# PERFORMANCE CONTRACT

This Performance Contract (this "Agreement") is made this ___ day of _____, 20__ between:

## PARTIES

JOHNSON CONTROLS, INC. ("JCI")
27 Inwood Rd
Rocky Hill, CT 06067

and

City of Derby, CT ("Customer")
1 Elizabeth St. Derby, CT 06418

## RECITALS

**WHEREAS**, Customer desires to retain JCI to perform the work specified in Schedule 1 (Scope of Work) hereto (the "Work") relating to the installation of the improvement measures (the "Improvement Measures") described therein; and

**WHEREAS**, Customer is authorized and empowered under applicable Laws (as defined below) to enter into this Agreement, and has taken all necessary action under applicable Laws to enter into this Agreement; and

**WHEREAS**, Customer has selected JCI to perform the Work after it determined JCI's proposal was the most advantageous to Customer in accordance with all applicable procurement and other Laws.

**NOW, THEREFORE**, in consideration of the mutual promises set forth herein, the parties agree as follows:

## AGREEMENT

1. **SCOPE OF THE AGREEMENT.** JCI shall perform the Work set forth in Schedule 1. After the Work is Substantially Complete (as defined below) and the Certificate of Substantial Completion is executed by Customer and JCI, JCI shall provide the assured performance guarantee (the "Assured Performance Guarantee") and the measurement and verification services (the "M&V Services") set forth in Schedule 2 (Assured Performance Guarantee), as applicable. Customer shall make payments to JCI for the Work and the M&V Services in accordance with Schedule 4 (Price and Payment Terms).

2. **AGREEMENT DOCUMENTS:** In addition to the terms and conditions of this Agreement, the following Schedules are incorporated into and shall be deemed an integral part of this Agreement:

   Schedule 1 – Scope of Work
   Schedule 2 – Assured Performance Guarantee
   Schedule 2A – Assured Performance Guarantee – Utility Meters
   Schedule 3 – Customer Responsibilities
   Schedule 4 – Price and Payment Terms

3. **NOTICE TO PROCEED; SUBSTANTIAL COMPLETION; M&V SERVICES.** This Agreement shall become effective on the date of the last signature on the signature page below. JCI shall commence performance of the Work within ten (10) business days of receipt of Customer's Notice to Proceed, a form of which is attached hereto as Attachment 1, and shall achieve Substantial Completion of the Work by the Substantial Completion date, which shall be the earlier of:

(a) the date on which Customer executes a Certificate of Substantial Completion substantially in the form attached hereto as Attachment 3;

or

(b) **[14** months] after JCI's receipt of Customer's Notice to Proceed, subject to adjustments set forth in Section 4 and Section 5 below.

For purposes of this Agreement, "Substantial Completion" means that JCI has provided sufficient materials and services to permit Customer to operate the Improvement Measures. The M&V Services shall commence on the first day of the month following the month in which Customer executes a Certificate of Substantial Completion and shall continue throughout the Guarantee Term, subject to earlier termination of the Assured Performance Guarantee as provided herein. Customer acknowledges and agrees that if, for any reason, it (i) cancels or terminates receipt of M&V Services, (ii) fails to pay for M&V Services in accordance with Schedule 4, (iii) fails to fulfill any of Customer's responsibilities necessary to enable JCI to complete the Work and provide the M&V Services, or (iv) otherwise cancels, terminates or materially breaches this Agreement, the Assured Performance Guarantee shall automatically terminate and JCI shall have no liability thereunder.

4. **DELAYS AND IMPACTS.** If JCI is delayed in the commencement, performance, or completion of the Work and/or M&V Services by causes beyond its control and without its fault, including but not limited to inability to access property; concealed or unknown conditions encountered at the project, differing from the conditions represented by Customer in the bid documents or otherwise disclosed by Customer to JCI prior to the commencement of the Work; a Force Majeure (as defined below) condition; failure by Customer to perform its obligations under this Agreement; or failure by Customer to cooperate with JCI in the timely completion of the Work, JCI shall provide written notice to Customer of the existence, extent of, and reason for such delays and impacts. Under such circumstances, an equitable adjustment in the time for performance, price and payment terms, and the Assured Performance Guarantee shall be made.

5. **ACCESS.** Customer shall provide JCI, its subcontractors, and its agents reasonable and safe access to all facilities and properties in Customer's control that are subject to the Work and M&V Services. Customer further agrees to assist JCI, its subcontractors, and its agents to gain access to facilities and properties that are not controlled by Customer but are necessary for JCI to complete the Work and provide the M&V Services. An equitable adjustment in the time for performance, price and payment terms, and Assured Performance Guarantee shall be made as a result of any failure to grant such access.

6. **PERMITS, TAXES, AND FEES.** Unless otherwise specified in Schedule 3 (Customer Responsibilities), JCI shall be responsible for obtaining all building permits required for it to perform the Work. Unless otherwise specified in Schedule 1 (Scope of Work), Customer shall be responsible for obtaining all other permits, licenses, approvals, permissions and certifications, including but not limited to, all zoning and land use changes or exceptions required for the provision of the Work or the ownership and use of the Improvement Measures. JCI shall not be obligated to provide any changes to or improvement of the facilities or any portion thereof required under any applicable building, fire, safety, sprinkler or other applicable code, standard, law, regulation, ordinance or other requirement unless the same expressly regulates the installation of the Improvement Measures. Without limiting the foregoing, JCI's obligations with respect to the Work is not intended to encompass any changes or improvements that relate to any compliance matters (whether known or unknown) that are not directly related to the installation of the Improvement Measures or which have been imposed or enforced because of the occasion or opportunity of review by any governmental authority. Customer shall be responsible for and shall pay when due all assessments, charges and sales, use, property, excise, or other taxes now or hereafter imposed by any governmental body or agency upon the provision of the Work or the M&V Services, implementation or presence of the Improvement Measures, the use of the Improvement Measures or payments due to JCI under this Agreement, other than taxes upon the net income of JCI. Customer shall also be responsible for real or personal property taxes relating to equipment or material included in the Improvement Measures. Any fees, taxes, or other lawful charges paid by JCI on account of Customer shall become immediately due from Customer to JCI.

7. **WARRANTY.** JCI will perform the Work in a professional, workman-like manner. JCI will promptly re-perform any non-conforming Work for no charge, as long as Customer provides written notice to JCI within one (1) year following Substantial Completion or such other period identified in Schedule 1. If JCI installs or furnishes goods or equipment under this Agreement, and such goods or equipment are covered by an end-user warranty from

their manufacturer, JCI will transfer the benefits of such warranty to Customer. The foregoing remedy with respect to the Work, together with any remedy provided by goods or equipment manufacturers, shall be Customer's sole and exclusive remedies for warranty claims. Customer agrees that the one (1) year period following Substantial Completion, or such other period identified in Schedule 1, shall be a reasonable time for purposes of submitting valid warranty claims with respect to the Work. These exclusive remedies shall not have failed of their essential purpose so long as JCI transfers the benefits of any goods or equipment end-user warranty to Customer and remains willing to re-perform any non-conforming Work for no charge within the one (1) year period described above or such other period identified in Schedule 1. NO OTHER EXPRESS OR IMPLIED WARRANTIES, INCLUDING IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, ARE PROVIDED BY JCI. This warranty does not extend to any Work that has been abused, altered, or misused, or repaired by Customer or third parties without the supervision or prior written approval of JCI. Except with respect to goods or equipment manufactured by JCI and furnished to Customer hereunder, for which JCI shall provide its express written manufacturer's warranty, JCI shall not be considered a merchant or vendor of goods or equipment.

8. **CLEANUP.** JCI shall keep the premises and the surrounding area free from accumulation of waste materials or rubbish caused by the Work and, upon completion of the Work, JCI shall remove all waste materials, rubbish, tools, construction equipment, machinery, and surplus materials.

9. **SAFETY; COMPLIANCE WITH LAWS.** JCI shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the performance of the Work and M&V Services. Each of JCI and Customer shall comply with all applicable laws, ordinances, rules, regulations, and lawful orders of public authorities (collectively, "Laws") in connection with its performance hereunder.

10. **ASBESTOS-CONTAINING MATERIALS AND OTHER HAZARDOUS MATERIALS.**

Asbestos-Containing Materials: Neither party desires to or is licensed to undertake direct obligations relating to the identification, abatement, cleanup, control, removal or disposal of asbestos-containing materials ("ACM"). Consistent with applicable Laws, Customer shall supply JCI with any information in its possession relating to the presence of ACM in areas where JCI undertakes any Work or M&V Services (the "ACM Documentation") that may result in the disturbance of ACM. It is JCI's policy to seek certification for facilities constructed prior to 1982 that no ACM is present, and Customer shall provide available records for buildings it owns, or aid JCI in obtaining such records from facility owners in the case of buildings that Customer does not own, if JCI will undertake Work or M&V Services in the facility that could disturb ACM. JCI may rely on the ACM Documentation to determine if ACM will be disturbed or handled during the Work and shall notify the Customer in writing two (2) business days prior to performing any work in a location where, according to the ACM Documentation, ACM is present, may be present, or is assumed to be present. If the ACM Documentation indicates that no ACM is present in an area where JCI undertakes work and if either Customer or JCI becomes aware of or suspects the presence of ACM that may be disturbed by JCI's Work or M&V Services, it shall promptly stop the Work or M&V Services in the affected area and notify the other. Except as required by Schedule 1 – Scope of Work or except where the ACM Documentation is silent as to or indicates the presence or possibility of ACM, as between Customer and JCI, Customer shall be responsible at its sole expense for addressing the potential for or the presence of ACM in conformance with all applicable Laws and addressing the impact of its disturbance before JCI continues with its Work or M&V Services. If JCI had actual knowledge that ACM was present, or the ACM Documentation is silent as to or indicates the presence or possibility of ACM, JCI shall be responsible at is sole expense for remediating areas impacted by the disturbance of the ACM and the implementation of the work described in Schedule 1 – Scope of work. JCI shall have no liability to Customer for (a) the identification, abatement, cleanup, removal, or disposal of ACM in areas where the ACM Documentation indicates that no ACM is present, and (b) any JCI action or inaction due to inaccuracies in the ACM Documentation.

Other Hazardous Materials: JCI shall be responsible for removing or disposing of any Hazardous Materials (as defined below) that it uses in providing Work or M&V Services ("JCI Hazardous Materials") and for the remediation of any areas impacted by the release of JCI Hazardous Materials. For other Hazardous Materials that may be otherwise present at Customer's facilities ("Non-JCI Hazardous Materials"), Customer shall supply JCI with any information in its possession relating to the presence of such materials if their presence may affect JCI's performance of the Work or M&V Services. JCI must determine if Hazardous Materials will be disturbed

or handled during the Work and JCI must notify the Customer in writing two (2) business days prior to performing any Work in or about a location where Hazardous Material are present or likely will be found. When such Work is completed, JCI must notify the Customer in writing within one (1) business day of completion of the work. If either Customer or JCI becomes aware of or suspects the presence of Non-JCI Hazardous Materials that may interfere with JCI's Work or M&V Services, it shall promptly stop the Work or M&V Services in the affected area and notify the other. As between Customer and JCI, Customer shall be responsible at its sole expense for removing and disposing of Non-JCI Hazardous Materials from its facilities and the remediation of any areas impacted by the release of Non-JCI Hazardous Materials, unless JCI had actual knowledge that Non-JCI Hazardous Materials were present and acted with intentional disregard of that knowledge, in which case (i) JCI shall be responsible at its sole expense for the remediation of any areas impacted by its release of such Non-JCI Hazardous Materials, and (ii) Customer shall remain responsible at its sole expense for the removal of Non-JCI Hazardous Materials that have not been released and for releases not resulting from JCI's performance of the Work or M&V Services. For purposes of this Agreement, "Hazardous Materials" means any material or substance that, whether by its nature or use, is now or hereafter defined or regulated as a hazardous waste, hazardous substance, pollutant or contaminant under applicable Law relating to or addressing public or employee health and safety and protection of the environment, or which is toxic, explosive, corrosive, flammable, radioactive, carcinogenic, mutagenic or otherwise hazardous or which is or contains petroleum, gasoline, diesel, fuel, another petroleum hydrocarbon product, or polychlorinated biphenyls. "Hazardous Materials" specifically includes mold and lead-based paint and specifically excludes ACM. JCI shall have no obligations relating to the identification, abatement, cleanup, control, removal, or disposal of mold, regardless of the cause of the mold.

Environmental Indemnity: To the fullest extent permitted by Law, Customer shall indemnify and hold harmless JCI and JCI's subcontractors, and their respective directors, officers, employees, agents, representatives, shareholders, affiliates, and assigns and successors, from and against any and all losses, costs, damages, expenses (including reasonable legal fees and defense costs), claims, causes of action or liability, directly or indirectly, relating to or arising from the Customer's use, or the storage, release, discharge, handling or presence of ACM, mold (actual or alleged and regardless of the cause of such condition) or Non-JCI Hazardous Materials on, under or about the facilities, or Customer's failure to comply with this Section 10.

**11. CHANGE ORDERS.** The parties, without invalidating this Agreement, may request changes in the Work to be performed under this Agreement, consisting of additions, deletions, or other revisions to the Work ("Change Orders"). The price and payment terms, time for performance and, if necessary, the Assured Performance Guarantee, shall be equitably adjusted in accordance with the Change Order. Such adjustments shall be determined by mutual agreement of the parties. JCI may delay performance until adjustments arising out of the Change Order are clarified and agreed upon. Any Change Order must be signed by an authorized representative of each party. If concealed or unknown conditions are encountered at the project, differing from the conditions represented by Customer in the bid documents or otherwise disclosed by Customer to JCI prior to the commencement of the Work, price and payment terms, time for performance and, if necessary, the Assured Performance Guarantee, shall be equitably adjusted. Claims for equitable adjustment may be asserted in writing within a reasonable time from the date a party becomes aware of a change to the Work by written notification. Failure to promptly assert a request for equitable adjustment, however, shall not constitute a waiver of any rights to seek any equitable adjustment with respect to such change.

**12. CUSTOMER FINANCING; TREATMENT; TAXES.** The parties acknowledge and agree that JCI is not making any representation or warranty to Customer with respect to matters not expressly addressed in this Agreement, including, but not limited to:

(a) Customer's ability to obtain or make payments on any financing associated with paying for the Improvement Measures, related services, or otherwise;
(b) Customer's proper legal, tax, accounting, or credit rating agency treatment relating to this Agreement; and
(c) the necessity of Customer to raise taxes or seek additional funding for any purpose.

Customer is solely responsible for its obligations and determinations with respect to the foregoing matters. In addition, the parties acknowledge and agree that Customer shall be responsible to comply, at its cost and expense, with all Laws that may be applicable to it relating to performance contracting, including, without

limitation, any requirements relating to the procurement of goods and/or services and any legal, accounting, or engineering opinions or reviews required or obtained in connection with this Agreement.

**13. INSURANCE.** JCI shall maintain insurance in amounts no less than those set forth below in full force and effect at all times until the Work has been completed, and shall provide a certificate evidencing such coverage promptly following Customer's request therefor.

| COVERAGES | LIMITS OF LIABILITY |
|---|---|
| Workmen's Compensation Insurance or self insurance, including Employer's Liability | Statutory |
| Commercial General Liability Insurance | $5,000,000 Per Occurrence<br>$5,000,000 Aggregate |
| Comprehensive Automobile Liability Insurance | $5,000,000 Combined Single Limit |

The above limits may be obtained through primary and excess policies, and may be subject to self-insured retentions.

Customer shall be responsible for obtaining builder's risk insurance coverage for the Improvement Measures and shall at all times be responsible for any loss or casualty to the Improvement Measures. Customer shall also maintain insurance coverage, of the types and in the amounts customary for the conduct of its business, throughout the term of this Agreement.

**14. INDEMNIFICATION.** To the fullest extent permitted by applicable Law, each party shall indemnify the other with respect to any third party claim alleging bodily injury, including death, or property damage to the extent such injury or damage is caused by the negligence or willful misconduct of the indemnifying party. A condition precedent to any obligation of a party to indemnify the other pursuant to this Section 14 shall be for the indemnified party to promptly advise the indemnifying party of the claim pursuant to the notice provision of this Agreement.

**15. LIMITATION OF LIABILITY.** NEITHER JCI NOR CUSTOMER WILL BE RESPONSIBLE TO THE OTHER FOR ANY SPECIAL, INDIRECT, CONSEQUENTIAL, REMOTE, PUNITIVE, EXEMPLARY, LOSS OF PROFITS OR REVENUE, LOSS OF USE, OR SIMILAR DAMAGES, REGARDLESS OF HOW CHARACTERIZED AND REGARDLESS OF A PARTY HAVING BEEN ADVISED OF THE POSSIBILITY OF SUCH POTENTIAL LOSSES OR RELIEF, ARISING IN ANY MANNER FROM THIS AGREEMENT, THE WORK, THE IMPROVEMENT MEASURES, THE PREMISES, THE M&V SERVICES, OR OTHERWISE. WITHOUT LIMITING JCI'S EXPRESS OBLIGATIONS UNDER THE ASSURED PERFORMANCE GUARANTEE, JCI'S LIABILITY UNDER THIS AGREEMENT, REGARDLESS OF THE FORM OF ACTION, SHALL IN NO EVENT EXCEED THE AMOUNT OF THE PAYMENTS ACTUALLY RECEIVED BY JCI UNDER SCHEDULE 4. If this Agreement covers fire safety or security equipment, Customer understands that JCI is not an insurer regarding those services, and that JCI shall not be responsible for any damage or loss that may result from fire safety or security equipment that fails to prevent a casualty loss. The foregoing waivers and limitations are fundamental elements of the basis for this Agreement between JCI and Customer, and each party acknowledges that JCI would not be able to provide the work and services contemplated by this Agreement on an economic basis in the absence of such waivers and limitations, and would not have entered into this Agreement without such waivers and limitations.

**16. FORCE MAJEURE.** Neither party will be responsible to the other for damages, loss, injury, or delay caused by conditions that are beyond the reasonable control, and without the intentional misconduct or negligence of that party. Such conditions (each, a "Force Majeure") include, but are not limited to: acts of God; acts of government agencies; strikes; labor disputes; fires; explosions or other casualties; thefts; vandalism; riots or war; acts of terrorism; electrical power outages; interruptions or degradations in telecommunications, computer, or electronic communications systems; changes in Laws; or unavailability of parts, materials or supplies.

**17. JCI'S PROPERTY.** All materials furnished or used by JCI personnel and/or JCI subcontractors or agents at the installation site, including documentation, schematics, test equipment, software and associated media remain the exclusive property of JCI or such other third party. Customer agrees not to use such materials for any purpose at any time without the express authorization of JCI. Customer agrees to allow JCI personnel and/or JCI subcontractors or agents to retrieve and to remove all such materials remaining after installation or

maintenance operations have been completed. Customer acknowledges that any software furnished in connection with the Work and/or M&V Services is proprietary and subject to the provisions of any software license agreement associated with such software.

18. **DISPUTES.** JCI and Customer will attempt to settle any controversy, dispute, difference, or claim between them concerning the performance, enforcement, or interpretation of this Agreement (collectively, "Dispute") through direct discussion in good faith, but if unsuccessful, will submit any Dispute to non-binding mediation in the nearest major metropolitan area of the state where the project is performed. If the parties are unable to agree on a mediator or a date for mediation, either party may request JAMS, Inc. to appoint a mediator and designate the time and procedure for mediation. Such mediator shall be knowledgeable, to each party's reasonable satisfaction, with respect to matters concerning construction law. Neither JCI nor Customer will file a lawsuit against the other until not less than sixty (60) days after the mediation referred to herein has occurred, unless one or both parties is genuinely and reasonably concerned that any applicable statute of limitations is on the verge of expiring. JCI AND CUSTOMER HEREBY WAIVE THEIR RESPECTIVE RIGHTS TO A JURY TRIAL AS TO ANY CLAIM OR CAUSE OF ACTION BASED UPON, ARISING OUT OF OR DIRECTLY OR INDIRECTLY RELATED TO THIS AGREEMENT, INCLUDING CONTRACT, TORT AND STATUTORY CLAIMS, AND EACH OF THE PARTIES HERETO ACKNOWLEDGES THAT THIS WAIVER IS A MATERIAL INDUCEMENT TO ENTER INTO A BUSINESS RELATIONSHIP, THAT EACH HAS RELIED ON THIS WAIVER IN ENTERING INTO THIS AGREEMENT, AND THAT EACH WILL CONTINUE TO RELY ON THIS WAIVER IN THEIR RELATED FUTURE DEALINGS UNDER THIS AGREEMENT.

19. **GOVERNING LAW.** This Agreement and the construction and enforceability thereof shall be interpreted in accordance with the laws of the state where the Work is conducted.

20. **CONSENTS; APPROVALS; COOPERATION**. Whenever Customer's consent, approval, satisfaction or determination shall be required or permitted under this Agreement, and this Agreement does not expressly state that Customer may act in its sole discretion, such consent, approval, satisfaction or determination shall not be unreasonably withheld, qualified, conditioned or delayed, whether or not such a "reasonableness" standard is expressly stated in this Agreement. Whenever Customer's cooperation is required by JCI in order to carry out JCI's obligations hereunder, Customer agrees that it shall act in good faith and reasonably in so cooperating with JCI and/or JCI's designated representatives or assignees or subcontractors. Customer shall furnish decisions, information, and approvals required by this Agreement in a timely manner so as not to delay the performance of the Work or M&V Services.

21. **FURTHER ASSURANCES.** 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.

22. **INDEPENDENT CONTRACTOR.** The relationship of the parties hereunder shall be that of independent contractors. Nothing in this Agreement shall be deemed to create a partnership, joint venture, fiduciary, or similar relationship between the parties.

23. **POWER AND AUTHORITY.** Each party represents and warrants to the other that (i) it has all requisite power and authority to execute and deliver this Agreement and perform its obligations hereunder, (ii) all corporate, board, body politic, or other approvals necessary for its execution, delivery, and performance of this Agreement have been or will be obtained, and (iii) this Agreement constitutes its legal, valid, and binding obligation.

23. **SEVERABILITY.** In the event that any clause, provision, or portion of this Agreement or any part thereof shall be declared invalid, void, or unenforceable by any court having jurisdiction, such invalidity shall not affect the validity or enforceability of the remaining portions of this Agreement unless the result would be manifestly inequitable or materially impair the benefits intended to inure to either party under this Agreement.

24. **COMPLETE AGREEMENT.** It is understood and agreed that this Agreement contains the entire agreement between the parties relating to all issues involving the subject matter of this Agreement. No binding understandings, statements, promises or inducements contrary to this Agreement exist. This Agreement supersedes and cancels all previous agreements, negotiations, communications, commitments and understandings with respect to the subject matter hereof, whether made orally or in writing. Each of the parties to this Agreement expressly warrants and represents to the other that no promise or agreement which is not

herein expressed has been made to the other, and that neither party is relying upon any statement or representation of the other that is not expressly set forth in this Agreement. Each party hereto is relying exclusively on the terms of this Agreement, its own judgment, and the advice of its own legal counsel and/or other advisors in entering into this Agreement. Customer acknowledges and agrees that any purchase order issued by Customer associated with this Agreement is intended only to establish payment authority for Customer's internal accounting purposes. No purchase order shall be considered a counteroffer, amendment, modification, or other revision to the terms of this Agreement.

25. **HEADINGS.** The captions and titles in this Agreement are for convenience only and shall not affect the interpretation or meaning of this Agreement.

26. **COUNTERPARTS.** This Agreement may be executed in any number of counterparts, all of which when taken together shall constitute one single agreement between the parties.

27. **NOTICES.** All notices or communications related to this Agreement shall be in writing and shall be deemed served if and when sent by facsimile or mailed by certified or registered mail: to Johnson Controls, Inc. at the address listed on the first page of this Agreement, ATTN: Regional Solutions Manager, with a copy to Johnson Controls, Inc., ATTN: General Counsel – Building Efficiency Americas, 507 East Michigan Street, Milwaukee, Wisconsin, 53202: and to Customer at the address listed on the first page of this Agreement.

| **CITY OF DERBY** | **JOHNSON CONTROLS, INC.** |
|---|---|
| Signature:_____ | Signature:_____ |
| Printed Name:_____ | Printed Name:_____ |
| Title:_____ | Title:_____ |
| Date:_____ | Date:_____ |

**Schedule 1**

# SCOPE OF WORK

**Table 1.1**

Derby City and School District

Facility Information

| Name of Building | Address | SF |
|---|---|---|
| Derby High School | 95 Chatfield St | 135,689 |
| Derby Middle School | 73 Chatfield Street | 72,000 |
| Bradley Elementary School | 155 David Humphreys Road | 41,489 |
| Irving Elementary School | 9 Garden Place | 58,120 |
| City Hall | 1 Elizabeth Street | 17,224 |
| DPW HWY 1 | 5 Coon Hollow Road | 38,401 |
| Library | 313 Elizabeth Street | 14,700 |
| Fire 1 (Hotchkiss Hose Co.) | 250 David Humphrey Road | 6,570 |
| Fire 2 (Storm Engine Co.) | 151 Olivia Street | 5,850 |
| Fire 3 (East End Hose) | 1750 Derby Milford Road | 3,074 |
| Fire 4 (Paugassett H & L) | 55 Derby Avenue | 10,000 |
| Police | 125 Water Street | 12,326 |
| Veteran Community Center/Central Office | 35 Fifth Street | 22,770 |
| WPCA | 1 Caroline Street | 11,625 |
| Senior Center | 293 Main Street | 11,723 |
| Total | | 461,561 |

**Schedule 1**

## SUMMARY OF MEASURES

Table 1.2 summarizes the Facility Improvement Measures (ECMs) included in the Energy Performance Contract for the City of Derby & Derby School District facilities as listed in Table 1.1.

