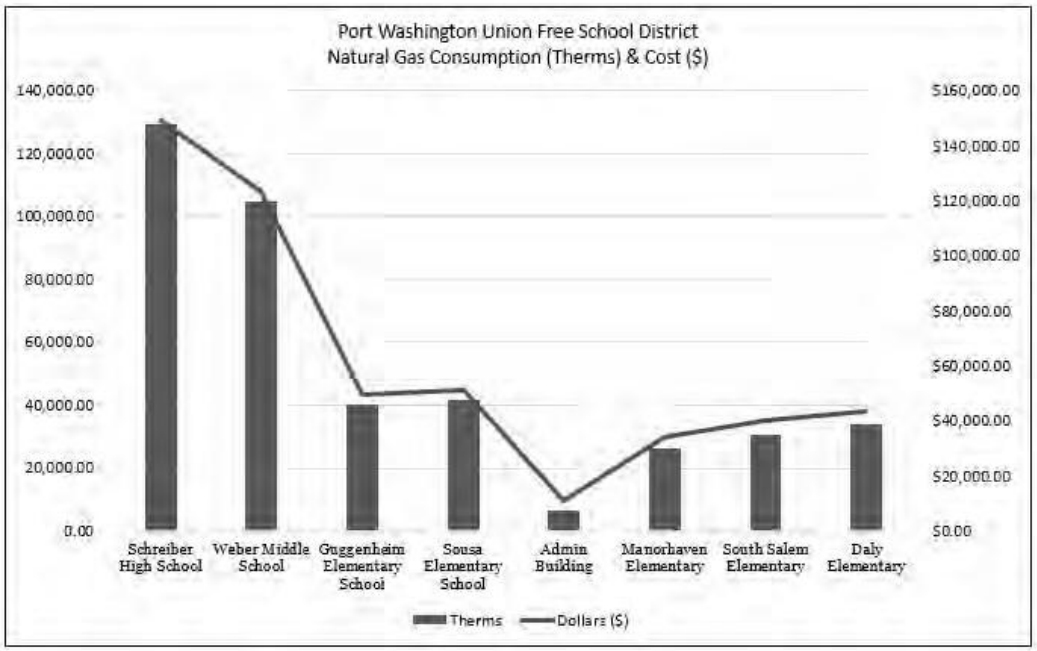
The effective supply therm rate is the most recent in the baseline period. The effective therm rate is based on the one-year average across all district buildings at a supply rate of $0.66/therm which reflects the current natural gas supply contract.

3.2.3 Building Utility Cost Breakdown

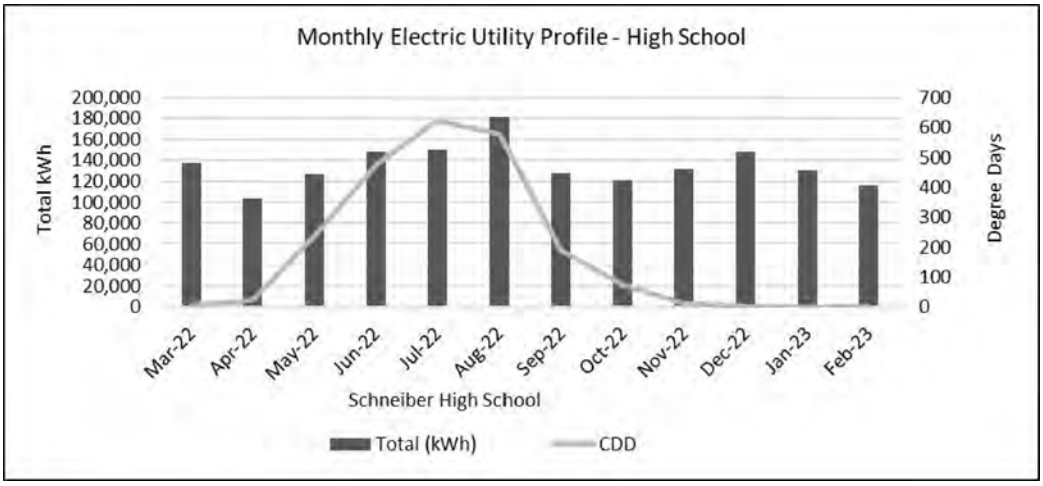
Table 3.2.3

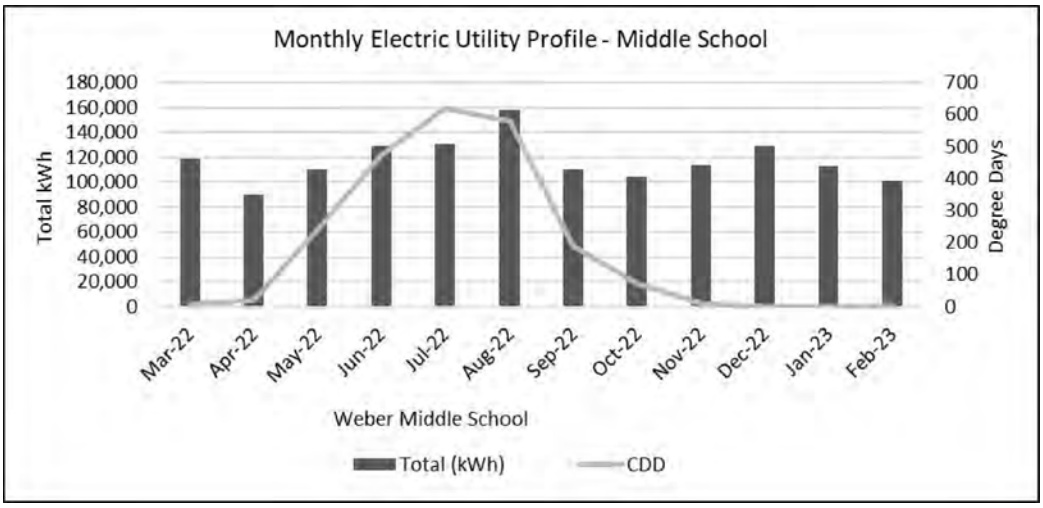
			Electric								Natural Gas		Total Utility Cost ($)
Building #	Building Name	Area (ft²)	Annual Usage (kWh)	Annual Demand (kW)	kWh Cost ($)	kW Cost ($)	Total Electric Cost ($)	Avg. $/kWh	Avg. $/kW	Avg. Blended ($/kWh)	Therms	Cost ($)	
1	Schreiber High School	269,199	1,621,800	7,412	$261,780.17	$72,397.78	$334,177.94	$0.16	$9.77	$0.21	129,179.00	$149,149.31	$439,190.54
2	Weber Middle School	305,821	1,407,600	6,433	$227,205.43	$62,835.81	$290,041.23	$0.16	$9.77	$0.21	104,940.00	$123,368.63	$457,546.57
3	Guggenheim Elementary School	67,500	442,249	2,505	$77,624.50	$28,486.65	$106,111.15	$0.18	$11.37	$0.24	40,356.00	$49,807.83	$155,918.98
4	Sousa Elementary School	81,000	361,600	2,183	$67,413.18	$20,953.03	$88,366.21	$0.19	$9.60	$0.24	41,581.00	$51,158.43	$139,524.64
5	Admin Building	4,450	30,600	140	$4,939.25	$1,366.00	$6,305.24	$0.16	$9.77	$0.21	6,528.00	$11,229.72	$17,534.96
6	Manorhaven Elementary	51,030	338,960	1,140	$53,731.40	$23,358.63	$77,090.03	$0.16	$20.50	$0.23	26,098.00	$33,884.21	$110,974.24
7	South Salem Elementary	55,000	393,900	1,646	$69,233.73	$21,361.84	$90,595.57	$0.18	$12.98	$0.23	30,771.00	$40,359.16	$130,954.73
8	Daly Elementary	81,564	512,640	2,755	$87,997.48	$30,592.78	$118,590.26	$0.17	$11.10	$0.23	34,089.00	$43,605.29	$162,195.55
	TOTAL	-	5,109,349	24,214	$ 849,925.13	$ 261,352.51	$ 1,111,277.64	$ 0.17	$10.79	$ 0.22	413,542	502,563	1,613,840

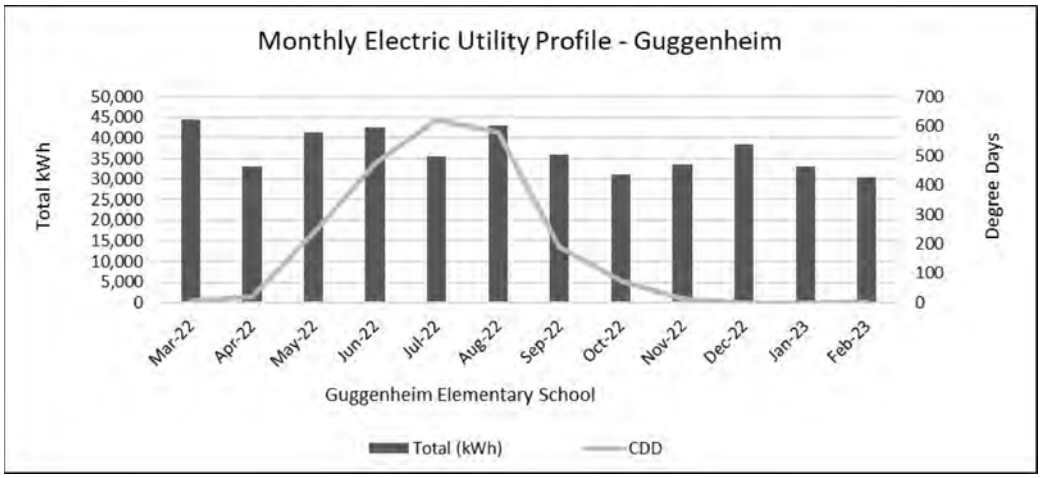


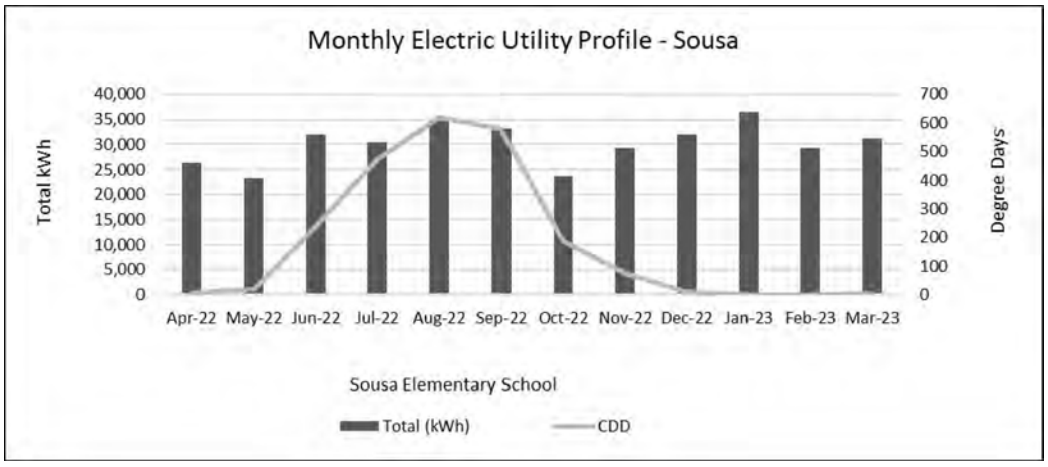

Port Washington Union Free School District
Natural Gas Consumption (Therms) & Cost ($)
140,000.00
120,000.00
100,000.00
80,000.00
60,000.00
40,000.00
20,000.00
0.00
$160,000.00
$140,000.00
$120,000.00
$100,000.00
$80,000.00
$60,000.00
$40,000.00
$20,000.00
$0.00
Schreiber High School
Weber Middle School
Guggenheim Elementary School
Sousa Elementary School
Admin Building
Manorhaven Elementary
South Salem Elementary
Daly Elementary
Therms
Dollars ($)

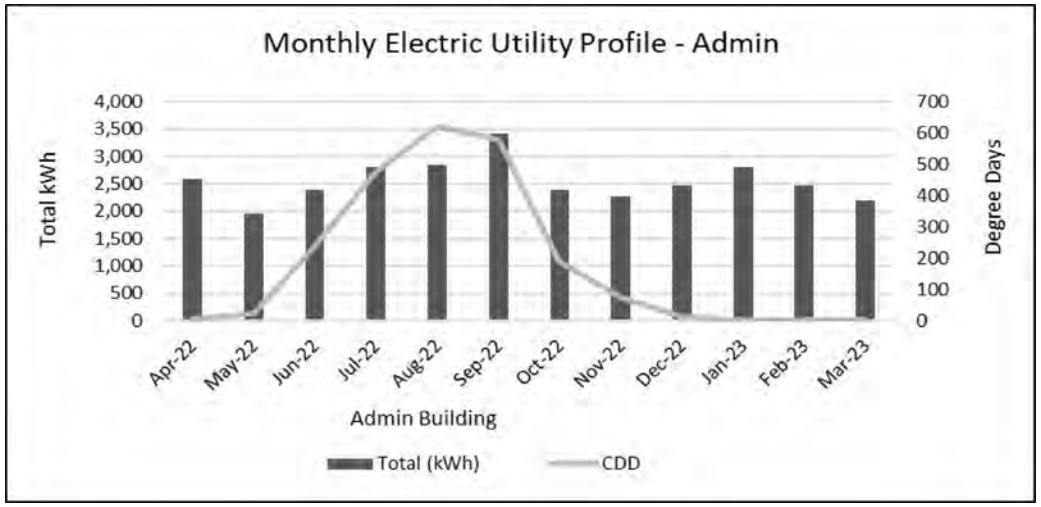
3.2.4 Yearly Electric Consumption by Building kWh & CDD (Cooling Degree Days)

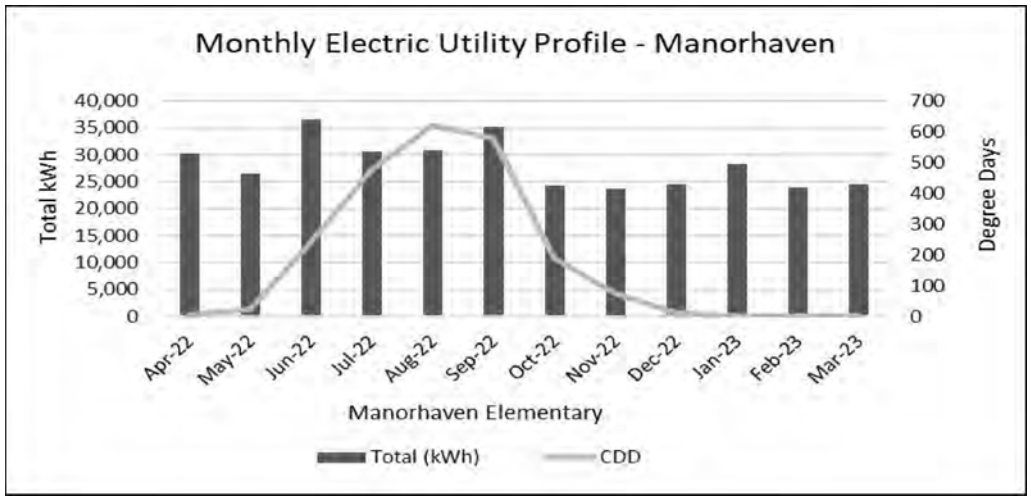


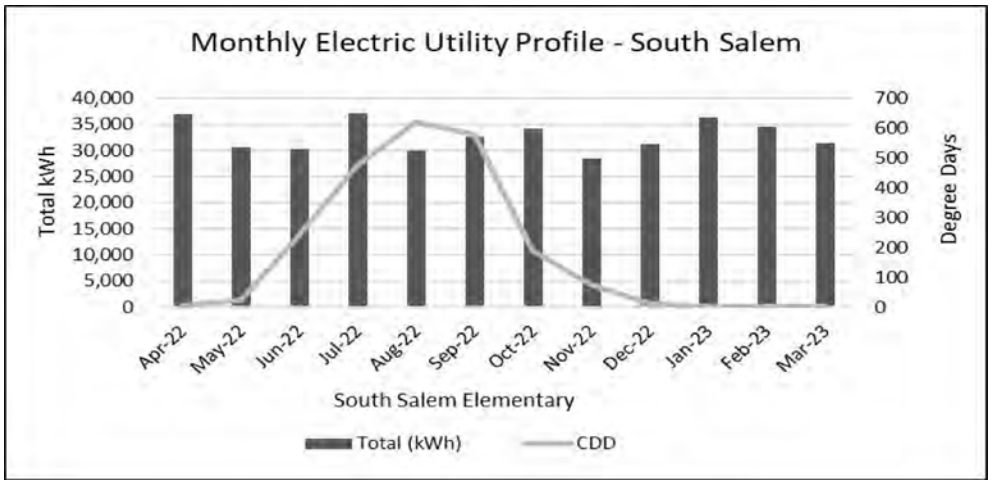


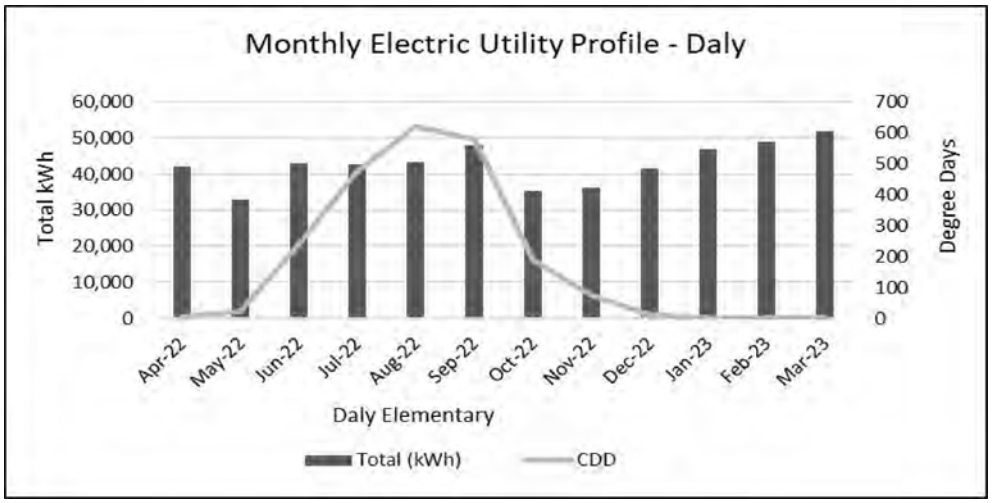



Monthly Electric Utility Profile - Sousa
Total kWh
Degree Days
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
700
600
500
400
300
200
100
0
Apr-22 May-22 Jun-22 Jul-22 Aug-22 Sep-22 Oct-22 Nov-22 Dec-22 Jan-23 Feb-23 Mar-23
Sousa Elementary School
Total (kWh)
CDD

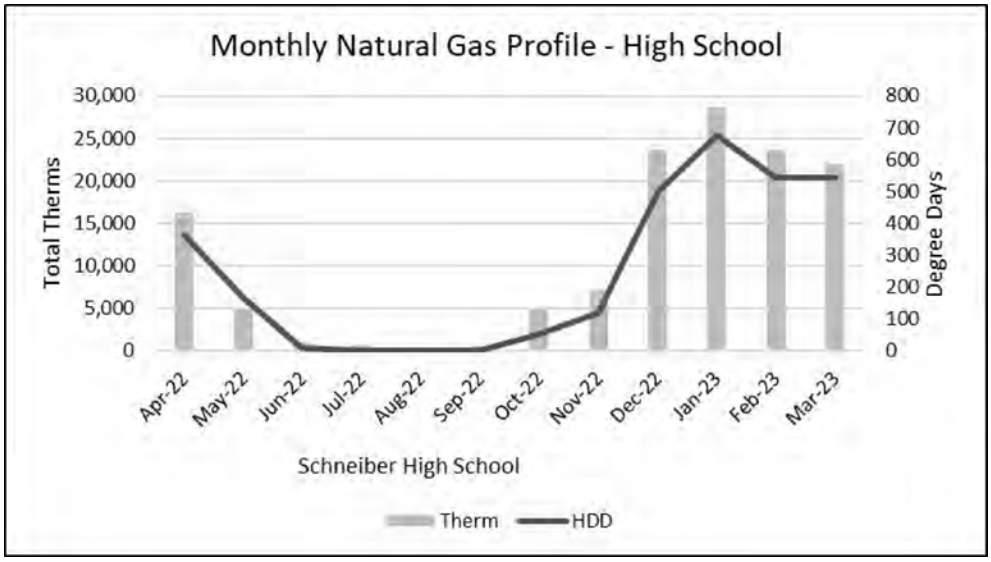

Monthly Electric Utility Profile - Admin
Total kWh
Degree Days
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
700
600
500
400
300
200
100
0
Apr-22 May-22 Jun-22 Jul-22 Aug-22 Sep-22 Oct-22 Nov-22 Dec-22 Jan-23 Feb-23 Mar-23
Admin Building
Total (kWh)
CDD

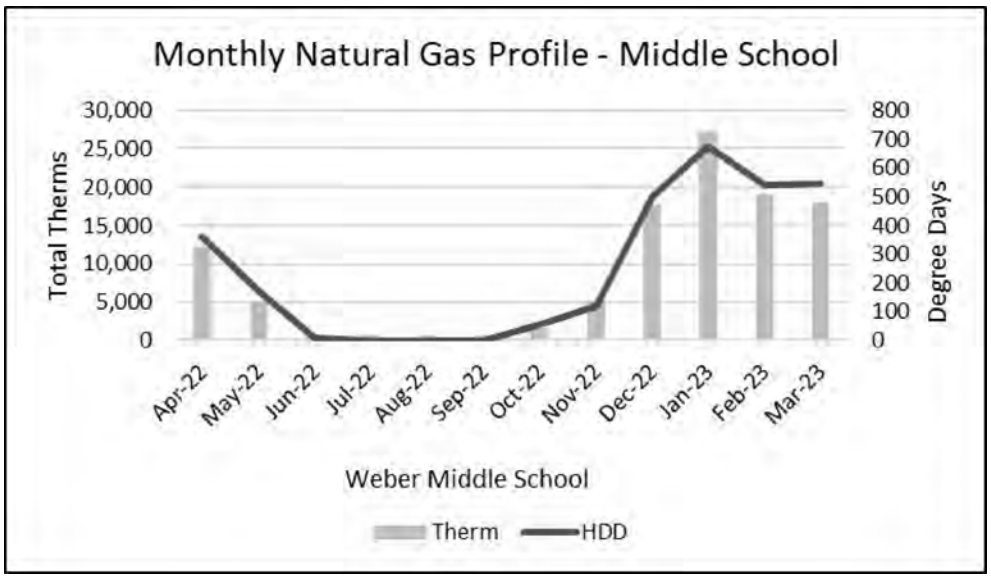

Monthly Electric Utility Profile - Manorhaven
Total kWh
Degree Days
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
700
600
500
400
300
200
100
0
Apr-22 May-22 Jun-22 Jul-22 Aug-22 Sep-22 Oct-22 Nov-22 Dec-22 Jan-23 Feb-23 Mar-23
Manorhaven Elementary
Total (kWh)
CDD

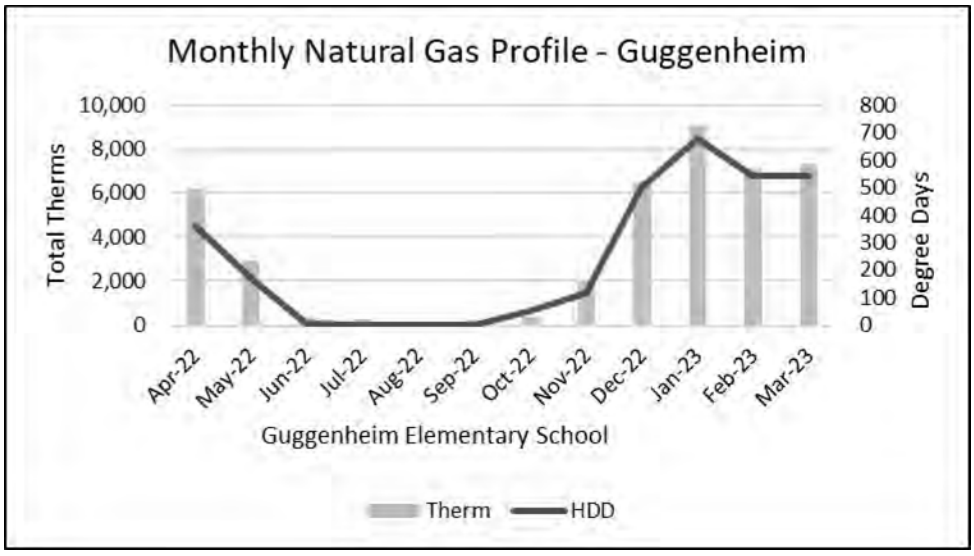

Monthly Electric Utility Profile - South Salem
Total kWh
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
Degree Days
700
600
500
400
300
200
100
0
Apr-22
May-22
Jun-22
Jul-22
Aug-22
Sep-22
Oct-22
Nov-22
Dec-22
Jan-23
Feb-23
Mar-23
South Salem Elementary
Total (kWh)
CDD

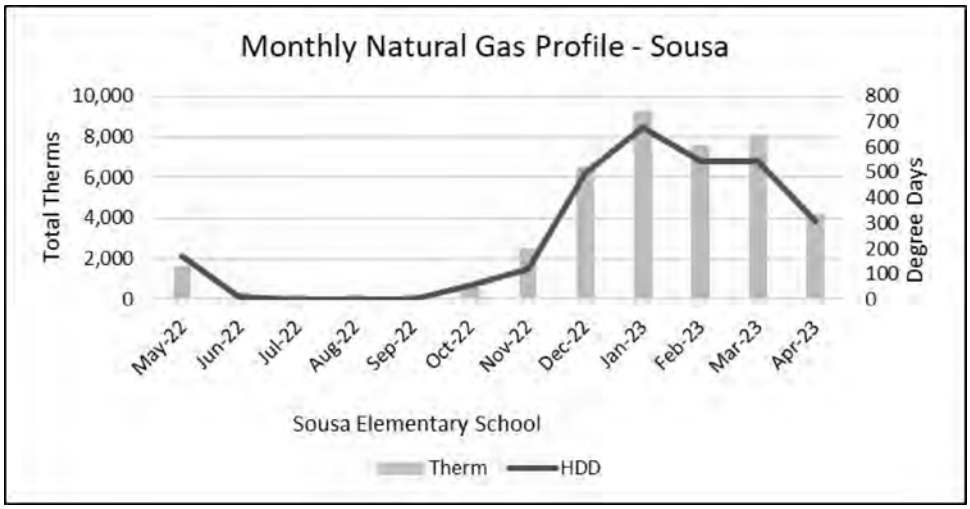

Monthly Electric Utility Profile - Daly
Total kWh
60,000
50,000
40,000
30,000
20,000
10,000
0
Degree Days
700
600
500
400
300
200
100
0
Apr-22
May-22
Jun-22
Jul-22
Aug-22
Sep-22
Oct-22
Nov-22
Dec-22
Jan-23
Feb-23
Mar-23
Daly Elementary
Total (kWh)
CDD

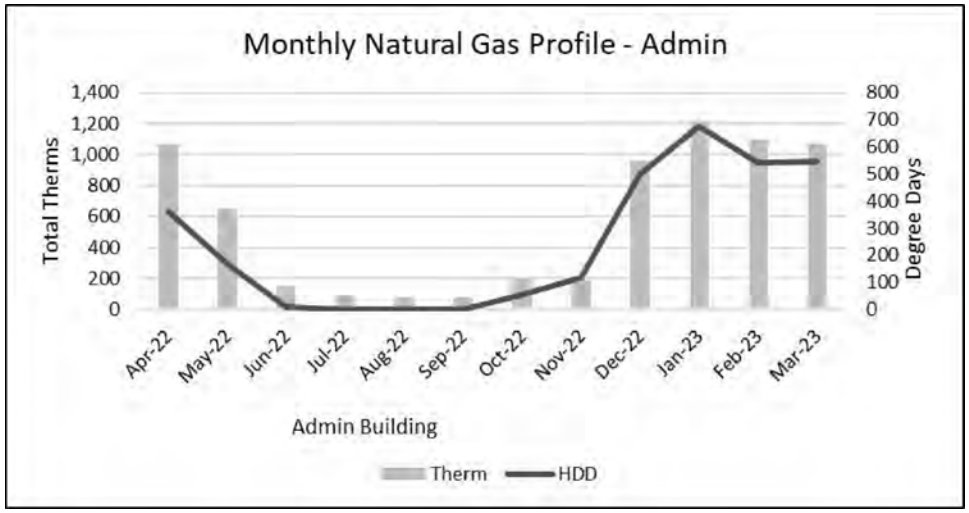
3.2.5 Yearly Natural Gas Consumption by Building Therms & HDD (Heating Degree Days)

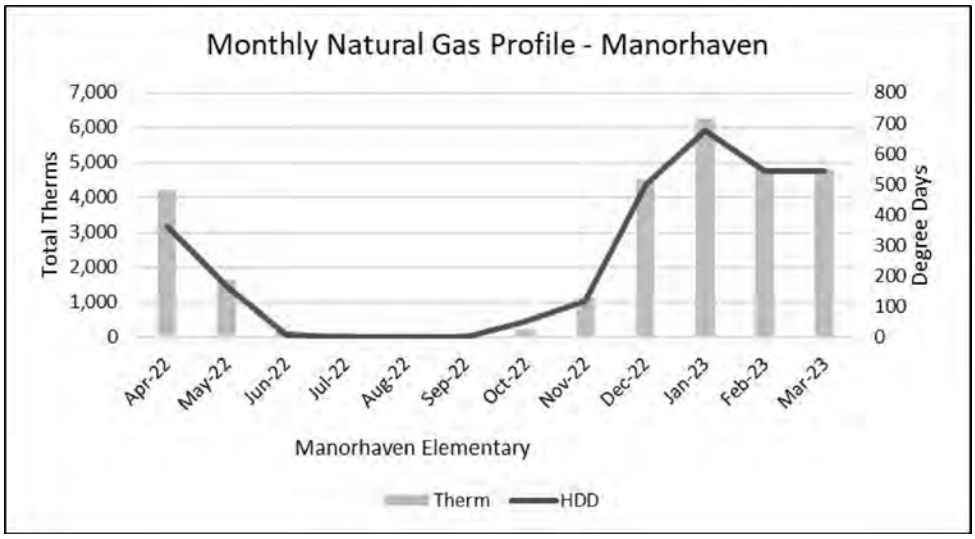


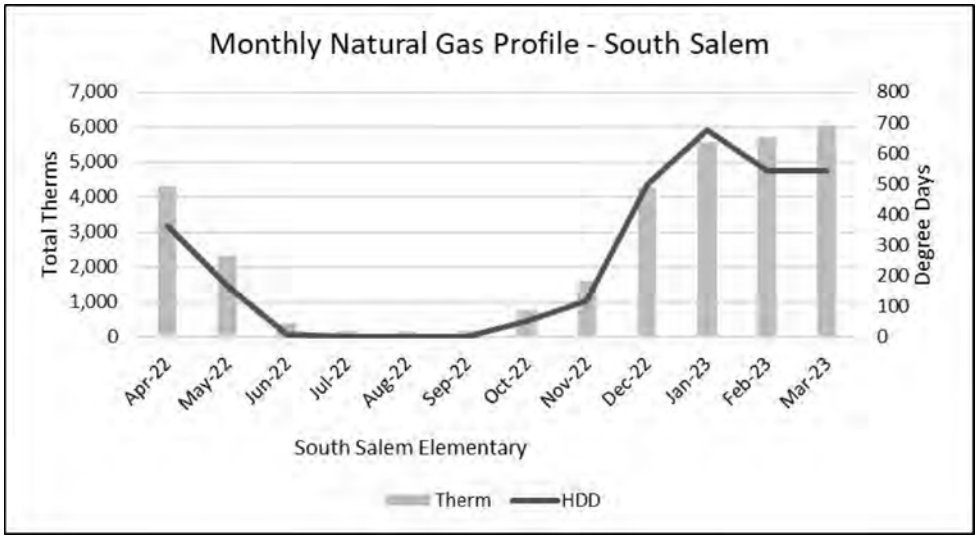


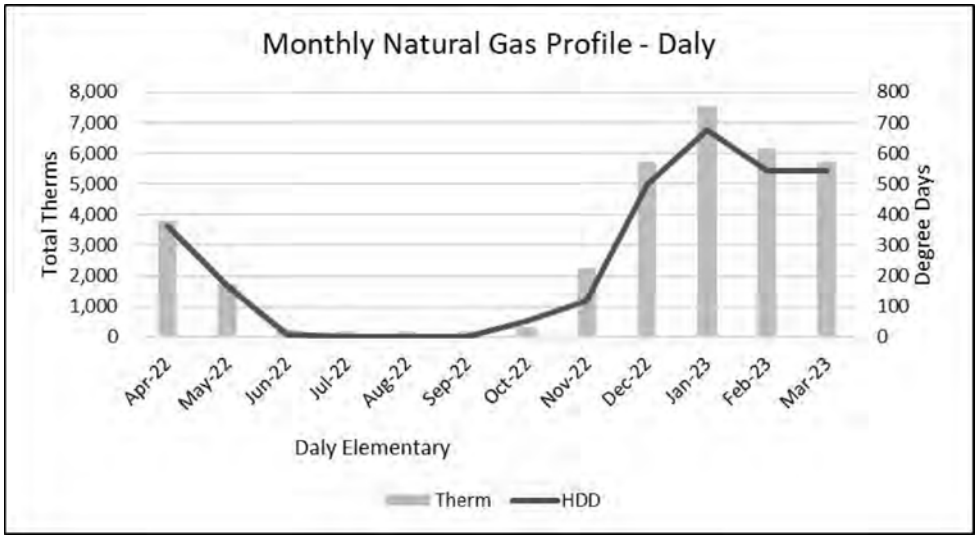

Monthly Natural Gas Profile - Guggenheim
Total Therms
Degree Days
10,000
8,000
6,000
4,000
2,000
0
800
700
600
500
400
300
200
100
0
Apr-22
May-22
Jun-22
Jul-22
Aug-22
Sep-22
Oct-22
Nov-22
Dec-22
Jan-23
Feb-23
Mar-23
Guggenheim Elementary School
Therm
HDD


Monthly Natural Gas Profile - Sousa
Total Therms
Degree Days
10,000
8,000
6,000
4,000
2,000
0
800
700
600
500
400
300
200
100
0
May-22
Jun-22
Jul-22
Aug-22
Sep-22
Oct-22
Nov-22
Dec-22
Jan-23
Feb-23
Mar-23
Apr-23
Sousa Elementary School
Therm
HDD


Monthly Natural Gas Profile - Admin
Total Therms
Degree Days
1,400
1,200
1,000
800
600
400
200
0
800
700
600
500
400
300
200
100
0
Apr-22
May-22
Jun-22
Jul-22
Aug-22
Sep-22
Oct-22
Nov-22
Dec-22
Jan-23
Feb-23
Mar-23
Admin Building
Therm
HDD


Monthly Natural Gas Profile - Manorhaven
Total Therms
Degree Days
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
800
700
600
500
400
300
200
100
0
Apr-22
May-22
Jun-22
Jul-22
Aug-22
Sep-22
Oct-22
Nov-22
Dec-22
Jan-23
Feb-23
Mar-23
Manorhaven Elementary
Therm
HDD


Monthly Natural Gas Profile - South Salem
Total Therms
Degree Days
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
800
700
600
500
400
300
200
100
0
Apr-22
May-22
Jun-22
Jul-22
Aug-22
Sep-22
Oct-22
Nov-22
Dec-22
Jan-23
Feb-23
Mar-23
South Salem Elementary
Therm
HDD


Monthly Natural Gas Profile - Daly
Total Therms
Degree Days
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
800
700
600
500
400
300
200
100
0
Apr-22
May-22
Jun-22
Jul-22
Aug-22
Sep-22
Oct-22
Nov-22
Dec-22
Jan-23
Feb-23
Mar-23
Daly Elementary
Therm
HDD

3.2.6 Utility Escalation Rates

Table 3.2.6
The utility escalation rates used in the financial analysis for the project is shown in the table below:

Name of School	Energy					
	Electric Consumption		Annual Electric Demand		Natural Gas	
	Escalation Rate	Start Year of Escalation	Escalation Rate	Start Year of Escalation	Escalation Rate	Start Year of Escalation
Paul D. Schreiber High School	2.5%	Year 1	2.5%	Year 1	2.5%	Year 1
Carrie P. Weber Middle School	2.5%	Year 1	2.5%	Year 1	2.5%	Year 1
Administration Building	2.5%	Year 1	2.5%	Year 1	2.5%	Year 1
John Philip Sousa Elementary	2.5%	Year 1	2.5%	Year 1	2.5%	Year 1
Guggenheim Elementary	2.5%	Year 1	2.5%	Year 1	2.5%	Year 1
South Salem Elementary	2.5%	Year 1	2.5%	Year 1	2.5%	Year 1
John J. Daly Elementary	2.5%	Year 1	2.5%	Year 1	2.5%	Year 1
Manorhaven Elementary	2.5%	Year 1	2.5%	Year 1	2.5%	Year 1

Section 4. Energy Conservation Measures

ECM Summary Table	ECM 1	ECM 2	ECM 3	ECM 4	ECM 5	ECM 6	ECM 7
Building	Lighting	Solar	Pipe and Valve Insulation	Plug Load Controls	Weatherization	Ceiling Replacements	Pump Skid
Schreiber H.S.	X	X		X	X		X
Weber M.S.	X		X	X	X		
Admin. Bldg.	X			X	X	X	
Sousa E.S.	X	X		X	X	X	
Guggenheim E.S.	X	X		X	X		
Salem E.S.	X	X		X	X		
Daly E.S.	X	X		X	X		
Manorhaven E.S.		X		X	X	X	

4.1 ECM 1: LED Lighting and Lighting Controls

Project Cost	Estimated Rebates/Incentives	Net Cost	Guaranteed Annual Energy Savings	O&M Savings
$196,042	$0	$196,042	$17,614	$250



South Salem Library lights to be retrofitted with efficient LED lamps



Existing Sousa Gym High Bays to be upgraded to new more efficient LED high bay fixtures.

ECM General Scope of Work:
The ECM proposed involves the replacement of fluorescent lamp-containing fixtures with new LED light fixtures to conserve energy. The use of LED technology can significantly reduce power consumption while providing an equivalent level of light output. In some instances, fluorescent fixtures can be retrofitted with screw-based LED lamps. Although replacing the entire fixture with a new LED fixture generally provides better lighting, the fluorescent lamp replacement with a screw-in LED lamp is less costly. It is advisable to consult with the lighting contractor to select the best retrofit solution that suits your needs and is compatible with your current fixtures. Replacing fluorescent lamps with LEDs also provides maintenance savings since LED lamps have a longer lifespan than other light sources, thus reducing the need for frequent replacements. The project's general scope of work includes disconnecting the existing lighting system, disposing of the old fluorescent fixture, securely installing the new LED fixture, wiring and controls connection, and thorough testing of the new fixture to ensure proper operation. All lighting work will comply with New York state laws and permit requirements, and clean-up will be conducted after each installation.

Lighting controls offer an effective solution for areas where lighting is often left on unnecessarily due to the inconvenience of manual switches or frequent use. This is particularly true for rooms that have short occupancy periods. Various forms of lighting controls are available, including additional switches, occupancy sensors that detect movement and switch on the lights, and ceiling or corner mounted sensors for large areas. It is recommended to install lighting controls in offices, break rooms, and restrooms where appropriate. RENU will conduct measurements to identify spaces suitable for lighting controls in the next phase of the project. The project's scope of work involves installing occupancy sensors, where deemed suitable, and connecting electrical wiring in accordance with New York laws and permit requirements. Cleanup will be conducted after each installation. The lighting scope will maintain the same level of light quality as the existing installation. Detailed product information will be provided during the design stage and included in the O&M manuals after installation.

Scope of Work

The ECM proposed involves the replacement of non-LED fixtures with new LED lighting to conserve energy and improve the quality of the lighting. The scope of work for each building is described below.

1. **Paul D. Schreiber HS**
   The High School lighting has been upgraded to LED, with a few minor exceptions. There are existing round downlights that have compact fluorescent lamps in them that should be replaced with new LED downlights (not re-lamped with LED bulbs). There is an old, exterior building-mounted High Pressure Sodium fixture that is visible from the parking lot and is noted by its orange-yellow light. This will be replaced with a new LED fixture.

2. **Carrie P. Weber Middle School**
   The middle school lighting has been upgraded to LED, with a few exceptions. The two gyms were not upgraded, which totals (38) high bay fixtures, which are either induction or Metal Halide. Both gyms are currently underlit and will benefit from the installation of LED high bay/gym fixtures with occupancy and dimming controls.

3. **Guggenheim Elementary School**
   Most of this school has been upgraded to LED tubes. However, the Library has not been completely upgraded to LED, and the Gym has fixtures that were upgraded to T8 LED tubes, and fixtures that were still T12 fluorescent tubes.

4. **John J. Daly Elementary School/Admin Annex**
   The lighting in this building has been upgraded to LED, with a few minor exceptions. There are existing round downlights that have compact fluorescent lamps in them that will be upgraded to LED.

5. **John Philip Sousa Elementary School**
   Lighting: This school has been upgraded to LED, with a few minor exceptions. Specifically, the Gym has (12) 2x4 6-light T8 fluorescent fixtures with a cage guard that will be replaced with new high bay LED fixtures with built-in occupancy sensors.

6. **Manorhaven Elementary School**
   Lighting: The lighting has been upgraded to LED.

7. **South Salem Elementary School**
   Lighting: The lighting has predominantly been upgraded to LED with a few exceptions. The exception areas are the library, music room, (2) hallways, kitchen, and Classroom 105.

8. **Administration Office**
   Lighting: The lighting has been upgraded to LED, with a few minor exceptions.

Benefits:
Replacing existing fixtures containing fluorescent lamps with new LED light fixtures offers several benefits. First, the measure saves energy by installing LEDs which use less power than other technologies with comparable or better light output. This results in reduced electricity consumption and lower energy bills. Second, maintenance savings are achieved since LED lamps last longer than other light sources and therefore do not need to be replaced as often. This reduces the frequency of lamp replacements, which can result in lower maintenance costs and less downtime. Third, replacing an existing fluorescent fixture with a new LED fixture will generally provide better overall lighting optics. This can result in improved lighting quality and comfort for occupants and may even contribute to increased productivity in workspaces. The benefit of the installation of occupancy sensor lighting controls is energy savings. By using occupancy sensors to automatically switch lights

on and off when a room is occupied or empty, the amount of time that lights are left on unnecessarily is reduced, resulting in lower energy usage and cost savings. Additionally, the use of lighting controls can also extend the lifespan of lighting fixtures and reduce maintenance costs by reducing the frequency of replacement. Overall, the installation of occupancy sensor lighting controls can help to create a more energy-efficient and cost effective lighting system. Overall, the ECM offers a cost-effective and energy-efficient solution for upgrading lighting systems, resulting in long-term benefits for both the environment and building occupants.

School Name	Lighting
Paul D. Schreiber H.S.	**X**
Carrie P. Weber M.S.	**X**
Administration Building	**X**
John Philip Sousa E.S.	**X**
Gugenheim E.S.	**X**
South Salem E.S.	**X**
John J. Daly E.S.	**X**
Manorhaven E.S.	**-**

Savings Calculation Method		
Baseline Energy Usage (kWh/yr)	=	Existing Fixture Watts x Operating Hours / yr x 1 kW / 1000 Watts
Estimated Energy Usage (kWh/yr)	=	Proposed Fixture Watts x Op. Hours/yr x 1 kW / 1000 Watts
Energy Savings (kWh/yr)	=	Baseline Energy Usage – Estimated Energy Usage
Baseline Demand (kW)	=	Existing Fixture Watts / 1000 Watts
Retrofit Demand (kW)	=	Proposed Fixture Watts / 1000 Watts

Energy Savings (kW)	=	(Existing Fixture Watts – Proposed Fixture Watts) x 1 kW / 1000 Watts

4.2 ECM 2: Solar – Rooftop

Project Cost	Estimated Rebates/Incentives	Net Cost	Guaranteed Annual Energy Savings	O&M Savings
$6,481,548	$1,944,464	$4,537,084	$394,454	-

ECM General Description:



Grid-tied solar electric systems convert sunlight into electricity, with solar panels that are mounted on the roof. By connecting to the existing electric service, the clean electricity generated by the solar electric system can be used in a building or even "banked" into the utility grid for future use. Through a process known as net metering, excess solar power can be sold to the utility, and the grid can supply reliable power when the solar system is not generating enough electricity. The utility company (PSEG) will calculate the bill based on the difference between solar production and electric use. The district has flat roof sections that are suitable for installing a solar system as the roof is already being replaced, or has been recently replaced, as part of this project, and there are parking areas that are suitable for the installation of carports. The scope of work also includes the installation of inverters for the systems which will be located in the building. An energy revenue grade metering system will be included to track the generated energy. We will also provide a network link for internet access, which will be required near each inverter.

A structural strength analysis of the existing school structures will need to be performed to ensure that the roofs can support the proposed photovoltaic (PV system). The cost of this is not included in our proposal, nor is the cost of any repairs that may be required. A roofing placement plan for all components will be provided. Additionally, a registered professional engineering review will be conducted to ensure that the proposed system meets applicable electrical and structural codes. Some of the solar arrays may require tree trimming. For the carports we have included protection for the base of the supports. We have included a budget for these proposed upgrades, as well the CESIR study for each building, which would need to be verified at a later date. In addition, several transformers are located in areas that were not accessible to our designers, and we were unable to determine their kVA ratings. This will need to be further identified.

We will provide PV system start-up and commissioning services. An O&M manual will be provided, which includes a detailed summary of inverter operation, troubleshooting, and maintenance. The system documentation will include as-built drawings, site plan, 3-line electrical diagram, conduit

route diagram, inverter diagram, string diagram, and component data sheets such as module data sheet, inverter data sheet, and racking data sheet.
Please note these estimates are based on the assumption that the roofs have enough useful life, and structural integrity, to support the installation of solar panels. Structural analysis to be performed by others.

Benefits

Solar energy offers numerous benefits for school districts. First, by generating electricity on-site, Districts can reduce their dependence on grid-supplied power, leading to substantial cost savings on utility bills. Solar power provides a long-term, stable energy source, shielding Districts from unpredictable price fluctuations in traditional energy sources. Moreover, various financial incentives, such as tax credits, rebates, and grants, are often available, further enhancing the financial viability of solar installations. These incentives can significantly offset upfront costs and accelerate the return on investment. The district will also participate in helping alleviate reliance on the utility grid while also producing clean energy, helping create a better environment for the future.

Port Washington School District Solar Summary

Location	Module Quantity	Size in kW (DC)	Est. Annual kWh Production
Paul D. Schreiber H.S Carrie P. Weber M.S.	1,322	641.2	815,008
Administration Building	-	-	-
John Philip Sousa E.S.	663	321.6	414,393
Guggenheim E.S.	805	397.8	497,698
South Salem E.S.	418	202.7	264,938
John J. Daly E.S.	311	150.8	197,253
Manorhaven E.S.	525	254.6	328,052
Total	**4,044**	**1,968.7**	**2,517,343**



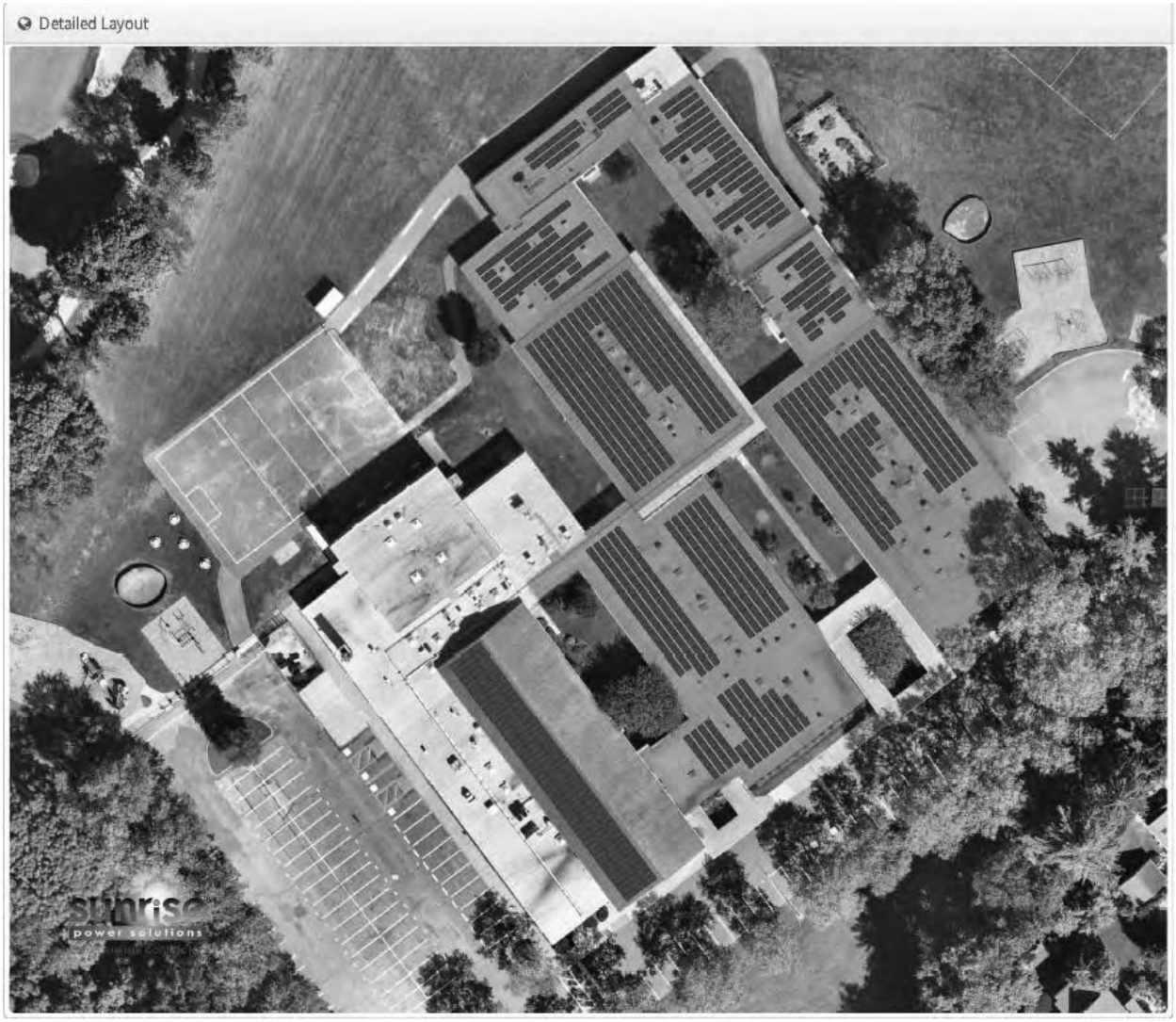
Schreiber High School

Schreiber High School
-Install (1,322) Hanwha Q Peak DUO XL Solar Panels
-Install (17) Sunny Tri-Power DC-AC Inverters
-Furnish and Install Rooftop Solar as per Helioscope design included in document.



