A G R E E M E N T

THIS AGREEMENT (this "Agreement") is made between the **CITY AND COUNTY OF DENVER**, a municipal corporation of the State of Colorado (the "City") and Ameresco, Inc., a Delaware corporation, with its principal place of business located at 111 Speen Street, Suite 410, Framingham, MA 01701 (the "Contractor"), jointly "the parties".

The parties agree as follows:

1. COORDINATION AND LIAISON: The Contractor shall fully coordinate all work under this Agreement with the Executive Director of General Services, ("Executive Director") or, the Executive Director's authorized representative identified in sub-section 2.b.

2. WORK TO BE PERFORMED:

a. Work: Upon the Contractor's receipt of a "Notice To Proceed," substantially in the form included in **Exhibit A**, the Contractor shall furnish all labor, tools, supplies, equipment, materials and everything necessary for and required to do, perform and complete all of the work described in the Statement of Work included in **Exhibit A** (the "Work"), including installation of the energy conservation and facility improvement measures (the "ECMs") described therein. Contractor shall perform Work in a highly skilled manner consistent with the performance standards and technical requirements set forth in **Exhibit A**. The Contractor shall diligently prosecute the Work to completion using its best efforts, highly skilled work effort and attention. The Contractor shall be solely responsible for all means, methods and techniques of performance, protection of property and safety relating to the Work. The Contractor shall be responsible to the City for the acts and omissions of the Contractor's employees and any other persons performing any of the work or furnishing materials.

b. Oversight: The Executive Director is the City's representative responsible for authorizing and approving the work performed under this Agreement. The Executive Director hereby designates David Basich, Energy Manager as the Executive Director's authorized representative for the purpose of designating a project manager (the "Project Manager"), and administering, coordinating and initially approving the work performed and services provided by the Contractor. The Project Manager shall report to Dionne Williams, Director of Strategic Initiatives, and shall be responsible for the day-to-day administration, coordination and approval or acceptance of the Work, except for those approvals or acceptances identified herein as requiring Executive Director action. The Executive Director expressly

reserves the right to designate another authorized representative to perform on his/her behalf upon written notice to the Contractor.

c. **Cooperation and Coordination**: The Contractor shall make every reasonable effort to fully coordinate the Work with any City agency or any person or firm under contract with the City doing work which affects the Contractor's Work. The Contractor agrees to allow the City to review any of the procedures used by it in doing the Work under this Agreement and to make available for inspection all notes and other documents used in performing the Work.

d. **Inspection of the Work**: Persons who are employees of the City or who are under contract to the City will be assigned to inspect and test the Work. These persons may perform any tests and observe the Work to determine whether or not materials used, manufacturing and construction processes and methods applied, and equipment installed satisfy the requirements of the technical specifications, all other Agreement requirements, and the Contractor's warranties and guarantees. The Contractor shall permit these inspectors unlimited access to the Work and provide means of safe access to the Work. In addition, the Contractor shall provide whatever access and means of access are needed to off-site facilities used to store or manufacture materials and equipment to be incorporated into the Work and shall respond to any other reasonable request to further the inspector's ability to observe or complete any tests. Such inspections shall not relieve the Contractor of any of its quality control responsibilities or any other obligations under the Contract. All inspections and all tests conducted by the City are for the convenience and benefit of the City. These inspections and tests do not constitute acceptance of the materials or Work tested or inspected, and the City may reject or accept any Work or materials at any time prior to the inspections, whether or not previous inspections or tests were conducted by the inspector or a City representative.

e. **Warranties; Correction of Work**: The Contractor warrants that all parts, materials, components, equipment, systems and other items incorporated into the Work ("Items") shall be new, unless otherwise specified, and suitable for the purpose used, and will be of good quality, free from faults and defects, and in keeping with common industry standards and that said Items shall be properly installed or incorporated into the Work in accordance with manufacturer's specifications and standard practices for said Items, and all of this shall be in conformance with the specifications and requirements of this Agreement. The Contractor's

warranty shall be effective for a one-year period following the Substantial Completion (as defined in sub-section 2.g) of the final ECM, and shall be extended, with respect to any specific Item repaired or replaced or for which other corrective action was required under the warranty during such one-year period, for one year following any such repair, replacement or other corrective action. Any manufacturers' warranties which exceed this one-year period shall be assigned to the City to the extent allowed by the manufacturer. The Contractor, when requested in connection with any warranty work, shall furnish the Project Manager with satisfactory evidence of the kind and quality of Items proposed to be incorporated into the Work. At any time during such one-year warranty period, the Contractor shall, at no cost to the City, promptly investigate, repair, replace, or otherwise correct any of its workmanship and/or Items in the Work which contain fault(s) or defect(s), whether such failure(s) are observed by the City or the Contractor, and promptly repair, replace, or otherwise correct any damage to any personal or real property owned by the City or another person resulting from said fault(s) or defect(s) or from the repair, replacement, or correction of the fault(s) or defect(s).

f. **Title**: The Contractor warrants that it has full title to all Items, that its transfer of such title to the City is rightful and free and clear from all security interests, liens, claims, or encumbrances whatsoever, and that the Contractor will defend such title against all persons claiming the whole or part of any Item, at no cost to the City.

g. **Completion; Deficiency; Acceptance**: Upon Substantial Completion (as defined below) of each ECM in each facility is identified on **Exhibit A**, the Contractor shall promptly send a Substantial Completion Certificate in the form included in **Exhibit A** to notify the Project Manager as to the completion of the Work with respect to such ECM at such facility so that inspection of such Work may be made by the City. If the Work performed is determined by the City to be defective, deficient or incomplete, the Contractor shall correct or complete the Work, at no additional cost to the City, within the timeframe specified in a notice of deficiency issued by the Executive Director, and promptly notify the Executive Director upon correction or completion of the Work. Upon Substantial Completion and acceptance of the final ECM at all facilities, the City shall sign a Delivery and Acceptance Certificate in the form included in **Exhibit A**. As used in this Agreement, "Substantial Completion" means that each subject ECM has been installed by the Contractor and, if such ECM is equipment, such equipment is then operating in a manner such that the City is deriving beneficial use thereof.

h. **Subcontracting**: Except as approved by the Executive Director in advance and in writing, the Contractor shall not subcontract with another contractor to perform the Work. The Contractor is prohibited from hiring any subcontractor currently debarred by the City in accordance with section 20-77 of the Denver Revised Municipal Code.

i. **Standards of Comfort**: Contractor's performance of the Project shall maintain and provide the standards of heating, cooling, ventilation, hot water supply, and lighting quality as described in **Exhibit C (section titled Standards of Comfort)**.

j. **Training**: Contractor shall provide a total of up to forty (40) hours of training to the City and to City personnel regarding operation of all new equipment installed hereunder. Contractor shall provide training per equipment manufacturer specifications and recommendations to the City personnel regarding operation of all new equipment. Training shall be conducted during the installation of the energy-saving equipment and building modification phase and shall include, but not be limited to, any HVAC equipment installed, controls, utilities, lighting, safety, manufacturer's warranties, and operation and maintenance manuals. Training involving start up of equipment shall be conducted with manufacturer representatives and Contractor. All other training activities shall be conducted by Contractor personnel unless otherwise previously approved by the City and Contractor. Location of training activities shall be at agreed upon locations, subject to the approval of the City, and such locations shall be pertinent to the type of training. Contractor shall provide sign-up sheets and agendas for each session. All training performed by Contractor shall meet the standards established by the equipment manufacturers.

k. **Application for Certification**: Contractor shall organize information necessary for City to submit applications of certification to the United States Environmental Protection Agency (EPA) Energy Star Program, the U.S. Green Building Council (GBC) LEED Program, or other certification program as determined by the City in the City's sole discretion if said programs are applicable and possible based on existing conditions of each facility.

l. **Contractor Access**: The City shall provide access to the facilities for Contractor to perform any function related to this Agreement during regular business hours, or such other reasonable hours requested by Contractor that are acceptable to the City. Contractor shall be granted immediate access to make emergency repairs or corrections as Contractor determines are needed. Contractor shall provide a written memorialization within three business

days of the access specifying the emergency action taken, the reasons therefore, and the impact on the facilities.

3. METHODS OF WORK:

a. Resources, Personnel, and Time Commitment: The Work shall be promptly commenced and actively prosecuted with the optimum complement of workers and equipment in order to complete the Work in an effective and expeditious manner. The Contractor shall furnish all labor, tools, supplies, equipment, materials and everything necessary for and required to perform and complete the Work. The Work shall be undertaken by workers skilled, proficient, and experienced in the trades required by this Agreement and shall be performed in an orderly and responsible manner in accordance with recognized standards and the plans and specifications contained in this Agreement or provided to the Contractor by the City. If the City reasonably believes that the Work is not proceeding satisfactorily or timely because the Contractor has not utilized an adequate number of qualified and skilled personnel or workers or provided sufficient tools, supplies, equipment, or materials, then the City may require the Contractor, at no additional cost to the City, to utilize additional qualified and skilled personnel or workers or provide additional tools, supplies, equipment, or materials to perform the Work in a manner reasonably acceptable to the City.

b. Permits and Licenses: Any tasks specified under this Agreement that require the employment of licensed or registered personnel shall be performed by licensed or registered personnel. The Contractor shall obtain, at its own expense, and maintain all permits or licenses, including any prescribed governmental authorizations or approvals, required for the performance of the Work and shall demonstrate, if requested, what actions the Contractor has taken to comply with the required permits, licenses, authorizations or approvals. The City shall cooperate as reasonably necessary with Contractor to obtain such permit, license or authorization.

c. Work Site Conditions: Work sites and nearby locations shall be kept clean and neat. Equipment, vehicles, and materials no longer needed at the site shall be promptly removed from the site, and any such items lawfully stored for use on the site shall be so placed and secured as to protect the public health and safety. All scraps, debris, trash, excess soil, and other waste materials generated by the Contractor's Work hereunder shall be regularly removed

and properly disposed of. Disposal in solid waste containers provided by the City is prohibited unless written authorization is obtained.

d. Protection of Property: The Contractor shall assume full responsibility and expense for the protection of all public and private property, including but not limited to structures, street improvements, pathways, irrigation systems, landscaping, water lines, sewers, and other utilities, both above and below ground, at or near the site or sites of the Work or at any other location affected by the prosecution of the Work or the transportation or utilization of workers, equipment, or materials in connection with the Work. The Contractor shall provide, in a timely manner and in advance, written notice to: 1) the City department having charge of any property, right of way, or utility affected by the Work; 2) any utility having charge of any utility affected by the Work; and 3) any private property owner whose property or improvements will be affected by the Work, and shall make all necessary arrangements with such City department, utility, or private property owner for the removal and replacement or the protection of such property. The Contractor shall arrange and obtain any utility locations required by law or necessary to protect utilities or underground facilities on public or private property and shall be liable for any failure to obtain or comply with such utility locations. To the extent that any permit or license is required by a City department or other governmental entity for any work on public property, said permit or license shall be obtained and paid for by the Contractor in advance of performing the Work and shall be complied with in the performance of the Work. If the Contractor or its employees, agents, or subcontractors destroy or damage any property, public or private, the Contractor shall promptly repair or replace such property, to the reasonable satisfaction of the Department, before the City will accept or pay for the Work performed with respect to the applicable ECM at the applicable facility. If the Contractor fails to make such repairs or replacement, the Executive Director may, at the Executive Director's discretion, undertake such repair or replacement and deduct the cost of the same from amounts payable to the Contractor under this Agreement.

e. Safety: The Contractor is responsible for the health and safety of every person on or at the Work site and shall take all necessary and appropriate precautions and actions to protect such persons from injury, death or loss. The Contractor shall be responsible for being fully familiar with and complying with all applicable City, state and federal laws, ordinances, rules and regulations, requirements and guidelines, including the Occupational Safety and Health Act and any regulations or directives adopted thereunder ("Safety Laws"). The Contractor shall

promptly notify the City in writing of any violations of said Safety Laws, along with copies of any injury reports, and any citations, orders, or warnings issued by governmental agencies in the enforcement of said Safety Laws. The Contractor shall provide and properly locate all necessary protective devices and safety precautions, including warning signs, barricades, or other devices or precautions as required by Safety Laws or the City. For all operations requiring the placement and movement of equipment or materials, the Contractor shall observe and exercise, and shall direct its employees or agents to observe and exercise, all appropriate and prudent caution so as to avoid injury to persons or damage to property and to minimize annoyance to or undue interference with the movement of the public and the performance of City functions. All ladders, scaffolding, or other devices used to reach objects not otherwise accessible, shall be of sound construction, firm and stable and shall be maintained in good, operable condition. All such equipment shall be moved, placed, shifted, and removed from work areas in such a manner as to provide maximum safety to persons and property and cause the least possible interference with the normal usage of such areas by the public and City personnel.

f. Disposal of Non-Hazardous Waste at DADS: In accordance with the Landfill Agreement made between the City and Waste Management of Colorado, Inc., the Contractor will be required to haul dedicated loads (non-hazardous entire loads of waste) to the Denver-Arapahoe Disposal Site ("DADS") for disposal. DADS is located at Highway 30 and Hampden Avenue in Arapahoe County, Colorado. Non-hazardous waste is defined as those substances and materials not defined or classified as hazardous by the Colorado Hazardous Waste Commission pursuant to C.R.S. §25-15-207, as amended from time to time, and includes construction debris, soil and asbestos.

g. Waiver of Part 8 of Article 20 of Title 13, Colorado Revised Statutes: The Contractor specifically waives all the provisions of Part 8 of Article 20 of Title 13, Colorado Revised Statutes regarding defects in the Work under this Agreement.

h. Liens and Other Encumbrances: The Contractor shall not permit any mechanic's or materialman's liens or any other liens to be imposed and remain for more than ninety (90) days upon any City-owned property, or any part thereof, by reason of any worker labor performed or materials or equipment furnished by any person or legal entity to or on behalf of the Contractor, either pursuant to C.R.S. § 38-26-107 or by any other authority. The Contractor shall promptly pay when due all bills, debts and obligations incurred in connection

with this Agreement and shall not permit the same to become delinquent. The Contractor shall not permit any lien, mortgage, judgment, execution or adjudication of bankruptcy which will in any way impair the rights of the City under this Agreement. The Contractor will indemnify and save harmless the City for the extent of any and all payments, interests, and penalties resulting from failure to comply with this section. The Contractor's obligations set out in this section shall survive the termination of this Agreement.

i. Environmental Compliance: The Contractor shall obtain all necessary federal, state, and local environmental permits and comply with all applicable federal, state, and local environmental permit requirements relating to the Work. The Contractor shall comply with all applicable local, state, and federal environmental guidelines, rules, regulations, statutes, laws, and orders (collectively, "Environmental Requirements"), including but not limited to Environmental Requirements regarding the storage, use, transportation, and disposal of Hazardous Materials and regarding releases or threatened releases of Hazardous Materials to the environment. The term "Hazardous Materials" shall mean asbestos and asbestos-containing materials, special wastes, polychlorinated biphenyls (PCBs), any petroleum products, natural gas, radioactive source material, pesticides, any hazardous waste as defined at 42 U.S.C. § 6903(5) of the Solid Waste Disposal Act, any hazardous substance as defined at 42 U.S.C. § 9601(14) of the Comprehensive Environmental Response, Compensation and Liability Act, and chemical substance as defined at 15 U.S.C.§ 2602(2) of the Toxic Substances Control Act, and any guidelines issued and rules or regulations promulgated pursuant to such statutes or any other applicable federal or state statute.

j. Attorney's Fees: Colorado Revised Statute 38-26-107 requires that in the event any person or company files a verified statement of amounts due and unpaid in connection with a claim for labor and materials supplied on this project the City shall withhold from payments to the Contractor sufficient funds to insure the payment of any such claims. Should the City and County of Denver be made a party to any lawsuit to enforce such unpaid claims or any lawsuit arising out of or relating to such withheld funds, the Contractor agrees to pay to the City its costs and reasonable attorney's fee which cost shall be included as a Cost of the Work. Because the City Attorney Staff does not bill the City for legal services on an hourly basis, the Contractor agrees a reasonable fee shall be computed at the rate of one hundred dollars per hour of City Attorney time.

4. MEASUREMENT AND VERIFICATION SERVICES:

a. Performance of Measurement and Verification Services: Contractor shall provide measurement and verification services pursuant to **Exhibit C** and **Exhibit D** during the M&V Term (as defined in sub-section 4.b). Contractor agrees that **Exhibit D** shall follow and use as a standard the procedures and protocol for measurement and verification located in the document *Measurement and Verification (M&V) Guidelines for Energy Saving Performance Contracts in State of Colorado Facilities*. For each twelve (12) month period during the M&V Term, Contractor will submit to Customer a measurement and verification report (the "M&V Report"), which shall include a guarantee reconciliation (the "Guarantee Reconciliation") upon the later of (i) ninety (90) days after the end of each Guarantee Year and (ii) sixty (60) days after Contractor receives or obtains all utility billing and other energy usage data necessary for Contractor's completion of the Guarantee Reconciliation. The Guarantee Reconciliation will set forth the calculation of the annual savings achieved in relation to the Guaranteed Savings Amount for the period being reconciled.

b. Measurement and Verification Term: Contractor shall begin providing the measurement and verification services on the first day of the month following the date of the Delivery and Acceptance Certificate provided for in sub-section 2.g (the "M&V Commencement Date") and continue for a term of three years, unless extended or earlier terminated as provided for below (as so extended or earlier terminated, the "M&V Term"). By written notice to Contractor provided no later than ninety (90) days prior to an anniversary of the M&V Commencement Date, the City, in its sole discretion, may elect to discontinue the measurement and verification services, provided however, the Guaranteed Savings Amount (as defined in section 5 below) will be deemed achieved for the balance of the period identified in Table 4 of the Technical Energy Audit, attached hereto as **Exhibit D** (the "Guarantee Period"), and no further measurement and verification services will be performed. The Guaranteed Savings Amount will be deemed achieved for each year for which measurement and verification services are not required to be performed. Upon written notice to Contractor, given at least ninety (90) days prior to any of the third through fourteenth anniversaries of the M&V Commencement Date, Contractor will continue the measurement and verification services, provided however, such notice may be given only for consecutive years. In the event of early termination of this Agreement or of the measurement and verification services, unless termination is effective on an

anniversary of the M&V Commencement Date, no annual M&V Report as described in sub-section 4.a above will be produced for the twelve (12)-month guarantee year then in effect, and the Guaranteed Savings Amount shall be deemed achieved for such guarantee year then in effect and for the balance of the Guarantee Period. Upon termination of the M&V Term, the City shall have no further liability or responsibility for any further payment to Contractor for such services.

c. Measurement and Verification Fee: The City shall pay to Contractor for performance of the measurement and verification services the fee set forth at page 112 of **Exhibit D**. The fee for periods after the third anniversary of the M&V Commencement date shall escalate at the rate of 3.5% per year for each consecutive year until the measurement and verification services terminate.

d. Measurement and Verification Information Procedure: Monitoring and verification of energy savings shall be calculated as outlined in **Exhibit D**.

e. Independent Monitor: The City, at its sole expense, may hire an independent third party monitor to review Contractor's monitoring and verification reports, including verifying the prorated share of the Guarantee in any event of contract termination. The City shall pay the cost of any independent monitoring to any independent third-party monitor through a separate contract.

f. Monitoring Equipment: Contractor shall provide all equipment required to perform the measurement and verification services.

5. GUARANTEE:

a. Guaranteed Savings: The guaranteed savings shall be in the amounts specified in row 5 of Table 4 of the Technical Energy Audit, attached hereto as **Exhibit D ("Guaranteed Savings Amount")**. Contractor hereby warrants and guarantees that during the M&V Term the installation and operation of the ECMs shall result in annual and aggregate savings equal to or greater than the Guaranteed Savings Amount.

b. Payment: In addition to any other remedies provided for herein, within 60 days of each 12 month anniversary of the M&V Commencement Date, Contractor shall pay to the City the amount by which the actual savings amount for such year is less than the Guaranteed Savings Amount for such year, if any, calculated as set forth at **Exhibit D**. Interest shall accrue on amounts not in dispute and rightfully owed for past due balance, owed to the City hereunder at the rate of one percent per month or the maximum rate permitted by law, whichever is higher.

c. **Sufficiency of Savings**: Contractor hereby warrants, guarantees, and represents that the savings calculated under sub-section 5.a shall be as a result of Contractor's Work, and shall be sufficient to meet or exceed payments due to Contractor for Contractor's completion of the Work.

d. Effect of Termination: If this Agreement is terminated by the City for any reason, the guarantee shall be cancelled and Contractor shall have no further obligations hereunder, except to guarantee the City the prorated portion of the annual amount of guarantee up to the date of termination. The prorated portion shall include any savings incurred prior to the termination date.

e. Energy Usage Records and Data: The City shall furnish, or authorize its energy suppliers to furnish, to Contractor or its designee upon Contractor's written request, all available records and data regarding energy and water usage and related maintenance at the facilities no later than 45 days from date of request. Further, the City shall make available to Contractor, on an ongoing basis for the Term of this Agreement, remote access to the monitoring system or the City's network server for purposes of collecting such data as authorized by the City's Technology Services Department.

6. MODIFICATION, UPGRADE OR ALTERATIONS OF EQUIPMENT:

a. Modification of Equipment: Without Contractor's prior written approval, which shall not be unreasonably withheld, during the Term, the City shall not affix or install any accessory equipment or device on any of the equipment installed hereunder (the "Equipment") if such addition changes or impairs the originally intended functions, value or use of such equipment.

b. Upgrade or Alteration of Equipment: During the performance of this Agreement, Contractor may, subject to the City's prior written approval, change the Equipment, revise any procedures for the operation of the Equipment or implement other energy saving actions in the facilities, provided that: (i) Contractor complies with the Standards of Comfort, as set forth in **Exhibit C**; (ii) such modifications or additions to, or replacement of the Equipment, and any operational changes, or new procedures enable Contractor to achieve a greater amount of energy and cost savings than the Guaranteed Savings Amount, at the facilities; (iii) any cost incurred relative to such modifications, additions or replacement of the Equipment, or operational changes or new procedures are solely borne by Contractor; and (iv) any such action

complies with all laws and is in the public interest of the City, in the City's sole discretion. Any such upgrade or alteration shall not result in any additional cost to the City.

7. MALFUNCTIONS AND EMERGENCIES:

a. The City will use its best efforts to notify Contractor within 24 hours of the City's actual knowledge and occurrence of: (i) any malfunction in the operation of the Equipment or any preexisting energy related equipment that might materially impact the Savings or Guarantee, (ii) any interruption or alteration to the energy supply to any facility, or (iii) any alteration or modification in any energy-related equipment or its operation. When the City exercises reasonable due diligence in attempting to assess the existence of a malfunction, interruption, or alteration it shall be deemed not at fault in failing to correctly identify any such conditions as having a material impact upon the savings or guarantee.

b. If such malfunction, interruption, or alteration occurs during the one-year equipment warranty period, Contractor shall use commercially reasonable efforts to respond to any such notice within twenty four hours of receipt of notice for emergency situations and a reasonable response time for non-emergencies, and shall promptly thereafter proceed with corrective measures. The City will provide Contractor with written memorialization of any telephone notice within three business days after the notice was given.

c. Contractor shall provide a written record of all service work performed for each malfunction or emergency. This record shall indicate the reason for the service, description of the problem and the corrective action performed.

d. The City may take reasonable steps to protect the Equipment if, due to an emergency, it is not possible or reasonable to notify Contractor before taking any such actions.