### Facility Improvement Measures (ECMs)

**Table 1.2**

| ECM | PROPOSED MEASURES | Derby HS | Derby MS | Bradley | Irving | DPW | Library | City Hall | Fire 1 |
|---|---|---|---|---|---|---|---|---|---|
| FIM 1 | Lighting - Fixture Retrofit | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| FIM 3 | Lighting - Exterior Lighting | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| FIM 4 | Building Envelope Improvements - Weatherization | ✗ | ✗ | ✗ | ✗ | ✗ | ✗ | ✗ | ✗ |
| FIM 5.1 | Energy Management System - Temperature Setback | ✗ | | | ✓ | | | | |
| FIM 5.2 | Energy Management System - Recommissioning | | ✓ | ✗ | ✓ | | ✗ | ✓ | |
| FIM 7 | Heating Distribution System - Pipe and Valve Insulation | ✓ | ✓ | ✓ | ✓ | | ✓ | | ✓ |
| FIM 8.2 | Oil to Gas Conversion - Boiler/Burner Replacements | | | ✓ | ✓ | | | | |
| FIM 10 | Domestic Hot Water System - Energy Efficient DHW Installation | ✓ | | | | ✗ | | | |
| FIM 20.2 | Kitchen Hood - Exhaust Fan Control w/Override Timer | ✗ | ✗ | ✗ | ✗ | | | | |
| FIM 21 | Computers - Power Management | ✓ | ✓ | ✓ | ✓ | | ✗ | ✗ | |
| FIM 22 | Water Conservation | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| FIM 23 | Vending Machine Controllers | ✓ | ✓ | ✓ | ✓ | | | | |
| FIM 24 | Renewable Energy- Photovoltaic Electric Generation | ✗ | ✓ | ✓ | ✓ | | | | |
| FIM 31 | Plug Load Controllers | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | |
| FIM 36 | VRF Installation | ✗ | | ✗ | ✓ | | | | |
| FIM 37 | Air Conditioning Compressor Controllers | | | | ✓ | ✓ | ✓ | ✓ | ✓ |
| FIM 39 | Transformers - Replacements | ✗ | ✓ | | | | | | |
| FIM 40 | Refrigeration Compressor Controllers | ✓ | ✓ | | | | | | |
| FIM 41 | RTU Replacement | | | | | | | ✓ | |
| Totals | | 9 | 11 | 9 | 13 | 5 | 6 | 6 | 5 |

**Table 1.2 (continued)**

| ECM | PROPOSED MEASURES | Fire 2 | Fire 3 | Fire 4 | Police | Senior Center | Community Center | WPCA | VARCA |
|---|---|---|---|---|---|---|---|---|---|
| FIM 1 | Lighting - Fixture Retrofit | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✗ |
| FIM 3 | Lighting - Exterior Lighting | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✗ |
| FIM 4 | Building Envelope Improvements - Weatherization | ✗ | ✗ | ✗ | ✗ | ✗ | ✗ | ✗ | |
| FIM 5.1 | Energy Management System - Temperature Setback | | | | | ✗ | ✓ | | |
| FIM 5.2 | Energy Management System - Recommissioning | | | | | | | | |
| FIM 7 | Heating Distribution System - Pipe and Valve Insulation | ✓ | | ✓ | | | ✓ | | |
| FIM 8.2 | Oil to Gas Conversion - Boiler/Burner Replacements | | | | | | | | |
| FIM 10 | Domestic Hot Water System - Energy Efficient DHW Installation | | | | | | ✗ | | |
| FIM 20.2 | Kitchen Hood - Exhaust Fan Control w/Override Timer | | | | | | | | |
| FIM 21 | Computers - Power Management | | | | | ✗ | ✗ | | |
| FIM 22 | Water Conservation | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | |
| FIM 23 | Vending Machine Controllers | ✓ | | | ✓ | | | | |
| FIM 24 | Renewable Energy- Photovoltaic Electric Generation | | | ✗ | | | ✗ | ✗ | |
| FIM 31 | Plug Load Controllers | | | | | ✓ | ✓ | | |
| FIM 36 | VRF Installation | | | | | | | | |
| FIM 37 | Air Conditioning Compressor Controllers | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | |
| FIM 39 | Transformers - Replacements | | | | | | | ✓ | |
| FIM 40 | Refrigeration Compressor Controllers | | | | | | | | |
| FIM 41 | RTU Replacement | | | | | | | | |
| Totals | | 6 | 4 | 5 | 5 | 5 | 7 | 5 | 0 |

| Legend: | |
|---|---|
| ✓ | Measure(s) Selected |
| ✗ | Measure(s) not included in this package |
| ✓ | Measure(s) added as a result of 11/19/2018 meeting |
| ✗ | Measure(s) removed as a result of 10/23/2018 conference call |
| | Measure(s) modified February 2019 |

## Schedule 1

1. JCI will provide submittals of the materials and equipment to be installed in the scopes of work for review by Customer.
2. The Customer will provide JCI with a timely response to requests for approval for material to be used in Schedule 1.
3. The Customer will provide all Ethernet drops and IP Addresses as needed for the ECMs where controls are installed.
4. JCI and its subcontractors will acquire necessary permits and inspections for work done under this agreement
5. Correction of any existing applicable building code violations identified by JCI during the execution of the Work are excluded
6. Both JCI and Customer agree that maintaining a budget neutral project consisting of Energy Conservation Measures (ECMs) selected in table 1.2, is contingent upon State reimbursement for Solar PV systems. The Notice to Proceed in Attachment 1 has been structured so as Customer may authorize implementation with the majority of ECMs while application for State reimbursement is processed.

## ECM-1 & 2 Lighting Retrofit

Johnson Controls will install new high efficiency lighting.
Johnson Controls has performed a lighting survey. A lighting Line-by Line of the survey is included as Attachment 1. Buildings that have been selected for lighting retrofits are included in tables 1.3 and 1.4 below.

1.1. **Scope of Work**
1.2. As specified in Attachment 1, older technology T8 and T12 lamps will be removed and new LED lamps will be installed in its place.
1.3. Recessed 2'x4', 2'x2' and 1'x4' troffers will be retrofit with LED Volumetric retrofit kits equipped with fixture integrated occupancy sensor to allow for "Adaptive Control" strategies
1.4. Screw-in Incandescent and Screw-in compact fluorescent lamps at pendant mount cans and high-hat fixture locations will be replaced with LED bulbs.
1.5. High bay and low bay fixtures will be replaced with New LED High/Low Bay fixtures equipped with fixture integrated sensors to allow for "Adaptive Control "strategies.
1.6. Exterior HID fixtures, (115 Watts and higher) including building mounted wall-packs and flood lights, will be replaced with new LED fixtures.
1.7. Low voltage Exterior HID fixtures (50-100W) will be retrofitted with LED Bulbs and Linear Tubes.
1.8. Existing Drum Fixtures will be replaced with New 14W LED Drum Fixtures.
1.9. "Adaptable Controls" is the name given to the control strategy that utilizes fixture integrated occupancy sensors that can be adjusted wirelessly from the ground, have a high-end trim to reduce the initial light output, a low light level setting for when occupancy is not present with an additional time delay before going off. Daylight harvesting is also provided by the same sensor and will dim each fixture to take advantage of available sunlight.
1.10. Emergency Ballasts will be replaced and compatible with New Direct Drive LED Lamps.

**Table 1.3**

| Summary by Building - Interior | New Fixtures | Retrofit Kits | Re-Lamp | Re-Lamp/ Re Ballast |
|---|---|---|---|---|
| Bradley School | 43 | 141 | 22 | 189 |
| DPW HWY 1 & 2 | 38 | 0 | 20 | 23 |
| Fire 1 | 0 | 32 | 24 | 38 |
| Fire 2 | 0 | 49 | 0 | 33 |
| Fire 2-Ambulance Building Next Door | 0 | 8 | 1 | 9 |
| Fire 3 | 1 | 8 | 4 | 12 |
| Fire 4 | 13 | 16 | 9 | 16 |
| High School | 28 | 66 | 62 | 192 |
| Irving School | 18 | 316 | 12 | 129 |
| Library | 2 | 84 | 48 | 160 |
| Marcucio sports field | 0 | 10 | 0 | 14 |
| Middle School | 6 | 62 | 82 | 73 |
| Muni parking garage | 95 | 0 | 7 | 6 |
| Parking deck | 0 | 0 | 0 | 0 |
| Police | 14 | 111 | 23 | 63 |
| Senior Center | 18 | 53 | 40 | 73 |
| Town Hall | 4 | 223 | 53 | 40 |
| Vet Comm Cntr | 109 | 17 | 32 | 41 |
| WPCA | 18 | 16 | 0 | 78 |
| **Total Interior** | **407** | **1212** | **439** | **1189** |

**Table 1.4**

| Summary by Building - Exterior | Exisiting Fixtures | Retrofit Fixtures | New Fixtures | Total |
|---|---|---|---|---|
| Bradley School | 55 | 55 | 12 | 67 |
| DPW HWY 1 & 2 | 8 | 8 | 0 | 8 |
| Fire 1 | 7 | 7 | 0 | 7 |
| Fire 2 | 7 | 7 | 0 | 7 |
| Fire 2-Ambulance Building Next Door | 0 | 0 | 0 | 0 |
| Fire 3 | 5 | 5 | 1 | 6 |
| Fire 4 | 7 | 7 | 0 | 7 |
| High School | 22 | 22 | 0 | 22 |
| Irving School | 5 | 5 | 3 | 8 |
| Library | 5 | 5 | 3 | 8 |
| Marcucio sports field | 16 | 16 | 0 | 16 |
| Middle School | 4 | 4 | 0 | 4 |
| Muni parking garage | 0 | 0 | 0 | 0 |
| Parking deck | 7 | 7 | 6 | 13 |
| Police | 12 | 12 | 0 | 12 |
| Senior Center | 3 | 3 | 0 | 3 |
| Town Hall | 11 | 11 | 0 | 11 |
| Vet Comm Cntr | 7 | 7 | 2 | 9 |
| WPCA | 27 | 27 | 0 | 27 |
| **Total Exterior** | **208** | **208** | **27** | **235** |

2. **Clarifications**

2.1. All existing LED fixtures will remain in place.

2.2. Repair or upgrades required to rectify existing lighting or electrical system code violations unless specifically described in this scope of work are excluded.

2.3. Repair or replacement of defective equipment, other than the equipment specifically described above. Johnson Controls will identify the location of defective equipment and notify the owner

2.4. Reconfiguration of existing lighting system layout, is excluded, except where noted herein

2.5. Scope of work excludes decorative HIDs, remote ballasted HIDs, and HIDs recessed in solid ceilings or walls.

2.6. Customer is responsible for repair and replacement throughout the term of the guarantee.

2.7. Repair, replacement, or calibration of damaged or defective motion sensors, time clocks, switches, breakers, and wiring unless otherwise noted in the Scope of Work

2.8. Repair, replacement or upgrade of existing indoor or exterior emergency and/or egress lighting system unless otherwise noted in the Scope of Work.

2.9. Repair or replacement of cracked, broken, missing, yellowed, or damaged fixture lenses or louvers unless otherwise noted in the Scope of Work.

## ECM-4 Energy Management System – Install new DDC system

1. **Supervisory Controller**
   **Community Center**

- Provide new web-enabled platform network supervisory controller for each building. New and existing points scheduled for migration shall be incorporated in the new supervisory network. Incorporate the functionality of existing systems and the new control sequences described below as required to meet savings guarantee. Provide alarming and trending.
- Network supervisory controllers shall be integrated into a temperature control network running on remote server at owner-specified location.
- Owner IT department to provide addresses and permissions for integration to site LAN.

2. **Air Handling Unit DDC Refit**
   **Community Center**

- Convert / migrate existing air-handling units to DDC Control, including replacement of existing pneumatic end devices with electronic type.
- This includes the following points and sequences:
  - Economizer control, including outdoor air enthalpy change-over on cooling equipment
  - Mixed air/low-limit control
  - Heating (discharge or room control as required by current configuration)
  - Cooling (discharge or room control as required by current configuration)
  - Discharge control
  - Freeze protection
  - Local or remote set point control
  - Warm-up/Cool-down

| Building | # of Units |
|---|---|
| Community Center | 4 |

| Building | Location | Area Served | Equipment | Fuel / Energy | Manufacturer |
|---|---|---|---|---|---|
| Community Center | Pool MER | Pool | HV-1 | Electric/HW | Trane |
| Community Center | Stage | Gymnasium | HV-2 | Electric/HW | Trane |
| Community Center | Roof | Central Offices | RTU | Electric/Gas | Trane |
| Community Center | Roof | Central Offices | RTU | Electric | No Nameplate |

3. **DDC Refit ECM**
**Irving School & Community Center**

- Convert / migrate pneumatics controls to DDC Control, including electronic end-devices.
- This includes the following points and sequences:
  - Economizer control, including outdoor air enthalpy change-over on cooling equipment
  - Heating
  - Cooling
  - Discharge control
  - Freeze protection
  - Local or remote set point control
  - Warm-up/Cool-down

**Schedule 1**

| Building | Unit Ventilator | Pneumatic T-Stat | Radiator Classroom / Office | Radiator Hall / Storage | Electric T-Stat | DDC T-Stat | Progr. T-Stat | Fan Coil | Convector | Unit Heater |
|---|---|---|---|---|---|---|---|---|---|---|
| Irving School | 0 | 24 | 29 | 21 | 0 | 6 | 0 | 1 | 1 | 0 |
| Community Center | 0 | 8 | 4 | 7 | 2 | 1 | 2 | 0 | 3 | 2 |

**4. Clarifications**

1) Repair or replacement of defective electrical, mechanical or controls equipment, other than the equipment specifically described in the ECM description is excluded. Johnson Controls will identify the location of observed defective equipment and notify the owner.
2) Repair or upgrades required due to rectify existing code violations, unless specifically described in this scope of work.
3) Repair, replacement or upgrade of existing emergency systems unless otherwise noted in the Scope of Work.
4) Resolution of existing design, service, and or distribution conditions known or unknown

## ECM-4.1 Energy Management System - Recommissioning

1. **Derby Middle School:**

- Provide repair and refurbishment of existing Alerton DDC controls.
  - Verify sequence of operations will achieve specified energy savings and meet customers' needs
  - Stroke end devices.
  - Verify operation of control devices. Calibrate as necessary; replace devices which prove defective or unreliable.
  - Program night setback controls.

| Building | DDC T-Stat | Fan Coil | Convector |
|---|---|---|---|
| Derby Middle School | 47 | 6 | 1 |

2. **Irving School:**

- Provide repair and refurbishment of existing Automated Logic DDC controls.
  - Verify sequence of operations will achieve specified energy savings and meet customers' needs
  - Stroke end devices.
  - Verify operation of control devices. Calibrate as necessary; replace devices which prove defective or unreliable.
  - Program night setback controls.
- Install new DDC thermostats in areas where they not installed (Some classrooms did not have thermostats installed).

| Building | Pneumatic T-Stat | Radiator Classroom / Office | Radiator Hall / Storage | DDC T-Stat | Fan Coil | Convector |
|---|---|---|---|---|---|---|
| Irving School | 24 | 29 | 21 | 6 | 1 | 1 |

3. **City Hall:**

- Provide repair and refurbishment of existing Trane DDC controls.
  - Verify sequence of operations will achieve specified energy savings and meet customers' needs. Verify that the 1st floor VAV system is capable of meeting required temperature setpoints in all modes of operation.
    - Stroke end devices.
    - Verify operation of control devices. Calibrate as necessary; replace devices which prove defective or unreliable.
    - Program night setback controls.
    -

| Building | Radiator Hall / Storage | Electric T-Stat | DDC T-Stat | Programable T-Stat | Convector |
|---|---|---|---|---|---|
| City Hall | 13 | 1 | 19 | 1 | 4 |

**4. Clarifications**

1. Repair or replacement of defective electrical, mechanical or controls equipment, other than the equipment specifically described in the ECM description is excluded. Johnson Controls will identify the location of observed defective equipment and notify the owner.
2. Repair or upgrades required due to rectify existing code violations, unless specifically described in this scope of work.
3. Repair, replacement or upgrade of existing emergency systems unless otherwise noted in the Scope of Work.
4. Resolution of existing design, service, and or distribution conditions known or unknown

## ECM-4.2 Energy Management System – Exhaust Fan/Relief Damper Controls

### 1. Relief Dampers

**Irving School**

- Provide DDC control for relief dampers
- Repair or replace damper assemblies as required
- Provide manually activated or schedule control to achieve specified energy savings and meet customers' needs
- Control is to be open/close (not proportional)

| Building | Relief Dampers |
|---|---|
| Irving School | 7 |

### 2. Exhaust Fans

**Community Center**

- Provide DDC control for all exhaust fans, quantities as indicated in itemization
- Provide start/stop, status, and alarm
- Provide occupancy programming/control to achieve specified energy savings and meet customers' needs
- Tie in existing units that are already tied into the existing pneumatic controls to the new BMS

| Building | Exhaust Fans |
|---|---|
| Community Center | 8 |
| Total | 8 |

### 3. Clarifications

1. Repair or replacement of defective electrical, mechanical or controls equipment, other than the equipment specifically described in the ECM description is excluded. Johnson Controls will identify the location of observed defective equipment and notify the owner.
2. Repair or upgrades required due to rectify existing code violations, unless specifically described in this scope of work.
3. Repair, replacement or upgrade of existing emergency systems unless otherwise noted in the Scope of Work.
4. Resolution of existing design, service, and or distribution conditions known or unknown

## ECM-4.3 Energy Management System – Optimal Start

### 1. Community Center

Provide additional programming that controlled HVAC equipment will operate with an optimal start warm up cycle.

### 2. Clarifications

1. Repair or replacement of defective electrical, mechanical or controls equipment, other than the equipment specifically described in the ECM description is excluded. Johnson Controls will identify the location of observed defective equipment and notify the owner.
2. Repair or upgrades required due to rectify existing code violations, unless specifically described in this scope of work.
3. Repair, replacement or upgrade of existing emergency systems unless otherwise noted in the Scope of Work.
4. Resolution of existing design, service, and or distribution conditions known or unknown

## ECM-5 Pipe & Valve Insulation

### 1. Scope of Work

Johnson Controls will insulate the exposed piping and valves in locations identified in Table 1.7. The insulation will prevent the loss of heat from the pipes, thereby saving boiler energy as well as reducing overheating conditions in adjacent spaces.

1.1. Pipe insulation shall be pre-formed fiberglass with protective all-service jacketing, with R-Value to meet current energy code guidelines.

1.2. Valves, flanges, Heat exchanger heads insulated with custom fabricated removable insulation blankets.

1.3. Tanks & Heat exchanger bodies insulated with fiberglass pipe & tank wrap, covered with all-service protective jackets.

**Table 1.7**

| Building | Room | Component | Pipe Material | Fluid Type | Nominal Pipe Dia (") or Tank Surface Area | Qty or Length / Size | Units |
|---|---|---|---|---|---|---|---|
| Bradley Elementary School | Boiler Room | 90 Degree Elbow | Iron | MTHW | 4 | 2 | Units |
| Bradley Elementary School | Boiler Room | Flange | Iron | MTHW | 4 | 2 | Units |
| Bradley Elementary School | Boiler Room | Gate Valve | Iron | MTHW | 4 | 4 | Units |
| Bradley Elementary School | Boiler Room | Straight Pipe | Iron | MTHW | 2 | 15 | LF |
| Bradley Elementary School | Boiler Room | 90 Degree Elbow | Iron | MTHW | 2 | 8 | Units |
| Bradley Elementary School | Boiler Room | Straight Pipe | Iron | MTHW | 3 | 6 | LF |
| Bradley Elementary School | Boiler Room | T Intersection | Iron | MTHW | 3 | 4 | Units |
| Bradley Elementary School | Boiler Room | Straight Pipe | Iron | MTHW | 4 | 9 | LF |
| Bradley Elementary School | Boiler Room | 90 Degree Elbow | Iron | MTHW | 4 | 4 | Units |
| Bradley Elementary School | Boiler Room | T Intersection | Iron | MTHW | 4 | 2 | Units |
| Bradley Elementary School | Boiler Room | In-Line Pump | Iron | MTHW | 2 | 2 | Units |
| Bradley Elementary School | Boiler Room | In-Line Pump | Iron | MTHW | 2 | 4 | Units |
| Bradley Elementary School | Boiler Room | Straight Pipe | Iron | MTHW | 2 | 15 | LF |
| Bradley Elementary School | Boiler Room | 90 Degree Elbow | Iron | MTHW | 2 | 13 | Units |
| Bradley Elementary School | Boiler Room | Straight Pipe | Copper - polis | MTHW | 2.5 | 6 | LF |
| Bradley Elementary School | Boiler Room | 90 Degree Elbow | Copper - polis | MTHW | 2.5 | 2 | Units |
| Bradley Elementary School | Boiler Room | Strainer | Iron | MTHW | 2 | 1 | Units |

## ECM-5 Pipe & Valve Insulation – Table 1.7 (continued)

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Bradley Elementary School | Boiler Room | In-Line Pump | Iron | MTHW | 2 | 1 | Units |
| Bradley Elementary School | Boiler Room | Check Valve | Iron | MTHW | 2 | 7 | Units |
| Bradley Elementary School | Boiler Room | Straight Pipe | Iron | MTHW | 1.5 | 12 | LF |
| Bradley Elementary School | Boiler Room | 90 Degree Elbow | Iron | MTHW | 1.5 | 11 | Units |
| Bradley Elementary School | Boiler Room | Control Valve | Iron | MTHW | 1.5 | 1 | Units |
| Bradley Elementary School | Boiler Room | Control Valve | Iron | MTHW | 2 | 1 | Units |
| Bradley Elementary School | Boiler Room | Flo-Check | Iron | MTHW | 2 | 3 | Units |
| Library | Boiler Room | Air Seperator Tank | Iron | MTHW | 7.85 | 1 | Units |
| Library | Boiler Room | Strainer | Iron | MTHW | 2.5 | 1 | Units |
| Library | Boiler Room | In-Line Pump | Iron | MTHW | 2.5 | 2 | Units |
| Library | Boiler Room | Check Valve | Iron | MTHW | 2.5 | 2 | Units |
| Library | Boiler Room | Check Valve | Iron | MTHW | 2.5 | 1 | Units |
| Library | Boiler Room | Flange | Iron | MTHW | 2.5 | 2 | Units |
| Library | Boiler Room | Straight Pipe | Iron | MTHW | 2.5 | 2 | LF |
| Library | Boiler Room | 90 Degree Elbow | Iron | MTHW | 2 | 1 | Units |
| Library | Boiler Room | Gate Valve | Iron | MTHW | 2 | 1 | Units |
| Library | Boiler Room | Flange | Iron | MTHW | 2 | 4 | Units |
| Veteran Community Center/Central Office | Boiler Room | Straight Pipe | Iron | MTHW | 5 | 2 | LF |
| Veteran Community Center/Central Office | Boiler Room | 90 Degree Elbow | Iron | MTHW | 5 | 2 | Units |
| Veteran Community Center/Central Office | Boiler Room | Straight Pipe | Iron | MTHW | 4 | 3 | LF |
| Veteran Community Center/Central Office | Boiler Room | 90 Degree Elbow | Iron | MTHW | 4 | 1 | Units |
| Veteran Community Center/Central Office | Boiler Room | T Intersection | Iron | MTHW | 4 | 1 | Units |
| Veteran Community Center/Central Office | Boiler Room | Butterfly Valve | Iron | MTHW | 4 | 1 | Units |

## ECM-5 Pipe & Valve Insulation – Table 1.7 (continued)

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Veteran Community Center/Central Office | Boiler Room | Flange | Iron | MTHW | 4 | 1 | Units |
| Veteran Community Center/Central Office | Boiler Room | Gate Valve | Iron | MTHW | 3 | 2 | Units |
| Veteran Community Center/Central Office | Boiler Room | 3-Way Valve | Iron | MTHW | 3 | 1 | Units |
| Veteran Community Center/Central Office | Boiler Room | Straight Pipe | Iron | MTHW | 3 | 1 | LF |
| Veteran Community Center/Central Office | Boiler Room | 90 Degree Elbow | Iron | MTHW | 3 | 1 | Units |
| Veteran Community Center/Central Office | Boiler Room | Flo-Check | Iron | MTHW | 3 | 1 | Units |
| Veteran Community Center/Central Office | Boiler Room | Flo-Check | Iron | MTHW | 2 | 2 | Units |
| Veteran Community Center/Central Office | Boiler Room | Check Valve | Iron | MTHW | 2 | 2 | Units |
| Veteran Community Center/Central Office | Boiler Room | Gate Valve | Iron | MTHW | 2.5 | 2 | Units |
| Veteran Community Center/Central Office | Boiler Room | Gate Valve | Iron | MTHW | 2 | 1 | Units |
| Veteran Community Center/Central Office | Boiler Room | In-Line Pump | Iron | MTHW | 2.5 | 2 | Units |
| Veteran Community Center/Central Office | Boiler Room | Straight Pipe | Iron | MTHW | 1.5 | 4 | LF |
| Veteran Community Center/Central Office | Boiler Room | 90 Degree Elbow | Iron | MTHW | 1 1/2 | 2 | Units |
| Veteran Community Center/Central Office | Boiler Room | Straight Pipe | Copper - polis | MTHW | 1 1/2 | 30 | LF |
| Veteran Community Center/Central Office | Boiler Room | 90 Degree Elbow | Copper - polis | MTHW | 1 1/2 | 10 | Units |
| Veteran Community Center/Central Office | Boiler Room | Straight Pipe | Iron | MTHW | 2 | 21 | LF |
| Veteran Community Center/Central Office | Boiler Room | 90 Degree Elbow | Iron | MTHW | 2 | 4 | Units |
| Veteran Community Center/Central Office | Boiler Room | In-Line Pump | Iron | MTHW | 1 1/2 | 1 | Units |
| Veteran Community Center/Central Office | Boiler Room | In-Line Pump | Iron | MTHW | 2 | 1 | Units |
| Veteran Community Center/Central Office | Boiler Room | Straight Pipe | Iron | MTHW | 6 | 1 | LF |
| Veteran Community Center/Central Office | Boiler Room | 90 Degree Elbow | Iron | MTHW | 6 | 1 | Units |
| Veteran Community Center/Central Office | Boiler Room | T Intersection | Iron | MTHW | 6 | 1 | Units |
| Veteran Community Center/Central Office | Boiler Room | Flange | Iron | MTHW | 6 | 1 | Units |
| Veteran Community Center/Central Office | Boiler Room | Straight Pipe | Iron | MTHW | 5 | 2 | LF |
| Veteran Community Center/Central Office | Boiler Room | 90 Degree Elbow | Iron | MTHW | 5 | 1 | Units |
| Veteran Community Center/Central Office | Boiler Room | Straight Pipe | Iron | MTHW | 4 | 3 | LF |
| Veteran Community Center/Central Office | Boiler Room | 90 Degree Elbow | Iron | MTHW | 4 | 1 | Units |
| Veteran Community Center/Central Office | Boiler Room | Butterfly Valve | Iron | MTHW | 4 | 1 | Units |
| Veteran Community Center/Central Office | Boiler Room | Straight Pipe | Iron | MTHW | 2 | 1 | LF |
| Veteran Community Center/Central Office | Boiler Room | 90 Degree Elbow | Iron | MTHW | 2 | 1 | Units |