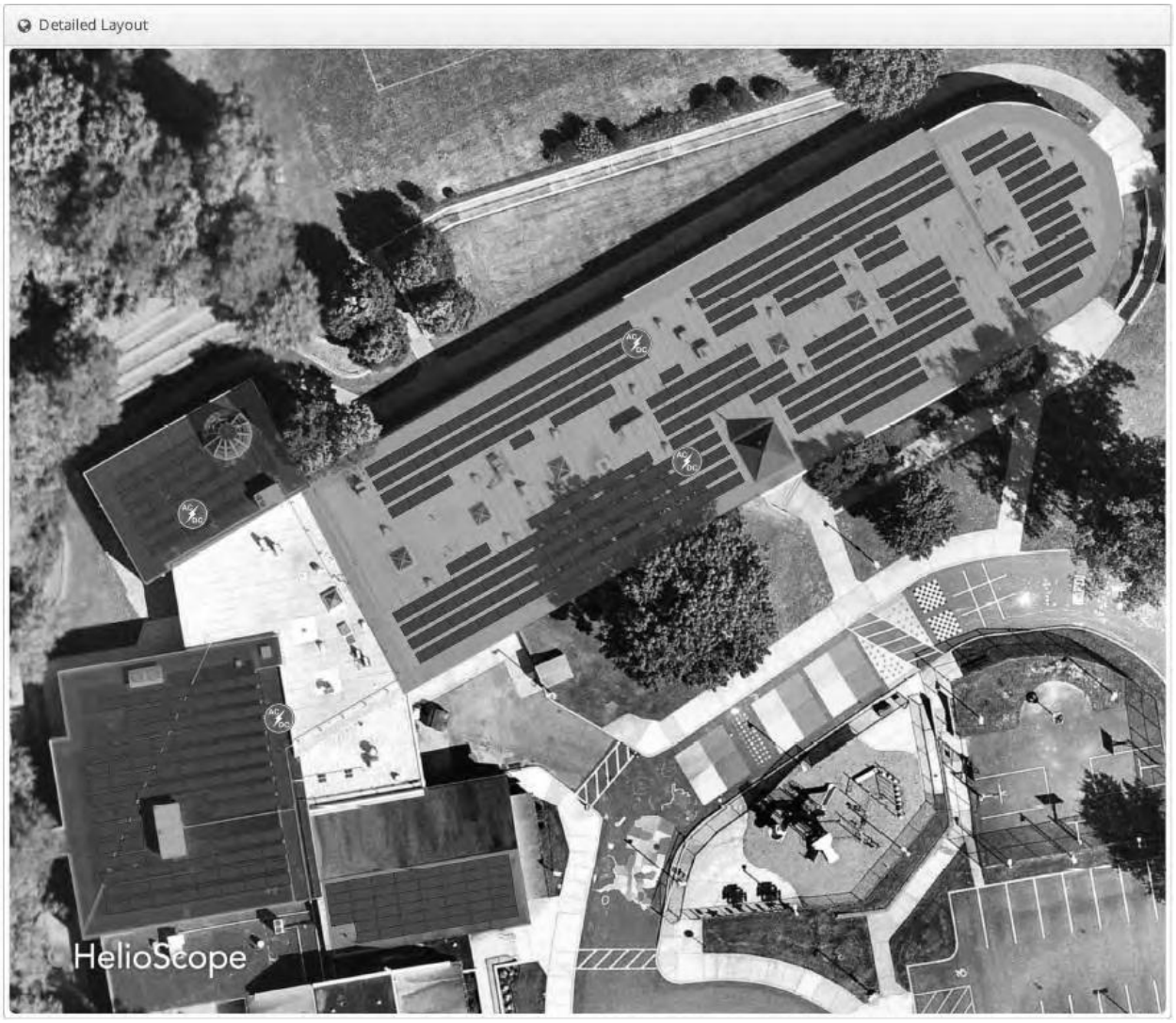
Sousa Elementary School

Sousa Elementary School
-Install (663) Hanwha Q Peak DUO XL Solar Panels
-Install (7) Sunny Tri-Power DC-AC Inverters
-Furnish and Install Rooftop Solar as per Helioscope design included in document.



Guggenheim Elementary School

Guggenheim Elementary School
-Install (805) Hanwha Q Peak DUO XL Solar Panels
-Install (7) Sunny Tri-Power DC-AC Inverters
-Furnish and Install Rooftop Solar as per Helioscope design included in document.



South Salem Elementary School

South Salem Elementary School
-Install (418) Hanwha Q Peak DUO XL Solar Panels
-Install (4) Sunny Tri-Power DC-AC Inverters
-Furnish and Install Rooftop Solar as per Helioscope design included in document.



Daly Elementary School

Daly Elementary School
-Install (311) Hanwha Q Peak DUO XL Solar Panels
-Install (2) Sunny Tri-Power DC-AC Inverters
-Furnish and Install Rooftop Solar as per Helioscope design included in document.



Manorhaven Elementary School

Manorhaven Elementary School
-Install (525) Hanwha Q Peak DUO XL Solar Panels
-Install (6) Sunny Tri-Power DC-AC Inverters
-Furnish and Install Rooftop Solar as per Helioscope design included in document.

General Scope of Work for Solar ECM

- All wiring to meet the requirements of the 2020 National Electrical Code.
- Solar modular to be Bankable Quality 480 or higher
- Inverters is to be Bankable Quality 480/208 volt Inverters
- Install web-based Monitoring System/ Internet services are by other
- Furnish and install As Built drawings
- Inverter 10-year warranty
- 1-year parts and labor warranty.
- 1-year Maintenance program.
- **Port Washington to provide 2 IP addresses at each location for remote monitoring**
- PSEG Coordination
- Commissioning of system and start up report upon close out
- Restoration of areas disturbed by this contract
- Underwriters Certificate
- Provide P.E. stamp rooftop ballast calculations.
- Provide P.E. stamp interconnection electrical design and SED Submission.
- PSEG interconnection application filings
- Roofing Slip Sheets for Solar Racking System only
- Solar Racking engineering drawings PE Stamped.
- Rapid Shut Down Device or 3307 UL Certification
- Furnish and install hot rolled with a hot dipped galvanized finish and cold formed galvanized purlin carport system at location as per the description line items.
- Tree Removal or pruning
- CESIR Study fee, if necessary.
- SCADA Requirements and Utility requirements, if necessary

Exclusions:
- Roofing structural certifications
- Roofing warranty requirements other than slip sheets
- Electrical building incoming service upgrades
- Roof certification of capacity for additional load.

Savings Calculation Method
The Helioscope calculator determines the energy production and cost savings of grid-connected photovoltaic (PV) energy systems by creating hour-by-hour performance simulations that provide estimated monthly and annual energy production in kilowatts and energy value. Users select a geographic location of the PV installation and establish system parameters for size, electric cost, array type, tilt angle, and azimuth angle. Using typical meteorological year weather data for the selected location, the Helioscope calculator determines the solar radiation incident of the PV array and the PV cell temperature for each hour of the year. The DC energy for each hour is calculated from the PV system DC rating and the incident solar radiation and then corrected for the PV cell temperature. The AC energy for each hour is calculated by multiplying the DC energy by the overall

DC-to-AC derate factor and adjusting for inverter efficiency as a function of load. Hourly values of AC energy are then summed to calculate monthly and annual AC energy production.

4.3 ECM 3: Pipe and Valve Insulation

Project Cost	Estimated Rebates/Incentives	Net Cost	Guaranteed Annual Energy Savings	O&M Savings
$37,356	-	$37,356	$1,830	-



Uninsulated Pipe



Insulated Pipe Thermal Pic

ECM General Description:

Pipe insulation serves as a thermal barrier, minimizing heat transfer and preventing energy losses in heating or cooling systems. Uninsulated pipes and valves can lead to significant heat dispersion, resulting in increased energy consumption as the system works harder to maintain desired temperatures. By enveloping pipes and valves with insulation materials, heat losses are dramatically curtailed, ensuring that the conveyed fluids remain at the intended temperature for more extended periods. This translates to reduced demand on heating or cooling equipment, subsequently lowering energy consumption and, consequently, utility costs. The insulation acts as a cost-efficient solution, creating a more thermally efficient infrastructure that optimizes energy usage, enhances system performance, and ultimately contributes to savings on utility bills.

Below is a summary of building receiving new pipe insulation.

School Name	Pipe and Valve Insulation
Paul D. Schreiber H.S.	-
Carrie P. Weber M.S.	X
Administration Building	-
John Philip Sousa E.S.	-
Gugenheim E.S.	-
South Salem E.S.	-
John J. Daly E.S.	-
Manorhaven E.S.	-
Total	

ECM Scope of Work

1. Pipe Insulation – un-insulated pipes in the steam, condensate, and heating and hot water systems are leading to unnecessary distribution losses and wasted energy.
2. Valve & Fitting Insulation – valves and fittings are difficult components of a mechanical system to insulate and as a result are frequently left un-insulated. These un-insulated or poorly insulated components have the same temperature fluids passing through them as the pipes that are more likely to be insulated; un-insulated components of the distribution system lead to unnecessary distribution losses and wasted energy.

Building & Location	System	Insulation Sizing	Insulation Material	Footage
Weber Middle School - Café	Hot Water	3/4" x 1 1/2"	Mineral Fiber	42'
Weber Middle School - Café	Hot Water	1"x 1 1/2"	Mineral Fiber	252'
Weber Middle School - Café	Hot Water	1 1/4" x 1 1/2"	Mineral Fiber	84'
Weber Middle School - Café	Hot Water	1 1/2" x 1 1/2"	Mineral Fiber	75'
Weber Middle School - Café	Hot Water	2" x 2"	Mineral Fiber	261'
Weber Middle School - Café	Hot Water	2 1/2" x 2"	Mineral Fiber	45'
Weber Middle School - Café	Hot Water	3" x 2"	Mineral Fiber	201'
Weber Middle School - Café	Domestic Hot Water	3/4" x 1"	Mineral Fiber	90'
Weber Middle School - Café	Domestic Hot Water	1" x 1"	Mineral Fiber	90'
Weber Middle School - Café	Domestic Hot Water	1 1/4" x 1"	Mineral Fiber	165'
Weber Middle School - Café	Domestic Hot Water	2" x 1"	Mineral Fiber	204'
Weber Middle School - Café	Domestic Hot Water	2 1/2" x 1"	Mineral Fiber	165'
Weber Middle School - Café	Domestic Hot Water	3" x 1"	Mineral Fiber	75'

Savings Calculation Method		
Heat Loss (Btu/h)	=	*(Heat Loss / lin.ft. bare pipe) * (lin.ft. of pipe) * [1 – (%insulated)] + (Heat Loss / lin.ft. insulated pipe) * (lin.ft. of pipe) * (%insulated)*
Fuel Loss (MMBtu/yr)	=	*(Heat Loss Btu/h) * (heating hrs/year) ÷ (efficiency)*
Electric Loss (kWh/yr)	=	(Heat Loss Btu/h) * (cooling hrs/year) / (12,000 Btu/ton-hr) x (cooling kW/ton)

4.4 ECM 4: Plug Load Controls

Project Cost	Estimated Rebates/Incentives	Net Cost	Guaranteed Annual Energy Savings	O&M Savings
$156,563	-	$156,563	$14,271	-



BERT Plug Load Management Software



BERT Plug Load Management Devices

ECM General Description:

Managing plug loads effectively can lead to significant reductions in utility bills. Plug loads refer to the energy consumed by devices plugged into outlets, such as electronics, appliances, and chargers. By adopting energy-efficient practices, like unplugging devices when not in use or using smart power strips to cut off power to idle electronics, you can curb unnecessary energy consumption. Many devices consume standby power even when turned off, contributing to what is known as phantom load. Addressing these phantom loads by disconnecting devices eliminates this wasted energy.

The existing plug loads were observed to have no existing plug load controls. Plug loads with significant parasitic loses will be good candidates for plug load controllers.

School Name	Plug Load Controllers
Paul D. Schreiber H.S.	154
Carrie P. Weber M.S.	176
Administration Building	9
John Philip Sousa E.S.	79
Gugenheim E.S.	91
South Salem E.S.	43
John J. Daly E.S.	67
Manorhaven E.S.	97
Total	716

Scope of Work

Install plug load controls on 716 electronic devices across eight buildings throughout the district, such as projectors, printers, and copiers. The plug load controls will be installed to automatically turn off electronic devices or put them in standby mode. See attached spreadsheet of exact locations in appendixes.

Benefits:

Plug load controls will reduce energy consumption from plugged-in electronic devices, resulting in energy cost savings for the library. The ECM will also contribute to the library's sustainability goals by reducing its carbon footprint and promoting energy efficiency. Overall, the proposed ECM for plug load controls is expected to provide significant energy savings, reduce environmental impact, and support the library's commitment to sustainability.

Savings Calculation Methodology		
Baseline Energy Usage (kWh/yr)	=	Average kW x Baseline Weekly Hours x 4.348 wks/mo. x Months/yr
Proposed Energy Usage (kWh/yr)	=	Average kW x Proposed Weekly Hours x 4.348 wks/mo. x Months/yr
Electrical Savings (kWh/yr)	=	Baseline Energy Usage – Proposed Energy Usage

4.5 ECM 5: Weatherization

Project Cost	Estimated Rebates/Incentives	Net Cost	Guaranteed Annual Energy Savings	O&M Savings
$252,533	$0	$252,533	$22,595	-









ECM General Description:

Building envelope enhancements are a crucial measure in the pursuit of energy efficiency and sustainable practices within a structure. This involves upgrading the physical barriers that separate the interior and exterior environments of a building, including walls, roofs, windows, and doors. By improving insulation materials and techniques, such as adding high-performance insulation and weather-stripping, the building envelope becomes more effective in preventing heat transfer. These measures collectively reduce the need for excessive heating or cooling, leading to energy savings. Moreover, a well-sealed and insulated building envelope not only conserves energy but also enhances occupant comfort by maintaining a consistent and desirable indoor temperature. This sustainable approach not only positively impacts utility bills but also aligns with the broader goal of creating environmentally responsible and energy-efficient structures.

The tables below provide an overview for each school the total units and the total surface area of the cracks that would need to be sealed and protected.

PORT WASHINGTON UFSD, NY
BUILDING ENVELOPE WORK SUMMARY

Task	Admin Building 1	Admin Building 2	Daly ES	Guggenheim ES	Manorhaven ES	Schreiber HS	Sousa ES	South Salem ES	Weber MS	Total Quantity
Building Envelope Improvement										
Buck Frame Air Sealing (LF)			145	23						168
Door - Install Jamb Spacer (Units)			1					9		10
Door Weather Striping - Doubles (Units)	1		14	22	15	25	7	13	23	120
Door Weather Stripping - Singles (Units)	3	1	2	2	3	18	8	3	15	55
Overhang Air Sealing (LF)								428		428
Overhang Air Sealing (SF)							63	10		73
Overhead Door Weather Stripping (Units)		2		1		1				4
Roll-Up Door Weather Stripping (Units)	3					2	1			6
Roof-Wall Intersection Air Sealing (LF)	109		566	751	496	650	1,330			3,902

Scope of Work

1. Supply and install weather stripping around doors and attic access hatches.
2. Provide tenting over attic pipes to bring pipes into thermal envelope of attic.
3. Supply and install flat insulation in attics at South Salem Elementary and Weber Middle on under-insulated surfaces.
4. Seal buck frame area at Daly and Guggenheim Elementary Schools.
5. Seal overhang areas that extend over exterior walls Sousa and South Salem Elementary Schools.
6. Remove existing weather stripping and replace with commercial-grade weather stripping on overhead and/or roll-up doors at Schreiber High School, Guggenheim & Sousa Elementary Schools, and the Administration building.
7. Seal roof-wall intersections to prevent air infiltration at Schreiber High School, Daly, Guggenheim, Manorhaven, and Sousa Elementary Schools, and the Administration building.
8. See appendix for floorplans for areas of installation.

Savings Calculation Method

Standard heat loss calculations (U, A, ΔT) to calculate savings from thermal barrier improvements.

INFILTRATION/ EXFILTRATION SAVINGS CALCULATION METHODOLOGY

Heating Savings

			Flow Factor		$(\Delta P)^{n}$		A		CFM Reduction
1)	Q	=	Flow Factor	x	Wind Pressure	x	Aggregate Air Leakage Pathway Hole	=	Cubic Feet / Minute (CFM)

			Q		HDD		Fuel $/MMBTU		
2)	Savings	=	CFM	x	HDD for Location	x	Fuel Cost in $	=	Savings in Dollars

Fuel / Mechanical Efficiency Factor

Efficiency Factor

3)	Savings from Air Leakage Control	..... =	Savings in Dollars
4)	Project Investment	..... =	Investment in Dollars
5)	Simple Payback	..... =	Investment / Savings

INFILTRATION/ EXFILTRATION SAVINGS CALCULATION METHODOLOGY

Cooling Savings

			Flow Factor		$(\Delta P)^{n}$		A		CFM Reduction
1)	Q	=	Flow Factor	x	Wind Pressure	x	Aggregate Air Leakage Pathway Hole	=	Cubic Feet / Minute (CFM)
			Total Heat Constant		CFM Reduction		Enthalpy		Tons
2)	Tons	=	4.5	x	CFM Reduction / 12,000 (BTU Hour per Ton)	x	Enthalpy Value	=	Tons
			Tons		kW per Ton		Cooling Hours		kWh
3)	kWh Savings	=	Tons	x	1.0	x	Cooling Hours for Location	=	kWh
			kWh		Fuel Cost/kWh				
4)	Savings	=	kWh Savings	x	Fuel Cost in $	=	Savings in Dollars		
5)	Savings from Air Leakage Control		.....					=	Savings in Dollars
6)	Project Investment		.....					=	Investment in Dollars
7)	Simple Payback		.....					=	Investment / Savings

THERMAL INSULATION SAVINGS CALCULATION METHODOLOGY

Heating and Cooling Savings

1) Pre-retrofit Heat Loss

		U-Value		ΔT		A		
Heat Loss	=	Existing U	x	HDD (or CDD) *24 hrs/day * 0.75	x	Surface Area	=	Pre-retrofit Heat Loss in MMBtu

1,000,000

Convert MMBtu

		MMBtu		$ / Unit		
Heat Loss	=	Pre-Retrofit Heat Loss in MMBtu	x	Cost / MMBtu	=	Pre-retrofit Heat Loss in $

2) Post-retrofit Heat Loss - Same Calculations as Above = Post-retrofit Heat Loss in $

		#1 Result		#2 Result		
3) Savings	=	Pre-retrofit Loss	-	Post-retrofit Loss	=	Savings in Dollars

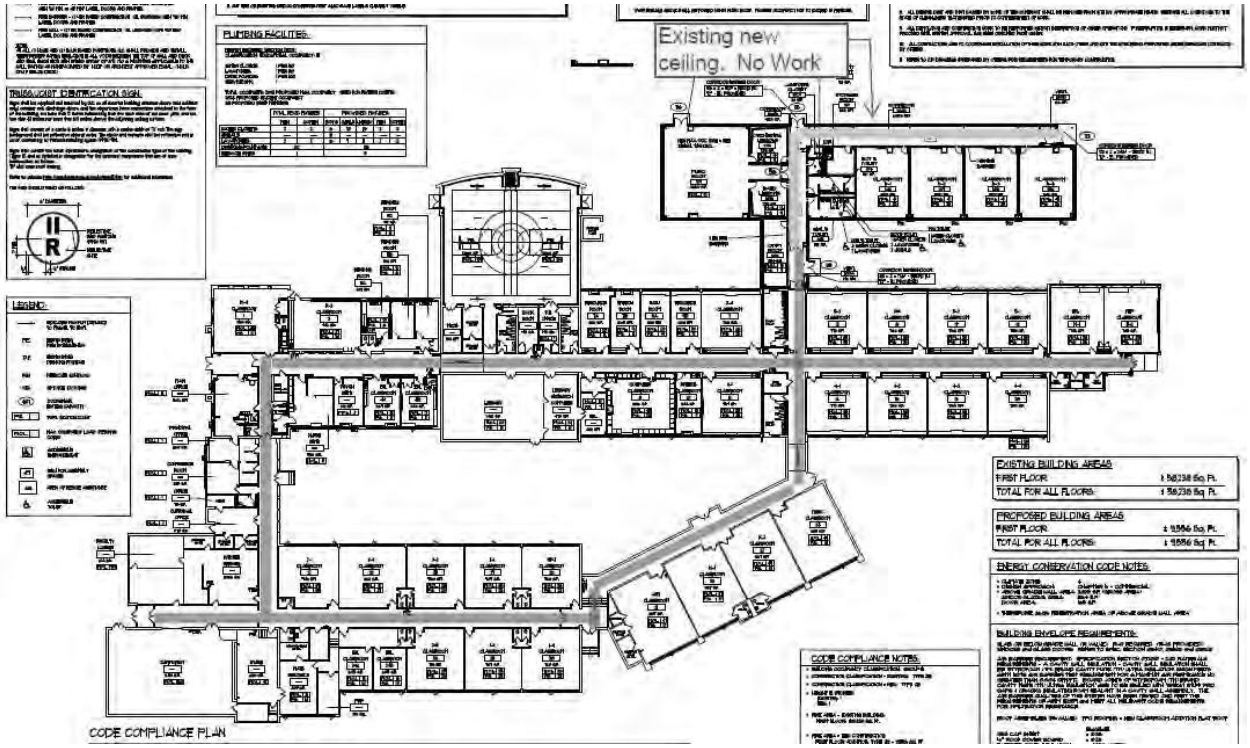
4) Project Investment ..... = Investment in Dollars

5) Simple Payback ..... = Investment / Savings

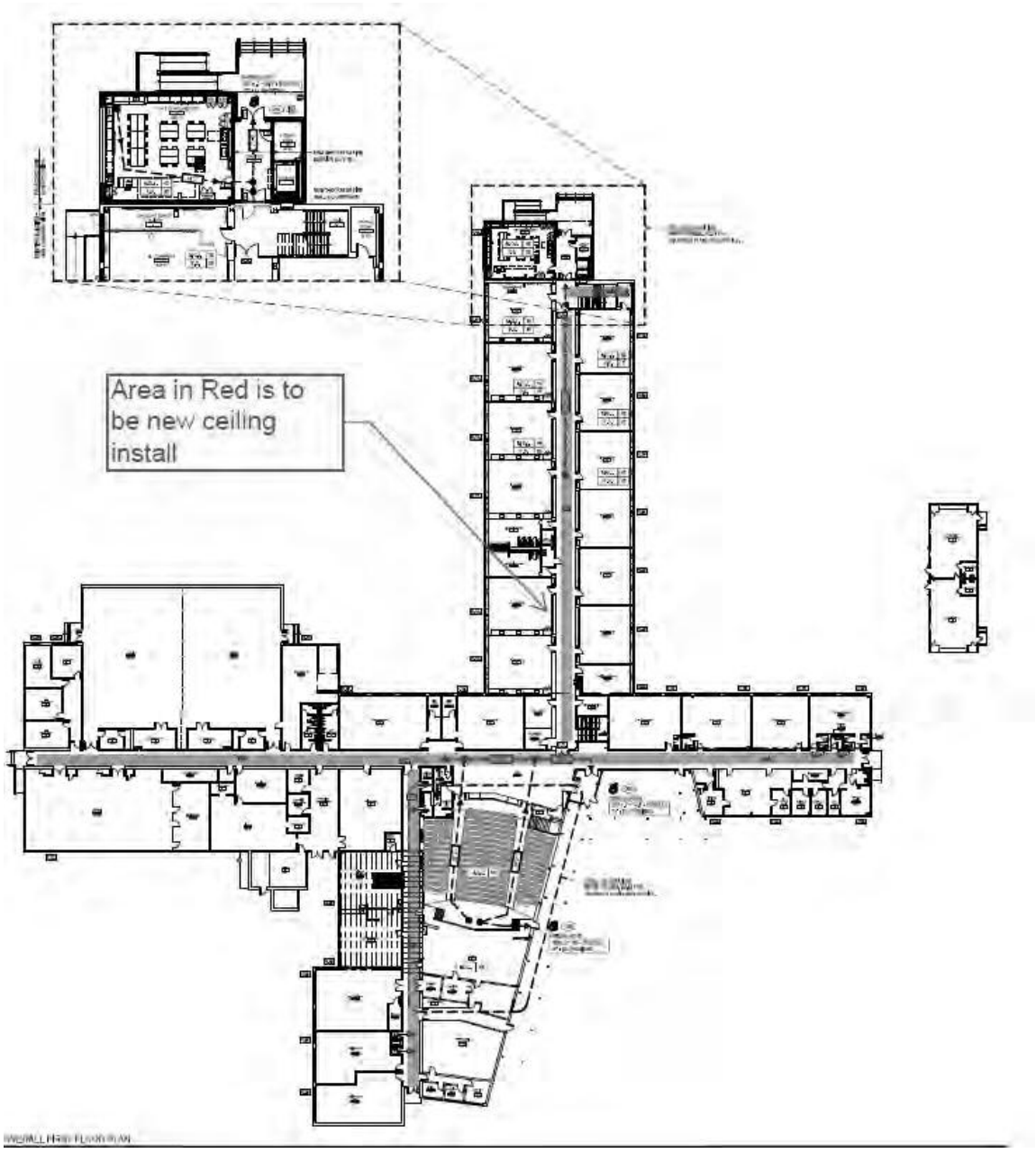
4.6 ECM 6: Ceiling Replacements

Project Cost	Estimated Rebates/Incentives	Net Cost	Guaranteed Annual Energy Savings	O&M Savings
$554,268	$0	$420,486	$0	$0

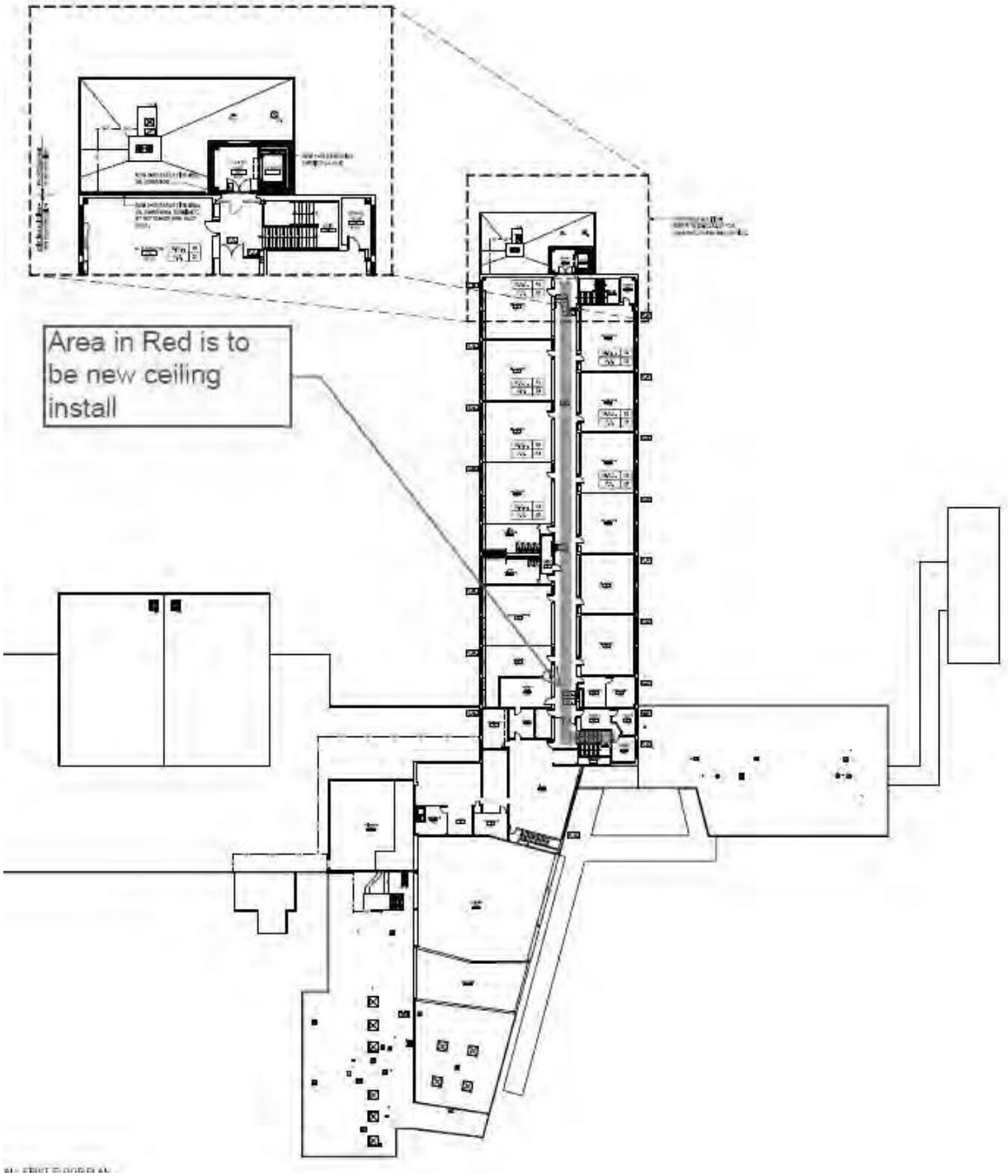
Manorhaven Elementary School



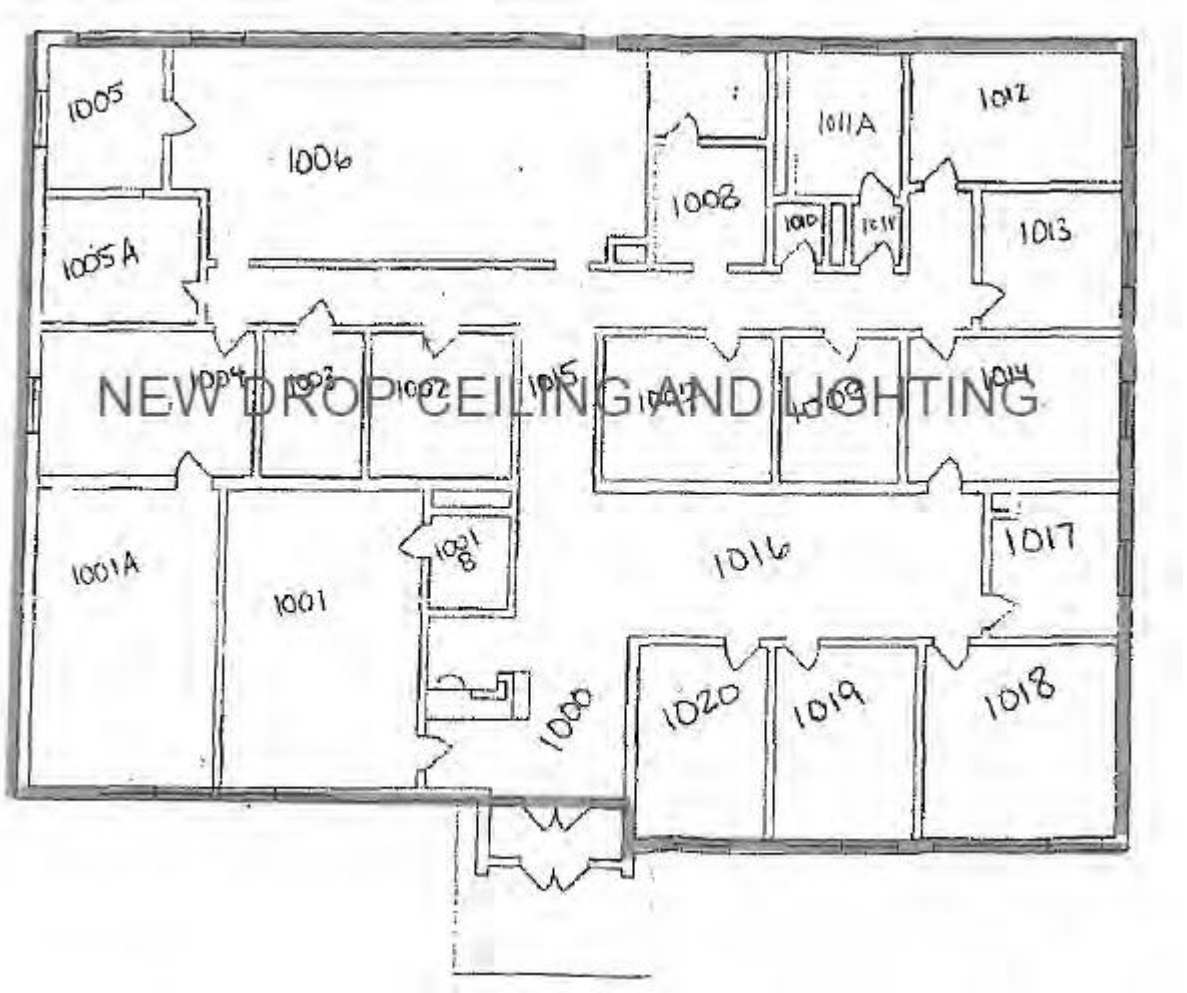
Sousa Elementary School First Floor



Sousa Elementary School 2nd Floor



Administration Building



ECM General Description:

This measure includes upgrading ceilings throughout Manorhaven and Sousa Elementary corridors. The administration building will get its existing ceilings replaced throughout the space. We will be removing existing non-plaster ceilings and installing new 2x2 drop ceilings to give the spaces highlighted above with a fresh and modern look. Included will be the supply and installation of new 2x2 recessed LED lights.

Scope of Work

1. Removal of existing drop ceilings and light fixtures.
2. Temporary removal of existing alarms, speakers, etc.
3. Provide temporary lighting during construction.
4. Furnish & Install New 2x2 LED recessed light fixtures.
5. Install new drop ceiling with reinstallation of existing alarms, speakers, etc.

Benefits:
The proposed ECM involves replacing the current ceiling system with a new drop ceiling and new recessed 2x2 LED lights. This will improve the overall appearance of the corridors and optimize the lighting layout.

4.7 ECM 7: New Condensate Pump Skid

Project Cost	Estimated Rebates/Incentives	Net Cost	Guaranteed Annual Energy Savings	O&M Savings
$104,326	$0	$104,326	$0	$0



Existing Condensate Return System



Existing Condensate Return System

ECM General Description:

This measure includes replacing the condensate return system located in the Schreiber High School boiler room. The existing has reached the end of its life and has significant leakage of condensate.

Benefits:

The proposed will eliminate the loss of condensate from the existing tank's leaking. The loss of condensate requires additional makeup water and natural gas to heat city water to the same temperature of the condensate. Also, additional makeup water requires additional water treatment, which can be avoided with a new tank system.

Scope of Work

1. Removal of existing tank and pumps
2. Install new stainless steel vacuum condensate system
3. Provide startup and commissioning of new system

ECMs Considered But Not Recommended

High Efficiency RTUs, Mini-Splits, and Spilt Systems & Controls – Replacing HVAC systems that have reached the end of their useful life with new, high efficiency units can provide an energy savings and improved comfort to the occupants. Additionally, new units will reduce the maintenance requirements of the older equipment as it ages. Due to the high cost of the ECM compared to the savings provided, this ECM is not included in the project.

Unit Ventilator Refurbishment – This ECM involves cleaning and repairing the internal components of unit ventilators, including heating coils, damper linkages, etc. These measures will improve the overall performance of the unit ventilators. Due to the high cost of the ECM compared to the savings provided, this ECM is not included in the project.

Boiler Replacement – This ECM was investigated at each of the schools to determine the feasibility of upgrading steam/HHW boilers to higher efficiency boilers. While there exists opportunities to increase efficiencies and reduce energy consumption, the cost of the measure could not be financially justified by the savings.

Boiler Burner Replacement – As the boilers throughout the district are older, updating the burners to improve combustion efficiency would reduce overall fuel usage. Each of the district schools' boilers were analyzed for energy savings through this measure. Due to the high cost of the ECM compared to the savings provided, this ECM is not included in the project.

VFDs on HHW Pumps – Adding VFDs to variable demand systems can produce significant savings. While each of the pumping systems throughout the district were evaluated, South Salem Elementary School provided the greatest opportunity for upgrade. However, the ROI for completing this upgrade did not meet the financial requirements of the project.

VFDs on Constant Volume Fans – Similar to VFDs on pumps, VFDs on constant volume fans that serve variable demands will produce overall savings for the system. All fan systems were evaluated throughout the district and many application opportunities were identified. However, the ROE for completing this upgrade did not meet the financial requirements of the project.

High-efficiency Domestic Water Heaters – There were several opportunities throughout identified for the upgrade of existing standard efficiency domestic water heaters to high efficiency units. There is an energy savings for this ECM and a recommendation to implement on a maintenance replacement basis. However, the ROI for completing this upgrade did not meet the financial requirements of the project.

Steam System Repair – Upon investigation of the Schreiber High School steam system, it is noted that there are several instances of steam loss throughout the system. Multiple condensate receiver/pump stations are leaking condensate and a potential leaking steam supply pipe exists in an underground pipe chase. The effort to address this issue will entail the repair/replacement of the leaking condensate systems, tracking/trending of makeup water into the system, pipe testing, etc.

Section 5: Measurement & Verification

Measurement & Verification (M&V) Methodologies

This section contains a description of the types of Measurement and Verification (M&V) methodologies that RENU will use to guarantee the performance of this project. They have been developed and defined by two independent authorities:

1. International Performance Measurement and Verification Protocol (IPMVP)
2. Federal Energy Management Program (FEMP)

5.1 M&V Options

There are four guarantee options that may be used to measure and verify the performance of a particular energy conservation measure. Each one is described below.

1. Option A – Retrofit Isolation: Key Parameter Measurement

Energy savings is determined by field measurement of the key parameters affecting the energy use of the system(s) to which an improvement measure was applied separate from the energy use of the rest of the facility. Measurement frequency ranges from short-term to continuous, depending on the expected variations in the measured parameter, and the length of the reporting period.

Measurement of key parameters means that those parameters not selected for field measurement will be estimated. Estimates can be based on historical data, manufacturer's specifications, or engineering judgment. Documentation of the source or justification of the estimated parameter will be described in the M&V plan in the contract. Energy savings is determined through engineering calculations of the baseline and post-retrofit energy used based on the combination of measured and estimated parameters, along with any routine adjustments.

2. Option B – Retrofit Isolation: All Parameter Measurement

Like Option A, energy savings is determined by field measurement of the energy use of the systems to which an improvement measure was applied separate from the energy use of the rest of the facility. However, all of the key parameters affecting energy use are measured; there are no estimated parameters used for Option B. Measurement frequency ranges from short-term to continuous, depending on the expected variations in the savings and the length of the reporting period. Energy savings is determined through engineering calculations of the baseline and post-retrofit energy used based on the measured parameters, along with any routine adjustments.

3. Option C – Whole Building Metering/Utility Bill Comparisons

Option C involves the use of utility meters or whole building sub-meters to assess the energy performance of a total building. Option C assesses the impact of any type of improvement measure, but not individually if more than one is applied to an energy meter. This option determines the collective savings of all improvement measures applied to the part of the facility monitored by the

energy meter. In addition, since whole building meters are used, savings reported under Option C include the impact of any other change made in facility energy use (positive or negative).

Option C may be used in cases where there is a high degree of interaction between installed improvement measures or between improvement measures and the rest of the building or the isolation and measurement of individual improvement measures is difficult or too costly.

This Option is intended for projects where savings are expected to be large enough to be discernable from the random or unexplained energy variations that are normally found at the level of the whole facility meter. The larger the savings, or the smaller the unexplained variations in the baseline, the easier it will be to identify savings. In addition, the longer the period of savings analysis after installing the improvement measure, the less significant is the impact of short-term unexplained variations. Typically, savings should be more than 20% of the baseline energy use if they are to be separated from the noise in the baseline data.

Periodic inspections should be made of all equipment and operations in the facility after the improvement measure installation. These inspections will identify changes from baseline conditions or intended operations. Accounting for changes (other than those caused by the improvement measures) is the major challenge associated with Option C-particularly when savings are to be monitored for long periods. Savings are calculated through analysis of whole facility utility meter or sub-meter data using techniques from simple comparison to regression analysis.

4. Option D – Calibrated Simulation

Option D involves the use of computer simulation software to predict energy use, most often in cases where baseline data does not exist. Such simulation models must be calibrated so that it predicts an energy use and demand pattern that reasonably matches actual utility consumption and demand data from either the base-year or a post-retrofit year. Option D may be used to assess the performance of all improvement measures in a facility, akin to Option C. However, different from Option C, multiple runs of the simulation in Option D allow estimates of the savings attributable to each improvement measure within a multiple improvement measure project.

Option D may also be used to assess just the performance of individual systems within a facility, akin to Option A and B. In this case, the system's energy use must be isolated from that of the rest of the facility by appropriate meters. Savings are calculated using energy use simulation models, calibrated with hourly or monthly utility billing data and/or end-use metering.

5.2 Recommended Performance Verification Methods

The goal of this project is to achieve energy savings through upgrades to the building's lighting, improvements in the pipe & valve insulation, the installation of plug load controls, and the addition of solar photovoltaic panels to offset the electric usage and building envelope upgrades (roof replacement, air infiltration treatments, plug loads). This project will also result in improved lighting levels and more efficient buildings, thereby reducing maintenance costs. The objective of Measurement and Verification (M&V) activities at the Project level is to confirm that the Measures that are recommended for the district energy performance contract (EPC) are installed and resulting in energy savings. The selection of the M&V methods to be used is based on the criteria as detailed by IPMVP and RENU's experience with successful contracts in the K-12, state, and local government sectors. Following is a table illustrating how the savings of the major energy conservation measures proposed for this project will be verified.

ECM	Electric Energy Savings (kWh/yr)	Electric Demand Savings (kW/yr)	Natural Gas Savings (Therms/yr)
LED Lighting & Lighting Controls	90,345	27.1	-
Solar – Rooftop	2,517,342	-	-
Pipe & Valve Insulation	-	-	1,548
Plug Load Controls	90,303	-	-
Building Weatherization	26,730	-	15,543
Ceiling Replacements	-	-	-
Condensate Pump Skid	-	-	-
Total	2,724,720	27.1	17,091

The expected annual consumption values above will be adjusted based on weather data, occupancy levels, and system operating parameters realized during the year-long period during which energy consumption measurements are in place. The adjusted expected savings will then be compared to actual savings.

RENU will perform measurement and verification (M&V) activities for each of the ECMs in order to estimate the actual cost savings achieved in the project. The M&V plans for the ECMs are described in Sections down below of this document and are summarized in the Table down the below.

ECM Description	Measurement and Verification Method – Summary	Detail of M&V Methodology
ECM-1 LED Lighting and Lighting Controls **M&V Option: A**	Key Parameters	Lighting fixture power consumption, operating hours, lighting levels
	Baseline	Measure a sample of fixture wattages. Determine operating hours through stipulated values. Baseline shall be generated using Energy calculations
	Post-Installation	Measure a sample of fixture wattages. Operating hours remain the same as baseline, except for adjustment due to implementation of lighting controls. Lighting controls are to be verified for on/off and/or dimming capability and timing.
	Performance Period	Annual visual inspection of a sample set of lighting fixtures and controls to ensure the integrity of the fixtures and controls and confirm that the ECM still has the potential to perform as specified.
ECM-2 Solar (Rooftop) **M&V Option: B**	Key Parameters	System name plate DC rating, array tilt, array azimuth, DC to AC conversion efficiency, hours and intensity of solar radiation, annual kwh generation
	Baseline	Baseline electrical energy is equivalent to the portion of the facility electrical load to be offset by the PV system electrical generation. PV system generation shall be calculated using the FEMP ENABLE IGA Tool, which is linked with the Helioscope tool.
	Post-Installation	Verify that proposed PV system has been implemented and is operating as intended. Instantaneous array performance to be compared against designed system output through measurement of solar insolation, module temperature and inverter output. Post installation savings is determined from the same baseline calculation modified for the as-built condition of the PV system
	Performance Period	Annual on-site inspections of PV equipment for ongoing verification that system is in place, operational and that guaranteed electrical generation is sustainable. Energy generation is continuously metered by the PV system's revenue grade meter. All metered generation is reported as verified savings.
ECM-3 Pipe & Valve Insulation **M&V Option: C**	Key Parameters	Weather, temperature setting, heating & cooling system efficiency
	Baseline	Stipulated weather values, derived from detailed simulation modeling. The model shall account for air flow. The model shall be adjusted to the specific site conditions
	Post-Installation	Month-by-month annual whole building energy simulation model calibrated against whole building metered data for electricity and natural gas used in the buildings
	Performance Period	Annual on-site inspections of equipment for ongoing verification. Baseline Adjustment should be made based on cooling and heating load and

		operating hours
ECM-4 Plug Load Controls **M&V Option: A**	Key Parameters	Device wattage, number of Berts and Scheduled ON hours
	Baseline	Reported operation from facility staff was used to establish baseline operation and equipment stipulated wattage. savings shall be generated using Energy calculations
	Post-Installation	A sample of equipment being controlled will be monitored for two-week period
	Performance Period	Annual on-site inspections of equipment for ongoing verification that energy control strategies are in place and sustainable
ECM-5 Building Weatherization **M&V Option: C**	Key Parameters	Weather, heating, and cooling system efficiency
	Baseline	Stipulated weather values, derived from detailed simulation modeling. The model shall account for air flow. The model shall be adjusted to the specific site conditions
	Post-Installation	Month-by-month annual whole building energy simulation model calibrated against whole building metered data for electricity and natural gas used in the buildings
	Performance Period	Annual on-site inspections of equipment for ongoing verification. Baseline Adjustment should be made based on cooling and heating load and operating hours

RENU Option A Savings Calculations

The verification methods for RENU Option A savings involve conducting field measurements of the energy usage of the system(s) where an ECM is implemented. These measurements are taken separately from the energy consumption of the rest of the facility. The measurement process may be either short-term or continuous.

In this approach, certain parameters are defined fairly to represent the probable actual value, although not all parameters are measured. This method is cost-effective while maintaining an acceptable level of accuracy.

All RENU Option A savings will undergo verification using one-time pre- and post-implementation measurements, along with engineering calculations as specified in the Measurement and Verification (M&V) Plan. These verified savings will then be carried forward, with annual escalation. Further details regarding the measurement process are provided below.

Option B Savings Calculation (Solar)

During the design phase of this ECM, a solar simulation model was used to determine the electric generation of the proposed photovoltaic (PV) system using 30 year weather data from Helioscope.

Once installed, the PV system will collect and monitor the electric generation of the System. This data will be stored on local hardware for a minimum of 18 months. The energy baseline will be adjusted to account for variables such as weather conditions, and normal degradation of the solar panels. The electric generation of the System is on the historical weather data used in the solar simulation model.

If during the guaranteed year, the annual peak sun hours are lower than those recorded in the baseline, an adjustment will be applied to the baseline figures to accommodate this deviation. This adjustment ensures that the annual peak sun hours guaranteed for the guaranteed year will not be less than those documented in the baseline.

RENU has the right to adjust the maximum guaranteed solar demand capacity and production based upon material changes to the stipulated baseline annual peak sun hours.

ECM Parameters

-Energy unit cost Section 3, Table 3.2.1 with escalation applied as outlined in Section 3, Table 3.2.6.

-Solar intensity from the typical meteorological year TMY, 10km Grid (40.85,-73.75), NREL (Prospector, NY was used to establish the baseline annual peak sun hours and calibrate the system production models.

-Upon achieving the guaranteed solar production and demand capacity for the guaranteed years 1, 2 and 3, Guarantee years 4 through 15 solar production and demand capacity are considered stipulated and agreed to.

-Solar capacity generation will decrease by 0.004% per guaranteed year of kWh production beginning in year 2.

RENU Option C Savings Calculations

RENU Option C will result in an analysis of savings in utility consumption by comparing data from a base year to a current year with similar operational and environmental conditions. The necessary information is sourced directly from the utility bills of a given facility, along with regional weather data.

The applicable buildings and accounts listed in Tables 3.1.5 and 3.1.6 will be utilized and will be monitored under RENU Option C during the Guarantee Term, the following steps outline the process for measuring savings using Option C:

1) Billing Periods

The number of days in the billing month under audit is compared to the base month's billing period. Energy bills from the base year are prorated to determine calendar month consumption. This adjustment helps standardize varying billing periods and align bills with weather data.

2) Weather Conditions

The temperature significantly influences the load requirements of HVAC-related equipment. Therefore, it's crucial to track weather data to identify any variations between the base and current years. Any deviations will be adjusted to ensure an accurate comparison.

A certain portion of each month's energy consumption is due to base load not related to weather such as lighting, computers, and office equipment. This non-weather sensitive consumption will be present no matter what the weather conditions are; therefore, they will be separated from the weather-sensitive consumption. Using standard logic and the assumption that the energy consumption-to-weather relationship is linear.

3) Adjust for Current Conditions

The base year data is modified to account for the environmental and operational conditions of the current year. Energy savings are then determined by comparing the current year's consumption to the adjusted consumption from the base year. Factors considered include, Changes in Billing Period Length, Variations in Weather Conditions, Alterations in Facility Occupancy or Usage, Additions or Removals of Energy-Consuming Equipment, Changes in Building Square Footage, and Fluctuations in Energy Prices and Rate Structures.

4) Guaranteed Savings

Utility bill cost avoidance is the metric used to assess the effectiveness of energy conservation measures post-project completion. This is calculated by subtracting the Current Year Energy Cost from the Adjusted Base Year Energy Cost, yielding the overall cost avoidance related to that energy type. Cost avoidance directly corresponds to the Energy Savings Guarantee.