8. TERM: This Agreement will commence on the date executed by the City as indicated on the City's signature page and will expire at the end of the Guarantee Period, no later than sixteen (16) years from the date of execution as reflected on the City's signature page, unless earlier terminated in accordance with this Agreement.

9. COMPENSATION AND PAYMENT:

a. Budget. The City shall pay and the Contractor shall accept as the sole compensation for work performed and costs incurred under this Agreement the line item amounts set forth in the budget contained in **Exhibit B**. Amounts billed may not exceed the budget set forth in **Exhibit B**.

b. **Reimbursable Expenses**: There are no reimbursable expenses allowed under this Agreement. All of the Contractor's expenses are contained in the budget in **Exhibit B**.

c. **Invoicing; Conditions of Payment**: On or before the first day of each month and no more than five days prior thereto, Contractor may submit applications for payment for the Work performed during such month covering each ECM at each facility completed and accepted completed as of the date indicated as evidenced by one or more signed Delivery and Acceptance Certificates, and payments on account of such Work in the applicable amounts as provided for on **Exhibit B** within the timeframes specified in the City's prompt payment ordinance, D.R.M.C. §§ 20-107, *et seq*. If payments are made on account of materials not incorporated in the Work but delivered and suitably stored at the facilities, or at some other location agreed upon in writing, such payments shall be conditioned upon submission by Contractor of bills of sale or such other procedure as will establish the City's title to such material or otherwise adequately protect the City's interests, and shall provide proof of insurance whenever requested by the City and shall be subject to the right to inspect the materials at the request of the City. A properly issued and signed final receipt and lien waiver shall be a condition precedent to any obligation for the City to make final payment for Work performed by the Contractor. The request for payment submitted by the Contractor must fully document and itemize the Work rendered and all equipment, supplies, materials, labor, and other authorized and actually incurred costs. The request for payment shall affirmatively represent that: i) all of the Work specified for the particular facility has been fully performed and completed and any efficiency notice has been satisfied; ii) no claims, liens, or amounts owed to employees, suppliers, or materialmen are outstanding and all requirements and conditions of section 31 below have been fully complied with; iii) all rights, title and interests to the materials or improvements provided or installed as the result of the Work have transferred to the City; and iv) no interest or encumbrance of any kind associated with the Work will be asserted, has been acquired, or will be made by the Contractor or any other person or entity. If the request for payment does not contain these representations, the representations are hereby deemed to contain them. Along with the request for payment, the Contractor shall complete, arrange for the execution and notarization, and submit the final lien release(s) in substantially the same form as set forth in Table 4 of **Exhibit D.** The request for payment must be approved by the Executive Director in writing in order to be eligible for compensation under this Agreement. Any payment

may be reduced by any liquidated damages assessed by the Executive Director under sub-section 10.d.ii below.

d. Allocation of Energy Efficiency Rebates and Tax Benefits:

(i) The Contractor shall prepare applications, on behalf of the City, for all energy efficiency rebates for which the City qualifies as a result of the Work on the Project.

(ii) The Contractor shall disclose City in writing any tax benefits received by Contractor as a result of its Work on this Project. Such tax benefits, less the direct cost to Contractor for attaining such tax benefits ("net tax benefits"), shall be shared between Contractor and City as follows: fifty percent (50%) of the net tax benefits shall be paid to City and fifty percent (50%) of the net tax benefits shall be retained by Contractor. The Contractor shall in no event be obligated to pursue any such tax benefits.

e. Maximum Contract Amount:

(i) Notwithstanding any other provision of this Agreement, the City's maximum payment obligation will not exceed **ONE MILLION NINE HUNDRED NINETY-TWO THOUSAND SIX HUNDRED FORTY-ONE DOLLARS AND NO CENTS ($1,992,641.00)** (the "Maximum Contract Amount"). The City is not obligated to execute an Agreement or any amendments for any further work, including any work performed by Contractor beyond that specifically described in **Exhibit A**. Any work performed beyond that in **Exhibit A** is performed at Contractor's risk and without authorization under this Agreement.

(ii) The City's payment obligation, whether direct or contingent, extends only to funds appropriated annually by the Denver City Council, paid into the Treasury of the City, and encumbered for the purpose of this Agreement. The City does not by this Agreement irrevocably pledge present cash reserves for payment or performance in future fiscal years. This Agreement does not and is not intended to create a multiple-fiscal year direct or indirect debt or financial obligation of the City.

10. TERMINATION:

a. Termination for Convenience of the City. The Executive Director, upon giving twenty (20) calendar days written notice (unless a longer period is given), may terminate this Agreement, in whole or part, when it is in the best interest of the City as determined by the Executive Director. To the extent that the Contractor has initiated or completed Work for which the Contractor has not yet been compensated in accordance with this Agreement, appropriate

compensation for all such Work shall be paid to the Contractor in accordance with this Agreement.

b. Termination, With Cause, by the City. The occurrence of any one or more of the following shall constitute a breach of this Agreement ("Breach"), for which the Executive Director may terminate this Agreement, with cause, upon written notice to the Contractor, subject to the Contractor's opportunity to cure as provided for below:

(i) The Contractor fails or refuses after being notified, to expeditiously and actively undertake or substantially or timely perform its responsibilities and obligations or fails or refuses to make adequate progress in performing its responsibilities and obligations under this Agreement, including the due diligence obligations set forth in section 2 of this Agreement or the Work Methods under section 3 of this Agreement, provided that the failure or refusal to undertake, make good progress, or complete the Work is not due to matters beyond the Contractor's control such as weather disaster or persistent bad weather, floods, or other acts of God, civil unrest, acts of the public enemy, national calamity, or strike, boycott or labor dispute at a manufacturer, supplier or subcontractor for the Work;

(ii) There is substantial evidence that it has been or will be impossible for the Contractor to perform the Work required due to matters within the Contractor's control such as voluntary bankruptcy, strikes, boycotts, and labor disputes involving Contractor's employees or closure or suspension of operations by regulatory order of a governmental entity or an order of a court due to violations or infractions by the Contractor or Contractor's employees;

(iii) The Contractor has persistently or flagrantly failed to perform the Work or failed to timely perform the Work or to comply with the specifications and requirements as set forth in the Statement of Work in **Exhibit A** to this Contract;

(iv) The Contractor has submitted one or more requests for payment under this Agreement that are fraudulent or persistently or flagrantly erroneous or misleading;

(v) The Contractor has made an assignment or transfer of, or subcontracted, its responsibilities and obligations under this Agreement without obtaining the Executive Director's written consent or not in conformance with this Contract;

(vi) The Contractor fails to obtain, renew, replace, or maintain the insurance coverage required by this Agreement or causes or is at fault for damage to property or

injury to persons that is not covered or not adequately covered by insurance and the Contractor fails to remedy the situation to the satisfaction of the Executive Director;

(vii) The Contractor fails to obtain or properly and timely maintain any financial assurances required by this Contract;

(viii) Any lien is filed against City property because of any act or omission of the Contractor and is not timely discharged, unless the Contractor furnishes to the City such bond or other financial assurance reasonably acceptable to the Executive Director to protect the interests of the City;

(ix) The Contractor has failed to obtain or maintain any required permit or license or has utilized personnel or workers not licensed or registered as required by law;

(x) The Contractor has failed to deliver title or warranties or has failed to honor warranties as required by this Contract;

(xi) The Contractor fails, after being notified, to comply with, or fails to compel its subcontractors to comply with, the prevailing wage requirements or other City ordinances applicable to the type and nature of Work being performed under this Contract; or

(xii) The Contractor or any of its officers or employees are convicted, plead nolo contendere, enter into a formal contract in which they admit guilt, enter a plea of guilty, or otherwise admit culpability to criminal offenses of bribery, kickbacks, collusive bidding, bid-rigging, antitrust, fraud, undue influence, theft, racketeering, extortion or any offense of a similar nature, in connection with the Contractor's business.

In the event of a Breach of any of clauses (i), (v), (vi), (vii), (viii), (ix), (x) or (xi) above, notice of such shall be given in writing by the City to the Contractor. If such Breach is not cured within fifteen (15) days of receipt of written notice, or if a cure cannot be completed within such fifteen (15) days, or if cure of the breach has not begun within fifteen (15) days and pursued with due diligence, the City may terminate this Agreement or exercise any of the remedies set forth in sub-section 10.d below. Notwithstanding anything to the contrary herein, the City, in its sole discretion, need not provide advance notice or a cure period and may immediately terminate this Contract in whole or in part if reasonably necessary to preserve public safety or to prevent immediate public crisis.

c. Compensation. Upon termination of this Agreement by the City, with cause, under sub-section 10.b above, the Contractor shall be compensated for the Work that the Executive Director determines to have been satisfactorily completed, except that the City shall be entitled to keep any unpaid amount owing to the Contractor to the extent that said amount or some portion of said amount is needed to compensate the City for: 1) liquidated damages, if specified under sub-section 10.d.ii below; 2) the costs of releasing any liens or satisfying any claims related to the Contractor's Work; and 3) the costs of paying a new contractor for those services necessary to complete or rectify the Contractor's Work or to repair or replace any damaged or lost property caused by the Breach of this Agreement. The Contractor shall have no claim of any kind whatsoever against the City for any termination with cause, except for compensation for the Work satisfactorily performed as described herein.

d. Remedies.

(i) *Termination:* For any termination with cause of this Agreement, the City shall have the right to any or all of the following remedies through the courts or other means of legal recourse available to the City: a) cancellation of the Contract; b) actual damages or costs caused by Breach of the Contractor; and c) recovery of costs incurred by the City itself in paying for the release of liens related to the Contractor's Work or in completing or rectifying the Contractor's Work or in retaining and compensating another contractor to complete or rectify the Contractor's Work, to the extent not covered in sub-section 10.c. above. In any legal action brought by the Contractor, the Contractor shall not be entitled to recover any more than the full amount, not previously paid, of any Work Orders executed with and performed in whole or part by the Contractor. The City and the Contractor understand and agree that the rights of specific performance and to incidental, consequential, or punitive damages have been hereby expressly waived and released by both Parties.

(ii) *Liquidated Damages:* If the Executive Director determines, for a Breach of this Agreement under sub-section 10.b above, not to terminate this Agreement but to apply liquidated damages as provided in this paragraph, the Contractor shall be liable to the City for liquidated damages in the amount of one hundred dollars ($100.00) per day, calculated from the later of (A) with respect to Breaches for which the Contractor has no opportunity to cure as provided for in sub-section 10.b, the day that the Executive Director issues notice to the Contractor of such Breach under sub-section 10.b and (B) with respect to Breaches for which the

Contractor has an opportunity to cure as provided for in sub-section 10.b, fifteen (15) days after the day that the Executive Director issues notice to the Contractor of such Breach under sub-section 10.b, in either case, through the day before the Breach is remedied. The Contractor and City hereby acknowledges and agrees that it would be impractical and extremely difficult to estimate the damages which the City might incur for said breach, and that, in the interest of assuring that the Work is timely and properly performed, the liquidated damages provided herein is the most fair and reasonable way to compensate the City for any delay or inadequate performance without termination of this Agreement or litigation.

11. WHEN RIGHTS AND REMEDIES NOT WAIVED: In no event will any payment or other action by the City constitute or be construed to be a waiver by the City of any breach of covenant or default that may then exist on the part of the Contractor. No payment, other action, or inaction by the City when any breach or default exists will impair or prejudice any right or remedy available to it with respect to any breach or default. No assent, expressed or implied, to any breach of any term of this Agreement constitutes a waiver of any other breach. This section 11 shall not be construed as to limit or reduce the effectiveness of any waiver or assent expressly provided for in any certificate or other instrument or acknowledgement signed by the City and delivered to the Contractor hereunder.

12. INDEPENDENT CONTRACTOR: The Contractor is an independent contractor retained to perform work for limited periods of time. Neither the Contractor nor any of its employees are employees or officers of the City under Chapter 18 of the Denver Revised Municipal Code, or for any purpose whatsoever. The Contractor is responsible for the operational management, errors and omissions of the Contractor's employees, agents, and subcontractors. Without limiting the foregoing, the Contractor understands and acknowledges that the Contractor and the Contractor's employees, agents and subcontractors: a) are not entitled to workers' compensation benefits through the City; b) are not entitled to unemployment insurance benefits unless unemployment compensation coverage is provided by the Contractor or some other entity besides the City; and c) are obligated to pay federal and state taxes on any monies earned pursuant to this Agreement. Furthermore, it is understood and agreed that nothing in this Agreement is intended, or shall be construed, to constitute a joint venture between the Parties.

13. EXAMINATION OF RECORDS: Any authorized agent of the City, including the City Auditor or his or her representative, has the right to access and the right to examine any pertinent books, documents, papers and records of the Contractor, involving transactions related to this Agreement until the latter of three (3) years after the final payment under this Agreement or expiration of the applicable statute of limitations.

14. INSURANCE:

a. General Conditions: Contractor agrees to secure, at or before the time of execution of this Agreement, the following insurance covering all operations, goods or services provided pursuant to this Agreement. Contractor shall keep the required insurance coverage in force at all times during the term of this Agreement, or any extension thereof, during any warranty period, and for eight (8) years after termination of this Agreement. The required insurance shall be underwritten by an insurer licensed or authorized to do business in Colorado and rated by A.M. Best Company as "A-"VIII or better. Each policy shall contain a valid provision or endorsement requiring notification to the City in the event any of the above-described policies be canceled or non-renewed before the expiration date thereof. Such written notice shall be sent to the parties identified in the Notices section of this Agreement and shall reference the City contract number listed on the signature page of this Agreement. Said notice shall be sent thirty (30) days prior to such cancellation or non-renewal unless due to non-payment of premiums for which notice shall be sent ten (10) days prior. If such written notice is unavailable from the insurer, Contractor shall provide written notice of cancellation, non-renewal and any reduction in coverage to the parties identified in the Notices section by certified mail, return receipt requested within three (3) business days of such notice by its insurer(s) and referencing the City's contract number. If any policy is in excess of a deductible or self-insured retention, the City must be notified by the Contractor. Contractor shall be responsible for the payment of any deductible or self-insured retention. The insurance coverages specified in this Agreement are the minimum requirements, and these requirements do not lessen or limit the liability of the Contractor. The Contractor shall maintain, at its own expense, any additional kinds or amounts of insurance that it may deem necessary to cover its obligations and liabilities under this Agreement.

b. Proof of Insurance: Contractor shall provide a copy of this Agreement to its insurance agent or broker. Contractor may not commence services or work relating to this

Agreement prior to placement of coverages required under this Agreement. Contractor certifies that the certificate of insurance attached as **Exhibit E**, preferably an ACORD certificate, complies with all insurance requirements of this Agreement. The City requests that the City's contract number be referenced on the Certificate. The City's acceptance of a certificate of insurance or other proof of insurance that does not comply with all insurance requirements set forth in this Agreement shall not act as a waiver of Contractor's breach of this Agreement or of any of the City's rights or remedies under this Agreement. The City's Risk Management Office may require additional proof of insurance, including but not limited to policies and endorsements.

c. **Additional Insureds**: For Commercial General Liability and Auto Liability, Contractor and subcontractor's insurer(s) shall include the City and County of Denver, its elected and appointed officials, employees and volunteers as additional insured.

d. **Waiver of Subrogation**: For all coverages required under this Agreement, Contractor's insurer shall waive subrogation rights against the City.

e. **Subcontractors and Subconsultants**: All subcontractors and subconsultants (including independent contractors, suppliers or other entities providing goods or services required by this Agreement) shall be subject to all of the requirements herein and shall procure and maintain the same coverages required of the Contractor. Contractor shall include all such subcontractors as additional insured under its policies (with the exception of Workers' Compensation) or shall ensure that all such subcontractors and subconsultants maintain the required coverages. Contractor agrees to provide proof of insurance for all such subcontractors and subconsultants upon request by the City.

f. **Workers' Compensation/Employer's Liability Insurance**: Contractor shall maintain the coverage as required by statute for each work location and shall maintain Employer's Liability insurance with limits of $100,000 per occurrence for each bodily injury claim, $100,000 per occurrence for each bodily injury caused by disease claim, and $500,000 aggregate for all bodily injuries caused by disease claims. Contractor expressly represents to the City, as a material representation upon which the City is relying in entering into this Agreement, that none of the Contractor's officers or employees who may be eligible under any statute or law to reject Workers' Compensation Insurance shall effect such rejection during any part of the term

of this Agreement, and that any such rejections previously effected, have been revoked as of the date Contractor executes this Agreement.

g. **Commercial General Liability**: Contractor shall maintain a Commercial General Liability insurance policy with limits of $1,000,000 for each occurrence, $1,000,000 for each personal and advertising injury claim, $2,000,000 products and completed operations aggregate, and $2,000,000 policy aggregate.

h. **Business Automobile Liability**: Contractor shall maintain Business Automobile Liability with limits of $1,000,000 combined single limit applicable to all owned, hired and non-owned vehicles used in performing Work under this Agreement.

i. **Professional Liability (Errors & Omissions)**: Contractor shall maintain limits of $1,000,000 per claim and $1,000,000 policy aggregate limit. Policy shall include a severability of interest or separation of insured provision (no insured vs. insured exclusion).

j. **Additional Provisions**:

(i) For Commercial General Liability, the policy must provide the following:

(a) That this Agreement is an Insured Contract under the policy;

(b) Defense costs are outside the limits of liability;

(c) A severability of interests, separation of insureds provision (no insured vs. insured exclusion); and

(d) A provision that coverage is primary and non-contributory with other coverage or self-insurance maintained by the City.

(ii) For claims-made coverage:

(a) The retroactive date must be on or before the contract date or the first date when any goods or services were provided to the City, whichever is earlier.

(b) Contractor shall advise the City in the event any general aggregate or other aggregate limits are reduced below the required per occurrence limits. At their own expense, and where such general aggregate or other aggregate limits have been reduced below the required per occurrence limit, the Contractor will procure such per occurrence limits and furnish a new certificate of insurance showing such coverage is in force.

15. **DEFENSE AND INDEMNIFICATION**

a. To the fullest extent permitted by law, Contractor hereby agrees to defend, indemnify, reimburse and hold harmless the City, its appointed and elected officials, agents and employees for, from and against all liabilities, claims, judgments, suits or demands for damages arising out of, resulting from, or related to work performed or services provided under this Agreement to the extent and for an amount equal to the total percentage of negligence or fault, whichever is greater, attributable to Contractor and Contractor's agents, representatives, subcontractors and suppliers.

b. If Contractor is providing architectural, engineering, surveying or other design services the extent of Contractor's obligation to defend, indemnify and hold harmless will be determined after Contractor's liability or fault, whichever is greater, as well as the liability or fault of Contractor's agents, representatives, subcontractors and suppliers has been determined by adjudication, alternative dispute resolution or mutual agreement.

c. In all other cases, Contractor's duty to defend and indemnify City shall arise at the time written notice of a claim is provided to City regardless of whether suit has been filed and even if Contractor is not named as a Defendant.

d. Contractor's defense obligation includes all expenses incurred including, but not limited to, court costs and documented attorney fees incurred in defending and investigating claims or seeking to enforce this defense and indemnity obligation. Such payments on behalf of City shall be in addition to any other legal remedies available to City and shall not be considered City's exclusive remedy.

e. Insurance coverage requirements specified in this Agreement shall in no way lessen or limit the liability of the Contractor under the terms of this indemnification obligation. The Contractor shall obtain, at its own expense, any additional insurance that it deems necessary for the City's protection.

f. This defense and indemnification obligation shall survive the expiration or termination of this Agreement.

g. This defense and indemnification requirement does not require that Contractor defend, indemnify or hold the City harmless for the City's own negligence.

16. **FINANCIAL ASSURANCES**: The Contractor shall deliver to the City Payment and Performance Bonds in a sum equal to **ONE MILLION FIVE HUNDRED THOUSAND DOLLARS AND NO CENTS ($1,500,000.00)** conditioned upon faithful performance of this

Agreement by the Contractor, for the implementation of the ECM(s) as it may be from time to time modified by duly executed change orders. Bonds must be substantially in the form specified in **Exhibit F**, which is attached hereto and incorporated herein by reference. Notwithstanding any provision to the contrary herein, any payment and performance bonds associated with this Agreement guarantee only the performance of the installation portion of this Agreement, and shall not be construed to guarantee the performance of: (1) any efficiency or energy savings guarantees, (2) any support or maintenance service agreement, or (3) any other guarantees or warranties with terms beyond one (1) year in duration from the completion of the installation portion of this Agreement.

17. TAXES, CHARGES AND PENALTIES: The City is not liable for the payment of taxes, late charges or penalties of any nature, except for any additional amounts that the City may be required to pay under the City's prompt payment ordinance D.R.M.C. § 20-107, *et seq*. The Contractor shall promptly pay when due, all taxes, bills, debts and obligations it incurs performing the Work under this Agreement and shall not allow any lien, mortgage, judgment or execution to be filed against City property.

18. ASSIGNMENT; SUBCONTRACTING: The Contractor shall not voluntarily or involuntarily assign any of its rights or obligations, or subcontract performance obligations, under this Agreement without obtaining the Executive Director's prior written consent. Any assignment or subcontracting without such consent will be ineffective and void, and will be cause for termination of this Agreement by the City. The Executive Director has sole and absolute discretion whether to consent to any assignment or subcontracting, or to terminate this Agreement because of unauthorized assignment or subcontracting. In the event of any subcontracting or unauthorized assignment: (i) the Contractor shall remain responsible to the City; and (ii) no contractual relationship shall be created between the City and any sub-consultant, subcontractor or assign.

19. INUREMENT: The rights and obligations of the parties to this Agreement inure to the benefit of and shall be binding upon the parties and their respective successors and assigns, provided assignments are consented to in accordance with the terms of this Agreement.

20. NO THIRD PARTY BENEFICIARY: Enforcement of the terms of this Agreement and all rights of action relating to enforcement are strictly reserved to the parties. Nothing contained in this Agreement gives or allows any claim or right of action to any third

person or entity. Any person or entity other than the City or the Contractor receiving services or benefits pursuant to this Agreement is an incidental beneficiary only.

21. NO AUTHORITY TO BIND CITY TO CONTRACTS: The Contractor lacks any authority to bind the City on any contractual matters. Final approval of all contractual matters that purport to obligate the City must be executed by the City in accordance with the City's Charter and the Denver Revised Municipal Code.

22. SEVERABILITY: Except for the provisions of this Agreement requiring appropriation of funds and limiting the total amount payable by the City, if a court of competent jurisdiction finds any provision of this Agreement or any portion of it to be invalid, illegal, or unenforceable, the validity of the remaining portions or provisions will not be affected, if the intent of the parties can be fulfilled.