## ECM-5 Pipe & Valve Insulation – Table 1.7 (continued)

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Veteran Community Center/Central Office | Pool Pump om | Straight Pipe | Copper - polis | MTHW | 2 | 24 | LF |
| Veteran Community Center/Central Office | Pool Pump Room | 90 Degree Elbow | Copper - polis | MTHW | 2 | 12 | Units |
| Veteran Community Center/Central Office | Pool Pump Room | Straight Pipe | Steel | MTHW | 2 | 11 | LF |
| Veteran Community Center/Central Office | Pool Pump Room | Heat Exchanger | Iron | MTHW | 9 4/5 | 1 | Units |
| Veteran Community Center/Central Office | Pool Pump Room | Flange | Iron | MTHW | 10 | 1 | Units |
| Veteran Community Center/Central Office | Pool Pump Room | Gate Valve | Iron | MTHW | 2 | 1 | Units |
| Veteran Community Center/Central Office | Pool Pump Room | Control Valve | Iron | MTHW | 2 | 1 | Units |
| Veteran Community Center/Central Office | Pool Pump Room | Straight Pipe | Iron | MTHW | 2 | 2 | LF |
| Veteran Community Center/Central Office | Pool Pump Room | 90 Degree Elbow | Iron | MTHW | 2 | 1 | Units |
| Middle School | Boiler Room | 90 Degree Elbow | Iron | MTHW | 2 1/2 | 2 | Units |
| Middle School | Boiler Room | 90 Degree Elbow | Iron | CHW | 4 | 2 | Units |
| Middle School | Boiler Room | Flange | Iron | CHW | 4 | 2 | Units |
| Middle School | Boiler Room | Air Seperator Tank | Iron | MTHW | 31 2/5 | 1 | Units |
| Middle School | Boiler Room | Straight Pipe | Iron | MTHW | 6 | 3 | LF |
| Middle School | Boiler Room | Flange | Iron | MTHW | 6 | 2 | Units |
| Middle School | Boiler Room | Strainer | Iron | MTHW | 4 | 1 | Units |
| Middle School | Boiler Room | Strainer | Iron | MTHW | 2 1/2 | 1 | Units |
| Middle School | Boiler Room | Straight Pipe | Iron | MTHW | 4 | 9 | LF |
| Middle School | Boiler Room | 90 Degree Elbow | Iron | MTHW | 4 | 4 | Units |
| Middle School | Boiler Room | T Intersection | Iron | MTHW | 4 | 1 | Units |
| Middle School | Boiler Room | Flange | Iron | MTHW | 4 | 2 | Units |
| Middle School | Boiler Room | Flange | Iron | MTHW | 2 1/2 | 4 | Units |
| Middle School | Boiler Room | Centrifugal Pump | Iron | MTHW | 2 1/2 | 2 | Units |
| Middle School | Boiler Room | Centrifugal Pump | Iron | MTHW | 4 | 1 | Units |
| Middle School | Boiler Room | Check Valve | Iron | MTHW | 4 | 2 | Units |

## ECM-5 Pipe & Valve Insulation – Table 1.7(continued)

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Irving Elementary School | Boiler Room | Flange | Iron | LPS | 6 | 2 | Units |
| Irving Elementary School | Boiler Room | Gate Valve | Iron | LPS | 6 | 2 | Units |
| Irving Elementary School | Boiler Room | Gate Valve | Iron | LPS | 5 | 1 | Units |
| Irving Elementary School | Boiler Room | Bonnet | Iron | LPS | 4 | 1 | Units |
| Irving Elementary School | Boiler Room | Gate Valve | Iron | LPS | 4 | 2 | Units |
| Irving Elementary School | Boiler Room | Strainer | Iron | LPS | 2 | 1 | Units |
| Irving Elementary School | Boiler Room | Control Valve | Iron | LPS | 2 | 1 | Units |
| Irving Elementary School | Boiler Room | Flange | Iron | LPS | 4 | 1 | Units |
| Irving Elementary School | Boiler Room | Flange | Iron | MTHW | 12 | 1 | Units |
| Irving Elementary School | Boiler Room | Straight Pipe | Iron | MTHW | 2 | 6 | LF |
| Irving Elementary School | Boiler Room | 90 Degree Elbow | Iron | MTHW | 2 | 2 | Units |
| Irving Elementary School | Boiler Room | Flo-Check | Iron | MTHW | 2 | 1 | Units |
| Irving Elementary School | Boiler Room | Ball valve | Iron | MTHW | 2 | 1 | Units |
| Irving Elementary School | Boiler Room | Air Seperator Tank | Iron | MTHW | 7 6/7 | 1 | Units |
| Irving Elementary School | Boiler Room | Strainer | Iron | MTHW | 2 | 1 | Units |
| Irving Elementary School | Boiler Room | In-Line Pump | Iron | MTHW | 2 | 1 | Units |
| Irving Elementary School | Boiler Room | Straight Pipe | Iron | Cond | 1 | 3 | LF |
| Irving Elementary School | Boiler Room | 90 Degree Elbow | Iron | Cond | 1 | 2 | Units |
| Irving Elementary School | Boiler Room | Strainer | Iron | Cond | 1 | 3 | Units |
| Irving Elementary School | Boiler Room | Steam Trap | Iron | Cond | 1 | 1 | Units |
| Irving Elementary School | Boiler Room | Straight Pipe | Iron | Cond | 2 | 2 | LF |
| Irving Elementary School | Boiler Room | 90 Degree Elbow | Iron | Cond | 2 | 3 | Units |
| Irving Elementary School | Boiler Room | Straight Pipe | Iron | Cond | 1 1/2 | 4 | LF |
| Irving Elementary School | Boiler Room | 90 Degree Elbow | Iron | Cond | 1 1/2 | 1 | Units |
| Irving Elementary School | Boiler Room | Strainer | Iron | Cond | 1 1/2 | 1 | Units |
| Irving Elementary School | Boiler Room | Steam Trap | Iron | Cond | 1 1/2 | 1 | Units |
| Irving Elementary School | Boiler Room | Strainer | Iron | Cond | 2 | 1 | Units |
| Irving Elementary School | Boiler Room | Steam Trap | Iron | Cond | 2 | 1 | Units |
| Irving Elementary School | Boiler Room | Gate Valve | Iron | Cond | 3 | 1 | Units |

## ECM-5 Pipe & Valve Insulation – Table 1.7(continued)

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Irving Elementary School | Boiler Room | 90 Degree Elbow | Iron | Cond | 3 | 2 | Units |
| Irving Elementary School | Boiler Room | Steam Trap | Iron | Cond | 1 | 1 | Units |
| Irving Elementary School | Boiler Room | 90 Degree Elbow | Iron | Cond | 1 1/4 | 4 | Units |
| Irving Elementary School | Boiler Room | Straight Pipe | Iron | Cond | 2 | 8 | LF |
| Irving Elementary School | Boiler Room | Straight Pipe | Iron | Cond | 1 | 1 | LF |
| Irving Elementary School | Boiler Room | Straight Pipe | Iron | Cond | 2 | 2 | LF |
| Irving Elementary School | Boiler Room | Strainer | Iron | Cond | 1 | 1 | Units |
| Irving Elementary School | Boiler Room | Strainer | Iron | LPS | 1 1/2 | 1 | Units |
| Irving Elementary School | Boiler Room | Heat Exchanger | Iron | MTHW | 6 2/3 | 1 | Units |
| Irving Elementary School | Boiler Room | Flange | Iron | MTHW | 10 | 1 | Units |
| Irving Elementary School | Boiler Room | 90 Degree Elbow | Iron | MTHW | 2 | 1 | Units |
| Irving Elementary School | Boiler Room | Straight Pipe | Copper - polis | MTHW | 1 1/4 | 4 | LF |
| Irving Elementary School | Boiler Room | 90 Degree Elbow | Copper - polis | MTHW | 1 1/4 | 1 | Units |
| Irving Elementary School | Boiler Room | Straight Pipe | Iron | MTHW | 1 1/2 | 1 | LF |
| Irving Elementary School | Boiler Room | 90 Degree Elbow | Iron | MTHW | 1 1/2 | 2 | Units |
| Irving Elementary School | Boiler Room | Strainer | Iron | MTHW | 1 1/2 | 1 | Units |
| Irving Elementary School | Boiler Room | In-Line Pump | Iron | MTHW | 1 1/4 | 3 | Units |
| Paugassett Hook & Ladder Co. | Boiler Room | Straight Pipe | Copper - polis | MTHW | 2 | 9 | LF |
| Paugassett Hook & Ladder Co. | Boiler Room | 90 Degree Elbow | Copper - polis | MTHW | 2 | 4 | Units |
| Paugassett Hook & Ladder Co. | Boiler Room | Straight Pipe | Iron | MTHW | 2 | 18 | LF |
| Paugassett Hook & Ladder Co. | Boiler Room | 90 Degree Elbow | Iron | MTHW | 2 | 5 | Units |
| Paugassett Hook & Ladder Co. | Boiler Room | Straight Pipe | Copper - polis | MTHW | 1 1/4 | 2 | LF |
| Paugassett Hook & Ladder Co. | Boiler Room | 90 Degree Elbow | Copper - polis | MTHW | 1 1/4 | 1 | Units |
| Paugassett Hook & Ladder Co. | Boiler Room | Flo-Check | Iron | MTHW | 1 1/4 | 1 | Units |
| Paugassett Hook & Ladder Co. | Boiler Room | Straight Pipe | Iron | MTHW | 1 1/2 | 6 | LF |
| Paugassett Hook & Ladder Co. | Boiler Room | Air Scoop | Iron | MTHW | 1 1/2 | 1 | Units |
| Paugassett Hook & Ladder Co. | Boiler Room | In-Line Pump | Iron | MTHW | 1 1/2 | 1 | Units |
| Paugassett Hook & Ladder Co. | Boiler Room | In-Line Pump | Iron | MTHW | 2 | 1 | Units |
| Storm Engine Co. | Boiler Room | Straight Pipe | Iron | MTHW | 2 | 24 | LF |
| Storm Engine Co. | Boiler Room | 90 Degree Elbow | Iron | MTHW | 2 | 10 | Units |
| Storm Engine Co. | Boiler Room | 45 Degree Elbow | Iron | MTHW | 2 | 2 | Units |

## ECM-5 Pipe & Valve Insulation – Table 1.7 (continued)

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Storm Engine Co. | Boiler Room | Straight Pipe | Iron | MTHW | 1 | 69 | LF |
| Storm Engine Co. | Boiler Room | 90 Degree Elbow | Iron | MTHW | 1 | 8 | Units |
| Storm Engine Co. | Boiler Room | Straight Pipe | Iron | MTHW | 1 1/4 | 32 | LF |
| Storm Engine Co. | Boiler Room | 90 Degree Elbow | Iron | MTHW | 1 1/4 | 7 | Units |
| Storm Engine Co. | Boiler Room | 45 Degree Elbow | Iron | MTHW | 1 1/4 | 2 | Units |
| Storm Engine Co. | Boiler Room | Straight Pipe | Copper - polis | MTHW | 2 | 9 | LF |
| Storm Engine Co. | Boiler Room | 90 Degree Elbow | Copper - polis | MTHW | 2 | 2 | Units |
| Storm Engine Co. | Boiler Room | Straight Pipe | Copper - polis | MTHW | 1 | 6 | LF |
| Storm Engine Co. | Boiler Room | 90 Degree Elbow | Copper - polis | MTHW | 1 | 1 | Units |
| Storm Engine Co. | Boiler Room | In-Line Pump | Iron | MTHW | 1 | 4 | Units |
| Hotchkiss Hose Co. | Boiler Room | Straight Pipe | Iron | MTHW | 2 | 13 | LF |
| Hotchkiss Hose Co. | Boiler Room | 90 Degree Elbow | Iron | MTHW | 2 | 6 | Units |
| Hotchkiss Hose Co. | Boiler Room | Flo-Check | Iron | MTHW | 1 1/2 | 1 | Units |
| Hotchkiss Hose Co. | Boiler Room | Straight Pipe | Iron | MTHW | 1 1/2 | 24 | LF |
| Hotchkiss Hose Co. | Boiler Room | 90 Degree Elbow | Iron | MTHW | 1 1/2 | 9 | Units |
| Hotchkiss Hose Co. | Boiler Room | Straight Pipe | Iron | MTHW | 1 | 16 | LF |
| Hotchkiss Hose Co. | Boiler Room | 90 Degree Elbow | Iron | MTHW | 1 | 8 | Units |
| Hotchkiss Hose Co. | Boiler Room | Straight Pipe | Iron | MTHW | 3/4 | 6 | LF |
| Hotchkiss Hose Co. | Boiler Room | 90 Degree Elbow | Iron | MTHW | 3/4 | 3 | Units |
| Hotchkiss Hose Co. | Boiler Room | Ball Valve | Iron | MTHW | 1 | 4 | Units |
| Hotchkiss Hose Co. | Boiler Room | Ball Valve | Iron | MTHW | 2 | 2 | Units |
| Hotchkiss Hose Co. | Boiler Room | In-Line Pump | Iron | MTHW | 1 | 2 | Units |
| Hotchkiss Hose Co. | Boiler Room | In-Line Pump | Iron | MTHW | 2 | 1 | Units |
| Hotchkiss Hose Co. | Boiler Room | Air Scoop | Iron | MTHW | 1 1/2 | 1 | Units |
| Hotchkiss Hose Co. | Boiler Room | In-Line Pump | Iron | MTHW | 1 1/2 | 1 | Units |

MTHW- Medium Temperature Hot Water
LPS- Low Pressure Steam
Cond- Condensate
CHW- Chilled Water

## 2. Clarifications

2.1. Asbestos abatement and hazardous material remediation is excluded except as described in Article 10

2.2. Repairs/replacement of piping and piping ancillaries found to be corroded or rusted or otherwise unacceptable for installation of the insulation other than what is specified in the Scope of Work are excluded

## ECM-6 Oil to Gas Fuel Conversions – Boiler/Burner Replacements

**1. Bradley School**

1.1. Remove two (2) existing boilers and dispose of properly.
1.2. Furnish & Install two (2) HB S.th28 RTS-HE-W-7 with Powerflame dual fuel C2-GO-15 full modulation burner with control links and a Heat Timer Multi-mod modulating controller
1.3. Install a new natural gas service to boiler room and connect to new gas train furnished with boilers. New service to be installed from Utility provided meter at building exterior.
1.4. Connect new boilers to existing oil lines.
1.5. Install new boilers in same location.
1.6. Assemble and install boiler-burner units in compliance with manufacturer's installation instructions.
1.7. Boilers shall be hydrostatically pressure tested at factory in accordance with ASME requirements.
1.8. Connect new piping to the existing header.
1.9. New header isolation valves valves will be installed.
1.10. Furnish & Install new breaching in accordance with manufacturer's recommendation, along with proper drains and acid neutralization.
1.11. Piping to be insulated in compliance with applicable 2012 Energy Code.
1.12. Startup boilers. Perform combustion efficiency test per M&V requirements.
1.13. Provide Pipe Supports, Hangers and Brackets
1.14. Provide Valve Tags and ID Chart
1.15. Provide Pipe Labeling and Directional Arrows
1.16. Boilers will be equipped with lead lag control performed by the new DDC control system.

**2. Irving School**

2.1. Remove and dispose of existing burners. Boilers to remain in place.
2.2. Furnish & install two (2) new Power Flame dual fuel burners (matching existing boiler input).
2.3. Burners to be equipped with Honeywell linkageless fuel air controllers.
2.4. Install a new natural gas service to boiler room and connect to new gas train furnished with burners. New service to be installed from Utility provided meter at building exterior.
2.5. Assemble and install burner units in compliance with manufacturer's installation instructions.
2.6. Startup burners. Perform combustion efficiency test per M&V requirements.

**3. Clarifications**

3.1. Asbestos abatement and hazardous material remediation is excluded except as described in Article 10
3.2. Boiler(s) and controls to comply with applicable regulations in effect at the time of contract signing.
3.3. Existing Housekeeping pads (Bradley School) will be re-used for new equipment.
3.4. JCI will coordinate with Utility for installation of new gas services. Cost of new gas services is not included in this scope.
3.5. Resolution of existing design, service, and or distribution conditions known or unknown is excluded
3.6. Correction of any existing applicable building code violations and Federal Americans with Disabilities Act (ADA) violations identified by JCI during the execution of the Work is excluded. Such violations will be brought to the attention of the Customer for remedy
3.7. Repair or replacement of defective mechanical, electrical and controls equipment and electrical distribution system is excluded, except the equipment described in the Scope of Work (Defective equipment identified by JCI during implementation of the Scope of Work will be brought to the attention of the Customer)
3.8. Existing fuel oil system will be reused. Repairs, replacements or upgrades to this system are excluded.

3.9. Excludes CO and Combustible Gas Detectors
3.10. Excludes all Fire Alarm Work, Testing, and Tie In
3.11. Includes testing and balancing for newly installed equipment only
3.12. All references in this document to the applicable Energy Code refer to the International Code Council International Energy Conservation Code (ICC IECC), version 2012. ICC IECC 2012 is the energy code mandated and incorporated by the State of Connecticut at the time of contract execution.

## ECM-7 Domestic Hot Water (DHW) Replacement

JCI will install new high efficiency hot water heaters. The schools currently utilize standard efficiency domestic hot water heaters.

**1. High School Locker Rooms**

1.1. Remove existing two electric DHW heaters and dispose of properly (one DHW heater in each Fan Room)
1.2. Provide and install one (1) AO Smith Model BTH-250 gas fired, condensing domestic hot water heater in the boys' locker room fan room that will supply both the boys' and girls' locker rooms.
1.3. Reconnect piping to Boy's DHW system in Fan Room, provide new piping to connection points located in Girl's Locker room Fan Room
1.4. Provide new gas feed from adjacent gas service.
1.5. Furnish & install new breaching in accordance with manufacturer's instructions.
1.6. Provide Pipe Supports, Hangers and Brackets
1.7. Provide Valve Tags and ID Chart
1.8. Provide Pipe Labeling and Directional Arrows
1.9. Replace two (2) re-circulation Bronze Pumps (DHW)
1.10. Replace two (2) Domestic Hot Water 3 Way Mixing Valves, one for each DHW system.
1.11. Seal new roof penetrations.
1.12. Furnish and install piping required.
1.13. Insulate new piping in accordance with applicable 2012 Energy Code
1.14. Provide Required Electrical Control Wiring
1.15. Provide Manufacturer's warranty on new equipment

**2. High School Kitchen**

2.1. Remove existing DHW heater and dispose of properly
2.2. Provide and install one (1) AO Smith Model BTH-300 gas fired, condensing domestic hot water heater
2.3. Reconnect piping to kitchen DHW system.
2.4. Provide new gas feed from adjacent gas service.
2.5. Furnish & install new breaching in accordance with manufacturer's instructions.
2.6. Provide Pipe Supports, Hangers and Brackets
2.7. Provide Valve Tags and ID Chart
2.8. Provide Pipe Labeling and Directional Arrows
2.9. Replace re-circulation Bronze Pump (DHW)
2.10. Replace Domestic Hot Water 3 Way Mixing Valve
2.11. Seal new roof penetrations.
2.12. Furnish and install piping required.
2.13. Insulate all new piping in accordance with applicable 2012 Energy Code
2.14. Provide Required Electrical Control Wiring
2.15. Provide Manufacturer's warranty on new equipment

**3. Clarifications**

3.1. Asbestos Abatement and hazardous materials remediation is Excluded except as described in Article 10 of this agreement
3.2. Resolution of existing design, service, and or distribution conditions known or unknown is excluded
3.3. Correction of any existing applicable building code violations and Federal Americans with Disabilities Act (ADA) violations identified by JCI during the execution of the Work is excluded. Such violations will be brought to the attention of the Customer for remedy

3.4. Repair or replacement of defective mechanical, electrical and controls equipment and electrical distribution system is excluded, except the equipment described in the Scope of Work (Defective equipment identified by JCI during implementation of the Scope of Work will be brought to the attention of the Customer)

3.5. Repairs/replacement of wiring, insulation, piping or ductwork found to be corroded or rusted and unacceptable for installation of components or fittings required for installation other than what is specified in the Scope of Work

## ECM-9 Computer Power Management

JCI will install computer power management software in Schools to increase efficiency and optimize savings. Software will be installed per table 1.10 below.

**Table 1.8**

| Unit Type | Count |
|---|---|
| Personal Computer | 370 |

**1. Scope of Work**

1.1. Furnish and install Surveyor Perpetual computer power management software
1.2. Software will be pushed to client computers with the assistance of School District IT Department.
1.3. Includes one time, lifetime license fee
1.4. Provide four (4) years of technical support
1.5. Provide four (4) years of updates
1.6. Provide four (4) years of upgrades

2. **Clarifications:**

2.1. Repair, upgrades or replacement of defective computer equipment is excluded.
2.2. Upgrades & updates beyond 4 years are excluded
2.3. Customer is responsible to push software onto new and/or replacement computers.

## ECM-10 Water Conservation

Bathroom fixtures offer water saving opportunities because many of these fixtures can be retrofit to reduce the amount of water consumed per flush (toilets and urinals) or per minute of use (sinks). Reducing sink water usage also saves the thermal energy used to make hot water.

Table 1.11 lists the existing fixtures that will be replaced with new energy efficient fixtures

**Table 1.9**

| | Existing Fixtures Quantities | | | | | Quantities to be Replaced/Retrofit | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Site** | **Toilets** | **Urinals** | **Lavatory Sinks** | **Showers** | **Classroom / Other Sinks** | **Toilets** | **Urinals** | **Lavatory Sinks** | **Showers** | **Classroom / Other Sinks** |
| Bradley ES | 25 | 8 | 20 | | 24 | 3 | 0 | 10 | | 13 |
| Central Office | 5 | 2 | 5 | | | 0 | 0 | 4 | | |
| City Hall | 11 | 1 | 11 | | | 8 | 1 | 3 | | |
| DPW HWY | 3 | 2 | 2 | 4 | 3 | 0 | 0 | 2 | 4 | 2 |
| Fire 1 | 9 | 3 | 7 | 1 | 2 | 8 | 0 | 7 | 1 | 2 |
| Fire 2 | 4 | 2 | 4 | 2 | 2 | 4 | 0 | 4 | 2 | 1 |
| Fire 3 | 2 | | 2 | | 3 | 2 | | 2 | | 2 |
| Fire 4 | 5 | 2 | 5 | 1 | 2 | 5 | 1 | 5 | 1 | 1 |
| High School | 51 | 13 | 51 | 29 | 1 | 20 | 0 | 20 | 2 | 1 |
| Irving ES | 27 | 10 | 29 | 7 | 25 | 0 | 0 | 13 | 0 | 25 |
| Library | 6 | | 6 | | 1 | 1 | | 4 | | 1 |
| Middle School | 42 | 10 | 44 | 14 | 4 | 0 | 8 | 8 | 1 | 4 |
| Police | 15 | 4 | 15 | 6 | 5 | 8 | 4 | 8 | 5 | 3 |
| Senior Center | 9 | | 9 | | 1 | 6 | | 9 | | 1 |
| Veteran Community Ctr | 7 | 3 | 9 | 8 | 2 | 0 | 0 | 4 | 7 | 0 |
| WPCA | 2 | 2 | 2 | 2 | 5 | 2 | 0 | 1 | 0 | 2 |
| **Total** | **223** | **62** | **221** | **74** | **80** | **67** | **14** | **104** | **23** | **58** |

**1. Toilet Replacement – 44 Fixtures**

36 existing flushometer toilets will be replaced like for like with new, 1.28 gpf toilets. New 1.28 gpf china and a new, manual piston flush valve will be installed. 8 existing tank toilets will be replaced like for like with new, 1.1 or 1.28 gpf tank fixtures.

1.1. 1.1 or 1.28 gpf in kind china replacement (American Standard)
1.2. New outlet seals and closet bolts if applicable
1.3. New toilet seats with stainless steel hardware
1.4. New manual piston flush valve (Sloan)
1.5. 10% stop valve replacement is anticipated for toilet flush valves. If additional work is required due to faulty stop valves or isolation valves, it will be considered an extra cost.
1.6. 10% flange and carrier rod replacement or repair work is anticipated and is included in this scope.

**2. Toilet Flush Valve Retrofit – 23 Fixtures**

23 existing Toto piston valves that are flushing higher than the rated 1.6 gpf will be screw adjusted back to the rated flow. Existing china and flush valve will remain in place.

**3. Urinal Flush Valve Retrofit – 14 Fixtures**

3.1. 14 existing high flow urinals will have their flush valves retrofit to 0.5 gpf. Existing china and flush valve body will remain in place.

3.1.1. New 0.5 gpf flush valve diaphragm kit (Sloan)

3.1.2. 10% stop valve replacement is anticipated for urinal flush valves. If additional work is required due to faulty stop valves or isolation valves, it will be considered an extra cost.

**4. Sink Faucets – 152 Sinks**

4.1. Existing high flow faucets on 152 sinks (lavatory, classroom, and kitchenette/hand/other) will be retrofit to low flow specifications (0.5, 1.0, or 1.5 gpm, depending on the sink use type). In general, lavatory sinks will have lower flow and utility sinks will be retrofit to higher flows.

4.2. For those faucets from which existing flow restrictors cannot be removed without damaging the faucet, a replacement flow restrictor will not be installed. The replacement flow restrictor will be turned over to Owner with the project's shelf stock.

4.3. Where possible, tamper resistant flow restrictor will be installed. For faucets that cannot accept a tamper resistant flow restrictor, a regular flow restrictor will be installed.

**5. Showerheads – 23 Units**

5.1. 23 existing high flow showerheads/wands will be replaced like for like with new, 1.5 gpm showerheads/wands.

**6. Clarifications**

6.1. JCI has included like-for-like fixture upgrades in this proposal: existing high-flow, ADA-height toilets will be replaced with low-flow, ADA height-toilets; existing high-flow, standard height toilets will be replaced with low-flow, standard height toilets. Any and all ADA bathroom partitions, grab bars, extensions, sink faucet actuators, piping insulation, or other ADA requirements are hereby excluded from this proposal. JCI does not take responsibility for any existing or future ADA compliance issues and if required to modify bathrooms or fixtures to meet an ADA code this will be completed for an additional cost.

6.2. Repair of existing faucets and sink basins or leaking parts in existing faucets is excluded.

6.3. Repair of pre-existing water damaged floors, walls and ceilings is excluded.

6.4. Repair or replacement of pre-existing cracked, lose or missing floor and wall tiles is excluded.

6.5. Replacement or modification of existing floor and wall coverings is excluded.

6.6. 10% flange and carrier rod replacement for toilets is anticipated and is included in this scope.

6.7. 10% stop valve replacement is anticipated for urinal flush valves and is included in this scope

6.8. JCI will sample pre and post measurements in accordance with Schedule 2 M&V requirements

## ECM-11 Vending Machine Controllers

Johnson Controls Inc. shall install Vending Miser controls on vending machines listed below. Utilizing a custom passive infrared sensor, the controller powers down a vending machine when the area surrounding it is unoccupied and automatically re-powers the vending machine when the area is reoccupied.