Each billing cycle throughout the term will be compared to a Base Period. Actual energy usage and savings will be evaluated and compared to the guaranteed energy savings. The findings of this analysis will be provided to the District on an annual basis.

5.3 Development of the Baseline

The model of the existing building will accurately represent the building’s physical dimensions, construction materials, thermal properties, HVAC zoning, etc. This information was collected from construction plans and site surveys. In addition, data on the building’s operation schedule, zone set-points, occupancy rate, etc. was collected from the BMS. Actual weather data for the 12-month period between 04/22 and 04/23 was obtained from the closet airport weather station. This data will be used to construct the existing building model. Data that has been used in the existing

building model to characterize the building's operation conditions and occupancy rates will be reviewed and updated, as necessary. Any unanticipated changes in the new equipment's performance, discovered during its installation or commissioning process, will be noted and used to model the post-installation building. Weather data from the local weather station will be collected and prepared for use in the post-installation model.

Measurement Boundary
All ECMs at each facility are fed by the utility electric meter and natural gas meter used in the analysis, so the building's billed energy usage, encompassing the heating, cooling, and DHW systems as well as other loads, is the measurement boundary for the facility.

Interactive Effects
ECMs for the building envelope interact with HVAC equipment and the BMS, as they are all associated with the operation of the building's heating and cooling system. These interactive effects will be captured as a part of the billing analysis.

5.4 Energy Savings Calculations

Because the building will receive several energy efficiency upgrades, a combination of M&V options A and C are preferred. Utility bill analysis and metering will be performed.

Excel spread sheets will be used to create models of the building. The existing building model will use actual building characteristics, performance data of existing equipment, and actual building operation conditions---occupancy, schedules, and set points.

Determination of First-year Savings
Once the basic model of the existing building(s) is developed, it will be tuned with the best available data in order to make it reasonably accurate in predicting the existing buildings' monthly energy usage. Increased model accuracy is achieved by investigating the model's simulation of its energy-consuming sub-systems and adjusting model inputs until it reasonably predicts monthly kWh usage in comparison with the utility bills. We will also use spot measurements of kW on the lighting circuits and compare them to the model's predicted usage of the same equipment to determine whether discrepancies exist, and to decide which adjustments to make. Other ECMS verification procedures are detailed in sections 5.5 below.

The estimated first-year savings will be calculated by subtracting the annual kWh usage of the post-installation model from that of the baseline model. The annual kWh savings and therm savings from the building envelope, pipe insulation, Lighting and plug loads will be determined from the differences in usages between the post-installation model and the baseline model.

5.4.1 Utility Escalation Rates

The Guaranteed Savings will be adjusted to compensate for Material Changes. Material Changes are defined as changes that could potentially increase or decrease energy usage and/or cost in the facilities. These changes include, but are not limited to:

a. Changes in the operating hours of the buildings;
b. Fluctuations in building occupancy;
c. Structural modifications or renovations to buildings within the Facilities, encompassing architectural adjustments and building components;
e. Changes to the Energy Conservation Measures (ECMs);
f. Variations in utility prices or changes in rate structures.
g. Switches in utility suppliers.
h. Alterations in the method of utility billing or procurement concerning the Facilities.
i. Installation or removal of energy-consuming equipment on-site.
j. Deviations in weather patterns between the base year and the current year.
k. Failure by the district to fulfill operating and maintenance responsibilities as outlined by equipment manufacturers.
l. Introduction of new ventilation requirements to meet state government codes for any buildings within the Facilities.
m. Mandated increases in lighting levels to comply with state government codes for any buildings within the Facilities.
n. Any circumstance caused by the District or its representatives that impacts the energy demand or consumption of the Facilities. Significant occupancy and use changes in the Facilities (i.e., continuous evening-time use of material portions of the Facilities, wholesale changes to the NYSED's school calendar, large renovations increasing the square footage subject to heating/cooling, etc.)

The District is obligated to inform RENU of any actual or proposed significant alterations to the site that may affect energy usage and consumption. This notification must be provided no less than forty five (45) days before planned changes or within seventy-two (72) hours in the case of emergencies or unforeseen alterations.

The District commits to:

a. Not altering the initial building control system program without prior notification to RENU.
b. Refraining from setting the building control system to a permanent 'on' status, and not manually overriding any part of the system except in cases of equipment failure or emergencies.
c. Granting RENU access to adjust the Energy Conservation Measures (ECMs) to ensure optimal performance and maximum energy conservation.
d. Maintaining space temperature settings for heating not less than 68°F or more than 74°F.

5.5 M&V Plan for ECMs

5.5.1 ECM 1 — LED Lighting and Lighting Controls

The M&V plan for the lighting efficiency retrofit throughout Port Washington UFSD will follow M&V Option A. The Option A approach will be used to quantify energy consumption savings associated with the lighting equipment upgrades and annual verify that the measure continues to operate and perform as specified in the Final Proposal.

The M&V Plan for this retrofit assumes:

- Operating hours will be measured before the retrofit. The hours for the lighting fixtures will be the same before and after the equipment retrofit for the purpose of energy savings calculations.
- All fixtures installed will not be measured, an effective NEMVP recommended sampling method will be used. Lighting fixture types that account for greater than 10% of the total fixtures installed will be sampled. Lighting fixtures will be separated to homogenous groups and sampled to achieve ±10% precision with 90% confidence with an assumed 0.50 coefficient of variance.
- Interactive effects on heating and cooling equipment from the lighting retrofit will not be considered.

Overview of Baseline and Savings Calculations

The baseline energy consumption was documented through accurate accounting of all existing lighting equipment within the scope of the project during the CEA. A room-by-room inventory of fixture counts, types, and circuits was made. Fixture powers will be measured based on a sample of the most common fixture types. For less common fixture types, fixture power will be based on manufacturer's data.

Typical lighting hours for facility spaces were obtained from the typical hours of operation, categorized in "usage groups" and input into the CEA lighting tool. Further, run-time meters were installed that showed actual run hours to be in line with our estimates. Each of the room-by-room equipment entries within the CEA tool are assigned an appropriate usage group representative of the number of hours that piece of equipment is expected to operate. In instances where lighting controls are deployed, the CEA tool adjusts the post-retrofit operating hours by a factor appropriate for the control technology. The established post-retrofit operating hours will be held constant as annual operating hours during the performance period.

Post Installation and Performance Period Activities

Upon project completion, an as-built inventory of post-installation lighting fixtures will be supplied, including the lighting ballasts and lamps installed, and lighting illumination levels (foot-candles) in each area. Savings predictions will be corrected based on as-built data and will be reported in the Post-Installation Report. Fixture power will be measured in a manner identical to that for the baseline fixtures. Sample sizes for measurements and procedures are described. These measurements will be used to calculate actual expected energy savings and will be detailed in the

Post-Installation Report. The initial lighting power consumption was assessed and detailed in a breakdown by location and the type of fixtures used. This breakdown of kilowatts (kW) will serve as the basis for calculating energy savings before the retrofit. We will also take actual measurements of the pre-retrofit kilowatt usage to confirm the accuracy of the breakdown by location. Additionally, we will measure the illumination levels in selected areas to gain insight into the current lighting conditions.

The M&V team will quality check the line by line and take photographs for documentation.

Measuring Equipment: True-RMS Wattmeter (kW measurement) and HOBO loggers for Logging Operating Hours.

Energy Savings Calculations and Methodology
After completion of the field survey RENU compiled the audit data, field measurements and operating hours data. Utilizing the CEA Tool, details of existing fixture types, quantities, wattages and operating hours were generated. Based on RENU's retrofit strategy, proposed retrofit equipment is applied against the room-by-room equipment entries within the CEA tool. The CEA tool then calculates the energy and cost savings by comparing the baseline and post installation energy consumption at the designated energy rate.

5.5.2 ECM 2 — Solar

The M&V Plan for the Solar PV installations throughout the Port Washington UFSD will follow M&V Option B. Option B approach will be used to quantify the energy savings associated with the Solar PV installation and annually verify that the measure continues to operate and perform as specified in the Final Proposal.

The M&V plan for this ECM assumes:

- The annual solar radiation as utilized in the calculation of the annual electrical generation of the PV array will be assumed to represent a typical meteorological year (TMY) and will be held constant during the performance period for the purpose of energy generation calculations.
- PV Module Performance and inverter efficiencies are based on manufacturer's data.
- An annual verification of the measure will be performed to document that the PV system remains installed and performing as specified in the Final Proposal.
- An annual collection of the generated electrical output from the PV system will be performed and recorded as verified savings.

Option B will be used in the verification of solar production (kWh) output for this project. The verification of savings will be done by sub-meters and/or system control platform, with an overall measurement uncertainty of +- 10% at each system location. This means, any M&V result within 10% of the guaranteed level is deemed to meet the guarantee. The above variability is recommended, as the panel's output is dependent on solar insolation, and independent variable.

For Solar energy production (kWh)

For this ECM, once the system is installed and operational, RENU will collect the electric generation data. Measurement and Verification shall be performed using utility grade sub-meters and or the System software platform for each building. If electric generation data is not available or any part of the PV system is not operational for more than 15 days during each guarantee year then the guarantee year solar data from TMY3, 10km Grid (40.85,-73.75), NREL (Prospector, NY) will be used, and a model will be generated using the latest version of Helioscope to calculate the PV system production.

Overview of baseline and Savings Calculations

Given that the solar PV system is not installed at present, the energy baseline is considered to be the maximum potential annual output of the array. The baseline energy was established through collection of various data parameters including:

- Geographic location of array
- DC system size (name plate rating)
- DC-to-AC derate Factors
- Array type (fixed, tracking, etc)
- Array tilt, azimuth

The data collected is used within the proposal to generate baseline energy generation for the PV system.

Post Installation and Performance Period Activities

- Inspections of the renewable energy system to ensure proper operation and maximum performance.
- Submeter the renewable energy source to verify energy production and savings.
- The general approach for calculating energy savings from renewable energy project is the Net energy generation (the total kWh generation from the PV system).
- Solar capacity generation will decrease by 0.004% per guaranteed year of KWH production beginning in year 2.

The approach involves directly measuring the energy output from the system and quantifying any additional costs incurred or savings realized. This approach is suitable for PV, as the measurement concept assumes that energy (electrical) produced by the renewable system is used at the project site and displaces energy that would have been provided by an existing source. Savings are determined by measuring the net amount of energy produced by the renewable system and used at the project site valued at prescribed utility rates. This approach eliminates the need for a baseline.

When an on site net metering approach is used, meter(s) will typically show the measure's gross output (in kW and kWh) and credits from the local utility. The goal with this method is usually to measure net generation delivered to the project site. Metering, interconnection (including safety provisions), reporting, and other related issues are to be in accordance with current electrical standards and the requirements of the servicing electric utility. For every guaranteed year, the

calculation of energy savings from solar kWh production involves multiplying the solar production for the guaranteed year by the utility rate specified for that year in Table 3.1.5, along with any applicable escalation detailed in Section 3.2.6.

The effectiveness of the proposed PV system in generating kWh is directly influenced by solar isolation, which encompasses factors like cloud cover and other uncontrollable variables, even over short intervals, typically around 30 minutes.

Solar system availability: In estimating the guarantee for the proposed PV systems, RENU assumes that the PV system undergoes proper maintenance, and timely corrective actions are taken to ensure consistent system availability. If the PV system experiences adverse impacts during any given period, including but not limited to issues with the availability of generated electrical energy (kWh), RENU will consider the guarantee for that period is met.

Energy Savings Calculations and Methodology

The calculator determines the energy production and cost savings of grid-connected photovoltaic (PV) energy systems by creating hour-by-hour performance simulations that provide estimated monthly and annual energy production in kilowatts and energy value. Users select a geographic location of the PV installation and establish system parameters for size, electric cost, array type, tilt angle, and azimuth angle. Using typical meteorological year weather data for the selected location, the Helioscope calculator determines the solar radiation incident of the PV array and the PV cell temperature for each hour of the year. The DC energy for each hour is calculated from the PV system DC rating and the incident solar radiation and then corrected for the PV cell temperature. The AC energy for each hour is calculated by multiplying the DC energy by the overall DC-to-AC derate factor and adjusting for inverter efficiency as a function of load. Hourly values of AC energy are then summed to calculate monthly and annual AC energy production.

5.5.3 ECM 3— Pipe and Valve Insulation

The M&V Plan for the Pipe & Valve Insulation upgrades at Weber Middle School will follow M&V Option C. The Option C approach will be used to quantify the energy savings associated with the pipe & valve insulation and verify that the measure continues to operate and perform as specified in the Final Proposal. Pipe & valve insulation assessment evaluates existing pipe & valve distribution for missing and degraded insulation. Our assessments identify locations of thermal losses.

Overview of baseline and Savings Calculations

The Baseline was validated by verifying the linear feet and area contributing to heat loss. Accepted engineering principles were used for Baseline and Post-Installation calculations. Baseline energy use is affected by weather patterns, building loads, and pipe & valve deficiencies.

The data collected during the Feasibility Study was input into calculations to create the Baseline to determine the performance of the building envelope improvements.

Post Installation and Performance Period Activities

The Post-Installation performance factors are heating system efficiencies and thermal integrity of pipe & valve insulation. The intent of Performance Period verification activities is to ensure that the heat loss experienced by the piping prior to implementing this ECM has been reduced as a result of various building envelope improvements. The intent is also to ensure that the pipe & valve insulation improvements are being properly maintained. The savings from this measure will impact the building gas consumption and by utilizing Option C we will be able to run the bill analysis to indicate the savings occurred from this measure.

Energy Savings Calculations and Methodology

The formulas below were used to calculate the baseline and savings for this ECM. A linear foot/temperature difference calculation method was used to estimate the savings associated with improving the building's insulation characteristics and reducing the building's unwanted infiltration. Details of the calculation can be found below:

Port Washington

Facility	Weber MS										
						SAVINGS SUMMARY					
						95.8 MMBtu/yr					
NOTE: The calculations presented here are for underground as well as above-ground piping.Columns not relevant are hidden, but for clarity included and discussed in the 'Keys' section.											
Pipe Material	Steel										
k value (ins. Per LF)	24.7	Btu/h/ft/degF									
Boiler plant efficiency	80%										
Pipe Size (NPS) **(A)**	Pipe Outside Radius (feet) **(D)**	Length (ft) Above Ground **(E1)**	AG Piping % of bare pipe **(F1)**	Fluid Temperature (deg. F) **(G)**	Daily Hours of Operation **(K)**	Operational Months Each Year **(L)**	Avoidable Heat Loss for AG piping[c] (Btu/h-ft) **(P)**	Heat Loss (Btu/Hr) **(S)**	Hours of Operation Each Year **(U)**	Heat Loss (MMBtu/Year) **(V)**	
0.5	0.0350	-	30%	180	24	6	6.5	-	4,380	-	
0.75	0.0438	42	30%	180	24	6	10.0	421	4,380	2	
1	0.0548	252	30%	180	24	6	10.8	2,709	4,380	12	
1.25	0.0692	84	30%	180	24	6	16.6	1,394	4,380	6	
1.5	0.0792	75	30%	180	24	6	18.1	1,358	4,380	6	
2	0.0990	261	30%	180	24	6	25.7	6,708	4,380	29	
2.5	0.1198	45	30%	180	24	6	33.8	1,521	4,380	7	
3	0.1458	201	30%	180	24	6	40.7	8,181	4,380	36	
4	0.1875		30%	180	24	6	54.2	-	4,380	-	
5	0.2318	-	30%	180	24	6	71.9	-	4,380	-	
6	0.2760	-	30%	180	24	6	84.3	-	4,380	-	
8	0.3594	-	30%	180	24	6	111.1	-	4,380	-	
10	0.4479	-	30%	180	24	6	137.5	-	4,380	-	
12	0.5313	-	30%	180	24	6	163.5	-	4,380	-	

[a]Estimated

[b]Estimated from Table 13, page 25.22, ASHRAE Fundamentals, 2001

[c]Modified from the ASHRAE values referenced in Footnote b

[d]From Equation 7, page 11.10, ASHRAE Systems and Equipment Handbook, 2000

[e]From ASHRAE Systems and Equipment Handbook, 2000, page 11.11 (refer to Eq. 8, pg. 11.10). The insulation thickness "t" is: pipe OD < 2 in. = 2.5 in.; 2 in. < OD < 3 in. = 3.5 in.; 3 in. < OD < 6 in. = 4 in.; 6 in. < OD < 8 in. = 4.5 in.; OD > 8 in. = 5 in. (Construction Criteria Base, UF-02553N)

Port Washington

Facility Weber MS

SAVINGS SUMMARY
81.6 MMBtu/yr

NOTE: The calculations presented here are for underground as well as above-ground piping.Columns not relevant are hidden, but for clarity included and discussed in the 'Keys' section.

Pipe Material	Steel														
k value (ins. Per LF)	24.7	Btu/h/ft/degF													
Boiler plant efficiency	80%			hide		hide	hide	hide							
Pipe Size (NPS) (A)	Pipe Outside Radius (feet) (D)	Length (ft) Above Ground (E1)	AG Piping % of bare pipe (F1)	UG Piping Insulation Effectiveness (F2)	Fluid Temperature (deg. F) (G)	Length (ft) Above Ground (H)	Depth UG (ft) (I)	Average Air Temp (°F) (J)	Daily Hours of Operation (K)	Operational Months Each Year (L)	Avoidable Heat Loss for AG piping[c] (Btu/h-ft) (P)	Heat Loss (Btu/Hr) (S)	Hours of Operation Each Year (U)	Heat Loss (MMBtu/Year) (V)	
0.5	0.0350	-	30%	50%	120	NOT USED	10	80	24	6	6.5	-	4,380	-	
0.75	0.0438	90	30%	50%	120	NOT USED	10	80	24	6	10.0	903	4,380	4	
1	0.0548	90	30%	50%	120	NOT USED	10	80	24	6	10.8	968	4,380	4	
1.25	0.0692	165	30%	50%	120	NOT USED	10	80	24	6	16.6	2,739	4,380	12	
1.5	0.0792	-	30%	50%	120	NOT USED	10	80	24	6	18.1	-	4,380	-	
2	0.0990	240	30%	50%	120	NOT USED	10	80	24	6	25.7	6,168	4,380	27	
2.5	0.1198	165	30%	50%	120	NOT USED	10	80	24	6	33.8	5,577	4,380	24	
3	0.1458	78	30%	50%	120	NOT USED	10	80	24	6	40.7	3,175	4,380	14	
4	0.1875		30%	50%	120	NOT USED	10	80	24	6	54.2	-	4,380	-	
5	0.2318	-	30%	50%	120	NOT USED	10	80	24	6	71.9	-	4,380	-	
6	0.2760	-	30%	50%	120	NOT USED	10	80	24	6	84.3	-	4,380	-	
8	0.3594	-	30%	50%	120	NOT USED	10	80	24	6	111.1	-	4,380	-	
10	0.4479	-	30%	50%	120	NOT USED	10	80	24	6	137.5	-	4,380	-	
12	0.5313	-	30%	50%	120	NOT USED	10	80	24	6	163.5	-	4,380	-	

[a]Estimated
[b]Estimated from Table 13, page 25.22, ASHRAE Fundamentals, 2001
[c]Modified from the ASHRAE values referenced in Footnote b
[d]From Equation 7, page 11.10, ASHRAE Systems and Equipment Handbook, 2000
[e]From ASHRAE Systems and Equipment Handbook, 2000, page 11.11 (refer to Eq. 8, pg. 11.10). The insulation thickness "t" is: pipe OD < 2 in. = 2.5 in.; 2 in. < OD < 3 in. = 3.5 in.; 3 in. < OD < 6 in. = 4 in.; 6 in. < OD < 8 in. = 4.5 in.; OD > 8 in. = 5 in. (Construction Criteria Base, UF-02553N)

5.5.4 ECM 4 — Plug Load Controls

The primary intent of the M&V plan Option A for Plug Load Control is to verify and quantify the energy savings achieved by automatically turning off or putting electronic devices in standby mode when they are not in use.

Plug load controllers are used to shut down plug loads during times of low or no occupancy. RENU will document the completed scope and savings will be based upon the measured field variable of wattage. Standard calculation methodologies are as follows:

Existing Plug Load Machine Energy Usage (kWh) = Number of Plug load Machines x Average Measured Wattage per Plug load Machine x Hours of Operation I 1000

Proposed Plug Load Machine Energy Usage (kWh) = Number of Plug load Machines x Average Measured Wattage per Plug load Machine x Hours of Operation I 1000

Energy Saved= Total Existing Plug load Machine Energy Usage - Total Proposed Plug load Machine Energy Usage

Overview of baseline and Savings Calculations

The activities include:

- Confirm that the actual energy consumption aligns with the projected energy savings by utilizing plug load data loggers at a percentage of the loads.
- Validate that plug load control measures effectively reduce energy use by managing and optimizing equipment and appliances.

- Ensure that the installation meets or exceeds relevant energy efficiency standards and guidelines.

Engineering Calculation:

(1) Plug load usage (kWh)= Number of plug loads x Average Watts per plug load x Hours of Operation/ 1000
(2) Power Usage (kW) = (Number of plug loads Average Watts per plug load/ 1000) I K-Factor
(3) Energy Usage (kWh) = NC Power Usage x Operation Hours
(4) Total Existing Energy Usage = Existing plug load Energy Usage + Existing Energy
(5) Plug load Controls Power Usage= Voltage Rating of Controller x Current through Controller
(6) Total Proposed Energy Usage= Proposed plug load Usage + Proposed Energy Usage + plug load Controls Power Usage
(7) Energy Saved = Total Existing Energy Usage - Total Proposed Energy Usage

Assumptions:

- The plug load is assumed to be on for 168 hours per week. The plug load is assumed off for 12 hours per day during the work week.
- The plug load is assumed off for 24 hours per day during the weekend.
- The average power requirement of smart board is assumed to be 8 Watts.
- The average power requirement of Large Copier Machines is assumed to be 40 Watts.
- The average power requirement of a medium sized Printer is assumed to be 15 Watts.
- The average power requirement of a small sized Projector is assumed to be 8 Watts.
- The average power requirement of a Laptop Charging Cart is assumed to be 37 Watts.
- The average power requirement of a Soda Vending Machine is assumed to be 320 Watts.
- The average power requirement of a Hot or Cold-Water Dispenser is assumed to be 61 Watts.
- The average power requirement of an air scrubber is assumed to be 68 Watts.
- The average power requirement of a 110V or 220V Window AC Unit is assumed to be 300 Watts.

Post Installation and Performance Period Activities

- Installation and commissioning of plug load control devices and network communication system, quantity of post device installation to be verified against as-builts.
- Post-installation data collection will be collected using the manufacture monitoring network software. This measuring period will collect usage data for a period of two weeks. This measured data will be used to evaluate savings.
- Periodic inspections and maintenance to ensure the continued operation and optimization of plug load control systems.

Overview of Savings Calculations

Savings calculation methods for Plug Load Control often involve the comparison of pre-installation and post-installation energy consumption data. Key steps include:

- Calculating energy consumption before and after control measures are implemented, taking into account factors like equipment schedules and occupancy patterns.
- Analyzing energy meter data and utility bills to assess changes in energy usage. Estimating energy savings based on control system specifications and their impact on plug load

Investment Grade Audit for	Port Washington UFSD									Total
# of Berts	265	187	16	3	145	2	78	16	4	716
Total Annual Net kWh Savings	13,374	17,611	3,720	149	7,311	480	33,440	6,161	8,058	90,303
Total Annual Net $ Savings	2,274	2,994	632	25	1,243	82	5,685	1,047	1,370	15,352
Device Type:	Projector	M Printer	g Cart/Station	Smartboard	AC-220 20A	pier- 110 15A	Air Scrubber	H/C Water	Soda Vend	
Watts:	8	15	37	8	8	40	68	61	320	
# Hours Scheduled ON per Year: BASELINE	8,760	8,760	8,760	8,760	8,760	8,760	8,760	8,760	8,760	
Manorhaven Elementary	**$0.17**									
# of Berts	35	17	0	0	23	0	18	3	1	97
# Hours Scheduled ON per Year: BERT	2,420	2,420	2,420	2,420	2,420	2,420	2,420	2,420	2,420	
# Hours Scheduled OFF per Year: BERT	6,340	6,340	6,340	6,340	6,340	6,340	6,340	6,340	6,340	
Total Annual kWh Savings	1,775	1,617	00	00	1,167	00	7,760	1,160	2,029	15,508
Total Annual Savings	$302	$275	$0	$0	$198	$0	$1,319	$197	$345	$2,636
Annual $ Savings per Device	$8.62	$16.17	$0.00	$0.00	$8.62	$0.00	$73.29	$65.75	$344.90	
Sousa Elementary	**$0.17**									
# of Berts	29	21	3	0	22	0	3	0	1	79
# Hours Scheduled ON per Year: BERT	2,420	2,420	2,420	2,420	2,420	2,420	2,420	2,420	2,420	
# Hours Scheduled OFF per Year: BERT	6,340	6,340	6,340	6,340	6,340	6,340	6,340	6,340	6,340	
Total Annual kWh Savings	1,471	1,997	704	00	1,116	00	1,293	00	2,029	8,610
Total Annual Savings	$250	$340	$120	$0	$190	$0	$220	$0	$345	$1,464
Annual $ Savings per Device	$8.62	$16.17	$39.88	$0.00	$8.62	$0.00	$73.29	$0.00	$344.90	
Guggenheim Elementary	**$0.17**									
# of Berts	34	19	4	0	20	0	11	2	1	91
# Hours Scheduled ON per Year: BERT	2,420	2,420	2,420	2,420	2,420	2,420	2,420	2,420	2,420	
# Hours Scheduled OFF per Year: BERT	6,340	6,340	6,340	6,340	6,340	6,340	6,340	6,340	6,340	
Total Annual kWh Savings	1,724	1,807	938	00	1,014	00	4,742	773	2,029	13,029
Total Annual Savings	$293	$307	$160	$0	$172	$0	$806	$131	$345	$2,215
Annual $ Savings per Device	$8.62	$16.17	$39.88	$0.00	$8.62	$0.00	$73.29	$65.75	$344.90	
Daly Elementary	**$0.17**									
# of Berts	29	14	3	0	15	0	3	3	0	67
# Hours Scheduled ON per Year: BERT	2,420	2,420	2,420	2,420	2,420	2,420	2,420	2,420	2,420	
# Hours Scheduled OFF per Year: BERT	6,340	6,340	6,340	6,340	6,340	6,340	6,340	6,340	6,340	
Total Annual kWh Savings	1,471	1,331	704	00	761	00	1,293	1,160	00	6,720
Total Annual Savings	$250	$226	$120	$0	$129	$0	$220	$197	$0	$1,142
Annual $ Savings per Device	$8.62	$16.17	$39.88	$0.00	$8.62	$0.00	$73.29	$65.75	$0.00	

Investment Grade Audit for	Port Washington UFSD									Total
# of Berts	265	187	16	3	145	2	78	16	4	716
Total Annual Net kWh Savings	13,374	17,611	3,720	149	7,311	480	33,440	6,161	8,058	90,303
Total Annual Net $ Savings	2,274	2,994	632	25	1,243	82	5,685	1,047	1,370	15,352
Device Type:	Projector	M Printer	g Cart/Station	Smartboard	AC-220 20A	pier- 110 15A	Air Scrubber	H/C Water	Soda Vend	
Watts:	8	15	37	8	8	40	68	61	320	
# Hours Scheduled ON per Year: BASELINE	8,760	8,760	8,760	8,760	8,760	8,760	8,760	8,760	8,760	
South Salem Elementary	$0.17									
# of Berts	15	14	1	0	12	0	1	0	0	43
# Hours Scheduled ON per Year: BERT	2,420	2,420	2,420	2,420	2,420	2,420	2,420	2,420	2,420	
# Hours Scheduled OFF per Year: BERT	6,340	6,340	6,340	6,340	6,340	6,340	6,340	6,340	6,340	
Total Annual kWh Savings	761	1,331	235	00	609	00	431	00	00	3,367
Total Annual Savings	$129	$226	$40	$0	$103	$0	$73	$0	$0	$572
Annual $ Savings per Device	$8.62	$16.17	$39.88	$0.00	$8.62	$0.00	$73.29	$0.00	$0.00	
Admin Building	$0.17									
# of Berts	0	7	0	0	1	1	0	0	0	9
# Hours Scheduled ON per Year: BERT	3,132	3,132	3,132	3,132	3,132	3,132	3,132	3,132	3,132	
# Hours Scheduled OFF per Year: BERT	5,628	5,628	5,628	5,628	5,628	5,628	5,628	5,628	5,628	
Total Annual kWh Savings	00	591	00	00	45	225	00	00	00	861
Total Annual Savings	$0	$100	$0	$0	$8	$38	$0	$0	$0	$146
Annual $ Savings per Device	$0.00	$14.35	$0.00	$0.00	$7.65	$38.27	$0.00	$0.00	$0.00	
Weber Middle School	$0.17									
# of Berts	69	53	0	1	23	1	24	5	0	176
# Hours Scheduled ON per Year: BERT	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	
# Hours Scheduled OFF per Year: BERT	6,360	6,360	6,360	6,360	6,360	6,360	6,360	6,360	6,360	
Total Annual kWh Savings	3,511	5,056	00	51	1,170	254	10,380	1,940	00	22,362
Total Annual Savings	$597	$860	$0	$9	$199	$43	$1,765	$330	$0	$3,801
Annual $ Savings per Device	$8.65	$16.22	$0.00	$8.65	$8.65	$43.25	$73.52	$65.95	$0.00	
Schreiber High School	$0.17									
# of Berts	54	42	5	2	29	0	18	3	1	154
# Hours Scheduled ON per Year: BERT	2,600	2,600	2,600	2,600	2,600	2,600	2,600	2,600	2,600	
# Hours Scheduled OFF per Year: BERT	6,160	6,160	6,160	6,160	6,160	6,160	6,160	6,160	6,160	
Total Annual kWh Savings	2,661	3,881	1,140	99	1,429	00	7,540	1,127	1,971	19,848
Total Annual Savings	$452	$660	$194	$17	$243	$0	$1,282	$192	$335	$3,374
Annual $ Savings per Device	$8.38	$15.71	$38.75	$8.38	$8.38	$0.00	$71.21	$63.88	$335.10	

5.5.5 ECM 5 — Building Envelope

The M&V Plan for the Building Envelope upgrades throughout the Port Washington UFSD will follow M&V Option C. The Option C approach will be used to quantify the energy savings associated with the building envelope and verify that the measure continues to operate and perform as specified in the Final Proposal. Building envelope assessment evaluates sides of the building, including the attics/roofs, walls, and floors and all of intersections connecting the building's assemblies. Our assessments identify locations of air leakage losses and thermal transfer – the two primary modes of energy loss in buildings.

Cooling and heating loss (or gain in the case of any system) resulting from inadequate insulation can be mitigated by both reinforcing insulation and implementing air barriers to minimize air leakage. RENU will record the finalized scope of work, and the savings will be determined based on the measured field variables such as the length and thickness of insulation, as well as the materials used for air sealing.

Overview of Baseline and Savings Calculations

The Baseline was validated by verifying the linear feet and area contributing to infiltration. Accepted engineering principles were used for Baseline and Post-Installation calculations. Baseline energy use is affected by weather patterns, building loads, and building envelope deficiencies. The data collected was input into calculations to create the Baselines to determine the performance of the building envelope improvements.

The fundamental principle guiding the calculation of energy savings for this measure is indicated below:

For fittings (valves, elbows, strainers, etc.), we estimate heat loss based on equivalent length of straight pipe, which is the ratio of the area of the fitting to the area of 1 linear foot of pipe of the same size (fitting equivalent length = Area of fitting, ft2 / Area of pipe of equivalent diameter, ft2).

$$q_{pipe} = \frac{2 * \pi * \Delta T}{\frac{1}{h * \left(D_{outer}/_{2}\right)}}$$

Where:
q_{pipe} = *heat loss per linear foot = Btu/h/lin.ft.*

$h = total\ convective\ heat\ transfer\ factor = h_{convection} + h_{radiation}$

$h_{convection} = 0.213 * \left(\frac{\Delta T}{D}\right)^{\left(\frac{1}{4}\right)}$ [ASHRAE 2005, Ch. 3, Eq. T10.16]

$\Delta T = T_{surface} - T_{air}$
$\Delta T = T_{surface} - T_{air}$
D = Outer diameter

$h_{radiation} = \varepsilon * \sigma * {\left(T_{surface}^4 - T_{air}^4\right)}/{\left(T_{surface} - T_{air}\right)}$

e = emissivity of surface
s = Stefan-Boltzmann constant = 0.1714 x 10-8 Btu / (hr-ft^2-°R^4)
$T_{surface}$ = *Temperature of surface*
T_{air} = *Average ambient air temperature*

Pipes & Fittings

(1) Heat Loss (Btu/h) = (Heat Loss / lin.ft. bare pipe) * (lin.ft. of pipe) * [1 – (%insulated)] + (Heat Loss / lin.ft. insulated pipe) * (lin.ft. of pipe) * (%insulated)

(2) Fuel Loss (MMBTU/yr) = (Heat Loss Btu/h) * (heating hrs/year) ÷ (efficiency)

Post Installation and Performance Period Activities

The Post-Installation performance factors are heating system efficiencies and thermal integrity of windows, doors, roofs, and wall insulation. The intent of Performance Period verification activities is to ensure that the infiltration experienced in the building prior to implementing this ECM has been reduced as a result of various building envelope improvements. The savings from this measure will impact the building gas consumption and by utilizing the Option C we will be able to run the bill analysis to indicate the savings occurred from this measure. The intent is also to ensure that the building envelope improvements are being properly maintained.

Energy Savings Calculations and Methodology

A Microsoft Excel spreadsheet was developed to calculate the baseline and savings for this ECM. A bin calculation method was used to estimate the savings associated with improving the building's insulation characteristics and reducing the building's unwanted infiltration. Details of the calculation can be found below:

PORT WASHINGTON UFSD, NY

BUILDING ENVELOPE INVESTMENT & SAVINGS SUMMARY

Building/ Measure	Location	Heating Fuel Units	Cooling Fuel Units	Units, LF or SF	Heating Savings (Fuel Units)	Cooling Savings (Fuel Units)	Total Energy Savings (MMBtu)
Admin Building 1							
Door Weather Stripping							
Double Door - Sides, Top, Sweep, Center (UT)	See Floor Plan	therms	kWh	1	38	65	4
Single Door - Sides, Top, Sweep (UT)	See Floor Plan	therms	kWh	3	68	118	7
Garage Door Weather Stripping							
Roll-Up Door Weather Strip - Sides, Top	See Floor Plan	therms	kWh	1	96	165	10
Roll-Up Door Weather Strip - Sides, Top, Botto	See Floor Plan	therms	kWh	2	283	486	30
Roof-Wall Intersection Air Sealing							
Seal (LF)	See Floor Plan	therms	kWh	109	124	214	13
Admin Building 1 Total					609	1,046	64
Admin Building 2							
Door Weather Stripping							
Single Door - Sides, Top, Sweep (UT)	See Floor Plan	therms	kWh	1	23	39	2
Garage Door Weather Stripping							
Overhead Door Weather Strip - Sides, Top, Bott	See Floor Plan	therms	kWh	2	185	317	20
Admin Building 2 Total					207	357	22
Daly ES							
Buck Frame Air Sealing							
Block, Seal (LF)	See Floor Plan	therms	kWh	145	165	284	17
Door Weather Stripping							
Double Door - Sides, Top, Sweep, Center (UT)	See Floor Plan	therms	kWh	14	526	905	56
Install Door Jamb Spacer (UT)	See Floor Plan	therms	kWh	1	---	---	---
Single Door - Sides, Top, Sweep (UT)	See Floor Plan	therms	kWh	2	46	78	5
Roof-Wall Intersection Air Sealing							
Block, Seal (LF)	See Floor Plan	therms	kWh	566	645	1,109	68
Daly ES Total					1,382	2,377	146

PORT WASHINGTON UFSD, NY

BUILDING ENVELOPE INVESTMENT & SAVINGS SUMMARY

Building/ Measure	Location	Heating Fuel Units	Cooling Fuel Units	Units, LF or SF	Heating Savings (Fuel Units)	Cooling Savings (Fuel Units)	Total Energy Savings (MMBtu)
Guggenheim ES							
Buck Frame Air Sealing							
Block, Seal (LF)	See Floor Plan	therms	kWh	23	26	45	3
Door Weather Stripping							
Double Door - Sides, Top, Sweep, Center (UT	See Floor Plan	therms	kWh	22	827	1,423	88
Single Door - Sides, Top, Sweep (UT)	See Floor Plan	therms	kWh	2	46	78	5
Garage Door Weather Stripping							
Overhead Door Weather Strip - Sides, Top, E	See Floor Plan	therms	kWh	1	57	98	6
Roof-Wall Intersection Air Sealing							
Block, Seal (LF)	See Floor Plan	therms	kWh	685	1,561	2,685	165
Seal (LF)	See Floor Plan	therms	kWh	66	75	129	8
Guggenheim ES Total					2,592	4,458	274
Manorhaven ES							
Door Weather Stripping							
Double Door - Sides, Top, Sweep, Center (UT	See Floor Plan	therms	kWh	15	564	970	60
Single Door - Sides, Top, Sweep (UT)	See Floor Plan	therms	kWh	3	68	118	7
Roof-Wall Intersection Air Sealing							
Block, Seal (LF)	See Floor Plan	therms	kWh	496	1,130	1,944	120
Manorhaven ES Total					1,763	3,032	187
Schreiber HS							
Door Weather Stripping							
Double Door - Sides, Top, Sweep, Center (UT	See Floor Plan	therms	kWh	25	940	1,617	100
Single Door - Sides, Top, Sweep (UT)	See Floor Plan	therms	kWh	18	410	705	43
Garage Door Weather Stripping							
Overhead Door Weather Strip - Sides, Top, E	See Floor Plan	therms	kWh	1	100	172	11
Roll-Up Door Weather Strip - Sides, Top, Bot	See Floor Plan	therms	kWh	2	155	267	16
Roof-Wall Intersection Air Sealing							
Seal (LF)	See Floor Plan	therms	kWh	650	988	1,698	105
Schreiber HS Total					2,593	4,459	275

PORT WASHINGTON UFSD, NY

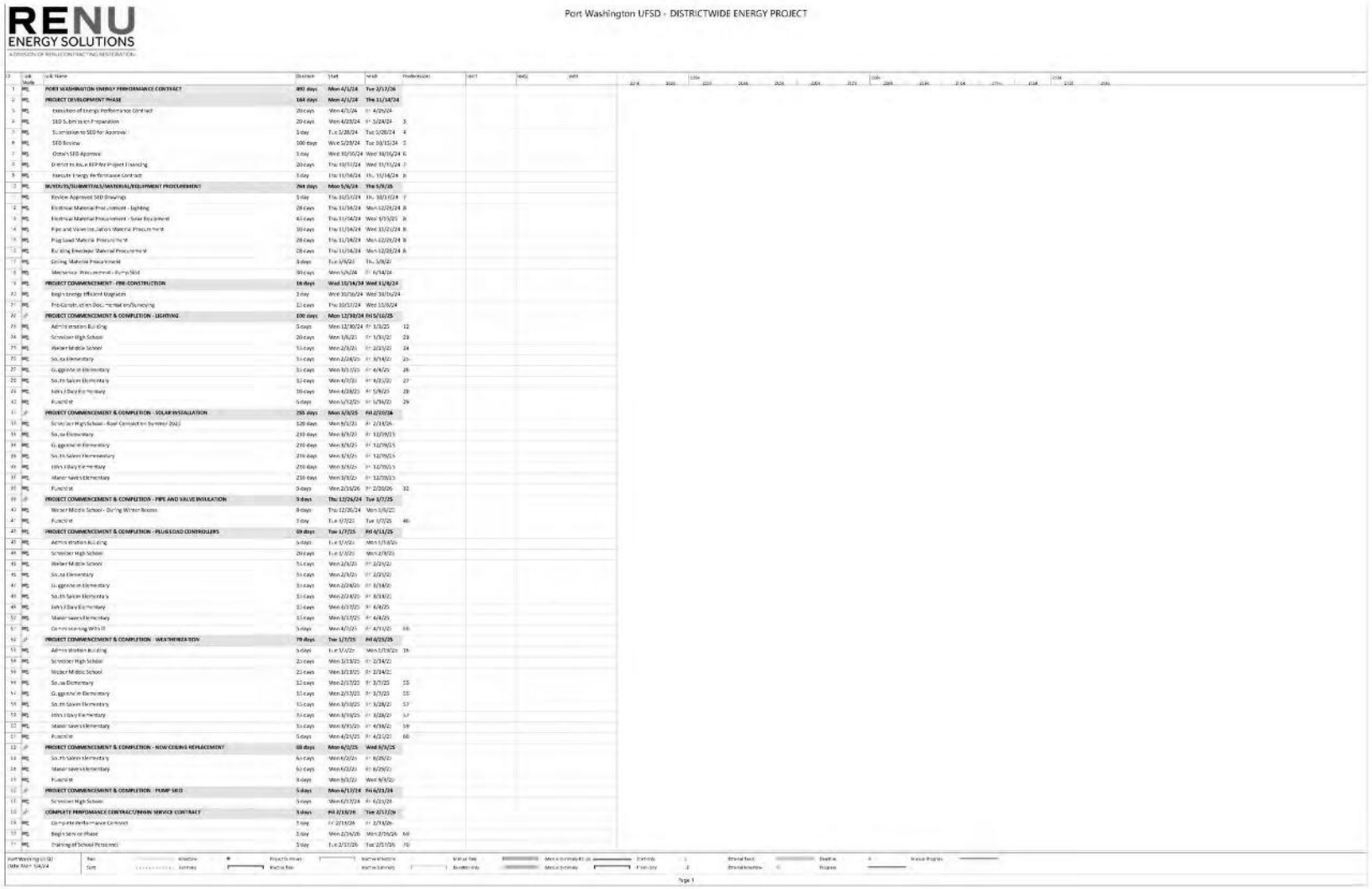
BUILDING ENVELOPE INVESTMENT & SAVINGS SUMMARY

Building/ Measure	Location	Heating Fuel Units	Cooling Fuel Units	Units, LF or SF	Heating Savings (Fuel Units)	Cooling Savings (Fuel Units)	Total Energy Savings (MMBtu)
Sousa ES							
Door Weather Stripping							
Double Door - Sides, Top, Sweep, Center (UT	See Floor Plan	therms	kWh	7	263	453	28
Single Door - Sides, Top, Sweep (UT)	See Floor Plan	therms	kWh	8	182	314	19
Garage Door Weather Stripping							
Roll-Up Door Weather Strip - Sides, Top, Bot	See Floor Plan	therms	kWh	1	68	118	7
Overhang Air Sealing							
Block, Seal (SF)	See Floor Plan	therms	kWh	63	95	163	10
Roof-Wall Intersection Air Sealing							
Block, Seal (LF)	See Floor Plan	therms	kWh	1,330	3,031	5,213	321
Sousa ES Total					3,640	6,260	385
South Salem ES							
Attic Bypass Air Sealing							
Attic Air Barrier Retrofit (SF)	See Floor Plan	therms	kWh	6,790	1,633	4,169	177
Attic Insulation							
8" Open Blow Cellulose (SF)	See Floor Plan	therms	kWh	6,790	304	1,431	35
Door Weather Stripping							
Double Door - Sides, Top, Sweep, Center (UT	See Floor Plan	therms	kWh	13	489	841	52
Install Door Jamb Spacer (UT)	See Floor Plan	therms	kWh	9	---	---	---
Single Door - Sides, Top, Sweep (UT)	See Floor Plan	therms	kWh	3	68	118	7
Overhang Air Sealing							
Block, Seal (LF)	See Floor Plan	therms	kWh	421	959	1,650	102
Block, Seal (SF)	See Floor Plan	therms	kWh	10	23	39	2
Seal (LF)	See Floor Plan	therms	kWh	7	11	18	1
South Salem ES Total					3,487	8,266	377
Weber MS							
Door Weather Stripping							
Double Door - Sides, Top, Sweep, Center (UT	See Floor Plan	therms	kWh	23	865	1,487	92
Single Door - Sides, Top, Sweep (UT)	See Floor Plan	therms	kWh	15	342	588	36

Section 6: Implementation Schedule

RENU ENERGY SOLUTIONS

Port Washington UFSD - DISTRICTWIDE ENERGY PROJECT



Section 7: Appendices

7.1 Lighting Spreadsheets

ADMINISTRATION BUILDING

RENU ENERGY SOLUTIONS

Cost of Power $0.22

													SOLUTIONS										SAVINGS		
																							ENERGY SAVINGS		
ID#	LOCATION	ROOM NAME	LAMP SYSTEM TYPE	FIXTURE TYPE	FIXTURE HEIGHT	CEILING TYPE	EXISTING CONTROLS TYPE	LAMPS PER FIXTURE	FIXTURE WATTAGE	EXISTING QUANTITY	TOTAL KW	ANNUAL OPERATING HOURS	ENERGY USAGE (KWH)	LED UPGRADE TYPE	LED UPGRADE DESCRIPTION	Controls Upgrade	Controls QTY	FIXTURE WATTAGE	UPGRADE QUANTITY	Control Factor	TOTAL KW	PROPOSED ANNUAL OPERATING HOURS	ENERGY USAGE (KWH)	KWH	% REDUCTION	COST SAVINGS ($)
1	1st Floor	Dr Haynes Office	LED-L13-2	Troffer-2X4-Prismatic-Recessed-*	8	Drop	None	2	26.0 W	6	0.2 kW	2,000 Hrs	312.0 kWh	Control Only		CW-1-WH (1),LRF2-VCR2B-P-WH (2),MRF2S-8S-DV-WH (1)	4	26.0 W	6	24 %	0.156 kW	1,520 Hrs	237.1 kWh	74.9 kWh	24%	$16
2	1st Floor	Admin Area Outside of Dr. Hynes Office	LED-L13-2	Troffer-2X4-Prismatic-Recessed-*	8	Drop	None	2	26.0 W	6	0.2 kW	2,000 Hrs	312.0 kWh	Control Only		CW-3-WH (1),LRF2-OCR2B-P-WH (2),MRF2S-8S-DV-WH (3)	6	26.0 W	6	24 %	0.156 kW	1,520 Hrs	237.1 kWh	74.9 kWh	24%	$16
										12	**0.3 kW**		**624.0 kWh**						**12**		**0.3 kW**		**474.2 kWh**	**149.8 kWh**	**24%**	**$33**

ANNEX BUILDING

RENU ENERGY SOLUTIONS

Cost of Power $0.22

ID#	LOCATION	ROOM NAME	LAMP SYSTEM TYPE	FIXTURE TYPE	EXISTING CONTROLS TYPE	LAMPS PER FIXTURE	FIXTURE WATTAGE	EXISTING QUANTITY	TOTAL KW	ANNUAL OPERATING HOURS	ENERGY USAGE (KWH)	SOLUTIONS									SAVINGS		
												LED UPGRADE TYPE	LED UPGRADE DESCRIPTION	Controls Upgrade	Controls QTY	FIXTURE WATTAGE	UPGRADE QUANTITY	Control Factor	TOTAL KW	PROPOSED ANNUAL OPERATING HOURS	ENERGY USAGE (KWH)	ENERGY SAVINGS		
																						KWH	% REDUCTION	COST SAVINGS ($)
1	Lower Level	Hallways	CFQ-CFQ32/G24Q-1	6 in Can-Horizontal-Parabolic-Recessed-*		1	34.0 W	23	0.8 kW	3,000 Hrs	2346.0 kWh	Retrofit	RETRO-1X-6IN-DRS-CAN-12W-35K-86		0	12.0 W	23	0 %	0.276 kW	3,000 Hrs	828.0 kWh	1518.0 kWh	65%	$334
2	Lower Level	Hallways	CFQ-CFQ32/G24Q-1	6 in Can-Horizontal-Parabolic-Recessed-EM		1	34.0 W	3	0.1 kW	3,000 Hrs	306.0 kWh	Retrofit	RETRO-1X-6IN-DRS-CAN-12W-35K-EM-86		0	12.0 W	3	0 %	0.036 kW	3,000 Hrs	108.0 kWh	198.0 kWh	65%	$44
								26	**0.9 kW**		**2652.0 kWh**						**26**		**0.3 kW**		**936.0 kWh**	**1716.0 kWh**	**65%**	**$378**