23. CONFLICT OF INTEREST:

a. No employee of the City shall have any personal or beneficial interest in the work or property described in this Agreement. The Contractor shall not hire, or contract for services with, any employee or officer of the City that would be in violation of the City's Code of Ethics, D.R.M.C. §2-51, et seq. or the Charter §§ 1.2.8, 1.2.9, and 1.2.12.

b. The Contractor shall not engage in any transaction, activity or conduct that would result in a conflict of interest under this Agreement. The Contractor represents that it has disclosed any and all current or potential conflicts of interest. A conflict of interest shall include transactions, activities or conduct that would affect the judgment, actions or work of the Contractor by placing the Contractor's own interests, or the interests of any party with whom the Contractor has a contractual arrangement, in conflict with those of the City. The City, in its sole discretion, will determine the existence of a conflict of interest and may terminate this Agreement if it determines a conflict exists, after it has given the Contractor written notice describing the conflict.

24. NOTICES: All notices required by the terms of this Agreement must be hand delivered, sent by overnight courier service, mailed by certified mail, return receipt requested, or mailed via United States mail, postage prepaid, if to Contractor at the address first above written, and if to the City at:

Executive Director of General Services or Designee
201 West Colfax Avenue, Dept. 1110
Denver, Colorado 80202

With a copy of any such notice to:

Denver City Attorney's Office
1437 Bannock St., Room 353
Denver, Colorado 80202

Notices hand delivered or sent by overnight courier are effective upon delivery. Notices sent by certified mail are effective upon receipt. Notices sent by mail are effective upon deposit with the U.S. Postal Service. The parties may designate substitute addresses where or persons to whom notices are to be mailed or delivered. However, these substitutions will not become effective until actual receipt of written notification.

25. NO EMPLOYMENT OF ILLEGAL ALIENS TO PERFORM WORK UNDER THE AGREEMENT:

a. This Agreement is subject to Division 5 of Article IV of Chapter 20 of the Denver Revised Municipal Code, and any amendments (the "Certification Ordinance").

b. The Contractor certifies that:

(1) At the time of its execution of this Agreement, it does not knowingly employ or contract with an illegal alien who will perform work under this Agreement.

(2) It will participate in the E-Verify Program, as defined in § 8-17.5-101(3.7), C.R.S., to confirm the employment eligibility of all employees who are newly hired for employment to perform work under this Agreement.

c. The Contractor also agrees and represents that:

(1) It shall not knowingly employ or contract with an illegal alien to perform work under this Agreement.

(2) It shall not enter into a contract with a subconsultant or subcontractor that fails to certify to the Contractor that it shall not knowingly employ or contract with an illegal alien to perform work under this Agreement.

(3) It has confirmed the employment eligibility of all employees who are newly hired for employment to perform work under this Agreement, through participation in either the E-Verify Program.

(4) It is prohibited from using either the E-Verify Program procedures to undertake pre-employment screening of job applicants while performing its obligations under this Agreement, and it is required to comply with any and all federal requirements related to use

of the E-Verify Program including, by way of example, all program requirements related to employee notification and preservation of employee rights.

(5) If it obtains actual knowledge that a subconsultant or subcontractor performing work under this Agreement knowingly employs or contracts with an illegal alien, it will notify such subconsultant or subcontractor and the City within three (3) days. The Contractor shall also terminate such subconsultant or subcontractor if within three (3) days after such notice the subconsultant or subcontractor does not stop employing or contracting with the illegal alien, unless during such three-day period the subconsultant or subcontractor provides information to establish that the subconsultant or subcontractor has not knowingly employed or contracted with an illegal alien.

(6) It will comply with any reasonable request made in the course of an investigation by the Colorado Department of Labor and Employment under authority of § 8-17.5-102(5), C.R.S., or the City Auditor, under authority of D.R.M.C. 20-90.3.

d. The Contractor is liable for any violations as provided in the Certification Ordinance. If Contractor violates any provision of this section or the Certification Ordinance, the City may terminate this Agreement for a breach of this Agreement. If this Agreement is so terminated, the Contractor shall be liable for actual and consequential damages to the City. Any such termination of a contract due to a violation of this section or the Certification Ordinance may also, at the discretion of the City, constitute grounds for disqualifying Contractor from submitting bids or proposals for future contracts with the City.

26. PREVAILING WAGES:

a. Contractor's employees and those of its subconsultants and subcontractors are subject to the payment of prevailing wages pursuant to § 20-76 et seq., D.R.M.C. By executing this Agreement, Contractor covenants and affirms that it is familiar with the prevailing wages provisions and is prepared to pay or cause to be paid prevailing wages for the affected services to be provided under this Agreement by Contractor or its subconsultants or subcontractors. The prevailing wages provisions are applicable to all contracts in excess of two thousand dollars ($2,000.00).

b. Contractor shall pay every covered worker, as defined in § 20-76(a) D.R.M.C., a living wage as provided in § 20-76, D.R.M.C. A copy of the applicable prevailing wage rate schedule is attached as **Exhibit G**.

c. In accordance with § 20-76(b) and (d), D.R.M.C., the following mandatory provisions are included:

(i) The minimum wages to be paid for every covered worker may not be less than the scale of wages from time to time determined under § 20-76(b) and (c) to be the prevailing wages.

(ii) Contractor or its subconsultant and subcontractor shall pay covered workers performing Services under this Agreement the full amounts accrued at time of payment, computed at wage rates not less than those stated or referenced in the Auditor's specifications, and any addenda thereto, on the actual date of proposal opening, regardless of any contractual relationship that may be alleged to exist between Contractor or subconsultant or subcontractor and the covered workers. Increases in prevailing wages subsequent to the date of this Agreement for a period not to exceed one (1) year is mandatory on either Contractor or subconsultants or subcontractors. Future increases in living wages on contracts whose period of performance exceeds one (1) year is mandatory for Contractor and subconsultants or subcontractors only on the yearly anniversary date of this Agreement. The City agrees to reimburse Contractor for mandatory increases in prevailing wages that occur on or after January 1, 2013. Decreases in prevailing wages subsequent to the date of this Agreement for a period not to exceed one (1) year are not permitted. Decreases in prevailing wages on contracts whose period of performance exceed one (1) year are not effective except on the yearly anniversary date of this Agreement.

(iii) Contractor and its subconsultants and subcontractors shall pay all covered workers at least once a week the full amounts of wages accrued at the time of payment, except that Contractor and subconsultant and subcontractor shall pay non-construction workers, such as janitorial or custodial workers performing services under this Agreement, at least twice per month.

(iv) Contractor shall post in a prominent and easily accessible place at the site of work the scale of wages to be paid by Contractor and all subconsultants and subcontractors working under Contractor.

(v) If Contractor or any subconsultant or subcontractor fails to pay wages required by this Agreement, no warrant or demand for payment to Contractor will be honored until Contractor furnishes the Auditor evidence satisfactory to the Auditor that the required wages by this Agreement have been paid.

(vi) Contractor shall furnish to the Auditor each week during which Services were performed or are in progress under this Agreement, a true and correct copy of the payroll records of all covered workers employed under this Agreement, either by Contractor or subconsultants or subcontractors. These payroll records must include, among other things, information showing the number of hours worked by each covered worker employed under this Agreement, the hourly pay of the covered workers, any deductions made from pay, and the net amount of pay received by each covered worker for the period covered by the payroll.

(vii) The copy of the payroll record must be accompanied by a sworn statement of Contractor that the copy is a true and correct copy of the payroll records of all covered workers working under this Agreement either for Contractor or subconsultants or subcontractors, that payments were made to them as set forth in the payroll records, that no deductions were made other than those set forth in the payroll records, and that all covered workers performing Services under this Agreement, either by Contractor or by any subconsultant or subcontractor, have been paid the prevailing wages as set forth in the Auditor's specifications.

(viii) If any covered worker employed by Contractor or any subconsultant or subcontractor under this Agreement has been or is being paid a rate of wages less than the rate of wages required by this Agreement, the City may, by written notice to Contractor, suspend or terminate Contractor's right to proceed with Services, or any part of the Services for which there has been a failure to pay the required wages, and in the event of termination may prosecute the Services to completion by contract or otherwise, and Contractor and any sureties will be liable to the City for any excess costs occasioned the City thereby.

27. DISPUTES: All disputes between the City and Contractor arising out of or regarding this Agreement will be resolved by administrative hearing pursuant to the procedure established by D.R.M.C. § 56-106(b)-(f). For the purposes of that administrative procedure, the City official rendering a final determination shall be the Executive Director as defined in this Agreement.

28. GOVERNING LAW; VENUE: This Agreement will be construed and enforced in accordance with applicable federal law, the laws of the State of Colorado, and the Charter, Revised Municipal Code, ordinances, regulations and Executive Orders of the City and County of Denver, which are expressly incorporated into this Agreement. Unless otherwise specified, any reference to statutes, laws, regulations, charter or code provisions, ordinances, executive

orders, or related memoranda, includes amendments or supplements to same. Venue for any legal action relating to this Agreement will be in the District Court of the State of Colorado, Second Judicial District (Denver District Court).

29. NO DISCRIMINATION IN EMPLOYMENT: In connection with the performance of work under this Agreement, the Contractor may not refuse to hire, discharge, promote or demote, or discriminate in matters of compensation against any person otherwise qualified, solely because of race, color, religion, national origin, gender, age, military status, sexual orientation, gender variance, marital status, or physical or mental disability. The Contractor shall insert the foregoing provision in all subcontracts.

30. COMPLIANCE WITH M/WBE REQUIREMENTS: This Agreement is subject to all applicable provisions of Divisions 1 and 3 of Article III, of Chapter 28, Denver Revised Municipal Code (D.R.M.C.), designated as Sections 28-31 to 28-36 and 28-117 to 28-158 D.R.M.C. and referred to in this Agreement as the "M/WBE Ordinance." Without limiting the general applicability of the foregoing, Contractor acknowledges its continuing duty, pursuant to Sections 28-132, 28-133, and 28-135 of the D.R.M.C., to maintain throughout the duration of this Agreement, compliance with the TEN PERCENT (10%) M/WBE participation commitment, upon which the City approved the award of this Agreement to Contractor and Contractor further acknowledges that failure to maintain the participation commitments or otherwise comply with the requirements of the M/WBE Ordinance will subject Contractor to sanctions in accordance with Section 28-135 of the D.R.M.C. Nothing contained in this provision or in the M/WBE Ordinance negates the City's right to prior approval of subconsultants and subcontractors, or substitutes therefore, under this Agreement.

31. COMPLIANCE WITH ALL LAWS: Contractor shall perform or cause to be performed all work in full compliance with all applicable laws, rules, regulations and codes of the United States, the State of Colorado; and with the Charter, ordinances, rules, regulations and Executive Orders of the City and County of Denver.

32. LEGAL AUTHORITY: Contractor represents and warrants that it possesses the legal authority, pursuant to any proper, appropriate and official motion, resolution or action passed or taken, to enter into this Agreement. Each person signing and executing this Agreement on behalf of Contractor represents and warrants that he has been fully authorized by Contractor to execute this Agreement on behalf of Contractor and to validly and legally bind Contractor to

all the terms, performances and provisions of this Agreement. The City shall have the right, in its sole discretion, to either temporarily suspend or permanently terminate this Agreement if there is a dispute as to the legal authority of either Contractor or the person signing this Agreement to enter into this Agreement.

33. NO CONSTRUCTION AGAINST DRAFTING PARTY: The parties and their respective counsel have had the opportunity to review this Agreement, and this Agreement will not be construed against any party merely because any provisions of this Agreement were prepared by a particular party.

34. CONTRACT DOCUMENTS; ORDER OF PRECEDENCE: This Agreement consists of paragraphs 1 through 42 which precede the signature page(s) ("Contract Text"), and the following exhibits and attachments which are incorporated herein and made a part hereof by reference:

Exhibit A	Statement of Work; Notice to Proceed; Substantial Completion Certificate; Delivery and Acceptance Certificate
Exhibit B	Schedule of Values
Exhibit C	Standards of Comfort; City's Maintenance Responsibilities; Baseline Adjustments
Exhibit D	Technical Energy Audit Report
Exhibit E	Insurance Certificate
Exhibit F	Surety
Exhibit G	Prevailing Wage Rate Schedules

In the event of an irreconcilable conflict (i) between a provision of the Contract Text and any of the listed exhibits or attachments or (ii) among provisions of any exhibits or attachments, such that it is impossible to give reasonable effect to all, the order of precedence to determine which document shall control to resolve such conflict, is as follows, in descending order:

Contract Text
Exhibit A
Exhibit B
Exhibit C
Exhibit D
Exhibit E
Exhibit F
Exhibit G

35. INTELLECTUAL PROPERTY RIGHTS: The City and Contractor intend that all property rights to any and all materials, text, logos, documents, booklets, manuals,

references, guides, brochures, advertisements, URLs, domain names, music, sketches, web pages, plans, drawings, prints, photographs, specifications, software, data, products, ideas, inventions, and any other work or recorded information created by the Contractor and paid for by the City pursuant to this Agreement, in preliminary or final form and on any media whatsoever (collectively, "Materials"), shall belong to the City. The Contractor shall disclose all such items to the City unless the Executive Director directs otherwise in writing. To the extent permitted by the U.S. Copyright Act, 17 USC § 101, *et seq*., the Materials are a "work made for hire" and all ownership of copyright in the Materials shall vest in the City at the time the Materials are created. To the extent that the Materials are not a "work made for hire," the Contractor (by this Agreement) sells, assigns and transfers all right, title and interest in and to the Materials to the City, including the right to secure copyright, patent, trademark, and other intellectual property rights throughout the world and to have and to hold such rights in perpetuity. The City shall not acquire an ownership interest in any of Contractor's intellectual property purchased, licensed or developed by Contractor prior to or outside of this Agreement or purchased, licensed or developed by Contractor or its Subcontractors as a tool for their use in performing the Work, plus any modifications or enhancements thereto and derivative works based thereon ("Contractor Intellectual Property"), or similar items of property which are or may be used in connection with the Work or the Equipment, except as provided herein. Contractor hereby grants to the City a perpetual, irrevocable, royalty-free license to use any and all Contractor Intellectual Property or similar proprietary rights associated with Contractor's Work or the Equipment which may be required to use, operate, or maintain the Work or the Equipment for its intended purpose. Such license shall continue subsequent to any termination of this Agreement.

36. <u>SURVIVAL OF CERTAIN PROVISIONS</u>: The terms of this Agreement and any exhibits and attachments that by reasonable implication contemplate continued performance, rights, or compliance beyond expiration or termination of this Agreement survive this Agreement and will continue to be enforceable. Without limiting the generality of this provision, the Contractor's obligations to provide insurance and to indemnify the City will survive for a period equal to any and all relevant statutes of limitation, plus the time necessary to fully resolve any claims, matters, or actions begun within that period.

37. <u>ADVERTISING AND PUBLIC DISCLOSURE</u>: The Contractor shall not include any reference to this Agreement or to work performed pursuant to this Agreement in any

of the Contractor's advertising or public relations materials without first obtaining the written approval of the Executive Director. Any oral presentation or written materials related to work performed under this Agreement will be limited to work that have been accepted by the City. The Contractor shall notify the Executive Director in advance of the date and time of any presentation. Nothing in this provision precludes the transmittal of any information to City officials.

38. CONFIDENTIAL INFORMATION:

a. City Information: Contractor acknowledges and accepts that, in performance of all work under the terms of this Agreement, Contractor may have access to Proprietary Data or confidential information that may be owned or controlled by the City, and that the disclosure of such Proprietary Data or information may be damaging to the City or third parties. Contractor agrees that all Proprietary Data, confidential information or any other data or information provided or otherwise disclosed by the City to Contractor shall be held in confidence and used only in the performance of its obligations under this Agreement. Contractor shall exercise the same standard of care to protect such Proprietary Data and information as a reasonably prudent contractor would to protect its own proprietary or confidential data. "Proprietary Data" shall mean any materials or information which may be designated or marked "Proprietary" or "Confidential", or which would not be documents subject to disclosure pursuant to the Colorado Open Records Act or City ordinance, and provided or made available to Contractor by the City. Such Proprietary Data may be in hardcopy, printed, digital or electronic format.

39. CITY EXECUTION OF AGREEMENT: This Agreement will not be effective or binding on the City until it has been fully executed by all required signatories of the City and County of Denver, and if required by Charter, approved by the City Council.

40. AGREEMENT AS COMPLETE INTEGRATION-AMENDMENTS: This Agreement is the complete integration of all understandings between the parties as to the subject matter of this Agreement. No prior, contemporaneous or subsequent addition, deletion, or other modification has any force or effect, unless embodied in this Agreement in writing. No oral representation by any officer or employee of the City at variance with the terms of this

Agreement or any written amendment to this Agreement will have any force or effect or bind the City.

41. **USE, POSSESSION OR SALE OF ALCOHOL OR DRUGS**: Contractor shall cooperate and comply with the provisions of Executive Order 94 and its Attachment A concerning the use, possession or sale of alcohol or drugs. Violation of these provisions or refusal to cooperate with implementation of the policy can result in contract personnel being barred from City facilities and from participating in City operations.

42. **ELECTRONIC SIGNATURES AND ELECTRONIC RECORDS**: Contractor consents to the use of electronic signatures by the City. This Agreement, and any other documents requiring a signature under this Agreement, may be signed electronically by the City in the manner specified by the City. The Parties agree not to deny the legal effect or enforceability of this Agreement solely because it is in electronic form or because an electronic record was used in its formation. The Parties agree not to object to the admissibility of this Agreement in the form of an electronic record, or a paper copy of an electronic document, or a paper copy of a document bearing an electronic signature, on the ground that it is an electronic record or electronic signature or that it is not in its original form or is not an original.

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Contract Control Number:

IN WITNESS WHEREOF, the parties have set their hands and affixed their seals at Denver, Colorado as of

SEAL

CITY AND COUNTY OF DENVER

ATTEST:

By_____

_____

APPROVED AS TO FORM:

REGISTERED AND COUNTERSIGNED:

By_____

By_____

By_____

Contract Control Number: GENRL-201522732-00

Contractor Name: AMERESCO INC

By: _____

Name: Louis P. Maltezos
(please print)

Title: Executive Vice President
(please print)

ATTEST: [if required]

By: _____

Name: _____
(please print)

Title: _____
(please print)

EXHIBIT A

STATEMENT OF WORK;
NOTICE TO PROCEED;
SUBSTANTIAL COMPLETION CERTIFICATE;
and DELIVERY AND ACCEPTANCE CERITIFICATE

Facility	**Improvement Measures**
Fire Station #1 (HQ)	(1) Interior Lighting Retrofit (a) Refer to Exhibit D, Attachment B for detailed room by room retrofits. (2) Exterior Lighting Retrofit (a) Refer to Exhibit D, Attachment B for detailed room by room retrofits. (3) Energy Management Control System Upgrade (a) Reprogram programmable thermostats to reset the space temperatures to set back during unoccupied periods. (4) Pipe & Equipment Insulation (a) Install approximately twenty LF of new 1" fiberglas insulation on domestic hot water, heating hot water, and chilled water pipe that is not insulated or where past leaks have saturated and deteriorated the existing insulation. (5) Building Envelope Measures (a) Seal seven overhead doors on three (3) sides. (b) Weather-strip and seal twelve exterior doors. (c) Seal four interior isolation doors for equipment bay. (6) Education Program & Live Energy Monitoring (a) With participation of CCD "First Responders"; develop and implement an energy conservation education system specific to First Responders. (b) Install *Building Dynamics* live energy monitoring system in the facility along with equipment to access utility metering interval data.
Fire Station #8	(1) Interior Lighting Retrofit (a) Refer to Exhibit D, Attachment B for detailed room by room retrofits. (2) Exterior Lighting Retrofit (a) Refer to Exhibit D, Attachment B for detailed room by room retrofits. (3) Energy Management Control System Upgrade (a) Hot deck, cold deck AHU: Convert to VAV system; implement heating and cooling equipment lockout, DCV and economizer. As part of conversion, a new DX system will be provided. (4) Pipe & Equipment Insulation (a) Install approximately thirty LF of new 1" fiberglas insulation on domestic hot water, heating hot water, and chilled water pipe that is not insulated or where past leaks have saturated and deteriorated the existing insulation. (5) Building Envelope Measures (a) Seal eight overhead doors on three (3) sides. (b) Weather-strip and seal five exterior doors. (c) Seal six interior isolation doors for equipment bay. (d) Insulate approximately 990 square feet of attic above conditioned space (not including equipment bay.) (6) Education Program & Live Energy Monitoring (a) With participation of CCD "First Responders"; develop and implement an energy conservation education system specific to First Responders. (b) Install *Building Dynamics* live energy monitoring system in the facility along with equipment to access utility metering interval data.

Fire Station #9	(1) Interior Lighting Retrofit (a) Refer to Exhibit D, Attachment B for detailed room by room retrofits. (2) Exterior Lighting Retrofit (a) Refer to Exhibit D, Attachment B for detailed room by room retrofits. (3) Education Program & Live Energy Monitoring (a) With participation of CCD "First Responders"; develop and implement an energy conservation education system specific to First Responders. (b) Install *Building Dynamics* live energy monitoring system in the facility along with equipment to access utility metering interval data.
Police District #1	(1) Interior Lighting Retrofit (a) Refer to Exhibit D, Attachment B for detailed room by room retrofits. (2) Exterior Lighting Retrofit (a) Refer to Exhibit D, Attachment B for detailed room by room retrofits. (3) Energy Management Control System Upgrade (a) For RTUs 1-4: Recommission existing controls, add DCV, and reset the duct pressure using critical zone reset. For the second floor - equipment scheduling will be implemented. (4) Pipe & Equipment Insulation (a) Install approximately 4 LF of new 1" fiberglas insulation on domestic hot water, heating hot water and chilled water pipe that is not insulated or where past leaks have saturated and deteriorated the existing insulation. (b) Install approximately 20 LF of new 2" fiberglas insulation on domestic hot water, heating hot water and chilled water pipe that is not insulated or where past leaks have saturated and deteriorated the existing insulation. (c) Install pipe insulation blankets on two (2) hot water pumps. (d) Install pipe insulation blankets on two (2) chilled water pumps. (e) Install pipe insulation blankets on hot water pump flex couplings, balance valves, and suction fitting (5) Vending Machine Controls (a) Install one (1) vending machine power saver control for machines in the recreation room. (6) Transport Gas (a) Facilitate conversion to transport gas using existing umbrella contract with CenterPoint Energy, Inc. and Internal Technical Services. (7) Education Program & Live Energy Monitoring (a) With participation of CCD "First Responders"; develop and implement an energy conservation education system specific to First Responders. (b) Install *Building Dynamics* live energy monitoring system in the facility along with equipment to access utility metering interval data.
911 Call Center	(1) Interior Lighting Retrofit (a) Refer to Exhibit D, Attachment B for detailed room by room retrofits. (2) Exterior Lighting Retrofit (a) Refer to Exhibit D, Attachment B for detailed room by room retrofits. (3) Lighting Controls (a) Install lighting occupancy sensors. (4) Energy Management Control System Upgrade (a) For RTUs 1 - 2: Install four (4) new CO2 Sensors in the Dispatch Room 202 and one (1) new CO2 sensor on the roof. (b) Recommission existing controls, add DCV, and reset the duct pressure during unoccupied time. (c) First floor: Equipment scheduling with setbacks will be implemented. (5) Pipe & Equipment Insulation (a) Install approximately 30 LF of new 2" fiberglas insulation on domestic hot water, heating hot water and chilled water pipe that is not insulated or where the existing insulation is damaged. (b) Install pipe insulation blanket on heating hot water air separator (c) Install pipe insulation blankets on two (2) hot water pumps (d) Install pipe insulation blankets on hot water pump flex couplings, balance valves, and suction fitting (6) Building Envelope Measures (a) Weather-strip and seal six exterior doors. (b) Seal six glass block windows in lower level bathrooms.