Table 1.12 lists the vending machines that will be retrofit with new Vending Misers

**Table 1.10**

| Building | Location | Type |
|---|---|---|
| Derby High School | 135 - Faculty Room | Beverage |
| Derby Middle School | Faculty Room | Beverage |
| Bradley School | Faculty Room | Beverage |
| Irving School | Faculty Room | Beverage |
| Fire Station 2 | Garage Bay | Beverage |
| Fire Station 2 | Garage Bay | Snack |
| Police Station | Break Area | Beverage |
| Police Station | Break Area | Snack |

### 1. Scope of Work

1.1. Unplug the vending machine's power chord from the outlet.
1.2. Identify a suitable mounting location for Vending Miser®, mostly likely on the wall behind the vending machine
1.3. Operational lights of Vending Miser shall be viewable by maintenance personnel
1.4. Plug the vending machine's power cord into Vending Miser®
1.5. The PIR sensor shall be located so it can see people approaching the vending machine.
1.6. The sensor cable shall be secured to the wall or ceiling by covering It with plastic low voltage wire raceway.
1.7. Plug the Vending Miser into the wall outlet. The following shall occur:
  1.7.1. The Vending machine shall power up immediately
  1.7.2. The Green LED shall flash twice to indicate that the temperature sensor is functional
  1.7.3. The Amber LED shall then come on as the Vending Miser attempts to synchronize with the compressor's operation. This typically will require that the compressor cycle in on and off
  1.7.4. The Red LED shall come on, indicating occupancy direction.

### 2. Clarifications

2.1. If the vending machines are moved or changed out it is the customer's responsibility to ensure that the controllers are re-attached.
2.2. Repair or replacement of the vending machines is excluded

## ECM-12 Solar Photovoltaics (PV)

### Scope of Work

Reference Attachment 2, Preliminary Solar PV Designs and Production Report

Subject to Structural evaluations of existing roof structures, Johnson Controls will furnish and Install equipment, engineering, materials, permitting, and labor for four (4) Solar PV systems included in the following table 1.13:

**Table 1.11**

| Building | Design Size (kWdc) | Design Size (kWhac) |
|---|---|---|
| Derby Middle School | 220.320 | 263,406 |
| Bradley Elementary School | 151.805 | 180,406 |
| Irving Elementary School | 139.191 | 166,269 |
| **Total** | **511** | **610,081** |

In the event that the structural evaluations,Regulatory/ Utility constraints, or quantity of awarded ZRECs require a change in the capacity of the equipment to be installed as part of the Work provided in connection with this ECM, JCI and Customer agree that the price to be paid for the Work set forth on Schedule 4 and the Solar PV Credits (ZRECs) and Measured Energy Cost Avoidance shall be reduced on a pro rata basis based on the number of kWdc that are changed as part of the ECM. In such event JCI and Customer agree that the Agreement shall be automatically adjusted by JCI as appropriate to effect the changes in the prior sentence without the need to amend this Agreement, provided that JCI will provide Customer with a written summary of such changes, showing cost and savings impacts.

1. **Pre-Construction**
   - 1.1. PV production analysis of each proposed location.
   - 1.2. Design engineering and PV system sizing.
   - 1.3. Structural analysis of existing roof structures.
   - 1.4. Prepare Utility Interconnection application and related documentation, and coordination to achieve interconnection pre-approval.
   - 1.5. Includes cost of interconnection application and permit

2. **Installation**
   - 2.1. Furnish & Install ballasted or attached roof mounted PV racking systems at selected locations. Furnish and install ballast for systems on flat roofs, including protective slip sheets under racking systems.
   - 2.2. Furnish and install Hyundai (or equivalent) solar modules
   - 2.3. Furnish and Install string Solar Edge Inverters (or equivalent) and accompanying supports.
   - 2.4. Perform necessary electrical, mechanical, and structural testing and inspections
   - 2.5. Furnish and Install Data Acquisition System, including Revenue Grade Electrical Metering.
   - 2.6. Provide 5-year web-based monitoring service. Connect to Data Acquisition System
   - 2.7. Furnish necessary wiring and conduit, including interconnection metering requirements.
   - 2.8. Coordinate interconnection related activities with Utility in order to achieve authority to interconnect.
   - 2.9. Test completed systems, including protocol to achieve authority to interconnect.
   - 2.10. Work shall comply with state and local codes and regulations and with the latest edition of applicable standards, codes and specifications in effect at the time of contract signing.
   - 2.11. Conduct training (8 hours) for designated personnel in the routine maintenance and care of the systems.

**3. Clarifications**

3.1. JCI does not include any upgrades or modifications to line side of utility meter.

3.2. Prior to Grid connection, one power outage will be required for final electrical tie-ins. Work will be scheduled during unoccupied periods. No temporary power will be provided

3.3. JCI will prepare and submit applications for Interconnection with the Utility. Work will commence after Utility approval.

3.4. JCI does not include any resolution of existing design, service, and or distribution conditions known or unknown or any existing code issues

3.5. Repair or replacement of defective electrical equipment and electrical distribution system is excluded, except the equipment described in the Scope of Work (Defective equipment identified by JCI during implementation of the Scope of Work will be brought to the attention of the Customer)

## ECM-13 Plug Load Controllers

Johnson Controls will install a plug load management system that will gain control of numerous plug load equipment as listed below. The system will use an existing Wi-Fi network that will communicate to an energy management user interface. Through the user interface, equipment can be monitored, scheduled and turned on / off. In areas where no Wi-Fi connection exists, plugs shall be programmed with the intended schedule for the equipment.

### 1. Scope of Work

1.1. Provide and install BERT plug load control devices as per schedule of outlets

**Table 1.12**

| Building | Copier | Printer | Smart TV | Projector | Window AC | Water Fountain | Large Coffee Maker | Flat Screen TV |
|---|---|---|---|---|---|---|---|---|
| Derby High School | 3 | 8 | 1 | 35 | 13 | 9 | 1 | 0 |
| Derby Middle School | 3 | 3 | 0 | 35 | 0 | 15 | 0 | 2 |
| Bradley School | 2 | 0 | 0 | 27 | 3 | 3 | 0 | 0 |
| Irving School | 2 | 1 | 0 | 28 | 5 | 4 | 0 | 0 |
| City Hall | 4 | 10 | 0 | 1 | 0 | 0 | 0 | 0 |
| Community Center - Central Office | 2 | 9 | 0 | 1 | 8 | 1 | 1 | 0 |
| DPW | 1 | 1 | 0 | 0 | 2 | 0 | 1 | 0 |
| Library | 1 | 3 | 0 | 0 | 0 | 2 | 0 | 0 |
| Senior Center | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 0 |
| **Total** | **19** | **36** | **1** | **127** | **31** | **35** | **4** | **2** |

1.2. Install and connect BERT devices
1.3. Load and configure BERT software on an owner-designated supervisory PC
1.4. Start and test the systems
1.5. Provide end-user training (4 hours)

### 2. Clarifications

2.1. Controllers will communicate to a user interface via existing Wi-Fi.
2.2. In areas with no Wi-Fi connectivity, controllers will operate in a stand-alone configuration.
2.3. If the controlled equipment is moved or changed out it is the customer's responsibility to ensure that the controllers are re-attached.
2.4. Johnson controls is not responsible for repairs, replacements, or upgrades to the plug load controlled equipment

## ECM-14 Variable Refrigerant Flow (VRF) Installation

The Irving Elementary School's HVAC requirements are met with various Air Handling units. These units provide only partial cooling to the spaces. Several of the existing air handlers are at the end of their useful life and will be replaced as part of this measure. New Variable Refrigerant Flow Systems (VRF) will be installed in order to provide 100% cooling capability.

**Scope of Work:**

1. Abandon the existing (1) air handling unit in the GYM and installing (1) new packaged air handling unit
   - 1.1. 25 Ton Cooling Capacity, 10,000 CFM
   - 1.2. Electric cooling with steam coil
   - 1.3. Existing AHU to be abandoned in place
2. Remove & replace the (1) Rooftop Unit for the Cafeteria with a new, roof-mounted, packaged RTU, JCI Model # J20ZJN40R2B1FAA1A1.
3. Remove & replace the (1) Rooftop Unit for basement rooms 001, 003, and Mechanical Room with a new, roof-mounted, packaged RTU, JCI Model J20ZJN40R2B1FAA1A1.
4. At the following locations, install new VRF unit ventilators (42 total).
   - 4.1. At (10) Old Section classroom spaces (window above doors to be replaced with a structural insulated panel and fitted with an outside air opening)
   - 4.2. At (12) New Section classroom spaces (opening to be cut in wall for outside air opening and sealed weathertight)
   - 4.3. At (6) Misc. use rooms
   - 4.4. At (6) Office / Locker rooms
   - 4.5. At Hallways on 1st & 2nd Floor (4 units per floor)
   - 4.6. Note: No upgrade/retrofit at Room 004 Split System, Room 002 Split System, Room 100 RTU, (6) Bathrooms
5. Provide upgrade to existing electrical system to include the following:
   - 5.1. Coordination for the removal and replacement of the existing pad mounted transformer with a larger transformer as required for the service upgrade, to be in the same location
   - 5.2. Utility provided 15KV/120/208v pad mounted transformer
   - 5.3. Removal and replacement of the existing transformer pad with an new pad as required
   - 5.4. Transformer connections and grounding as required
   - 5.5. 120/208v 1200amp underground electric service
   - 5.6. Required excavation, backfill, restoration, sand, gravel, rigging, blacktop cutting and repair and sidewalk cutting and repairs
   - 5.7. Core drilling and patching of the foundation wall
   - 5.8. 1200amp switchgear to be installed in the existing electric room
   - 5.9. 600amp sub-feed to the existing building main switchboard
   - 5.10. Disconnection of the existing 600amp electric service
   - 5.11. Power wiring to 1 – new Gym air handling unit (60amp)
   - 5.12. Power wiring to a new Packaged cafeteria RTU (100amp)
   - 5.13. Power wiring to a new Packaged room 001,003 RTU (100amp)
   - 5.14. Power wiring to 42 – VRF units
   - 5.15. Low voltage wiring of 42 – VRF controllers
   - 5.16. Power wiring to 7 change over boxes
   - 5.17. Low voltage wiring of 7 change over boxes
   - 5.18. Power wiring to 8 VRF condensers
   - 5.19. Low voltage wiring of 8 VRF condensers
   - 5.20. Low voltage wiring of 1 VRF master control

### 1. Clarifications

1.1. The scope of work required for the electric service upgrades is contingent upon approval of the local utility company.
1.2. Asbestos abatement is excluded except as described in Article 10
1.3. Refrigerant piping to indoor units will be concealed above ceilings to the extent possible. Where concealment is not feasible, piping will be installed tight to ceilings.
1.4. Correction of any existing applicable building code violations and Federal Americans with Disabilities Act (ADA) violations identified by JCI during the execution of the Work is excluded. Such violations will be brought to the attention of the Customer for remedy
1.5. Repair or replacement of defective mechanical, electrical and controls equipment and electrical distribution system is excluded, except the equipment described in the Scope of Work (Defective equipment identified by JCI during implementation of the Scope of Work will be brought to the attention of the Customer)
1.6. Resolution of existing design, service, and or distribution conditions known or unknown is excluded
1.7. Temporary power, heating, and cooling during the installation is excluded
1.8. Post construction balancing is included at newly installed units only

## ECM-15 AC Compressor Controllers

Johnson Controls shall install new IntelliCon-CAC controllers on the individual compressor units listed below.

**1. Scope of Work**

1.1. Install compressor controls on the equipment listed in table 1.16 below:
1.2. Provide power and control wiring
1.3. Startup & test new equipment
1.4. Provide one-time end-user instruction (4 hours) on proper operation.

**Table 1.13**

| Building | Location | Name | Manufacturer | Model Number | Compressor Data | No. of Compressors |
|---|---|---|---|---|---|---|
| Irving School | Roof | Condensing Unit | | | Nameplate Faded | 1 |
| Irving School | Roof | RTU | Carrier | | Could not access unit. | 1 |
| | | | | | | |
| City Hall | Outside | Condensing Unit | Trane | 2TTB2024A1000AA | 8.4 RLA | 1 |
| City Hall | Roof | AHU-1 | Trane | YHC120A3 | x2, 17.3 RLA ea. | 2 |
| City Hall | Roof | RTU-1 | Carrier | 48MA-028--- | x2: 63.6 & 44.4 RLA | 2 |
| City Hall | Roof | RTU-2 | Trane | YCD300B3HGHB | x2: 36.6 RLA ea. | 2 |
| Community Center | Outside | Condensing Unit | Carrier | 38CKC048300 | 24.4 RLA | 1 |
| Community Center | Roof | RTU | Trane | YHC092F3RHA0BG | x2: 15.9 & 10 RLA | 2 |
| Community Center | Roof | RTU | Carrier? | | Nameplate Faded | 2 |
| DPW | Roof | RTU | Lennox | KGA036S4DM3Y | 10.4 RLA | 1 |
| Fire 1 | Outside | Condensing Unit | Nordyne | FS5BD-060KA | 28.2 RLA | 1 |
| Fire 1 | Outside | Condensing Unit | Unitary Products Group | HBHB-T120AE | x2 (Tandem): 17.3 RLA ea. | 1 |
| Fire 1 | Outside | Condensing Unit | Amana | VCA48B3A | 14.5 RLA | 1 |
| Fire 2 | Outside | Condensing Unit | Payne | PA10JA024-A | 10.9 RLA | 1 |
| Fire 2 | Outside | Condensing Unit | Payne | PA10JA024-A | 10.9 RLA | 1 |
| Fire 2 | Outside | Condensing Unit | Payne | PA10JA024-A | 10.9 RLA | 1 |
| Fire 2 | Outside | Condensing Unit | Goodman | GSC130241FA | 10.8 RLA | 1 |
| Fire 2 | Outside | Condensing Unit | Payne | PA10JA024-A | 10.9 RLA | 1 |
| Fire 2 - Ambulance | Roof | RTU | Rheem | RRNL-B024JK06E | 12.6 RLA | 1 |
| Fire 3 | Outside | Condensing Unit | Bryant | 113ANA048-E | 19.9 RLA | 1 |
| Fire 4 | Roof | RTU | York | ZF180N24P2AAA1 | Could not access unit. | 2 |
| Library | Outside | CU-1 | Unitary Products | H2DB060S25A | 16 RLA | 1 |
| Library | Outside | CU-2 | Unitary Products | H2DB048S25A | 14 RLA | 1 |

| Building | Location | Name | Manufacturer | Model Number | Compressor Data | No. of Compressors |
|---|---|---|---|---|---|---|
| Library | Outside | CU-3 | Unitary Products | H2DB048S25A | 14 RLA | 1 |
| Library | Outside | CU-4 | Unitary Products | H2DB060S25A | 16 RLA | 1 |
| Library | Outside | CU-5 | Unitary Products | H2DB060S25A | 16 RLA | 1 |
| Library | Outside | CU-6 | Unitary Products | H1CE180A25E | 15 hp, 59.6 RLA | 1 |
| Police Station | Roof | RTU-1 | Carrier | 48HJE008---541DA | x2: 12.4 RLA ea. | 2 |
| Police Station | Roof | RTU-2 | Carrier | 48HJE006---541DA | 17.3 RLA | 1 |
| Police Station | Roof | RTU-3 | Carrier | 48HJE006---541DA | 17.3 RLA | 1 |
| Police Station | Roof | RTU-4 | Carrier | 48HJE006---541DA | 17.3 RLA | 1 |
| Police Station | Roof | RTU-5 | Carrier | 48HJE006---541DA | 17.3 RLA | 1 |
| Police Station | Roof | RTU-6 | Carrier | 48HJE009---541DA | x2: 15 RLA ea. | 2 |
| Police Station | Roof | RTU-7 | Carrier | 48HJE006---541DA | 17.3 RLA | 1 |
| Senior Center | Outside | Condensing Unit | Trane | 2TTA0036A3000AA | 11.3 RLA | 1 |
| Senior Center | Outside | Condensing Unit | Trane | 2TTA0072A3000AA | 19.8 RLA | 1 |
| Senior Center | Roof | Condensing Unit | Trane | | Could not access unit. | 1 |
| Senior Center | Roof | RTU | Trane | | Could not access unit. | 1 |
| WCPA | Outside | Condensing Unit | Lennox | TSA060H4N43Y | 16 RLA | 1 |

## 2. Clarifications

2.1. IntelliCon-controllers work in conjunction with the existing thermostat.

2.2. Includes 1-year warranty on workmanship and 15-year manufacturer's warranty on defects

2.3. Resolution of existing design, service, and or distribution conditions known or unknown is excluded

2.4. Temporary cooling during the installation is excluded

2.5. Repair or replacement of defective mechanical, electrical and controls equipment and electrical distribution system is excluded, except the equipment described in the Scope of Work (Defective equipment identified by JCI during implementation of the Scope of Work will be brought to the attention of the Customer)

2.6. Correction of any existing applicable building code violations and Federal Americans with Disabilities Act (ADA) violations identified by JCI during the execution of the Work. Such violations will be brought to the attention of the Customer for remedy.

## ECM-16 Transformer Replacement

JCI shall replace the indicated transformers with new high efficiency units. The transformers will be PowerSmith, OPAL-R Series E-Saver 80R or equivalent.

**Facilities included for this Measure**

Derby Middle School
WPCA

1. **Scope of Work**
   - 1.1. Arrange for the delivery of the list of transformers purchased to be stored at pre-arranged location.
   - 1.2. Remove and replace each transformer listed in Table 1.17
   - 1.3. Stage old transformers on site in a pre-designated area until disposal by JCI can be arranged.
   - 1.4. Make provisions for removal and disposal of existing transformers

**TABLE 1.14**

| Building | Location | Manufacturer | Model Number | Capacity | %IMP |
|---|---|---|---|---|---|
| Derby Middle School | Basement Electric Room | Siemens | 3F3Y045BTP1 | 45 kVA | 4.3% IMP |
| Derby Middle School | Boiler Room | Siemens | 3F3Y045BTP1 | 45 kVA | 4.3% IMP |
| Derby Middle School | Cafeteria | Siemens | 3F3Y045BTP1 | 45 kVA | 4.3% IMP |
| WCPA | Addition Building | Square D Company | 75T3HF | 75 kVA | 4.5% IMP |
| WCPA | Electric Room | Square D Company | 75T3HF | 75 kVA | 4.5% IMP |
| WCPA | Storage Area | Square D Company | 45T3HF | 45 kVA | 3.2% IMP |

**2. Clarifications**

- 2.1 Transformer replacements will require coordinated electrical shutdowns of affected areas.
- 2.2 Temporary power is excluded.
- 2.3 Remediation of electrical code issues is excluded.
- 2.4 Repair or replacement of defective existing electrical equipment and electrical distribution system, except the equipment described in the Scope of Work, is excluded.

## ECM-17 Refrigeration Compressor Controllers

Johnson Controls shall install new IntelliCon-RU controllers on the individual compressor units listed below.

1. **Scope of Work**
   - 1.1. Furnish and install Dynamic Cycle Management refrigeration compressor controls on the equipment listed in Table 1.18:
   - 1.2. Provide power and control wiring to existing temperature controls
   - 1.3. Startup & test new equipment
   - 1.4. Provide one time end-user instruction (4 hours) on proper operation.

**Table 1.15**

| Building | Location | System Served | Manufacturer | Model Number | Serial Number | Compressor Data |
|---|---|---|---|---|---|---|
| Derby High School | Roof | Walk-In Freezer Unit | Kolpak | PC249LOP | 410125396 | 16.7 RLA |
| Derby High School | Roof | Walk-In Refrigeration Unit | Kolpak | PC149MOP | 410125397 | 9.6 RLA |
| Derby High School | Roof | Walk-In Freezer Unit | Kolpak | PC249LOP | 410125396 | 16.7 RLA |
| Derby High School | Roof | Walk-In Refrigeration Unit | Kolpak | PC69MOP | 410125399 | 6.8 RLA |
| Derby Middle School | Roof | Walk-In Refrigeration Unit | | | | |
| Derby Middle School | Roof | Walk-In Freezer Unit | | | | |

2. **Clarifications**
   - 2.1. IntelliCon-controllers work in conjunction with the existing temperature controls.
   - 2.2. Includes 1-year warranty on workmanship and 15-year manufacturer's warranty on defects.
   - 2.3. Repair or replacement of defective refrigeration equipment, except the equipment described in the Scope of Work is excluded (Defective equipment identified by JCI during implementation of the Scope of Work will be brought to the attention of the Customer).

## ECM-18 RTU Replacement

The Carrier Rooftop unit located a City Hall is at the end of its useful life. Johnson Controls will replace the existing unit.

1. Scope of Work
   - 1.1. Reclaim refrigerant from the existing Carrier 48MA-028 multi-zone unit and dispose of according to state and federal regulations in effect at the time of contract signing
   - 1.2. Disconnect Gas and Electrical feeds to the extent required for new equipment installation. Circuit breaker/disconnect switch to be re-used.
   - 1.3. Disconnect and remove the Carrier multi-zone unit. Unit will be removed from the property and disposed of according to state and federal regulations in effect at the time of contract signing.
   - 1.4. Provide and install one (1) Alliance Air Rooftop Unit ( gas fired heat, 208/230 Volt, 3-Phase, combination heating and cooling, with 10 zones)
   - 1.5. Existing rooftop curb will be re-used. The Alliance Air RTU is designed to fit the existing Carrier roof curb.
   - 1.6. Re-connect gas piping and electrical power wiring
   - 1.7. Re-charge system with refrigerant in accordance with current regulations
   - 1.8. Provide low voltage control wiring for the Alliance Air units, re-connect to existing Trane BMS
   - 1.9. Provide all crane and rigging services
   - 1.10. Start, test & balance, and commission HVAC system
   - 1.11. Provide 2 hours training on operation and preventative maintenance
   - 1.12. Provide a five (5) year Alliance Air factory compressor warranty
   - 1.13. Provide a ten (10) year Alliance Air factory heat exchanger warranty

2. Clarifications
   - 2.1. The Alliance Air Products RTU is manufactured as a direct replacement for the Carrier MMA-028 mutli-zone unit. No modifications to exiting systems or building structure are required.
   - 2.2. The front parking lot will be used for rigging equipment in place. The parking areas will need to be closed for a 4-6 hour period during the day of installation.
   - 2.3. Repair or replacement of defective equipment, except the equipment described in the Scope of Work is excluded (Defective equipment identified by JCI during implementation of the Scope of Work will be brought to the attention of the Customer)
   - 2.4. Resolution of existing design, service, and or distribution conditions known or unknown is excluded
   - 2.5. Temporary heating and cooling during the installation is excluded

**Schedule 2**

# ASSURED PERFORMANCE GUARANTEE

## I. PROJECT BENEFITS

**A. Certain Definitions.** For purposes of this Agreement, the following terms have the meanings set forth below:

**Annual Project Benefits** are the portion of the projected Total Project Benefits to be achieved in any one year of the Guarantee Term.

**Annual Project Benefits Realized** are the Project Benefits actually realized for any one year of the Guarantee Term.

**Annual Project Benefits Shortfall** is the amount by which the Annual Project Benefits exceed the Annual Project Benefits Realized in any one year of the Guarantee Term.

**Annual Project Benefits Surplus** is the amount by which the Annual Project Benefits Realized exceed the Annual Project Benefits in any one year of the Guarantee Term.

**Baseline** is the mutually agreed upon data and/or usage amounts that reflect conditions prior to the installation of the Improvement Measures as set forth in Section IV below.

**Guarantee Term** will commence on the first day of the month next following the Substantial Completion date and will continue through the duration of the M&V Services, subject to earlier termination as provided in this Agreement.

**Installation Period** is the period beginning on JCI's receipt of Customer's Notice to Proceed and ending on the commencement of the Guarantee Term.

**Measured Project Benefits** are the utility savings and cost avoidance calculated in accordance with the methodologies set forth in Section III below.

**Non-Measured Project Benefits** are identified in Section II below. The Non-Measured Project Benefits have been agreed to by Customer and will be deemed achieved in accordance with the schedule set forth in the Total Project Benefits table below. Customer and JCI agree that: (i) the Non-Measured Project Benefits may include, but are not limited to, future capital and operational costs avoided as a result of the Work and implementation of the Improvement Measures, (ii) achievement of the Non-Measured Project Benefits is outside of JCI's control, and (iii) Customer has evaluated sufficient information to conclude that the Non-Measured Project Benefits will occur and bears sole responsibility for ensuring that the Non-Measured Project Benefits will be realized. Accordingly, the Non-Measured Project Benefits shall not be measured or monitored by JCI at any time during the Guarantee Term, but rather shall be deemed achieved in accordance with the schedule set forth in the Total Project Benefits table below.

**Project Benefits** are the Measured Project Benefits plus the Non-Measured Project Benefits to be achieved for a particular period during the term of this Agreement.

**Total Project Benefits** are the projected Project Benefits to be achieved during the entire term of this Agreement.

**B. Project Benefits Summary.** Subject to the terms and conditions of this Agreement, JCI and Customer agree that Customer will be deemed to achieve a total of **$299,624** in Non-Measured Project Benefits and JCI guarantees that Customer will achieve a total of **$6,183,598** in Measured Project Benefits, **$782,060** in Renewable Energy Credits and **$214,182** in O&M savings, for Total Project Benefits of **$7,479,465** as set forth in the Total Project Benefits table below.