RENU ENERGY SOLUTIONS

Cost of Power $0.22

														SOLUTIONS										SAVINGS		
																								ENERGY SAVINGS		
ID#	LOCATION	ROOM NAME	LAMP SYSTEM TYPE	FIXTURE TYPE	FIXTURE HEIGHT	CEILING TYPE	EXISTING CONTROLS TYPE	LAMPS PER FIXTURE	FIXTURE WATTAGE	EXISTING QUANTITY	TOTAL KW	ANNUAL OPERATING HOURS	ENERGY USAGE (KWH)	LED UPGRADE TYPE	LED UPGRADE DESCRIPTION	Controls Upgrade	Controls QTY	FIXTURE WATTAGE	UPGRADE QUANTITY	Control Factor	TOTAL KW	PROPOSED ANNUAL OPERATING HOURS	ENERGY USAGE (KWH)	KWH	% REDUCTION	COST SAVINGS ($)
1	1st Floor	Hallways	CFQ-CFQ32/G24Q-1	6 in Can-Horizontal-Parabolic-Recessed-*	8	Drop	None	1	34.0 W	12	0.4 kW	3,000 Hrs	1224.0 kWh	Retrofit	RETRO-1X-6IN-DRS-CAN-12W-35K-86		0	12.0 W	12	0 %	0.144 kW	3,000 Hrs	432.0 kWh	792.0 kWh	65%	$174
2	1st Floor	Hallways	CFQ-CFQ32/G24Q-1	6 in Can-Vertical-None-Recessed-*	10	Hard	None	1	34.0 W	5	0.2 kW	3,000 Hrs	510.0 kWh	Retrofit	RETRO-1X-6IN-DRS-CAN-12W-35K-86		0	12.0 W	5	0 %	0.060 kW	3,000 Hrs	180.0 kWh	330.0 kWh	65%	$73
3	1st Floor	Hallways	CFQ-CFQ32/G24Q-1	6 in Can-Vertical-None-Recessed-EM	10	Hard	None	1	34.0 W	1	0.0 kW	3,000 Hrs	102.0 kWh	Retrofit	RETRO-1X-6IN-DRS-CAN-12W-35K-EM-86		0	12.0 W	1	0 %	0.012 kW	3,000 Hrs	36.0 kWh	66.0 kWh	65%	$15
4	2nd Floor	Hallways	CFQ-CFQ32/G24Q-1	6 in Can-Vertical-None-Recessed-*	8	Drop	None	1	34.0 W	6	0.2 kW	3,000 Hrs	612.0 kWh	Retrofit	RETRO-1X-6IN-DRS-CAN-12W-35K-86		0	12.0 W	6	0 %	0.072 kW	3,000 Hrs	216.0 kWh	396.0 kWh	65%	$87
5	Lower Level	Elevator Lobby	UFL-FU32T8U-2	Troffer-2X2-Parabolic-Recessed-EM				2	59.0 W	1	0.1 kW	3,000 Hrs	177.0 kWh	Retrofit	BYP-2X-U6T8-TYPE-B-13W-35K-EM-45		0	30.0 W	1	0 %	0.030 kW	3,000 Hrs	90.0 kWh	87.0 kWh	49%	$19
6	Lower Level	Elevator Lobby	CFQ-CFQ32/G24Q-2	14 in Drum-Horizontal-Frosted-Surface-*				2	68.0 W	1	0.1 kW	3,000 Hrs	204.0 kWh	Replace	NEW-1X-14IN-DRD-DRUM-10W-35K-45		0	10.0 W	1	0 %	0.010 kW	3,000 Hrs	30.0 kWh	174.0 kWh	85%	$38
7	Exterior	Exterior	HPS-HPS200-1	Wallpack-Mogul-Prismatic-Wall-*				1	250.0 W	1	0.3 kW	4,380 Hrs	1095.0 kWh	Replace	NEW-1X-WP-100W-40K-PC-86		0	100.0 W	1	0 %	0.100 kW	4,380 Hrs	438.0 kWh	657.0 kWh	60%	$145
8	Exterior	Exterior	MH-MH175-1	Acorn-Medium-Prismatic-14ft Pole-*				1	215.0 W	4	0.9 kW	4,380 Hrs	3766.8 kWh	Retrofit	BYP-1X-POST-TOP-HID-E26-35W-TYPE-B-40K-48		0	35.0 W	4	0 %	0.140 kW	4,380 Hrs	613.2 kWh	3153.6 kWh	84%	$694
9	Exterior	Exterior	CF-CF23W-1	Wallpack-Medium-Clear-Wall-*	20			1	23.0 W	8	0.2 kW	4,380 Hrs	805.9 kWh	Relamp	RL-1X-A19-8.8W-40K-DIM-1		0	8.8 W	8	0 %	0.070 kW	4,380 Hrs	308.4 kWh	497.6 kWh	62%	$109
10	Exterior	Exterior	INCAN-I60-1	Step Light-Medium-Clear-Wall-*				1	60.0 W	4	0.2 kW	4,380 Hrs	1051.2 kWh	Relamp	RL-1X-A19-8.8W-40K-DIM-1		0	8.8 W	4	0 %	0.035 kW	4,380 Hrs	154.2 kWh	897.0 kWh	85%	$197
11	Exterior	Exterior	MH-MH100-1	Bollard-Medium-Clear-Ground-*			None	1	128.0 W	16	2.0 kW	4,380 Hrs	8970.2 kWh	Retrofit	BYP-1X-A21-E26-17W-35K-34		0	17.0 W	16	0 %	0.272 kW	4,380 Hrs	1191.4 kWh	7778.9 kWh	87%	$1,711
12	Exterior	Exterior	T8-F40T8-2	Indirect-1X5-Clear-Surface-Vaportight				2	80.0 W	4	0.3 kW	4,380 Hrs	1401.6 kWh	Replace	NEW-1X-4FT-SEAL-VAPOR-30W-40K-3		0	30.0 W	4	0 %	0.120 kW	4,380 Hrs	525.6 kWh	876.0 kWh	63%	$193
13	Exterior	Exterior	HPS-HPS200-1	Bardyard-Medium-Clear-Wall-*				1	250.0 W	1	0.3 kW	4,380 Hrs	1095.0 kWh	Replace	NEW-1X-YARDBLASTER-FA-60W-40K-PC-3		0	60.0 W	1	0 %	0.060 kW	4,380 Hrs	262.8 kWh	832.2 kWh	76%	$183
14	Exterior	Exterior	MH-MH250-1	Wallpack-Medium-Prismatic-Wall-*				1	295.0 W	1	0.3 kW	4,380 Hrs	1292.1 kWh	Replace	NEW-1X-WP-100W-40K-PC-86		0	100.0 W	1	0 %	0.100 kW	4,380 Hrs	438.0 kWh	854.1 kWh	66%	$188
15	Exterior	Side Entrance to Cafeteria	CFQ-CFQ13/GX23-2	Canopy-Horizontal-Clear-Surface-*				2	31.0 W	2	0.1 kW	4,380 Hrs	271.6 kWh	Replace	NEW-1X-CANOPY-40W-40K-86		0	40.0 W	2	0 %	0.080 kW	4,380 Hrs	350.4 kWh	-78.8 kWh	-29%	-$17
										67	**5.5 kW**		**22578.4 kWh**					**67**		**1.3 kW**		**5265.9 kWh**	**17312.5 kWh**	**77%**	**$3,809**

Guggenheim Elementary

RENU ENERGY SOLUTIONS

Quote #5705-1 - Port Washington School District - Guggenheim Elementary School - LED Proposal

Cost of Power $0.22

GENERAL INFORMATION																	SOLUTIONS										SAVINGS										
																											ENERGY SAVINGS			HVAC SAVINGS		DEMAND					
LUM NUMBER	QTY	LOCATION	AREA	ROOM NAME	LAMP SYSTEM TYPE	FIXTURE TYPE	FIXTURE HEIGHT	VOLTAGE	CEILING TYPE	EXISTING CONTROLS TYPE	LAMPS PER FIXTURE	FIXTURE WATTAGE	EXISTING QUANTITY	TOTAL KW	Barn Door Group	ANNUAL OPERATING HOURS	ENERGY USAGE (KWH)	LED UPGRADE TYPE	LED UPGRADE DESCRIPTION	Controls Upgrade	Controls QTY	FIXTURE WATTAGE	UPGRADE QUANTITY	Control Factor	TOTAL KW	PROPOSED ANNUAL OPERATING HOURS	ENERGY USAGE (KWH)	KWH	% REDUCTION	COST SAVINGS ($)	KWH	COST SAVINGS ($)	KW	% REDUCTION	UTILITY COST SAVINGS ($)	MAINTENANCE COST SAVINGS	TOTAL COST SAVINGS
1	1	Guggenheim ES	1st Floor	Library	INCAN-HID-6	Decorative-Medium-None-Surface-*	10	120	Hard	None	6	80.0 W	9	0.5 kW	Library	3,000 Hrs	1620.0 kWh	Retrofit	NL-BK-A10-8.8W-30K-DIM-1	CW-3-WH (1),CW-6-WH (1),LRF2-OCSDB-P-WH (SD),FLD-2S-CW-L-(1)	10	52.8 W	9	24 %	0.475 kW	2,280 Hrs	1083.5 kWh	536.5 kWh	33%	$118	0.0 kWh	$0	0.06	12%	$118	$648	$766
2	2	Guggenheim ES	1st Floor	Library	INCAN-HID-1	Jelly Jar-Medium-Prismatic Wall-*	8	120	Hard	None	1	60.0 W	1	0.1 kW	Library	3,000 Hrs	180.0 kWh	Retrofit	NL-1K-A10-8.8W-30K-DIM-1	Control Factor - Occ/Vac (1)	1	8.8 W	1	24 %	0.009 kW	2,280 Hrs	20.1 kWh	159.9 kWh	89%	$35	0.0 kWh	$0	0.05	85%	$35	$12	$47
3	3	Guggenheim ES	1st Floor	Library	HAL-HTS-1	Sconi-Medium-None-Surface-*	8	120	Hard	None	1	75.0 W	1	0.1 kW	Library	3,000 Hrs	225.0 kWh	Retrofit	PL-1K-PAR38-EZ6-12W-40DEC-30K-DIM-3	Control Factor - Occ/Vac (1)	1	12.0 W	1	24 %	0.012 kW	2,280 Hrs	27.4 kWh	197.6 kWh	88%	$43	0.0 kWh	$0	0.06	84%	$43	$2	$45
4	4	Guggenheim ES	1st Floor	Library	INCAN-HID-2	Decorative-Medium-None-Surface-*	10	120	Hard	None	2	120.0 W	2	0.2 kW	Library	3,000 Hrs	720.0 kWh	Retrofit	NL-2K-A15-8.8W-30K-DIM-1	Control Factor - Occ/Vac (1)	1	17.6 W	2	24 %	0.035 kW	2,280 Hrs	80.3 kWh	639.7 kWh	89%	$141	0.0 kWh	$0	0.20	85%	$141	$48	$189
5	5	Guggenheim ES	1st Floor	Library	MH-MH150-1	Sconce-Medium-Prismatic-Wall-*	8	120	Hard	None	1	190.0 W	1	0.2 kW	Library	3,000 Hrs	570.0 kWh	Retrofit	RM-13-A21-12K-/VA-35K-34	Control Factor - Occ/Vac (1)	1	17.0 W	1	24 %	0.017 kW	2,280 Hrs	38.8 kWh	531.2 kWh	93%	$117	0.0 kWh	$0	0.17	91%	$117	$14	$131
6	6	Guggenheim ES	1st Floor	Cafeteria	TS-T54TSHO-4	Highbay-1X4-None-Surface-*	12	120	Hard	None	4	240.0 W	16	3.8 kW	Cafeteria	3,000 Hrs	11520.0 kWh	Retrofit	BYP-4X-4'TSHO-TYPE-B-25W-40K-2	CW-3-WH (2),LRF2-OWLB-P-WH (1),P2-2B-DIMH-LCS + P2CO-WM-Control Factor - Fixture Integrated Sensor (1)	10	100.0 W	16	24 %	1.600 kW	2,280 Hrs	3648.0 kWh	7872.0 kWh	68%	$1,732	0.0 kWh	$0	2.24	58%	$1,732	$164	$1,896
7	7	Guggenheim ES	1st Floor	Gym	TB-F32T8-6	Highbay-2X4-Cage-Chain-*-*	18	120	Open Truss	None	6	192.0 W	12	2.3 kW	Gymnasium	3,000 Hrs	6912.0 kWh	Retrofit	NEW-1K-HIGH-BAY-66W-40K-OCC-WG-BS		1	86.0 W	12	24 %	1.032 kW	2,280 Hrs	2353.0 kWh	4559.0 kWh	66%	$1,003	0.0 kWh	$0	1.27	55%	$1,003	$128	$1,131
8	8	Guggenheim ES	1st Floor	Exterior	H-FS-HPS250-1	Flood-Mogul-Clear-Wall-Trunnion	18	120	Exterior	None	1	295.0 W	2	0.6 kW	Exterior	4,380 Hrs	2584.2 kWh	Retrofit	NEW-1X-FLOOD-TRUN-100W-40K-BR		0	100.0 W	2	0 %	0.200 kW	4,380 Hrs	876.0 kWh	1708.2 kWh	66%	$376	0.0 kWh	$0	0.39	66%	$376	$26	$402
9	9	Guggenheim ES	1st Floor	Exterior	H-FS-HPS400-1	Flood-Mogul-Clear-Wall-Bloffiter	18	120	Exterior	None	1	465.0 W	2	0.9 kW	Exterior	4,380 Hrs	4073.4 kWh	Retrofit	NEW-1X-FLOOD-SURF-135W-40K-BR		0	135.0 W	2	0 %	0.270 kW	4,380 Hrs	1182.6 kWh	2890.8 kWh	71%	$636	0.0 kWh	$0	0.66	71%	$636	$26	$662
10	10	Guggenheim ES	1st Floor	Exterior	H-FS-HPS400-1	Flood-Mogul-Clear-Wall-Bloffiter	18	120	Exterior	None	1	465.0 W	1	0.5 kW	Exterior	4,380 Hrs	2036.7 kWh	Retrofit	NEW-1X-FLOOD-SURF-135W-40K-BR		0	135.0 W	1	0 %	0.135 kW	4,380 Hrs	591.3 kWh	1445.4 kWh	71%	$318	0.0 kWh	$0	0.33	71%	$318	$13	$331
													47	**9.2 kW**			**30441.5 kWh**						**47**		**3.8 kW**		**9903.8 kWh**	**20540.5 kWh**	**67%**	**$4,519**	**0**	**$0**	**5.4**	**59%**	**$4,519**	**$1,080**	**$5,598**

RENO ENERGY SOLUTIONS

Cost of Power $0.22

														SOLUTIONS										SAVINGS		
ID#	LOCATION	ROOM NAME	LAMP SYSTEM TYPE	FIXTURE TYPE	FIXTURE HEIGHT	CEILING TYPE	EXISTING CONTROLS TYPE	LAMPS PER FIXTURE	FIXTURE WATTAGE	EXISTING QUANTITY	TOTAL KW	ANNUAL OPERATING HOURS	ENERGY USAGE (KWH)	LED UPGRADE TYPE	LED UPGRADE DESCRIPTION	Controls Upgrade	Controls QTY	FIXTURE WATTAGE	UPGRADE QUANTITY	Control Factor	TOTAL KW	PROPOSED ANNUAL OPERATING HOURS	ENERGY USAGE (KWH)	ENERGY SAVINGS		
																								KWH	% REDUCTION	COST SAVINGS ($)
2	Lower Level	Hallway	CFQ-CFQ32/G24Q-1	6 in Can-Horizontal-Parabolic-Recessed-*			None	1	34.0 W	31	1.1 kW	3,000 Hrs	3162.0 kWh	Retrofit	RETRO-1X-6IN-DRS-CAN-12W-35K-86		0	12.0 W	31	0 %	0.372 kW	3,000 Hrs	1116.0 kWh	2046.0 kWh	65%	$450
3	1st Floor	Hallway	CFQ-CFQ32/G24Q-1	6 in Can-Horizontal-Parabolic-Recessed-*	8	Drop	None	1	34.0 W	24	0.8 kW	3,000 Hrs	2448.0 kWh	Retrofit	RETRO-1X-6IN-DRS-CAN-12W-35K-86		0	12.0 W	24	0 %	0.288 kW	3,000 Hrs	864.0 kWh	1584.0 kWh	65%	$348
4	1st Floor	Band Room	CFQ-CFQ32/G24Q-1	6 in Can-Horizontal-Parabolic-Recessed-*	8	Drop	None	1	34.0 W	2	0.1 kW	2,000 Hrs	136.0 kWh	Retrofit	RETRO-1X-6IN-DRS-CAN-12W-35K-86		0	12.0 W	2	0 %	0.024 kW	2,000 Hrs	48.0 kWh	88.0 kWh	65%	$19
5	1st Floor	Band Room	CFQ-CFQ32/G24Q-1	Decorative-Vertical-Parabolic-Suspended-*	18	Drop	None	1	34.0 W	4	0.1 kW	2,000 Hrs	272.0 kWh	Retrofit	BYP-1X-OMNI-G24Q/D-TYPE-B-7W-35K-45		0	7.0 W	4	0 %	0.028 kW	2,000 Hrs	56.0 kWh	216.0 kWh	79%	$48
6	1st Floor	Chorus Room	UFL-FU32T8U-2	Troffer-2X2-Parabolic-Recessed-LV DIM	8	Drop	Ceiling Occ Sensor	2	59.0 W	10	0.6 kW	2,000 Hrs	1180.0 kWh	Retrofit	RETRO-2X-2FT-BARKIT-LBE-12.5W-35K-1X-LVD-DR-45		0	25.0 W	10	0 %	0.250 kW	2,000 Hrs	500.0 kWh	680.0 kWh	58%	$150
7	1st Floor	Chorus Room	UFL-FU32T8U-2	Troffer-2X2-Parabolic-Recessed-LV DIM - EM	8	Drop	Ceiling Occ Sensor	2	59.0 W	4	0.2 kW	2,000 Hrs	472.0 kWh	Retrofit	RETRO-2X-2FT-BARKIT-LBE-12.5W-35K-1X-LVD-DR-EM-		0	25.0 W	4	0 %	0.100 kW	2,000 Hrs	200.0 kWh	272.0 kWh	58%	$60
8	1st Floor	Chorus Room	T8-F32T8-2	Troffer-2X4-Parabolic-Recessed-*	8	Drop	Ceiling Occ Sensor	2	59.0 W	12	0.7 kW	2,000 Hrs	1416.0 kWh	Retrofit	BYP-2X-4'T8-TYPE-B-12W-35K-1		0	24.0 W	12	0 %	0.288 kW	2,000 Hrs	576.0 kWh	840.0 kWh	59%	$185
9	1st Floor	Chorus Room	T8-F32T8-2	Troffer-2X4-Parabolic-Recessed-EM	8	Drop	Ceiling Occ Sensor	2	59.0 W	2	0.1 kW	2,000 Hrs	236.0 kWh	Retrofit	BYP-2X-4'T8-TYPE-B-12W-35K-EM-1		0	24.0 W	2	0 %	0.048 kW	2,000 Hrs	96.0 kWh	140.0 kWh	59%	$31
10	1st Floor	Chorus Room	INCAN-I90-1	Track-PAR30-Parabolic-*-*	8	Drop	Ceiling Occ Sensor	1	90.0 W	11	1.0 kW	2,000 Hrs	1980.0 kWh	Relamp	RL-1X-PAR30S-10W-40D-30K-DIM-1		0	10.0 W	11	0 %	0.110 kW	2,000 Hrs	220.0 kWh	1760.0 kWh	89%	$387
1	2nd Floor	Hallways	CFQ-CFQ32/G24Q-1	6 in Can-Horizontal-Parabolic-Recessed-*	8	Drop	None	1	34.0 W	4	0.1 kW	3,000 Hrs	408.0 kWh	Retrofit	RETRO-1X-6IN-DRS-CAN-12W-35K-86		0	12.0 W	4	0 %	0.048 kW	3,000 Hrs	144.0 kWh	264.0 kWh	65%	$58
11	2nd Floor	Library Book Cases	T5-F21T5-1	Strip-1X3-None-Surface-Book Case	6	Hard	None	1	25.0 W	48	1.2 kW	3,000 Hrs	3600.0 kWh	Retrofit	BYP-1X-3'T5HE-TYPE-B-12W-35K-34		0	12.0 W	48	0 %	0.576 kW	3,000 Hrs	1728.0 kWh	1872.0 kWh	52%	$412
12	2nd Floor	Library Desk Lighting	CFQ-CFQ9/G23-1	Undercabinet-Horizontal-None-Surface-*	6	Hard	None	1	10.7 W	53	0.6 kW	3,000 Hrs	1701.3 kWh	Retrofit	BYP-1X-H-G23-TYPE-B-3.5W-35K-34		0	3.5 W	53	0 %	0.186 kW	3,000 Hrs	556.5 kWh	1144.8 kWh	67%	$252
13	2nd Floor	Library Open Area	CFQ-CFQ32/G24Q-1	Decorative-Vertical-Parabolic-Suspended-*	20	Hard	None	1	34.0 W	42	1.4 kW	3,000 Hrs	4284.0 kWh	Retrofit	BYP-1X-OMNI-G24Q/D-TYPE-B-7W-35K-45		0	7.0 W	42	0 %	0.294 kW	3,000 Hrs	882.0 kWh	3402.0 kWh	79%	$748
14	2nd Floor	Library Open Area	INCAN-I60-1	Decorative-Medium-Parabolic-Suspended-*				1	60.0 W	8	0.5 kW	3,000 Hrs	1440.0 kWh	Relamp	RL-1X-A19-8.8W-30K-DIM-1		0	8.8 W	8	0 %	0.070 kW	3,000 Hrs	211.2 kWh	1228.8 kWh	85%	$270
15	2nd Floor	Library Open Area	MH-MH100-1	Decorative-Medium-Parabolic-Suspended-*				1	128.0 W	3	0.4 kW	3,000 Hrs	1152.0 kWh	Retrofit	BYP-1X-A21-E26-17W-35K-34		0	17.0 W	3	0 %	0.051 kW	3,000 Hrs	153.0 kWh	999.0 kWh	87%	$220
16	Exterior	Center Courtyard	HPS-HPS200-1	Barn Light-Mogul-None-Wall-*	20	Hard		1	250.0 W	1	0.3 kW	4,380 Hrs	1095.0 kWh	Replace	NEW-1X-YARDBLASTER-FA-60W-40K-PC-3		0	60.0 W	1	0 %	0.060 kW	4,380 Hrs	262.8 kWh	832.2 kWh	76%	$183
17	Exterior	Back of Building	HPS-HPS200-1	Barn Light-Mogul-None-Wall-*				1	250.0 W	1	0.3 kW	4,380 Hrs	1095.0 kWh	Replace	NEW-1X-YARDBLASTER-FA-60W-40K-PC-3		0	60.0 W	1	0 %	0.060 kW	4,380 Hrs	262.8 kWh	832.2 kWh	76%	$183
18	Exterior	Near West 6 Entrance	HPS-HPS250-1	Wallpack-Mogul-Prismatic-Wall-*				1	295.0 W	1	0.3 kW	4,380 Hrs	1292.1 kWh	Replace	NEW-1X-WP-100W-40K-PC-86		0	100.0 W	1	0 %	0.100 kW	4,380 Hrs	438.0 kWh	854.1 kWh	66%	$188
										261	**9.7 kW**		**27369.4 kWh**						**261**		**3.0 kW**		**8314.3 kWh**	**19055.1 kWh**	**70%**	**$4,192**

RENU ENERGY SOLUTIONS

Cost of Power $0.22

														SOLUTIONS										SAVINGS		
																								ENERGY SAVINGS		
ID#	LOCATION	ROOM NAME	LAMP SYSTEM TYPE	FIXTURE TYPE	FIXTURE HEIGHT	CEILING TYPE	EXISTING CONTROLS TYPE	LAMPS PER FIXTURE	FIXTURE WATTAGE	EXISTING QUANTITY	TOTAL KW	ANNUAL OPERATING HOURS	ENERGY USAGE (KWH)	LED UPGRADE TYPE	LED UPGRADE DESCRIPTION	Controls Upgrade	Controls QTY	FIXTURE WATTAGE	UPGRADE QUANTITY	Control Factor	TOTAL KW	PROPOSED ANNUAL OPERATING HOURS	ENERGY USAGE (KWH)	KWH	% REDUCTION	COST SAVINGS ($)
1	Salem ES	Music Room	LED-L13-2	Box-2X4-Parabolic-Surface-*	8	Drop	None	2	26.0 W	10	0.3 kW	2,000 Hrs	520.0 kWh	ControlOnly		CW-2-WH (1),LRF2-OCR2B-P-WH (2),MRF2S-8S-DV-WH (2)	5	26.0 W	10	24 %	0.260 kW	1,520 Hrs	395.2 kWh	124.8 kWh	24%	$27
2	Salem ES	Library	MH-MH150-1	Lowbay-Medium-Clear-Pendant-Restrike	8	Hard	None	1	190.0 W	8	1.5 kW	3,000 Hrs	4560.0 kWh	Retrofit	BYP-1X-A21-E26-17W-35K-34		0	17.0 W	8	0 %	0.136 kW	3,000 Hrs	408.0 kWh	4152.0 kWh	91%	$913
3	Salem ES	Library	CFQ-CFQ9/G23-1	Task-*-*-*-*				1	10.7 W	11	0.1 kW	3,000 Hrs	353.1 kWh	Retrofit	BYP-1X-H-G23-TYPE-B-3.5W-35K-34		0	3.5 W	11	0 %	0.039 kW	3,000 Hrs	115.5 kWh	237.6 kWh	67%	$52
4	Salem ES	Library	CFQ-CFQ32/G24Q-1	6 in Can-Horizontal-Prismatic-Recessed-EM				1	34.0 W	4	0.1 kW	3,000 Hrs	408.0 kWh	Retrofit	RETRO-1X-6IN-DRS-CAN-12W-35K-EM-86		0	12.0 W	4	0 %	0.048 kW	3,000 Hrs	144.0 kWh	264.0 kWh	65%	$58
5	Salem ES	Library	CFQ-CFQ32/G24Q-1	6 in Can-Horizontal-Prismatic-Recessed-x				1	34.0 W	6	0.2 kW	3,000 Hrs	612.0 kWh	Retrofit	RETRO-1X-6IN-DRS-CAN-12W-35K-86		0	12.0 W	6	0 %	0.072 kW	3,000 Hrs	216.0 kWh	396.0 kWh	65%	$87
6	Salem ES	Hallway 219 to 201 2nd Fl	CFQ-CFQ32/G24Q-1	6 in Can-Horizontal-Prismatic-Recessed-x	8	Drop	None	1	34.0 W	39	1.3 kW	3,000 Hrs	3978.0 kWh	Retrofit	RETRO-1X-6IN-DRS-CAN-12W-35K-86		0	12.0 W	39	0 %	0.468 kW	3,000 Hrs	1404.0 kWh	2574.0 kWh	65%	$566
7	Salem ES	1st Floor Hall	CFQ-CFQ32/G24Q-1	6 in Can-Horizontal-Prismatic-Recessed-x	8	Drop	None	1	34.0 W	27	0.9 kW	3,000 Hrs	2754.0 kWh	Retrofit	RETRO-1X-6IN-DRS-CAN-12W-35K-86		0	12.0 W	27	0 %	0.324 kW	3,000 Hrs	972.0 kWh	1782.0 kWh	65%	$392
8	Salem ES	Classroom 105	MH-MH150-1	Lowbay-Medium-Clear-Pendant-Restrike	8	Hard	None	1	190.0 W	4	0.8 kW	2,000 Hrs	1520.0 kWh	Retrofit	BYP-1X-A21-E26-17W-35K-34		0	17.0 W	4	0 %	0.068 kW	2,000 Hrs	136.0 kWh	1384.0 kWh	91%	$304
9	Salem ES	Kitchen	T8-F32T8-3	Troffer-2X4-Prismatic-Recessed-*	8	Drop	None	3	88.0 W	2	0.2 kW	3,000 Hrs	528.0 kWh	Retrofit	BYP-3X-4'T8-TYPE-B-12W-35K-1		0	36.0 W	2	0 %	0.072 kW	3,000 Hrs	216.0 kWh	312.0 kWh	59%	$69
										111	**5.4 kW**		**15233.1 kWh**						**111**		**1.5 kW**		**4006.7 kWh**	**11226.4 kWh**	**74%**	**$2,470**

RENU ENERGY SOLUTIONS

Cost of Power $0.22

														SOLUTIONS										SAVINGS		
																								ENERGY SAVINGS		
ID#	LOCATION	ROOM NAME	LAMP SYSTEM TYPE	FIXTURE TYPE	FIXTURE HEIGHT	CEILING TYPE	EXISTING CONTROLS TYPE	LAMPS PER FIXTURE	FIXTURE WATTAGE	EXISTING QUANTITY	TOTAL KW	ANNUAL OPERATING HOURS	ENERGY USAGE (KWH)	LED UPGRADE TYPE	LED UPGRADE DESCRIPTION	Controls Upgrade	Controls QTY	FIXTURE WATTAGE	UPGRADE QUANTITY	Control Factor	TOTAL KW	PROPOSED ANNUAL OPERATING HOURS	ENERGY USAGE (KWH)	KWH	% REDUCTION	COST SAVINGS ($)
1	1st Floor	Gym	T8-F32T8-6	Highbay-2X4-Cage-Surface-*				6	192.0 W	12	2.3 kW	3,000 Hrs	6912.0 kWh	Retrofit	NEW-1X-HIGHBAY-86W-40K-OCC-WG-86	Control Factor - Fixture Integrated Sensor (1)	1	86.0 W	12	24 %	1.032 kW	2,280 Hrs	2353.0 kWh	4559.0 kWh	66%	$1,003
2	1st Floor	Hallway 1st	LED-L13-2	Troffer-2X4-Prismatic-Recessed-*				2	26.0 W	38	1.0 kW	3,000 Hrs	2964.0 kWh	Do Nothing	Do Nothing		0	26.0 W	38	0 %	0.988 kW	3,000 Hrs	2964.0 kWh	0.0 kWh	0%	$0
3	1st Floor	Hallway 1st	LED-L25-1	Troffer-2X2-Frosted-Recessed-HC				1	25.0 W	12	0.3 kW	3,000 Hrs	900.0 kWh	Do Nothing	Do Nothing		0	25.0 W	12	0 %	0.300 kW	3,000 Hrs	900.0 kWh	0.0 kWh	0%	$0
4	1st Floor	Hallway 1st	LED-L13-2	Troffer-1X4-Parabolic-Recessed-*				2	26.0 W	12	0.3 kW	3,000 Hrs	936.0 kWh	Do Nothing	Do Nothing		0	26.0 W	12	0 %	0.312 kW	3,000 Hrs	936.0 kWh	0.0 kWh	0%	$0
5	1st Floor	Hallway 2nd	LED-L13-3	Troffer-2X4-Prismatic-Recessed-*				3	39.0 W	18	0.7 kW	3,000 Hrs	2106.0 kWh	Do Nothing	Do Nothing		0	39.0 W	18	0 %	0.702 kW	3,000 Hrs	2106.0 kWh	0.0 kWh	0%	$0
6	1st Floor	Stairwell	LED-L9-1	7in Can-Medium-None-Recessed-*				1	10.0 W	7	0.1 kW	3,000 Hrs	210.0 kWh	Do Nothing	Do Nothing		0	10.0 W	7	0 %	0.070 kW	3,000 Hrs	210.0 kWh	0.0 kWh	0%	$0
7	1st Floor	Portable Classroom Office	T8-F96T8-2	Wrap-1X8-Prismatic-Surface-*	8	Hard		2	192.0 W	6	1.2 kW	3,000 Hrs	3456.0 kWh	Retrofit	NEW-2X-4'-GUS-WRAP-36W-35K-1X-JOINER-1	CW-1-WH (2),LRF2-OCR2B-P-WH (4),MRF2S-8S-DV-WH (2)	8	72.0 W	6	24 %	0.432 kW	2,280 Hrs	985.0 kWh	2471.0 kWh	72%	$544
8	1st Floor	Portable Classroom Office	T8-F32T8-2	Wrap-1X4-Prismatic-Surface-*				2	59.0 W	2	0.1 kW	3,000 Hrs	354.0 kWh	Retrofit	NEW-1X-4'-GUS-WRAP-36W-35K-1	Control Factor - Occ/Vac (1)	1	36.0 W	2	24 %	0.072 kW	2,280 Hrs	164.2 kWh	189.8 kWh	54%	$42
9	1st Floor	Portable Bathroom	INCAN-I60-1	Jelly Jar-Medium-Prismatic-Wall-*				1	60.0 W	1	0.1 kW	3,000 Hrs	180.0 kWh	Retrofit	RL-1X-A19-8.8W-30K-DIM-1	CW-1-WH (1),MS-OPS6M2-DV-WH (1)	2	8.8 W	1	24 %	0.009 kW	2,280 Hrs	20.1 kWh	159.9 kWh	89%	$35
10	1st Floor	Portable Classroom Office 2	T8-F96T8-2	Wrap-1X8-Prismatic-Surface-*	8	Hard		2	192.0 W	6	1.2 kW	3,000 Hrs	3456.0 kWh	Retrofit	NEW-2X-4'-GUS-WRAP-36W-35K-1X-JOINER-1	CW-1-WH (2),LRF2-OCR2B-P-WH (4),MRF2S-8S-DV-WH (2)	8	72.0 W	6	24 %	0.432 kW	2,280 Hrs	985.0 kWh	2471.0 kWh	72%	$544
11	1st Floor	Portable Classroom Office 2	T8-F32T8-2	Wrap-1X4-Prismatic-Surface-*				2	59.0 W	3	0.2 kW	3,000 Hrs	531.0 kWh	Retrofit	NEW-1X-4'-GUS-WRAP-36W-35K-1	Control Factor - Occ/Vac (1)	1	36.0 W	3	24 %	0.108 kW	2,280 Hrs	246.2 kWh	284.8 kWh	54%	$63
12	1st Floor	Portable Bathroom 2	INCAN-I60-1	Jelly Jar-Medium-Prismatic-Wall-*				1	60.0 W	1	0.1 kW	3,000 Hrs	180.0 kWh	Retrofit	RL-1X-A19-8.8W-30K-DIM-1	CW-1-WH (1),MS-OPS6M2-DV-WH (1)	2	8.8 W	1	24 %	0.009 kW	2,280 Hrs	20.1 kWh	159.9 kWh	89%	$35
										118	**7.4 kW**		**22185.0 kWh**						**118**		**4.5 kW**		**11889.4 kWh**	**10295.6 kWh**	**46%**	**$2,265**

RENU ENERGY SOLUTIONS

Cost of Power $0.22

														SOLUTIONS										SAVINGS		
																								ENERGY SAVINGS		
ID#	LOCATION	ROOM NAME	LAMP SYSTEM TYPE	FIXTURE TYPE	FIXTURE HEIGHT	CEILING TYPE	EXISTING CONTROLS TYPE	LAMPS PER FIXTURE	FIXTURE WATTAGE	EXISTING QUANTITY	TOTAL KW	ANNUAL OPERATING HOURS	ENERGY USAGE (KWH)	LED UPGRADE TYPE	LED UPGRADE DESCRIPTION	Controls Upgrade	Controls QTY	FIXTURE WATTAGE	UPGRADE QUANTITY	Control Factor	TOTAL KW	PROPOSED ANNUAL OPERATING HOURS	ENERGY USAGE (KWH)	KWH	% REDUCTION	COST SAVINGS ($)
1	1st Floor	Hallway	CFQ-CFQ32/G24Q-1	6 in Can-Horizontal-Parabolic-Recessed-*	8	Drop		1	34.0 W	12	0.4 kW	3,000 Hrs	1224.0 kWh	Retrofit	RETRO-1X-6IN-DRS-CAN-9W-35K-86		0	9.0 W	12	0 %	0.108 kW	3,000 Hrs	324.0 kWh	900.0 kWh	74%	$198
2	1st Floor	Library	CFQ-CFQ32/G24Q-1	6 in Can-Horizontal-Parabolic-Recessed-*	8	Drop	None	1	34.0 W	15	0.5 kW	3,000 Hrs	1530.0 kWh	Retrofit	RETRO-1X-6IN-DRS-CAN-9W-35K-86		0	9.0 W	15	0 %	0.135 kW	3,000 Hrs	405.0 kWh	1125.0 kWh	74%	$248
3	1st Floor	Library	CFQ-CFQ32/G24Q-1	Decorative-Vertical-Parabolic-Suspended-*				1	34.0 W	30	1.0 kW	3,000 Hrs	3060.0 kWh	Retrofit	BYP-1X-OMNI-G24Q/D-TYPE-B-7W-35K-45		0	7.0 W	30	0 %	0.210 kW	3,000 Hrs	630.0 kWh	2430.0 kWh	79%	$535
4	2nd Floor	Hallway	CFQ-CFQ32/G24Q-1	6 in Can-Horizontal-Parabolic-Recessed-*	8	Drop	None	1	34.0 W	47	1.6 kW	3,000 Hrs	4794.0 kWh	Retrofit	RETRO-1X-6IN-DRS-CAN-9W-35K-86		0	9.0 W	47	0 %	0.423 kW	3,000 Hrs	1269.0 kWh	3525.0 kWh	74%	$776
										104	**3.5 kW**		**10608.0 kWh**						**104**		**0.9 kW**		**2628.0 kWh**	**7980.0 kWh**	**75%**	**$1,756**

7.2 Cut Sheets

Project Name:	Type:
Part Number:	Date:

GREENCREATIVE

T5 BYP (UL Type B - Single Ended Bypass)

FEATURES

- Replace 2', 3', and 4' T5 fluorescent lamps
- Integral LED driver - Directly operate on 120-277V line voltage
- BYP - Single ended installation in bypass mode working with only non-shunted lamp holders
- Frosted glass tube optimizes light distribution
- Exceptional efficacy up to 138 LPW
- Options of 3000K, 3500K, 4000K, and 5000K
- L70 rated lifetime up to 60,000 hours
- 5 year limited warranty* / Optional 10 year available (see EXTENDED WARRANTIES table for information)
- Suitable for use in totally enclosed fixtures and damp locations
- Fixture operating temperature: -4°F to 95°F (-20°C to 35°C)
- Lamp ambient temperature: -4°F to 113°F (-20°C to 45°C)
- NSF (National Sanitation Foundation)certified for Food Zone (Non-Contact),Splash, and Non-Food Zones



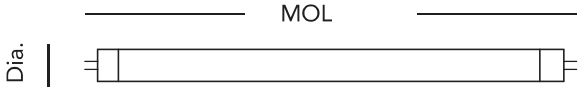
011024

SPECIFICATIONS

Product	Model	Nominal Length	Equiv.	Input Voltage	Life (hrs)	Wattage	Lumens	CCT	Efficacy (LPW)	CRI	Power Factor	THD	Beam Angle	DLC / NSF
36946	9.5T5HE/2F/835/BYP/R	2'	14W	120-277V	60,000	9.5	1,150	3500K	121	82	0.9	<20%	160°	N.A. / √
36947	9.5T5HE/2F/840/BYP/R	2'	14W	120-277V	60,000	9.5	1,200	4000K	126	82	0.9	<20%	160°	N.A. / √
37110	11.5T5HO/2F/830/BYP/R	2'	24W	120-277V	60,000	11.5	1,350	3000K	117	82	0.9	<20%	160°	N.A. / √
36948	11.5T5HO/2F/835/BYP/R	2'	24W	120-277V	60,000	11.5	1,400	3500K	122	82	0.9	<20%	160°	N.A. / √
36949	11.5T5HO/2F/840/BYP/R	2'	24W	120-277V	60,000	11.5	1,500	4000K	130	82	0.9	<20%	160°	N.A. / √
37112	12T5HE/3F/830/BYP/R	3'	21W	120-277V	60,000	12	1,350	3000K	113	82	0.9	<20%	160°	N.A. / √
36950	12T5HE/3F/835/BYP/R	3'	21W	120-277V	60,000	12	1,450	3500K	121	82	0.9	<20%	160°	N.A. / √
36951	12T5HE/3F/840/BYP/R	3'	21W	120-277V	60,000	12	1,500	4000K	125	82	0.9	<20%	160°	N.A. / √
36952	14.5T5HO/3F/835/BYP/R	3'	39W	120-277V	60,000	14.5	1,850	3500K	128	82	0.9	<20%	160°	N.A. / √
36953	14.5T5HO/3F/840/BYP/R	3'	39W	120-277V	60,000	14.5	1,900	4000K	131	82	0.9	<20%	160°	N.A. / √
36954	14.5T5HE/4F/830/BYP/R	4'	28W	120-277V	60,000	14.5	1,800	3000K	124	82	0.9	<20%	160°	√ / √
36955	14.5T5HE/4F/835/BYP/R	4'	28W	120-277V	60,000	14.5	1,800	3500K	124	82	0.9	<20%	160°	√ / √
36956	14.5T5HE/4F/840/BYP/R	4'	28W	120-277V	60,000	14.5	2,000	4000K	138	82	0.9	<20%	160°	√ / √

* Please visit www.greencreative.com for Limited Warranty terms.

DIMENSION & WEIGHT



Model	Base	MCL	Dia.	Weight
9.5T5HE/2F/xxx/BYP/R	G5	22"	7/8"	0.19lb
1.5T5HO/2F/xxx/BYP/R	G5	22"	7/8"	0.19lb
12T5HE/3F/xxx/BYP/R	G5	34"	7/8"	0.28lb
14.5T5HO/3F/xxx/BYP/R	G5	34"	7/8"	0.28lb
14.5T5HE/4F/xxx/BYP/R	G5	45-3/4"	7/8"	0.41lb

Where xxx means 824-965 which indicates CRI and color temperature

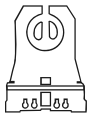
GREENCREATIVE

T5 BYP (UL Type B - Single Ended Bypass)

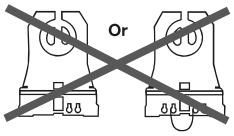
INSTALLATION

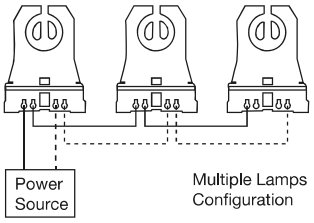
Suitable for use with Non-Shunted lamp holders only.

Programmed Start or Rapid Start (Non-Shunted Lamp Holders)

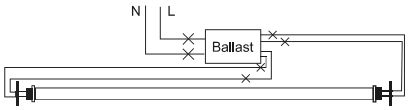


Instant Start (Shunted Lamp Holders)





Step 1. Cut all wires connected to the existing ballast, and remove the ballast.

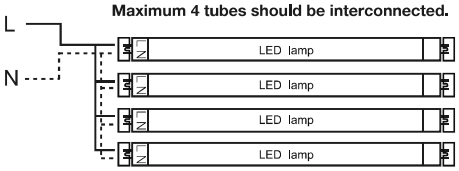


Step 2. Connect power to one end (the end with L and N markings) according to the diagram. Wiring should be made using Non-Shunted lamp holders only.

Single Lamp



Multiple Lamps
Maximum 4 tubes should be interconnected.



EXTENDED WARRANTIES***

Model	Description****
9.5T5HE/2F/BYP/10YEARWARRANTY	10 Year warranty for 9.5T5HE/2F/8xx/BYP/yy
11.5T5HO/2F/BYP/10YEARWARRANTY	10 Year warranty for 11.5T5HO/2F/8xx/BYP/yy
12T5HE/3F/10YEARWARRANTY	10 Year warranty for 12T5HE/3F/8xx/BYP/yy
14.5T5HE/4F/10YEARWARRANTY	10 Year warranty for 14.5T5HE/4F/8xx/BYP/yy
14.5T5HO/3F/10YEARWARRANTY	10 Year warranty for 14.5T5HO/3F/8xx/BYP/yy

*** Warranty based on a maximum of 4,368 annual operating hours (per year for ten years) and exposure to a maximum fixture operating temperature of 80°F / 27°C.
**** xx – Refers to the CCT yy – Refers to model generations within the same nominal performance. Typically blank, 'R', or 'RC'

CERTIFICATION INFORMATION

Product	Model	DLC ID#
36954	14.5T5HE/4F/830/BYP/R	S-X094HR
36955	14.5T5HE/4F/835/BYP/R	S-2EXO8F
36956	14.5T5HE/4F/840/BYP/R	S-OC3HSK

ORDERING INFORMATION

Model	Master Carton			Shipping Carton		
	Case Qty	Case Dimensions (LxWxH)	Case Weight	Case Qty	Case Dimensions (LxWxH)	Case Weight
9.5T5HE/2F/xxx/BYP/R	6PCS	23" x 2-3/4" x 1-15/16"	1.3lb	24PCS	25-3/16" x 6-5/16"x 4-3/4"	6lb
11.5T5HO/2F/xxx/BYP/R	6PCS	22-15/16" x 2-13/16" x 1-15/16"	1.4lb	24PCS	25-1/16" x 6-9/16" x 4-7/8"	6.2lb
12T5HE/3F/xxx/BYP/R	6PCS	34-13/16" x 2-3/4" x 1-15/16"	2lb	24PCS	37-3/16" x 6-5/16"x 4-3/4"	9lb
14.5T5HO/3F/xxx/BYP/R	6PCS	34-13/16" x 2-3/4" x 1-15/16"	2lb	24PCS	37-3/16" x 6-5/16"x 4-3/4"	9lb
14.5T5HE/4F/xxx/BYP/R	6PCS	46-5/8" x 2-3/4" x 1-15/16"	3.2lb	24PCS	48-13/16" x 6-5/16"x 4-3/4"	13.8lb

Where xxx means 824-965 which indicates CRI and color temperature

Note: All rights reserved. All sizes and specifications are subject to change at any time without notice.

Project Name:	Type:
Part Number:	Date:

GREENCREATIVE

COMPACT HID REPLACEMENT BULB

012624

FEATURES

- Integral driver suitable for 120-277V
- Integral thermal sensor reduces power to the lamp in the event ambient temperature exceeds specified limitations
- E26 versions are smooth dimming with existing installations*
- EX39 versions are step-dimming using SelectDrive technology
- A21 replaces up to 125W Inc.
- A23 replaces up to 200W Inc.
- PS30 replaces up to 100-175W HID, E26 version replaces up to 300W Inc.
- Suitable for damp locations and totally enclosed fixtures**
- Lamp ambient temperature: -4°F to 140°F (-20°C to 60°C)
- Fixture operating temperature: -4°F to 113°F (-20°C to 45°C)
- Rated lifetime (L70): 50,000hrs
- 5 year limited warranty***
- Supplied with safety cable to provide secondary support for A23 and PS30
- 4kV integral surge protector
- For installation in Post Top, Area light, or other fixtures exposed to high surge conditions, the use of our 10KV surge protector 97718-10SURGE/277V is recommended.



FOCUS FEATURE

EX39 version has integrated side switch for step-dimming



3 Level power output

Power select switch allows power to be tailored to application requirements and can be adjusted from high to low.

SelectDrive

	CCT	Wattage	Lumen	LPW
34HID/8xx/277V/EX39/SD	3000K	40%-13.6W	1,800	132
		60%-20.4W	2,700	132
		100%-34W	4,500	132
	4000K	40%-13.6W	2,000	147
		60%-20.4W	3,000	147
		100%-34W	5,000	147
	5000K	40%-13.6W	2,000	147
		60%-20.4W	3,000	147
		100%-34W	5,000	147

	CCT	Wattage	Lumen	LPW
24HID/8xx/277V/EX39/SD	3000K	40%-9W	1,250	139
		60%-14W	1,850	132
		100%-24W	3,100	129
	3500K	40%-9W	1,250	139
		60%-14W	1,850	132
		100%-24W	3,100	129
	4000K	40%-9W	1,300	144
		60%-14W	1,900	136
		100%-24W	3,200	133
	5000K	40%-9W	1,300	144
		60%-14W	1,900	136
		100%-24W	3,200	133

Where xxx means 824-965 which indicates CRI and color temperature

GREENCREATIVE

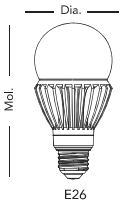
COMPACT HID REPLACEMENT BULB

SPECIFICATIONS

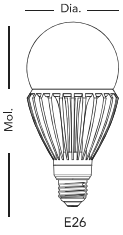
Product	Model	Equiv.	Input Voltage	Wattage	Lumens	CCT	CRI	Efficacy (LPW)	Beam Angle	Dim.*	Power Factor	THD	Fixture Rating	DLC / ES
36165	17A21/830/277V/DIM	125W Inc.	120-277V	17	2,000	3000K	82	118	230°	Yes	0.9	<20%	Enclosed	N.A. / √
36166	17A21/835/277V/DIM	125W Inc.	120-277V	17	2,000	3500K	82	118	230°	Yes	0.9	<20%	Enclosed	N.A. / √
36167	17A21/840/277V/DIM	125W Inc.	120-277V	17	2,100	4000K	82	124	230°	Yes	0.9	<20%	Enclosed	N.A. / √
36168	17A21/850/277V/DIM	125W Inc.	120-277V	17	2,100	5000K	82	124	230°	Yes	0.9	<20%	Enclosed	N.A. / √
36169	24HID/830/277V/E26/DIM	200W Inc.	120-277V	24	3,100	3000K	82	129	230°	Yes	0.9	<20%	Enclosed	N.A. / √
36170	24HID/840/277V/E26/DIM	200W Inc.	120-277V	24	3,200	4000K	82	133	230°	Yes	0.9	<20%	Enclosed	N.A. / √
36171	24HID/850/277V/E26/DIM	200W Inc.	120-277V	24	3,200	5000K	82	133	230°	Yes	0.9	<20%	Enclosed	N.A. / √
36160	24HID/840/277V/EX39/SD	70-100W HID	120-277V	24	3,200	4000K	82	144	230°	No	0.9	<20%	Enclosed	√ / N.A.
36161	24HID/850/277V/EX39/SD	70-100W HID	120-277V	24	3,200	5000K	82	144	230°	No	0.9	<20%	Enclosed	√ / N.A.
36173	34HID/840/277V/E26/DIM	300W Inc.	120-277V	34	5,000	4000K	82	147	230°	Yes	0.9	<20%	Enclosed	N.A. / √
36163	34HID/840/277V/EX39/SD	100-175W HID	120-277V	34	5,000	4000K	82	147	230°	No	0.9	<20%	Enclosed	√ / N.A.

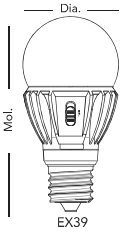
*This lamp is available for dimming with 120V line voltage only and might not be compatible with all dimmers. Please visit www.greencreative.com for compatibility information.
***Please visit www.greencreative.com for Limited Warranty terms.