	(7) Transport Gas (a) Facilitate conversion to transport gas using existing umbrella contract with CenterPoint Energy, Inc. and Internal Technical Services. (8) Education Program & Live Energy Monitoring (a) With participation of CCD "First Responders"; develop and implement an energy conservation education system specific to First Responders. (b) Install *Building Dynamics* live energy monitoring system in the facility along with equipment to access utility metering interval data.
Ashland Pool	(1) Interior Lighting Retrofit (a) Refer to Exhibit D, Attachment B for detailed room by room retrofits. (2) Exterior Lighting Retrofit (a) Refer to Exhibit D, Attachment B for detailed room by room retrofits. (3) Lighting Controls (a) Install lighting occupancy sensors. (4) Pump Improvements (a) Install one (1) variable frequency drive (VFD) on the leisure pool pump. (b) Install one (1) variable frequency drive (VFD) on the lap pool pump. (5) Vending Machine Controls (a) Install one (1) vending machine power saver control for the machine in the lobby. (6) Pool Covers (a) Install new pool cover system on the lap pool. System includes cover, mounting hardware, motor, cables and electrical controller. (7) Building Envelope Measures (a) Weather-strip and seal eleven exterior doors. (b) Seal four interior isolation doors for natatorium. (8) Transport Gas (a) Facilitate conversion to transport gas using existing umbrella contract with CenterPoint Energy, Inc. and Internal Technical Services. (9) Education Program & Live Energy Monitoring (a) With participation of CCD Parks and Recreation staff; develop and implement an energy conservation education system specific to recreation facilities. (b) Install *Building Dynamics* live energy monitoring system in the facility along with equipment to access utility metering interval data.
Ashland Recreation Center	(1) Interior Lighting Retrofit (a) Refer to Exhibit D, Attachment B for detailed room by room retrofits. (2) Exterior Lighting Retrofit (a) Refer to Exhibit D, Attachment B for detailed room by room retrofits. (3) Vending Machine Controls (a) Install two (2) vending machine power saver controls for machines in the recreation room. (4) Building Envelope Measures (a) Weather-strip and seal nine exterior doors. (b) Seal approximately 90 linear feet of interior roof wall joint. (5) Education Program & Live Energy Monitoring (a) With participation of CCD Parks and Recreation staff; develop and implement an energy conservation education system specific to recreation facilities. (b) Install *Building Dynamics* live energy monitoring system in the facility along with equipment to access utility metering interval data.
Glenarm Recreation Center	(1) Interior Lighting Retrofit (a) Refer to Exhibit D, Attachment B for detailed room by room retrofits. (2) Exterior Lighting Retrofit (a) Refer to Exhibit D, Attachment B for detailed room by room retrofits. (3) Lighting Controls (a) Install lighting occupancy sensors. (4) Pump Improvements (a) Install one (1) variable frequency drive (VFD) on the lap pool pump (5) Pipe & Equipment Insulation

	(a) Insulate approximately 30 feet of existing domestic and/or heating hot water pipe in the mechanical rooms. (6) Vending Machine Controls (a) Install five (5) vending machine power saver controls for machines in the recreation room. (Includes soda and snack machines and video games.) (7) Pool Covers (a) Remove and replace existing pool cover system with new pool cover system. System includes cover, mounting hardware, motor, cables and electrical controller. (8) Building Envelope Measures (a) Weather-strip and seal six exterior doors. (b) Seal three interior isolation doors for natatorium. (9) Education Program & Live Energy Monitoring (a) With participation of CCD Parks and Recreation staff; develop and implement an energy conservation education system specific to recreation facilities. (b) Install *Building Dynamics* live energy monitoring system in the facility along with equipment to access utility metering interval data.
Scheitler Recreation Center	(1) Interior Lighting Retrofit (a) Refer to Exhibit D, Attachment B for detailed room by room retrofits. (2) Exterior Lighting Retrofit (a) Refer to Exhibit D, Attachment B for detailed room by room retrofits. (3) Pipe & Equipment Insulation (a) Insulate approximately 90 feet of existing domestic and/or heating hot water pipes in the mechanical rooms. (4) Building Envelope Measures (a) Weather-strip and seal twelve exterior doors. (b) Seal two interior isolation doors for natatorium. (5) Education Program & Live Energy Monitoring (a) With participation of CCD Parks and Recreation staff; develop and implement an energy conservation education system specific to recreation facilities. (b) Install *Building Dynamics* live energy monitoring system in the facility along with equipment to access utility metering interval data.
Twentieth Street Recreation Center	(1) Interior Lighting Retrofit (a) Refer to Exhibit D, Attachment B for detailed room by room retrofits. (2) Exterior Lighting Retrofit (a) Refer to Exhibit D, Attachment B for detailed room by room retrofits. (3) Energy Management Control System Upgrade (a) Install web-based Building Automation System (BAS). (4) Pump Improvements (a) Install one (1) variable frequency drive (VFD) on the lap pool pump (5) Vending Machine Controls (a) Install one (1) vending / arcade power saving control for machines in the recreation room. (6) Building Envelope Measures (a) Weather-strip and seal seven exterior doors. (b) Seal two interior isolation doors for natatorium. (c) Seal one attic hatch. (d) Insulate approximately 8,400 square feet of attic above conditioned space. (7) Education Program & Live Energy Monitoring (a) With participation of CCD Parks and Recreation staff; develop and implement an energy conservation education system specific to recreation facilities. (b) Install *Building Dynamics* live energy monitoring system in the facility along with equipment to access utility metering interval data.
Barnum Library	(1) Interior Lighting Retrofit (a) Refer to Exhibit D, Attachment B for detailed room by room retrofits. (2) Exterior Lighting Retrofit (a) Refer to Exhibit D, Attachment B for detailed room by room retrofits. (3) Energy Management Control System Upgrade

	(a) RTU 1: Convert existing hot deck / cold deck system into VAV system. (4) Building Envelope Measures (a) Weather-strip and seal seven exterior doors. (5) Education Program & Live Energy Monitoring (a) With participation of CCD Library staff; develop and implement an energy conservation education system specific to library facilities. (b) Install *Building Dynamics* live energy monitoring system in the facility along with equipment to access utility metering interval data.
Bear Valley Library	(1) Interior Lighting Retrofit (a) Refer to Exhibit D, Attachment B for detailed room by room retrofits. (2) Exterior Lighting Retrofit (a) Refer to Exhibit D, Attachment B for detailed room by room retrofits. (3) Lighting Controls (a) Install lighting occupancy sensors. (4) Energy Management Control System Upgrade (a) RTU 1: Reset unoccupied set back temperatures and implement DCV. (5) Building Envelope Measures (a) Weather-strip and seal six exterior doors. (6) Education Program & Live Energy Monitoring (a) With participation of CCD Library staff; develop and implement an energy conservation education system specific to library facilities. (b) Install *Building Dynamics* live energy monitoring system in the facility along with equipment to access utility metering interval data.
Eugene Field Library	(1) Interior Lighting Retrofit (a) Refer to Exhibit D, Attachment B for detailed room by room retrofits. (2) Exterior Lighting Retrofit (a) Refer to Exhibit D, Attachment B for detailed room by room retrofits. (3) Lighting Controls (a) Install lighting occupancy sensors. (4) Energy Management Control System Upgrade (a) RTU 1: Install web-based Building Automation System (BAS). (b) RTU 1: Convert existing hot deck, cold deck system into VAV system. (5) Building Envelope Measures (a) Weather-strip and seal five exterior doors. (6) Education Program & Live Energy Monitoring (a) With participation of CCD Library staff; develop and implement an energy conservation education system specific to library facilities. (b) Install *Building Dynamics* live energy monitoring system in the facility along with equipment to access utility metering interval data.
Schlessman Family Library	(1) Interior Lighting Retrofit (a) Refer to Exhibit D, Attachment B for detailed room by room retrofits. (2) Exterior Lighting Retrofit (a) Refer to Exhibit D, Attachment B for detailed room by room retrofits. (3) Lighting Controls (a) Install lighting occupancy sensors. (4) Building Envelope Measures (a) Weather-strip and seal seven exterior doors. (5) Energy Management Control System Upgrade (a) For AHU 1: Recommission the existing VAV system; implement DCV; reset economizer sequence. (6) Building Envelope Measures (a) Weather-strip and seal seven exterior doors. (7) Education Program & Live Energy Monitoring (a) With participation of CCD Library staff; develop and implement an energy conservation education system specific to library facilities. (b) Install *Building Dynamics* live energy monitoring system in the facility along with equipment to access utility metering interval data.

General Notes and Clarifications:

- This Exhibit sets forth a summary description of existing equipment and the Energy Conservation Measures (ECMs) and related equipment to be installed by Contractor at the buildings, facilities, and areas noted above. Installation of the ECMs and the included equipment is subject to change if Contractor discovers unforeseen conditions at the properties that render its preliminary analysis of the property inaccurate, or significantly affects achievement of the Guaranteed Savings. Any changes to the installation of the ECMs and the included equipment are subject to approval by the City, which approval shall not be unreasonably withheld, conditioned or delayed.

Lighting Scope Clarifications:

- The scope includes retrofit of the noted fixtures only and does not address or include any fix-up / upgrade / replacement of existing wiring, switching, conduits, hangers, etc. If items are found to be in need of repair or replacement – this is not included in the Scope of Services and associated costing. The Scope of Services does include replacement of existing broken lighting sockets when replacing bulbs.
- It is assumed that all emergency lighting is on generator or independent battery control. Replacements of emergency ballasts are not included in the project.
- Replacement or repair of fixture lenses or louvers are not included, fixture lenses will be wiped with a dry cloth.
- Contractor is not responsible for fixtures that are found to be damaged prior to commencement of its Scope of Services.
- All manufacturers' warranties (and related information) will be transferred to City at project close-out.
- With respect to the specific lighting scope - Contractor will remove and lawfully recycle / dispose of existing lamps and PCB ballasts. All ballasts that are determined to be non-PCB shall be disposed of with non-hazardous waste. Noted items will be carefully recycled and disposed of through a licensed recycling firm in accordance with all state and federal guidelines. Certificates verifying the proper disposal and recycling of PCB containing materials will be provided by the vendor.
- Lighting levels, if existing is identified to be over-lit per recommended standards, may be reduced.
- Contractor is not responsible for any pre-existing electrical code violations or electrical system deficiencies.

Plumbing Scope Clarifications:

- Labor to replace shut off valves or repair main water valves that do not close completely or that will not fully re-open is excluded. Contractor will require the assistance of maintenance staff, at no additional cost to Contractor, to shut off zone valves or operating water mains when existing shutoff valves do not function correctly.
- Labor to repair previously deteriorated plumbing not associated with the work defined in this scope is excluded.
- Upgrading bathrooms that are not ADA compliant to meet such standards is excluded.

General Scope of Services Comments:

- The parties do not anticipate a need to abate asbestos containing materials in performance of this Scope of Work. In the event that asbestos containing materials are encountered, Contractor will stop work on the effected ECM(s) and seek direction from the Project Manager regarding whether and how to proceed with respect to those ECMs. Any investigation and/or abatement of asbestos containing materials shall be addressed through a duly executed change order and performed under the supervision of the City's Department of Environmental Health.
- As final engineering is not started and equipment is not ordered until Contractor has a signed contract / notice to proceed - Contractor cannot guarantee delivery dates / system start-up and is not responsible for costs associated with additional mobilizations, temporary equipment, etc. if long lead times affect construction schedule.
- Material ordering and final scheduling will not occur until a signed agreement is received.
- Contractor pricing assumes 100% availability of rooms to do the work. Unless noted otherwise, pricing based on 1st shift only (Monday through Friday).
- Unless specifically noted in the Scope of Services – paint / patch is excluded. If noted in the Scope of Services – only the affected areas will be addressed (not the entire area / wall). Paint will match existing adjacent as close as possible but an exact match cannot be guaranteed.
- Piping / conduit / wire mold may be run exposed in occupied spaces (as applicable).
- Unless specifically noted in the Scope of Services – conduit / wire mold is un-painted.
- Some existing equipment may be left abandoned in place.
- Unless specifically noted in the Scope of Services – no piping covers have been included.
- If applicable - tile and carpet in-fill strips will match adjacent existing as close as possible but an exact match cannot be

guaranteed.

- If applicable - existing ceiling tiles will be removed and reinstalled. New ceiling / grid is not included in the Scope of Services unless specifically noted.

SAMPLE NOTICE TO PROCEED

MONTH DAY YEAR

Louis P. Maltezos
Executive Vice President
Contractor, Inc.
150 N. Michigan Avenue, Suite 420
Chicago, IL 60601

SUBJECT: NOTICE TO PROCEED

Mr. Maltezos:

In accordance with the terms of the Agreement dated [month day year] , City hereby issues this **Notice to Proceed** to Contractor in relation to the Scope of Services set forth in this Agreement.

Sincerely,

CITY

_____
Name:
Title:

SUBSTANTIAL COMPLETION CERTIFICATE

PROJECT NAME & ADDRESS:

PROJECT NO.: _
CONTRACT DATE: _
DESCRIPTION: __

The installation of [list each ECM being accepted with this certificate] under the Agreement has/have been reviewed and found to be substantially complete. The date of Substantial Completion of the forgoing ECM(s) is hereby established as:

SUBSTANTIAL COMPLETION DATE:

The date of Substantial Completion of an ECM is the date when such ECM is sufficiently complete in accordance with the Agreement so that City derives beneficial use thereof. City agrees that the Stipulated Savings associated with the ECMs listed have been satisfied for the term of the Guarantee Period.

The Substantial Completion date set forth above is the date of commencement of applicable warranties for such ECM(s), as required by the Agreement. A list of items to be completed or corrected is identified below as punch list items.

CONTRACTOR: Contractor, Inc., 111 Speen Street, Suite 410, Framingham, Massachusetts 01701

AUTHORIZED **DATE:** _

NAME:
(type or print)

CITY:

AUTHORIZED **DATE:** _

NAME:
(type or print)

PUNCHLIST ITEMS

Attach additional page(s) as necessary. Number of pages attached____.

DELIVERY AND ACCEPTANCE CERTIFICATE

PROJECT COMPLETION LOG

Sub-Project Tasks/Punch List items	Completion Date

Notes (special instructions etc.):

Items furnished to CITY with this Delivery and Acceptance Certificate:

- ☐ Receipt of owner's manuals; sets.
- ☐ Receipt of instruction and training; _____
- ☐ Completion of inspection and walk-through.
- ☐ Receipt of warranty information.

The punch list items are hereby completed in accordance with the Agreement. City agrees that the Stipulated Savings have been satisfied for the term of the Guarantee Period.

CITY	By:	Title:	Date:

EXHIBIT B

SCHEDULE OF VALUES

Description	Barnum Library	Bear Valley Library	Eugene Field Library	Schlessman Family Library	Ashland Pool	Ashland Rec	Glenarm Rec
Performance Bond							
Interior Lighting Retrofit	$ 39,623	$ 45,067	$ 33,839	$ 17,277	$ 28,253	$ 17,148	$ 28,371
Materials	$ 23,774	$ 27,040	$ 20,303	$ 10,366	$ 16,952	$ 10,289	$ 17,023
Labor	$ 15,849	$ 18,027	$ 13,536	$ 6,911	$ 11,301	$ 6,859	$ 11,348
Exterior Lighting Retrofit	$ 10,154	$ 3,556	$ 6,735	$ 10,181	$ 9,966	$ 10,048	$ 16,533
Materials	$ 6,093	$ 2,134	$ 4,041	$ 6,109	$ 5,979	$ 6,029	$ 9,920
Labor	$ 4,062	$ 1,422	$ 2,694	$ 4,072	$ 3,986	$ 4,019	$ 6,613
Lighting Controls		$ 788	$ 1,046	$ 2,037	$ 4,708		$ 3,759
Energy Management Control System Upgrades	$ 36,756	$ 6,378	$ 97,031	$ 6,556			
Materials	$ 11,027	$ 1,913	$ 29,109	$ 1,967			
Labor	$ 25,729	$ 4,464	$ 67,922	$ 4,589			
Pump Improvements					$ 41,097		$ 22,060
Materials					$ 24,658		$ 13,236
Labor					$ 16,439		$ 8,824
Pipe & Equipment Insulation							$ 3,581
Vending Machine Controls					$ 802	$ 1,908	$ 3,020
Pool Covers					$ 103,655		$ 107,992
Materials					$ 62,193		$ 64,795
Labor					$ 41,462		$ 43,197
Building Envelope Measures	$ 2,724	$ 1,827	$ 1,781	$ 2,009	$ 3,283	$ 3,367	$ 3,400
Transport Gas					$ 4,233		
Education Program & Live Energy Monitoring	$ 5,619	$ 5,470	$ 5,424	$ 5,649	$ 5,430	$ 5,513	$ 5,547
Contingency							
Commissioning							
TOTALS	**$ 94,876**	**$ 63,086**	**$ 145,855**	**$ 43,709**	**$ 201,425**	**$ 37,984**	**$ 194,264**

Description	20th St. Rec	Scheitler Rec	Fire Station #9	Fire Station #8	Fire Station #1	911 Call Center	Police District #1	TOTALS
Performance Bond								**$ 32,485**
Interior Lighting Retrofit	$ 45,619	$ 56,873	$ 17,446	$ 22,716	$ 96,257	$ 78,813	$ 40,231	**$ 567,534**
Materials	$ 27,371	$ 34,124	$ 10,468	$ 13,630	$ 57,754	$ 47,288	$ 24,139	$ 340,520
Labor	$ 18,248	$ 22,749	$ 6,979	$ 9,087	$ 38,503	$ 31,525	$ 16,092	$ 227,014
Exterior Lighting Retrofit	$ 1,689	$ 4,197	$ 15,183	$ 1,152	$ 9,275	$ 13,421	$ 57,517	**$ 169,605**
Materials	$ 1,013	$ 2,518	$ 9,110	$ 691	$ 5,565	$ 8,052	$ 34,510	$ 101,763
Labor	$ 676	$ 1,679	$ 6,073	$ 461	$ 3,710	$ 5,368	$ 23,007	$ 67,842
Lighting Controls						$ 5,243		**$ 17,581**
Energy Management Control System Upgrades	$ 145,993			$ 211,987		$ 73,079	$ 31,320	**$ 609,100**
Materials	$ 43,798			$ 63,596		$ 21,924	$ 9,396	$ 182,730
Labor	$ 102,195			$ 148,391		$ 51,156	$ 21,924	$ 426,370
Pump Improvements	$ 21,700							**$ 84,857**
Materials	$ 13,020							$ 50,914
Labor	$ 8,680							$ 33,943
Pipe & Equipment Insulation		$ 10,197		$ 3,807	$ 4,674	$ 5,423	$ 5,706	**$ 33,388**
Vending Machine Controls	$ 1,393						$ 1,604	**$ 8,727**
Pool Covers								**$ 211,647**
Materials								$ 126,988
Labor								$ 84,659
Building Envelope Measures	$ 19,581	$ 9,197		$ 16,054	$ 16,170	$ 2,017		**$ 81,410**
Transport Gas						$ 4,463	$ 5,034	**$ 13,730**
Education Program & Live Energy Monitoring	$ 6,021	$ 6,110	$ 5,816	$ 5,485	$ 6,352	$ 5,660	$ 6,231	**$ 80,326**
Contingency								**$ 35,020**
Commissioning								**$ 47,231**
TOTALS	**$ 241,996**	**$ 86,575**	**$ 38,445**	**$ 261,201**	**$ 132,728**	**$ 188,119**	**$ 147,642**	**$ 1,992,641**

EXHIBIT C

STANDARDS OF COMFORT;
CITY'S MAINTENANCE RESPONSIBILITIES;
BASELINE ADJUSTMENTS

STANDARDS OF COMFORT

Space temperature set points for locations served by new controls and programmable thermostats will be initially set by Contractor and maintained by City as shown in the tables below.

Contractor shall not be responsible for existing HVAC equipment and ancillary services (HVAC equipment ancillary services not replaced as part of project).