**Schedule 2**

# Total Project Benefits

**Table 2.1**

| Year | Measured Energy Cost Avoidance[1] | Non-Measured Energy Cost Avoidance[2] | Renewable Energy Credits[3] | Operations & Maintenance Cost Avoidance[4] | Annual Guaranteed Cost Avoidance[5] |
|---|---|---|---|---|---|
| 1 | $ 257,969 | $ 12,500 | $ 54,731 | $ 11,899 | $ 337,099 |
| 2 | $ 266,361 | $ 12,906 | $ 54,350 | $ 11,899 | $ 345,516 |
| 3 | $ 275,029 | $ 13,326 | $ 53,970 | $ 11,899 | $ 354,225 |
| 4 | $ 283,983 | $ 13,760 | $ 53,594 | $ 11,899 | $ 363,236 |
| 5 | $ 293,231 | $ 14,208 | $ 53,220 | $ 11,899 | $ 372,558 |
| 6 | $ 302,783 | $ 14,671 | $ 52,848 | $ 11,899 | $ 382,202 |
| 7 | $ 312,651 | $ 15,149 | $ 52,480 | $ 11,899 | $ 392,179 |
| 8 | $ 322,843 | $ 15,643 | $ 52,114 | $ 11,899 | $ 402,499 |
| 9 | $ 333,371 | $ 16,153 | $ 51,750 | $ 11,899 | $ 413,173 |
| 10 | $ 344,246 | $ 16,680 | $ 51,389 | $ 11,899 | $ 424,215 |
| 11 | $ 355,480 | $ 17,225 | $ 51,030 | $ 11,899 | $ 435,634 |
| 12 | $ 367,085 | $ 17,787 | $ 50,674 | $ 11,899 | $ 447,445 |
| 13 | $ 379,072 | $ 18,368 | $ 50,321 | $ 11,899 | $ 459,660 |
| 14 | $ 391,456 | $ 18,968 | $ 49,969 | $ 11,899 | $ 472,292 |
| 15 | $ 404,248 | $ 19,588 | $ 49,621 | $ 11,899 | $ 485,355 |
| 16 | $ 417,462 | $ 20,228 | $ - | $ 11,899 | $ 449,589 |
| 17 | $ 431,113 | $ 20,889 | $ - | $ 11,899 | $ 463,902 |
| 18 | $ 445,215 | $ 21,573 | $ - | $ 11,899 | $ 478,687 |
| **TOTAL** | **$ 6,183,598** | **$ 299,624** | **$ 782,060** | **$ 214,182** | **$ 7,479,465** |

[1]Measured Energy Cost Avoidance project benefits commencing in Year 1 are escalated annually by 3.5% (unit energy cost basis are set forth in the energy rates tables in the Baseline Calculations & Utility Rates Section IV below)
[2]Non-measured Energy are Non-measured project benefits that escalate 3.5% annually during the guarantee term starting in Year 1
[3]Renewable Energy Credits (ZRECs) are a Non-Measured benefit and will continue for 15 years starting in 2019. Annual cost avoidance accounts for solar PV system production degradation factor of 0.7%/year.
[4]Operations & Maintenance Cost Avoidance are Non-measured project benefits that do not escalate.
[5]Annual Guaranteed Cost Avoidance = Measured energy cost avoidance + Non-measured cost avoidance + Renewable energy credits + O&M cost avoidance

Within sixty (60) days of the commencement of the Guarantee Term, JCI will calculate the Measured Project Benefits achieved during the Installation Period plus any Non-Measured Project Benefits applicable to such period and advise Customer of same. Any Project Benefits achieved during the Installation Period may, at JCI's discretion, be allocated to the Annual Project Benefits for the first year of the Guarantee Term. Within sixty (60) days of each anniversary of the commencement of the Guarantee Term, JCI will calculate the Measured Project Benefits achieved for the applicable year plus any Non-Measured Project Benefits applicable to such period and advise Customer of same.

Customer acknowledges and agrees that if, for any reason, it (i) cancels or terminates receipt of M&V Services, (ii) fails to pay for M&V Services in accordance with Schedule 4, (iii) fails to fulfill any of its responsibilities necessary to enable JCI to complete the Work and provide the M&V Services, or (iv) otherwise cancels, terminates or materially

breaches this Agreement, the Assured Performance Guarantee shall automatically terminate and JCI shall have no liability hereunder.

**C. Project Benefits Shortfalls or Surpluses.**

*(i)* *Project Benefits Shortfalls*. If an Annual Project Benefits Shortfall occurs for any one year of the Guarantee Term, JCI shall, at its discretion and in any combination, (a) set off the amount of such shortfall against any unpaid balance Customer then owes to JCI, (b) where permitted by applicable law, increase the next year's amount of Annual Project Benefits by the amount of such shortfall, (c) pay to Customer the amount of such shortfall, or (d) subject to Customer's agreement, provide to Customer additional products or services, in the value of such shortfall, at no additional cost to Customer.*

(ii) *Project Benefits Surpluses*. If an Annual Project Benefits Surplus occurs for any one year of the Guarantee Term, JCI may, at its discretion and in any combination, (a) apply the amount of such surplus to set off any subsequent Annual Project Benefit Shortfall during the Guarantee Term, or (b) bill Customer for the amount of payments made pursuant to Section C(i)(c) above and/or the value of the products or services provided pursuant to clause C(i)(d) above, in an amount not to exceed the amount of such surplus.

(iii) *Additional Improvements*. Where an Annual Project Benefits Shortfall has occurred, JCI may, subject to Customer's approval (which approval shall not be unreasonably withheld, conditioned, or delayed), implement additional Improvement Measures, at no cost to Customer, which may generate additional Project Benefits in future years of the Guarantee Term.

**Schedule 2**

## II. NON-MEASURED PROJECT BENEFITS

The Project Benefits identified below shall be Non-Measured, as defined in Schedule 2, Section 1.A above. The amount of the Non-Measured Energy Benefits shall change each year of the Guarantee Term based on the applied utility rates as defined in the Baseline Calculation and Utility Rates presented in Schedule 2, Section IV.

**Table 2.2**

| Non-Measured Energy & Non-Energy Avoidance Summary | | | |
|---|---|---|---|
| **Non-Measured Energy Cost Avoidance Summary** | | | |
| **FIM Description** | | **First Year Projected Benefits** | |
| ECM-5 | Pipe and Valve Insulation | $ | 4,218 |
| ECM-11 | Vending Machine Controllers | $ | 952 |
| ECM-13 | Plug Load Controllers | $ | 1,959 |
| ECM-14 | Resistance Heating to VRF System | $ | - |
| ECM-15 | AC Compressor Controllers | $ | 3,576 |
| ECM-17 | Refrig Compressor Controllers | $ | 586 |
| ECM-18 | Energy Efficient RTU Replacment | $ | 1,209 |
| **Total Non-Measured Energy Cost Avoidance** | | **$** | **12,500** |
| | **Non-Energy Cost Avoidance** | | |
| | L/ZRECs (Low/Zero Renewable Energy Credits) | $ | 54,731 |
| | Operations & Maintenance (O & M) | $ | 11,899 |
| | **Total Non-Energy Cost Avoidance** | **$** | **66,630** |
| | **Total Non-Measured Cost Avoidance** | **$** | **79,130** |

*Operational verification, commissioning, and visual inspection of equipment operation in accordance with the scope of work are the primary methods for validating non-measured ECM cost avoidance. The savings calculations, engineering standards, equipment specifications, and customer furnished information used to determine non-measured cost avoidance during project development, will be used to calculate ongoing annual cost avoidance for each of these measures. Any assumptions used in the project development calculations, adjustments made to the baseline, and/or performance measurements recorded during a period, will be applied in the annual non-measured cost avoidance calculations. The customer agrees that the non-measured project benefits are reasonable and that the installation of the improvement measures will result in the achievement of such non-measured benefits.*

*Engineering calculations, measure variables, assumptions, and references of Non-measured ECMs are included in the Investment Grade Audit (IGA). The IGA is an addendum of this contract and part of the deliverable to the customer. The Lighting Detail (i.e. Line-by-Line) is in digital form as Attachment 5 and the Energy calculations relating to savings in Schedule 2 are in digital form as Attachment 7.*

**ECM-5 Pipe & Valve Insulation**

**Table 2.3**

| Site | Pipe and Valve Insulation Savings Natural Gas Therms | Total First Year Projected Energy Cost Avoidance |
|---|---|---|
| Middle School | 446.58 | $ 380 |
| Bradley ES | 738.95 | $ 732 |
| Irving ES | 640.42 | $ 635 |
| Veteran Comm. Ctr. | 777.04 | $ 996 |
| Library | 214.15 | $ 469 |
| Fire 1 | 138.82 | $ 206 |
| Fire 2 | 239.60 | $ 343 |
| Fire 4 | 327.58 | $ 457 |
| **Sites Total** | **3,523.14** | **$ 4,218** |

Savings are realized through reduced thermal losses within heating distribution systems. The heating system have locations with pipe lengths and fittings that are un-insulated resulting in heating losses (i.e. heating unintended spaces and having to produce more heat to meet space/zone temperature set point). By insulating heating system pipes and valves, more heat is delivered to the intended spaces resulting in less boiler operation.

*Pre-Installation:* Re-check audit. Verify linear footages of exposed piping and quantities of uninsulated valves, bonnets, flanges, and pumps. Conduct thermal imaging in selected areas.

*Post-Installation:* Verify that approved scope of work has been completed and that the insulation is properly installed. Field verification to verify counts and linear footages as stated in the scope and make adjustments to calculations based on post retrofit audit. Savings will be based on engineering calculations and assumptions detailed in the IGA (see Attachment 7 for energy calculations)

*Source Data:* Product specifications, customer information, inspection, thermal imaging

**ECM-11 Vending Machine Control**

**Table 2.4**

| Site | Vending Maching Conrollers Savings Electric Energy kWh | Total First Year Projected Energy Cost Avoidance |
|---|---|---|
| High School | 1,296 | $ 114 |
| Middle School | 1,296 | $ 166 |
| Bradley ES | 1,296 | $ 209 |
| Irving ES | 1,296 | $ 163 |
| Police | 1,757 | $ 192 |
| Fire 2 | 902 | $ 108 |
| **Sites Total** | **7,845** | **$ 952** |

Through the use of photo electric sensors, this measure turns off the vending machines lights when the immediate vicinity around the machine is unoccupied and also resets the refrigerators set point to a higher temperature during the unoccupied period to reduce compressors duty cycle.

*Pre-Installation:* Re-check vending survey and measure application for the targeted machines

*Post-Installation:* Verify that approved scope of work has been completed and that the sensors were properly installed and operational. Savings will be based on engineering calculations and assumptions detailed in the IGA (see Attachment 7 for energy calculations). Measure locations are in Table 2.6a below

*Source Data:* Product specifications, customer information, inspection

**Table 2.4a**

| Building | Location | Type |
|---|---|---|
| High School | 135-Faculty Room | Beverage |
| Middle School | Faculty Room | Beverage |
| Bradley ES | Faculty Room | Beverage |
| Irving ES | Faculty Room | Beverage |
| Police | Break Area | Beverage |
| Police | Break Area | Snack |
| Fire 2 | Garage Bay | Beverage |
| Fire 2 | Garage Bay | Snack |

**ECM-13 Plug Load Controllers**

**Table 2.5**

| | Plug Load Controllers Savings | Total First Year Projected Energy Cost Avoidance |
|---|---|---|
| | Electric Energy | |
| **Site** | **kWh** | |
| **High School** | 2,277 | **$ 201** |
| **Middle School** | 1,780 | **$ 227** |
| **Bradley ES** | 4,387 | **$ 707** |
| **Irving ES** | 2,564 | **$ 323** |
| **City Hall** | 2,659 | **$ 263** |
| **Senior Center** | 56 | **$ 7** |
| **Veteran Comm. Ctr.** | 742 | **$ 81** |
| **Library** | 1,237 | **$ 150** |
| **Sites Total** | **15,701** | **$ 1,959** |

JCI will install a plug load management system that will control numerous plug load equipment (e.g. printers, copiers, vending machines) as stated in the scope of work. The system will use an existing Wi-Fi network that will communicate to an energy management user interface. Through the user interface, equipment will be monitored, scheduled, and turned on/off. In areas where no Wi-Fi connection exists, plugs will be programmed with the intended schedule for the equipment.

*Pre-Installation:* A detailed survey of each facility was performed using a Google form-based mobile application. Plug load device numbers, type and associated space characteristics were assembled. Verification of Wi Fi network coverage in each room/office was performed.

*Post-Installation:* Verify that approved scope of work has been completed and that the equipment is properly installed and that controllers are communicating through the Wi Fi network to the plug load control software (Bertbrain®). Verify on/off schedule programs. Savings will be based on engineering calculations and assumptions detailed in the IGA (see Attachment 7 for energy calculations)

*Source Data:* Product specifications, customer information, equipment inspection, data logger/software

**Table 2.5a**

| Building | Projector | Charging Cart | Medium Printer | Copier | H/C Water Dispenser | Air Conditioner - 110V (15A) | Water Fountain | Electric Hot Water Heater | Total |
|---|---|---|---|---|---|---|---|---|---|
| High School | 27 | 0 | 0 | 1 | 1 | 7 | 0 | 0 | 36 |
| Middle School | 27 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 28 |
| Bradley ES | 26 | 11 | 0 | 1 | 0 | 0 | 0 | 0 | 38 |
| Irving ES | 24 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 29 |
| City Hall | 0 | 0 | 3 | 4 | 3 | 0 | 0 | 1 | 11 |
| Senior Center | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 |
| Veteran Comm. Ctr. | 0 | 0 | 1 | 1 | 1 | 2 | 0 | 0 | 5 |
| Library | 0 | 0 | 5 | 2 | 0 | 0 | 0 | 1 | 8 |
| **Total** | **104** | **16** | **9** | **10** | **5** | **9** | **1** | **2** | **156** |

**ECM-14 VRF System Installation**

**Table 2.6**

| | VRF System Installation | | Total First Year Projected Energy Cost Avoidance |
|---|---|---|---|
| | Electric Energy | Natural Gas | |
| Site | kWh | therms | |
| **Irving Elementary School** | **0** | **0** | **$0** |
| **Site Total** | **0** | **0** | **$0** |

The variable refrigerant flow (VRF) system provides cooling and heating by distributing refrigerant from outdoor units to multiple indoor units improving efficiency and individual end unit control. VRF has the capability to concurrently cool zones while heating other areas or target temperature control to zones that are in use.

*Pre-Installation:* No energy use modeling was performed for this measure; no energy savings are claimed.

*Post-Installation:* Verify that approved VRF system scope of work has been completed and is commissioned/operating per design. Record any changes to the scope.

*Duration of Verification:* No ongoing measurements are required for this measure.

*Source Data:* VRF system controls and specifications, as required

**Schedule 2**

**ECM-15 AC Compressor Controls**

**Table 2.7**

| Site | AC Compessor Controllers Savings<br>Electric Energy<br>kWh | Total First Year Projected Energy Cost Avoidance |
|---|---|---|
| **Irving ES** | 1,011 | **$ 127** |
| **City Hall** | 2,966 | **$ 293** |
| **DPW** | 274 | **$ 48** |
| **Senior Center** | 2,857 | **$ 356** |
| **Veteran Comm. Ctr.** | 2,840 | **$ 310** |
| **WPCA** | 843 | **$ 103** |
| **Library** | 7,141 | **$ 868** |
| **Police** | 7,441 | **$ 813** |
| **Fire 1** | 3,122 | **$ 387** |
| **Fire 2** | 498 | **$ 60** |
| **Fire 3** | 606 | **$ 74** |
| **Fire 4** | 1,264 | **$ 138** |
| **Sites Total** | **30,860** | **$ 3,576** |

Buildings equipped with rooftop units and/or outdoor condensing units use standard pressure switches that do not utilize advanced control methodology. Intelligent control systems determine the cooling demand and thermal characteristics of the entire air-conditioning system by analyzing the compressor's cycle pattern, and dynamically modifying that cycle pattern to provide the required cooling in the most efficient manner.

*Pre-Installation:* Verify existing audit of rooftop units and condensing units of buildings in this measure. Check mechanical operation and type of pressure switches in pre-retrofit equipment. Specifications of pre and post retrofit equipment are used to calculate pre-retrofit baseline energy use.

*Post-Installation:* Verify that approved scope of work has been completed and that the AC Compressor controllers have been properly installed and commissioned. Record any changes to the scope and adjust potential savings if necessary. Savings will be based on assumptions and engineering calculations within the IGA and Table 2.7a below (see Attachment 7 for energy calculations).

*Source Data:* Product specifications, customer information, inspection.

**Table 2.7a**

| Building | Pre-Retrofit | | | Post-Retrofit | | |
|---|---|---|---|---|---|---|
| | # of Units | Total kW | EFLH | # of Units | Total kW | EFLH** |
| **Irving ES** | 2 | 8.64 | 1,301 | 2 | 8.64 | 1,171 |
| **City Hall*** | 5 | 40.54 | 1,626 | 5 | 40.54 | 1,463 |
| **DPW*** | 1 | 3.74 | 1,626 | 1 | 3.74 | 1,463 |
| **Senior Center** | 4 | 17.57 | 1,626 | 4 | 17.57 | 1,463 |
| **Veteran Comm. Ctr.** | 5 | 19.41 | 1,626 | 5 | 19.41 | 1,463 |
| **WPCA** | 1 | 5.76 | 1,626 | 1 | 5.76 | 1,463 |
| **Library** | 6 | 48.79 | 1,626 | 6 | 48.79 | 1,463 |
| **Police** | 9 | 40.99 | 1,626 | 9 | 40.99 | 1,463 |
| **Fire 1** | 4 | 21.33 | 1,626 | 4 | 21.33 | 1,463 |
| **Fire 2** | 5 | 11.34 | 488 | 5 | 11.34 | 439 |
| **Fire 3** | 1 | 4.14 | 1,626 | 1 | 4.14 | 1,463 |
| **Fire 4** | 2 | 8.64 | 1,626 | 2 | 8.64 | 1,463 |
| | **45** | **230.87** | | **45** | **230.87** | |

* Savings use 50 percent loading

** Post-retrofit EFLH are 90 percent of pre-retrofit EFLH

### ECM-17 Refrigeration Compressor Controllers

**Table 2.8**

| Site | Refrigeration Compressor Controllers Savings<br>Electric Energy<br>kWh | Total First Year Projected Energy Cost Avoidance |
|---|---|---|
| **High School** | 3,759 | **$ 332** |
| **Middle School** | 1,985 | **$ 254** |
| **Sites Total** | **5,744** | **$ 586** |

Refrigeration compressor controls provide computer chip control that automatically adjust the compressor cycles to achieve improved efficiency and reduced electrical usage (i.e. less frequent & more efficient compressor cycles).

*Pre-Installation:* Re-check refrigeration survey and calculations associated with individual units

*Post-Installation:* Verify that approved scope of work has been completed and that the controls are properly commissioned and working per design. Savings will be based on engineering calculations and assumptions detailed in the IGA (see Attachment 7 for energy calculations).

*Source Data:* Product specifications, customer information, inspection

**Schedule 2**

**Table 2.8a**

| | Existing Refrigeration Compressors | | | | |
|---|---|---|---|---|---|
| **Location** | **Qty.** | **Unit kW** | **Total kW** | **Ann. EFLH (12 Hrs/day)** | **Total kWh** |
| High School | 2 | 3.5 | 6.3 | 4,032 | 25,210 |
| High School | 1 | 2.0 | 1.8 | 4,032 | 7,246 |
| High School | 1 | 1.4 | 1.3 | 4,032 | 5,133 |
| Middle School | 1 | 3.5 | 3.1 | 4,032 | 12,605 |
| Middle School | 1 | 2.0 | 1.8 | 4,032 | 7,246 |
| Total | | | | | 57,440 |
| | **Proposed Refrigeration Compressors** | | | | |
| **Location** | **Qty.** | **Unit kW** | **Total kW** | **Ann. EFLH (10.8 Hrs/day)** | **Total kWh** |
| High School | 2 | 3.5 | 6.3 | 3,629 | 22,689 |
| High School | 1 | 2.0 | 1.8 | 3,629 | 6,521 |
| High School | 1 | 1.4 | 1.3 | 3,629 | 4,619 |
| Middle School | 1 | 2.1 | 1.9 | 3,629 | 6,793 |
| Middle School | 1 | 1.5 | 1.3 | 3,629 | 4,755 |
| Total | | | | | 45,378 |

**Schedule 2**

## ECM-18 RTU Replacement

**Table 2.9**

| Site | RTU Replacement Savings | | Total First Year Projected Energy Cost Avodance |
|---|---|---|---|
| | Electric Energy | Natural Gas | |
| | kWh | Therms | |
| City Hall | 6,090 | 183 | $ 1,209 |
| Sites Total | 6,090 | 183 | $ 1,209 |

*Pre-Installation:* JCI performed energy modeling to calculate the heating and cooling energy use based on the pre-retrofit equipment in-place and space use within the City Hall areas to receive the RTU replacement measure. Factors used in the modeling are listed in Table 2.9a below.

*Post-Installation:* Verify that approved RTU replacement scope of work has been completed, networked to the EMS, and is commissioned/operating per design. Record any changes to the scope and adjust potential savings if necessary. Savings from the measure may be verified by trending system use, setpoints, and schedules within each space. JCI will use the Electric and Natural Gas rates as defined in the Baseline Calculations and Utility Rates section of this document and savings will be based on assumptions and engineering calculations.

*Duration of Measurement:* Annual visual inspection, continued EMS trending

*Source Data:* Product specifications, customer input, standard engineering parameters, equipment inspection

**Table 2.9a**

| Parameter | Value | Units | Source |
|---|---|---|---|
| RTU-1 Cooling Capacity | 28 | Tons | Model # / nameplate |
| RTU-1 Existing EER | 9 | BTU/W/hr | Assumption based on equipment age and condition |
| RTU-1 Proposed EER | 12 | BTU/W/hr | Assumption based on performance of common new equipment |
| Cooling EFLH | 797 | hours | UI/CL&P C&LM Program Savings Documentation – 2013 https://neep.org/sites/default/files/resources/CTTechnicalreferencemanual2013.pdf |
| RTU-1 Heating Capacity | 405 | MBH | nameplate |
| RTU-1 Existing Eff. | 75 | % | Assumption based on equipment age and condition |
| RTU-1 Proposed Eff. | 81 | % | Assumption based on performance of common new equipment |
| Heating EFLH | 562 | hours | 1248 hours (UI/CL&P C&LM Program Savings Documentation – 2013) * 55% deration. A deration is used to calibrate RTU energy usage against total building thermal energy use. |

**Schedule 2**

# III. MEASUREMENT AND VERIFICATION METHODOLOGIES

*The following is a brief overview of the Measurement and Verification (M&V) methodologies applicable to the Improvement Measures set forth below. JCI uses these methodologies as a guideline for M&V planning. These methodologies are more fully detailed in the guidelines and standards of the International Measurement and Verification Protocol (IPMVP) in connection with the provision of M&V Services hereunder.*

**Option A**
**Retrofit Isolation – Key Parameter Measurement**

Measured Project Benefits are determined by field measurement of the key performance parameter which define the energy use of the improvement measure's affected systems. Measurement frequency ranges from one-time/short-term to continuous, depending on the expected variations in the measured parameter and the length of the measurement and verification period.

Parameters not selected for field measurement are estimated. Estimates can be based on historical data, manufacturers' specifications, customer input/operations information or engineering judgments. Energy quantities can be derived from a computation using a combination of measurements and estimates of others.

**Option B**
**Retrofit Isolation: All Parameter Measurement**

Measured Project Benefits are 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. Short-term, long-term or continuous measurements are taken throughout the pre and post-retrofit periods. Engineering calculations using short term, long-term or continuous pre and post-retrofit measurements are used to calculate the Measured Project Benefits for the duration of the Guarantee Term.

Measured Project Benefits for the following ECMs will utilize Option A or Option B methodology as described above.

**Table 2.10**

| Measured Energy Cost Avoidance Summary | | | |
|---|---|---|---|
| FIM Description | | First Year Projected Benefits | |
| ECM-1 | Lighting - Interior | $ | 65,588 |
| ECM-2 | Lighting - Exterior | $ | 18,217 |
| ECM-4 | Energy Management System | $ | 13,201 |
| ECM-6 | Oil to Gas Conv - Boiler/Burner Replacement | $ | 35,537 |
| ECM-7 | Energy Efficient DHW Installation | $ | 15,998 |
| ECM-9 | Computers - Power Management | $ | 3,565 |
| ECM-10 | Water Conservation | $ | 9,353 |
| ECM-12 | Photovoltaic Electric Generation | $ | 92,147 |
| ECM-16 | Transformers - Replacements | $ | 4,361 |
| **Total Measured Energy Cost Avoidance** | | **$** | **257,969** |

**Schedule 2**

## ECM-1 Lighting Retrofit - Interior

**Table 2.11**

| | Lighting - Interior Savings | | | | | | |
|---|---|---|---|---|---|---|---|
| | Electric Energy | Annual Electric Demand | Natural Gas | Number 2 Fuel Oil | Water | Other | Total First Year Projected Energy Cost Avoidance |
| Site | kWh | kW | Therms | gal | kGal | | |
| High School | 28,343 | 129 | 0.00 | - | - | - | $ 4,433 |
| Middle School | 29,230 | 94 | (311.60) | - | - | - | $ 4,874 |
| Bradley ES | 48,881 | 216 | (470.53) | - | - | - | $ 10,636 |
| Irving ES | 61,984 | 257 | (632.02) | - | - | - | $ 11,029 |
| City Hall | 34,708 | 154 | (428.65) | - | - | - | $ 6,056 |
| DPW | 9,822 | 53 | (158.97) | - | - | - | $ 2,575 |
| Senior Center | 13,942 | 70 | (187.86) | - | - | - | $ 2,871 |
| Veteran Comm. Ctr. | 28,346 | 116 | (384.12) | - | - | - | $ 5,041 |
| WPCA | 13,490 | 61 | (193.61) | - | - | - | $ 2,302 |
| Library | 40,675 | 149 | (587.67) | - | - | - | $ 5,949 |
| Police | 31,517 | 88 | (225.68) | - | - | - | $ 4,450 |
| Fire 1 | 3,856 | 67 | (57.04) | - | - | - | $ 1,800 |
| Fire 2 | 7,843 | 45 | (113.81) | - | - | - | $ 1,720 |
| Fire 3 | 4,704 | 15 | (56.72) | - | - | - | $ 714 |
| Fire 4 | 5,273 | 31 | (65.07) | - | - | - | $ 1,138 |
| **Sites Total** | **362,614** | **1,544** | **(3,873.34)** | **-** | **-** | **-** | **$ 65,588** |

Existing interior lighting equipment at various locations within the Derby buildings will be upgraded to improve lighting equipment efficiency (i.e. using less energy to produce similar light output). The lighting retrofit design incorporates energy efficient LED lamps, ballasts, and fixtures where the existing fixture condition warrants a replacement.

### Measurement & Verification Plan (M&V Option A)

*Pre-Installation:* JCI completed a detailed audit of the lighting equipment in each building and quantified fixture wattage power use in kilowatts (kW) using available nameplate information. Annual Burn Hours (ABH) for usage groups (i.e. classrooms, offices, hallways) and annual kW was determined through source documentation and customer interviews (ABH and kW for usage groups are listed in the Lighting Detail Attachment 5).

*Post-Installation:* Verify that approved "Scope of Work" has been completed. Record any changes to the scope and adjust savings if necessary based on as-built lighting. Perform a one-time post installation circuit wattage measurement on a representative sample of installed interior fixture combinations where a quantity of 50 or more of the same type of fixtures will be tested using a 90% confidence and 20% precision level (see Table 2.11a for sample size determinations). Use post retrofit wattage measurement to adjust savings estimates for all like fixtures in each facility, adjusted savings values will be used in post retrofit calculations.