DIMENSION & WEIGHT

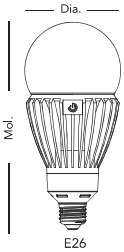


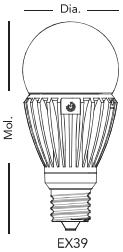
Model	Base	Mol.	Dia.	Weight
17A21/xxx/277V/DIM	E26	5-1/4"	2-5/8"	0.46 lb





Model	Base	Mol.	Dia.	Weight
24HID/xxx/277V/E26/DIM	E26	6-5/8"	3-5/16"	0.82 lb
24HID/xxx/277V/EX39/SD	EX39	6-11/16"	3-5/16"	0.87 lb





Model	Base	Mol.	Dia.	Weight
34HID/xxx/277V/E26/DIM	E26	8-1/8"	3-3/4"	1.42 lb
34HID/xxx/277V/EX39/SD	EX39	8-1/8"	3-3/4"	1.49 lb

Where xxx means 824-965 which indicates CRI and color temperature

GREENCREATIVE

COMPACT HID REPLACEMENT BULB

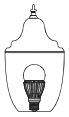
ORDERING INFORMATION

Model Number	Master Carton			Shipping Carton		
	Case Qty	Case Dimensions (LxWxH)	Case Weight	Case Qty	Case Dimensions (LxWxH)	Case Weight
17A21/xxx/277V/DIM	6PCS	8-15/16"x 6-1/4" x 6-1/2"	3.5 lb	24PCS	12-7/8" x 9-5/16" x 13-3/4"	15 lb
24HID/xxx/277V/E26/DIM	6PCS	11-1/4" x 7-9/16" x 7-13/16"	6.4 lb	24PCS	15-1/2" x 11-9/16" x 8-7/16"	13.4 lb
24HID/xxx/277V/EX39/SD	6PCS	11-1/8" x 7-1/2" x 7-7/8"	7.5lb	24PCS	15-1/2" x 11-3/4" x 8-7/16"	15.2lb
34HID/xxx/277V/E26/DIM	N.A.	N.A.	N.A.	12PCS	16-9/16"x 12-3/8"x 9-9/16"	21.2 lb
34HID/xxx/277V/EX39/SD	N.A.	N.A.	N.A.	12PCS	16-9/16" x 12-3/8"x 9-9/16"	22.1 lb

Where xxx means 824-965 which indicates CRI and color temperature

**MINIMUM COMPARTMENT DIMENSIONS (FOR ENCLOSED FIXTURES)

Low bay installation 	Model Number		24HID/xxx/277V/EX39/SD	34HID/xxx/277V/EX39/SD
	Lamp Compartment Dimensions	Diameter	6"	8''
		Height	8-1/2"	11''
	Maximum Lamps in Luminaire		1	1

Post top installation 	Model Number		24HID/xxx/277V/EX39/SD	34HID/xxx/277V/EX39/SD
	Lamp Compartment Dimensions	Diameter	3-9/16"	8"
		Height	7-7/8"	11"
	Maximum Lamps in Luminaire		1	1

	Model Number		17A21/xxx/277V/DIM	24HID/xxx/277V/E26/DIM	34HID/xxx/277V/E26/DIM
Low bay installation 	Lamp Compartment Dimensions	Diameter	6"	6"	8''
		Height	8-1/2"	8-1/2"	11''
Post top installation 		Diameter	3-9/16"	3-9/16"	8''
		Height	7-7/8"	7-7/8"	11''
Maximum Lamps in Luminaire			1	1	1

**Installing lamp in a fixture that does not have the minimum compartment dimensions will void the warranty and could cause product failures.

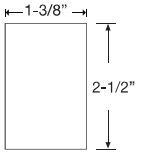
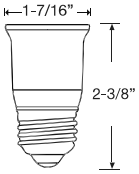
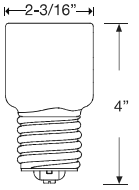
SUPPLIED ACCESSORY

Description	Picture	Dimensions
Safety Cable		22-13/16"

GREENCREATIVE

COMPACT HID REPLACEMENT BULB

OPTIONAL ACCESSORY ORDERING INFORMATION

Product	Model	Description	Picture	Dimensions
97718	10SURGE/277V	10 kV Surge Protector (For use in outdoor and other applications subject to high surge conditions)		
16325	E26 EXTENDER	E26 Lamp Extender Adds 1-5/16" to Lamp Height		
35050	E39 EXTENDER	EX39 Lamp Extender Adds 1-11/16" to Lamp Height		

CERTIFICATION INFORMATION

Product	Model	DLC ID#	ES ID#
36160	24HID/840/277V/EX39/SD	PRDUFT1V	N.A.
36161	24HID/850/277V/EX39/SD	PLEQ5F7K	N.A.
36162	34HID/830/277V/EX39/SD	PSE1QG12	N.A.
36163	34HID/840/277V/EX39/SD	P7TYZ0PO	N.A.
36165	17A21/830/277V/DIM	N.A.	2390212
36166	17A21/835/277V/DIM	N.A.	2390213
36167	17A21/840/277V/DIM	N.A.	2390214
36168	17A21/850/277V/DIM	N.A.	2390215
36169	24HID/830/277V/E26/DIM	N.A.	2390216
36170	24HID/840/277V/E26/DIM	N.A.	2390218
36171	24HID/850/277V/E26/DIM	N.A.	2390219
36173	34HID/840/277V/E26/DIM	N.A.	2390221

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Project Name:	Type:
Part Number:	Date:

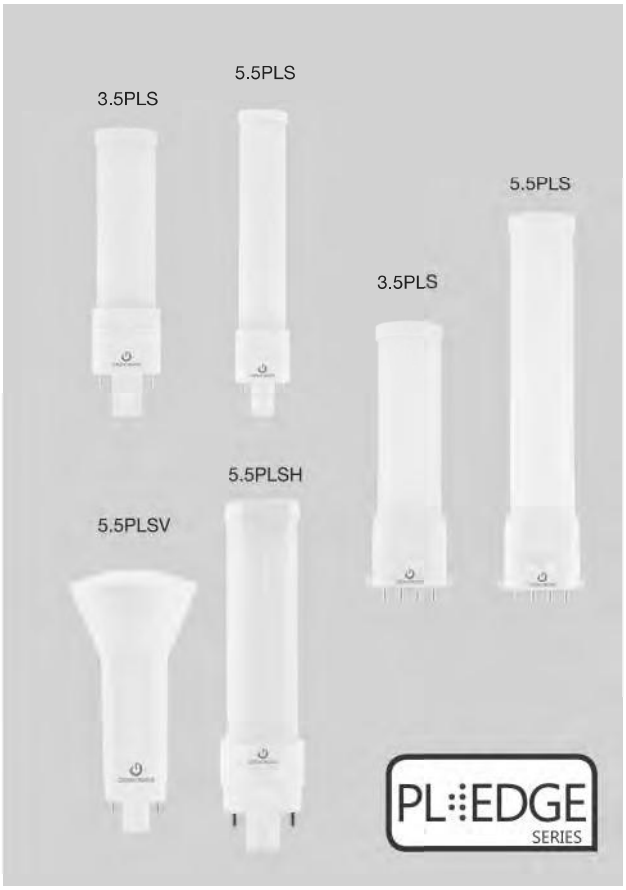
GREENCREATIVE

BYPASS AND HYBRID BYPASS PLS

092223

FEATURES

- Built-in universal driver – Bypass installation operates directly on 120 – 277V line voltage
- Hybrid Bypass versions can also operate directly on most magnetic ballasts*
- Bypass versions replace 7W-13W CFL lamps with 2G7 & 2GX7 bases
- Hybrid Bypass versions replace 7W-13W CFL lamps with G23 & GX23 (2-pin) bases
- Exceptional efficacy up to 113 LPW
- Suitable for damp locations
- Lamp ambient temperature: -4°F to 113°F (-20°C to 45°C)
- Fixture operating temperature: -4°F to 95°F (-20°C to 35°C)
- Rated lifetime (L70): 50,000hrs
- 5 year limited warranty**/ 10 year available
  (see EXTENDED WARRANTIES table for information)



SPECIFICATIONS

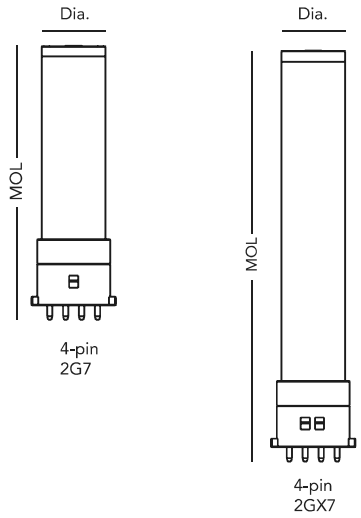
Product	Model	Equiv.	Input Voltage	Wattage	Lumens	CCT	CRI	Efficacy (LPW)	Power Factor	THD	Beam Angle	Base Rotatable Angle	Installation Orientation	Fixture Rating
36631	3.5PLS/835/BYP/2G7/R	7-9W	120-277V	3.5	350	3500K	82	100	0.9	<20%	120°	180°	Horizontal	Enclosed
36637	5.5PLS/835/BYP/2GX7/R	13W	120-277V	3.5	600	3500K	82	109	0.9	<20%	110°	180°	Horizontal	Enclosed
36627	3.5PLS/827/HYB/G23/R	7-9W	120-277V	3.5	325	2700K	82	93	0.9	<20%	120°	170°	Horizontal	Enclosed
36628	3.5PLS/830/HYB/G23/R	7-9W	120-277V	3.5	340	3000K	82	97	0.9	<20%	120°	170°	Horizontal	Enclosed
36629	3.5PLS/835/HYB/G23/R	7-9W	120-277V	3.5	350	3500K	82	100	0.9	<20%	120°	170°	Horizontal	Enclosed
36630	3.5PLS/840/HYB/G23/R	7-9W	120-277V	3.5	370	4000K	82	106	0.9	<20%	120°	170°	Horizontal	Enclosed
36632	5.5PLS/827/HYB/GX23/R	13W	120-277V	5.5	520	2700K	82	95	0.9	<20%	110°	170°	Horizontal	Enclosed
36633	5.5PLS/830/HYB/GX23/R	13W	120-277V	5.5	550	3000K	82	100	0.9	<20%	110°	170°	Horizontal	Enclosed
36634	5.5PLS/835/HYB/GX23/R	13W	120-277V	5.5	600	3500K	82	109	0.9	<20%	110°	170°	Horizontal	Enclosed
36635	5.5PLS/840/HYB/GX23/R	13W	120-277V	5.5	620	4000K	82	113	0.9	<20%	110°	170°	Horizontal	Enclosed
36644	5.5PLSH/827/HYB/GX23/R	13W	120-277V	5.5	570	2700K	82	104	0.9	<20%	110°	310°	Horizontal	Non-Enclosed
36645	5.5PLSH/830/HYB/GX23/R	13W	120-277V	5.5	580	3000K	82	105	0.9	<20%	110°	310°	Horizontal	Non-Enclosed
36646	5.5PLSH/835/HYB/GX23/R	13W	120-277V	5.5	600	3500K	82	109	0.9	<20%	110°	310°	Horizontal	Non-Enclosed
36647	5.5PLSH/840/HYB/GX23/R	13W	120-277V	5.5	620	4000K	82	113	0.9	<20%	110°	310°	Horizontal	Non-Enclosed
98403	5.5PLSV/827/HYB/GX23	13W	120-277V	5.5	570	2700K	82	104	0.9	<20%	120°	N.A.	Vertical	Non-Enclosed
98404	5.5PLSV/830/HYB/GX23	13W	120-277V	5.5	600	3000K	82	109	0.9	<20%	120°	N.A.	Vertical	Non-Enclosed
98405	5.5PLSV/835/HYB/GX23	13W	120-277V	5.5	600	3500K	82	109	0.9	<20%	120°	N.A.	Vertical	Non-Enclosed
98406	5.5PLSV/840/HYB/GX23	13W	120-277V	5.5	620	4000K	82	113	0.9	<20%	120°	N.A.	Vertical	Non-Enclosed

* Ballast Dependent. Please refer to www.greencreative.com for full ballast compatibility list.
** Please visit www.greencreative.com for Limited Warranty terms.

GREENCREATIVE

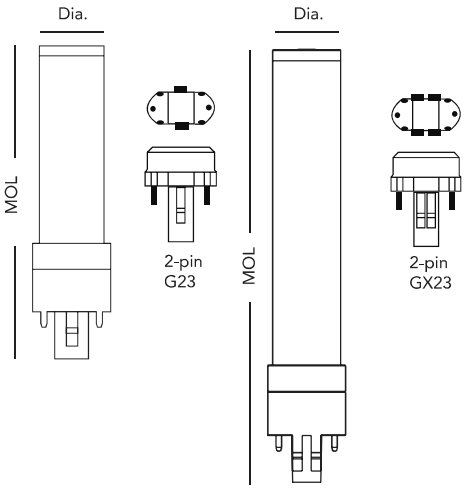
BYPASS AND HYBRID BYPASS PLS

DIMENSION & WEIGHT



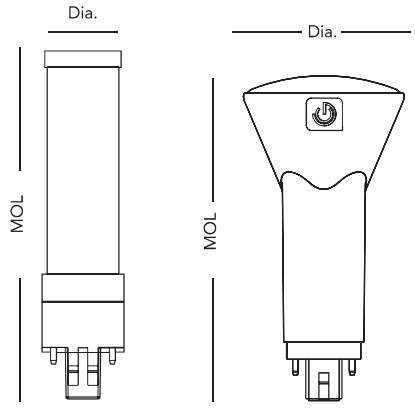
Model	3.5PLS/xxx/BYP/2G7/R	5.5PLS/xxx/BYP/2GX7/R
Compatible base	2G7 (4-pin)	2GX7 (4-pin)
MOL	4-3/4”	6-9/16"
Dia	1-7/16"	1-7/16"
Weight	0.06 lb	0.06lb

Where xxx means 824-965 which indicates CRI and color temperature



Model	3.5PLS/xxx/HYB/G23/R	5.5PLS/xxx/HYB/GX23/R
Compatible base	G23 (2-pin)	GX23 (2-pin)
MOL	5-5/16"	7"
Dia	1-1/4"	1-1/4"
Weight	0.08 lb	0.08 lb

Where xxx means 824-965 which indicates CRI and color temperature



Model	5.5PLSH/xxx/HYB/GX23/R	5.5PLSV/xxx/HYB/GX23
Compatible base	GX23 (2-pin)	GX23 (2-pin)
MOL	5-1/2"	5-1/4"
Dia	1-3/8"	2-9/16"
Weight	0.15 lb	0.16lb

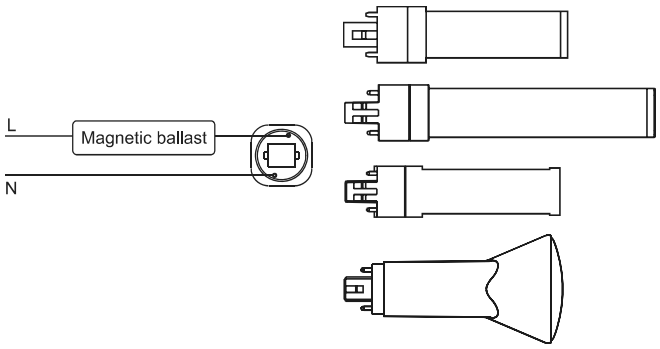
Where xxx means 824-965 which indicates CRI and color temperature

GREENCREATIVE

BYPASS AND HYBRID BYPASS PLS

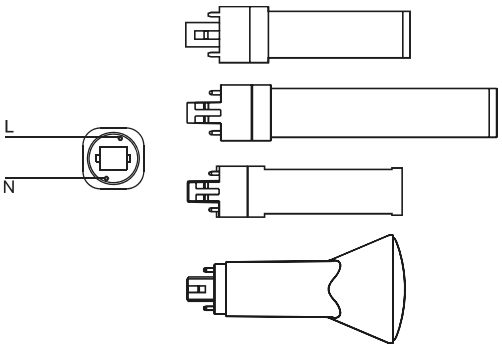
HYBrid Installation - DIRect (Magnetic Ballasts) or BYPass

When used with a magnetic ballast, the lamp can function as a plug & play lamp and operate with the existing ballast.

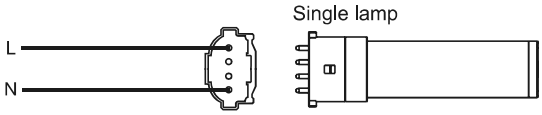


OR

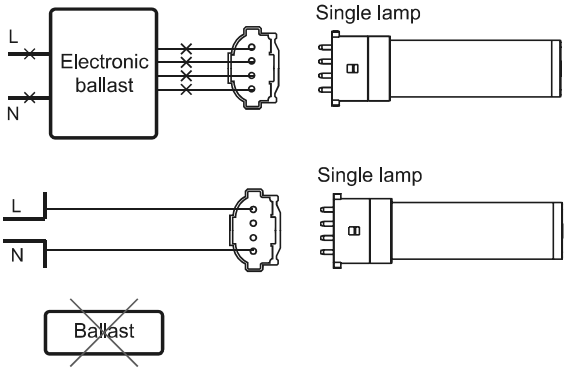
If the ballast is not compatible, it can be bypassed and the lamp can run directly off line voltage.



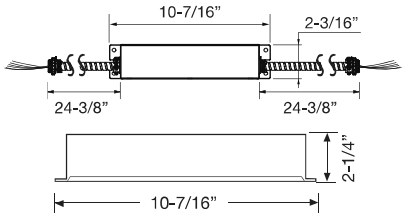
BYPass Installation



OR



ACCESSORY ORDERING INFORMATION

Product	Model	Description	Pictures	Dimensions
98003	23EMDRIVER	California Title 20 Compliant 23W Emergency LED Driver (Field Installation)		

Note: 23EMDRIVER is working for 3.5PLS HYB and 5.5PLSV HYB only.

EXTENDED WARRANTIES***

Model	Description****
3.5PLS/BYP/10YEARWARRANTY	10 Year warranty for 3.5PLS/8xx/BYP/2G7/yy
5.5PLS/BYP/10YEARWARRANTY	10 Year warranty for 5.5PLS/8xx/BYP/2GX7/yy
3.5PLS/HYB/10YEARWARRANTY	10 Year warranty for 3.5PLS/8xx/HYB/G23/yy
5.5PLS/HYB/10YEARWARRANTY	10 Year warranty for 5.5PLS/8xx/HYB/GX23/yy
5.5PLSH/HYB/10YEARWARRANTY	10 Year warranty for 5.5PLSH/8xx/HYB/GX23/yy
5.5PLSV/HYB/10YEARWARRANTY	10 Year warranty for 5.5PLSV/8xx/HYB/GX23/yy

*** Warranty based on a maximum of 4,368 annual operating hours (per year for ten years) and exposure to a maximum fixture operating temperature of 80°F / 27°C
**** xx – Refers to the CCT yy – Refers to model generations within the same nominal performance. Typically blank, 'R', or 'RC'

GREENCREATIVE

BYPASS AND HYBRID BYPASS PLS

ORDERING INFORMATION

Model	Master Carton			Shipping Carton		
	Case Qty	Case Dimensions (LxWxH)	Case Weight	Case Qty	Case Dimensions (LxWxH)	Case Weight
3.5PLS/xxx/BYP/2G7/R	6PCS	5-5/16" x 3-5/8" x 3-3/16"	0.55lb	24PCS	11-1/8" x 7-9/16" x 3-9/16"	2.75lb
3.5PLS/xxx/HYB/G23/R	6PCS	5-5/16" x 3-5/8" x 3-3/16"	0.55lb	24PCS	11-1/8" x 7-9/16" x 3-9/16"	2.75lb
5.5PLS/xxx/BYP/2GX7/R	6PCS	7-7/8" x 3-1/8" x3-1/8"	0.6lb	24PCS	16-1/4" x 6-3/4" x 3-1/2"	3.3lb
5.5PLS/xxx/HYB/GX23/R	6PCS	7-7/8" x 3-1/8" x3-1/8"	0.6lb	24PCS	16-1/4" x 6-3/4" x 3-1/2"	3.3lb
5.5PLSH/xxx/HYB/GX23/R	6PCS	5-15/16" x 4-3/4" x 4-3/16"	1lb	24PCS	12-1/2" x 10-1/16" x 4-1/2"	5lb
5.5PLSV/xxx/HYB/GX23	6PCS	5-11/16" x 8-11/16" x 6-11/16"	1.4lb	24PCS	23-1/16" x 9-1/16" x 7-1/16"	7lb

Where xxx means 824-965 which indicates CRI and color temperature

Note: All rights reserved. All sizes and specifications are subject to change at any time without notice.

Light Efficient Design

SCREW-IN RETROFITS

SUPERFLEX BOLLARD/POST TOPS



- LED-8029: switch between 12W, 18W & 24W replacing up to 150W HID.
- LED-8024: switch between 35W, 45W & 60W replacing up to 320W HID.
- LED-8027: switch between 80W, 100W & 110W replacing up to 400W HID.
- Change color temperatures with a flip of a switch (3000K, 4000K, 5000K).
- Multi-directional mounting capability & 360° design. Use base down, base up or base sideways without affecting performance.
- Pretested & potted drivers are burnt in 3x prior to shipping and protected against vibration & moisture.
- Lamps dim to 50-70% by adjusting the wattage switch on the side of the lamp only.
- Field adjustable light output.

5 YEAR WARRANTY

120/277V — ALSO WORKS ON 208V & 240V

ULTYPE B BALLAST BYPASS — INSTALL METHOD

MEDIUM + MOGUL BASE

ACTIVE COOLING

DIMMABLE

-40°F TO 122°F — OPERATING TEMP

L70 — 50,000hrs RATED LIFE

6kA — SURGE PROTECTION

80+ — CRI

PART #	UPC	REPLACES	WATTAGE	LUMENS	FLEXCOLOR	BASE
LED-8029E345-A-FW	84400606067	70W-100W-150W	12W-18W-24W	1550-3360	3000K/**4000K**/5000K	E26
LED-8029M345-A-FW	84400606068	70W-100W-150W	12W-18W-24W	1550-3360	3000K/**4000K**/5000K	EX39
LED-8024E345-G7-FW	844006060718	175W-250W-320W	35W-45W-60W	5140-8870	3000K/**4000K**/5000K	E26
LED-8024M345-G7-FW	844006060725	175W-250W-320W	35W-45W-60W	5140-8870	3000K/**4000K**/5000K	EX39
LED-8027M345-G7-FW	844006060756	320W-400W	80W-100W-110W	11370-15730	3000K/**4000K**/5000K	EX39
LED-8027M345-G7-FW-HV*	844006077129	320W-400W	80W-100W-110W	11370-15730	3000K/**4000K**/5000K	EX39

* 8027-HV runs on 277-480V

c UL us LISTED — RoHS Compliant — CLASSIFIED c UL us MOGUL OR 120V MEDIUM BASE ONLY — CE — FC — DLC LISTED

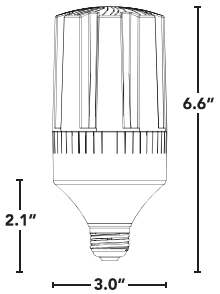
LIGHT EFFICIENT DESIGN HEADQUARTERS 188 S. Northwest Highway • Cary, IL 60013
INNOVATION & MANUFACTURING CENTER 30 Log Bridge Road, Building 200 • Middleton, MA 01949
847.380.3540 • led-llc.com

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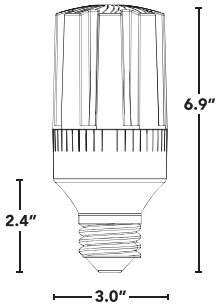
Light Efficient Design

SCREW-IN RETROFITS

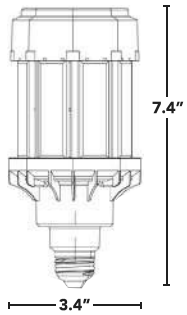
SUPERFLEX BOLLARD/POST TOPS



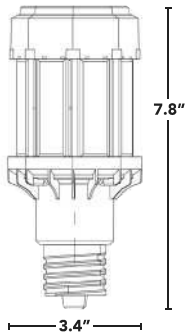
8029E



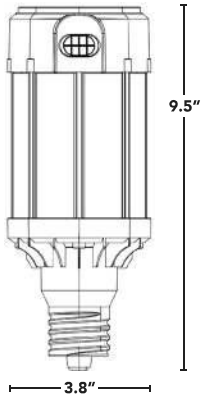
8029M



8024E345-G7-FW



8024M345-G7-FW



8027M345-G7-FW

PART #	UPC	REPLACES	WATTAGE	LUMENS	FLEXCOLOR	BASE	DLC CODES
LED-8029E345-A-FW	84400606067	70W-100W-150W	12W-18W-24W	1550-3360	3000K/**4000K**/5000K	E26	N/A
LED-8029M345-A-FW	84400606068	70W-100W-150W	12W-18W-24W	1550-3360	3000K/**4000K**/5000K	EX39	PVPFGTKS
LED-8024E345-G7-FW	844006060718	175W-250W-320W	35W-45W-60W	5140-8870	3000K/**4000K**/5000K	E26	N/A
LED-8024M345-G7-FW	844006060725	175W-250W-320W	35W-45W-60W	5140-8870	3000K/**4000K**/5000K	EX39	PE8R4NVO
LED-8027M345-G7-FW	844006060756	320W-400W	80W-100W-110W	11370-15730	3000K/**4000K**/5000K	EX39	PMXF5D5C
LED-8027M345-G7-FW-HV*	844006077129	320W-400W	80W-100W-110W	11370-15730	3000K/**4000K**/5000K	EX39	S-IESFDP

* 8027-HV runs on 277-480V

347 VOLT OPTIONS FOR CANADA

PART #	UPC	REPLACES	WATTAGE	LUMENS	FLEXCOLOR	BASE	DLC CODES
LED-8029E345C-A-FW	84400606069	70W-100W-150W	12W-18W-24W	1550-3360	3000K/**4000K**/5000K	E26	N/A
LED-8029M345C-A-FW	84400606070	70W-100W-150W	12W-18W-24W	1550-3360	3000K/**4000K**/5000K	EX39	P55Z8FTK
LED-8024E345C-G7-FW	844006060732	175W-250W-320W	35W-45W-60W	5140-8870	3000K/**4000K**/5000K	E26	N/A
LED-8024M345C-G7-FW	844006060749	175W-250W-320W	35W-45W-60W	5140-8870	3000K/**4000K**/5000K	EX39	P17WDCCW
LED-8027M345C-G7-FW	844006060763	320W-400W	80W-100W-110W	11370-15730	3000K/**4000K**/5000K	EX39	POIALL6T

LED-8029

WATTAGE	CCT	LUMENS
12W	3000K	1550
12W	4000K	1610
12W	5000K	1650
18W	3000K	2450
18W	4000K	2560
18W	5000K	2610
24W	3000K	3170
24W	4000K	3330
24W	5000K	3360

LED-8024

WATTAGE	CCT	LUMENS
35W	3000K	5140
35W	4000K	5290
35W	5000K	5360
45W	3000K	6200
45W	4000K	6510
45W	5000K	6620
60W	3000K	8440
60W	4000K	8790
60W	5000K	8870

LED-8027

WATTAGE	CCT	LUMENS
80W	3000K	10780
80W	4000K	11290
80W	5000K	11370
100W	3000K	13800
100W	4000K	14270
100W	5000K	14350
110W	3000K	15080
110W	4000K	15690
110W	5000K	15730

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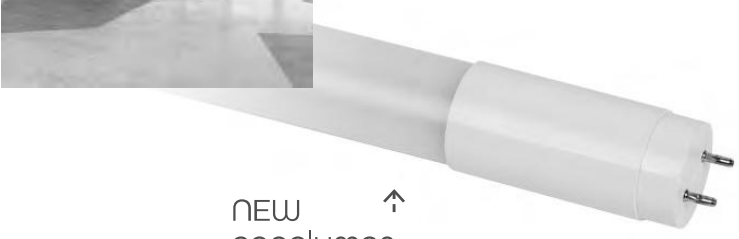
Light Efficient Design

RemPhos

PIN-BASE RETROFITS

TOTALTUBE T8 G3





NEW copolymer nano lens material

- 2 methods of installation (UL Type A + B).
- New wide 240° beam angle.
- New G3 SMARTSENSE-TLED Intelligent Safety System.
- Available in 2 ft, 3ft & 4ft lengths & U-Bend sizes.
- Suitable for dry & damp locations.
- UL classified retofit fit listed & DLC QPL listed.
- 5 year standard warranty, L70 > 100,000 HRS.
- New high performance NANO Lens material.
- New 136 LPW efficacy due to improved driver design, higher efficiency LED chips & high performance NANO Lens.

5 YEAR WARRANTY

120/277V — ALSO WORKS ON 208V & 240V

UL TYPE B BALLAST BYPASS — INSTALL METHOD

UL TYPE A BALLAST COMPATIBLE — INSTALL METHOD

80+ — CRI

240° — BEAM ANGLE

-4°F TO 113°F — OPERATING TEMP

<15% THD >0.99 — PWR FACTOR

L70 — 100,000hrs RATED LIFE

PART #	UPC	REPLACES	WATTAGE	LUMENS	COLOR	BASE
RPT-B-TOTALTUBE-T8-G3-2FT-840-A	844006010003	17W FL	10W	1350	4000K	G13
RPT-B-TOTALTUBE-T8-G3-3FT-840-A	844006010010	25W FL	10W	1350	4000K	G13
RPT-B-TOTALTUBE-T8-G3-4FT-840-A	844006010034	32W FL	12W	1620	4000K	G13
RPT-B-TOTALTUBE-T8-G3-4FTHO-840-A	844006010065	32W FL	15W	2025	4000K	G13
RPT-B-TOTALTUBE-T8-G3-2FTU1-840-A	844006011857	32W FL	15W	1950	4000K	G13
RPT-B-TOTALTUBE-T8-G3-2FTU6-840-A	844006011888	32W FL	15W	1950	4000K	G13

* additional color temperatures shown on page 2

c UL us LISTED — RoHS Compliant — DLC LISTED — NSF — FC

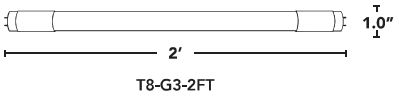
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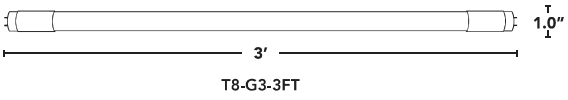
Light Efficient Design

PIN-BASE RETROFITS

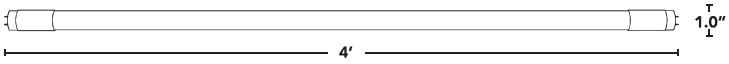
TOTALTUBE T8 G3



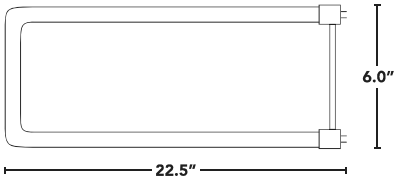
T8-G3-2FT



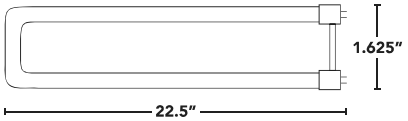
T8-G3-3FT



T8-G3-4FT



T8-G3-2FTU6



T8-G3-2FTU1

PART #	UPC	REPLACES	WATTAGE	LUMENS	COLOR	BASE	DLC CODE
RPT-B-TOTALTUBE-T8-G3-2FT-830-A	844006011802	17W FL	10W	1350	3000K	G13	N/A
RPT-B-TOTALTUBE-T8-G3-2FT-835-A	844006011819	17W FL	10W	1350	3500K	G13	N/A
RPT-B-TOTALTUBE-T8-G3-2FT-840-A	844006010003	17W FL	10W	1350	4000K	G13	N/A
RPT-B-TOTALTUBE-T8-G3-2FT-850-A	844006011826	17W FL	10W	1350	5000K	G13	N/A
RPT-B-TOTALTUBE-T8-G3-3FT-830-A	844006011901	25W FL	10W	1350	3000K	G13	N/A
RPT-B-TOTALTUBE-T8-G3-3FT-835-A	844006010027	25W FL	10W	1350	3500K	G13	PL56K1S3WXK5
RPT-B-TOTALTUBE-T8-G3-3FT-840-A	844006010010	25W FL	10W	1350	4000K	G13	PLWS9UUELN5C
RPT-B-TOTALTUBE-T8-G3-3FT-850-A	844006011918	25W FL	10W	1350	5000K	G13	PL7TNN06QF6X
RPT-B-TOTALTUBE-T8-G3-4FT-830-A	844006011925	32W FL	12W	1620	3000K	G13	PL3APLQDF6FO
RPT-B-TOTALTUBE-T8-G3-4FT-835-A	844006011932	32W FL	12W	1620	3500K	G13	PLVUI4UZR673
RPT-B-TOTALTUBE-T8-G3-4FT-840-A	844006010034	32W FL	12W	1620	4000K	G13	PLH56D7P9FSA
RPT-B-TOTALTUBE-T8-G3-4FT-850-A	844006010041	32W FL	12W	1620	5000K	G13	PL4C09IYD7MS
RPT-B-TOTALTUBE-T8-G3-4FT-HO-830-A	844006011949	32W FL	15W	2025	3000K	G13	PL1S87BVLZDG
RPT-B-TOTALTUBE-T8-G3-4FT-HO-835-A	844006010058	32W FL	15W	2025	3500K	G13	PLMF20ORM55F
RPT-B-TOTALTUBE-T8-G3-4FT-HO-840-A	844006010065	32W FL	15W	2025	4000K	G13	PLK392SE49X7
RPT-B-TOTALTUBE-T8-G3-4FT-HO-850-A	844006010072	32W FL	15W	2025	5000K	G13	PLZIIMNJ36R6
RPT-B-TOTALTUBE-T8-G3-2FTU1-830-A	844006011833	32W FL	15W	1950	3000K	G13	N/A
RPT-B-TOTALTUBE-T8-G3-2FTU1-835-A	844006011840	32W FL	15W	1950	3500K	G13	N/A
RPT-B-TOTALTUBE-T8-G3-2FTU1-840-A	844006011857	32W FL	15W	1950	4000K	G13	N/A
RPT-B-TOTALTUBE-T8-G3-2FTU6-830-A	844006011864	32W FL	15W	1950	3000K	G13	PLD98QC5DNTH
RPT-B-TOTALTUBE-T8-G3-2FTU6-835-A	844006011871	32W FL	15W	1950	3500K	G13	PL42DYDNXI8M
RPT-B-TOTALTUBE-T8-G3-2FTU6-840-A	844006011888	32W FL	15W	1950	4000K	G13	PLHIDDUA8DOO

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PIN-BASE RETROFITS

TOTALTUBE T8 G3

SYSTEM POWER AND LUMINOUS FLUX INFRMATION (WITH A BALLAST)

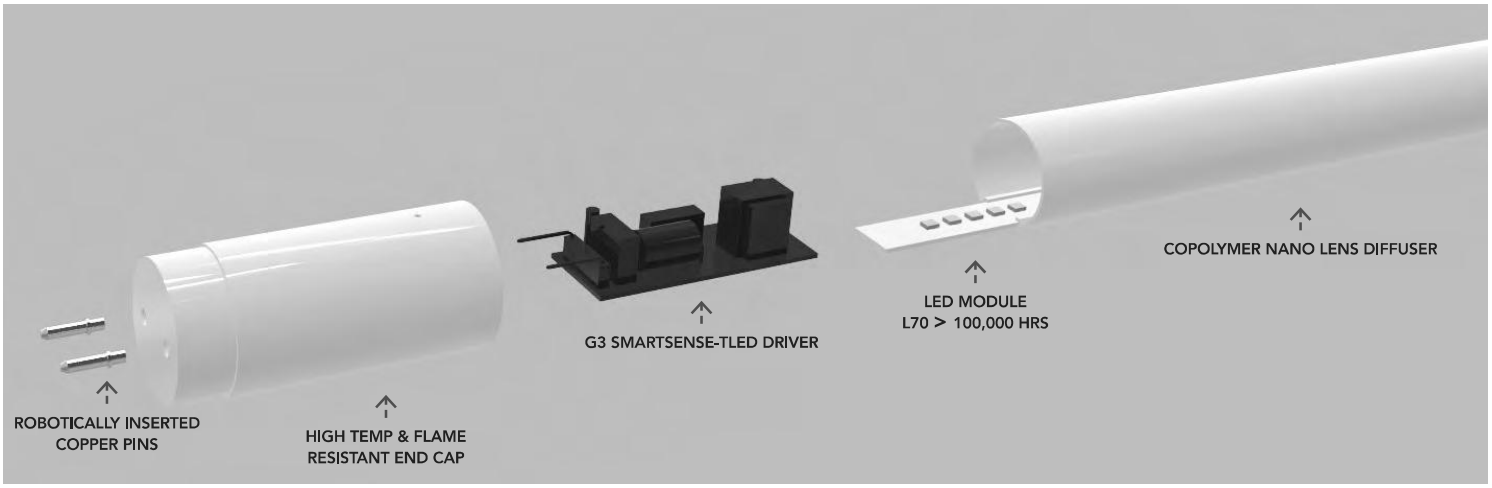
PART #	AVERAGE SYSTEM POWER (W)			AVERAGE LAMP FLUX (LM)		
	LOW BF (0.77)	NORMAL BF (0.88)	HIGH BF (1.18)	LOW BF (0.77)	NORMAL BF (0.88)	HIGH BF (1.18)
RPT-B-TOTALTUBE-T8-G3-2FT-8XX-A	9.2	10.5	12.5	1150	1350	1500
RPT-B-TOTALTUBE-T8-G3-3FT-8XX-A	9.2	10.5	12.5	1150	1350	1500
RPT-B-TOTALTUBE-T8-G3-4FT-8XX-A	12.5	15.5	16.5	1500	1860	1980
RPT-B-TOTALTUBE-T8-G3-4FTHO-8XX-A	14.2	16.5	17.8	1704	1980	2136
RPT-B-TOTALTUBE-T8-G3-2FTU1-8XX-A	12.5	15.5	16.5	1350	1700	1850
RPT-B-TOTALTUBE-T8-G3-2FTU6-8XX-A	12.5	15.5	16.5	1350	1700	1850

ACCESSORIES

PART #	DESCRIPTION	INPUT VOLTAGE (V AC)	FLUX OUTPUT (LM)	EST. EMG. RUN TIME (MIN)
RP-EM-SK1-500LM/90-4.7x0.8	UL Classified Emergency Kit	120-277	500	90-120
RP-EM-SKB-1000LM/90-4.7x.8-8W	UL Classified Emergency Kit	120-277	1000	90-120

DIMMING AND EMERGENCY OPERATION GUIDE

	UL TYPE A	UL TYPE B
DIMMABILITY	NO	NO
EMERGENCY OPERATION	YES (see ballast compatibility guide)	See accessories above for EMG Kit



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PIN-BASE RETROFITS



PL RETROFITS



omni-directional -> lamp

- -> Compatible with G24d (2-pin) & G24q (4-pin) sockets.
- -> Available in 2700K, 3500K, 4000K & 5000K color temperatures.
- -> Compact size allows it to fit in more applications.
- -> For use in recessed & semi-enclosed fixtures only.
- -> Not for use in enclosed fixtures.

5 YEAR WARRANTY

120/277V
ALSO WORKS ON 208V & 240V

UL TYPE B BALLAST BYPASS
INSTALL METHOD

G24D/G24Q
BASE TYPE

MOUNTING

360°
BEAM ANGLE

80+
CRI

-40°F TO 104°F
OPERATING TEMP

L70
50,000hrs RATED LIFE

PART #	UPC	REPLACES	WATTAGE	LUMENS	COLOR (K)	BASE
LED-7310-27K-G3	844006055615	Up to 32W CFL	7W	890	2700K	G24d/G24q
LED-7310-35K-G3	844006055639	Up to 32W CFL	7W	949	3500K	G24d/G24q
LED-7310-40K-G3	844006055646	Up to 32W CFL	7W	970	4000K	G24d/G24q
LED-7310-50K-G3	844006055653	Up to 32W CFL	7W	990	5000K	G24d/G24q

c UL us LISTED

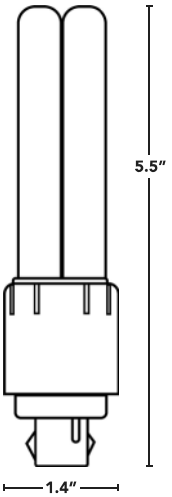
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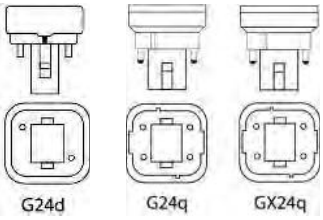
Light Efficient Design

PIN-BASE RETROFITS

TYPE A/B 2-PIN PL LAMPS



7310



PART #	UPC	REPLACES	WATTAGE	LUMENS	COLOR (K)	BASE
LED-7310-27K-G3	844006055615	Up to 32W CFL	7W	890	2700K	G24d/G24q
LED-7310-35K-G3	844006055639	Up to 32W CFL	7W	949	3500K	G24d/G24q
LED-7310-40K-G3	844006055646	Up to 32W CFL	7W	970	4000K	G24d/G24q
LED-7310-50K-G3	844006055653	Up to 32W CFL	7W	990	5000K	G24d/G24q

347 VOLT OPTIONS FOR CANADA

PART #	UPC	REPLACES	WATTAGE	LUMENS	COLOR (K)	BASE
LED-7310-27C-G3	844006055660	Up to 32W CFL	7W	890	2700K	G24d/G24q
LED-7310-35C-G3	844006055677	Up to 32W CFL	7W	949	3500K	G24d/G24q
LED-7310-40C-G3	844006055684	Up to 32W CFL	7W	970	4000K	G24d/G24q

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FIXTURES

SURFACE MOUNT DRUM



- Choose from 5 fixture styles with multiple diameters.
- Flexible: flexWATT allows you to select between 4 wattages & flexCOLOR between 3 colors...all in the same fixture!
- Future-proof: Powered by easily replaceable & upgradeable LEDSR G2 light engine.
- Optional emergency battery back-up and control options.

powered by the LEDSR G2 light engine

flexWATT STANDARD

6W 10W 16W 22W

flexCOLOR STANDARD

3000°K WARM WHITE

3500°K SOFT WHITE

4000°K NEUTRAL WHITE

flexCONTROL OPTIONAL

ORDER CONTROL READY, BASIC CONTROL OR LG ADVANCED CONTROL

10 YEAR WARRANTY

120/277V
ALSO WORKS ON 208V & 240V

0-10V DIM

130-150 LPW
EFFICACY

80+
CRI

EMG
OPTIONAL EMG BATTERY BACKUP

-20°C TO 60°C
OPERATING TEMP

<15% THD
>0.9
PWR FACTOR

L70
100,000hrs RATED LIFE

PART #	UPC	FLEXWATTAGE	LUMENS	LPW	FLEXCOLOR
RP-DRU-11N-14L-40K-WC-G2-A	844006022617	6W/**10W**/16W/22W	**780-3124**	**130-142**	3000K/3500K/**4000K**
RP-DRU-11N-14L-40K-WC-G2-OC1-A	844006022631	6W/**10W**/16W/22W	**780-3124**	**130-142**	3000K/3500K/**4000K**
RP-DRU-14N-14L-40K-WC-G2-A	844006022624	6W/**10W**/16W/22W	**780-3124**	**130-142**	3000K/3500K/**4000K**
RP-DRU-14N-14L-40K-WC-G2-OC1-A	844006022648	6W/**10W**/16W/22W	**780-3124**	**130-142**	3000K/3500K/**4000K**
RP-DRD-14N-14L-40K-WC-G2-A	844006040673	6W/**10W**/16W/22W	**780-3124**	**130-142**	3000K/3500K/**4000K**
RP-DRD-14N-14L-40K-WC-G2-OC1-A	844006040680	6W/**10W**/16W/22W	**780-3124**	**130-142**	3000K/3500K/**4000K**
RP-DRD-18N-14L-40K-WC-G2-A	844006040697	6W/**10W**/16W/22W	**780-3124**	**130-142**	3000K/3500K/**4000K**
RP-DRD-18N-14L-40K-WC-G2-OC1-A	844006040703	6W/**10W**/16W/22W	**780-3124**	**130-142**	3000K/3500K/**4000K**

ENERGY STAR RoHS Compliant ETL LISTED Intertek FC

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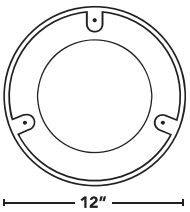
SURFACE MOUNT DRUM

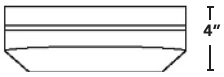
CCT SELECTION

LUMEN SELECTION	830	835	840
8L	780LM, 6W	780LM, 6W	816LM, 6W
14L	1370LM, 10W	1440LM, 10W	1370LM, 10W
23L	2256LM, 16W	2240LM, 16W	2352LM, 16W
31L	2970LM, 22W	3080LM, 22W	3124LM, 22W

DRO - OUTDOOR DRUM 12”





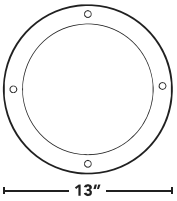


- Vandal resistant and watertight/wet-raised.
- Strong rigid lens made from high transmission, UV blocking polycarbonate.
- Strong white polycarbonate base.
- Available in 12in diameter.

PART #	UPC	FLEXWATTAGE	LUMENS	LPW	FLEXCOLOR	ENERGY STAR	QUICK SHIP
RP-DRO-12N-14L-40K-WC-G2	844006015763	6W/**10W**/16W/22W	780-3124	130-142	3000K/3500K/**4000K**	✓	✓
RP-DRO-12N-14L-40K-WC-G2-OC1	844006019983	6W/**10W**/16W/22W	780-3124	130-142	3000K/3500K/**4000K**	✓	✓

DRT -TOUGH DRUM 13”







- Vandal resistant and watertight/wet-raised.
- Strong rigid lens made from high transmission, UV blocking polycarbonate.
- Thick metal, brushed nickle plated base, trim rings and hardware.
- Available in 13in diameters. Contact us for custome paint colors such as white, brass or bronze

PART #	UPC	FLEXWATTAGE	LUMENS	LPW	FLEXCOLOR	ENERGY STAR	QUICK SHIP
RP-DRT-13N-14L-40K-WC-G2	844006015794	6W/**10W**/16W/22W	780-3124	130-142	3000K/3500K/**4000K**	✓	✓
RP-DRT-13N-14L-40K-WC-G2-OC1	844006010492	6W/**10W**/16W/22W	780-3124	130-142	3000K/3500K/**4000K**		✓

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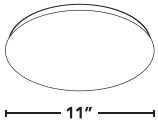
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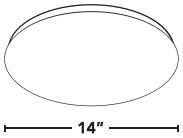
Light Efficient Design

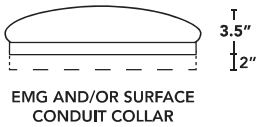
SURFACE MOUNT DRUM

DRU - UTILITY DRUM 11" OR 14"







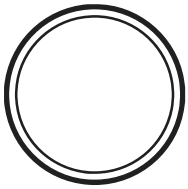


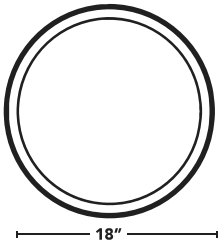
- Flexible lens made from high transmission, UV blocking acrylic plastic.
- Thick metal, white painted base.
- Lens attaches to metal base via twist lock - no tools required.
- Available in 11in and 14in diameters.

PART #	UPC	FLEXWATTAGE	LUMENS	LPW	FLEXCOLOR	ENERGY STAR	QUICK SHIP
RP-DRU-11N-14L-40K-WC-G2-A	844006022617	6W/**10W**/16W/22W	780-3124	130-142	3000K/3500K/**4000K**	✓	✓
RP-DRU-11N-14L-40K-WC-G2-OC1-A	844006022631	6W/**10W**/16W/22W	780-3124	130-142	3000K/3500K/**4000K**	✓	✓
RP-DRU-14N-14L-40K-WC-G2-A	844006022624	6W/**10W**/16W/22W	780-3124	130-142	3000K/3500K/**4000K**	✓	✓
RP-DRU-14N-14L-40K-WC-G2-OC1-A	844006022648	6W/**10W**/16W/22W	780-3124	130-142	3000K/3500K/**4000K**	✓	✓

DRD - DESIGNER DRUM 14" OR 18"









- Flexible lens made from high transmission, UV blocking acrylic plastic.
- Thick metal, brushed nickle plated base, trim rings and hardware.
- Available in 14 and 18 in diameters.
- Contact us for customer paint colors such as white, brass or bronze.

PART #	UPC	FLEXWATTAGE	LUMENS	LPW	FLEXCOLOR	ENERGY STAR	QUICK SHIP
RP-DRD-14N-14L-40K-WC-G2-A	844006040673	6W/**10W**/16W/22W	780-3124	130-142	3000K/3500K/**4000K**	✓	✓
RP-DRD-14N-14L-40K-WC-G2-OC1-A	844006040680	6W/**10W**/16W/22W	780-3124	130-142	3000K/3500K/**4000K**	✓	✓
RP-DRD-18N-14L-40K-WC-G2-A	844006040697	6W/**10W**/16W/22W	780-3124	130-142	3000K/3500K/**4000K**	✓	✓
RP-DRD-18N-14L-40K-WC-G2-OC1-A	844006040703	6W/**10W**/16W/22W	780-3124	130-142	3000K/3500K/**4000K**	✓	✓

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Light Efficient Design

SURFACE MOUNT DRUM

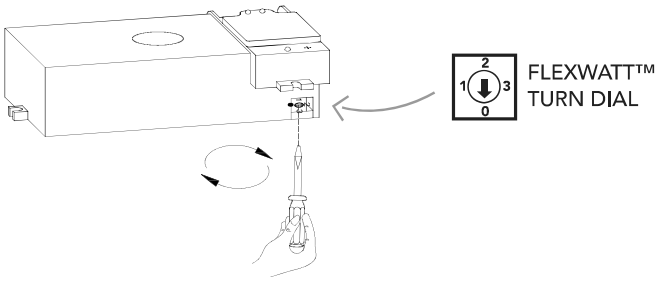
flexWATT

HOW DOES IT WORK?
Our exclusive LED driver is designed to operate at 90%+ efficiency at each wattage setting. Standard drivers would have much lower efficiency as low as 60% and would result in poor performance and reduced efficacy.

WHAT ARE THE WATTAGE CHOICES?
Please reference this table and the ordering guide on the last page of the cut sheet.

FLEXWATT TURN DIAL POSITION				
STYLE	0	1	2	3
LEDCR	6W (8L)	10W (14L)	16W (23L)	22W (31L)

HOW EASY IS IT TO SET?
Simply slide off the driver door, adjust the 4-position turn dial with a small, flat-head screw driver, and replace the door. Quick and easy. Can be "locked-out" to prevent field-adjustability if desired.



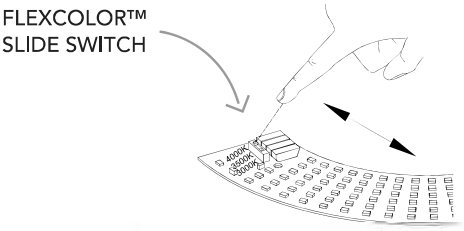
flexCOLOR

HOW DOES IT WORK?
We select the highest efficacy, multiple color LED diodes from quality suppliers, and mount them on the same circuit board. A proprietary LED binning process ensures color consistency between fixtures. The FlexColor technology controller ensures the correct color is selected, every time.