Heating/Cooling Schedule								
	Monday		Tuesday		Wednesday		Thursday	
	On	Off	On	Off	On	Off	On	Off
Ashland Pool	5:30 AM	8:30 PM	5:30 AM	8:30 PM	5:30 AM	8:30 PM	5:30 AM	8:30 PM
Ashland Rec Ctr	5:30 AM	8:30 PM	5:30 AM	8:30 PM	5:30 AM	8:30 PM	5:30 AM	8:30 PM
Barnum Library	9:30 AM	6:00 PM	9:30 AM	6:00 PM	11:30 AM	8:00 PM	11:30 AM	8:00 PM
Bear Valley Library	9:30 AM	6:00 PM	9:30 AM	8:00 PM	9:30 AM	6:00 PM	9:30 AM	8:00 PM
Combined Communication Center - 1st Floor	6:00 AM	6:00 PM	6:00 AM	6:00 PM	6:00 AM	6:00 PM	6:00 AM	6:00 PM
Combined Communication Center - 2nd Floor	24/7	24/7	24/7	24/7	24/7	24/7	24/7	24/7
Eugene Field Library	9:30 AM	6:00 PM	9:30 AM	6:00 PM	11:30 AM	8:00 PM	11:30 AM	8:00 PM
Fire Station #8	24/7	24/7	24/7	24/7	24/7	24/7	24/7	24/7
Fire Station #9	24/7	24/7	24/7	24/7	24/7	24/7	24/7	24/7
Fire Station#1(HQ) - Office Side	5:30 AM	6:00 PM	5:30 AM	6:00 PM	5:30 AM	6:00 PM	5:30 AM	6:00 PM
Fire Station#1(HQ) - Station Side	24/7	24/7	24/7	24/7	24/7	24/7	24/7	24/7
Glenarm Rec Ctr	9:30 AM	8:00 PM	5:30 AM	8:00 PM	9:30 AM	8:00 PM	5:30 AM	8:00 PM
Police District #1 - 1st Floor	24/7	24/7	24/7	24/7	24/7	24/7	24/7	24/7
Police District #1 - 2nd Floor	6:00 AM	6:00 PM	6:00 AM	6:00 PM	6:00 AM	6:00 PM	6:00 AM	6:00 PM
Scheitler Rec Ctr	5:30 AM	8:30 PM	5:30 AM	8:30 PM	5:30 AM	8:30 PM	5:30 AM	8:30 PM
Schlessman Family Library	11:30 AM	8:00 PM	9:30 AM	6:00 PM	11:30 AM	8:00 PM	9:30 AM	6:00 PM
Twentieth Street Rec Ctr	6:00 AM	8:00 PM	6:00 AM	8:00 PM	6:00 AM	8:00 PM	6:00 AM	8:00 PM

Heating/Cooling Schedule						
	Friday		Saturday		Sunday	
	On	Off	On	Off	On	Off
Ashland Pool	11:00 AM	8:30 PM	10:30 AM	5:00 PM	Off	Off
Ashland Rec Ctr	11:00 AM	8:30 PM	10:30 AM	5:00 PM	Off	Off
Barnum Library	9:30 AM	6:00 PM	8:30 AM	5:00 PM	Off	Off
Bear Valley Library	9:30 AM	6:00 PM	8:30 AM	5:00 PM	Off	Off
Combined Communication Center - 1st Floor	6:00 AM	6:00 PM	6:00 AM	6:00 PM	Off	Off
Combined Communication Center - 2nd Floor	24/7	24/7	24/7	24/7	24/7	24/7
Eugene Field Library	9:30 AM	6:00 PM	8:30 AM	5:00 PM	Off	Off
Fire Station #8	24/7	24/7	24/7	24/7	24/7	24/7
Fire Station #9	24/7	24/7	24/7	24/7	24/7	24/7
Fire Station#1(HQ) - Office Side	5:30 AM	6:00 PM	5:30 AM	6:00 PM	Off	Off
Fire Station#1(HQ) - Station Side	24/7	24/7	24/7	24/7	24/7	24/7
Glenarm Rec Ctr	9:30 AM	7:00 PM	9:00 AM	3:30 PM	Off	Off
Police District #1 - 1st Floor	24/7	24/7	24/7	24/7	24/7	24/7
Police District #1 - 2nd Floor	6:00 AM	6:00 PM	6:00 AM	6:00 PM	Off	Off
Scheitler Rec Ctr	5:30 AM	8:00 PM	8:30 AM	4:00 PM	8:30 AM	1:00 PM
Schlessman Family Library	9:30 AM	6:00 PM	8:30 AM	5:00 PM	12:30 PM	5:00 PM
Twentieth Street Rec Ctr	6:00 AM	7:00 PM	8:30 AM	1:00 PM	Off	Off

Notes:

Above schedule represents when the heating and cooling systems are in operation, i.e. setpoint schedules.

Set points:

Occupied Heating Set point	72°F
Occupied Cooling Set point	75°F
Unoccupied Heating Set point	60°F
Unoccupied Cooling Set point**	90°F
Economizer Cooling Set point	65°F
Mechanical Cooling Set point	65°F
Unoccupied Cooling Lockout Set point	80°F
Electric Baseboard OAT Set point	40°F
Duct Static Supply Pressure	¾"WC
CO2 Set point	900PPM
Damper Minimum Position Set point	Fully Closed

Unoccupied Cooling Set point is not applicable to server rooms or other areas were 24/7 cooling is required

911 Call Center, first floor - equipment scheduling with setbacks will be implemented. For this to be fully implemented, this floor should remain unoccupied other than M-F from 6am to 6pm.

Police District #1, second floor - equipment scheduling will be implemented. For this to be fully implemented, this floor should remain unoccupied other than M-F from 6am to 6pm.

Fans cycle with heating, cooling, and CO2 levels

Lights are on at the libraries two (2) hours before operating hours.

Occupancy sensor timeout delay:

High traffic areas: 20 minutes

Low to medium traffic areas: 10 minutes

CITY'S MAINTENANCE RESPONSIBILITIES

City, at its own expense, will keep and maintain, or cause to be kept and maintained, the ECMs and all equipment in as good operating condition as when delivered to the City hereunder, ordinary wear and tear resulting from proper use thereof alone excepted, and will provide maintenance and service and make all repairs necessary for such purpose. Responsibility for the proper maintenance, service, repair and adjustments to each ECM, ECM system and related ancillary systems and equipment, including related expenses, shall transfer to the City on an ECM by ECM basis on the date of Substantial Completion of each ECM as such date is determined in accordance with the definition of Substantial Completion set forth in Section 1 of the Agreement. The City will be responsible for such maintenance, service, repair and adjustments for the remainder of the Term. Operation and Maintenance Manuals (O&M Manuals) will be provided to the City, by the Contractor. Included with the O&M manuals will be a list of maintenance responsibilities and tasks for the City.

Start-up and Shutdown: The City's responsibilities include all system start-ups and shut-downs. System start-up (beginning of season) and shut-down (end of season) refers to specific manufacturer recommendations with respect to "proper" system start-up, operation, maintenance, and shut-down as defined in the manufacturer's installation / operation / maintenance (O&M) manuals which will be provided to the City upon Substantial Completion and / or Delivery and Acceptance, as appropriate.

Operations: The City shall operate the equipment installed hereunder in accordance with parameters noted in the manufacturers' recommendations, and any supplemental procedures supplied to the City by Contractor, including those set forth in the O&M manuals. The City shall also operate the equipment and systems (including ancillary related systems) in accordance with the Standards of Comfort.

Maintenance: The City's maintenance responsibilities include the proper operation and prompt repair and maintenance of each ECM, ECM system and related ancillary systems and equipment such that they are maintained in good working order during the Term. The City shall repair and maintain (i) the equipment and all other components which comprise the ECM and (ii) all other equipment which is attached thereto and/or is integral to the proper functioning of the ECM, including performance of the maintenance tasks, manufacturer's recommendations and supplemental procedures included in the O&M Manuals. Maintenance also refers to performing required maintenance of ancillary systems.

Access: During the Term of this Agreement, the City shall reasonably provide Contractor reasonable access to facilities, equipment, and building controls installed as a part of this project to confirm proper operation of systems.

In addition to any of its other obligations under this Agreement, City agrees to operate and maintain all ECM's to the standards set forth in this Exhibit. Deviation from these standards may result in adjustments to baseline energy consumption and Guaranteed Savings.

BASELINE ADJUSTMENTS

Routine adjustments to energy consumption are changes to the baseline energy consumption due to factors which are both significant to the energy consumption and vary predictably. Factors resulting in routine adjustments include, but are not limited to, weather, building temperature setpoints, hours of operation, and number of occupants. Routine adjustments, if required according to the respective measurement and verification plan, will be performed annually and will affect the performance period in which the adjustment occurs only, and will not be continued into later performance periods. If routine adjustments result in a reduction of energy savings and are beyond the control of Contractor, the value of the savings guarantee will be reduced by the magnitude of the routine adjustment.

Non-routine adjustments are changes to the baseline energy consumption due to factors that are significant to the energy consumption but do not vary predictably. Factors resulting in non-routine adjustments include, but are not limited to, additions or reductions to the area of a building, changes to the use of a building, installation, modification, or replacement of equipment, and changes to the building envelope. Non-routine adjustments, if required according to the respective measurement and verification plan, will be performed once and will be affective for the remainder of the M&V Term. If non-routine adjustments result in a reduction of energy savings and are beyond the control of Contractor, the value of the savings guarantee will be reduced by the magnitude of the routine adjustment.

Both Contractor and City share responsibility in identifying routine and non-routine adjustments. Contractor will monitor key parameters and perform site visits as required per the measurement and verification plan. If, during the course of these actions, Contractor identifies operations or changes to the buildings or systems that would result in a baseline adjustment, Contractor will notify City accordingly as outlined in the measurement and verification plan. City is obligated to notify Contractor when material changes occur within the facilities and provide additional information, if required, to perform baseline adjustments, including, but not limited to, equipment submittals, building plans, and dates that such changes occurred. Contractor will calculate baseline adjustments, when required, and submit the results to City and it agents.

Energy Performance Contracting Services

Prepared for
City and County of Denver

Technical Energy Audit Report

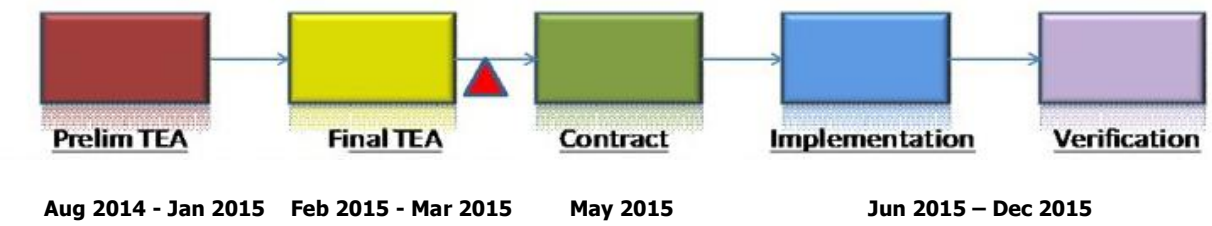
March 26, 2015

AMERESCO
Green • Clean • Sustainable

Table of Contents

Executive Summary

In August of 2014, Ameresco began working with the City & County of Denver (CCD) to evaluate ways to reduce CCD's utility, operational, and future capital costs while upgrading facility infrastructure. Ameresco followed the standard Colorado Energy Office (CEO) process; performing a preliminary evaluation, followed by a detailed Technical Energy Audit (TEA), which has concluded with the submission of this report.



Ameresco has audited the facilities and developed a unique set of Energy Conservation Measures (ECMs) appropriate for each audited facility. The proposed solutions are based on customer needs identified during the needs assessment meeting, a detailed utility analysis and site inspections of the buildings and their associated lighting and heating, ventilation and air conditioning (HVAC) systems. This report identifies problematic areas within each audited facility, with regard to its current equipment and operation. Additionally, this report proposes energy efficient solutions and outlines potential financial commitments and projected paybacks.

CCD staff and Ameresco have been working towards a project that will address specific issues within CCDs facilities while also reducing future facility concerns. Ameresco has developed a project scope to meet the needs and goals expressed by CCD staff.

Some expressed needs of the project are:

- Reduce utility and maintenance costs with a goal of 30% reduction
- Replace aging and unreliable heating and cooling systems
- Improve comfort conditions
- Replace outdated and inefficient lighting systems
- Evaluate long term outlook on utilities and operational costs

Facilities

Fourteen (14) Facilities were reviewed for the City & County of Denver:

Table 1: Facilities Included in TEA Report

Facility Group	Location Name	Address	Square Feet
Fire Station	Fire Station#1(HQ)	745 W Colfax Ave	33,442
Fire Station	Fire Station #8	1616 Park Ave	11,112
Fire Station	Fire Station #9	4400 Brighton Blvd	12,491
Facilities	Police District #1	1311 W 46th Ave	40,131
Facilities	911 Call Center	950 Josephine St	21,518
Rec Center	Ashland Pool	2501 W Dunkeld Pl	16,332
Rec Center	Ashland Rec Ctr	2475 W Dunkeld Pl	10,354
Rec Center	Glenarm Rec Ctr	2800 Glenarm Pl	18,731
Rec Center	Scheitler Rec Ctr	5105 W 46th Ave	26,801
Rec Center	Twentieth Street Rec Ctr	1009 20th St	32,395
Library	Barnum Library	3570 W 1st Ave	13,230
Library	Bear Valley Library	5171 W Dartmouth Ave	10,644
Library	Eugene Field Library	810 S University Blvd	9,142
Library	Schlessman Family Library	100 Poplar St	16,548

Findings Summary

Overall, the facilities included in this report are some of the more energy intensive buildings within CCD's portfolio. The condition of the buildings and equipment varies by facility group and age of the building. During the investigation, Ameresco identified several issues with the buildings including;

- Mixture of new and inefficient, outdated lighting
- Aging and/or inefficient heating and cooling equipment
- Maintenance-intensive HVAC systems
- Inefficient control of heating and cooling systems
- High natural gas utility rates

Ameresco's review of these facilities' energy use and infrastructure is provided in detail in the findings section of this report. Based on these findings, the following opportunities were identified:

Lighting

Ameresco recommends a lighting retrofit to replace remaining inefficient lighting with new high efficiency lighting. Lighting levels for each space shall be evaluated and new lighting levels adjusted as necessary to insure adequate light is being provided. This measure is a blend of the retrofit technology. Logic for upgrades is based on payback, maintenance, case-by-case scenarios and aesthetics (not mixing two types in one area).

The proposed measures for exterior lighting are all LED technology. The options for exterior lighting are many, the hours of operation tend to be over 4,000 per year which helps the paybacks, and the technology excels in efficacy for nighttime illumination.

Lighting Controls

This measure consists of installing infrared and/or ultrasonic lighting occupancy sensors in most office and high use spaces to reduce the amount of energy consumed by the lights by automatically turning them off during times when the space is unoccupied (during lunch breaks, meetings, week nights, and weekends). The lights will automatically be turned back on whenever occupancy is sensed within a space.

Energy Management Controls System Optimization

Many of the present facilities have on-site controls systems that cannot be accessed remotely. All monitoring and programming must be on-site. Ameresco recommends the installation of a web based building control system to help reduce energy use, provide a more comfortable environment, reduce the number of service calls and fuel used driving to and from service calls. The benefits of an upgraded EMCS system include the following:

- Equipment scheduling (turns equipment on/off based on time of day, day of week, holidays and outdoor air conditions
- Optimal start/stop programming will determine the length of time required to bring each zone from an unoccupied set point to the occupied set point temperature
- Lockouts will ensure equipment doesn't turn on until needed
- Resets will reduce energy consumption by operating equipment and systems to meet building loads
- Diagnostics can be used to monitor temperatures, flows, pressures, and actuator positions to determine whether equipment is operating incorrectly or inefficiently

Pump Improvement

The circulation pumps for commercial pools are sized to pump the required volume of water in a "worst case scenario." Typically this is when the filters are clogged. Having the pumps oversized leads to reducing the flow to achieve a specific flow rate, based on the pool size, by a manual hand valves that typically does not modulate. The circulation pumps operate year round under these conditions.

Installing a variable frequency drive (VFD) controlled by a flow meter, will allow the speed of the motor to adjust to changes in the system pressure while maintaining a constant flow rate. This reduction in speed, when the filter is not clogged, will reduce energy use, filter wear and will reduce the frequency of filter maintenance. The VFD will include an alarm to indicate that the filter needs to be cleaned, further improving energy savings by reducing the amount of time the pump is at its maximum speed.

Pipe & Equipment Insulation

Ameresco has identified, in several facilities, pipes and equipment that are not properly insulated. Uninsulated piping and equipment is a constant source of energy loss. The primary function of insulation is to reduce the loss of energy from a surface that is at a temperature other than ambient. Insulating piping on a hot water system is relatively inexpensive and can reduce energy losses by a range of 90% to 100%.

Vending Misers

Ameresco recommends installing occupancy sensors on existing vending machines. After a defined period of occupant inactivity in the vicinity of the machine, the controller sends the machine to a powered-down state which turns off the light and limits compressor use. Refrigerated vending machines are programmed to cycle the compressor regardless of detected motion to ensure that the products are kept at the desired temperature.

The vending machine occupancy sensors will reduce electricity consumption and utility costs by only cooling the product during periods of occupancy.

Pool Covers

Swimming pools lose energy in a variety of ways, but evaporation is by far the largest source of energy loss. Evaporating water requires tremendous amounts of energy. It only takes 1 Btu (British thermal unit) to raise 1 pound of water 1 degree, but each pound of 80ºF water that evaporates takes 1,048 Btu of heat out of the pool.

Indoor pools aren't subjected to the environment, but still lose a lot of energy from evaporation. Additionally, conditioned room ventilation to control indoor humidity caused by the large amount of evaporation, is necessary, which adds to the overall energy costs.

Pool covers minimize evaporation from indoor pools. Covering a pool when it is not in use is the single most effective means of reducing pool heating costs. Savings of 50%–70% are possible.

Pool covers on indoor pools not only can reduce evaporation but also the need to ventilate indoor air and replace it with unconditioned outdoor air. Exhaust fans may also be shut off when an indoor pool is covered, saving even more energy.

Building Envelope

Air leakage is defined as, "the uncontrolled migration of conditioned air through the building envelope". Caused by pressure differences due to wind, chimney (or stack) effect and mechanical systems, air leakage is the single largest source of heat loss or gain through the building envelopes of nearly all types of buildings. Beyond representing potential for energy savings; uncontrolled air leakage can affect thermal comfort of occupants, air quality through ingress of contaminants from outside and the imbalance of mechanical systems and the structural integrity of the building envelope through moisture migration.

Control of air leakage involves the sealing of gaps, cracks and holes using appropriate materials such as fire retardant, polyurethane foam, caulking materials and appropriate weather stripping materials. The goal is to create a continuous plane of "airtightness" to completely encompass the building envelope; including the need to "decouple" floor-to-floor and to "compartmentalize" components of the building in order to equalize pressure differences.

Additionally, Fire Station 8 and 20th Street Recreation Center do not have adequate insulation in their attic spaces. Blown cellulose insulation will be installed to achieve an insulation value of R-30.

Transport Gas

Presently CCD is receiving natural gas from Xcel Energy at their standard rate for most of the locations included in this report. Historically, this has not been the most advantageous rate. Ameresco recommends moving three of these buildings to transport gas using the existing umbrella contract with CenterPoint Energy, Inc and Internal Technical Services.

Education Program & Live Energy Modeling

Throughout our investigative process, CCD has directed the inclusion of a behavior-based energy awareness component as an ECM for all of the audited facilities. In the past, CCD has implemented programs, on a limited scale, which engaged building occupants in saving resources through simple changes in their everyday behavior; such as unplugging unused devices, turning off lights, etc. For example, in 2011, such a program was implemented at the Eugene Field Library which – according to library staff – produced a 3% savings in overall utility costs for the facility.

Ameresco recommends implementation of a facility-specific, behavior-based program to change / develop everyday behaviors into energy-saving habits. Such a program will emphasize that energy awareness is not a one-time event; and that outreach and education must be ongoing in order to achieve and maintain energy savings. The objectives of our recommended program are:

Education: Develop a comprehensive energy education strategy:

- Identifies and addresses energy reduction goals through changes in occupant behavior
- Meets CCD's objectives and constraints of building occupants and staff
- Will be continuous and on a regular basis
- Creates new communication channels for sharing education and goals

Action: Develop a comprehensive energy efficiency action plan:

- A prioritized list of low-cost / no-cost measures for reducing electricity demand
- Internal actions and projects that could lead to substantial electricity savings
- An education and training component for all building occupants on how to efficiently operate the building
- A plan for implementing recommended measures that can reduce electricity usage
- A review of operating practices during peak and off-peak periods
- A web-based dashboard (Ameresco Building Dynamics) for analysis of building energy use and peak energy use times with ¼ hour accuracy

Recommendations Summary

Ameresco has developed and analyzed numerous potential Energy Conservation Measures (ECMs) to reduce utility and operational costs and address capital equipment replacement needs. The table below shows the ECMs that are recommended for inclusion in an Energy Savings Performance Contract. These ECMs were developed in conjunction with CCD to create a self-funding project with numerous benefits for the facilities.

Table 2: Energy Conservation Measures Evaluated

#	ECM Evaluated
1	Interior Lighting System Improvements
2	Exterior Lighting System Improvements
3	Lighting Controls
4	Energy Management Control System Upgrades
5	Pump Improvement Measures
6	Pipe and Equipment Insulation
7	Vending Machine Controls
8	Pool Covers
9	Building Envelope Measures
10	Transport Gas
11	Education Program & Live Energy Monitoring

Financial Summary

Ameresco has considered a variety of different energy conservation measures. At the direction of CCD, Ameresco has explored all of the options identified during the preliminary review of the opportunities. The measures included in the recommend scope provide the best solution that meets the financial requirements for this project.

The full scope of ECMs achieves a total utility and operational savings of $122,913 in the first year. In addition to cost savings, this project will provide the following benefits:

- New, modern and energy efficient HVAC equipment and controls
- Improved comfort in Fire Station #8
- Reduced utility and maintenance costs
- Training of maintenance staff in equipment operation and maintenance

Based on the needs expressed by CCD employees, observations by Ameresco's staff, and detailed utility and data analysis, Ameresco believes that CCD will recognize an improvement in occupant comfort, a modernization of the infrastructure of facilities with energy efficient equipment, and a reduction in energy costs by implementing the energy conservation measures contained within this report.

Our recommended scope is provided in the table below. The itemized financial details for the recommended scope are outlined in the table below:

Table 3: Recommended Scope and Financial Summary

#	ECM Savings - Units	Guaranteed Savings	Price	Simple Payback
1	Interior Lighting System Improvements	$39,312	$588,667	15.0
2	Exterior Lighting System Improvements	$7,786	$179,877	23.1
3	Lighting Controls	$404	$17,044	42.2
4	Energy Management Control System Upgrades	$35,261	$664,806	18.9
5	Pump Improvement Measures	$11,084	$92,496	8.3
6	Pipe and Equipment Insulation	$1,408	$32,031	22.8
7	Vending Machine Controls	$556	$6,305	11.3
8	Pool Covers	$9,911	$235,291	23.7
9	Building Envelope Measures	$3,638	$83,079	22.8
10	Transport Gas	$3,755	$13,135	3.5
11	Education Program & Live Energy Monitoring	$9,799	$79,910	8.2
	Total	**122,913**	**1,992,641**	**16.2**

If CCD finances the program as prescribed, the annual cash flow that result is shown in the table below.