*Duration of Measurement:* One time post retrofit power measurement on a sample of fixtures and annual visual inspections

*Source Data:* Equipment specifications, customer interviews, power meters, lighting equipment specifications data

### Sample Size Determinations

Required post installation sample size determinations will be made, with an estimated coefficient of variation of 0.5 (CV = 0.5). Usage groups will draw samples sizes from a 90% confidence & 20% precision for lamp and ballast combination (LBC) power measurements. JCI will execute wattage sampling from logical project site groupings and/or usage groups rather than individual building level sampling. See Table 2.11a below for sample size determinations.

**Table 2.11a: Sample Size Estimation Table**

| Precision | 20% | Precision | 20% |
|---|---|---|---|
| Confidence | 90% | Confidence | 90% |
| Z-Statistic | 1.645 | Z-Statistic | 1.645 |
| Population Size, N | Sample Size, n* | Population Size, N | Sample Size, n* |
| 4 | 4 | 60 | 14 |
| 8 | 6 | 70 | 14 |
| 12 | 8 | 80 | 15 |
| 16 | 9 | 90 | 15 |
| 20 | 10 | 100 | 15 |
| 25 | 11 | 125 | 15 |
| 30 | 11 | 150 | 16 |
| 35 | 12 | 175 | 16 |
| 40 | 12 | 200 | 16 |
| 45 | 13 | 300 | 17 |
| 50 | 13 | 400 | 17 |

Note: The coefficient of variation in the above table is estimated to be 0.5.

**Existing/Proposed Burn Hours:**
Annual Burn Hours (ABH) is a parameter that is mutually agreed upon and is defined as the number of hours the lighting equipment operates in a given year. In the calculations, ABH was determined through discussion with Facilities personnel and site observation during the audit. These values are used to calculate savings for the upgrade. For the purposes of this agreement, the Existing/Proposed (i.e. pre-retrofit/post retrofit) values in the lighting audit shall be deemed as the floor-annual-burn-hours (i.e. the ABH shall never go below the usage group floor values).

**Lighting Savings Calculations**
JCI will use the unit Incremental Electrical Energy ($/kWh) rate (IER) and Demand Rate ($/kW) (DR), as defined in the Baseline Calculations and Utility Rates section of this document, to calculate avoided energy cost savings.

The following formulas represent the basis for calculating energy savings as described in the lighting calculations:

**Demand Savings (kW):**

$$\textit{Connected kW Saving} = \sum_u [\,(\textit{Ann. kW/Fixture}_{baseline} \times \textit{Quantity}_{baseline} - \textit{Ann. kW/Fixture}_{post} \times \textit{Quantity}_{post})\,]_u$$

*where*:

$kW/fixture_{baseline}$ = Annual lighting baseline demand per fixture type for usage group u
$kW/fixture_{post}$ = Annual lighting demand per fixture type during post-installation period for usage group
$Quantity_{baseline}$ = quantity of affected fixtures before the lighting retrofit for usage group u
$Quantity_{post}$ = quantity of affected fixtures after the lighting retrofit for usage group u

**Energy Savings (kWh):**

$$\textit{kWh Savings}_{(Lighting)} = \sum_u [\,\textit{Connected kW Savings}_u \times \textit{ABH}_{(Usage\ Group)}\,]_u$$

$$\textit{kWh Savings Occupancy Sensors} = (\textit{ABH Pre} - \textit{ABH Post}) \times \textit{kW Post}$$

**Energy Cost Savings ($):**

$$\textit{Energy Cost Savings}_{(Lighting)} = \textit{kWh Savings}_{(Lighting)} \times \textit{IER} + \textit{Connected kW Savings} \times \textit{DR} - \textit{H/C Factor}$$

*where: DR = Demand Rate ($/kW)*
*IER = Incremental Electric Energy Rate ($/kWh)*
*H/C Factor = Heating/Cooling Factor = HP – CC*
*ABH Pre & ABH Post = Annual Burn Hours in Spaces with Occupancy sensors Post (Lighting Detail Attachment A)*

*HP (Heating Penalty):* *(KWHRED * 3413 * %HTRET * % Savings Heating Season) / BTUs/UNIT / EFF = MMBTU*

*CC (Cooling Credit):* *(KWHRED * 3413 * %HTRET *% Savings Cooling Season * %COOLED) / 12000 * KW/TON = KWH*

*where:*

HTRET (heat returned to space), Heating System Efficiency, % of Building Cooled, and Winter & Summer coincident hours are in table below.

**Table 2.11b**

| | DERBY | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | **High School** | **Middle School** | **Bradley ES** | **Irving ES** | **City Hall** | **DPW** | **Senior Center** | **Veteran Comm. Ctr.** |
| ...PERCENTAGE OF LIGHT HEAT RETURNED TO HVAC (%HTRET) | 75% | 75% | 75% | 75% | 75% | 75% | 75% | 75% |
| …HEATING SYSTEM EFFICIENCY (EFF) | 219% | 82% | 92% | 82% | 80% | 79% | 79% | 87% |
| ....% OF BUILDING COOLED | 20% | 95% | 2% | 5% | 95% | 5% | 95% | 40% |
| ...WINTER HEATING COINCIDENT HRS (HTGCOHRS) | 939 | 1,045 | 770 | 773 | 1,082 | 1,153 | 1,034 | 1,392 |
| ...SUMMER COOLING COINCIDENT HRS (CLGCOHRS) | 0 | 0 | 0 | 0 | 248 | 264 | 236 | 318 |

| | **WPCA** | **Library** | **Police** | **Fire 1** | **Fire 2** | **Fire 3** | **Fire 4** |
|---|---|---|---|---|---|---|---|
| ...PERCENTAGE OF LIGHT HEAT RETURNED TO HVAC (%HTRET) | 75% | 75% | 50% | 75% | 75% | 75% | 75% |
| …HEATING SYSTEM EFFICIENCY (EFF) | 79% | 79% | 81% | 79% | 87% | 79% | 82% |
| ....% OF BUILDING COOLED | 10% | 95% | 95% | 50% | 50% | 50% | 50% |
| ...WINTER HEATING COINCIDENT HRS (HTGCOHRS) | 1,211 | 1,512 | 1,517 | 325 | 2,513 | 1,472 | 829 |
| ...SUMMER COOLING COINCIDENT HRS (CLGCOHRS) | 277 | 346 | 347 | 74 | 575 | 0 | 190 |

**Schedule 2**

**ECM-2 Lighting Retrofit - Exterior**

**Table 2.12**

| Site | Lighting - Exterior Savings: Electric Energy kWh | Total First Year Projected Energy Cost Avoidance |
|---|---|---|
| **High School** | 21,069 | **$ 1,860** |
| **Middle School** | 454 | **$ 58** |
| **Bradley ES** | 26,331 | **$ 4,242** |
| **Irving ES** | 3,180 | **$ 400** |
| **City Hall** | 12,877 | **$ 1,273** |
| **DPW** | 8,025 | **$ 1,399** |
| **Senior Center** | 708 | **$ 88** |
| **Veteran Comm. Ctr.** | 2,680 | **$ 293** |
| **WPCA** | 21,023 | **$ 2,572** |
| **Library** | 636 | **$ 78** |
| **Police** | 4,462 | **$ 487** |
| **Fire 1** | 3,171 | **$ 392** |
| **Fire 2** | 9,230 | **$ 1,104** |
| **Fire 3** | 2,263 | **$ 276** |
| **Fire 4** | 1,341 | **$ 146** |
| **Marcucio** | 22,848 | **$ 3,547** |
| **Sites Total** | **140,298** | **$ 18,217** |

Existing exterior lighting equipment at various locations within the Derby buildings will be upgraded to improve lighting equipment efficiency (i.e. using less energy to produce similar light output). The lighting retrofit design incorporates energy efficient LED lamps, ballasts, and fixtures where the existing fixture condition warrants a replacement.

**Measurement & Verification Plan (M&V Option A)**

*Pre-Installation:* JCI completed a detailed audit of the lighting equipment in each building and quantified fixture wattage power use in kilowatts (kW) using available nameplate information. Annual Burn Hours (ABH) for usage groups and annual kW was determined through source documentation and customer interviews (ABH and kW for usage groups are listed in the Lighting Detail Attachment 5).

*Post-Installation:* Verify that approved "Scope of Work" has been completed. Record any changes to the scope and adjust savings if necessary based on as-built lighting. Perform a one-time post installation circuit wattage measurement on a representative sample of installed fixture combinations where a quantity of 50 or more of the same type of fixtures will be tested using a 90% confidence and 20% precision level (see Table 2.12a for sample size determinations). Use post retrofit wattage measurement to adjust savings estimates for all like fixtures in each facility, adjusted savings values will be used in post retrofit calculations.

*Duration of Measurement:* One time post retrofit power measurement on a sample of fixtures and annual visual inspections

*Source Data:* Equipment specifications, customer interviews, power meters, lighting equipment specifications data

**Sample Size Determinations**

Required post installation sample size determinations will be made, with an estimated coefficient of variation of 0.5 (CV = 0.5). Usage groups will draw samples sizes from a 90% confidence & 20% precision for lamp and ballast

combination (LBC) power measurements. JCI will execute wattage sampling from logical project site groupings and/or usage groups rather than individual building level sampling. See Table 2.12a below for sample size determinations.

**Table 2.12a: Sample Size Estimation Table**

| Precision | 20% | Precision | 20% |
|---|---|---|---|
| Confidence | 90% | Confidence | 90% |
| Z-Statistic | 1.645 | Z-Statistic | 1.645 |
| Population Size, N | Sample Size, n* | Population Size, N | Sample Size, n* |
| 4 | 4 | 60 | 14 |
| 8 | 6 | 70 | 14 |
| 12 | 8 | 80 | 15 |
| 16 | 9 | 90 | 15 |
| 20 | 10 | 100 | 15 |
| 25 | 11 | 125 | 15 |
| 30 | 11 | 150 | 16 |
| 35 | 12 | 175 | 16 |
| 40 | 12 | 200 | 16 |
| 45 | 13 | 300 | 17 |
| 50 | 13 | 400 | 17 |

Note: The coefficient of variation in the above table is estimated to be 0.5.

**Existing/Proposed Burn Hours:**
Annual Burn Hours (ABH) is a parameter that is mutually agreed upon and is defined as the number of hours the lighting equipment operates in a given year. In the calculations, ABH was determined through discussion with Facilities personnel and site observation during the audit. These values are used to calculate savings for the upgrade. For the purposes of this agreement, the Existing/Proposed (i.e. pre-retrofit/post retrofit) values in the lighting audit shall be deemed as the floor-annual-burn-hours (i.e. the ABH shall never go below the usage group floor values).

**Lighting Savings Calculations**
JCI will use the unit Incremental Electrical Energy ($/kWh) rate (IER, as defined in the Baseline Calculations and Utility Rates section of this document, to calculate avoided energy cost savings.

The following formulas represent the basis for calculating energy savings as described in the lighting calculations:

**Demand Savings (kW):**

$$\textit{Connected kW Saving} = \sum[\ (\textit{Ann. kW/Fixture}_{baseline} \times \textit{Quantity}_{baseline} - \textit{Ann. kW/Fixture}_{post} \times \textit{Quantity}_{post})]$$

*where*:

$kW/fixture_{baseline}$ = Annual lighting baseline demand per fixture type
$kW/fixture_{post}$ = Annual lighting demand per fixture type during post-installation period
$Quantity_{baseline}$ = quantity of affected fixtures before the lighting retrofit
$Quantity_{post}$ = quantity of affected fixtures after the lighting retrofit

**Energy Savings (kWh):**

$$\textit{kWh Savings}_{(Lighting)} = \sum[\ \textit{Connected kW Savings}_u \times \textit{Annual Burn Hours}\ ]_u$$

**Energy Cost Savings ($):**

$$\textit{Energy Cost Savings}_{(Lighting)} = \textit{kWh Savings}_{(Lighting)} \times \textit{IER} + \textit{Connected kW Savings} \times \textit{DR}$$

*where: DR = Demand Rate ($/kW)*
*IER = Incremental Electric Energy Rate ($/kWh)*

**ECM-4 Energy Management System**

**Table 2.13**

| Site | Energy Management System Savings | | Total First Year Projected Energy Cost Avoidance |
|---|---|---|---|
| | Electric Energy | Natural Gas | |
| | kWh | Therms | |
| **Middle School** | 3,975 | 2,622.23 | **$ 2,742** |
| **Irving ES** | 2,473 | 3,443.03 | **$ 3,725** |
| **City Hall** | 727 | 600.70 | **$ 901** |
| **Senior Center** | 1,315 | 263.18 | **$ 616** |
| **Veteran Comm. Ctr.** | 1,723 | 3,923.01 | **$ 5,217** |
| **Sites Total** | **10,214** | **10,852.16** | **$ 13,201** |

Energy savings via the Energy Management System (EMS) upgrade at the Derby facilities in Table 2.13 will be achieved through a combination of HVAC controls strategies as shown below.

**Table 2.13a**

| Site | Temperature Setback | Recommissioning | Exhaust Fan/Releif Damper Control | Demand Controlled Ventilation | Optimal Start/Stop |
|---|---|---|---|---|---|
| Middle School | | ✓ | | ✓ | |
| Irving ES | ✓ | ✓ | ✓ | | |
| City Hall | | ✓ | | | |
| Senior Center | ✓ | | | | ✓ |
| Veteran Community Center | ✓ | | ✓ | | ✓ |

**Measurement & Verification Plan (M&V Option A)**

*Pre-Installation:* The savings potential (targets) for the EMS were determined using engineered calculations.

During project development, a profile of HVAC operations and systems including rooftop units, air handling units, boilers, and ventilation equipment was completed using nameplate factors, existing EMS parameters, sequences, and facility staff input. The information was used to develop projected savings for EMS control strategies of Temperature Setback, Exhaust Fan/Damper Relief Damper Control, Demand Controlled Ventilation and Optimal Start which are designed in effect to reduce system run hours by delaying the warm-up period required based on outside temperature conditions to times when it is only necessary to run associated HVAC equipment to meet occupied hour set points and ventilation needs.

The measurement boundaries for EMS upgrades include the HVAC and associated electrical and thermal systems.

*Post-Installation:* Verify EMS control sequence programming changes for Temperature Setback, Exhaust Fan/Damper Relief Control, Demand Controlled Ventilation and Optimal Start strategies. Implement trending to isolate HVAC equipment affected by the control sequence upgrades. Trends of outside air temperature coincident with unoccupied/occupied system start status will be compared to pre-retrofit start schedules. The delay of system occupied start status versus

scheduled starts will be the basis for energy savings. Engineering calculations within the IGA will be used as a basis for calculating energy savings and trend data (i.e. set points, on/off status, schedules, outside air temps) will be used as a means of verifying that parameters per the calculations are occurring. In working with the controls provider JCI will confirm metrics are being trended and data saved in the repository.

*Duration of Measurement:* Continuous data trending of HVAC equipment identified above

*Source Data:* Equipment specifications, customer information, utility billing, EMS control sequences, Building factors relating to development calculation are displayed in Table 2.13b & c.

**Table 2.13b**

| Facility Management System Operations | | | | |
|---|---|---|---|---|
| | Summer | | | |
| Facility | Existing Occupied/ On Hours | Existing Unoccupied / Off Hours | Proposed Occupied/ On Hours | Proposed Unoccupied / Off Hours |
| Middle School | 70 | 74 | 72 | 78 |
| Irving ES | 70 | 74 | 72 | 65 |
| City Hall | 70 | 74 | 72 | 78 |
| Senior Center | 70 | 74 | 72 | 78 |
| Veteran Community Center | 70 | 74 | 72 | 78 |
| | Winter | | | |
| Facility | Existing Occupied/ On Hours | Existing Unoccupied / Off Hours | Proposed Occupied/ On Hours | Proposed Unoccupied / Off Hours |
| Middle School | 72 | 65 | 68 | 55 |
| Irving ES | 72 | 78 | 68 | 55 |
| City Hall | 70 | 60 | 68 | 55 |
| Senior Center | 72 | 62 | 68 | 55 |
| Veteran Community Center | 72 | 78 | 68 | 55 |

**Table 2.13c**

| Assumptions: | Middle School | Irving ES | City Hall | Senior Center | Veteran Community Center |
|---|---|---|---|---|---|
| Occupied Days per Year | 217 | 217 | 261 | 261 | 261 |
| Is Cooling Space Affected by Measure? | Yes | No | Yes | Yes | Yes |
| Percent of Space Cooled | 95% | 5% | 95% | 95% | 40% |
| Estimated % of Space Cooling Controlled | 30% | 0% | 80% | 30% | 100% |
| Clg Sytem Eff. kW/Ton | 1.13 | 1.13 | 1.13 | 1.13 | 1.13 |
| Post Retrofit Htg Eff. % | 82% | 82% | 80% | 79% | 87% |
| Estimated % of Space Heating Controlled | 30% | 75% | 80% | 30% | 100% |
| Building Balance Point | 55 | 55 | 55 | 55 | 55 |

## ECM-6 Fuel Oil to Natural Gas Boiler/Burner Replacement

**Table 2.14**

| | Oil to Gas Conv - Boiler/Burner Replacement Savings | | Total First Year Projected Energy Cost Avoidance |
|---|---|---|---|
| | Natural Gas | Number 2 Fuel Oil | |
| Site | Therms | gal | |
| Bradley ES | (16,226.35) | 14,881 | $ 16,962 |
| Irving ES | (23,059.53) | 18,590 | $ 18,575 |
| Sites Total | (39,285.88) | 33,471 | $ 35,537 |

The Bradley Elementary School and Irving Elementary School each have two existing oil-fired boilers. The two hot water boilers will be replaced at Bradley Elementary School. The steam boilers will remain at Irving Elementary but the burners serving the boilers will be replaced with new Powerflame dual burners. New natural gas service with utility meters will be installed. The incremental controls will have a program to modulate the firing rate to 'follow the load' (i.e. incrementally modulate with heating demand). Savings for this ECM will result from fuel cost savings and from improvements in equipment energy efficiency.

**Measurement & Verification Plan (M&V Option A)**

*Pre-Installation:* The pre-retrofit boiler energy use was calculated using the existing equipment nameplate information, age, fuel consumption history and discussion with facility staff. Baseline boiler system efficiencies are shown in Table 2.14a.

*Post-Installation:* Verify that approved "Scope of Work" has been completed - inspection and verification of proper boiler installation. Record any changes to the scope and adjust potential savings if necessary. Using the natural gas fuel meters, measure performance period fuel consumption annually. Post-retrofit boiler system energy was calculated using published equipment performance metrics and Heating Degree Days (HDD) posted by the National Weather Service. During the Reporting period energy savings will be calculated using the Fuel Oil and Natural Rates as defined in Section IV Baseline Calculations and Utilities.

*Duration of Measurement:* Utility billing, EMS trending, and combustion efficiency testing

*Source Data:* Equipment specifications, fuel billing receipts, boiler nameplate specifications, National Weather Service Heating Degree Days.

*M&V Methodology*

JCI will use the pre retrofit assumed boiler efficiency, the performance curve for the installed boiler as well as the established baseline Fuel Oil usage at the facility to calculate annual savings. Industry standard weather normalization methodologies will be used to adjust the baseline fuel oil consumption to the performance period (i.e. reporting year) using Heating Degree Day data from the National Weather Service. The performance period energy savings will be determined using the weather adjusted baseline oil consumption value, multiplied by the efficiency gain realized from the installation of high efficiency natural gas boilers and burners. The dollar cost savings associated with fuel savings will be calculated using the Fuel Oil Rate and Natural Gas Rate. One (1) combustion efficiency test will be performed post-installation, the results of which will be plotted on the performance curve for the proposed boiler as a means of curve validation.

Efficiency: The table below presents the pre-retrofit and post-retrofit efficiencies used in the calculations. The values are based on equipment nameplate, equipment age and operations and data published for the new boilers and burners.

**Table 2.14a**

| Bradley ES Boiler Replacement (Boiler Fuel Baseline: 1,827 MBH) | |
|---|---|
| **Pre-Retrofit** | **Post-Retrofit** |
| Combustion Efficiency – 78% | Combustion Efficiency – Max 96.9%/Low 86.6 % |
| Standby Loss as percent of input – 0.28% | Standby Loss as percent of input – 0.03% |
| Cycling Losses - 1% | Cycling Losses - 1% |
| Combined Seasonal Efficiency - 71.1% | Combined Seasonal Efficiency - 87.4% |

| Irving ES Burner Replacement (Boiler Fuel Baseline: 2,411 MBH) | |
|---|---|
| **Pre-Retrofit** | **Post-Retrofit** |
| Combustion Efficiency – 78% | Combustion Efficiency – Max 82.9%/Low 80.0% |
| Standby Loss as percent of input – 0.28% | Standby Loss as percent of input – 0.28% |
| Cycling Losses - 1% | Cycling Losses - 1% |
| Combined Seasonal Efficiency - 72.2% | Combined Seasonal Efficiency - 78.2% |

Baseline Determination: The 3-year average annual fuel oil consumption for Bradley Elementary and Irving Elementary was 15,443 gallons and 18,592 gallons, respectively. However, Bradley Elementary is using an existing a standalone oil-fired domestic hot water (DHW) heater that is estimated to annual consume 562 gallons of oil. The fuel oil consumed for DHW is subtracted from the total annual fuel oil consumption leaving 14,881 gallons of fuel oil used for heating by the boilers. Therefore, 14,881 gallons and 18,590 gallons are used to establish the baseline oil consumption for Bradley Elementary and Irving Elementary, respectively. These values shall be considered a minimum value for the baseline fuel consumption annual savings calculations for future reporting periods.

Weather Normalization: The baseline boiler fuel oil consumption will be adjusted using reporting year weather conditions in the form of HDD data from the National Weather Service for Hartford, CT. The weather normalized consumption was calculated using the average HDD over the 3 year baseline fuel oil period (5,458 HDD) divided by a 15 Year average of (5,834 HDD) for the region. The 15 Year HDD for the region will be a floor Report Year HDD value if HDD in the reporting year is less than the 15 year average in the formula below.

JCI will calculate the annual Fuel Oil cost avoidance according to the following formula:

**WNBLFS = 3-Year Baseline Average Fuel Oil * (15HDD/3-Year Average HDD)**

Where:

WNBLFS: Weather Normalized Baseline Fuel Oil Savings (Gal.)
3-Year Average Baseline Heating Fuel Oil:
Bradley ES = 14,881 Gal.
Irving ES = 18,590 Gal
15YHDD: 15 Year Average HDD (5,834 per NWS Hartford, CT)
3-Year Average HDD: (Sep'15 –Aug'18) HDD (5,458 NWS Hartford, CT)

**NAFOS = WNBLFS * (RPHDD/15YHDD)**

Where:

NAFOS: Net Annual Fuel Oil Savings (Gal.)
WNBLFS: Weather Normalized Baseline Fuel Oil Savings (Gal.)
RPHDD: Report Period HDD (per NWS Hartford, CT) (or floor value of 5,834 HDD)
15YHDD: 15 Year Average HDD (5,834 per NWS Hartford, NY)

**Where:**

***Fuel Oil $ Savings = NAFOS x * (139,000 BTU/Gal.) * (MMBTU/1,000,000 BTU)* Fuel Oil Rate ($/MMBTU)***

JCI will calculate the annual Natural Gas cost according to the following formula:

**ANGC=NAFOS * (FOBEFF/NGBEFF) * (139,000 BTU/Gal) * (MMBTU/1,000,000 BTU)**
Where:

| | |
|---|---|
| ANGC: | Annual Natural Gas Consumption (MMBTU) |
| NAFOS: | Net Annual Fuel Oil Savings (Gal.) |
| NGBEFF: | Natural Gas Boiler System Efficiency |
| FOBEFF: | Fuel Oil Boiler System Efficiency |

**Where:**

***Annual Natural Gas Cost $ = ANGC x Natural Gas Rate ($/MMBTU.)***

Total Boiler Replacement cost savings reported will be the difference between Fuel Oil $ Savings and the Annual Natural Gas Cost $ as defined above.

### ECM-7 Energy Efficient DHW Installation

**Table 2.15**

| | Energy Efficient DHW Installation | | | Total First Year Projected Energy Cost Avoidance |
|---|---|---|---|---|
| | Electric Energy | Annual Electric Demand | Natural Gas | |
| Site | kWh | kW | Therms | |
| High School | 27,604 | 950 | (964) | $ 15,998 |

The High School boys' and girls' locker rooms are each separately served by a 500 gallon, 50 kW existing electric domestic hot water heater. Replace both electric water heaters with a single natural-gas fired condensing domestic hot water heater installed in the fan room in the boys' locker room. The new condensing hot water heater will serve both the boys and girls locker rooms. The 30 kW electric domestic hot water heater serving the kitchen will be replaced with a natural gas-fired condensing domestic hot water heater. Although the electric heaters are very energy efficient, the impact on the electric demand cost is costly. The condensing domestic hot water heaters can efficiently modulate capacity to follow the domestic hot water load JCI will use the Electric and Natural Gas rates as defined in the Baseline Calculations and Utility Rates section of this document to calculate annual avoided energy cost savings.

**Measurement & Verification Plan (M&V Option A)**

*Pre-Installation:* The pre-retrofit hot water heater energy use was calculated using the existing equipment nameplate information, age, and discussion with facility staff.

*Post-Installation:* Verify that approved "Scope of Work" has been completed - inspect and verify proper installation of the condensing domestic hot water heaters, two recirculation pump systems (one for each locker room), the hot water mixing valves serving each locker room, and the natural gas metering equipment serving the condensing domestic hot water heaters.

*Duration of Verification: Equipment inspections, one-time combustion efficiency test to verify domestic hot water heater performance.*

*Source Data:* Equipment specifications

Although the electric heaters are very energy efficient, the impact on the monthly electric demand cost is costly. The condensing domestic hot water heaters can efficiently modulate capacity to follow the domestic hot water load JCI will use the Electric and Natural Gas rates as defined in the Baseline Calculations and Utility Rates section of this document to calculate annual avoided energy cost savings. A one-time combustion efficiency test will be used to verify the published condensing boiler performance.