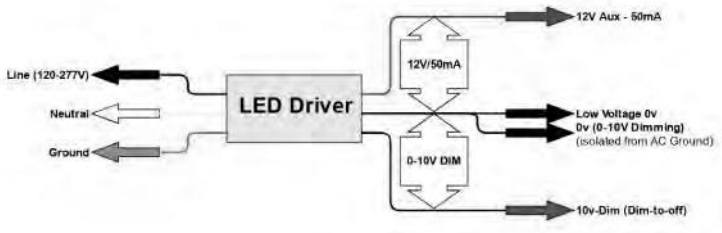
WHAT ARE THE COLOR CHOICES?
3000k, 3500k and 4000k. Please reference this table and the ordering guide on the last page of the cut sheet.

FLEXCOLOR SLIDE SWITCH POSITION		
TOP	MIDDLE	BOTTOM
3000K	3500K	4000K

HOW EASY IS IT TO SET?
Adjust the 3-position slide switch with your finger. Quick and easy. Can be "locked-out" to prevent field-adjustability if desired.



flexCONTROL

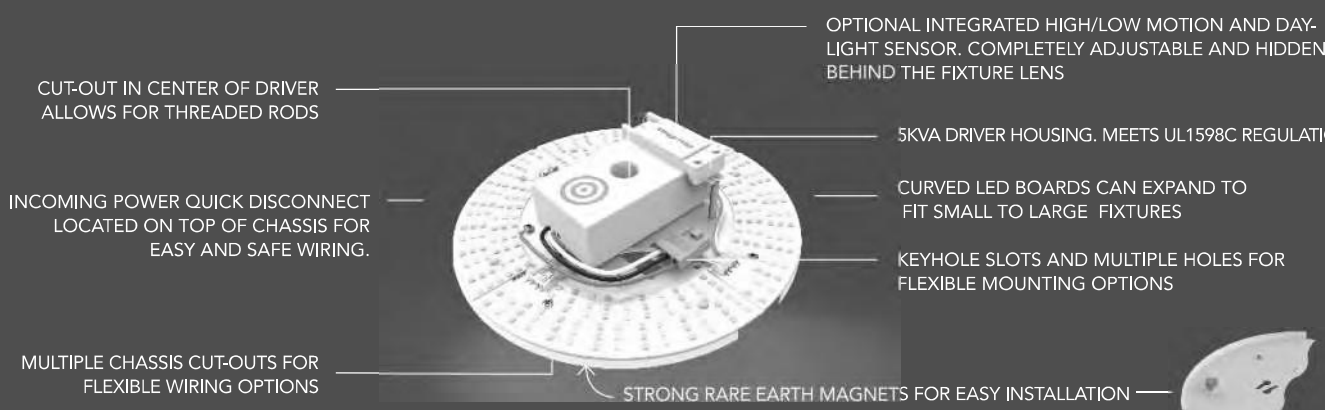


12v Aux - 50mA
10V DIM-to-OFF

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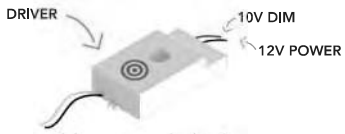
Light Efficient Design

SURFACE MOUNT DRUM



CONTROL OPTIONS

CONTROL READY



All LEDCR/SR models come standard as factory enabled to add controls at the factory, in the field or at a later date. Driver comes with 10V dimming and 12V DC power wiring.

BASIC CONTROL



Integrated high frequency, high/low motion and daylight sensor. Can be mounted behind glass or plastic lens. Purchase optional remote control to adjust settings.

ORDERING CODES
SENSOR = OCC / RC = HNSIII REMOTE

ADVANCED WIRELESS CONTROL



We partner with Magnum, avi-on, Philips, Lutron and other intelligent wireless lighting control systems. Allows for occupancy sensing, daylight harvesting, grouping, scheduling, high-end trim and more. Adjust settings via iPhone/Android apps. Contact us for

CONTACT US FOR ORDERING CODES

EASILY RETROFIT THESE FIXTURE STYLES, AND MORE!



LEDCR-G2-9IN/SURFACE MOUNT



LEDCR-G2-9IN/SURFACE MOUNT



LEDSR-G2-9IN/SCONCE

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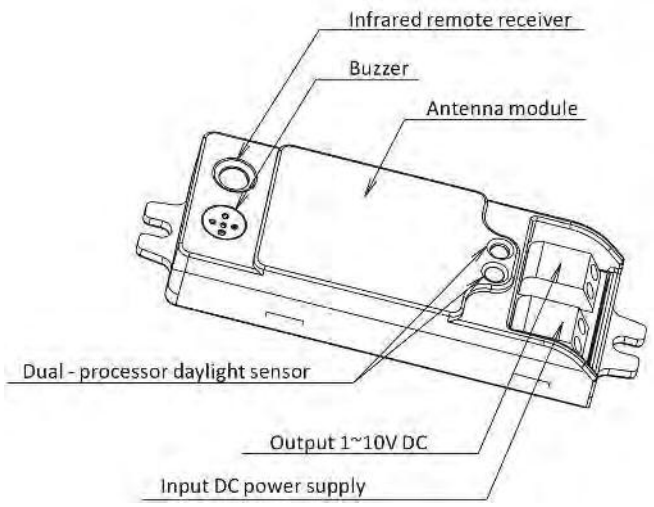
Light Efficient Design

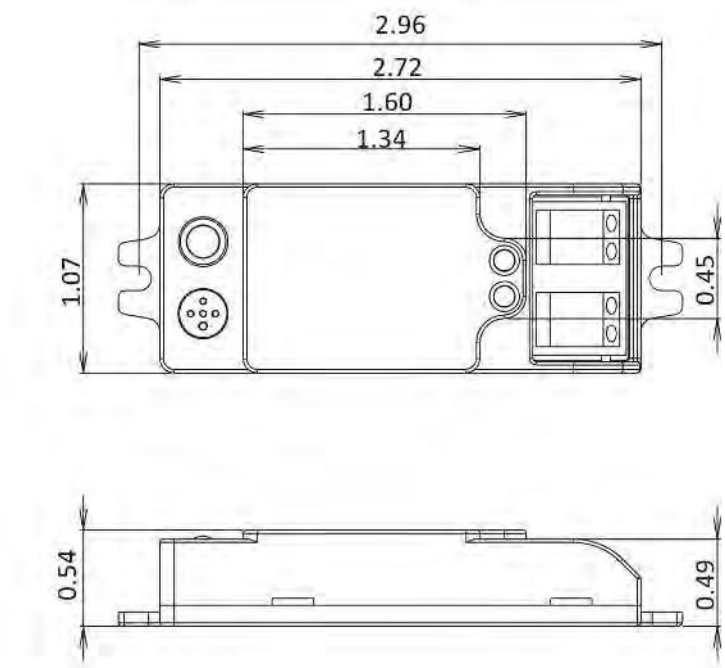
SURFACE MOUNT DRUM

SENSOR OPTIONS: OCC / OCCLR

-> OCC - Standard high/low motion sensor.
Remote: IR12

-> OCCLR - Limited range high/low motion sensor.
Remote: IR12





-> Occupancy sensor w/ daylight hold-off.

-> Powered by 12V DC LED driver from fixture - provided by the LED power supply.

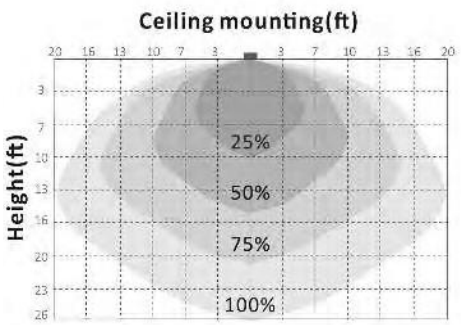
-> High frequency radar occupancy sensor.

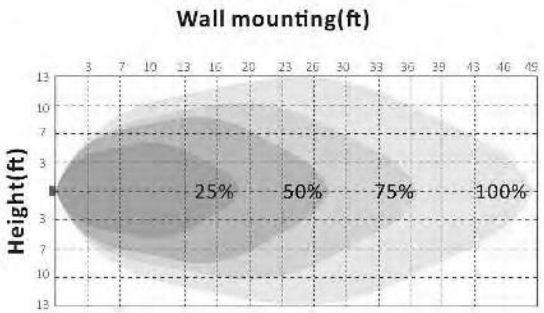
-> Infared remote control available (sold separately).

-> Uses less than 0.1W in standby mode.

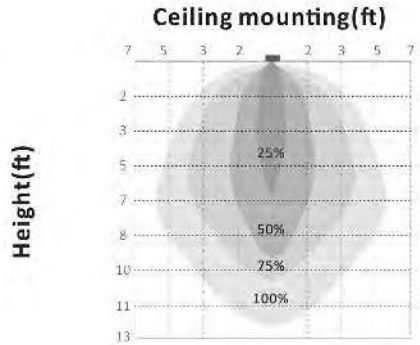
SURFACE MOUNT DRUM

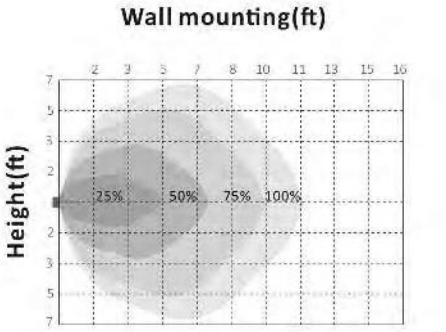
DETECTION PATTER OCC (STANDARD OPTION)





DETECTION PATTER OCCLR (LIMITED RANGE)



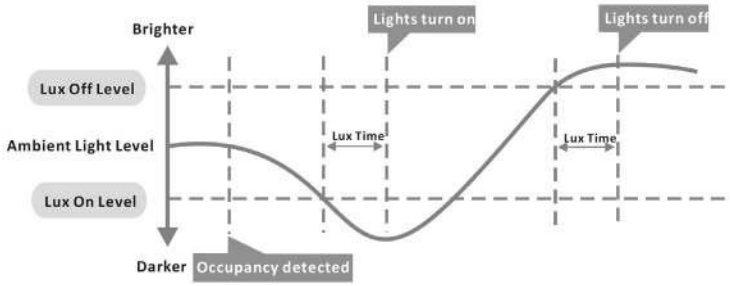


DAYLIGHT MONITORING FUNCTION

This sensor can tell the difference between natural light and artificial light (lamp) from behind the diffuser, switch on automatically (even without movements) when the ambient light is below the target value, and then switch off automatically whenever the artificial light is not required (ambient light is bright enough).

Note: Lux-Off sampling time - 30s; Lux-On sampling time - 10s

Lux-On function will only opperate without motion when standby is set to + ∞.



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Light Efficient Design

SURFACE MOUNT DRUM

SENSOR OPTIONS: OCC / OCCLR

Permanent ON/OFF function

Press "POWER" button, sensor is disabled.

*press "Auto", "Reset" or "Ambient learn" to quit this mode.

Dim +/-

Press "Dim" button to automatically dim up or down the light brightness during hold-time from 10% to 100%. Another press to lock it down when desired brightness is achieved.

*after desired brightness is locked down, if user wants to dim again reversely, just press the "Dim" button again and then lock down the new brightness again.



IR12

Note:

- The buzzer short beeps(~0.5s) ONCE when sensor successfully receives RC signal after pressing any buttons except for "Ambient learn".
- The buzzer short beeps(~0.5s) TWICE to start learning ambient lux after pressing "Ambient learn" Then followed by a long beep(~1s) to indicate the success of ambient learning.
- When "twilight level" set at 0%, it becomes ON/OFF control.

Sensor mode

Press "Auto" button, the sensor starts to work and all settings remain the same as the latest status before the sensor was disabled.

Reset function

Press "Reset" button, all settings go back to factory default settings.

*Factory default settings--

Sensitivity=100%
Daylight sensor=disable
Hold time=5min
Twilight time=+∞
Twilight level=30%

Ambient learn

Press "Ambient learn" button, the latest surrounding lux value overwrites previous lux value learned, and set as the daylight threshold. This feature enables the fixture to function well in any real application circumstance.

Test mode

"Test mode"is for testing purpose only, for users to check the functionality and choose the desired detection range. The sensor goes to test mode automatically after pressing this button.

Users can quit this mode by pressing "ON/OFF", "Reset", or any button of "Hold time". The sensor settings are changed accordingly .

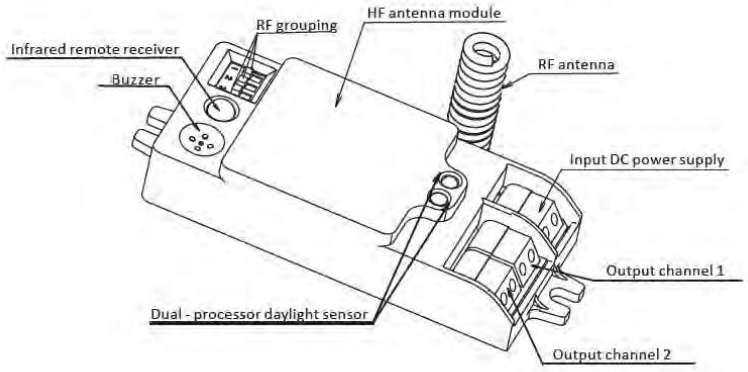
*Test mode defaulted settings--

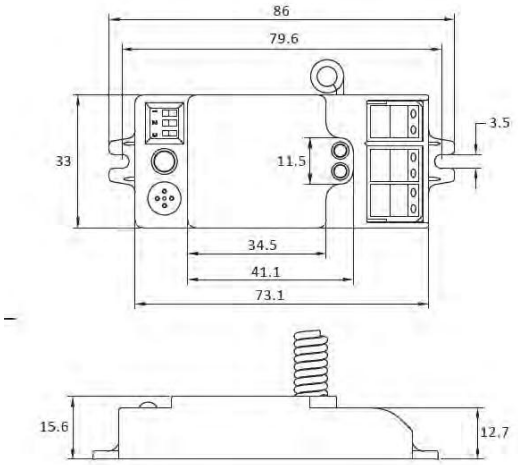
Daylight sensor=disable
Hold time=3s
Twilight time=N/A
Twilight level=N/A

SURFACE MOUNT DRUM

SENSOR OPTIONS: OCCRF (SIMPLE GROUPING SENSOR)

-> OCCRF - Standard high/low motion sensor.
Remote: IR13





-> Simple grouping motion sensor w/ daylight hold-off.

-> Powered by 12V DC - provided by the LED power supply.

-> Max 150 ft. grouping range.

-> Ideal for stairways, parking garages & hallways.

-> Grouping by remote or dip switch (infared remote control sold separately).

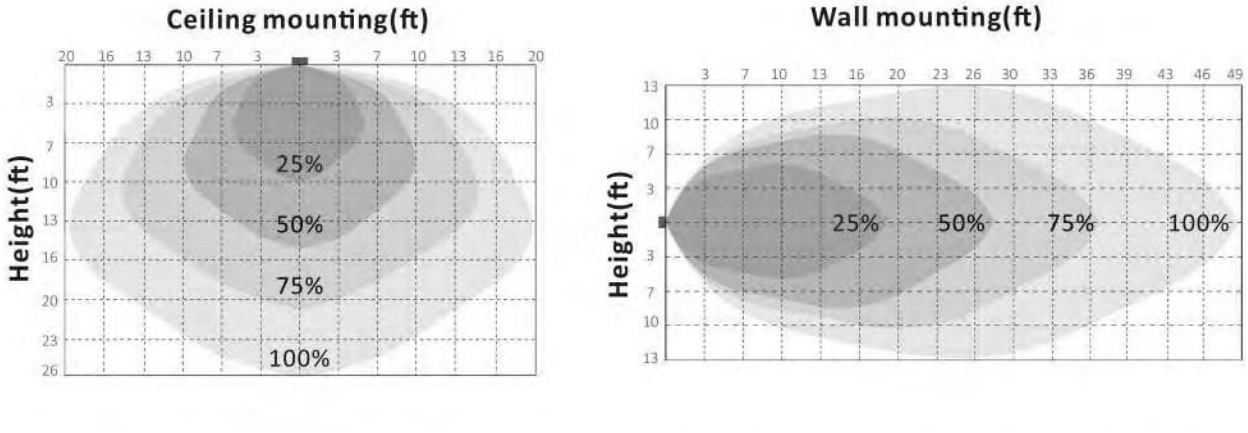
-> Uses less than 0.1W in standby mode.

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SURFACE MOUNT DRUM

DETECTION PATTER OCCRF

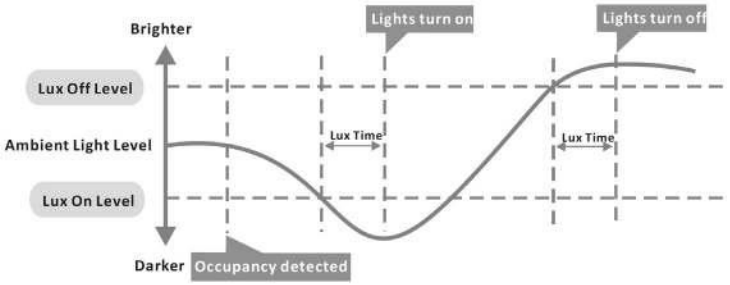


DAYLIGHT MONITORING FUNCTION

This sensor can tell the difference between natural light and artificial light (lamp) from behind the diffuser, switch on automatically (even without movements) when the ambient light is below the target value, and then switch off automatically whenever the artificial light is not required (ambient light is bright enough).

Note: Lux-Off sampling time - 30s; Lux-On sampling time - 10s

Lux-On function will only opperate without motion when standby is set to + ∞.



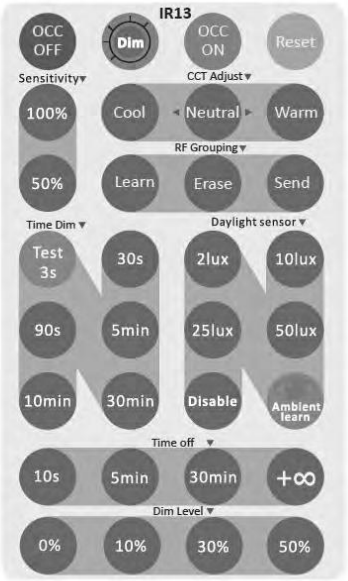
SURFACE MOUNT DRUM

SENSOR OPTIONS: OCCRF (SIMPLE GROUPING SENSOR)

OCC OFF function

Press “OCC OFF” button, the motion sensor will be disabled.

*press “OCC ON” , “Reset” or “Ambient” to re-activate the motion sensor.



Dim

Press “Dim” button to automatically dim up or down the light brightness during hold-time from 10% to 100%. Another press to lock it down when desired brightness is achieved.

*After desired brightness is locked down, if user wants to dim again reversely, just press the “Dim” button again and then lock down the new brightness again.

OCC ON function

Press “OCC ON” button, the sensor starts to work and all settings remain the same as the latest status before the light was switched on / off.

Reset function

Press “Reset” button, all sensor settings go back to factory default settings.

* Factory default setting:

Sensitivity=100%
Daylight sensor=disable
Hold time=90s
Twilight time=5min
Twilight level=10%
CCT=Neutral

Note:

- The buzzer short beeps (~0.5s) ONCE when sensor successfully receives RC signal after pressing any buttons except for“Ambient learn”.
- The buzzer short beeps (~0.5s) TWICE to start learning ambient lux after pressing “Ambient learn” Then followed by a long beep (~1s) to indicate the success of ambient learning.
- When“twilight level”set at 0%, it becomes ON/OFF control.
- Function zone of “CCT Adjust” is invalid for this model.

Ambient learn

Press “Ambient learn” button, the latest surrounding lux value overwrites previous lux value learned, and set as the daylight threshold. This feature enables the fixture to function well in any real application circumstance.

Test mode

“Test mode”is for testing purpose only, for users to check the functionality and choose the desired detection range. The sensor goes to test mode automatically after pressing this button.

Users can quit this mode by pressing “ON/OFF”, “Reset”, or any button of “Hold time”. The sensor settings are changed accordingly.

*Test mode defaulted settings--
Daylight sensor=disable
Hold time=3s
Twilight time=N/A
Twilight level=N/A

In this mode, when used for on/off control, after motion detected, sensor enters into a cycle of 3s on and 2s off.

In this mode, when used for tri-level dimming control, after motion detected, sensor enters into a cycle of 3s on and 2s off (0.5s soft off + 1.5s off).

SURFACE MOUNT DRUM

SENSOR OPTIONS: OCCRF (SIMPLE GROUPING SENSOR)

RF Grouping (via remote control)

Learn — Short press “Learn” button to the receiver unit to start grouping mode, the receiver unit will beep quickly (every second for 3min). This grouping mode will last for 3min, second short press on it will quit the grouping mode.

Send — Short press “Send” button to the commander unit, it will beep once to start a 5s RF signal sending, and then beep twice to indicate finish of it. After receiving the RF signal, the receiver unit will beep 1s to indicate the success of grouping.

Erase — Long press “Erase” button for 5s to the sensor unit, it will long beep once, to indicate the success of erasing.

Note:

1. If you want the sensor to work as both commander and receiver , you need to repeat the “learn” and “send” process again with the identification exchanged.
2. Each receiver can learn up to max. 32 commanders, commanders added beyond 32pcs will automatically substitute earlier ones.
3. Before using the remote control for grouping, you have to position the grouping DIP switch at OFF - OFF - OFF. (default from factory)

Steps for grouping with remote control:



Fast RF Grouping (via DIP switch)

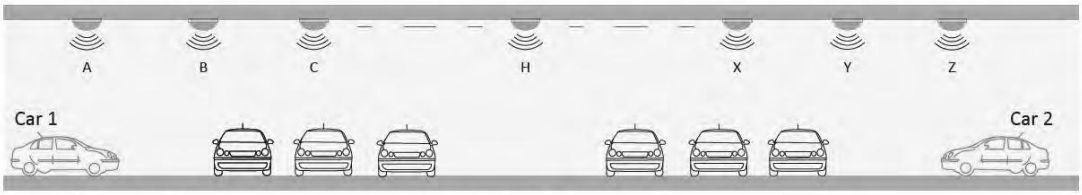
By simply selecting the same channel on each sensor unit, the grouping is quickly and automatically completed. Totally 7 channels are available for fast grouping.

*Channel OFF - OFF - OFF is not for fast grouping, it is for remote control grouping only.

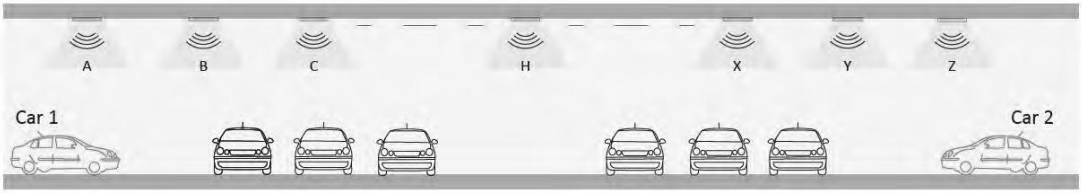
SURFACE MOUNT DRUM

SENSOR OPTIONS: OCCRF (SIMPLE GROUPING SENSOR)

ILLUSTRATION FOR TYPICAL PARKING GARAGE APPLICATION



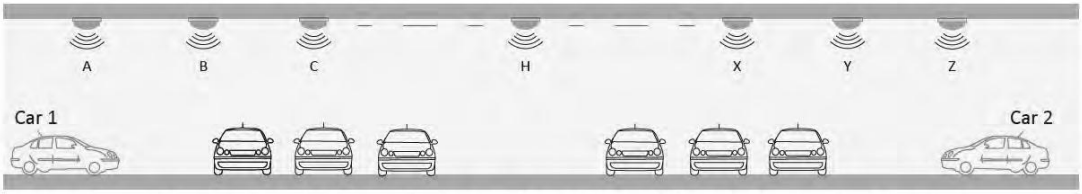
With sufficient daylight, sensor will not be triggered by motion, all lamps are off.



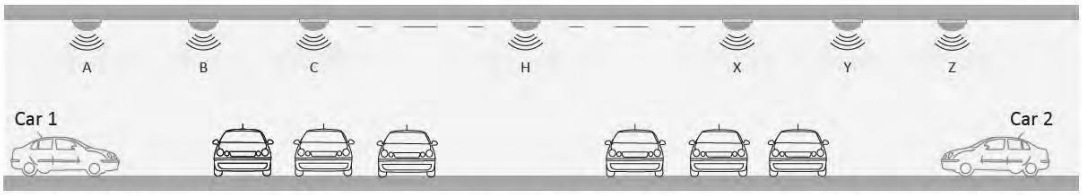
With insufficient natural light, either car 1 or car 2 enters the garage, sensor A or Z will be triggered on, and send RF signal simultaneously to all grouped sensors, all lamps will be 100% ON.



After the hold-time, the whole grouped lamps will dim to pre-defined dimming level (e.g., 10%) if no further movement detected.



The whole grouped lamps will switch off automatically after the stand-by period if no further movement detected.



Thanks to the daylight monitoring function, even no movement detected, the sensor will automatically switch on the lamp to pre-defined stand-by dimming level (e.g., 10%), as long as the natural light is below pre-defined lux threshold. (to achieve this unique function stand-by period of the sensor has to be set at +∞).

*Note:

1. The RF transmission is a triggering signal only to activate the grouped sensors, each sensor will act based on their own settings.
2. Thanks to the Dual-processor technology, the built-in daylight sensor will shut off the lamp in real time regardless of any movements as long as the detected natural light is higher than pre-defined lux threshold.

RemPhos | LBI

PART #	
JOB NAME	
TYPE	



SUPERflex

SWITCH BETWEEN 3 WATTAGES & 3 COLOR TEMPS

With up to 146 lumens per watt, and up to 25 years of virtually maintenance free operation, learn why smart decision makers use the The Linear Transformer (LBI) when upgrading to LED.

- Link 33 4ft units together @ 120VAC or 40 4ft units @ 277VAC (see page 5 for more details)
- Perfect replacement for: linear and general purpose strips, troffers, vapor tight fixtures, low and high bay fixtures, cove lighting, stairwells and much more.
- SuperFlex technology allows for 9 skus in one product.
- Use a number of controls and sensors with FlexControl technology.
- Use our various accessories to mount the LBI in many different locations.

10 YEAR WARRANTY

120-277V* *240-347V FOR CANADA ONLY

146 LPW EFFICACY

<20% THD >0.9 PWR FACTOR

80+ CRI (UNLESS NOTED)

0-10V DIM TO OFF 12V AUX

OCC

120° BEAM ANGLE

EMG OPTIONAL EMG BATTERY BACKUP

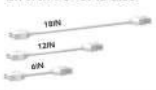
-13°F TO 140°F OPERATING TEMP

DEFAULT CONFIGURATIONS

PART #	UPC	DESCRIPTION	LUMENS*	WATTAGE	COLOR
RP-LBI-G1-2F-6W-27K-WC2	844006024826	2FT PRO WARM CCT INTERNAL DRIVE LIGHT BAR	696-1524	FLEXWATT 6W/9W/12W	FLEXCOLOR 2700/3000K/3500K
RP-LBI-G1-2F-6W-40K-WC	844006023867	2FT PRO INTERNAL DRIVE LIGHT BAR	780-1560		FLEXCOLOR 3500/4000K/5000K
RP-LBI-G1-3F-10W-27K-WC2	844006024833	3FT PRO WARM CCT INTERNAL DRIVE LIGHT BAR	1270-1980	FLEXWATT 10W/12W/15W	FLEXCOLOR 2700/3000K/3500K
RP-LBI-G1-3F-10W-40K-WC	844006023959	3FT PRO INTERNAL DRIVE LIGHT BAR	1400-2100		FLEXCOLOR 3500/4000K/5000K
RP-LBI-G1-4F-15W-27K-WC2	844006024840	4FT PRO WARM CCT INTERNAL DRIVE LIGHT BAR	1260-3400	FLEXWATT 10W/15W/25W	FLEXCOLOR 2700/3000K/3500K
RP-LBI-G1-4F-15W-40K-WC	844006024079	4FT PRO INTERNAL DRIVE LIGHT BAR	1462-3653		FLEXCOLOR 3500/4000K/5000K

POPULAR ACCESSORIES

SOLD SEPERATELY

EMG BATTERY BACKUP	LINKING CABLES	SEAMLESS CONNECTOR	OC2 SENSOR KIT	SUSPENDED IN-LINE BRACKET KIT	INCOMING POWER KIT*
					

RoHS Compliant

ETL LISTED c US UL 1598 LISTED FIXTURE

ETL LISTED c US UL 1598C LISTED RETROFIT KIT

FC CLASS A

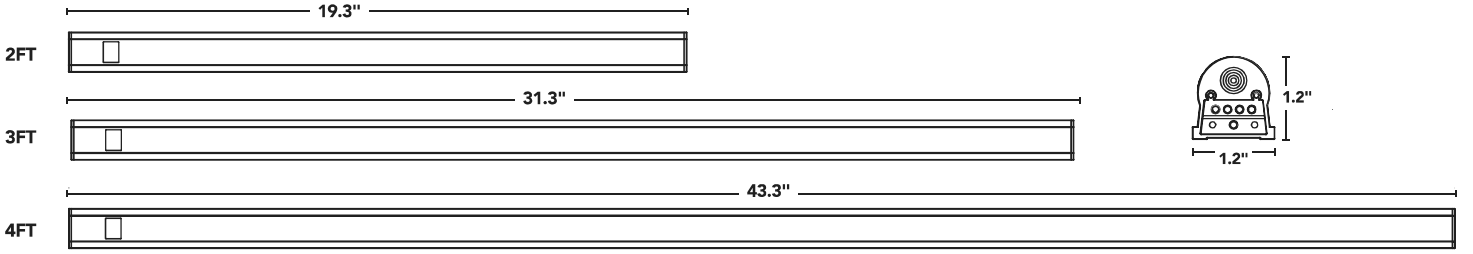
DLC LISTED

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Light Efficient Design

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RemPhos | TECHNICAL INFORMATION



PART NUMBER BUILDER

MFR	PRODUCT	GENERATION	LENGTH	WATTAGE	COLOR	FUNCTION
RP	LBI	G1				
			2F	6W 9W 12W	27K = 2700K	WC2 = WATTAGE + COLOR SELECTABLE WARM COLOR TEMPERATURES
			3F	10W 12W 15W	30K = 3000K	WC = WATTAGE + COLOR SELECTABLE NORMAL COLOR TEMPERATURES
			4F	10W 15W 25W	35K = 3500K	
					40K = 4000K	
					50K = 5000K	

EXAMPLE PART NUMBER

RP-LBI-G1-2F-6W-40K-WC

CONTROL OPTIONS

RP-LBI-OC2-A/ RP-LBI-OC3-A	RP-LBI-BLE-A	RP-LBI-PIR-A	RP-LBI-BLE-PIR-A
LBI IN LINE MICROWAVE OCCUPANCY SENSOR IR11 REMOTE	LBI IN LINE SILVAIR BLUETOOTH NODE SILVAIR APP	LBI IN LINE PASSIVE INFERRED OCCUPANCY SENSOR IR11 REMOTE	LBI IN LINE SILVAIR BLUETOOTH NODE WITH PASSIVE INFERRED OCCUPANCY SENSOR SILVAIR APP & IR11
			

FLEXWATT LUMENS @ 3500K

SIZE	POSITION 1	POSITION 2	POSITION 3
2FT	6W (706LM)	9W (1063LM)	12W (1419LM)
3FT	10W (1335LM)	12W (1648LM)	15W (1961LM)
4FT	10W (1344LM)	15W (2255LM)	25W (3166LM)

FLEXCOLOR SWITCH POSITION

COLOR TEMPS	POSITION 1	POSITION 2	POSITION 3
WARM (WC2)	2700K	3000K	3500K
STANDARD (WC)	3500K	4000K	5000K

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RemPhos | FEATURES

9 SKUs in 1 WITH FLEXWATT™ & FLEXCOLOR™ TECHNOLOGY

flexWATT

2FT	6W	9W	12W
3FT	10W	12W	15W
4FT	10W	15W	25W

- Eliminate ordering and stocking multiple wattages and color temperatures. Product offers 9 SKUs in 1 unit which can easily be configured to 3 different wattage packages and 3 different CCTs.

flexCOLOR

- 2700°K WARM
- 3000°K WARM
- 3500°K NEUTRAL
- 3500°K NEUTRAL
- 4000°K NEUTRAL
- 5000°K COOL

- Product ships at a default color temp (K) and wattage setting (install as is, or tailor the settings to fit your needs).
- Save on labor costs by having us factory pre-set the wattage and color temperature.

FLEXCONTROL™ TECHNOLOGY

- Order control ready or basic control (integrated high/low and daylight sensor) or advanced controls (such as, Philips Easy Sense, Avi-On Bluetooth or Lutron Vive).
- Optional sensors are directly linkable to the light bars.
- Our basic motion/daylight control (OC2 ordering code) is adjustable via remote control for (1) sensitivity (2)duration of time at high light level before dimming to low (2)duration of time at low light level before turning off (3)ramping up and down light levels based on daylight and (4) the dimmed light level %.

SUITABLE FOR DRY & DAMP LOCATIONS

PASS-THROUGH 0-10V DIMMING & AUXILIARY 12V OUTPUT

- Allows all light bars to be dimmed together as a group.

ADAPTABLE MOUNTING

- Various mounting clip options with integrated rare-earth magnets for easy placement in all style fixtures.
- High Bay pendant chain options available.

CONNECT UP TO 40 LIGHT BARS ON ONE INCOMING POWER CABLE

(CHECK LINKING CHART FOR VOLTAGE SPECIFIC LINKING QUANTITY)

Up to 146 LUMENS PER WATT EFFICACY

10 YEAR WARRANTY, L70 >100,000HRS

OPTIONAL EMERGENCY BATTERY BACKUP

OPTIONAL BAA SECTION 1605

(If you require BAA (ARRA Section 1605) add -AA at end of part number.)

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RemPhos | DLC INFORMATION

LINEAR AMBIENT

	PART #	DLC CODE	STANDARD/ PREMIUM	PRIMARY USE	# OF BARS	WATTAGE PER BAR	COLOR TEMP	TOTAL WATTAGE	TOTAL LUMENS
2FT	RP-LBI-G1-2F-6W-XXK-[WC,W]-[HV,Blank]-[Blank,OCN]-[Blank,BAA]	S-E4YHPK	Standard	Direct Linear Ambient Luminaires	1	6	35/**40**/50K	6	706
	RP-LBI-G1-2F-6W-XXK-[WC2,W]-[HV,Blank]-[Blank,OCN]-[Blank,BAA]	S-KI9ETC	Standard	Direct Linear Ambient Luminaires	1	6	**27**/30/35K	6	682
	RP-LBI-G1-2F-9W-XXK-[WC,W]-[HV,Blank]-[Blank,OCN]-[Blank,BAA]	S-2WQ4GZ	Standard	Direct Linear Ambient Luminaires	1	9	35/**40**/50K	9	1062
	RP-LBI-G1-2F-9W-XXK-[WC2,W]-[HV,Blank]-[Blank,OCN]-[Blank,BAA]	S-D5AI27	Standard	Direct Linear Ambient Luminaires	1	9	**27**/30/35K	9	1038
	RP-LBI-G1-2F-12W-XXK-[WC,W]-[HV,Blank]-[Blank,OCN]-[Blank,BAA]	S-5O1BQT	Standard	Direct Linear Ambient Luminaires	1	12	35/**40**/50K	12	1419
	RP-LBI-G1-2F-12W-XXK-[WC2,W]-[HV,Blank]-[Blank,OCN]-[Blank,BAA]	S-0KXIM8	Standard	Direct Linear Ambient Luminaires	1	12	**27**/30/35K	12	1394
3FT	RP-LBI-G1-3F-10W-XXK-[WC,W]-[HV,Blank]-[Blank,OCN]-[Blank,BAA]	S-SAGNV4	Standard	Direct Linear Ambient Luminaires	1	10	35/**40**/50K	10	1335
	RP-LBI-G1-3F-10W-XXK-[WC2,W]-[HV,Blank]-[Blank,OCN]-[Blank,BAA]	S-0A3PXW	Standard	Direct Linear Ambient Luminaires	1	10	**27**/30/35K	10	1267
	RP-LBI-G1-3F-12W-XXK-[WC,W]-[HV,Blank]-[Blank,OCN]-[Blank,BAA]	S-7HXUCZ	Standard	Direct Linear Ambient Luminaires	1	12	35/**40**/50K	12	1648
	RP-LBI-G1-3F-12W-XXK-[WC2,W]-[HV,Blank]-[Blank,OCN]-[Blank,BAA]	S-M0PSAV	Standard	Direct Linear Ambient Luminaires	1	12	**27**/30/35K	12	1554
	RP-LBI-G1-3F-15W-XXK-[WC,W]-[HV,Blank]-[Blank,OCN]-[Blank,BAA]	S-B34TUJ	Standard	Direct Linear Ambient Luminaires	1	15	35/**40**/50K	15	1961
	RP-LBI-G1-3F-15W-XXK-[WC2,W]-[HV,Blank]-[Blank,OCN]-[Blank,BAA]	S-BVPFAT	Standard	Direct Linear Ambient Luminaires	1	15	**27**/30/35K	15	1842
4FT	RP-LBI-G1-4F-10W-XXK-[WC,W]-[HV,blank]-[Blank,OCN]-[BAA,Blank]-2xYYY	S-12GC94	Standard	Retrofit Kits for Direct Linear Ambient Luminaires	2	10	35/**40**/50K	20	2527
	RP-LBI-G1-4F-10W-XXK-[WC,W]-[HV,blank]-[Blank,OCN]-[BAA,Blank]-3xYYY	S-QOGLP6	Standard	Retrofit Kits for Direct Linear Ambient Luminaires	3	10	35/**40**/50K	30	3758
	RP-LBI-G1-4F-10W-XXK-[WC,W]-[HV,Blank]-[Blank,OCN]-[Blank,BAA]	S-4J238A	Standard	Direct Linear Ambient Luminaires	1	10	35/**40**/50K	10	1344
	RP-LBI-G1-4F-10W-XXK-[WC2,W]-[HV,blank]-[Blank,OCN]-[BAA,Blank]-2xYYY	S-U5M1ES	Standard	Retrofit Kits for Direct Linear Ambient Luminaires	2	10	**27**/30/35K	20	2514
	RP-LBI-G1-4F-10W-XXK-[WC2,W]-[HV,blank]-[Blank,OCN]-[BAA,Blank]-3xYYY	S-5H1OJ6	Standard	Retrofit Kits for Direct Linear Ambient Luminaires	3	10	**27**/30/35K	30	3692
	RP-LBI-G1-4F-10W-XXK-[WC2,W]-[HV,Blank]-[Blank,OCN]-[Blank,BAA]	S-WBXZKE	Standard	Direct Linear Ambient Luminaires	1	10	**27**/30/35K	10	1198
	RP-LBI-G1-4F-15W-XXK-[WC,W]-[HV,blank]-[Blank,OCN]-[BAA,Blank]-2xYYY	S-729LG8	Standard	Retrofit Kits for Direct Linear Ambient Luminaires	2	15	35/**40**/50K	30	3762
	RP-LBI-G1-4F-15W-XXK-[WC,W]-[HV,blank]-[Blank,OCN]-[BAA,Blank]-3xYYY	S-6HZX92	Standard	Retrofit Kits for Direct Linear Ambient Luminaires	3	15	35/**40**/50K	45	5693
	RP-LBI-G1-4F-15W-XXK-[WC,W]-[HV,Blank]-[Blank,OCN]-[Blank,BAA]	S-F0N516	Standard	Direct Linear Ambient Luminaires	1	15	35/**40**/50K	15	2255
	RP-LBI-G1-4F-15W-XXK-[WC2,W]-[HV,blank]-[Blank,OCN]-[BAA,Blank]-2xYYY	S-2NIW3X	Standard	Retrofit Kits for Direct Linear Ambient Luminaires	2	15	**27**/30/35K	30	3638
	RP-LBI-G1-4F-15W-XXK-[WC2,W]-[HV,blank]-[Blank,OCN]-[BAA,Blank]-3xYYY	S-IN462Q	Standard	Retrofit Kits for Direct Linear Ambient Luminaires	3	15	**27**/30/35K	45	5631
	RP-LBI-G1-4F-15W-XXK-[WC2,W]-[HV,Blank]-[Blank,OCN]-[Blank,BAA]	S-1IZWG9	Standard	Direct Linear Ambient Luminaires	1	15	**27**/30/35K	15	2093
	RP-LBI-G1-4F-25W-XXK-[WC,W]-[HV,blank]-[Blank,OCN]-[BAA,Blank]-2xYYY	S-86BDPE	Standard	Retrofit Kits for Direct Linear Ambient Luminaires	2	25	35/**40**/50K	50	6197
	RP-LBI-G1-4F-25W-XXK-[WC,W]-[HV,blank]-[Blank,OCN]-[BAA,Blank]-3xYYY	S-A3LPKC	Standard	Retrofit Kits for Direct Linear Ambient Luminaires	3	25	35/**40**/50K	75	9292
	RP-LBI-G1-4F-25W-XXK-[WC,W]-[HV,Blank]-[Blank,OCN]-[Blank,BAA]	S-41DOBN	Standard	Direct Linear Ambient Luminaires	1	25	35/**40**/50K	25	3166
	RP-LBI-G1-4F-25W-XXK-[WC2,W]-[HV,blank]-[Blank,OCN]-[BAA,Blank]-2xYYY	S-AIYC2J	Standard	Retrofit Kits for Direct Linear Ambient Luminaires	2	25	**27**/30/35K	50	5988
	RP-LBI-G1-4F-25W-XXK-[WC2,W]-[HV,blank]-[Blank,OCN]-[BAA,Blank]-3xYYY	S-6TPCOV	Standard	Retrofit Kits for Direct Linear Ambient Luminaires	3	25	**27**/30/35K	75	9046
	RP-LBI-G1-4F-25W-XXK-[WC2,W]-[HV,Blank]-[Blank,OCN]-[Blank,BAA]	S-PACK0N	Standard	Direct Linear Ambient Luminaires	1	25	**27**/30/35K	25	2989

LOW-BAY

	PART #	DLC CODE	STANDARD/ PREMIUM	PRIMARY USE	# OF BARS	WATTAGE PER BAR	COLOR TEMP	TOTAL WATTAGE	TOTAL LUMENS
4FT	RP-LBI-G1-4F-10W-XXK-[WC,W]-[HV,blank]-[Blank,OCN]-[BAA,Blank]-2xYYY	S-1QKFA4	Standard	Low-Bay Luminaires for Commercial and Industrial Buildings	2	10	35/**40**/50K	20	2524
	RP-LBI-G1-4F-10W-XXK-[WC2,W]-[HV,blank]-[Blank,OCN]-[BAA,Blank]-2xYYY	S-UYKDGP	Standard	Low-Bay Luminaires for Commercial and Industrial Buildings	2	10	**27**/30/35K	20	2517
	RP-LBI-G1-4F-15W-XXK-[WC,W]-[HV,blank]-[Blank,OCN]-[BAA,Blank]-2xYYY	S-T0UZXD	Standard	Low-Bay Luminaires for Commercial and Industrial Buildings	2	15	35/**40**/50K	30	3758
	RP-LBI-G1-4F-15W-XXK-[WC2,W]-[HV,blank]-[Blank,OCN]-[BAA,Blank]-2xYYY	S-VXSNZ8	Standard	Low-Bay Luminaires for Commercial and Industrial Buildings	2	15	**27**/30/35K	30	3657
	RP-LBI-G1-4F-25W-XXK-[WC,W]-[HV,blank]-[Blank,OCN]-[BAA,Blank]-2xYYY	S-94HDWX	Standard	Low-Bay Luminaires for Commercial and Industrial Buildings	2	25	35/**40**/50K	50	6216
	RP-LBI-G1-4F-25W-XXK-[WC2,W]-[HV,blank]-[Blank,OCN]-[BAA,Blank]-2xYYY	S-XDOL53	Standard	Low-Bay Luminaires for Commercial and Industrial Buildings	2	25	**27**/30/35K	50	6005

RemPhos | DLC INFORMATION

HIGH-BAY

	PART #	DLC CODE	STANDARD/ PREMIUM	PRIMARY USE	# OF BARS	WATTAGE PER BAR	COLOR TEMP	TOTAL WATTAGE	TOTAL LUMENS
4FT	RP-LBI-G1-4F-10W-XXK-[WC,W]-[HV,blank]-[Blank,OCN]-[BAA,Blank]-3xYYY	S-ESC4J9	Standard	High-Bay Luminaires for Commercial and Industrial Buildings	3	10	35/**40**/50K	30	3770
	RP-LBI-G1-4F-10W-XXK-[WC2,W]-[HV,blank]-[Blank,OCN]-[BAA,Blank]-3xYYY	S-ISYDE5	Standard	High-Bay Luminaires for Commercial and Industrial Buildings	3	10	**27**/30/35K	30	3673
	RP-LBI-G1-4F-15W-XXK-[WC,W]-[HV,blank]-[Blank,OCN]-[BAA,Blank]-3xYYY	S-H9MO37	Standard	High-Bay Luminaires for Commercial and Industrial Buildings	3	15	35/**40**/50K	45	5695
	RP-LBI-G1-4F-15W-XXK-[WC2,W]-[HV,blank]-[Blank,OCN]-[BAA,Blank]-3xYYY	S-0CUKAJ	Standard	High-Bay Luminaires for Commercial and Industrial Buildings	3	15	**27**/30/35K	45	5660
	RP-LBI-G1-4F-25W-XXK-[WC,W]-[HV,blank]-[Blank,OCN]-[BAA,Blank]-3xYYY	S-8XVKZO	Standard	High-Bay Luminaires for Commercial and Industrial Buildings	3	25	35/**40**/50K	75	9300
	RP-LBI-G1-4F-25W-XXK-[WC2,W]-[HV,blank]-[Blank,OCN]-[BAA,Blank]-3xYYY	S-UGMZ8Q	Standard	High-Bay Luminaires for Commercial and Industrial Buildings	3	25	**27**/30/35K	75	9149

LOW OUTPUT

	PART #	DLC CODE	STANDARD/ PREMIUM	PRIMARY USE	# OF BARS	WATTAGE PER BAR	COLOR TEMP	TOTAL WATTAGE	TOTAL LUMENS
2FT	RP-LBI-G1-2F-6W-XXK-[WC,W]-[HV,Blank]-[Blank,OCN]-[Blank,BAA]	S-ZW28LU	Premium	Stairwell and Passageway Luminaires	1	6	35/**40**/50K	6	706
	RP-LBI-G1-2F-9W-XXK-[WC,W]-[HV,Blank]-[Blank,OCN]-[Blank,BAA]	S-9GJMU6	Premium	Stairwell and Passageway Luminaires	1	9	35/**40**/50K	9	1062
	RP-LBI-G1-2F-12W-XXK-[WC,W]-[HV,Blank]-[Blank,OCN]-[Blank,BAA]	S-JZTE4V	Premium	Stairwell and Passageway Luminaires	1	12	35/**40**/50K	12	1062
3FT	RP-LBI-G1-3F-10W-XXK-[WC,W]-[HV,Blank]-[Blank,OCN]-[Blank,BAA]	S-UJEG4S	Premium	Stairwell and Passageway Luminaires	1	10	35/**40**/50K	10	1335
	RP-LBI-G1-3F-10W-XXK-[WC2,W]-[HV,Blank]-[Blank,OCN]-[Blank,BAA]	S-7ZCIT5	Premium	Stairwell and Passageway Luminaires	1	10	**27**/30/35K	10	1267
	RP-LBI-G1-3F-12W-XXK-[WC,W]-[HV,Blank]-[Blank,OCN]-[Blank,BAA]	S-RBOCMU	Premium	Stairwell and Passageway Luminaires	1	12	35/**40**/50K	12	1648
	RP-LBI-G1-3F-12W-XXK-[WC2,W]-[HV,Blank]-[Blank,OCN]-[Blank,BAA]	S-YZBHXC	Premium	Stairwell and Passageway Luminaires	1	12	**27**/30/35K	12	1554
	RP-LBI-G1-3F-15W-XXK-[WC,W]-[HV,Blank]-[Blank,OCN]-[Blank,BAA]	S-KIJ4BH	Premium	Stairwell and Passageway Luminaires	1	15	35/**40**/50K	15	1961
	RP-LBI-G1-3F-15W-XXK-[WC2,W]-[HV,Blank]-[Blank,OCN]-[Blank,BAA]	S-OYXUA6	Premium	Stairwell and Passageway Luminaires	1	15	**27**/30/35K	15	1842
4FT	RP-LBI-G1-4F-10W-XXK-[WC,W]-[HV,Blank]-[Blank,OCN]-[Blank,BAA]	S-YSKB98	Premium	Stairwell and Passageway Luminaires	1	10	35/**40**/50K	10	1344
	RP-LBI-G1-4F-10W-XXK-[WC2,W]-[HV,Blank]-[Blank,OCN]-[Blank,BAA]	S-ZD1UMN	Premium	Stairwell and Passageway Luminaires	1	10	**27**/30/35K	10	1198
	RP-LBI-G1-4F-15W-XXK-[WC,W]-[HV,Blank]-[Blank,OCN]-[Blank,BAA]	S-HFJ9E4	Premium	Stairwell and Passageway Luminaires	1	15	35/**40**/50K	15	2255
	RP-LBI-G1-4F-15W-XXK-[WC2,W]-[HV,Blank]-[Blank,OCN]-[Blank,BAA]	S-YEJMDB	Premium	Stairwell and Passageway Luminaires	1	15	**27**/30/35K	15	2093
	RP-LBI-G1-4F-25W-XXK-[WC,W]-[HV,Blank]-[Blank,OCN]-[Blank,BAA]	S-S0ODEU	Premium	Stairwell and Passageway Luminaires	1	25	35/**40**/50K	25	3166
	RP-LBI-G1-4F-25W-XXK-[WC2,W]-[HV,Blank]-[Blank,OCN]-[Blank,BAA]	S-VXWUK0	Premium	Stairwell and Passageway Luminaires	1	25	**27**/30/35K	25	2989

LINKING QTY

	120V	208V	240V	277V
4FT	33 BARS	40 BARS	40 BARS	40 BARS
3FT	40 BARS	40 BARS	40 BARS	40 BARS
2FT	40 BARS	40 BARS	40 BARS	40 BARS

LINKING POSSIBILITIES

- Linking cables will lower connectable quantities.
- The Linking numbers are based on using the LBI Junction box and connected end to end.
- Linking does not include 0-10V linked control. This will depend on the controlling device.