Table 4: Recommended Scope Annual Cash Flow

Pro-forma			Year									
		Initial Values	1	2	3	4	5	6	7	8	9	10
1	Annual energy costs without improvements	$ 681,647	$ 705,505	$ 730,197	$ 755,754	$ 782,205	$ 809,583	$ 837,918	$ 867,245	$ 897,599	$ 929,015	$ 961,530
2	Annual energy costs with improvements	$ 582,757	$ 603,153	$ 624,264	$ 646,113	$ 668,727	$ 692,132	$ 716,357	$ 741,429	$ 767,379	$ 794,238	$ 822,036
3	Annual energy cost savings (1-2)	$ 98,890	$ 102,351	$ 105,934	$ 109,641	$ 113,479	$ 117,450	$ 121,561	$ 125,816	$ 130,219	$ 134,777	$ 139,494
4	O&M Savings	$ 24,023	$ 24,863	$ 25,734	$ 26,634	$ 27,566	$ 28,531	$ 29,530	$ 30,563	$ 31,633	$ 32,740	$ 33,886
5	Total Project Savings	$ 122,913	$ 127,215	$ 131,667	$ 136,275	$ 141,045	$ 145,982	$ 151,091	$ 156,379	$ 161,852	$ 167,517	$ 173,380
6	Payments for financing equipment		$ 91,393	$ 100,765	$ 105,374	$ 132,823	$ 137,760	$ 142,869	$ 148,158	$ 153,631	$ 159,296	$ 165,159
7	Payments for Ongoing Services	$ -	$ 27,600	$ 22,680	$ 22,680	$ -	$ -	$ -	$ -	$ -	$ -	$ -
8	Net annual benefits		$ 8,222	$ 8,222	$ 8,222	$ 8,222	$ 8,222	$ 8,222	$ 8,222	$ 8,222	$ 8,222	$ 8,222
9	Cumulative cash flow	**$ 123,325**	$ 8,222	$ 16,443	$ 24,665	$ 32,887	$ 41,108	$ 49,330	$ 57,552	$ 65,773	$ 73,995	$ 82,216
10	**Net Present Value of cash flow**	**$ 104,856**										

Line #	11	12	13	14	15	Totals
1	$ 995,184	$ 1,030,015	$ 1,066,066	$ 1,103,378	$ 1,141,996	$ 13,613,190
2	$ 850,807	$ 880,586	$ 911,406	$ 943,305	$ 976,321	$ 11,638,253
3	$ 144,377	$ 149,430	$ 154,660	$ 160,073	$ 165,675	$ 1,974,937
4	$ 35,072	$ 36,300	$ 37,570	$ 38,885	$ 40,246	$ 479,754
5	$ 179,449	$ 185,729	$ 192,230	$ 198,958	$ 205,922	$ 2,454,692
6	$ 171,227	$ 177,508	$ 184,008	$ 190,736	$ 197,700	$ 2,258,407
7	$ -	$ -	$ -	$ -	$ -	$ 72,960
8	$ 8,222	$ 8,222	$ 8,222	$ 8,222	$ 8,222	$ 123,325
9	$ 90,438	$ 98,660	$ 106,881	$ 115,103	$ 123,325	

CCD may make a change to financing terms as desired for a final Energy Performance Contract. All cost savings included in this project are guaranteed.

Findings

The Findings section of this report documents what the Ameresco engineering team discovered in the CCD facilities with our utility bill analysis, site visits, data logging, and detailed engineering evaluation. The information gathered during these processes was used as the basis for solution development and project recommendations.

Utilities Analysis

Ameresco was provided access to the City and County of Denver Energy Cap Portfolio. This provided three years of electrical and natural gas utility bills and data for all 14 locations. A summary of this data July 2011 through June 2014 is provided in Attachment A. CCD also provide a one year summary of water and sewer data for the 14 locations, which can also be found in Attachment A. This data was used to develop the below utility analysis. Energy Use Intensity (EUI)

Energy Use Intensity (EUI) is a common metric used for benchmarking and comparing building energy use. All 14 buildings in the scope of this study were grouped by type (libraries, fire stations, police stations and recreation centers with swimming pools) and compared to the minimum, maximum and average EUIs found within CCD's own stock of buildings. The results of this comparison are shown on the following page.

Since the 911 Call Center and Fire Station #1 operations does not fit well within a standard building type, these building were not compared to a standard EUI.

Ashland Recreation center and Ashland Pool were combined in the benchmarking to better fit the building type of Recreation Centers with Swimming Pools.

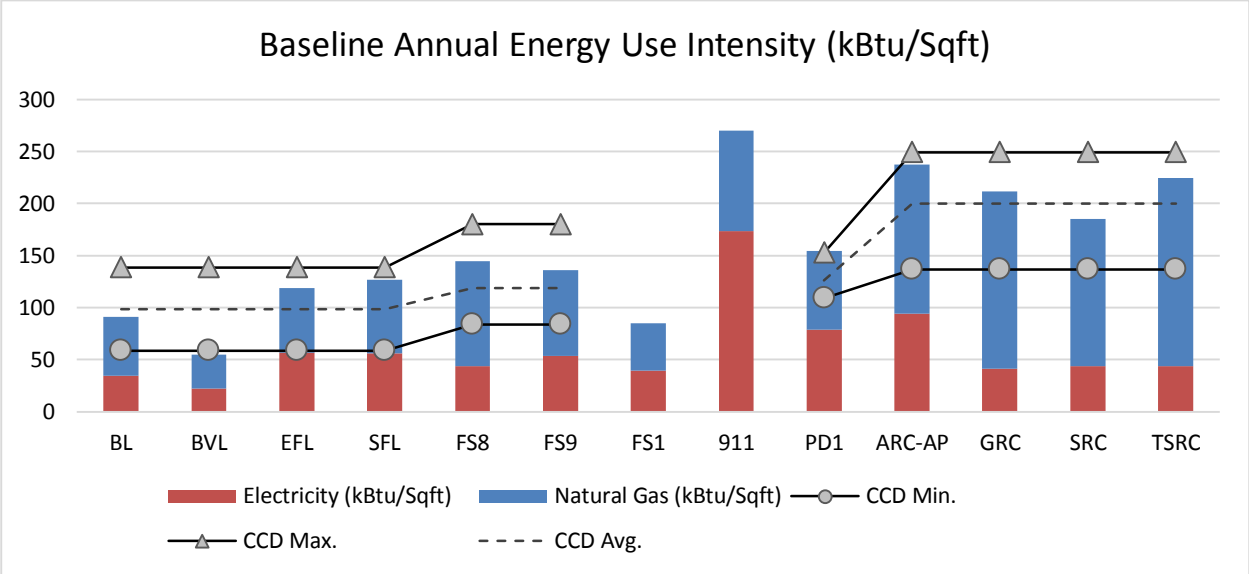


Table 5: Facility Energy Use Intensity (EUI)

Building Abbreviation	Building Name	Electricity (kBtu/Sqft)	Natural Gas (kBtu/Sqft)	Total (kBtu/Sqft)
BL	Barnum Library	34.26	56.60	90.86
BVL	Bear Valley Library	22.39	32.25	54.64
EFL	Eugene Field Library	56.74	61.98	118.72
SFL	Schlessman Family Library	56.23	70.38	126.61
FS8	Fire Station #8	43.69	100.93	144.61
FS9	Fire Station #9	53.41	82.68	136.08
FS1	Fire Station#1(HQ)	39.21	45.54	84.75
911	911 Call Center	173.56	96.51	270.07
PD1	Police District #1	78.68	75.51	154.19
ARC-AP	Ashland Rec Ctr-Ashland Pool	94.33	143.25	237.58
GRC	Glenarm Rec Ctr	41.46	170.09	211.55
SRC	Scheitler Rec Ctr	44.04	141.11	185.15
TSRC	Twentieth Street Rec Ctr	43.72	180.52	224.24
	Total	**63.72**	**103.51**	**167.24**

Energy Cost Intensity (ECI)

Another common metric used for benchmarking and comparing building energy use is Energy Cost Intensity (ECI). All 14 buildings in the scope of this study were benchmarked. The chart and table below show the ECIs that were found.

Ashland Recreation center and Ashland Pool were combined in the benchmarking to better fit the building type of Recreation Centers with Swimming Pools.

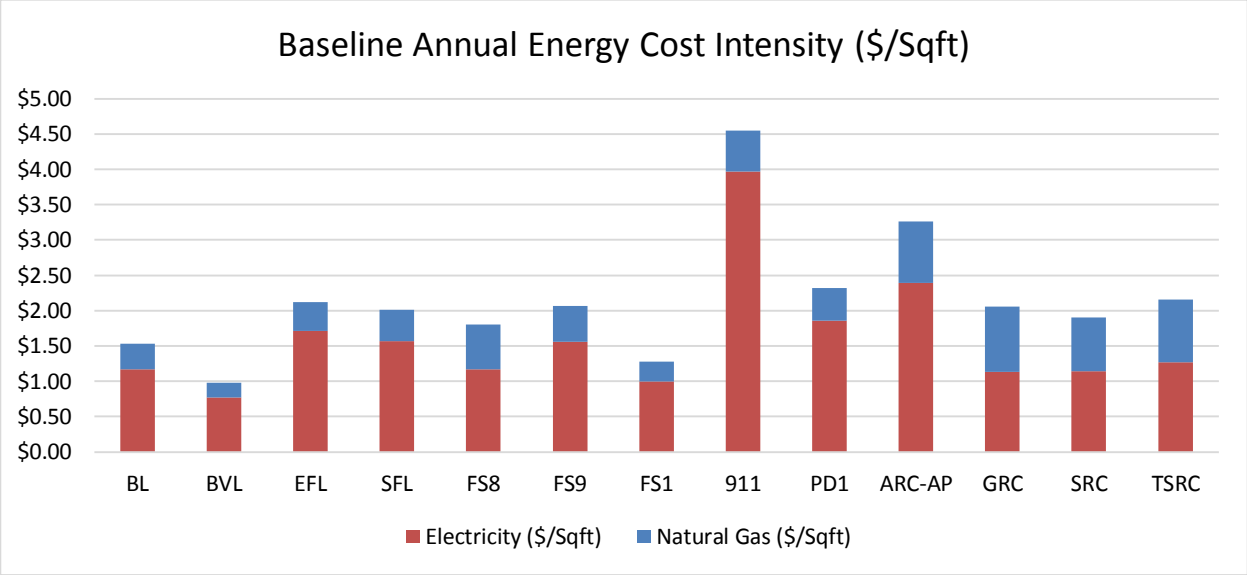


Table 6: Facility Annual Energy Cost Intensity

Building Abbreviation	Building Name	Electricity ($/Sqft)	Natural Gas ($/Sqft)	Total ($/Sqft)
BL	Barnum Library	$1.17	$0.37	$1.54
BVL	Bear Valley Library	$0.77	$0.21	$0.98
EFL	Eugene Field Library	$1.71	$0.41	$2.13
SFL	Schlessman Family Library	$1.57	$0.44	$2.01
FS8	Fire Station #8	$1.17	$0.63	$1.81
FS9	Fire Station #9	$1.56	$0.52	$2.07
FS1	Fire Station#1(HQ)	$1.00	$0.28	$1.28
911	911 Call Center	$3.97	$0.58	$4.55
PD1	Police District #1	$1.86	$0.46	$2.32
ARC-AP	Ashland Rec Ctr-Ashland Pool	$2.40	$0.87	$3.26
GRC	Glenarm Rec Ctr	$1.14	$0.92	$2.06
SRC	Scheitler Rec Ctr	$1.14	$0.76	$1.90
TSRC	Twentieth Street Rec Ctr	$1.27	$0.89	$2.16
Total		**$1.64**	**$0.59**	**$2.23**

Annual Energy Use

The baseline energy use for the 14 buildings within the scope of this study is shown in the chart and table below. The baseline energy use was taken from utility bills for the calendar year of 2013. Energy use is shown in units of one million Btu's (MMBtu). The billed units for electrical demand (kW), electrical usage (kWh) and natural gas usage (Therms) are also shown.

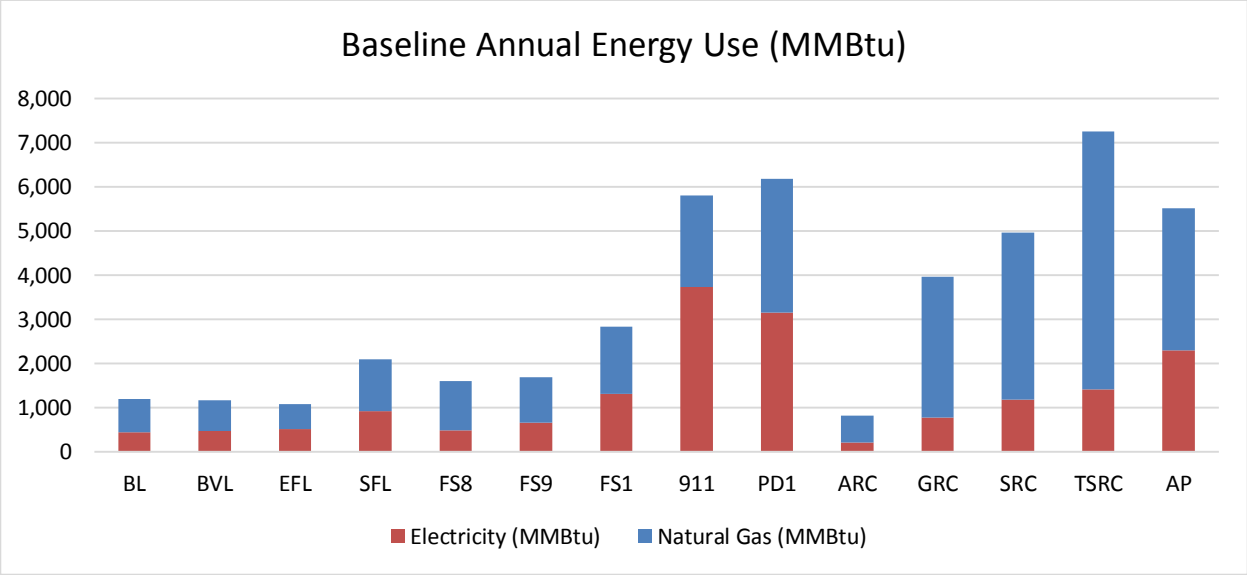


Table 7: Facility Annual Energy Use

Building Abbreviation	Building Name	Electricity (kWh)	Electric Demand (kW)	Electricity (MMBtu)	Natural Gas (Therms)	Natural Gas (MMBtu)	Total (MMBtu)
BL	Barnum Library	132,840	487	453	7,488	749	1,202
BVL	Bear Valley Library	141,200	533	482	6,939	694	1,176
EFL	Eugene Field Library	152,040	476	519	5,666	567	1,085
SFL	Schlessman Library	272,720	758	931	11,647	1,165	2,095
FS8	Fire Station #8	142,280	357	485	11,215	1,122	1,607
FS9	Fire Station #9	195,520	592	667	10,327	1,033	1,700
FS1	Fire Station#1(HQ)	384,320	926	1,311	15,230	1,523	2,834
911	911 Call Center	1,094,560	2,162	3,735	20,767	2,077	5,811
PD1	Police District #1	925,440	1,936	3,158	30,303	3,030	6,188
ARC	Ashland Rec Ctr	61,800	219	211	6,069	607	818
GRC	Glenarm Rec Ctr	227,600	606	777	31,860	3,186	3,963
SRC	Scheitler Rec Ctr	345,920	846	1,180	37,820	3,782	4,962
TSRC	Twentieth St. Rec	415,120	1,250	1,416	58,480	5,848	7,264
AP	Ashland Pool	676,000	1,540	2,307	32,158	3,216	5,522
Total		**5,167,360**	**12,688**	**17,631**	**285,969**	**28,597**	**46,228**

Annual Energy Costs

The baseline energy costs for the 14 buildings within the scope of this study are shown in the chart and table below. The baseline costs were taken from calendar year 2013 utility bills. Energy costs include costs for electrical usage, electrical demand and natural gas usage.

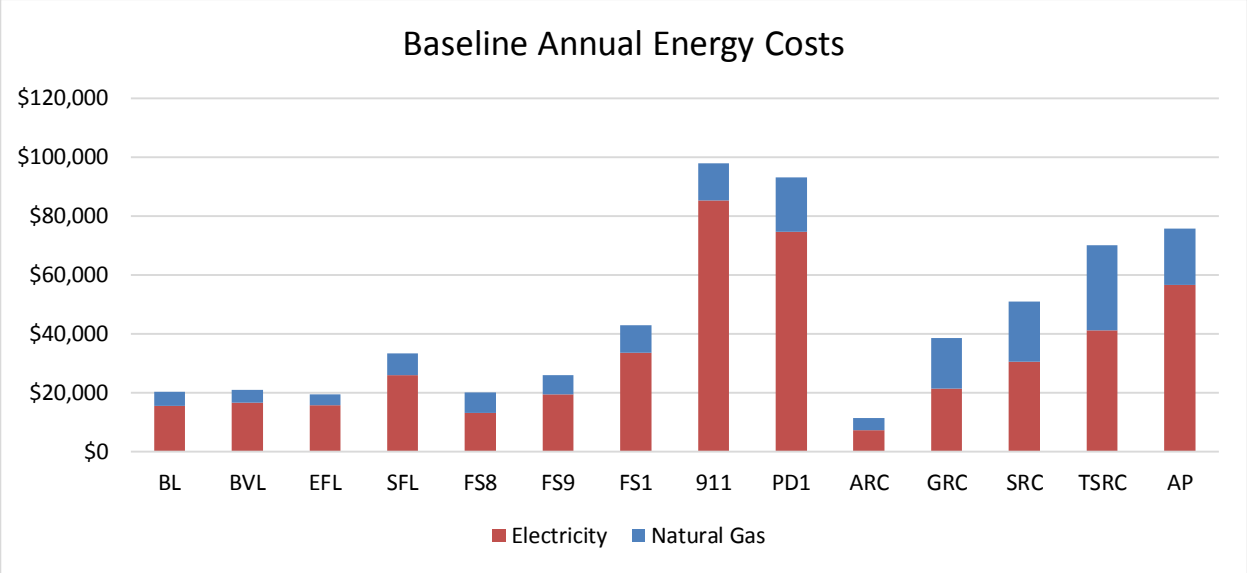


Table 8: Facility Baseline Annual Energy Costs

Building Abbreviation	Building Name	Electricity	Natural Gas	Total
BL	Barnum Library	$15,497	$4,833	$20,330
BVL	Bear Valley Library	$16,576	$4,446	$21,022
EFL	Eugene Field Library	$15,675	$3,752	$19,427
SFL	Schlessman Family Library	$25,992	$7,333	$33,325
FS8	Fire Station #8	$13,028	$7,033	$20,061
FS9	Fire Station #9	$19,431	$6,434	$25,865
FS1	Fire Station#1(HQ)	$33,472	$9,328	$42,799
911	911 Call Center	$85,337	$12,541	$97,878
PD1	Police District #1	$74,662	$18,375	$93,038
ARC	Ashland Rec Ctr	$7,278	$4,059	$11,338
GRC	Glenarm Rec Ctr	$21,277	$17,220	$38,497
SRC	Scheitler Rec Ctr	$30,552	$20,370	$50,922
TSRC	Twentieth Street Rec Ctr	$41,098	$28,904	$70,002
AP	Ashland Pool	$56,675	$19,085	$75,760
Total		**$456,551**	**$163,712**	**$620,263**

Annual Water Use

The baseline water use for the 14 buildings within the scope of this study is shown in the chart and table below. The baseline use was taken from utility bill summaries provided by CCD for the calendar year of 2014. Water use is shown in units of thousands of gallons (kGal).

Table 9: Facility Baseline Annual Water Use & Costs

Building Abbreviation	Building Name	Water Use (kGal)	Water Cost ($)	Sewer Cost ($)	Total Cost ($)
BL	Barnum Library	297	765	589	1,354
BVL	Bear Valley Library	270	704	942	1,646
EFL	Eugene Field Library	265	689	940	1,629
SFL	Schlessman Library	439	1,091	588	1,679
FS8	Fire Station #8	177	488	1,762	2,250
FS9	Fire Station #9	743	1,805	947	2,753
FS1	Fire Station#1(HQ)	823	1,985	1,766	3,751
911	911 Call Center	729	1,768	2,306	4,073
PD1	Police District #1	1,231	2,922	1,766	4,688
ARC	Ashland Rec Ctr	110	327	966	1,293
GRC	Glenarm Rec Ctr	336	849	1,203	2,052
SRC	Scheitler Rec Ctr	1,091	2,577	3,906	6,483
TSRC	Twentieth St. Rec Ctr	360	905	5,386	6,291
AP	Ashland Pool	955	2,273	3,419	5,692
Total		**7,826**	**19,149**	**26,485**	**45,634**

All locations except GRC, SRC, and AP are on an Other Sewer Items (OSI) rate or are restricted by the minimum charge associated with the meter size. These methods of charging do not track with actual use. This is most pronounced at the TSRC where the 6" meter is dramatically oversized. If the opportunity arises, TSRC water supply and meter should be exchanged for a smaller service. This could result in a cost reduction of $4,240 annually.

Utility Rate Escalation

Table 10: Annual Utility Rate Escalation

Year	All Facilities $/kWh	All Facilities $/kW	All Facilities $/Therm
July 2011 - June 2012			
July 2012 - June 2013	12.8%	-6.3%	-8.7%
July 2013 - June 2014	6.4%	2.8%	14.1%

During the last year of the utility analysis, utility rates increased as shown in the table above. Electric usage rates increased 6.4%, electric demand rates increased 2.8% and natural gas rates increased 14.1%.

Based on conversations with the CCD, energy savings calculations and pro-forma calculations will be based on a 3.5% escalation for all utilities.

Building Findings

The following represents the condition information documented during Ameresco's investigation of each of the CCD facilities. We have categorized them in three groups: Firehouses, Recreation Centers and Libraries

Fire Stations

Fire Station #1 HQ (745 W Colfax Ave)

General Conditions

Fire Station #1 Headquarters was built in 1974 and is 33,442 sqft. It is a three-story building, which includes the city fire department headquarters office and a full firehouse, with living quarters, common space, dayroom, kitchen and a five bay garage.

The headquarters is on the east side of the building, with the third floor extending over the fire house bays. There are approximately 65 people that work at the headquarters and hours are typically 5am to 5pm Monday through Friday.

As is common to Denver firehouses, the west side fire house is occupied all the time by an 8 person staff on a 24hr shift. It also has additional space for the fire department chief. During each shift it is common for two meals to be made. On average, each person takes a shower each shift and between 1 and 2 loads are laundry are done each day.

This firehouse responds to approximately 6,000 pumper and 6,000 truck calls per year. When the chief's vehicle is included this firehouse responds to over 13,700 calls per year. In addition they commonly provide the vehicles for community events.

Envelope

The building is of redbrick construction with original double pane windows and a flat roof. The garage has five 14' x 16' overhead bays doors (chief, engine, tower, collapse rescue, and water rescue) on the south side and two on the north side (a third bay has been boarded up on the north side).

Wall construction is face brick and unknown insulation. Windows are inoperable metal frame double pane.

HVAC

The office space is heated and cooled with a closed water loop heat pump system, also known as a California heat pump system. This system uses reversible water-to-air heat pumps connected to a closed water loop that circulates 60 to 90°F water throughout the building. Use of this water loop permits heat to be transferred to where it is needed.

Heat is only rejected or added to the building when the internal heat is insufficient to satisfy the load. Heat is provided by a 1999 Thermific N-100 PK 700kbtuh/ 595kbtuh output forced draft boiler. The boiler circulation pump is a 1/4hp pump. Cooling is provided by a fluid cooler that is vented to the roof. This system is controlled with an Alerton system. The closed water loop is circulated with a 3hp pump.

There are two Nesbitt AHU with DX cooling and NG heating (Mod: RSA1003-NG3CAYA000005). The unit for the fire house has failed and the other, for the center and east wing, is past its serviceable life. These units work in conjunction with the heat pump system and are the primary sources of ventilation.

The bay is heated with two makeup air units (100% OA and NG heating, MU 1 and 2) and 4 NG radiant heaters. These heaters are interlocked with the bay doors, so that if one is open longer than two minutes, the heater will deactivate.

There are also 25 exhaust fans that are controlled in various ways (interlock with MU, wall switch, time clock and on constantly) and a dedicated Liebert system for the workout room.