Baseline Determination: The baseline electric energy consumption of 84.767 MMBTU is based on the key assumptions presented in the Table 2.15a

**Table 2.15a**

| Key Assumptions | |
|---|---|
| 372 Number of Students | 90% Electric System Efficiency |
| 217 Equivalent Student-Days per Year | 85% Natural Gas System Efficiency |
| 1.8 Gallons/Student-Day | 70 Temperature Rise (F) |

JCI will calculate the cost savings resulting from the offset of electricity consumption with equivalent natural gas costs using the formula and conditions set forth below:

**Cost Savings = Electric Cost - Natural Gas Cost**

**Electric Cost = kWh Cost + kW cost**

**kWh Cost = ( DHWL* 1,000,000 * IER ) / ( ESEFF * 3,412 )**

Where:

| | |
|---|---|
| DHWL | = Domestic How Water Baseline Load (84.767 MMBTU) |
| 1,000,000 | = Unit Conversion Factor BTU/MMBTU |
| ESEFF | = Electric System Baseline Efficiency (90 percent) |
| 3,412 | = Unit Conversion Factor BTU/kWh |
| IER | = Incremental Electric Rate ($/kWh) |

**kW Cost = ( MD * MO * DR)**

Where

| | |
|---|---|
| MD | = Monthly Demand (100 kW) |
| MO | = Number of Months (9.5 Months) |
| DR | = Demand Rate ($/kW) |

**Natural Gas Cost = ( DHWL * NGR ) / NGSEFF**

Where:

| | |
|---|---|
| DHWL | = Domestic How Water Baseline Load (84.767 MMBTU) |
| NGR | = Natural Gas Rate ($/MMBTU) |
| NGESEFF | = Natural Gas System Efficiency (%) |

**Schedule 2**

**ECM-9 Computer Power Management**

**Table 2.16**

| Site | Computers - Power Management Savings<br>Electric Energy<br>kWh | Total First Year Projected Energy Cost Avoidance |
|---|---|---|
| **High School** | 7,780 | **$ 687** |
| **Middle School** | 7,780 | **$ 994** |
| **Bradley ES** | 6,224 | **$ 1,003** |
| **Irving ES** | 7,002 | **$ 881** |
| **Sites Total** | **28,786** | **$ 3,565** |

Installation and configuration of Computer Power Management (CPM) technology reduces energy consumption on a PC desktop level by commanding computers (CPUs) and monitors into active, standby or hibernation modes.

**Measurement & Verification Plan (M&V Option A)**

*Pre-Installation:* Baseline energy use was determined through hours of operation provided by schedules and facility personnel input, an equipment audit, and manufacturer energy use specifications. The number of computers to be controlled by the computer power management system was determined to be 370 PCs (see Table 2.16a below for building PC counts) and hours of operations at various levels (Active, Standby, Hibernate and Off modes - see Table 2.16b).

*Post-Installation:* Work with District IT management to verify that approved computer control software has been installed and working correctly. To determine run hours and associated computer state mode, perform at least one computer management system PC client survey trend log for a period of at least two weeks during each reporting year. Use measured results from annual logging period and incorporate into savings calculations for that year.

*Duration of Measurement:* Annual measurement of PC energy use

*Source Data:* Equipment specifications, PC management software analysis/computer state mode hours, District IT staff

**Table 2.16a**

| Building* | PC Quantity |
|---|---|
| High School | 100 |
| Middle School | 100 |
| Bradly ES | 80 |
| Irving ES | 90 |
| **Totals** | **370** |

*Assumption at 200 work days per year.

The performance of this measure is based on the composition of the Customer's network infrastructure, number of CPUs, and the assumptions regarding mode of operation and operational days/year. During the Project Term, JCI may adjust savings calculations to reflect changes in the assumptions set forth by Customer's change in the PC count, days of operation, new scheduling or failure to maintain or update the Power Management software in accordance with manufacturer's recommendations, or any other reason not related to an act or omission of JCI. In addition, if the changes are material and Customer is not able to provide adequate documentation to allow JCI to make the adjustments described, JCI will be entitled to deem that the Project Benefits relating to this Improvement Measure have been achieved at the targeted level set forth in the table above

*M&V Methodology*

Through customer input the number of PCs controlled as part of the project is determined to be 370. Input from and coordination with the District's IT group (or responsible IT person) is critical to annual PC usage surveying process. If JCI is unable to engage the assistance of the responsible District IT associate, JCI will use the baseline PC floor and associated baseline energy savings projection for performance year reporting. If the number of computers controlled within the District drops below 370, a savings adjustment using this value as a floor will be calculated and reported based on the change in PC numbers. Annually, in cooperation with the customer IT group, the computer management system will determine run hours/energy use and percentage in the different modes of operation (i.e. Active, Standby, Hibernate, and Off). An average of the results in each mode over the population of PCs will be the basis for annual energy savings. Table 2.16b provides a pre-retrofit benchmark of the average time the PCs operate in the various modes. Wattages for PC equipment and days per year as stated in the table and will be used for reporting through the term of the guarantee. The annual operational mode percentages will be compared to the pre-retrofit operational mode times in Table 2.16b – the differences between pre & post retrofit operational states will be the basis for calculating savings.

**Table 2.16b**

| Equipment | Operational Modes | | | | Energy |
|---|---|---|---|---|---|
| **CPU** | **Active** | **Standby** | **Hibernate** | **Off** | **kWh/year/unit** |
| Average Watts | 57 | 26 | 4.7 | 3 | |
| Existing Hrs. / Day | 10 | 2 | 2 | 10 | 132 |
| Proposed Hrs. / Day | 5 | 4 | 5 | 10 | 88 |
| **Monitor** | **Active** | **Standby** | **Hibernate** | **Off** | **kWh/year/unit** |
| Average Watts | 37 | 3 | 0 | 0 | |
| Existing Hrs. / Day | 10 | 4 | 0 | 10 | 76 |
| Proposed Hrs. / Day | 5 | 9 | 0 | 10 | 42 |

The savings for this ECM are generated through a reduction in run hours used by the network devices; therefore the measurement boundary is the network devices themselves.

The CPM software will measure the average operational states of PC during an annual measurement period (two or more consecutive weeks during school in session periods) and then be annualized to represent average annual energy use per PC. The annual savings will then be calculation according to the following formula:

*Annual Energy kWh Consumption = ((Days per year (200) x 24 hour/day + (Operational mode hours (Table 2.16b) x Watts per mode (measured)) / 1000*

*Annual Energy Savings (kWh)* $_{average\ per\ pc}$ *=Average PC Equipment Consumption (kWh) (Table 2.16b)* $_{pre\text{-}retrofit}$ *– Average PC Equipment Consumption (kWh)* $_{post\ retrofit}$

JCI will use the following formula to calculate annual cost avoided at each facility:

*Annual $ Savings = Annual Energy Savings* $_{average\ per\ pc}$ ** Qty * IER*

Where:

*IER = Incremental Energy Rate (kWh) (see section: Baseline Calculations & Utility Rates IV)*

**ECM-10 Water Conservation**

**Table 2.17**

| | Water Conservation Savings | | | |
|---|---|---|---|---|
| | Electric Energy | Natural Gas | Water | Total First Year Projected Energy Cost Avoidance |
| **Site** | **kWh** | **Therms** | **kGal*** | |
| **High School** | 4,439 | 0 | 184 | **$ 3,197** |
| **Middle School** | - | 80 | 23 | **$ 423** |
| **Bradley ES** | - | 162 | 51 | **$ 939** |
| **Irving ES** | - | 131 | 36 | **$ 674** |
| **City Hall** | 708 | 0 | 23 | **$ 416** |
| **DPW** | 598 | 0 | 5 | **$ 184** |
| **Senior Center** | - | 26 | 21 | **$ 358** |
| **Veteran Comm. Ctr.** | - | 61 | 13 | **$ 278** |
| **WPCA** | - | 7 | 8 | **$ 135** |
| **Library** | 368 | 0 | 7 | **$ 145** |
| **Police** | - | 74 | 48 | **$ 848** |
| **Fire 1** | - | 33 | 18 | **$ 325** |
| **Fire 2** | - | 52 | 53 | **$ 883** |
| **Fire 3** | - | 7 | 6 | **$ 108** |
| **Fire 4** | - | 70 | 22 | **$ 440** |
| **Sites Total** | **6,113** | **704** | **517** | **$ 9,353** |

*1 kGal equals 1000 gallons

A combination of water flow restrictors, new toilets, flushometers, and toilet flush valves designed to reduce the volume of water used with the City and School District will result in reduce water usage. Water savings result in lower water utility volumetric charges as well as associated sewer cost in most applications. In warm water applications, these devices reduce water waste and the associated thermal costs.

**Measurement & Verification Plan (M&V Option A)**

*Pre-Installation:* Re-check audit, savings calculations, and conduct and record flow readings on representative sample set of fixtures including toilets and sinks receiving flow restrictors in each building. Use table 2.17a below to determine initial sample sizes.

*Post-Installation:* Verify that the Scope of Work has been completed and that new equipment is performing per the scope. Record any changes to the scope and adjust potential savings if necessary. Conduct a visual inspection of water conservation improvements and perform a one-time post installation flow readings on the same representative sample of installed flow limiting equipment (including toilets and sinks) as measured during pre-retrofit. Assess performance using a 90% confidence and 20% precision level. Use post retrofit flow measurements that do not fall within precision levels to adjust savings estimates for all like fixtures in each facility that received flow restrictors, adjusted savings values will be used in post retrofit calculations. Verification of pedal valves will be done by visual inspection and functional testing.

*Duration of Measurement:* One pre & post retrofit measurements and visual inspection on sample fixtures.

*Source Data:* Product specifications, customer information, equipment inspection, measured flow data.

**Sample Size Determinations**

Required post installation sample size determinations will be made, with an estimated coefficient of variation of 0.5 (CV = 0.5). Usage groups will draw samples sizes from a 90% confidence and 20% precision for new flow restricting equipment that include toilets and sinks. . JCI will execute sampling from logical project site locations groups rather than individual building level sampling. See Table 2.19a below for sample size determinations.

**Table 2.17a**

| Precision | 20% | Precision | 20% |
|---|---|---|---|
| Confidence | 90% | Confidence | 90% |
| Z-Statistic | 1.645 | Z-Statistic | 1.645 |
| Population Size, N | Sample Size, n* | Population Size, N | Sample Size, n* |
| 4 | 4 | 60 | 14 |
| 8 | 6 | 70 | 14 |
| 12 | 8 | 80 | 15 |
| 16 | 9 | 90 | 15 |
| 20 | 10 | 100 | 15 |
| 25 | 11 | 125 | 15 |
| 30 | 11 | 150 | 16 |
| 35 | 12 | 175 | 16 |
| 40 | 12 | 200 | 16 |
| 45 | 13 | 300 | 17 |
| 50 | 13 | 400 | 17 |

Note: The coefficient of variation in the above table is estimated to be 0.5.

The Project Benefits associated with water fixture upgrades include water and sewer savings, along with a reduction in hot water heating fuel for sinks. As described above, savings will be verified by performing a functional tests on a sample set of toilets and faucets receiving flow restriction devices at the time of installation and through assumptions and individual building and fixture audit factors as stated within the IGA and/or calculations as an attachment to this contract.

**Schedule 2**

**ECM-12 Photovoltaic Electric Generation (PV)**

**Table 2.18**

| Site | Photovoltaic Electric Generation Savings<br>Electric Energy<br>kWh | Total First Year Projected Energy Cost Avoidance |
|---|---|---|
| **Middle School** | 263,406 | **$ 37,336** |
| **Bradley ES** | 180,406 | **$ 31,570** |
| **Irving ES** | 166,269 | **$ 23,242** |
| **Sites Total** | **610,081** | **$ 92,147** |

The Solar Photovoltaic (PV) system is a renewable energy resource measure designed to generate electricity from a total of 460 kW AC PV array over three Derby School District buildings. The system was designed using a commercial professional solar system design and analysis software. The PV system is projected to yield 610,081 kWh of electricity in its first year of operation. The system will be behind the meter but will be metered in order to qualify for ZREC credit (Zero Emissions Renewable Energy Credits) at the "bid-in" rates (see Table 2.18a below).

**Measurement & Verification Plan (Option B)**

*Pre-Installation:* Using a solar modeling tool (PVSYST) JCI designed a solar PV system consisting of PV modules, arrays and inverters at the Middle School, Bradley Elementary School, and Irving Elementary School buildings. The industry-standard PV-Syst calculation and Helioscope tools provided projected energy (kWh) generation for each building system. The tools account for specific system design factors and uses locational simulation data (i.e. Bridgeport CT Meteo weather data and published local hourly solar radiation data) to calculate projected electric energy (kWh) output. Modelled irradiance (kWh/$m^2$) factors for the Derby locations are documented in Table 2.18b, these values will be used in post retrofit calculations.

*Post-Installation:* Verify that approved scope of work has been completed and commissioned insuring that the solar PV system components are functioning per design. Test power measurement equipment and tracking system integration to insure accurate data recording. The new solar installation will have kWh meter installed that will track the energy generated from the solar array through a power generation tracking system. This value at contract rates, along with the ZRECs received, will be used to track the contract savings generated by the solar systems (savings tracking is subject to adjustments during the guarantee term – see Solar PV Measure Adjustments below). JCI will measure kWh generation and irradiance and then use the Solar PV energy system power generation calculations below.

*Duration of Measurement:* Continuous data logging through the Inverter of electric power generation. Periodic site inspections of the equipment and measurement equipment post installation. Report system performance annually throughout the M&V term.

*Source Data:* Utility and PV generation kWh, solar irradiance, manufacturer's product specifications, PVSYST modeling.

**Table 2.18a**

| | Middle School | Bradley ES | Irving ES |
|---|---|---|---|
| Installed Capacity AC ZREC app | 198.3 kW | 136.6 kW | 125.3 kW |
| Maximum Annual Quantity ZRECs (MWhs) | 263.4 | 180.4 | 166.2 |
| Purchase Price per ZREC $/kWh | 0.09 | 0.09 | 0.09 |

**Table 2.18b**

| Month | Horizontal Global Irradiation (kWh/m²)* |
|---|---|
| January | 58 |
| February | 73.9 |
| March | 113.1 |
| April | 139.7 |
| May | 168.1 |
| June | 175.7 |
| July | 180.8 |
| August | 160 |
| September | 126 |
| October | 94.5 |
| November | 58.3 |
| December | 47.6 |
| **Total** | **1395.7** |

*All locations with same modelled kWh/m²

**Solar PV Measure Adjustments**

**Definitions.** For purposes of this Agreement, the following terms have the meanings set forth below:

**Actual Energy** means the energy, over the course of an Energy Year, delivered to the Energy Delivery Point. Units are Megawatt-Hours (MWH).

**Baseline Incident Radiation** is solar insolation in the plane of the collectors developed from Baseline Weather Conditions and modeled with transformation functions from PVSyst over the course of a Year.

**Baseline Weather Conditions** means the meteorological data used to determine the Modeled Energy.

**Degradation Rate** means the percentage by which the Modeled Energy is downwardly adjusted on a compounded annual basis. For purposes of this Agreement, the Degradation Rate shall equal 0.7%.

**Energy Contract Rate** means the price that will be multiplied by an Energy Shortfall or Energy Surplus. Units are Dollars per Megawatt-Hour ($/MWH).

**Energy Delivery Point** means the point of interconnection to the distribution system or service panel.

**Energy Year** means the period of 365 days following the Commercial Operation Date and each 365 day anniversary thereafter throughout the Guarantee Term.

**Force Majeure** means conditions that are beyond the reasonable control, and without the intentional misconduct or negligence of the Party claiming the benefits of the Force Majeure, that include, but are not limited to: acts of God or nature; acts of government agencies; strikes; labor disputes; fires; explosions or other casualties; thefts; vandalism; riots or war; acts of terrorism; the unavailability of electrical transmission or

distribution service at any time; interruptions or degradations in telecommunications, computer, or electronic communications systems that are beyond the reasonable control of JCI; changes in Laws pertaining to the operation of the project; interruption of electrical service at the Property Site or to the Generating Station; requirement by a utility that the Generating Station discontinue operation for any reason; physical obstruction or interference of insolation to the Generating Station, such as overshadowing or shading; appropriation or diversion of electricity by sale or order of any governmental authority having jurisdiction thereof; any action by any governmental authority that prevents or prohibits the

Parties from carrying out their respective obligations under this Agreement; or unavailability of parts, materials or supplies despite commercially reasonable efforts to procure such parts, materials or supplies.

**Generating Station** means the entirety of the solar generating system, its electrical and mechanical components, mounting or tracking components, inverter(s), modules, meter(s), and monitoring components described in Schedule 1

**Global Horizon Irradiance** means solar insolation measured at local weather station over the course of an Energy Year from the horizon (flat). Units are Kilowatt-Hours per Square Meter (kWh/m2).

**Production Factor** means any event or action outside the control of JCI that has the effect of reducing the Actual Energy, including physical obstruction or interference of insolation to the Generating Station, such as overshadowing or shading; utility grid outage; outage directed by Host, Generating Station owner, or utility; casualty events; Force Majeure Events; theft; or vandalism.

**Target Energy** means the energy, over the course of an Energy Year, calculated by multiplying the Modeled Energy by the ratio of Measured Incident Radiation to the Baseline Incident Radiation and adjusted for events. Units are Megawatt-Hours (MWH).

**Annual Saving Determination**

Baseline solar power generation as modeled through the PV-Syst tool is equal to 610,081 kWh for year 1. As available solar power will vary from year-to-year and/or system malfunctions or interruptions may occur, only measured kWh generation (adjusted for irradiance) of the system equal to or above the baseline PV-Syst will be used in the annual savings calculations, otherwise the baseline modeled kWh energy generation will be used in performance period calculations.

***Solar PV Energy System Power Generation (kWh)*:**

$ASPVS\ \$ = (ASPG\ (kWh_{adj})) \times IER$

where:

*ASPV $ = Annual Solar PV Savings $*

$ASPG = \text{Annual Solar Power Generation } (kWh_{adj}) = (kWh_{measured})(kWh/m^2_{modellled})/(kWh/m^2_{actual})$
*(i.e. measured adjusted for irradiance per system inverter totalization or PV-Syst baseline x APVDF, whichever is higher)*

*APVDF = PV Degradation Factor (0.7%/year)*

*IER = Incremental Electric Rate (IER) Rate (per Section IV Baseline Calculations & Utility Rates)*

**Table 2.18c**

| Building | Proposed Array Size kWDC | Proposed Array Size kWAC | Performance Ratio | Collection Losses* (kWh/kWDC/day) | System Losses* (kWh/kWDC/day) | Inverter Output* (kWh/kWDC/day) |
|---|---|---|---|---|---|---|
| Middle School | 220.3 | 198.3 | 0.825 | 0.55 | 0.14 | 3.28 |
| Bradley ES | 151.8 | 136.6 | 0.818 | 0.59 | 0.13 | 3.26 |
| Irving ES | 139.2 | 125.3 | 0.823 | 0.58 | 0.13 | 3.27 |
| Total:/Average: | 511.3 | 460.2 | 0.822 | 0.57 | 0.13 | 3.27 |

* PVSYST Sites total metrics averaged over all locations

**ECM-16 Transformer Replacement**

**Table 2.19**

| | Transformers - Replacements Savings | | |
|---|---|---|---|
| | Electric Energy | Annual Electric Demand | Total First Year Projected Energy Cost Avoidance |
| Site | kWh | kW | |
| Middle School | 13,868 | 19 | $ 2,065 |
| WPCA | 16,024 | - | $ 2,296 |
| Sites Total | 29,893 | 19 | $ 4,361 |

Transformers are part of the electrical distribution system that increase/decrease alternating voltages within a building and over time can decrease in efficiency. Less efficient older transformers may produce excess heat (i.e. energy loss), affect the operating reliability of connected equipment (power quality), and may be noisy due to vibration. Transformers optimized for modern electronic equipment reduce losses and improves power quality.

**Measurement & Verification Plan (M&V Option A)**

*Pre-Installation:* An audit of transformers was completed at several of the Derby buildings. The project includes replacement of existing transformers with energy efficient transformers at the Middle School and WPCA. Using pre-retrofit equipment specification, calculations were developed to project savings across the units being replaced. Take thermal images of pre-retrofit equipment and prior to construction, perform power logging on a sample of the transformers within each building.

*Post-Installation:* Verify that approved transformer scope of work has been completed and the units are working properly. Conduct a visual inspection of transformer replacement and take thermal images/photographs of same sample and like time period of equipment imaged above. Perform power logging on new transformers in same locations as transformers logged pre-retrofit and under similar loading conditions and logging duration immediately after commissioning. Savings will be based on measured data and engineering calculations within the IGA. Table 2.19a below provides information on transformers to be replaced and associated variables used to calculate projected savings.

*Duration of Measurement:* One-time pre & post retrofit power logging, annual visual inspection

*Source Data:* Product specifications, customer information, inspection, equipment testing, thermal imaging

**Table 2.19a**

| | Location | Nameplate Rating (kVA) | % Load During Normal Op Hrs | % Load Outside Op Hrs | Eq. Normal Operating Hrs./ day | Eq. Normal Operating Days/yr. | Pre-Retrofit Efficiency (Op Hrs) | Post-Retrofit Efficiency (Op Hrs) | Pre-Retrofit Total kW Losses | Post-Retrofit Total kW Losses |
|---|---|---|---|---|---|---|---|---|---|---|
| Middle School | Basement Electric Rm | 45 | 15.0% | 10.0% | 16.0 | 255 | 91.2% | 98.2% | 1.28 | 0.22 |
| | Boiler Room | 45 | | | | | 91.2% | 98.2% | 1.28 | 0.22 |
| | Cafetorium | 45 | | | | | 91.2% | 98.2% | 1.28 | 0.22 |
| WPCA | Pump House | 75 | 15.0% | 10.0% | 16.0 | 255 | 93.1% | 97.6% | 1.62 | 0.32 |
| | Bsmt. Sludge Pump Rm | 75 | | | | | 93.1% | 98.2% | 1.62 | 0.32 |
| | Chemical House | 45 | | | | | 91.2% | 97.6% | 1.28 | 0.22 |

**Schedule 2**

## CHANGES IN USE OR CONDITION; ADJUSTMENT TO BASELINE AND/OR ANNUAL PROJECT BENEFITS

Customer agrees to notify JCI, within fourteen (14) days, of (i) any actual or intended change, whether before or during the Guarantee Term, in the use of any facility, equipment, or Improvement Measure to which this Schedule applies; (ii) any proposed or actual expansions or additions to the premises or any building or facility at the premises; (iii) a change to utility services to all or any portion of the premises; or (iv) any other change or condition arising before or during the Guarantee Term that reasonably could be expected to change the amount of Project Benefits realized under this Agreement.

Such a change, expansion, addition, or condition would include, but is not limited to: (a) changes in the primary use of any facility, Improvement Measure, or portion of the premises; (b) changes to the hours of operation of any facility, Improvement Measure, or portion of the premises; (c) changes or modifications to the Improvement Measures or any related equipment; (d) changes to the M&V Services provided under this Agreement; (e) failure of any portion of the premises to meet building codes; (f) changes in utility suppliers, utility rates, method of utility billing, or method of utility purchasing; (g) insufficient or improper maintenance or unsound usage of the Improvement Measures or any related equipment at any facility or portion of the premises (other than by JCI); (h) changes to the Improvement Measures or any related equipment or to any facility or portion of the premises required by building codes or any governmental or quasi-governmental entity; or (i) additions or deletions of Improvement Measures or any related equipment at any facility or portion of the premises.

Such a change or condition need not be identified in the Baseline in order to permit JCI to make an adjustment to the Baseline and/or the Annual Project Benefits. If JCI does not receive the notice within the time period specified above or travels to either Customer's location or the project site to determine the nature and scope of such changes, Customer agrees to pay JCI, in addition to any other amounts due under this Agreement, the applicable hourly consulting rate for the time it took to determine the changes and to make any adjustments and/or corrections to the project as a result of the changes, plus all reasonable and documented out-of pocket expenses, including travel costs. Upon receipt of such notice, or if JCI independently learns of any such change or condition, JCI shall calculate and send to Customer a notice of adjustment to the Baseline and/or Annual Project Benefits to reflect the impact of such change or condition, and the adjustment shall become effective as of the date the change or condition first arose. Should Customer fail to promptly provide JCI with notice of any such change or condition, JCI may make reasonable estimates as to the impact of such change or condition and as to the date on which such change or condition first arose in calculating the impact of such change or condition, and such estimates shall be conclusive.

# IV. BASELINE CALCULATIONS AND UTILITY RATES

**Basis for Determination of Fuel and Utility Escalation Rates**
The Base Utility Cost shall be escalated annually by the contracted utility cost escalation commencing during project construction and reflected in the first year guaranteed savings. This contracted escalated utility rate shall be considered the contracted floor rate. If the actual rate is lower than the floor rate shown, the floor rate shall be used. Otherwise the actual rate will be used.

**Basis for Determination of Fuel and Utility Floors and Ceilings**
JCI and the Customer both acknowledge that Floors and Ceilings are utilized because JCI cannot economically bare the risk associated with fluctuating utility prices that could negatively or positively affect the guaranteed performance savings in terms of dollars; rather JCI is accepting the risk of the performance of the equipment and systems installed under this contract to achieve the performance savings in terms of unit measures of energy, e.g. kW, kWh, MMBtu, kGal.

**Baseline Calculation and Utility Rates**
The unit utility costs for the baseline period are set forth below as "Base Utility Cost" and shall be used for calculations made under this Schedule. The base utility cost for non-fuel conversion ECMs using electric, natural gas, #2 fuel oil, and water & sewer rates shall be escalated by three and one half percent (3.5%) annually starting during project construction and reflected in the first year guaranteed savings. Energy savings resulting from fuel conversions shall have ceiling rates apply. Specifically, for ECM-6 Fuel Oil to Natural Gas Boiler / Burner Replacement, a ceiling rate no greater than the annual escalation rate shall apply to the natural gas rate. The utility cost used in JCI calculations are defined in the formulas in this section with baseline rates for electric, natural gas, #2 fuel oil, and water & sewer used as floor values. The baseline electricity, natural gas, water & sewer, and fuel oil consumption for Derby facilities represents the average billed costs over a one (1) to three (3) year period (dependent on billing history availability) from ***January 2015 through December 2017***.

**Electricity**
The table below lists the UI/Constellation delivery account numbers, and rates for each site during the baseline period. The Incremental Energy Rate (IER) for kilowatt hours (kWh) and Electric Demand Rate (EDR) for metered kilowatt (kW) at the facilities have been used in the calculations for electrical cost savings. These costs include the Gross Revenue Tax and Fuel Adjustment Charges. Some measures may result in reduced energy use without affecting the monthly peak demand; these will calculate savings for energy (kWh) costs only. Other measures that are likely to reduce the monthly peak demand have energy and demand (kW) savings calculated.