To order for continuous runs, please order "1 Bar Kits" + required accessory connectors (sold separately).
Connect up to 40 light bars on one incoming power cable. (Check linking chart for voltage specific linking quantity)

DEFAULT OCC SENSOR SETTINGS

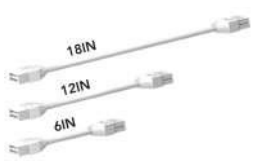
SENSITIVITY	DAYLIGHT SENSOR	HOLD TIME	TWILIGHT TIME	TWILIGHT LEVEL
100%	DISABLED	5 MIN	+ ∞	30%

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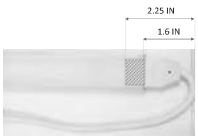
RemPhos | ACCESSORIES



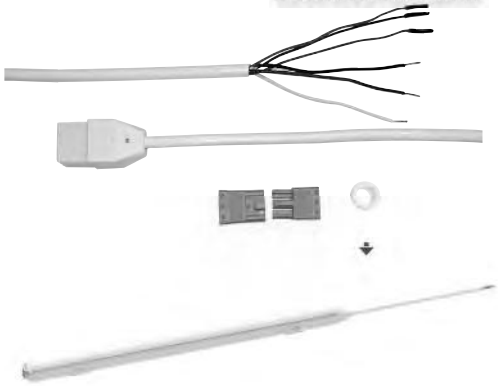
LINKING CABLES | RP-LBI-LC-6IN-DIM-10P
RP-LBI-LC-6IN-NODIM-10P

RP-LBI-LC-12IN-DIM-10P
RP-LBI-LC-12IN-NODIM-10P

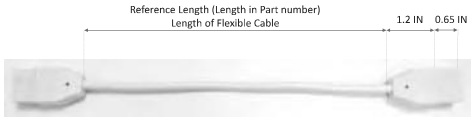
RP-LBI-LC-18IN-DIM-10P
RP-LBI-LC-18IN-NODIM-10P



INCOMING POWER KIT: RP-LBI-G1-IP-3F-DIM



CABLE DIMENSIONS
7.25mm - 0.28 Inch for DIM cable.
6.35mm - .25 inch for NO-DIM cables



DIM



SEAMLESS CONNECTOR | RP-LBI-SSC-DIM-10P
RP-LBI-SSC-NODIM-10P

NO-DIM



LINKING CABLES & SEAMLESS CONNECTORS
Use Linking Cables and Seamless Connectors to easily connect the power and control wires from one light bar to another. The **…-DIM** version of the linking cables and seamless connector link all connections (AC power; 12V Aux power; 0-10V DIM signal) from light bar to light bar. Use these items to control all light bars from one sensor or incoming cable connection. The **…-NODIM** version of these items only links the AC power. Use these items to AC power all light bars with a single power feed; but separate control signals into individual groups.



4.7IN SPACER CONNECTOR | RP-LBI-SRC-4.7IN (SINGLE PACK)
Use the 4.7in Spacer Connector to bring the length of the bar system to a standard dimension (24in, 36in, 48in). This is useful when retrofitting linear fixtures of a standard length. It allows for the bar to be centered on each standard-length fixture. Each 4.7in spacer connector comes with (2) Seamless Connector-DIM.
***Note: spacer does not emit light**



SENSOR KITS | RP-LBI-OC2-A **(STANDARD RANGE - SINGLE PACK)**
RP-LBI-OC3-A_LR **(LIMITED RANGE - SINGLE PACK)**
Sensors kits for LBI are Tri-Level, remote controllable high frequency radar sensor designed to easily integrate with the LBI bars. It is totally plug&play! It can dim the light bars down to conserve more energy from both motion and daylight. The sensor controls the 0-10V DIM signal in both directions from the Sensor unit. Each sensor kit comes with (1) sensor (4.7 inch); (1) surface mount magnetic clip; (2) Seamless Connector-DIM; (1) 12" Linking Cable-DIM. See **RP-LBI-OC2-A/OC3-A** data sheet for more details.



SURFACE MOUNT MAGNETIC CLIP | RP-LBI-SMM-10P (10 PACK ONLY)
The Surface Mount Magnetic Clip provides the most universal method for attaching the light bar to a wall, ceiling, or fixture to be retrofitted. The mounting tabs that extend perpendicularly from the light bar can be easily removed by bending and breaking on the pre-scored line. The strong rare-earth magnets are intended to hold light bars in place while installing mechanical fasteners. Not intended for permanent installation with magnets only.
Two of these clips are included in each light bar kit.



SUSPENDED IN-LINE KIT | RP-LBI-SIL-KIT-10P (10 PACK ONLY)
The Suspended In-Line Kit includes everything needed to suspend LBI from the ceiling.
The complete kit includes: Suspended In-Line Bracket, Aircraft Cable (9.8ft), Adjustable cable gripper, and a ceiling anchor.



SUSPENDED IN-LINE BRACKET (*BRACKET ONLY*) | RP-LBI-SIL-BRACKET-10P (10 PACK ONLY)
The Suspended In-Line Bracket (bracket only) is a wide clip that fastens over the junction between 2 LBI light bars to keep them straight in-line and provides mounting points for common suspension methods (air craft cable, drop chain, etc.) This part number is for the bracket only.

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RemPhos | ACCESSORIES



T-BAR CLIPS | RP-LBI-T1516-10P **(PARALLEL – DIRECTLY UNDER THE T-BAR – 10 PACK)**
RP-LBI-T1516-90-10P **(PERPENDICULAR – ACROSS THE BAR – 10 PACK)**
The T-Bar Clips is the fastest way to mount a light bar to a T-Bar grid ceiling. Works with standard 15/16" grid only.





BLADE CLIP | RP-LBI-BLC-10P **(10 PACK ONLY)**
The Blade Clip is designed to provide a retrofit solution for fixtures that have thin sheet metal or plastic film reflectors commonly found on high bay fixtures. The rotating mounting blade provides a degree of freedom to align the mounting holes on the blade with fastening locations that may not be in-line with the light bar or where the distance between available mounting points is greater than the length of the light bar. It is common to attach the blade to the same point holding the thin reflector to the fixture frame.



UP DOWN CLIP | RP-LBI-UDC-10P **(10 PACK ONLY)**
Use the Up/Down clip with our suspended in-line kit to clip a shorter bar to provide up-light. For example if suspending a 4ft, use the 3ft OR 2ft as the up-light, (so there is room for the suspension-kit connection). The RP-LBI-SIL-KIT comes with wire clips to hold linking power cable for UP bars in-line and neat. (linking cable not included)



LBI JUNCTION BOX | RP-LBI-JBOX-1.5X4
The LBI junction box is used to connect LBI wiring to branch circuits. Connections are made from the LBI Junction box to the Light Bar using seamless connector or linking cable. The internal wiring (except optional switch) are rated to 600V (for 347V operation) For undercabinet or task lighting, the junction box includes an optional 120V ON/OFF switch that can be installed into a rectangular knock-out on the cover. Kit includes 1pc RP-LBI-SSC-DIM.





12FT 90-DEGREE INCOMING POWER CABLE | RP-LBI-G1-IP-90DEG-12F-DIM
Use the 90 degree Incoming Power Cable for an easy and clean connection to suspended LBI fixtures.



OUTPUT CAP | RP-LBI-G2-OUTPUT-CAP-10P
Male power and control termination plug for the LBI linking connector 10 pack.



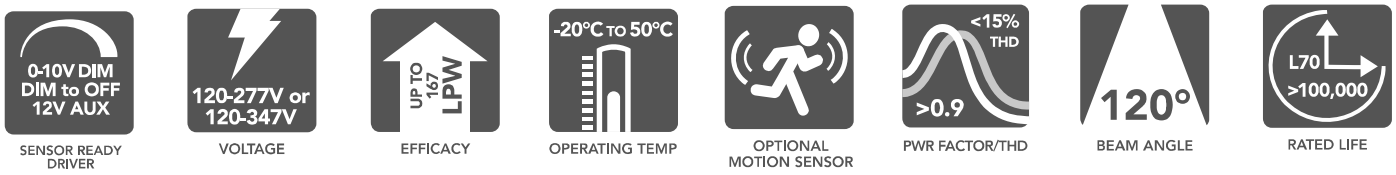
45 DEGREE BRACKET | RP-LBI-45DEG
45 degree bracket for cove lighting or displays. Works with included LBI mounting clips.



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RP-LBE-G2 RETROFIT FOR LINEAR FLUORESCENT LUMINAIRES



the ultimate LED retrofit kit

RemPhos' LBE (LEDBARKIT External-Drive) universal retrofit kit for linear fluorescent luminaires is the perfect retrofit solution. Delivers better long-term reliability, longer life (10yr warranty), controllability (standard 0-10V dimmable; Dim-to-Off; 12V Aux Standard) and faster paybacks (since Utility incentives are typically higher), when compared to LED tubes. Designed to easily fit into existing T5/T8/T12 linear fluorescent fixtures. Fast, one-person installation.



SIMPLE INSTALLATION

Convert existing fixtures fast with magnets on the back of the light bars that allow hands-free placement (self-drilling screws are pre-captivated on each magnetic bracket for fast & secure install). Electrical quick connects for simple, error-free power connections.

FITS BETWEEN THE SOCKETS

No need to remove existing T5/T8/T12 sockets. The LEDBAR is sized to fit in between the existing sockets, further reducing install time.

MAXIMUM VERSATILITY

Standard lengths along with multiple lamp/driver combinations (1L,2L,3L,4L) provides a fit for any application.

MANY LIGHT OUTPUT CHOICES flexWATT

Systems available from 6W (800LM) all the way to 80W (13,000LM). Standard 10V drivers now include FlexWatt that allows you to chose the exact lumen/wattage package needed. See ordering guide for available lumen packages.

STANDARD 10V DIMMABLE DRIVER W/ 12V AUX; DIM TO OFF

SUITABLE FOR DRY & DAMP LOCATIONS

UL 1598C CLASSIFIED RETROFIT KIT LISTED & PERFORMANCE QPL LISTED

10 YEAR WARRANTY, L70 >100,000HRS

CUSTOM BRACKET DESIGNS AVAILABLE

Stream line your retrofit project with custom profesional brackets to reduce install time and variation of install

CONTROLS/MOTION SENSORS (OPTIONAL)

Contact our engineering team to help choose the best sensor/ control for your application.

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RP-LBE-G2 RETROFIT FOR LINEAR FLUORESCENT LUMINAIRES

NEW WITH THE LBE-G2

	RemPhos LBE G2	RemPhos LBE G1	Competitor
PERFORMANCE			
Higher output option to match T5HO	√	X	√
8W option to replace T8 32W FL	√	X	X
FlexWatt driver standard	√	X	X
Dim-to-off driver standard	√	X	X
2-switch step-dim driver option	√	X	X
1-switch step-dim driver option	√	X	√
Compatibility with low cost 12V DC controls	√	X	X
Optional FlexColor adjustable CCT light bars	√	X	X
DLC Premium at 130-150LPW	√	√	√
Low cost emergency battery backup	√	X	√
CONSTRUCTION			
Metal case LED driver	√	X	X (plastic)
Aluminum heatsink for thermal dissipation of LEDs	√	√	X (plastic)
Removable, adjustable metal magnetic brackets	√	X	X (plastic)
Pre-captured self-drilling screws on brackets	√	X	X
Various "custom-shop" brackets available	√	X	X
RELIABILITY			
10-year warranty	√	√	√
100,000hr L70 LED lifetime	√	√	X (70,000hr)
OTHER			
BAA Assembly option	√ (Middleton, MA)	√ (Middleton, MA)	X (TAA)
Local USA factory support for changes to schedule	√	√	X

HIGHER OUTPUT TO MATCH T5HO

Previous generation could only be powered up to 20W for the 4ft bar. G2 can be powered at up to 25W for the 4ft bar to match the foot candles of a T5HO FL lamp. All light bars are over 150LPW, with AC wall efficiencies including the driver from 130-145LPW.

SINGLE CCT AVAILABLE

4FT: 25W Max, 3FT: 12W Max, 2FT: 12W Max, 1FT: 8W Max

FLEXWATT STANDARD

Each driver has 4 adjustable wattage choices. With FlexWatt, there are now significantly more wattage choices to allow you to select exactly what lumen/wattage package is needed to maximize energy savings.

DIM-TO-OFF SENSOR READY DRIVERS STANDARD

12V auxiliary power and 10V dimming wires are standard in every kit. Allows for easy interface with dimming switches and control systems.

VARIOUS CONTINUOUS AND STEP-DIM DRIVER OPTIONS.

We want to help you choose the lowest cost, easiest to implement method to dim our retrofit kits. While low voltage 10V dimming is a great approach, often it requires running new wiring. Therefore, we have line voltage phase dimming driver options, 2-switch step-dim driver options (to work with existing inbound/outbound wall switches), and 1-switch step-dim driver options (using 1 existing wall switch change brightness between pre-selected levels of 50%/100% for example).

LESS WATTS TO REPLACE YOUR FLUORESCENT LAMPS

Previously G1 was 10W to replace 32W T8 FL, now with G2 10W or even 8W can be used for deeper energy savings. ordering guide for available systems.

METAL, LINEAR BALLAST SHAPED LED DRIVERS

Previous G1 were plastic cases. New G2 are rigid metal cases, rugged and easy to mount. Thinner height to fit into even the most compact existing ballast compartments..

REMOVABLE, ADJUSTABLE METAL MAGNETIC MOUNTING BRACKETS

Previous G1 had plastic end caps which accepted self-drilling screws and fixed magnets. G2 has an innovative bracket that can be slid anywhere on the bar, so that the screws can be mounted in various places depending on what is fastest/easiest for the install.

LOWER COST EMERGENCY BATTERY BACKUP

VARIOUS BRACKETS AVAILABLE FROM OUR "CUSTOM-SHOP"

Have a direct/indirect pendant hungfixture and want a fast way to mount bars pointing up and down? No problem, we have asolution. Have a wide-body vapor tight where you want 6 bars mounted together along with amotion sensor on a single pan? No problem, we have a solution. Let our engineers help design abracket/mounting system that makes installation faster and easier for you.

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DIMMING OPTIONS

10V – Standard driver is controlled with 0-10V wall dimmer or 0-10V advanced control system. (Standard driver has Aux power [12V – 50mA]; Dim-to-Off)

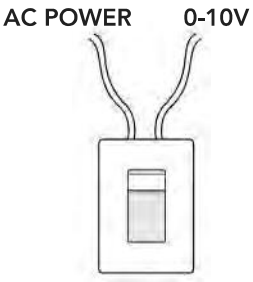
LVD – 120-277V TRIAC / AC Phase cut dimming (Driver) – Traditional AC modulated dimming. Compatible with forward or reverse phase cut dimming. CFL/LED compatible dimmer required.

1STEP – Single Switch Step-Dimming (Module to be used with LBE 10V kits) Quick flip [ON-OFF-ON] to toggle between step dimming. [30% - 60% - 100%]

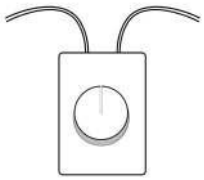
2STEP – Double Switch Step-Dimming (Driver) Use 2 switches to control dimming steps in logical way. Designed to retrofit fluorescent in-board / out-board set-up. [30% - 60% - 100%]

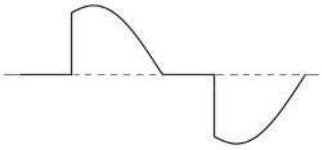
DIMMING EXPANDED

10V
(STANDARD DRIVER) → **0-10V DIM**
(Dim-to-off)
(Aux 12V; mA)
(0-10V use with wall dimmer or 0-10V Advanced Control)



LVD
(OPTIONAL DRIVER) → **120-277V TRIAC (PHASE CUT)**
(CFL/LED Compatible dimmer required)

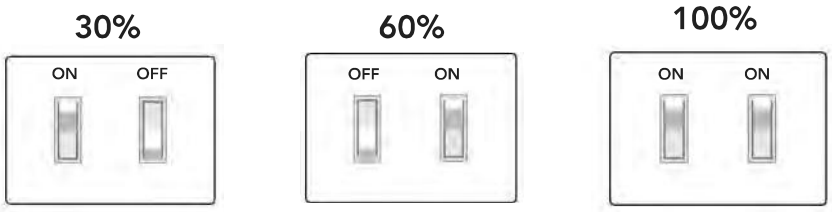




1STEP
(OPTIONAL CONTROL MODULE) → **SINGLE SWITCH STEP DIM MODULE**
(Use w/ standard LBE crontol ready driver)
Quick flip [ON-OFF-ON] to toggle between step dimming. [30% - 60% - 100%]



2STEP
(OPTIONAL DRIVER) → **2 SWITCH**
(Fluorescent in-board / out-board retrofit)



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RP-LBE-G2 RETROFIT FOR LINEAR FLUORESCENT LUMINAIRES

OPTIONAL MOUNTING BRACKETS - ORDERED SEPARATELY (SOLD IN PACKS OF 10)

Used when mounting to an uneven fixture surface or to match heights to driver channel when de-lamping

SHORT BRIDGE

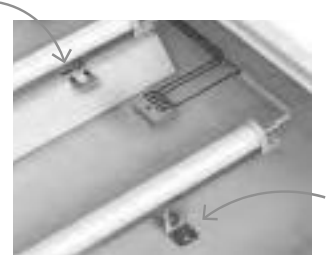


RP-LBE-G1-SHORTBRIDGE-10P

TALL BRIDGE



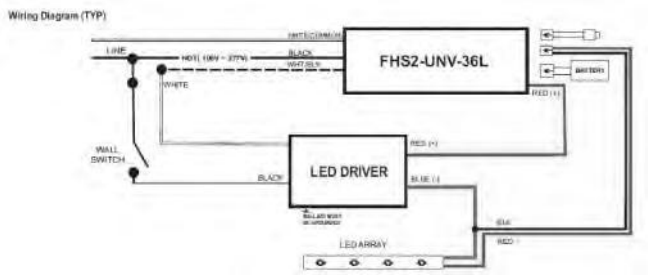
RP-LBE-G1-TALLBRIDGE-10P



OPTIONAL EMERGENCY BACKUP

A simple, effective solution when battery backup functionality is required. 500 lumen, 90-minute standard; specify EMG suffix in part number.
Contact us for other backup times and lumen packages.





KEY PRODUCT INFORMATION

- SIMPLE INSTALLATION
- FITS BETWEEN THE SOCKETS
- MAXIMUM VERSATILITY
- MANY LIGHT OUTPUT CHOICES
- CONTOL READY 10V DIMMABLE DRIVER
- SUITABLE FOR DRY & DAMP LOCATIONS
- UL 1598C CLASSIFIED RETROFIT KIT LISTED & PERFORMANCE QPL LISTED
- 10 YEAR WARRANTY, L70 >100,000HRS
- OPTIONAL "BAA" (ARRA SECTION 1605) BUY AMERICA ACT
- CUSTOM RETROFIT SOLUTIONS AVAILABLE
- OPTIONAL MOTION SENSOR/CONTROL READY

Intertek

HOW TO EASILY ADD OCCUPANCY SENSING AND DAYLIGHT CONTROL TO YOUR FIXTURE

Choose one of the control options below which best fits your needs. Any of these options can be easily installed under the existing glass or plastic fixture lens. These controls will allow the LED Barkit to adjust it's light level depending on occupancy or daylight levels, acheiving greater energy savings.

	PART #	DETAILS
	HNS 111	Remote mounted antenna can be screwed to outside of ballast cover. Can be mounted behind glass or plastic lens. Adjusts for occupancy and daylight. Optional remote control to adjust settings.

ADVANCED WIRELESS CONTROL



We partner with Magnum, avi-on, Philips, Lutron and other intelligent wireless lighting control systems. Allows for occupancy sensing, daylight harvesting, grouping, scheduling, high-end trim and more. Adjust settings via iPhone/Android apps. Contact us for

CONTACT US FOR ORDERING CODES

*If satisfied with LBE default settings, remote control is not needed.
If settings need to be changed, optional remote control (IR12), is required.

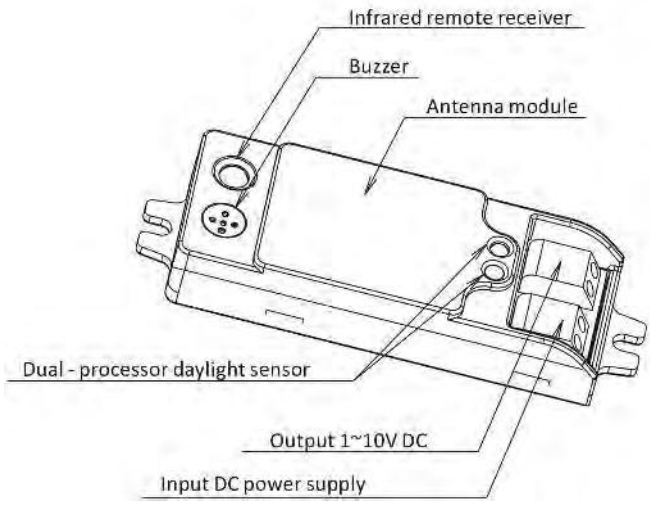
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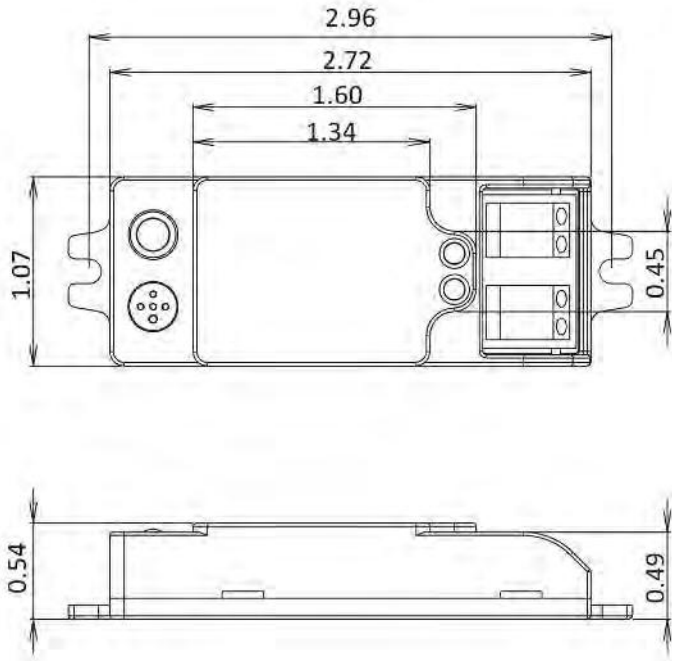
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SENSOR OPTIONS: OCC / OCCLR

-OCC Standard high/low motion sensor
-Remote IR12

-OCCLR Limited range high/low motion sensor
-Remote IR12

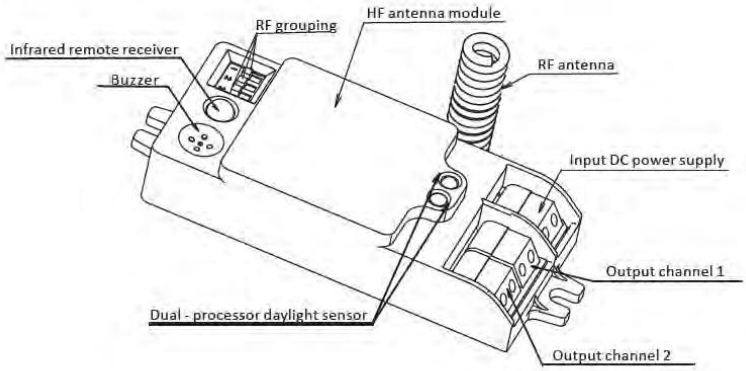


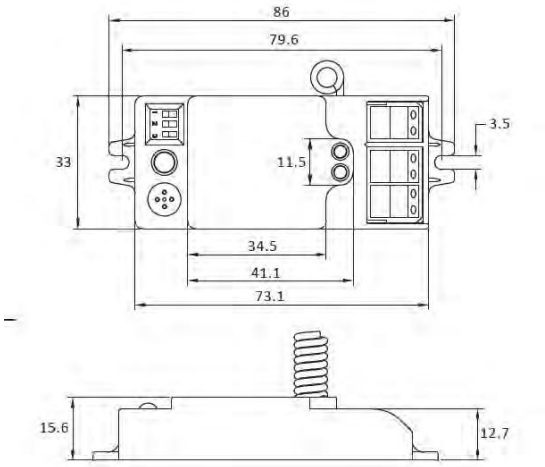


- occupancy sensor w/ daylight hold-off
- powered by 12V DC LED driver from fixture - provided by the LED power supply
- high frequency radar occupancy sensor
- infared remote control available (sold separately)
- uses less than 0.1W in standby mode

SENSOR OPTIONS: OCCRF (SIMPLE GROUPING SENSOR)

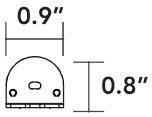
-OCCRF Simple grouping high/low motion sensor
-Remote IR13



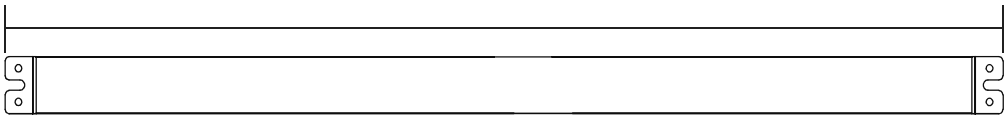


- simple grouping motion sensor w/ daylight hold-off
- powered by 12V DC - provided by the LED power supply
- max 150 ft grouping range
- ideal for stairways, parking garages and hallways
- grouping by remote or dip switch (infared remote control sold separately)
- uses less than 0.1W in standby mode

LED BAR DIMENSIONS



OVERALL LENGTH
1FT = 10.2”
2FT = 21.65”
3FT = 34.25”
4FT = 44.37”



SPECIFICATION GUIDE

OUTPUT

MODEL	RP-LBE-G2-DRV-12W	RP-LBE-G2-DRV-12W-HV	RP-LBE-G2-DRV-25W	RP-LBE-G2-DRV-25W-HV	RP-LBE-G2-DRV-45W	RP-LBE-G2-DRV-45W-HV	RP-LBE-G2-DRV-80W	RP-LBE-G2-DRV-80W-HV
LED OUTPUT CHANNEL(S)	Single Channel	Single Channel	Single Channel	Single Channel	Single Channel	Single Channel	Single Channel	Single Channel
LED OUTPUT CURRENT - SELECTABLE (MA)	100/150/190/230	100/150/190/230	290/350/390/490	290/350/390/490	580/680/780/880	580/680/780/880	1000/1160/1370/1570	1000/1160/1370/1570
LED DC VOLTAGE RANGE	30-48V	30-48V	30-48V	30-48V	30-48V	30-48V	30-48V	30-48V
RATED POWER (MAX)	12W	12W	25W	25W	45W	45W	80W	80W
AUX VOLTAGE SOURCE	12V/50mA	12V/50mA	12V/50mA	12V/50mA	12V/50mA	12V/50mA	12V/50mA	12V/50mA

INPUT

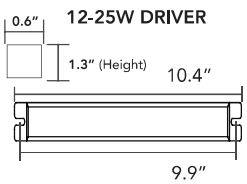
VOLTAGE RANGE	120-277VAC	120-347VAC	120-277VAC	120-347VAC	120-277VAC	120-347VAC	120-277VAC	120-347VAC
FREQUENCY RANGE	50~60HZ							
POWER FACTOR (TYP)	>0.9	>0.9	>0.9	>0.9	>0.9	>0.9	>0.9	>0.9
AC CURRENT (MAX)	0.15A @ 120V	0.15A @ 120V	0.22 @ 120V	0.22 @ 120V	0.38 @ 120V	0.38 @ 120V	0.70 @ 120V	0.70 @ 120V
LEAKAGE CURRENT	<0.75mA	<0.75mA	<0.75mA	<0.75mA	<0.75mA	<0.75mA	<0.75mA	<0.75mA
INRUSH CURRENT	50A @ 277V	50A @ 277V	50A @ 277V	50A @ 277V	50A @ 277V	50A @ 277V	50A @ 277V	50A @ 277V
THD	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20

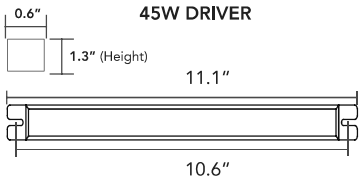
PROTECTION

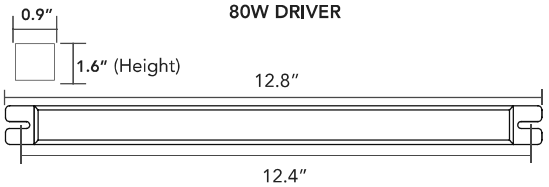
OVER CURRENT	105~125% Protection type: Shut down output voltage
LED SHORT CIRCUIT	A short condition on any of output shall cause no damage to the power supply. The unit shall recover and function automatically as soon as the short condition is removed.
LED OPEN CIRCUIT	An open condition on any of output shall cause no damage to the power supply. The unit shall recover and function automatically as soon as the open condition is removed.
OVER VOLTAGE	105~125% Protection type: Shut down output voltage
SAFTEY	UL8750 CLASS 2 CLASS P

ENVIRONMENT

WORKING TEMP	-20C to 50C
WORKING HUMIDITY	< 90% RH
STORAGE TEMP	-20C to 80C
STORAGE HUMIDITY	< 90% RH
TEMP COEFFICIENT	0.03%/°C (0~40°C)
VIBRATION	10~500Hz, 2G 12Min / 1cycle, period for 72min each along X, Y, Z axes







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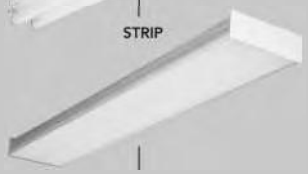
EASILY RETROFIT THESE FIXTURE STYLES, AND MORE!


VAPOR TIGHT

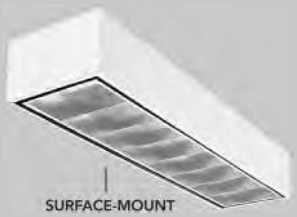

TROFFER


LOW BAY INDUSTRIAL


STRIP


WRAP


DIRECT/INDIRECT


SURFACE-MOUNT

ORDERING DIRECTIONS (SEE ORDERING GUIDE ON NEXT PAGE)

A) Choose your desired total system wattage and lumen output.
B) Choose your desired LEDBAR length (1,2, 3 or 4FT) and QTY of LED-BAR(s) per driver from column C.
D) Order system part # (a system will include 1pc LED driver + LEDBAR(s). Substitute "XX" in the 8XX for your desired CCT. 30 (3000K), 35 (3500K), 40 (4000K) and 50 (5000K) are standard color temps. 27 (2700K), 65 (6500K) are custom colors and are special order.
E) The wattage of each LEDBAR in the system.
F) The lumen output of each LEDBAR in the system.

If the system you want is not currently a listed part #, please contact us for a letter to send to your Utility for custom incentive approval.

CAUTION! MAX WATTAGES PER LEDBAR
1FT: 7.5W 2FT: 12.5W 3FT: 12.5W 4FT: 25W

If you require BAA (ARRA Section 1605) add -AA at end of part number.

For BAA projects, please contact our projects quotations team.

STANDARD COLOR TEMPS AVAILABLE
3000K, 3500K, 4000K, 5000K

SPECIAL ORDER COLOR TEMPS AVAILABLE
2700K, 6500K, RED, GREEN, BLUE, AMBER

ORDERING EXAMPLE
A 20W/2700LM system is desired utilizing 2pcs of 2FT LEDBAR in 4000K running off 1pc of driver. For this system you would order:

SYSTEM: **RP-LBE-G2-20W-2FT-2L-8XX-10V** (All kits include driver)
TOTAL SYSTEM WATTAGE: **20W**
TOTAL SYSTEM LUMEN OUTPUT: **2700LM**
LENGTH OF LED BAR: **2FT** (actual 21.65in)
OF LED BARS: **2pcs**
WATTAGE PER LED BAR: **10W**
LUMENS PER LED BAR: **1350LM**
PERFORMANCE LISTED KIT PART #:**RP-LBE-G2-20W-2FT-2L-8XX-10V**
PERFORMANCE QPL PRODUCT CODE: XXXXXX

PART NUMBER BUILDER

MFR	PRODUCT	GENERATION	WATTAGE	LENGTH	# OF LAMPS	COLOR	DIMMING	OPTIONS
RP	LBE	G2	W		L	8XX		

WATTAGE
- 12W: 6, 8, 10, 12
- 25W: 15, 18, 20, 25
- 45W: 30, 35, 40, 45
- 80W: 50, 60, 70, 80

LENGTH
1FT
2FT
3FT
4FT

 # OF LAMPS
1L
2L
3L
4L

COLOR
8 = 80+ CRI
XX =CCT
30 = 3000K
35 = 3500K
40 = 4000K
50 = 5000K

DIMMING
10V
LVD
1 Step
2 Step

OPTIONS
EMG
HV (120-347V)
AA (ARRA Section 1605)
OCC
OCCLR (Limited Range)
OCCRF

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RP-LBE-G2 RETROFIT FOR LINEAR FLUORESCENT LUMINAIRES

ORDERING GUIDE

	PART #	BARS PER DRIVER	BAR LENGTH	TOTAL LUMENS*	DLC CATEGORY	DLC CODES 3500K	4000K	5000K
6W	RP-LBE-G2-6W-1FT-1L-8XX-10V	1	1FT	930				
	RP-LBE-G2-6W-1FT-2L-8XX-10V	2	1FT	900				
	RP-LBE-G2-6W-2FT-1L-8XX-10V	1	2FT	936	Linear Ambient	PRB3E2VH	PX817GIG	PHGDUW8H
	RP-LBE-G2-6W-3FT-1L-8XX-10V	1	3FT	894	Linear Ambient	P1Q3OPXM	PP924MAB	PBNZQWRK
	RP-LBE-G2-6W-4FT-1L-8XX-10V	1	4FT	756	Linear Ambient	P8R5JB3E	P5QXPXX0	PSW5EGIT
8W	RP-LBE-G2-8W-1FT-1L-8XX-10V	1	1FT	1240				
	RP-LBE-G2-8W-1FT-2L-8XX-10V	2	1FT	1190				
	RP-LBE-G2-8W-2FT-1L-8XX-10V	1	2FT	1288	Linear Ambient	P62A55CE	PVJA0P94	PQE7OFFV
	RP-LBE-G2-8W-3FT-1L-8XX-10V	1	3FT	1264	Linear Ambient	PECHEP2F	PE3U62N3	P52SB5KC
	RP-LBE-G2-8W-4FT-1L-8XX-10V	1	4FT	1232	Linear Ambient	PQV4C8WI	PENZ5M00	PHDXFH50
10W	RP-LBE-G2-10W-1FT-2L-8XX-10V	2	1FT	1550				
	RP-LBE-G2-10W-1FT-3L-8XX-10V	3	1FT	1488				
	RP-LBE-G2-10W-2FT-1L-8XX-10V	1	2FT	1640	Linear Ambient	PAG1QYAT	PS05KCWZ	PON4R76H
	RP-LBE-G2-10W-2FT-2L-8XX-10V	2	2FT	1440				
	RP-LBE-G2-10W-2FT-3L-8XX-10V	3	2FT	1162				
	RP-LBE-G2-10W-3FT-1L-8XX-10V	1	3FT	1640	Linear Ambient	PO7JATAZ	PQSXHIOL	P9Y4IPU5
	RP-LBE-G2-10W-4FT-1L-8XX-10V	1	4FT	1630	Linear Ambient	PUPFZA3E	P7M0BTFL	P1JE9JZ6
12W	RP-LBE-G2-12W-1FT-2L-8XX-10V	2	1FT	1860				
	RP-LBE-G2-12W-1FT-3L-8XX-10V	3	1FT	1786				
	RP-LBE-G2-12W-2FT-1L-8XX-10V	1	2FT	1968	Linear Ambient	PLQ8PMUV	P44M01CD	PJDFP97Z
	RP-LBE-G2-12W-2FT-2L-8XX-10V	2	2FT	1728				
	RP-LBE-G2-12W-2FT-3L-8XX-10V	3	2FT	1728				
	RP-LBE-G2-12W-3FT-1L-8XX-10V	1	3FT	1992	Linear Ambient	POD0UQWQ	P8NS0WEQ	PYMKCGPJ
	RP-LBE-G2-12W-3FT-2L-8XX-10V	2	3FT	1788				
	RP-LBE-G2-12W-4FT-1L-8XX-10V	1	4FT	1956	Linear Ambient	PTM4M6BO	PLLHCS0Y	PZ8N20Q3
	RP-LBE-G2-12W-4FT-2L-8XX-10V	2	4FT	1848				
15W	RP-LBE-G2-15W-1FT-2L-8XX-10V	2	1FT	2325				
	RP-LBE-G2-15W-1FT-3L-8XX-10V	3	1FT	2232				
	RP-LBE-G2-15W-2FT-2L-8XX-10V	2	2FT	2340				
	RP-LBE-G2-15W-2FT-3L-8XX-10V	3	2FT	2160	Troffer	PGFMWM4H	PXBV2E1D	PACQE8VC
	RP-LBE-G2-15W-3FT-1L-8XX-10V	1	3FT	2505	Troffer	PTSOZL8L	PSC036CO	PGQ7VD51
	RP-LBE-G2-15W-3FT-2L-8XX-10V	2	3FT	2370				
	RP-LBE-G2-15W-3FT-3L-8XX-10V	3	3FT	2235				
	RP-LBE-G2-15W-4FT-1L-8XX-10V	1	4FT	2505	Linear Ambient	PFBAB42G	P95LQPN8	P4IB866H
	RP-LBE-G2-15W-4FT-2L-8XX-10V	2	4FT	2310	Troffer	P3TJZNK0	P2HEA375	PPCNUKDM
18W	RP-LBE-G2-18W-1FT-3L-8XX-10V	3	1FT	2790				
	RP-LBE-G2-18W-1FT-4L-8XX-10V	4	1FT	2678				
	RP-LBE-G2-18W-2FT-2L-8XX-10V	2	2FT	2898	Troffer	P2Y1B1X1	PUPC18ML	PB45RQR6
	RP-LBE-G2-18W-2FT-3L-8XX-10V	3	2FT	2592	Troffer	PKPOHC8J	PRJQYIEJ	PQ9SX3X8
	RP-LBE-G2-18W-2FT-4L-8XX-10V	4	2FT	2592				
	RP-LBE-G2-18W-3FT-2L-8XX-10V	2	3FT	2844				
	RP-LBE-G2-18W-3FT-3L-8XX-10V	3	3FT	2682				
	RP-LBE-G2-18W-3FT-4L-8XX-10V	4	3FT	2682				
	RP-LBE-G2-18W-4FT-1L-8XX-10V	1	4FT	3024	Linear Ambient	PAYNDYTS	PHFUO1IL	PEF3GEG2
	RP-LBE-G2-18W-4FT-2L-8XX-10V	2	4FT	2934	Troffer	P2JDXCOG	PC86OTIW	P9JWLLPC
	RP-LBE-G2-18W-4FT-3L-8XX-10V	3	4FT	2772	Troffer	PZCC33MV	PZ35A5M2	PHF5RB7K

*Bar lumens shown

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RP-LBE-G2 RETROFIT FOR LINEAR FLUORESCENT LUMINAIRES

ORDERING GUIDE

	PART #	BARS PER DRIVER	BAR LENGTH	TOTAL LUMENS*	DLC CATEGORY	DLC CODES 3500K	4000K	5000K
20W	RP-LBE-G2-20W-1FT-3L-8XX-10V	3	1FT	3100				
	RP-LBE-G2-20W-1FT-4L-8XX-10V	4	1FT	2976				
	RP-LBE-G2-20W-2FT-2L-8XX-10V	2	2FT	3220	Troffer	PBKQL1GY	PZA4UKKG	PUZ55K88
	RP-LBE-G2-20W-2FT-3L-8XX-10V	3	2FT	2880	Troffer	P8LQ5KD0	PZTA6GYH	PX49U54Z
	RP-LBE-G2-20W-2FT-4L-8XX-10V	4	2FT	2880				
	RP-LBE-G2-20W-3FT-2L-8XX-10V	2	3FT	3280				
	RP-LBE-G2-20W-3FT-3L-8XX-10V	3	3FT	3160				
	RP-LBE-G2-20W-3FT-4L-8XX-10V	4	3FT	3160				
	RP-LBE-G2-20W-4FT-1L-8XX-10V	1	4FT	3360	Linear Ambient	PLYHZD1Z	P3U4EIAF	P8NNERJ7
	RP-LBE-G2-20W-4FT-2L-8XX-10V	2	4FT	3260	Troffer	P9IB4W7O	POK6M2XP	PH9386HN
	RP-LBE-G2-20W-4FT-3L-8XX-10V	3	4FT	3080	Troffer	PLOSOXVE	PL4ZAMLI	PXBW8K6S
25W	RP-LBE-G2-25W-1FT-4L-8XX-10V	4	1FT	3875				
	RP-LBE-G2-25W-2FT-2L-8XX-10V	2	2FT	4100	Troffer	PMDC3DLY	PKL6SFJP	PSQD1UTC
	RP-LBE-G2-25W-2FT-3L-8XX-10V	3	2FT	4025	Troffer	PQUGP3E1	P6RV8JX4	PDPD6MP2
	RP-LBE-G2-25W-2FT-4L-8XX-10V	4	2FT	3900				
	RP-LBE-G2-25W-3FT-3L-8XX-10V	3	3FT	4100				
	RP-LBE-G2-25W-3FT-4L-8XX-10V	4	3FT	3950				
	RP-LBE-G2-25W-4FT-1L-8XX-10V	1	4FT	4175	Linear Ambient	POJBJTPC	PR17YM6C	PW9U36FX
	RP-LBE-G2-25W-4FT-2L-8XX-10V	2	4FT	4175	Troffer	PNVYU5CC	PHS92SIE	PY4COSG4
	RP-LBE-G2-25W-4FT-3L-8XX-10V	3	4FT	3850	Troffer	P3MWG6MS	PSE0GEDN	PA60KY3D
	RP-LBE-G2-25W-4FT-4L-8XX-10V	4	4FT	3850				
30W	RP-LBE-G2-30W-2FT-3L-8XX-10V	3	2FT	4920	Troffer	PM44IVJJ	P3A4HYT7	P5USDXGC
	RP-LBE-G2-30W-2FT-4L-8XX-10V	4	2FT	4830				
	RP-LBE-G2-30W-3FT-3L-8XX-10V	3	3FT	4980				
	RP-LBE-G2-30W-3FT-4L-8XX-10V	4	3FT	4740				
	RP-LBE-G2-30W-4FT-2L-8XX-10V	2	4FT	5040	Troffer	PQI4QKFX	PWS00OZ8	P3RAZEDK
	RP-LBE-G2-30W-4FT-3L-8XX-10V	3	4FT	4890	Troffer	PZ1WEY9T	PC8JJOIQ	PJ0GHEND
	RP-LBE-G2-30W-4FT-4L-8XX-10V	4	4FT	4620	Troffer	P43S4ILF	P4WSD7GG	PBYLVMZ2
35W	RP-LBE-G2-35W-2FT-3L-8XX-10V	3	2FT	5740	Troffer	PE0YFJMK	P00MVBYS	PDT0BYAZ
	RP-LBE-G2-35W-2FT-4L-8XX-10V	4	2FT	5635				
	RP-LBE-G2-35W-3FT-3L-8XX-10V	3	3FT	5810				
	RP-LBE-G2-35W-3FT-4L-8XX-10V	4	3FT	5740				
	RP-LBE-G2-35W-4FT-2L-8XX-10V	2	4FT	5880	Troffer	PCEAYOLH	PHHJJ7Q7	PO5E8UIB
	RP-LBE-G2-35W-4FT-3L-8XX-10V	3	4FT	5705	Troffer	PI206DOG	PA221SYC	PREJ56PF
	RP-LBE-G2-35W-4FT-4L-8XX-10V	4	4FT	5390	Troffer	PRNA6ERF	PHRLQ6NW	PLGQQSHD
40W	RP-LBE-G2-40W-2FT-4L-8XX-10V	4	2FT	6560				
	RP-LBE-G2-40W-3FT-4L-8XX-10V	4	3FT	6560				
	RP-LBE-G2-40W-4FT-2L-8XX-10V	2	4FT	6680	Troffer	PSAJ16B6	PIVVIEP1	PFE9LAKI
	RP-LBE-G2-40W-4FT-3L-8XX-10V	3	4FT	6680	Troffer	PJO5URF7	PNO08S2C	P4LWQKGI
	RP-LBE-G2-40W-4FT-4L-8XX-10V	4	4FT	6520	Troffer	PMUONBP2	P3IMKH82	P5DSYCK7

***Bar lumens shown**

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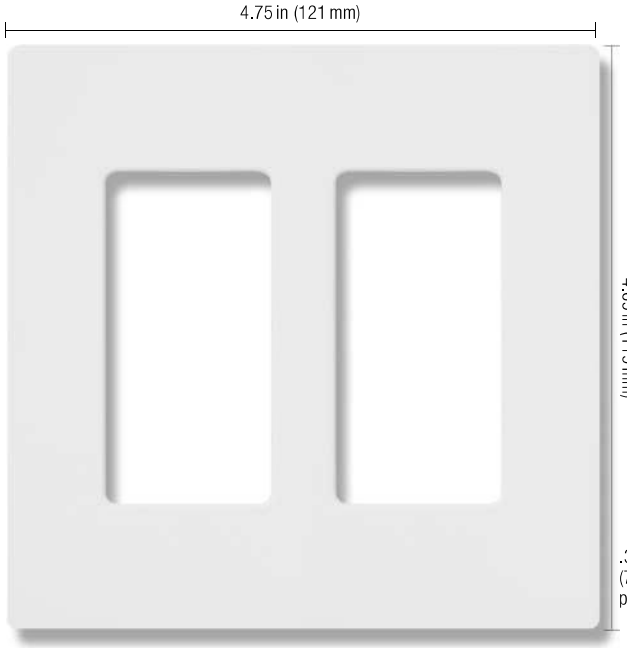
ORDERING GUIDE

	PART #	BARS PER DRIVER	BAR LENGTH	TOTAL LUMENS*	DLC CATEGORY	DLC CODES 3500K	4000K	5000K
45W	RP-LBE-G2-45W-2FT-4L-8XX-10V	4	2FT	7380				
	RP-LBE-G2-45W-3FT-4L-8XX-10V	4	3FT	7470				
	RP-LBE-G2-45W-4FT-2L-8XX-10V	2	4FT	7425	Troffer	P29BQ4XQ	PCGLIANA	P9AGK00M
	RP-LBE-G2-45W-4FT-3L-8XX-10V	3	4FT	7515	Troffer	P8K4KU9Y	P6Y6FQN6	PBM805KP
	RP-LBE-G2-45W-4FT-4L-8XX-10V	4	4FT	7335	Troffer	PZQKU0RR	PH63ZGAD	PRISOQAK
50W	RP-LBE-G2-50W-4FT-2L-8XX-10V	2	4FT	8200				
	RP-LBE-G2-50W-4FT-3L-8XX-10V	3	4FT	8400	Troffer	PSCL7TGG	PK9A6WJM	PGZMX0RE
	RP-LBE-G2-50W-4FT-4L-8XX-10V	4	4FT	8400	Troffer	PXY07A81	P0EJEM2B	P0R8NUEX
60W	RP-LBE-G2-60W-4FT-3L-8XX-10V	3	4FT	10,080	Troffer	PBEJYDS6	PO6P4ODV	P6YFJD6J
	RP-LBE-G2-60W-4FT-4L-8XX-10V	4	4FT	10,080	Troffer	P2EUH4QA	P1AAKG4I	PI5S9LRA
70W	RP-LBE-G2-70W-4FT-3L-8XX-10V	3	4FT	11,690	Troffer	P3HKNSD8	PMA24C2C	PDAXW1RS
	RP-LBE-G2-70W-4FT-4L-8XX-10V	4	4FT	11,760	Troffer	P7LFRT4B	PKSZD1GX	P0R0U83M
80W	RP-LBE-G2-80W-4FT-4L-8XX-10V	4	4FT	13,360	Troffer	PRPYODKD	PPW0IQ1S	PNCRDNHD

*Bar lumens shown

WHY USE THE LBE?

- **More efficient** because the higher efficiency optics, LEDs and drivers we use in these products provide higher lumens per watt and less wattage compared to LED tubes.
- **More reliable** because of the significant amount of aluminum that we use as a heat sink on the back of the LEDBAR to properly dissipate heat and keep the electronics cooler than LED tubes.
- **More universal fit** because our bars are designed to fit in between the sockets of either T5 or T8 fixtures. That means that you can specify a "4ft" LEDBAR for ANY T5 or T8 style fixture whether it be a troffer, a vapor tight, a pendant, a strip etc.
- **Less liability** because you will be getting rid of the old fluorescent tube sockets that often can lead to future issues such as arcing, early failure or even fire, all issues that have occurred in LED tube installations.
- **Better piece of mind** because the LEDBARKIT family comes standard with a 10-year system warranty. For example, something goes wrong with a UL Type A LED tube install, the contractor ends up arguing with the LED tube manufacturer, the ballast manufacturer and the socket manufacturer to see who is at blame. **By purchasing the LEDBARKIT system, RemPhos/Light Efficient Design provides a single, easy point of contact for the system warranty.**



Shown actual size: Maestro dimmers and 2-gang Claro wallplate in White (WH).