DHW

The DWH heater is a 100 gal, 300kbtu system with two 120 gal storage tanks (240 gal total). The circulation pump runs 24/7. There is no insulation on the DWH piping.

Lighting

Lighting is a mix of T-8 4" fixtures and can CFLs. The bay is lit with T-5 6 lamp fixtures. Outdoor lighting is a mixture of mercury vapor, metal halides, compact fluorescents, and LED technology that are controlled by a time clock.

Plug load

Plug load includes, approximately 70 computers, kitchen equipment, three refrigerators, two washers and two dryers, an air machine (runs about 30min/day) for refilling tanks, two electric hose dryers (each used only once a month, as typically hoses are laid out side to dry) and other mechanical equipment to maintain the trucks. There is also an air compressor (Ingersoll-Rand, BAP10AVES, 27 amp, 230/3/60) in the HVAC equipment room.

Fire Station #8 (1616 Park Ave)

General Conditions

Fire Station #8, built in 1965, is 11,112 sqft. It is a two-story building with a partial basement. It includes living quarters, common space, dayroom, kitchen, a three bay garage and a hose tower.

As is common to Denver firehouses, the building is occupied all the time by an 8 person staff on a 24hr shift. During this time it is common for two meals to be made. On average each person takes a shower each shift and between 1 and 2 loads are laundry are done each day.

This firehouse responds to approximately 15-20 pumper and 10-12 truck calls a day. In addition they do several community events.

Envelope

Redbrick construction with original single pane windows and an asphalt shingle roof. The roof structure is wood frame with almost no insulation in the attic space. The garage is not insulated and has three 14' x 16' overhead bay doors on the north side and three on the south side. The hose tower is directly connected to the garage, but unlike other facilities the tower goes down to the basement level.

Wall construction is wood frame with face brick and unknown insulation. Windows are metal frame single pane with seals that have primarily failed. Some of the windows are stuck in the open position.

HVAC

The bays are cooled with a portable swamp cooler. NG radiant heaters heat the bays and are controlled by a thermostat that keeps the space above 60F. These heaters are interlocked with the bay doors, so that if one is open longer than two minutes, the heater will deactivate.

The living space is heated and cooled by a constant volume four zone hot deck, cold deck AHU (9300 CFM, 418 MBH heat, 204 MBH cooling). The four zones are (1) kitchen, (2) common space, (3) upstairs bunk area and locker rooms and (4) the upstairs officer's dorms. This unit has an abandoned Richards Zeta control system and is running on limited controls. The 7.5hp supply fan runs 24/7. The majority of the piping in the attic space is uninsulated. These systems have ducted returns and provide a constant amount of outdoor air.

Heat is provided by a 2013 XFyer Raypack (input 850/output 799 kbtu) boiler located in the basement. This boiler uses internal controls to maintain a constant hot water supply temperature of 130˚F. It is configured in a primary, secondary system with a low loss header.

Cooling is provided by an older DX Carrier Weathermaker split system (Mod 38AH-024---511AA) that maintains a constant supply temperature of 55˚F-58˚F. On the day of our visit the condenser was constantly cycling on and then back off.

On the day of our visit, three window units were stacked in the door from the dorm room to the bay area. These were providing temporary cooling to the dorm.

Thermostats were set to the coolest setting because the system was not functioning correctly and was not keeping up with the load.

The basement common room is heated by baseboard electric heaters (approximately 12 ft) and is not cooled.

DHW

The DWH heater is a 100 gal, 199 kbtu system. The circulation pump runs 24/7.

Lighting

Lighting is a mix of T-8 4" fixtures and can CFLs. The bay is lit with T-5 6 lamp futures. Outdoor lighting is a primarily CFLs that are controlled by a time clock.

Plug load

Plug load includes, 2 TVs, 6 computers, kitchen equipment, three refrigerators, two washers and two dryers, an air machine for refilling tanks and other mechanical equipment to maintain the trucks.

Fire Station #9 (4400 Brighton Blvd)

General Conditions

Fire Station #9, built in 2002, is 11,112 sqft. It is a single-story building that includes a lobby, living quarters, common space, dayroom, kitchen, a three bay garage, and a hose tower.

As is common to Denver firehouses, the building is occupied all the time by an 8 person staff on a 24hr shift. During this time it is common for two meals to be made. On average each person takes a shower each shift and between 1 and 2 loads are laundry are done each day.

This firehouse responds to approximately 10 pumper and 5 truck calls a day. In addition they do several community events.

Envelope

Redbrick construction with double pane windows and an asphalt shingle roof installed in 2013. The roof structure is metal frame, ½" metal deck with R-30 bat insulation. The garage is not insulated and has the three 14' x 16' overhead bay doors. The 140 foot hose tower is directly connected to the garage.
Wall construction is metal frame with face brick and 2" extruded polystyrene board. Windows are aluminum frame with double pane glass.

HVAC

The bay is cooled with a two speed swamp cooler (7200 cfm) which blows in from the SE wall. The controls for the unit are mounted on the interior of the same wall. Four NG radiant heaters heat the bay (total of 500 MBH) and are controlled by a thermostat that keeps the space above 60F. These heaters are interlocked with the bay doors, so that if one is open longer than two minutes, the heater will deactivate.

The living space is heated and cooled by three heat pump systems. The first is a single zone system for the weight room; controlled with a wall mounted thermostat. The second is a single zone system supplying the kitchen and common space. The thermostat for this space is located in the common room. The third system is a VVT that provides conditioned air to the bunks. There are 10 rooms on this system, each with its own thermostat. These systems have ducted return and provide a constant amount of outdoor air. The lobby has a dedicated DX split system with electric heat controlled by a wall mounted thermostat.

All interior equipment is located above the drop celling. The condensers are located on the SE side of the building. All thermostat are set between 70-73F and no unoccupied schedule was in use. There are a total of 5 electric unit heaters providing a total of 33 kW of heating. These are located in and around the garage.

Table 11: FS9 AHU Information

Area	CFM	Cooling (MBH)	Heating (MBH)	Outdoor Air (CFM)	Outside Air %
Lobby	100	12.3	3.6 kwh	N/A	
Sleeping pods	4720	85.2	46.8	650	15% OA
Dayroom	3300	62.9	51.5	1700	50% OA
Workout room	1300	27.9	22.3	360	30% OA

There are Pear de-stratification fans in the space, but it is not clear how, or if they function.

There are 10 exhaust fans for bathrooms, kitchen and other spaces.

Table 12: FS9 Exhaust Fan Information

#	Service Area	CFM	Ctrl
1	Lobby RR	100	I
2	Pumper off bath	100	II
3	Truck off bath	100	II
4	Men's Lock room	730	I
5	Woman's lock room	360	I
6	Hose tower	3800	II
7	Infect control	230	II
8	Apparatus floor		II
9	Storage exhaust	250	II
10	kitchen	2100	III

I – interlock with light switch
II – control via wall switch
III - interlock with grease hood

DHW

The DWH heater was replaced in 2013 with a 100 gal, 199.9kbtu, State ultra-force DHW. This unit is a condensing water heater with a thermal efficiency of 95%. The circulation pump runs 24/7.

Lighting

Lighting is a mix of T-8 4" fixtures and can CFLs. The outdoor lighting is primarily T-8 florescent fixtures controlled with a time clock.

Plug load

Plug load includes, 2 TVs, 4 computers, kitchen equipment, two refrigerators, washer and dryer, air compressor and other mechanical equipment to maintain the trucks.

Facilities

Police District #1 (1311 W 46th Ave)

Police District #1, a 40,131 square foot facility, was originally constructed in 1972. The facility serves approximately 46 full time equivalent staff during the normal occupied period and approximately 15 FTE staff during the second and third shifts.

This facility is constructed of brick faced concrete blocks with a steel deck and ballasted built up roofing system over rigid insulation. Part of the building façade consists of a steel frame wall section with aluminum skin. Fenestration in the building consists of casement and window wall aluminum framed windows with thermal pane glazing.

HVAC Systems

A central boiler plant provides heating to the facility via a two pipe heating hot water system. The boiler plant consists of two Patterson Kelley P-K Thermific boilers. The boilers are copper fin boilers with radial fired burners. Each boiler has a lo-hi-lo burner operating controls. The boiler rated input energy is 2,000 MBTU/H with an 85% combustion efficiency. Each pump has a primary circulator with a 1 HP motor. Aquastat control from the energy management system provides control of the hot water supply temperature. During our site visit, the boilers were turned off and the outside air was 81°F.

Two 7.5 HP hot water pumps deliver heating hot water to the air handling units, radiation, and unit heaters in the building. Each pump is configured to deliver 97 gallons per minute of hot water at 94' of head. The distribution system is a constant volume configuration with circulating pumps also located at the air handling units on the roof. The distribution piping is filled with a 35% propylene glycol – 65% water solution to prevent freezing.
At the time of the site visit, the balance valves on the pumps were closed 20%, resulting in a 2 kW energy loss. The pumps, valves, air separators and some fittings were not insulated.

Chilled water is generated for the air handling units via a packaged air cooled chiller located on the roof of the building. The chiller is a Trane model RTAA110 air cooled model with a 110-ton rotary compressor. With the outside air temperature at 88°F, the CHS temperature was 55.7°F and the CHR was 59.4°F. The distribution piping is filled with a 35% propylene glycol – 65% water solution to prevent freezing. This solution is circulated to the AHUs and terminal equipment via two 10 HP pumps rated to deliver 84 GPM at 100' of head. At the time of the site visit, the balance valves on one pump were closed 30% and the other BV was closed 10%.

Forced air equipment is the primary source for space conditioning. Perimeter heating radiation systems augment the forced air heating units. Each air handling unit consists of a supply and return fan having VFDs, a pumped hot water heating coil, a pumped chilled water cooling coil, a return air damper, relief air damper and an outside air damper. The AHUs each have CO2 sensors.

A summary of the air handling equipment is listed below:

Table 13: PD1 RTU Information

Unit	Service Area	Supply Fan HP	Return Fan HP	Supply Fan CFM	Return Fan CFM	Min. OA CFM	HW Coil Pump HP	CHW Coil Pump HP	Notes
RTU-1	West Side	15	7.5	10,825	8,150	2,675	½	¾	VAV System
RTU-2	East Side	25	10	26,650	17,750	8,900	½	1-1/2	VAV System
RTU-3	Lobby North	5	3	4,000	3,600	400	½	¾	VAV System
RTU-4	Lobby South	10	7.5	7,950	7,550	400	1/2	¾	VAV System

A number of exhaust fans serve portions of the buildings. The fans are identified in the table below:

Table 14: PD1 Exhaust Fan Information

Unit	Location	Service	Exh. Fan HP	Exh. Fan CFM
EF-1	Roof	Detainment	0.75	2,850
EF-2	Roof	Bathroom	0.25	500
EF-3	Roof	Lockers	0.75	2,000
EF-4	Roof	Lockers	0.33	1,500
EF-5	Roof	Exercise	0.25	2,000
EF-6	Roof	Second Floor Relief	0.50	1,975
EF-7	Roof	Bathroom	0.25	400
EF-8	Roof	Armory	0.25	400
EF-9	Roof	Sally Port	0.50	2,340
EF-10	Roof	Vehicle Processing	0.50	2,100
EF-11	Roof	Kitchen	0.25	250
EF-12	Roof	Second Floor Relief	0.25	570

All major HVAC systems are controlled by a Landis & Gyr Apogee system with dial up modem access.

In general, the heating set-points are set to 70^0F during the occupied period and 60^0F during the unoccupied period. The cooling unoccupied set point is 80^0F. For the boiler plant, the boilers and heating pumps are programmed to energize when the outside air drops below 65^0F.

Carbon dioxide sensors are located in the air handling unit return ducts. The values depicted on the graphics were not in line with our measurements. The values shown on the screen ranged from 120 PPM to 678 PPM. Ameresco measured the outside air conditions at 515 PPM, indicating the sensors in the building need to be re-calibrated. Space temperature set points ranged from 69°F to 71°F.

DHW

The Aerco KC series DWH heater is original to the building. The circulation pump runs 24/7.

Lighting Systems

The light fixtures primarily employ 4 foot long T8 fluorescent lamps and electronic ballasts as the primary lighting source. The lamp wattage ranged from 32 watt to 25 watt depending on location and age. It appears that failed lamps are being replaced with 25 watt units. Outdoor lighting is primarily metal halide fixtures that are controlled by a time clock.

Plug Loads

The facility has approximately 50 computers with flat screen monitors, vending machines, and the standard array of office equipment.

911 Call Center (950 Josephine St)

The 911 Call Center is a 21,518 square foot building that houses the Denver Paramedics dispatchers, the Denver Police Department dispatchers and the Fire Department dispatchers. It is a two-story facility comprised of block walls with brick façade. One section of the flat roof is covered with a torch down rolled roofing system while the majority of the roof is a built up roofing system with stone ballast. The fenestration is a primarily fixed window units with 3/8" double pane, low-e glazing. The second floor of the facility consists of a large open area serving the various dispatchers, restrooms, a lunch room, a server room and storage. The first floor spaces consist of offices, training rooms, computer server areas, mechanical spaces and restrooms.

The first floor of the building is primarily occupied 8 to 10 hours per day while the second floor has a 24-hour per day occupancy. There are approximately 60 full time equivalent personnel during the first shift and 40 FTEs during the follow on shifts.

HVAC Systems

The building operates two completely redundant heating and cooling systems. The primary system is a forced air system with VAV terminal reheat units. Two roof mounted air handling units supply air to the spaces. The units consist of an indirect gas fired heating sections; packaged, air cooled, direct expansion cooling sections; air side economizer; supply fans; return fans. A central heating plant provides hot water to the terminal reheat coils located out in the spaces above the ceilings. The heating plant consists of a hot water gas fired boiler and constant volume circulating pumps. The boiler is a Burnham Series 5B cast iron boiler with atmospheric burners.

The boiler is rated for 1,482 MBTU input and 1,182 MBTU output, but is de-rated by 21% due to the site elevation. The hot water supply temperature is controlled via an aqua stat. The boiler was delivering 140^{0}F water on a 73°F day. The hot water is circulated using one of two 1.5 HP pumps sized to circulate 65 gallons per minute of water at 35 feet of head. The balance valves on the pump discharge were both 100% open.

Table 15: 911 Primary Air Handling Units

Unit	Service Area	Supply Fan HP	Return Fan HP	Supply Fan CFM (Total/OA)	Comment
AHU 1	East	25	7.5	20000 /6000	VFD On Fans
AHU 2	West	15	5	13500/2700	VFD On Fans

A backup cooling system consists of nine chilled water fan coil units located throughout the building. The units are served by a 35-ton McQuay air cooled chiller. The chiller is served by two 5 HP constant volume pumps that circulate a 45% propylene / water solution.

Temperature controls are provided by a combination of pneumatic controls and a Landis and Gyr Apogee energy management system. The building is controlled to maintain constant temperature in all spaces 24 hours per day. The air compressor appeared to cycle on 5 minute increments.

Measured office space temperatures ranged between 69°F to 73°F. The server room on the second floor was 66°F. The measured Dispatch Area CO2 was 787 PPM, corresponding to an outside air ventilation rate of 29 CFM per person, or approximately 30% more than required.

DWH

Two Bradford White MI40T6LN10 natural gas 40 gal, 34 MBH water heater and circulation pump provide domestic hot water to recreations spaces. The 1/8 hp circulation pump for the State water heater is on a time clock.

Lighting Systems

The primary lighting systems are a combination of 4' 32 watt T8 fixtures and 4' 34 watt T12 fixtures. The second floor dispatch area is illuminated by pendant mount indirect fixtures having T8 lamps and electronic ballasts. The first floor fixtures are predominately 2'x4' recessed troffers with 2, 3 or 4 lamps. Recessed can fixtures contained compact fluorescent lamps. Outdoor lighting is primarily provided by high pressure sodium fixtures that are controlled by a time clock.

Plug Loads

The facility has a high density of computers and servers. There are approximately 100 computers in the building with over 400 flat panel monitors. The monitors range between 19 and 21". The office computers are turned off manually at night, however the dispatcher computers and CAD machines are always on. There are two server rooms on the first floor and one server room on the second floor. There is also one uninterruptible power supply room on the first floor. The primary cooling for the UPS room is a chilled water fan coil unit.

The second floor server room has a liquid cooling rack system. This system consists of six in row rack cooling systems fed by an air cooled chiller located outside of the building. The chiller is a Motivair MPC-6000 unit rated for 42 tons of cooling. The system is designed to operate down to 10°F and has a free cooling mode. The 45% glycol / water solution is circulated via a 7.5 horsepower constant volume pump set located under the chiller.

Recreation Centers

Ashland Pool (2501 W Dunkeld Pl)

General Conditions

The Ashland Pool was constructed in 2003 and is 16,329 sqft. The facility is a single-story building, with administrative offices, lap pool and leisure pool, and locker rooms.

There are approximately 2 people that work at the recreation center, and hours are Mon-Thur: 6:00am to 8:30pm, Fri: 11:30am to 8:30pm, Sat: 11:00am to 5:00pm, and closed Sundays.

Envelope

The building exterior is brick construction, with a flat roof. All exterior windows are double pane.

HVAC

The HVAC design for recreation center uses multiple constant volume air handling systems. Pool space is served by one PoolPak rooftop unit for dehumidification and heating the pool space. A second Trane packaged MAU with gas heat and evaporative cooling serves the locker room areas. A third Trane packaged rooftop unit with gas heat and DX cooling serves the entry. A fourth Trane packaged rooftop unit with gas heat and DX cooling serves the office area. And a fifth Trane MAU with gas heat and evaporative cooling serves the mechanical room. Several electric unit heater and cabinet heater serve entry ways, storage and mechanical rooms.

Honeywell programmable thermostats control the heating and cooling systems in the recreation center spaces. The PoolPak unit is controlled by a separate PoolPak programmable thermostat. Incoming domestic water booster pumps (2) are required to maintain building water pressure.

Four exhaust fans serve the chlorine room, locker rooms, and electrical rooms.

Table 16: AP Exhaust Fan Information

EF	Service Area	Hp	Controlled
1	Pool locker rooms	3/4	Interlocked with MAH
2	Electrical room	1/4	Room Thermostat
3	CO2 room	1/4	Circuit breaker panel
4	Chlorine room	1/4	Circuit breaker panel

DHW

An Aerco natural gas 23 gal, 1000 kbtu water heater and circulation pump provide domestic hot water to recreations spaces. The ¼ hp circulation pump for the State water heater is on a time clock.

Lighting

Lighting throughout the recreation center is a mix of 32wtt fluorescent fixtures and CFLs. The pool space is lit with T5 fluorescent fixtures and controlled by wall switches. Lighting controls for the majority of spaces are wall mounted switches. Exterior wall and pole lights are 100wt and 200wt metal halide fixtures that are controlled by a time clock.

Plug load

Plug load include, computers, microwave, vending machines, and refrigerator.

Natatorium

A packaged PoolPak unit is located on the roof and serves the pool space. Water for the leisure and lap pools are heated by two Lochinvar non condensing boilers. Pool pumps run 24/7 365 days a year at a constant volume. The pool is 75' long by 30' wide with an area of 2,250 sqft. The average pool temperature is 83°F. The average air temperature is 83°F with a relative humidity at 52%.

Table 17: AP Pump Information

Pumps	Service Area	Hp	Controlled
1	Leisure pool	15	24/7
2	Lap pool	10	24/7
3	Slide pump	20	Wall switch
4	Activities pump	7-1/2	Wall Switch
5	PoolPak pump	5	Interlock
6	Leisure boiler pump	1/4	Interlock
7	Lap boiler pump	1/4	Interlock

Ashland Recreation Center (2475 W Dunkeld Pl)

General Conditions

The Ashland Recreation Center was built in 1972 and is 11,505 sqft. The recreation center is a two-story building, with gymnasium, weight room, multipurpose rooms, and locker rooms.

There are approximately 2 people that work at the recreation center, and hours are Mon-Thur: 6:00am to 8:30pm, Fri: 11:30am to 8:30pm, Sat: 11:00am to 5:00pm, and closed Sundays.

Envelope

The building exterior is brick construction, with a flat roof. All exterior windows are single pane.

HVAC

The HVAC design for recreation center uses multiple constant volume air handling systems. The gymnasium and main level are served by four gas fired Reznor roof top units. The gym is cooled by an evaporative cooling unit. Upstairs office and multipurpose rooms are served by two Reznor roof top units that are equipped with DX cooling and gas heat. Restrooms are heated by electric baseboard. Four Reznor units do not have cooling capability and are shut down during warmer summer months.

Honeywell programmable thermostats control the heating and cooling systems in the recreation center spaces. It appears there are two exhaust fans that serve restrooms and locker rooms.

Table 18: ARC Exhaust Fan Information

EF	Space	Hp	Controlled
1	Locker rooms	1/4	Interlock
2	Restrooms	1/4	Circuit Breaker

DHW

A State 50 gal, 40,000 btu/hr natural gas hot water heater provides domestic hot water to the recreation center. (No circulating pump)

Lighting

Lighting throughout the recreation center is a mix of 32wtt fluorescent fixtures and CFLs. The gym space is lit with T5 fluorescent fixtures. Lighting controls for the majority of spaces are circuit breakers and some wall mounted switches. Exterior wall lighting is high pressure sodium fixtures that are controlled by a time clock.

Plug load

Plug load include, computers, microwave, vending machines, and refrigerator, and vending machines.

Glenarm Recreation Center (2800 Glenarm Pl)

General Conditions

The Glenarm Recreation Center was built in 1983 and is 18,731 sqft. The recreation center is a single-story building, with an indoor pool, gymnasium, racquetball court, offices multipurpose room, locker rooms and aerobics room.

There are approximately 4 people that work at the recreation center, and hours are Mon/Wed: 10:00am to 8:00pm, Tue/Thur: 6:00am to 8:00pm, Sat: 9:30am to 3:30pm, and closed Sundays.

Envelope

The building exterior is brick construction, with a flat roof. All exterior windows are double pane.

HVAC

HVAC for recreation center spaces is primarily forced air. Four newer (2006) Trane RTUs with gas heat and DX cooling serve offices, restrooms, meeting, multipurpose, ceramics and aerobics rooms. The gym is cooled by a stand-alone evaporative cooling unit and heated by a Centralair RTU with hot water coil. A heating only unit ventilator serves the racquetball court. A HydroTherm boiler and pumps provides hot water to unit heaters, cabinet unit heaters and baseboard for most spaces in the recreations center. Three atmospheric draft hot water heating boilers and pumps provide hot water to baseboard and unit heaters.

Honeywell programmable thermostats control the heating and cooling systems in the recreation center spaces. The racquetball court unit ventilator operates via wall mounted twist timer.

Nine exhaust fans serve the pool space, chlorine, dark, spray, craft and locker rooms.