## Table 2.20 Electric Baseline Floor Rates

| Building/Location Name | Service Address (Derby, CT) | UI/Constellation Electric Account # | UI/Constellation Electric Rate | Incremental Electric (IER) $/kWh | Demand Rate (EDR) $/kW | Summer Demand Rate ($/kW) | Winter Demand Rate ($/kW) |
|---|---|---|---|---|---|---|---|
| Derby High School | 95 Chatfield St | 100001414243<br>100000188977 | Generation -FlatT&D-GS-TOD | $0.085 | $14.71 | $16.43 | $14.09 |
| Derby Middle School | 73 Chatfield Street | 100001414183 | Generation -FlatT&D-GS-TOD | $0.123 | $14.92 | $16.43 | $14.09 |
| Bradley Elementary School | 155 David Humphreys Road | 100000180367<br>3 meters | Multiple | $0.156 | $14.76 | $16.43 | $14.09 |
| Irving Elementary School | 9 Garden Place | 100001435527<br>2 meters | Generation -FlatT&D-GS-TOD | $0.122 | $14.85 | $16.43 | $14.09 |
| City Hall | 1 Elizabeth Street | 100000207128 | Generation -FlatT&D-GS-TOD | $0.095 | $20.36 | $21.61 | $19.55 |
| DPW HWY | 5 Coon Hollow Road | 100000193932<br>100000193941 | Generation -FlatT&D-GS | $0.168 | $19.94 | $21.61 | $19.55 |
| Senior Center | 293 Main Street | | | $0.120 | $20.24 | $21.61 | $19.55 |
| Veteran Community Center/Central Office | 35 Fifth Street | 100000223424 | Generation -Direct BillT&D-GS | $0.105 | $20.29 | $21.61 | $19.55 |
| WPCA | 1 Caroline Street | 100001433621 | Multiple | $0.118 | $14.76 | $16.43 | $14.09 |
| Library | 313 Elizabeth Street | 100000255408 | Generation -FlatT&D-GS-TOD | $0.117 | $14.89 | $16.43 | $14.09 |
| Police | 125 Water Street | 100000197457 | Generation -FlatT&D-GS | $0.106 | $20.33 | $16.43 | $14.09 |
| Fire 1 (Hotchkiss Hose Co.) | 250 David Humphrey Road | 100000279873<br>100000279877 | Acc 100000279873 Generation - Flat T&D-GS-TOD | $0.120 | $20.34 | $21.61 | $19.55 |
| Fire 2 (Storm Engine Co.) | 151 Olivia Street | 100000223468 | Generation -Direct BillT&D-GS | $0.116 | $20.34 | $21.61 | $19.55 |
| Fire 3 (East End Hose) | 1750 Derby Milford Road | 100000290797 | Generation -Direct BillT&D-GS | $0.118 | $20.24 | $16.43 | $14.09 |
| Fire 4 (Paugassett H & L) | 55 Derby Avenue | 100000313379 | Generation -Direct BillT&D-GS | $0.105 | $20.18 | $21.61 | $19.55 |

The kWh (IER) and kW (EDR) costs have been averaged over the course of the baseline period. In turn, kWh (IER) and kW (EDR) costs will be averaged over the course of the reporting period, as reflected on utility invoices, for equitable cost avoidance savings reporting.

**Baseline Electric Calculations**

The Incremental Electric Rate to be used in the calculation of savings for the current reporting period shall be the greater of Formulas A-1a or A-1b.

**FORMULA A-1a**

$$IER_n = \sum TKC_{1\text{-}12} \div \sum TKWH_{1\text{-}12}$$

Where:

$IER_n$: Incremental Electrical Rate (Dollars per kWh) for reporting year n.

$\sum TKC_{1\text{-}12}$: Sum Total of Monthly Electrical Utility Costs (Dollars) for kWh included Fuel Adjustment Cost and other related Energy Charges for Months 1 Through 12 of reporting year n.

$\sum TKWH_{1\text{-}12}$: Sum Total of Monthly Electrical Incremental Use (kWh) for Months 1 Through 12 of reporting year n.

**FORMULA A-1b**

$$IER_n = IER_{baseline} \times (1 + ER)^n$$

Where:

$IER_n$: Incremental Electric Rate ($/kWh) for reporting year n

$IER_{baseline}$: Incremental Electric Rate for the baseline period (Table 2.21)

ER: Escalation Rate, 3.5% annually

The Demand Rate to be used in the calculation of savings for the current reporting period shall be the greater of Formulas B-1a or B-1b.

**FORMULA B-1a**

$$EDR_n = \sum TKC_{1\text{-}12} \div \sum TKWH_{1\text{-}12}$$

Where:

$EDR_n$: Demand Electric Rate (Dollars per kW)

$\sum TKC_{1-12}$: Sum Total of Monthly Electrical Utility Costs (Dollars) for kW included Fuel Adjustment Cost and other related Energy kW Charges for Months 1 Through 12 of reporting year n.

$\sum TKW_{1-12}$: Sum Total of Monthly Electrical Demand (kW) for Months 1 Through 12 of reporting year n.

**FORMULA B-1b**

$$EDR_n = EDR_{baseline} \times (1 + ER)^n$$

Where:

$EDR_n$: Demand Electric Rate ($/kW) for reporting year n

$EDR_{baseline}$: Demand Electric Rate for the baseline period (Table 2.21)

ER: Escalation Rate, 3.5% annually

### Natural Gas

The table below lists the utility distribution company Eversource account numbers, and baseline rates for each Derby facility included in the performance contract. Natural Gas Rates listed are average for the baseline period.

**Table 2.21 Natural Gas Baseline Floor Rates**

| Building/Location Name | Service Address (Derby, CT) | Eversource Natural Gas Account # | Eversource Natural Gas Rate | Natural Gas Rate (NGR) $/Therm | Rate $/MMBtu |
|---|---|---|---|---|---|
| Derby High School | 95 Chatfield St | 57688210004 | R10 | $0.871 | $8.71 |
| Derby Middle School | 73 Chatfield Street | 57198505018<br>57228845095 | R30 | $0.796 | $7.96 |
| Bradley Elementary School | 155 David Humphreys Road | *See Note 1* | *See Note 1* | $0.926 | $9.26 |
| Irving Elementary School | 9 Garden Place | 57310960026 | R10 | $0.926 | $9.26 |
| City Hall | 1 Elizabeth Street | 57331216010 | R20 | $1.290 | $12.90 |
| DPW HWY | 5 Coon Hollow Road | 57055200067 | R20 | $1.429 | $14.29 |
| Senior Center | 293 Main Street | 57478410053 | R20 | $1.606 | $16.06 |
| Veteran Community Center/Central Office | 35 Fifth Street | 57920750031 | R30 | $1.198 | $11.98 |
| WPCA | 1 Caroline Street | 57806640017 | R20 | $1.404 | $14.04 |
| Library | 313 Elizabeth Street | 57970970067 | R10 | $2.044 | $20.44 |
| Police | 125 Water Street | 5756291000 | R10 | $1.409 | $14.09 |
| Fire 1 (Hotchkiss Hose Co.) | 250 David Humphrey Road | 57440940054 | R20 | $1.388 | $13.88 |
| Fire 2 (Storm Engine Co.) | 151 Olivia Street | 57814660098 | R10 | $1.337 | $13.37 |
| Fire 3 (East End Hose) | 1750 Derby Milford Road | 57079280012 | R10 | $1.426 | $14.26 |
| Fire 4 (Paugassett H & L) | 55 Derby Avenue | 57488110099 | R20 | $1.302 | $13.02 |

[1]New natural gas service will be installed at Bradley Elementary School. Baseline natural gas rates will based on Irving Elementary School natural gas rates.

### Baseline Natural Gas Calculations

The natural gas unit costs have been averaged over the course of the baseline period. In turn, unit costs will be averaged over the course of the reporting period, as reflected on utility invoices, for equitable cost avoidance savings reporting.

The Natural Gas Rate to be used in the calculation of savings for the current reporting period shall be the greater of Formulas C-1a or C-1b:

**FORMULA C-1a**

$NGR_n = \Sigma TGC_{1-12} \div \Sigma TGU_{1-12}$

Where:

$NGR_n$: Natural Gas Rate ($/MMBTU) for reporting year n

$\Sigma TGC_{1-12}$: Sum Total of Monthly Gas Volumetric charges (Utility) and Supply Costs ($) for reporting year n (note: Utility natural gas fixed delivery charges not included in monthly volumetric charges)

$\Sigma TGU_{1-12}$: Sum Total of Monthly Gas Purchased (Therms) for Months 1 Through 12 of reporting year n.

**FORMULA C-1b**

$NGR_n = NGR_{baseline} \times (1 + ER)^n$

Where:

$NGR_n$: Natural Gas Rate ($/MMBTU for reporting year n

$NGR_{baseline}$: Natural Gas Rate for the baseline period (Table 2.22)

ER: Escalation Rate, 3.5% annually

Gas consumption is metered and billed in CCF by Eversource.

**Fuel Oil**

The table below lists the local fuel oil distributor rates for the base period rates for each site in effect during the baseline period. Fuel Oil rates listed are average for the baseline period.

**Table 2.23 Fuel Oil #2 Baseline Floor Rates**

| Building/Location Name | Service Address (Derby, CT) | Fuel Oil Rate (FOR) $/Gals | Fuel Oil Rate (FOR) $/MMBtu |
|---|---|---|---|
| Bradley Elementary School | 155 David Humphreys Road | $2.153 | $15.492 |
| Irving Elementary School | 9 Garden Place | $2.153 | $15.492 |

**Baseline Fuel Oil Calculations**

The Fuel Oil unit costs have been averaged over the course of the baseline period. In turn, unit costs will be averaged over the course of the reporting period, as reflected on delivery receipts, for equitable cost avoidance savings reporting.

The Fuel Oil Rate to be used in the calculation of savings for the current reporting period shall be the greater of Formulas D-1a or D-1b:

**FORMULA D-1a**

$FOR_n = \Sigma TGC_{1-12} \div \Sigma TGU_{1-12}$

Where:

$FOR_n$: Fuel Oil Rate ($/Gal.) for reporting year n

$\Sigma TGC_{1-12}$: Sum Total of Monthly Gas Costs ($) for reporting year n

$\Sigma TGU_{1-12}$: Sum Total of Monthly Gas Purchased (Gals.) for Months 1 Through 12 of reporting year n.

**FORMULA D-1b**

$FOR_n = FOR_{baseline} \times (1 + ER)^{(n-1)}$

Where:

$FOR_n$: Fuel Oil Rate ($/Gal.) for reporting year n

$FOR_{baseline}$: Fuel Oil Rate for the baseline period (Table 2.23)

ER: Escalation Rate, 3.5% annually

**Water & Sewer**

The table below lists the water supplier (Regional Water Authority) in effect during the baseline period. Water and Sewer Rates listed below are those in effect at the end of the baseline period. These are the rates used in the savings calculations.

**Table 2.22**

| Building/Location Name | Service Address (Derby, CT) | Regional Water Authority Account Number | Water/Sewer $/kGal |
|---|---|---|---|
| Derby High School | 95 Chatfield St | | $14.75 |
| Derby Middle School | 73 Chatfield Street | | $14.75 |
| Bradley Elementary School | 155 David Humphreys Road | 211137732 | $14.72 |
| Irving Elementary School | 9 Garden Place | | $14.75 |
| City Hall | 1 Elizabeth Street | 211161914 | $14.71 |
| DPW HWY | 5 Coon Hollow Road | | $15.07 |
| Senior Center | 293 Main Street | 211161047 | $14.72 |
| Veteran Community Center/Central Office | 35 Fifth Street | | $14.74 |
| WPCA | 1 Caroline Street | 211160502 | $14.69 |
| Library | 313 Elizabeth Street | 211172515 | $14.69 |
| Police | 125 Water Street | | $14.71 |
| Fire 1 (Hotchkiss Hose Co.) | 250 David Humphrey Road | | $15.07 |
| Fire 2 (Storm Engine Co.) | 151 Olivia Street | 211144100 | $14.75 |
| Fire 3 (East End Hose) | 1750 Derby Milford Road | | $15.07 |
| Fire 4 (Paugassett H & L) | 55 Derby Avenue | | $15.07 |

The Water and Sewer Rate to be used in the calculation of savings for the current reporting year shall be the greater of Formulas E-1a or E-1b:

**FORMULA E-1a**

$$WSR_n = IW\&SR_n$$

Where:

$WSR_n$: Water and Sewer Rate ($/kGal) for reporting year n

$IW\&SR_n$: Water & Sewer rate ($/kGal) in effect at the end of reporting year n

**FORMULA E-1b**

$$WSR_n = WSR_{baseline} \times (1 + ER)^{(n-1)}$$

Where:

$WSR_n$: Water and Sewer Rate ($/kGal) for reporting year n

$WSR_{baseline}$: Water and Sewer Rate for the baseline period (Table 2.24)

ER: Escalation Rate, 3.5% annually

## V. MEASUREMENT & VERIFICATION SERVICES

JCI will provide the M&V Services set forth below in connection with the Assured Performance Guarantee.

1. During the Installation Period, a JCI Performance Assurance Specialist will track Measured Project Benefits. JCI will report the Measured Project Benefits achieved during the Installation Period, as well as any Non-Measured Project Benefits applicable to the Installation Period, to Customer within 60 days of the commencement of the Guarantee Term.

2. Within 60 days of each anniversary of the commencement of the Guarantee Term, JCI will provide Customer with an annual report containing:

    A. an executive overview of the project's performance and Project Benefits achieved to date;

    B. a summary analysis of the Measured Project Benefits accounting; and

    C. depending on the M&V Option, a detailed analysis of the Measured Project Benefits calculations.

3. During the Guarantee Term, a JCI Performance Assurance Specialist will monitor the on-going performance of the Improvement Measures, as specified in this Agreement, to determine whether anticipated Measured Project Benefits are being achieved. In this regard, the Performance Assurance Specialist will periodically assist Customer, on-site or remotely, with respect to the following activities:

    A. review of information furnished by Customer from the facility management system to confirm that control strategies are in place and functioning;

    B. advise Customer's designated personnel of any performance deficiencies based on such information;

    C. coordinate with Customer's designated personnel to address any performance deficiencies that affect the realization of Measured Project Benefits; and

    D. inform Customer of opportunities to further enhance project performance and of opportunities for the implementation of additional Improvement Measures.

4. For specified Improvement Measures, JCI will:

    A. conduct pre and post installation measurements required under this Agreement;

    B. confirm the building management system employs the control strategies and set points specified in this Agreement; and

    C. analyze actual as-built information and adjust the Baseline and/or Measured Project Benefits to conform to actual installation conditions (e.g., final lighting and water benefits calculations will be determined from the as-built information to reflect the actual mix of retrofits encountered during installation).

    D. confirm that the appropriate metering and data points required to track the variables associated with the applicable Improvement Measures' benefits calculation formulas are established; and

    E. set up appropriate data capture systems (e.g., trend and totalization data on the facility management system) necessary to track and report Measured Project Benefits for the applicable Improvement Measure.

    F. Trend data records maintained in the ordinary course of system operation shall be used and relied upon by Johnson Controls in connection with Project Benefit calculations. Johnson Controls will use commercially reasonable efforts to ensure the integrity of the data collected to calculate the required metrics. In the event data are lost due to equipment failure, power failure or other interruption in data collection, transmission or storage, Johnson Controls will use reasonable engineering methods to estimate the impact of or replace the lost data

# CUSTOMER RESPONSIBILITIES

In order for JCI to perform its obligations under this Agreement with respect to the Work, the Assured Performance Guarantee, and the M&V Services, Customer shall be responsible for:

1. Providing JCI, its subcontractors, and its agents reasonable and safe access to all facilities and properties that are subject to the Work and/or M&V Services;

2. Providing for shut down and scheduling of affected locations during installation, including timely shutdowns of chilled water and hot water systems as needed to accomplish the Work and/or M&V Services;

3. Providing timely reviews and approvals of design submissions, proposed change orders, and other project documents;

4. Providing the following information with respect to the project and project site as soon as practicable following JCI's request:

    a. surveys describing the property, boundaries, topography and reference points for use during construction, including existing service and utility lines;
    b. geotechnical studies describing subsurface conditions, and other surveys describing other latent or concealed physical conditions at the project site;
    c. temporary and permanent easements, zoning and other requirements and encumbrances affecting land use, or necessary to permit the proper design and construction of the project and enable JCI to perform the Work;
    d. a legal description of the project site;
    e. as-built and record drawings of any existing structures at the project site; and environmental studies, reports and impact statement describing the environmental conditions, including hazardous conditions or materials, in existence at the project site.

5. Securing and executing all necessary agreements with adjacent land or property owners that are necessary to enable JCI to perform the Work;

6. Providing assistance to JCI in obtaining any permits, approvals, and licenses that are JCI's responsibility to obtain as set forth in Schedule 1;

7. Obtaining any permits, approvals, and licenses that are necessary for the performance of the Work and are not JCI's responsibility to obtain as set forth in Schedule 1;

8. Properly maintaining, and performing appropriate preventative maintenance on, all equipment and building systems affecting the Assured Performance Guarantee in accordance with manufacturers' standards and specifications;

9. Providing the utility bills, reports, and similar information reasonably necessary for administering JCI's obligations under the Assured Performance Guarantee within five (5) days of Customer receipt and/or generation or JCI's request therefor;

10. Providing all records relating to energy and/or water usage and related maintenance of the premises and relevant equipment requested by JCI;

11. Providing and installing utility sub-meters on all new construction and/or additions built during the Guarantee Term as recommended by JCI or, alternatively, paying JCI's applicable fees for calculating necessary adjustments to the Assured Performance Guarantee as a result of the new construction;

12. Providing and maintaining a dedicated telephone line and/or TCP/IP remote connection to facilitate remote monitoring of relevant equipment;
13. Promptly notifying JCI of any change in use or condition described in Section III of Schedule 2 or any other matter that may impact the Assured Performance Guarantee;
14. Taking all actions reasonably necessary to achieve the Non-Measured Project Benefits;
15. If any equipment under control is changed out it is the responsibility of the customer to move the controls and the controls programming to the new equipment
16. Customer is responsible for furnishing or designating a computer for Plug Load Controls software and for maintaining schedules for associated plug load control equipment or equipment groupings
17. Computer software licensing fees after the initial subscriptions have come to term will be assumed by the Customer
18. Construction period staging space for items like equipment storage trailers, job trailers, JCI project employees and sub-contractor parking in / near the facilities to receive Facility Improvement Measures will be arranged by the Customer. Additionally, under the Customer security guidelines, grant access to facilities.
19. Customer is responsible for existing code issues. Any electrical or thermal utility services that increase as a result of code compliance will become the basis for a baseline adjustment.

**Schedule 4**

# PRICE AND PAYMENT TERMS

Customer shall make payments to JCI pursuant to this Schedule 4.

1. *Work*. The price to be paid by the Customer for the Work shall be **$6,485,848** (the "Agreement Price"). Progress payments (including payment for materials delivered to JCI and work performed on and off-site) shall be made to JCI as follows:

   i. An invoice for an Initial Payment (30% or **$1,945,754**) will be submitted by JCI to Customer within five business days after Contract is fully executed and Customer project financing is in place for project development, start up, initial project mobilization and other costs incurred by JCI not previously reimbursed by Customer. This invoice shall be paid to JCI within ten (10) business days of receipt of invoice.

   ii. The remainder of the Agreement Price will be invoiced via monthly progress invoices using standard AIA G702/703 forms. The Customer shall make progress payments promptly within fifteen (15) days of its receipt of an invoice. Payments that remain unpaid after thirty (30) days shall be subject to a monthly service charge of one and one-half percent (1.5%) per month.

2. *M&V Services*. In Performance Year 1 through Year 3 the Customer agrees that JCI shall provide M&V services at the pricing stated in Table 4.1. Before the end of Performance Year 3, the Customer can request additional years of M&V Services per the terms stated in Schedule 2, section V Measurement & Verification Services. The schedule of annual payments in Table 4.1 will be due and payable in advance upon receipt of JCI's invoice for such services.

**Table 4.1**

| | | |
|---|---|---|
| Year 1 | $ | 12,418 |
| Year 2 | $ | 12,418 |
| Year 3 | $ | 12,418 |
| Year 4 | $ | 16,695 |
| Year 5 | $ | 17,197 |
| Year 6 | $ | 17,713 |
| Year 7 | $ | 18,245 |
| Year 8 | $ | 18,792 |
| Year 9 | $ | 19,356 |
| Year 10 | $ | 19,936 |
| Year 11 | $ | 20,534 |
| Year 12 | $ | 21,150 |
| Year 13 | $ | 21,785 |
| Year 14 | $ | 22,438 |
| Year 15 | $ | 23,111 |
| Year 16 | $ | 23,805 |
| Year 17 | $ | 24,519 |
| Year 18 | $ | 25,254 |
| **Total:** | **$** | **310,532** |

**Schedule 4**

3. **Payments to The ECG Group**

JCI shall use and fund the services of the City's Technical Owner's Representative, The ECG Group, to develop and manage the project for the City and to supervise and approve the preparation of the plans and specifications for all Energy Conservation Measures (ECM) proposed. ECG's fee shall be **$367,123** and paid out by JCI in accordance with the following fee schedule:

30% upon Owner signing contract with JCI

30% upon submittal of plans and specifications (Payment shall be made incrementally on a pro-rated basis)

30% upon approval of plans and specifications (Payment shall be made incrementally on a pro-rated basis)

10% upon substantial completion

JCI will remit payment to ECG on a net-30 basis. Invoices that have not been paid by the ESCO within 45 days of receipt of such invoice shall be subject to interest at the rate of 18% per annum.

In addition to any other legal requirements, concerning energy performance contracts, ECG, the Owner's Representative shall certify that he or she is free from financial interest in JCI which conflicts with the proper representation of the City and that full disclosure has been made to the Owner detailing all financial compensation received from JCI

JCI agrees that ECG shall have the right to all environmental, energy, tax, financial, and electrical-related attributes, rights, credits, benefits and characteristics associated with or arising out of the transactions contemplated by this ESPC. This shall include, but not be limited to tax filings under Internal Revenue Code Section 179D. ECG will be designated the sole Section 179D beneficiary.

**Attachment 1**

## NOTICE TO PROCEED

Johnson Controls, Inc.
27 Inwood Rd
Rocky Hill, CT 06067
ATTN:

Re: Notice to Proceed for Energy Performance Contract

Dear JCI:
This Notice to Proceed is being issued by The City of Derby ("Customer") to Johnson Controls, Inc. ("JCI") pursuant to that certain Performance Contract entered into between Customer and JCI for the purpose of notifying JCI to commence work under such contract (check as applicable).

_____ All Work other than ECM 14, VRF System
_____ ECM 14, VRF System

In the event that this Notice to Proceed is delivered by Customer prior to the execution of the Performance Contract by Customer and JCI, Customer understands and expects JCI will incur significant costs and expenses in complying with this Notice to Proceed. In the event the Performance Contract is not executed by the parties, for any reason, Customer agrees to pay JCI for its costs and fees incurred in complying with this Notice to Proceed on a time and material basis. Customer also agrees JCI shall be entitled to a reasonable markup thereon for profit and overhead. Customer agrees to pay amounts billed by JCI no later than five (5) days after Customer receives JCI's payment application. JCI will continue to submit payment applications to Customer until the Performance Contract is executed. Once the Performance Contract is executed, JCI will begin submitting its payment applications to Customer in accordance with the terms and conditions set forth therein. Any amounts already paid by Customer will be credited towards the Performance Contract price.

By signing and dating this Notice to Proceed, the parties hereto agree to these terms and represent and warrant they have the authority to execute this Notice to Proceed on behalf of their respective organizations.

**City of Derby, CT**

Signature:_____

Printed Name:_____

Title:_____

Date:_____

***ACKNOWLEDGED & AGREED TO:***

**JOHNSON CONTROLS, INC.**

Signature:_____

Printed Name:_____

Title:_____

Date:_____

**Attachment 2**

# CHANGE ORDER

| | | | |
|---|---|---|---|
| Performance Contract dated , 20 between Johnson Controls, Inc. and Customer | Change Order No. | | Date (mo/day/yr) |
| Customer<br>[Insert Customer Name] | | | |

The above referenced Performance Contract is hereby modified to the extent described below in accordance with the Terms and Conditions of the CHANGE ORDERS section thereof.

Scope of Work changed as follows:

| | |
|---|---|
| Total amount of this Change Order ..... | $ |
| Total Performance Contract amount as revised by this Change Order..... | $ |
| The time for completion is: ☐ increased, ☐ decreased, ☐ unchanged.<br>The new completion date resulting from this Change Order is: | (mo, day, yr) |

[check if applicable] Assured Performance Guarantee changed as follows:

Unless specifically changed by this Change Order, all terms, conditions and provisions of the above referenced Performance Contract remain unchanged and in full effect.

| **JOHNSON CONTROLS, INC.** | **CUSTOMER** |
|---|---|
| Signature: | Signature: |
| Printed Name: | Printed Name: |
| Title: | Title: |

**Attachment 3**

# CERTIFICATE OF SUBSTANTIAL COMPLETION

**PARTIES:**
JOHNSON CONTROLS, INC. ("JCI")
27 Inwood Rd
Rocky Hill, CT 06067

City of Derby, CT ("Customer")

**PROJECT:** Performance Contract dated _____ __, 20__ between JCI and Customer

By executing this Certificate of Substantial Completion, Customer acknowledges the following:

a. The work set forth in the Performance Contract is substantially complete.

b. Customer has received the manuals, warranty information, and training required under the Performance Contract.

c. The following punch list items must be completed by JCI (check as applicable):

☐ punch list attached
☐ punch list complete

d. Upon completion of the punch list items, or if such punch list items are complete, JCI and Customer shall sign the Certificate of Final Completion attached hereto.

Dated , 20 .

| **CUSTOMER:** | **JOHNSON CONTROLS, INC.** |
|---|---|
| Signature:_____ | Signature:_____ |
| Printed Name:_____ | Printed Name:_____ |
| Title:_____ | Title:_____ |

**Attachment 4**

# CERTIFICATE OF FINAL COMPLETION

**PARTIES:**
JOHNSON CONTROLS, INC. ("JCI")
27 Inwood Rd
Rocky Hill, CT 06067

City of Derby, CT ("Customer")

**PROJECT:** Performance Contract dated _____ __, 20__ between JCI and Customer

By executing this Certificate of Final Completion, Customer acknowledges the following:

a. The work set forth in the Performance Contract has been reviewed and determined by Customer to be fully complete.

b. Customer accepts the work as complete and hereby releases JCI's obligations under any performance and payment bonds posted for the project as of the date set forth below.

Dated , 20 .

| **CUSTOMER:** | **JOHNSON CONTROLS, INC.** |
|---|---|
| Signature:_____ | Signature:_____ |
| Printed Name:_____ | Printed Name:_____ |
| Title:_____ | Title:_____ |