Product family features

- Can be used in conjunction with the following dimmer(s), switch(es), sensor(s), and accessories: Caséta Wireless, Diva, Luméa, Maestro, Pico wireless, Skylark, Skylark Contour, Sunnata, Vive Maestro Wireless controls, and Vive accessories
- All Lutron wallplates are screwless, seamless, and have no visible hardware; the front plate securely snaps into the alignment adapter plate
- Full line of wiring devices in Designer style opening
- Blank inserts available for Gloss (DV-BI-) and Satin Colors (SC-BI-)
- Customize your designer wallplate with engraving; visit **lutron.com/engraving** to get started

Ganging and derating

- Designer wallplates use standard ganging
- Requires fins to be removed from dimmers for proper spacing
- May require derating (i.e., reduction of dimmer capacity due to fin removal)

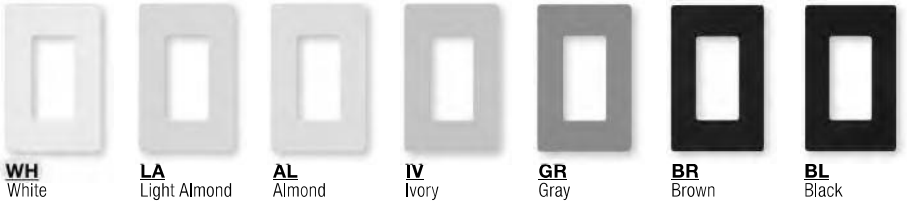
Claro wallplates and accessories

DESIGNER WALLPLATE OPENING

Available finishes

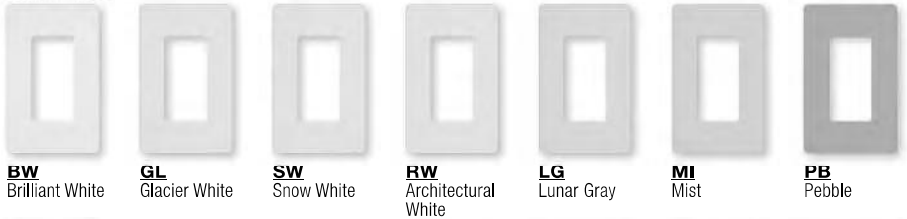
Use **BOLD** color code in model number (Example: SC-1-**PL**)

Gloss



WH White
LA Light Almond
AL Almond
IV Ivory
GR Gray
BR Brown
BL Black

Satin Finishes**



BW Brilliant White
GL Glacier White
SW Snow White
RW Architectural White
LG Lunar Gray
MI Mist
PB Pebble



CS Cobblestone
SL Slate
MN Midnight
BI Biscuit
SD Sand
TP Taupe
PM Pumice

Metal wallplate*

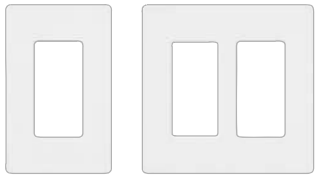


CY Clay
SA Sage
EP Espresso
TF Truffle
DE Deep Sea
SR Signal Red
SS Stainless Steel

* Stainless Steel metal wallplates include black plastic trim/adapter, visible from side. Match with separate Black (BL) or Midnight (MN) controls and accessories.

** Old satin colors are available while supplies last. To view, visit lutron.com/claro

Wallplates for Caséta Wireless, Diva, Luméa, Maestro, Maestro Wireless, Pico wireless, Skylark, Skylark Contour, Sunnata, Vive Maestro Wireless controls, and Vive accessories



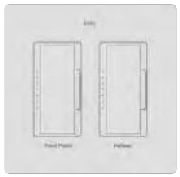
1-gang*,**	CW-1-**XX**[1]
W: 2.94 in (75 mm)	SC-1-**XX**[2]
2-gang*,**	CW-2-**XX**[1]
W: 4.75 in (121 mm)	SC-2-**XX**[2]
3-gang*,**	CW-3-**XX**[1]
W: 6.56 in (167 mm)	SC-3-**XX**[2]
4-gang*,**	CW-4-**XX**[1]
W: 8.37 in (213 mm)	SC-4-**XX**[2]
5-gang*	CW-5-**XX**[1]
W: 10.18 in (259 mm)	SC-5-**XX**[2]
6-gang*	CW-6-**XX**[1]
W: 12in (305mm)	SC-6-**XX**[2]

Important note

Multiple devices with line and low-voltage can be mounted behind a common wallplate using a standard barrier backbox. For more information consult Lutron Application Note #213, Combining Low-Voltage and Line Voltage Wiring Devices in a Multi-Gang Box, at **lutron.com/applicationnotes**.

* Stainless Steel metal wallplates include black plastic trim/adapter, visible from side. Match with separate Black (BL) or Midnight (MN) controls and accessories.

** **Bulk packaging available for Gloss colors. For more information, contact Customer Service at 1.888.LUTRON1.**



Custom engraving available for all Designer, Traditional, New Architectural, and Architectural style wallplates (except Stainless Steel). For wallplate engraving schedules, go to **lutron.com/engraving**.

Cable jacks



- F-style, 75-Ohm coaxial cable
- Wallplate sold separately

Single cable jack	CA-CJ-**XX**[3]
	SC-CJ-**XX**[2]

Telephone jacks



- 6-conductor telephone jack, RJ11
- Wallplate sold separately

Single telephone jack	CA-PJ-**XX**[3]
	SC-PJ-**XX**[2]

XX[1]: Gloss and metal color codes
XX[2]: Available in Snow (SW), Midnight (MN), Taupe (TP), Biscuit (BI), Signal Red (SR), and Mist (MI)
XX[3]: Gloss color codes

6-port frame



- Shipped with six blanks in matching colors
- Connectors sold separately
- Connectors snap in (no tools required)
- Connectors available in White (WH), unless noted

Field customizable 6-port frame	
6-port frame	CA-6PF-**XX**[1]
	SC-6PF-**XX**[4]

Connectors for 6-port frame

Telephone/network jacks	
8-conductor, RJ45 category 5e	CON-1P-C5E-**XX**[3]
8-conductor, RJ45 category 6	CON-1P-C6-**XX**[3]

Fiber jacks	
MT-RJ feed through	CON-1F-MTRJ-WH
SC simplex	CON-1F-SC-WH
LC non-flush mount	CON-1F-LC-WH
ST-style	CON-1F-ST-WH

Cable jack	
F-style, 75-Ohm coaxial cable	CON-1C-**XX**[3]

BNC jack	
BNC connector, 50-Ohm	CON-1B-WH

Connectors only for use with 6-port frame.

Receptacles



- Tamper-resistant receptacles include tamper-resistant shutter mechanism (shutters are white)

Receptacles	
15 A 125 V	CAR-15-**XX**[1]
	SCR-15-**XX**[2]
20 A 125 V	SCR-20-**XX**[2]

Tamper-resistant receptacles	
15 A 125 V	CARS-15-TR-**XX**[1]
	SCRS-15-TR-**XX**[2]
20 A 125 V	SCRS-20-TR-**XX**[2]

USB receptacles



- Includes two USB ports
- Ports are rated for a minimum of 10,000 insertions and removals

Tamper-resistant USB receptacles	
15 A 125 V	CAR-15-UBTR-**XX**[1]
	SCR-15-UBTR-**XX**[2]

XX[1]: Gloss color codes
XX[2]: Satin color codes
XX[3]: Available in White (WH) and Black (BL)
XX[4]: Available in Snow (SW), Midnight (MN), Taupe (TP), Biscuit (BI), Signal Red (SR), and Mist (MI)

Wallplates not included. Order separately.

GFCI Receptacles



- Self-testing technology allows GFCI to automatically check proper operation every 30 seconds
- LEDs indicate status of GFCI protection function
- Press reset button to reset GFCI after circuit interruption

Tamper-resistant, self-testing GFCI receptacles

15A 125V, GFCI	CAR-15-GFST-**XX**[1]
	SCR-15-GFST-**XX**[2]
20A 125V, GFCI	SCR-20-GFST-**XX**[2]

Receptacles for dimming use



- Duplex for dimming both connected loads
- Projecting nubs prevent standard plugs from being used
- Requires replacement plug for dimming table and floor lamps
- Tamper-resistant shutter mechanism

Dual dimming, tamper-resistant receptacles

15A 120/125V	CAR-15-DDTR-**XX**[1]
	SCR-15-DDTR-**XX**[2]
20A 120/125V	CAR-20-DDTR-**XX**[1]
	SCR-20-DDTR-**XX**[2]

Receptacles for half dimming use



- Top half for dimming
- Projecting nub prevents standard plug from being used
- Requires replacement plug for dimming table and floor lamps
- Bottom half is a general use receptacle and will fit standard duplex plugs
- Tamper-resistant shutter mechanism

Half dimming, tamper-resistant receptacles

15A 120/125V	CAR-15-HDTR-**XX**[1]
	SCR-15-HDTR-**XX**[2]
20A 120/125V	CAR-20-HDTR-**XX**[1]
	SCR-20-HDTR-**XX**[2]

XX[1]: Gloss color codes
XX[2]: Satin color codes

Wallplates not included. Order separately.

Claro wallplates and accessories

DESIGNER WALLPLATE OPENING

Replacement plug for dimming



- This plug required for use with Lutron receptacles for dimming use—plug will also work in standard receptacle
- Easily replaces the existing plugs on lamps

Replacement dimming plugs

120/125V	RP-FDU-10-**XX**[1]

UL/CSA/NOM regulatory approvals.

Important notes

- Receptacles and plugs for dimming use are UL Listed for use with all Lutron wallbox dimmers included in this catalog.
- If there is only one electrical feed to the receptacle, then the duplex DFDU must be used.
- If the hot and dimmed hot feeds to the split duplex HFDU are supplied from different circuits or split-wired with separate switch-legs, a means to simultaneously disconnect these circuits must be provided at the panel board where they originate (NEC 210.7(C) 2002 Edition). A 2-pole circuit breaker or two single-pole circuit breakers with an approved handle tie can be used to accomplish this simultaneous disconnect. Feed-through dimming panels, which are those without breakers, are recommended when using the HFDU.
- For more information on dimming lamps consult Lutron Application Note #109, Guide to Dimming Portable Lamps via Receptacles, at **lutron.com/applicationnotes**.

XX[1]: Available in White (WH) and Brown (BR)

Vive Maestro Wireless Dimmers and Switches

The Maestro Wireless solution incorporates Maestro Wireless load controls, wireless sensors, and wireless remote controls, which provide a system that delivers energy savings, convenience, and ease of installation.

Maestro Wireless dimmers and switches use Lutron patented Clear Connect RF Technology, which enables wireless communication with Radio Powr Savr sensors and Pico remote controls for light control and general switched loads.

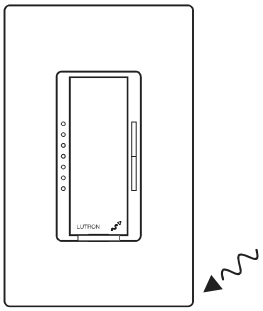
These products are also compatible with the Vive hub which enables a simple setup process using a standard web browser on any Wi-Fi enabled phone, tablet or computer. It also enables control and monitoring of all Vive devices. The Vive hub can be added at any time. System reprogramming will be required. For a complete list of features supported with the Vive hub, see specification submittal 369902.

Note for Replacement: MRF2S - the "S" model can replace the non-"S" model.

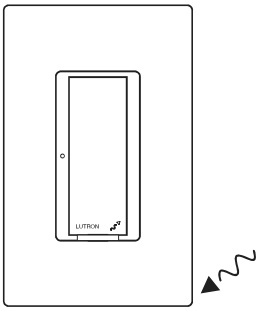
Features

- The Maestro Wireless solution provides dimming/switching of multiple load types, occupancy/vacancy sensing, and daylight harvesting.
- Lutron patented Clear Connect RF Technology works through walls and floors.
- Incorporates advanced features such as fade ON/fade OFF, high-end trim, and rapid full-ON (a Vive hub is required to set high-end trim).
- Controls include Front Accessible Service Switch (FASS) for safe lamp replacement.
- Two-wire dimmers and switches available for retrofit applications.
- Power failure memory: If power is interrupted, the control will return to its previously set level prior to interruption.

Receiving Devices
Maestro Wireless Controls

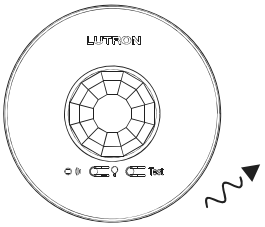


Neutral and Non-Neutral Dimmers

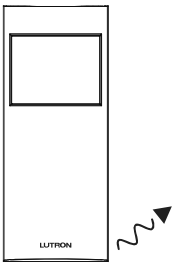


Neutral and Non-Neutral Switches

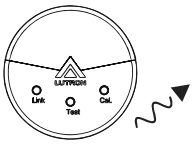
Transmitting Devices
Radio Powr Savr Sensors



Ceiling-Mounted Occupancy and Vacancy Sensors

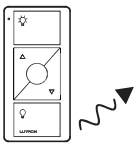


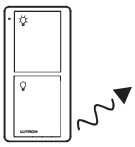
Wall-Mounted Occupancy and Vacancy Sensors



Daylight Sensors

Pico Remote Controls





Job Name:	Model Numbers:	
Job Number:		

Maestro Wireless Dimmers

Models Available

Dimmers

Dimmer



CFL/LED/Halogen/Incandescent

MRF2S-6CL-XX[1]	150 W CFL/LED Dimmer 600 W/600 VA Incandescent, 120 V~ 250 W (6 max) Lutron Hi-lume 1% 2-wire (LTE) LED drivers
MRF2S-6ND-120-XX[1,2]	600 W/600 VA Spec-Grade Neutral Wire Dimmer, 120 V~ 150 W CFL/LED Dimmer 350 W (8 max) Lutron Hi-lume 1% 2-wire (LTE) LED drivers

Electronic Low-Voltage Dimmer

MRF2S-6ELV120-XX[1]	600 W ELV Dimmer 120 V~ (neutral required) 150 W CFL/LED Dimmer

Companion Dimmers

Companion Dimmer



Claro Gloss Finishes

MA-R-XX[1,2]	Companion Dimmer 120 V~

Satin Colors Satin Finishes

MSC-AD-XX[1]	Companion Dimmer 120 V~

1 "XX" in the model number represents color/finish code. See **Colors and Finishes** at end of document.

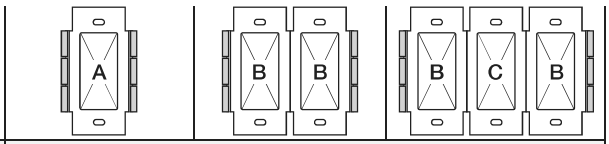
2 BAA-compliant model numbers available. Add a "U" prefix to the model number. For a complete list of BAA/TAA compliant products please visit our website at Lutron.com/BAA and select "Download BAA Product List".

Job Name:	Model Numbers:	
Job Number:		

Ganging and Derating

When combining controls in the same wallbox, derating is required.

Dimmer Load Type and Capacity



No Neutral Required

Control	Voltage	Load Type	Minimum Load	Maximum Load		
				A: Not Ganged	B: End of Gang	C: Middle of Gang
MRF2S-6CL [1,2,3]	120 V~	CFL/LED	See lamp list	See *Mixing Lamp Types*		
		Incandescent/Halogen	50 W	600 W	500 W	400 W
		Hi-lume 1% 2-wire (LTE) LED driver	1 driver	250 W (6 drivers)	250 W (6 drivers)	250 W (6 drivers)

Neutral Required

Control	Voltage	Load Type	Minimum Load	Maximum Load		
				A: Not Ganged	B: End of Gang	C: Middle of Gang
MRF2S-6ELV120 [1,2]	120 V~	ELV	5 W	600 W	500 W	400 W
		CFL/LED	See lamp list	See *Mixing Lamp Types*		
MRF2S-6ND-120 [1,2,3]	120 V~	Incandescent/Halogen	25 W	600 W	500 W	400 W
		MLV [2]	25 W/VA	450 W/600 VA	400 W/500 VA	300 W/400 VA
		CFL/LED	See lamp list	See *Mixing Lamp Types*		
		Hi-lume 1% 2-wire (LTE) LED driver	1 driver	350 W (8 drivers)	350 W (8 drivers)	350 W (8 drivers)

Note: Do not mix ELV and MLV load types on a single control.

1 Dimmer Load Type:
- MRF2S-6CL is designed for use with permanently-installed incandescent, CFL, LED, or tungsten halogen only.
- MRF2S-6ND-120 is designed for use with permanently-installed incandescent, CFL, LED, magnetic low-voltage, or tungsten halogen only. Can control Power Modules (PHPM-PA-DV, PHPM-3F-DV-WH, PHPM-WBX-DV-WH, and GRX-TVI) and legacy interfaces Hi-Power 2•4•6 Boosters (HP-2, HP-4, HP-6).
- MRF2S-6ELV120 is designed for use with permanently-installed electronic low-voltage, incandescent, CFL, LED or tungsten/halogen only. Do not install dimmers to control receptacles or motor-operated appliances.

2 Low-Voltage Applications:
- Use MRF2S-6ND-120 with magnetic (core and coil) low-voltage transformers only. Not for use with electronic (solid-state) low-voltage transformers.
- Use MRF2S-6ELV120 with electronic (solid-state) low-voltage transformers only. Operation of a low-voltage circuit with lamps inoperative or removed may result in transformer overheating and premature failure. Lutron strongly recommends the following:
  - Do not operate low-voltage circuits without operative lamps in place.
  - Replace burned-out lamps as quickly as possible.
  - Use transformers that incorporate thermal protection or fused transformer primary windings to prevent transformer failure due to overcurrent.
- See Application Note #559 for dimming low voltage LEDs.

3 BAA-compliant model numbers available. Add a "U" prefix to the model number. For a complete list of BAA/TAA compliant products please visit our website at Lutron.com/BAA and select "Download BAA Product List".

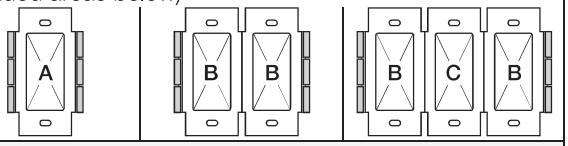
Mixing Lamp Types

Mixing lamp types (using a combination of CFL/LED, and Incandescent/Halogen bulbs) and ganging with other dimmers or electronic switches may reduce maximum wattage, as shown.

Example: If fins from one side of dimmer are removed and you have two 24 W bulbs installed (total CFL Wattage = 48 W), you may add up to 300 W of incandescent or halogen lighting.

Example: If a dimmer is installed in location "B" above and there are two 24 W CFL bulbs installed (Total CFL Wattage = 48 W), you may add up to 300 W of incandescent or halogen lighting.

Do not remove outside fins on ends of ganged controls (shaded areas below)



Total CFL/LED Wattage		Total Incandescent/Halogen Wattage				
		A: Not Ganged		B: End of Gang		C: Middle of Gang
MRF2S-6CL						
0 W	+	50 W–600 W	Or	50 W–500 W	Or	50 W–400 W
1 W–25 W	+	0 W–500 W	Or	0 W–400 W	Or	0 W–300 W
26 W–50 W	+	0 W–400 W	Or	0 W–300 W	Or	0 W–200 W
51 W–75 W	+	0 W–300 W	Or	0 W–200 W	Or	0 W–100 W
76 W–100 W	+	0 W–200 W	Or	0 W–100 W	Or	0 W–50 W
101 W–125 W	+	0 W–100 W	Or	0 W–50 W	Or	0 W
126 W–150 W	+	0 W	Or	0 W	Or	0 W

Job Name:	Model Numbers:	
Job Number:		

Maestro Wireless Switches

Models Available

Switches

Lighting and motor loads

MRF2S-6ANS-XX[1,2,4]	6 A Lighting / 3 A Fan (1/10 HP motor), Electronic Switch 120 V~
MRF2S-8ANS120-XX[1,2,4]	8 A Lighting, 5.8 A Fan (1/4 HP motor), Spec-Grade Electronic Switch 120 V~
MRF2S-8S-DV-XX[2,3,4]	8 A Lighting, 3 A Fan (1/10 HP motor, 120 V~ only), Spec-Grade Electronic Switch 120–277 V~, no neutral wire required

Switch



Companion Switches

Claro Gloss Finishes

MA-AS-XX[2,4]	Companion Switch 120 V~

Satin Colors Satin Finishes

MSC-AS-XX[4]	Companion Switch 120 V~

Companion Switch



1 Neutral wire required.

2 BAA-compliant model numbers available. Add a “U” prefix to the model number. For a complete list of BAA/TAA compliant products please visit our website at Lutron.com/BAA and select “Download BAA Product List”.

3 May require LUT-MLC (included with MRF2S-8S-DV models) to ensure proper function with low-wattage load types. See page 11 for details. If controlling Type B TLED bulbs, consult Application Note 812 (P/N 048812) on www.lutron.com

4 “XX” in the model number represents color / finish code. See **Colors and Finishes** at end of document.

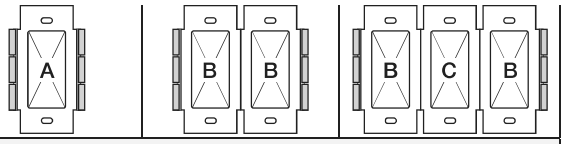
Job Name:	Model Numbers:	
Job Number:		

Ganging and Derating

When combining controls in the same wallbox, derating is required.

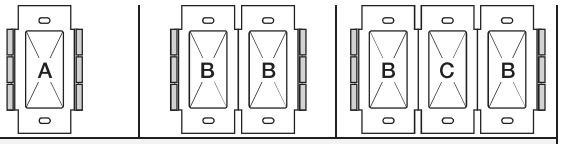
Switch Load Type and Capacity

Neutral Required



Control	Voltage	Load Type	Minimum Load	Maximum Load		
				A: Not Ganged	B: End of Gang	C: Middle of Gang
MRF2S-8ANS120 [1,2,5]	120 V~	Lighting	25 W	8 A	6.5 A	5 A
		Fan Motor	0.2 A	1/4 HP (5.8 A)	1/4 HP (5.8 A)	1/6 HP (4.4 A)
MRF2-6ANS [1]	120 V~	Lighting	25 W	6 A	5 A	3.5 A
		Fan Motor	0.2 A	1/10 HP (3 A)	1/10 HP (3 A)	1/10 HP (3 A)

No Neutral Required



Control	Voltage	Load Type	Minimum Load	Maximum Load		
				A: Not Ganged	B: End of Gang	C: Middle of Gang
MRF2S-8S-DV [1,5]	120–277 V~	Incandescent/Halogen	25 W	8 A	8 A/7 A[4]	7 A
	120–277 V~	Fluorescent/LED/CFL	40 W (LUT-MLC)[3]	8 A	8 A/7 A[4]	7 A
	120 V~	Fan Motor	0.4 A	1/10 HP (3 A)	1/10 HP (3 A)	1/10 HP (3 A)

[1] Switch Load Type:
- MRF2S-8ANS120 is designed for use with permanently-installed lighting loads and with fan motor loads up to 1/4 HP (5.8 A).
- MRF2S-8S-DV is designed for use with permanently-installed lighting loads and with fan motor loads up to 1/10 HP (3 A, 120 V~ only).
- MRF2-6ANS is designed for use with permanently-installed lighting loads and with fan motor loads up to 1/10 HP (3 A).

[2] For loads larger than 8 A (120 V~), the MRF2S-8ANS120 switch can be used with the PHPM-SW-DV-WH power booster.

[3] The LUT-MLC ensures proper function with low-wattage fluorescent, CFL, and LED load types. See page 11 for details.

[4] Maximum load for double-gang application is 8 A. Triple-gang application derates maximum load to 7 A.

[5] BAA-compliant model numbers available. Add a "U" prefix to the model number. For a complete list of BAA/TAA compliant products please visit our website at Lutron.com/BAA and select "Download BAA Product List".

Job Name:	Model Numbers:	
Job Number:		

Specifications

Regulatory Approvals

- UL® Listed.
- cUL® Listed (MRF2S-6CL only).
- CSA Certified (except for MRF2S-6CL).
- FCC Approved. Complies with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules.
- Industry Canada Certified.
- The following model numbers have been tested and found compliant with UL 2043 for use in air handling spaces: MRF2S-6CL-GR, MRF2S-6ELV-GR, MRF2S-6ND-GR. However, the RMJS-PNE-DV Phase Selectable PowPak is the recommended solution for these applications.

Power

Operating voltage:

- 120 V~ 50/60 Hz (all models)
- 277 V~ 50/60 Hz (MRF2S-8S-DV)

Environment

- Ambient operating temperature: 32 °F to 104 °F (0 °C to 40 °C)
- 0% to 90% humidity, non-condensing.
- Indoor use only.
- All drivers and ballasts used with Vive wireless controls must comply with the limits for a Class A device pursuant to Part 15 of the FCC Rules.

Key Design Features

Dimmers

- On a single-tap, lights fade UP or DOWN.
- On a double-tap, lights go to full ON.
- Light levels can be fine-tuned by pressing and holding the dimming rocker until the desired light level is reached.
- Two-wire dimmers available.

Switches

- On a single-tap, lights turn ON or OFF.
- Two-wire switches available.

All RF Local Controls

- Tested to withstand electrostatic discharge without damage or memory loss, in accordance with IEC 61000-4-2.
- Tested to withstand surge voltages without damage or loss of operation, in accordance with IEEE C62.41-1991 Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits.
- Controls always operate locally and do not require system control.
- Power failure memory: should power be interrupted, the control will return to its previously-set level prior to the interruption when power is restored.
- Uses conventional 3-way and 4-way wiring.
- Multiple location control from dimmer/switch and up to nine companion dimmers/switches.
- Use Lutron Designer (Claro and Satin Colors) wallplates or designer-style wallplates from other manufacturers. Wallplates are sold separately.
- Lutron Claro and Satin Colors wallplates snap on with no visible means of attachment.
- Requires a one-gang U.S. wallbox; 3½ in (89 mm) deep recommended, 2¼ in (57 mm) deep minimum.
- Green indicator lights.

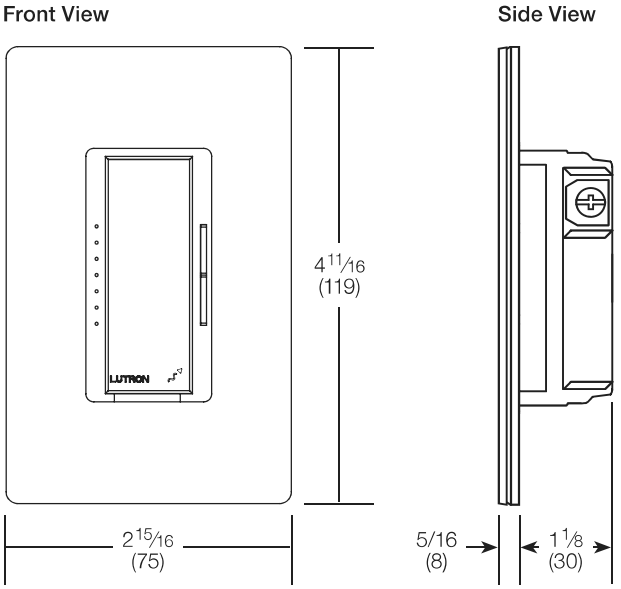
System Communications and Capacity

- Maestro Wireless controls communicate with the Pico remote controls and Radio Power Savr sensors through radio frequency (RF).
- Receives wireless inputs from up to 10 Pico remote controls, 10 Radio Powr Savr occupancy/vacancy sensors, and 1 Radio Powr Savr daylight sensor
- Maestro Wireless local controls must be located within 60 ft (18 m) line-of-sight or 30 ft (9 m) through walls, of Radio Power Savr sensors. The 60 ft (18 m) range is not reduced by a ceiling tile obstruction.
- Maestro Wireless local controls must be located within 60 ft (18 m) line-of-sight or 30 ft (9 m) through walls, of a Pico remote control. The 60 ft (18 m) range is not reduced by a ceiling tile obstruction.

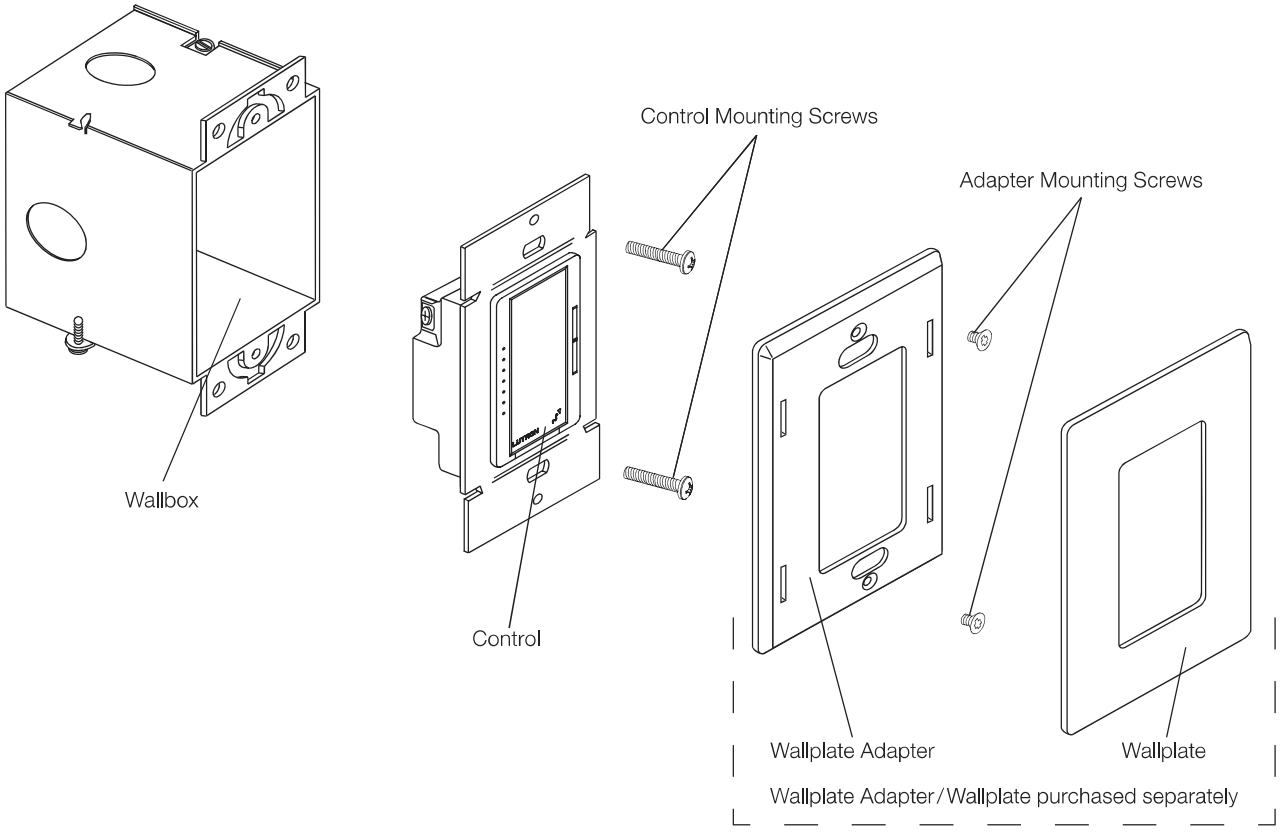
Job Name:	Model Numbers:	
Job Number:		

Dimensions

All dimensions are shown as: in (mm)



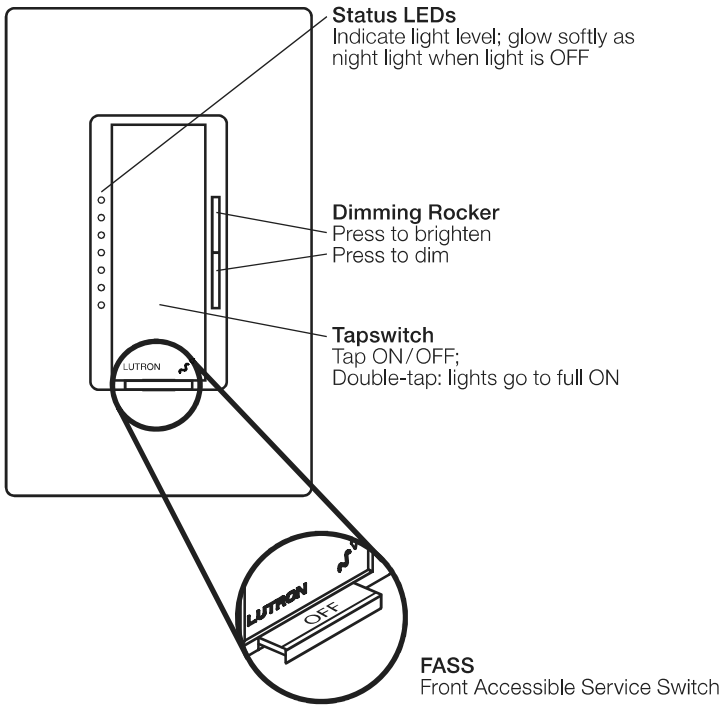
Mounting



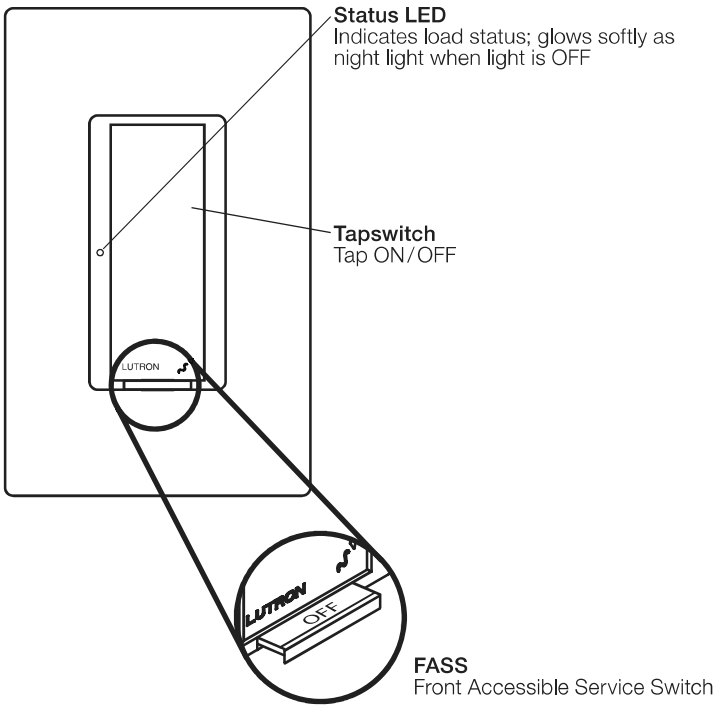
Job Name:	Model Numbers:	
Job Number:		

Operation

Dimmer



Switch



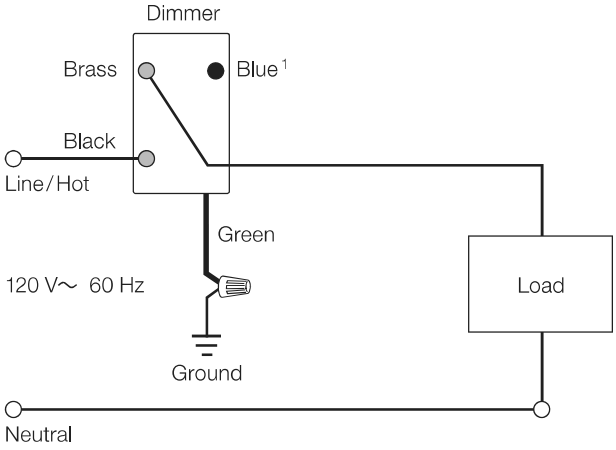
FASS Front Accessible Service Switch

Important Notice: To service load, remove power by pulling the FASS out completely on either the dimmer/switch or companion dimmer/switch. After servicing load, push the FASS back in fully to restore power to the control.

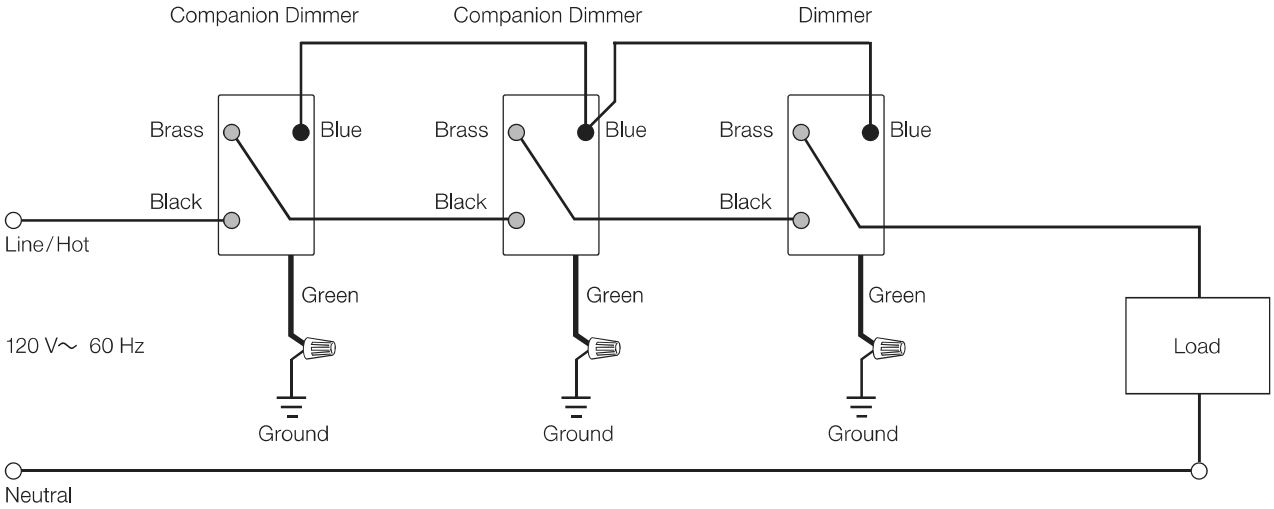
Job Name:	Model Numbers:	
Job Number:		

Wiring Diagrams

Single-Location Dimmer Installation without Neutral
MRF2S-6CL



Multi-Location Dimmer Installation without Neutral[2]
MRF2S-6CL with MA-R/MSC-AD



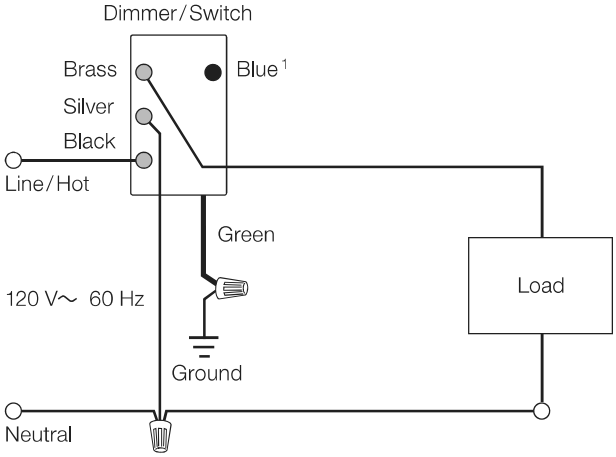
1 When using controls in single location installations, tighten the blue terminal without any wires attached. Do not connect the blue terminal to any other wiring or to ground.

2 Up to nine Maestro companion dimmers may be connected to the Maestro Wireless dimmer. Total blue terminal wire length may be up to 250 ft (76 m).

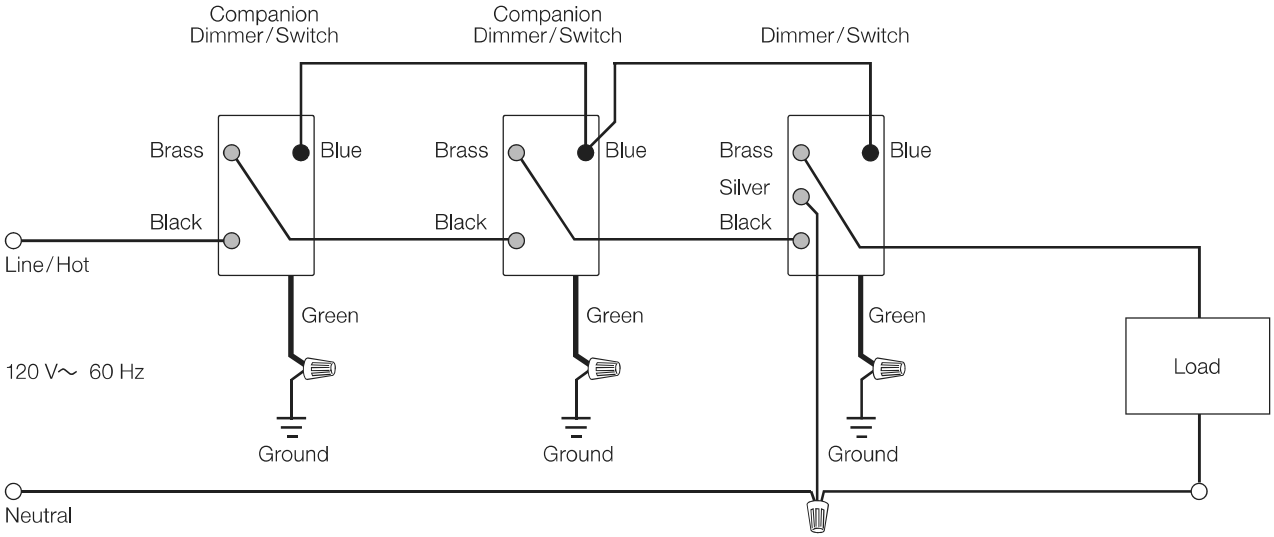
Job Name:	Model Numbers:	
Job Number:		

Wiring Diagrams (continued)

Single-Location Dimmer/Switch Installation with Neutral
MRF2S-6ND-120, -6ELV120, -8ANS120, and -6ANS



Multi-Location Dimmer/Switch Installation with Neutral[2,3]
MRF2S-6ND-120 and -6ELV120 with MA-R/MSC-AD or MRF2S-8ANS120 and -6ANS with MA-AS/MSC-AS



1 When using controls in single location installations, tighten the blue terminal without any wires attached. Do not connect the blue terminal to any other wiring or to ground.

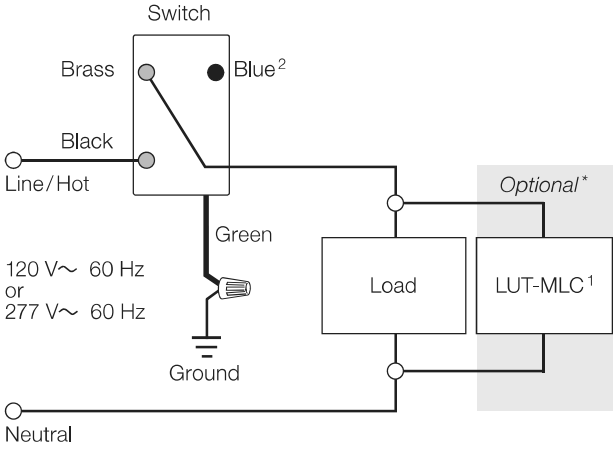
2 Up to nine Maestro companion dimmers/switches may be connected to the Maestro Wireless dimmer/switch. Total blue terminal wire length may be up to 250 ft (76 m).

3 Neutral-wire dimmers/switches must be connected on the Load side of a multi-location installation.

Job Name:	Model Numbers:	
Job Number:		

Wiring Diagrams (continued)

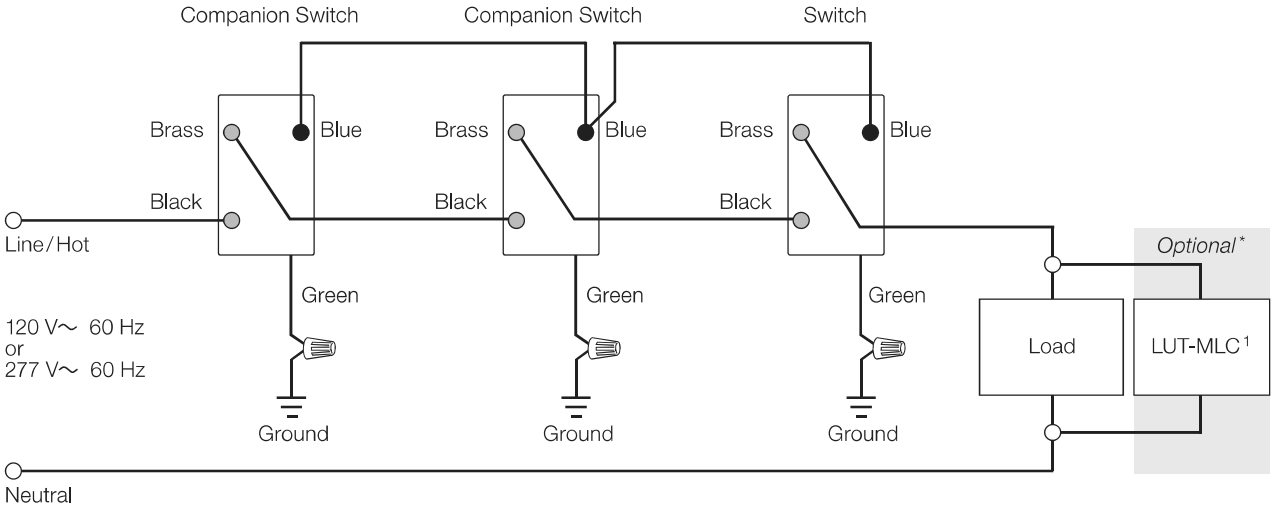
Single-Location Switch Installation with LUT-MLC[1]
MRF2S-8S-DV



*** Optional Procedure:**
Using LUT-MLC with MRF2S-8S-DV-XX

- Install MRF2S-8S-DV-XX first without LUT-MLC to see if required. Check for problems with load.
- Problems can occur when low-wattage loads are used (< 40 W).
- If controlling Type B TLED bulbs, consult Application Note 812 (P/N 048812) on www.lutron.com
- Watch for flickering loads when dimmer is in electronic OFF state.
- If required, LUT-MLC can be installed between switched hot and neutral in wallbox if neutral is present, or in any fixture on the switched circuit.

Multi-Location Switch Installation with LUT-MLC[1,2,3]
MRF2S-8S-DV with MA-AS/MA-AS-277 or MSC-AS/MSC-AS-277[4]



1 A LUT-MLC ensures proper function when fluorescent, CFL, or LED loads are used. Install the LUT-MLC inside a load fixture or in a separate J-box within the circuit.

2 When using controls in single-location installations, tighten the blue terminal without any wires attached. Do not connect the blue terminal to any other wiring or to ground.

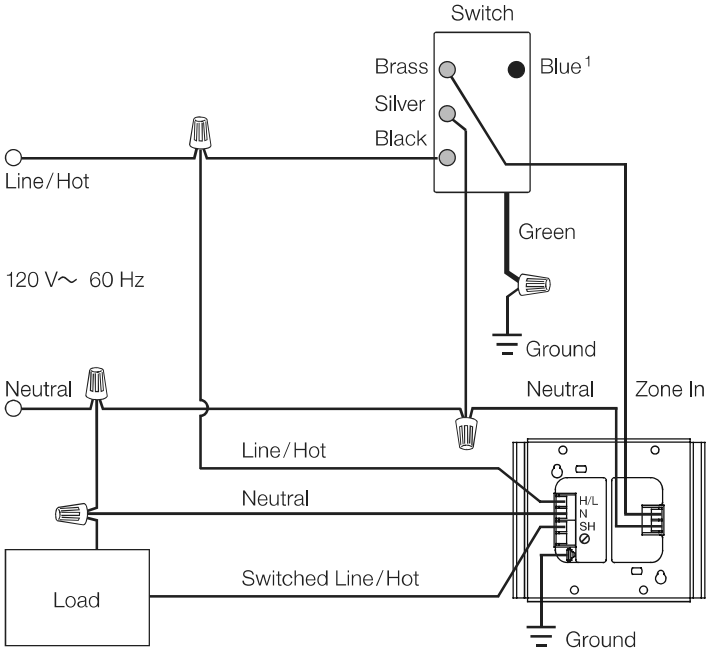
3 Up to nine Maestro companion switches may be connected to the Maestro Wireless switch. Total blue terminal wire length may be up to 250 ft (76 m).

4 Requires MA-AS/MSC-AS for 120 V~ applications, and MA-AS-277/MSC-AS-277 for 277 V~ applications.

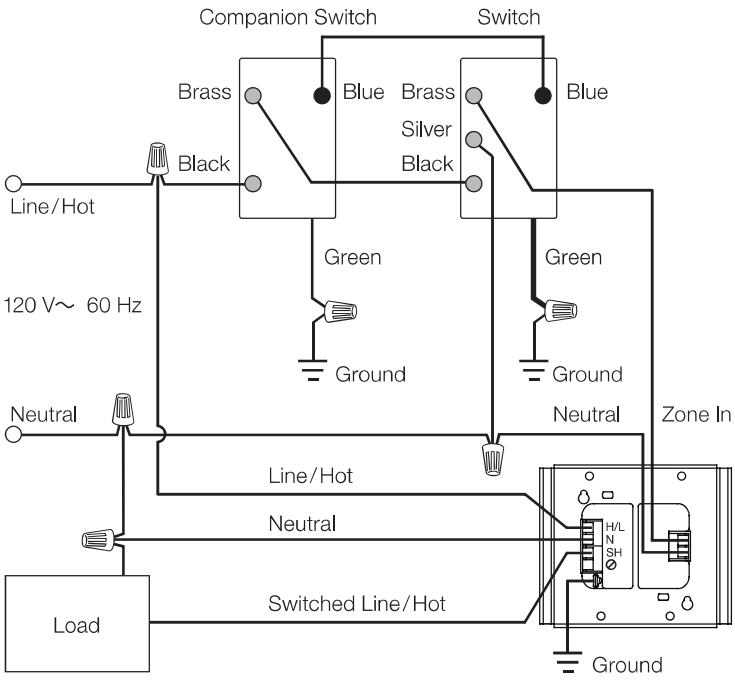
Job Name:	Model Numbers:	
Job Number:		

Wiring Diagrams (continued)

Single-Location Switch Installation with Power Booster Single Feed
MRF2S-8ANS120 and -6ANS with PHPM-SW-DV-WH



Multi-Location Switch Installation with Power Booster Single Feed [2,3]
MRF2S-8ANS120 and -6ANS with MA-AS/MSC-AS and PHPM-SW-DV-WH



1 When using controls in single-location installations, tighten the blue terminal. Do not connect the blue terminal to any other wiring or to ground.
2 Up to nine Maestro companion switches may be connected to the Maestro Wireless switch. Total blue terminal wire length may be up to 250 ft (76 m).
3 Neutral-wire switches must be connected on the Load side of a multi-location installation.

Job Name:	Model Numbers:	
Job Number:		