Table 19: GRC Exhaust Fan Information

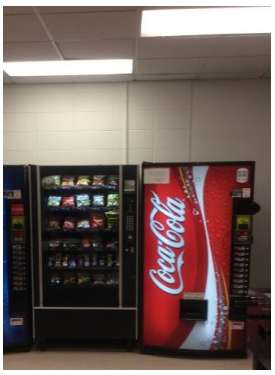
EF	Service Area	Hp	Controlled
VF-1	Ceiling above pool	1/3	Interlock
VF-1A	Ceiling plenum pool	1/3	Interlock
1	Restrooms	1/6	Wall switch
2	Kiln	1/6	Wall switch
3& 3A	Spray Room	1/10	Wall switch
4	Dark Room	1/12	Wall switch
5	Crafts	1/6	Wall switch
6	Chlorine Room	1/10	Circuit Breaker

DHW

A new State natural gas 130 gal, 399 kbtu water heater and circulation pump provide domestic hot water to recreations spaces. The circulation pump for the State water heater is on a time clock.

Lighting

Lighting throughout the recreation center is a mix of T-8 4" fixtures and CFLs. The pool and gym space is lit with T5 fluorescent fixtures and controlled by occupancy sensors. Lighting controls for the majority of spaces are wall mounted switches. Exterior lighting is primarily provided by high pressure sodium fixtures that are controlled by a time clock.



Plug load

Plug load include, computers, microwave, refrigerator, and one three vending machine.

Natatorium

The pool space temperature is maintained by the original (1982) heat recovery unit and exhaust fan. Pool water is heated by a LAARs non condensing boiler. Pool pumps run 24/7 365 days a year at a constant volume. (Solar thermal system has been abandoned). The pool is 75' long by 35' wide with an area of 2,625 sqft. The average pool temperature is 85°F. The average air temperature is 85°F with a relative humidity at 44%. There is a pool cover installed at this facility but it has not been in use for several years due to the condition of pool cover.

Table 20: GRC Pump Information

Pumps	Service Area	Hp	Controlled
1	Pool Recirc	7-1/2	24/7
2	Pool Boiler Pump	1/2	24/7

Scheitler Recreation Center (5031 W. 46th Ave)

General Conditions

The Scheitler Recreation Center was built in 1972 and is 26,801 sqft. The recreation center is a single-story building, with an indoor and outdoor pool, gymnasium, weight room, exercise room, and locker rooms. The facility has undergone several renovations over the years.

There are approximately 4 people that work at the recreation center, and hours are Mon-Thur: 6:00am to 8:30pm, Fri: 6:00am to 8:00pm, Sat: 9:00am to 4:00pm, and Sun: 9:00am to 1:00pm.

Envelope

The building exterior is brick construction, with a flat roof. The majority of exterior windows are double pane glass. The building does have ten 2'x5' single pane exterior windows.

HVAC

A dance/ballroom space is heated and cooled by 3 York forced air systems, with gas heat and DX cooling. These three York systems only serve the dance/ballroom space. Two York forced air systems with gas heat and DX cooling serve the weight rooms. Three Trane 100% outside air, heating only units, serve the lobby, locker rooms, and multipurpose room. The gym is cooled by a single evaporative cooler and heated by gas fired 100% outside air unit. Additionally, supplemental hot water baseboard heat and several unit heaters provide heat in the recreations center. Two atmospheric draft hot water heating boilers and pumps provide hot water to baseboard and unit heaters.

Honeywell programmable thermostats control all the heating and cooling systems in the recreation center spaces.

Five exhaust fans serve locker rooms, kiln, pool and chemical storage rooms.

Table 21: SRC Exhaust Fan Information

EF	Service Area	Hp	Controlled
1	Men's locker room	1/8	Interlock
2	Women's locker room	1/8	Interlock
3	Kiln	1/2	Wall switch
4	Pool	7-1/2	Interlock
5	Chemical storage	1/8	Circuit breaker

DHW

A 2004; State natural gas 100 gal, 250kbtu water heater and circulation pump provide domestic hot water to interior pool and recreations spaces . The circulation pump for the State water heater runs 24/7. Outdoor pool showers are heated by two Rinnai tankless domestic hot water heaters and pump.

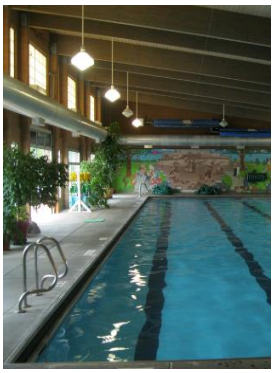
Lighting

Lighting throughout the recreation center is a mix of T-8 4" fixtures and CFLs. The pool space is lit with metal halide lamps. Lighting controls are wall mounted switches. Exterior lighting is mix of compact fluorescents and LED fixtures that are controlled by a time clock.

Plug load

Plug load include, computers, microwave, refrigerator, and vending machines.

Indoor Pool



The pool space temperature is maintained by an APR, pool heat recovery unit and exhaust fan. Pool water is heated by a newer non condensing boiler. Pool pumps run 24/7 365 days a year at a constant volume.

Table 22: SRC Indoor Pool Pump Information

Pumps	Service Area	Hp	Controlled
1	Pool Recirculation	5.0	24/7
2	Pool Boiler Pump	3/4	24/7

There is a pool cover at this location that is in use. When in place, it does not cover the last 2 feet of the pool.

Outdoor Pool

The outdoor pool is open for eleven months during summer. Outdoor pool boiler and pump systems are shut down and winterized when the pool closes at the end of summer. Pool water is heated by a newer non condensing boiler. Pool pumps run 24/7 365 days a year at a constant volume.

Table 23: SRC Outdoor Pool Pump Information

Pumps	Service Area	Hp	Controlled
1	Pool Recirculation	7-1/2	24/7
2	Pool Boiler Pump	1.0	24/7

Twentieth Street Recreation Center (1011 20th St)

General Conditions

The Twentieth Street Recreation Center was built in 1908 and is 32,395 sqft. The recreation center is a three-story building, with a pool, gymnasium, weight room, boxing gym, exercise room, and locker rooms. The facility has undergone multiple renovations over the years.

There are approximately 2 people that work at the recreation center, and hours are Mon-Thur: 6:30am to 8:00pm, Fri: 6:30am to 7:00pm, Sat: 9:00am to 1:00pm, and closed on Sundays.

Envelope

The building exterior is brick construction with new double pane windows and a flat roof. Attic and wall insulation is minimal. The new double pane windows are operable.

HVAC

The recreation center space is heated and cooled with a Governair 58-ton multi-zone air handler with DX cooling and gas heat, a 13-ton Aaon RTU provides gas heat and DX cooling to the gym. Domestic hot water for locker rooms and sinks are heated by a newer higher efficiency water heater.

An older Staefa control system (1990's) operates the Governair multi-zone air handler and associated space temperature set points for seven zones in the recreation center. A stand-alone Honeywell programmable thermostat controls the gym RTU, and pool MAU.

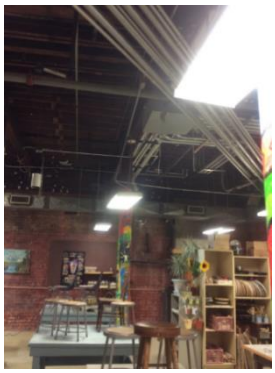
Four exhaust fans serve locker rooms, elevator room, janitorial closets and the pool space.

Table 24: TSRC Exhaust Fan Information

EF	Service Area	Hp	Controlled
1	Locker rooms	1/2	Time Clock
2	Elevator equip	190 W	Circuit breaker
3	Janitorial	1/6	Wall switch
4	Pool	2.0	Interlock

DHW

The DWH heater is a 2004; State natural gas 100 gal, 250kbtu water heater with a circulation pump. The circulation pump runs 24/7.



Lighting

Lighting throughout the recreation center is a mix of T-8 4" fixtures and CFLs. The pool space is lit with metal halide lamps. Lighting controls are wall mounted switches. Exterior lighting is limited to the entry way and is provided by two high pressure sodium fixtures that are controlled by a time clock.

Plug load

Plug load includes, a few computers, microwave, refrigerator, and one vending machine.

Natatorium

A gas fired Sterling MAU unit and exhaust fan serve the pool space. Pool water is heated by a newer non-condensing boiler. Pool pumps run 24/7- 365 days a year at a constant volume. The pool is 75' long by 35' wide with an area of 2,625 sqft. The average pool temperature is 81°F. The average air temperature is 81°F with a relative humidity at 44%. There is a pool cover installed at this facility but it has not been in use for several years due to the condition of pool cover.

Table 25: TSRC Pool Pump Information

Pumps	Service Area	Hp	Controlled
1	Pool Recirculation	7-1/2	24/7
2	Pool Boiler Pump	1.0	24/7

Libraries

Barnum Library (3570 W 1st Ave)

General Conditions

Barnum Library was built in 1954 and is 7,665 sqft. It is a single-story building, with a basement that is unused and unconditioned. In 2013, consistent with our baseline utility data, the library was open 10:00am – 6:00pm Mondays, Tuesdays and Fridays, 12:00pm – 8:00pm Wednesdays and Thursdays, 9:00am – 5:00pm on Saturdays and closed on Sundays.

Envelope

The building is of red brick construction with mostly double pane windows and a flat roof. There are however approximately 14 3x7 foot single-pane windows.

HVAC

The library is served by a 13,800 CFM Mammoth Inc. Multi-Zone AHU built in 2004. The AHU has VSDs on the 15 HP, 90% efficiency supply fan and the 3 HP, 89.5% efficiency return fan which maintain static pressure in the supply ducts. There are hot and a cold deck ducts serving each zone, each deck having its own independent actuator. The system was modified to operate as a VAV system but the programing was never completed. Presently it still functions as a constant volume dual deck system. The system is capable of economizer function. Premium efficiency motors are used in the AHU. OA damper close fully in unoccupied mode, and modulates to maintain a mixed air temperature of 52F. On average, OA is at 36%.

Heating is provided by single Patterson-Kelley Model CM-500 condensing boiler that was being installed in October of 2014. The boiler serves a hot water coil in the AHU, and also some perimeter baseboard units.

Cooling is provided by the AHU's integral 312 MBH 2-stage DX cooling section.

There are two exhaust fans. One is 160 CFM and serves the janitor's closet. The second is 400 CFM and serves the restrooms.

The building HVAC is controlled by an Andover building automation system with the operator controls located at the Central Library. Only room temperature sensors with no user adjustable parameters are available in the building. The control system includes supply air temperature reset, equipment scheduling/setback, and an optimal morning warm-up.

DHW

The 40 gal DWH heater is also being replaced with a side arm system as part of the boiler replacement.

Lighting

Interior lighting is a mix of T-8 4" 32W bulbs and CFLs. One main switch turns on all of the main interior lighting and two public restrooms. There are some occupancy sensors in secluded rooms. Outdoor lighting is mix of high pressure sodium and incandescent fixtures that are controlled by a time clock.

Plug load

Plug load includes approximately 30 computers, a microwave oven, a refrigerator, several printers and a large copier machine.

Bear Valley Library (5171 W Dartmouth Ave)

General Conditions

Bear Valley Library was built in 1975 and is 11,410 sqft. It is a two-story building, with no basement. In 2013, consistent with our baseline utility data, the library was open 10:00am – 6:00pm Mondays, Wednesdays and Fridays, 12:00pm – 8:00pm Tuesdays and Thursdays, 9:00am – 5:00pm on Saturdays and closed on Sundays.

Envelope

Construction is concrete block with a flat roof. There is a large amount of window area and it is nearly all single pane.

HVAC

The library is served by a 13,000 CFM Engineered Air constant volume Multi-Zone AHU built in 2006. The supply fan is 15 HP and there is no return fan. The AHU serves each zone with a hot and a cold deck, the hot and cold deck dampers are linked to a single actuator to mix the hot and cold decks appropriately. The AHU is capable of economizer function. The OA damper shuts completely in unoccupied mode, during occupied periods the OA damper is used to maintain a mixed air temperature, presently set to 60F. On average the OA damper is open 15%.

Heating is provided by the RTU's integral 500 MBTUH gas burner. There is approximately 10 kW of electric cabinet unit heaters serving smaller perimeter rooms. Cooling is provided by the RTU's integral 4-stage DX cooling section.

The building HVAC is controlled by an Andover BAS system with the operator controls located at the Central Library. Only room temperature sensors with no user adjustable parameters are available in the building. These controls include supply air temperature reset and equipment scheduling/setbacks.

DHW

The DHW heater is a 6,000 Watt dual-element electric unit located in the Janitor's closet.

Lighting

Interior lighting is a mix of T-8 4" 32W bulbs and can CFLs. Exterior lighting is provided by a mix of mercury vapor and incandescent fixtures. Both interior and exterior lighting are controlled by a time clock.

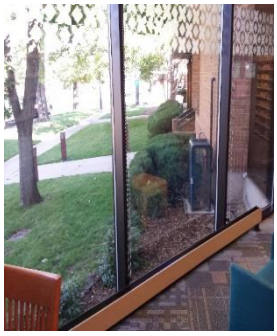
Plug load

Plug load includes, approximately 20 computers, a microwave oven, several printers and a large copier machine. In addition there is an elevator.

Eugene Field Library (810 S University Blvd)

General Conditions

Eugene Field Library was built in 1990 and is 9,142 sqft. It is a two-story building, with no basement. In 2013, consistent with our baseline utility data, the library was open 10:00am – 6:00pm Mondays, Tuesdays and Fridays, 12:00pm – 8:00pm Wednesdays and Thursdays, 9:00am – 5:00pm on Saturdays and closed on Sundays.



Envelope

Construction is red brick with a flat roof. There are fewer windows than most libraries, and they are a mix of single and double pane.

HVAC

The library is served by a 12,000 CFM Engineered Air constant volume AHU built in 2008. The supply fan is 15 HP and there is no return fan. Each zone has one damper actuator that mixes the hot and cold air streams together to serve the zone through a single duct. The RTU has a gas fired burner for heating and DX cooling section for cooling. Premium efficiency motors are used in the RTU. The unit is capable of economizer operation. When not in economizer mode, and during occupied periods, the OA damper is used to maintain a mixed air temperature. On average the OA damper is open 20%.

Heating is provided by the RTU's integral 500 MBTUH gas burner section which has a 1:15 modulating burner. Cooling is provided by the RTU's integral DX cooling section with four stages of cooling. There is also approximately 30 kW of electric baseboard heating.

The building HVAC is controlled by a combination of occupied and unoccupied thermostats. The electric baseboards have integral thermostats that are adjusted with a screwdriver. There is no EMCS at Eugene Field.

DHW

The DHW heater is a 40 gallon gas unit with a DHW recirculation pump and loop that circulates 24/7.

Lighting

Interior lighting is a mix of T-8 U-bulbs, T8 4" bulbs and a sizable population of LED flood lights. All interior lighting is controlled by manual switches, but a few smaller rooms have occupancy sensors. Exterior lighting is high pressure sodium fixtures that are controlled by a time clock.

Plug load

Plug load includes, approximately 20 computers, a microwave oven, several printers and a large copier machine.

Schlessman Family Library (100 Poplar St)

General Conditions

Schlessman Family Library was built in 2002 and is 14,884 sqft. It is a two-story building, with a basement housing the mechanical equipment. In 2013, consistent with our baseline utility data, the library was open 10:00am – 8:00pm Monday and Wednesdays, 10:00am – 6:00pm Tuesday and Thursday, Closed on Friday, 9:00am – 5:00pm on Saturdays, and 1:00pm – 5:00pm Sundays.

Envelope

Construction is mostly aluminum panels with some red brick and a flat roof. There is a large amount of window area but it is all double pane.

HVAC

The library is served by a 24,000 CFM Carrier variable air volume AHU with 20 zones with hot water reheat, built in 2002. The supply fan is 25 HP and the return fan is 15 HP, both are 91.7% efficient. The AHU has a hot water coil for heating and DX cooling built in. The unit is capable of economizer operation. When not in economizer mode and during occupied periods the OA damper modulates from 20% to 100% and is used to maintain a mixed air temperature, presently set to 55F. On average the OA damper is open 56%. Presently the return fan is set to 50% capacity to address a pressure issue in the building. The supply fan is modulating between 57%-63%.

Heating is provided by a single 1,000 MBH Patterson-Kelley N-1200 non-condensing boiler assumed to be the original (2002) boiler. The boiler is rated at 85% efficiency. There are also hot water fin-tube and unit heaters around the perimeter of the building.

Cooling is provided by the AHU's integral 64-Ton DX cooling section. The condenser unit is mounted on the roof and has a rated efficiency of 10.5 EER. This is a two stage condenser.

The building HVAC is controlled by an Andover BAS system with the operator controls located at the Central Library. Only room temperature sensors with no user adjustable parameters are available in the building. These controls include equipment scheduling/setbacks.

DHW

The DHW heater is a 48 gallon gas unit with a DHW recirculation pump and loop. The pump is scheduled on and off on the BAS.

Lighting

Interior lighting is a mix of T-8 4" bulbs and T5 bulbs. The lighting is scheduled on the BAS. Exterior lighting is a mix of met halide and high pressure sodium fixtures that are controlled by a time clock.

Plug load

There are approximately 40 computers and monitors, 2 copiers, one microwave oven, one refrigerator, one TV, a soda machine and a snack machine. There is also an elevator.

Recommendations

Overview

Ameresco evaluated many energy conservation measures (ECMs) that can be implemented to reduce energy usage, improve occupant comfort, and provide more modern and maintainable facilities for CCD. The table below displays the recommended ECMs that were selected for inclusion in the final project scope.

Table 21: Energy Conservation Measures

ECM #	1	2	3	4	5	6	7	8	9	10	11
Facility / Measure	Interior Lighting System Improvements	Exterior Lighting System Improvements	Lighting Controls	Energy Management Control System Upgrades	Pump Improvement Measures	Pipe and Equipment Insulation	Vending Machine Controls	Pool Covers	Building Envelope Measures	Transport Gas	Education Program & Live Energy Monitoring
Fire Station#1(HQ)	X	X		X		X			X		X
Fire Station #8	X	X		X		X			X		X
Fire Station #9	X	X									X
Police District #1	X	X		X		X	X			X	X
911 Call Center	X	X	X	X		X			X	X	X
Ashland Pool	X	X	X		X		X	X	X	X	X
Ashland Rec Ctr	X	X					X		X		X
Glenarm Rec Ctr	X	X	X		X	X	X	X	X		X
Scheitler Rec Ctr	X	X				X			X		X
Twentieth Street Rec Ctr	X	X		X	X		X		X		X
Barnum Library	X	X		X					X		X
Bear Valley Library	X	X	X	X					X		X
Eugene Field Library	X	X	X	X					X		X
Schlessman Family Library	X	X	X	X					X		X

The following pages describe each of the energy conservation measures. A detailed evaluation has been performed for the measures that were selected for the final project scope.

Energy Conservation Measures

ECM #1 - Interior Lighting System Improvements

Ameresco recommends a lighting retrofit to replace remaining inefficient lighting with new high efficiency lighting. Lighting levels for each space shall be evaluated and new lighting levels adjusted as necessary to insure adequate light is being provided. This measure is a blend of the retrofits listed below. Logic for upgrades is based on payback, maintenance, case-by-case scenarios and aesthetics (not mixing two types in one area).

Primary measures included in this ECM:

- Existing pin-based / ballasted compact fluorescents were not addressed due to long paybacks and limited options
- Replace 32w T8 lamps and ballasts with Low Wattage, 28w, extra-long life T8 lamps and high-efficiency electronic ballasts
- Replace T12 lamps and older generation ballasts with T8s (2' and 3') or 4' Low Wattage, 28w, extra-long life T8 lamps and high-efficiency electronic ballasts
- Use reflector technology to reduce the quantity of lamps per fixture where deemed appropriate
- Eliminating all 8' lamps wherever they existed by using conversion kits and installing 4' lamps
- Retrofit parabolic style troffers with volumetric style retrofit kits to make better use of the light that is produced from the lamps
- Replace 4' and 2' fluorescent lamps and ballasts with LED tubes that are powered by an external driver (low voltage at the sockets and cannot be re-lamped with fluorescent)
- Replace 3' fluorescent lamps and T8s and high-efficiency electronic ballasts (LED is not a good solution for this fixture type
- Utilize LED kits to upgrade troffers; providing a volumetric, high efficiency and modern look
- Utilize LED strip-style kits to eliminate 8' lamps
- Replace incandescent and screw in CFL lamps with screw in LED replacement lamps
- Use LED replacement lamps or recessed can kits to replace large wattage screw in CFL lamps
- Where integrated emergency drivers are not available, egress bug-eye lamps will be installed on a nearby wall

Table 27: Facilities Included in Interior Lighting System Improvements Measure

Facility	Measure Details
Fire Station #1 HQ	See Attachment B for detailed room by room retrofits
Fire Station #8	
Fire Station #9	
Police District #1	
911 Call Center	
Ashland Pool	
Ashland Rec Center	
Glenarm Rec Center	
Schleitler Rec Center	
Twentieth Street Rec Center	
Barnum Library	
Bear Valley Library	
Eugene Field Library	
Schlessman Family Library	

ECM #2 - Exterior Lighting System Improve

The proposed measures for building exteriors all utilize LED technology. The options for exterior lighting are many, the hours of operation tend to be over 4,000 per year which helps the paybacks, and the technology excels in efficacy for nighttime illumination.

Primary measures included this ECM:

- Decorative HID fixtures are retrofitted to retain aesthetic style
- Existing HID wall mounted fixtures are replaced with new night-sky friendly LED wall packs
- Existing pole / parking lights are replaced by new night-sky friendly LED shoe-box style fixtures
- Existing HID floods are replaced by new LED flood fixtures
- Existing HID Canopy fixtures are replaced by new LED canopy fixtures
- Existing pin-based CFL fixtures are left as-is

Table 28: Facilities Included in Exterior Lighting System Improvements Measure

Affected Facility	Measure Details
Fire Station #1 HQ	See Attachment B for detailed room by room retrofits
Fire Station #8	
Fire Station #9	
Police District #1	
911 Call Center	
Ashland Pool	
Ashland Rec Center	
Glenarm Rec Center	
Schleitler Rec Center	
Twentieth Street Rec Center	
Barnum Library	
Bear Valley Library	
Eugene Field Library	
Schlessman Family Library	

ECM #3 - Lighting Occupancy Sensors

This measure consists of installing infrared and/or ultrasonic lighting occupancy sensors in most office and high use spaces to reduce the amount of energy consumed by automatically turning off the lights during times when the space is unoccupied (lunch breaks, meetings, week nights, and weekends). The lights will automatically be turned back on whenever occupancy is sensed within a space.

Primary measures included this ECM:

- Wall switch sensors where switched loads were unobstructed and hours of operation were significant enough to warrant usage reduction
  - Wall switch sensors used were Passive Infrared, Dual Technology, wireless PIR, and PIR 2-pole
- Ceiling mounted sensors where the rooms are larger, have multiple zones or the switches are obstructed / missing
  - Ceiling mounted sensors used were Passive Infrared, Dual Technology, wireless PIR, and PIR 2-pole
- Photo-controls are specified for interior areas where large lighting loads can be extinguished due to ambient daylight in that space.
- Fixture mounted photocells are used in new exterior fixtures where the existing had a fixture-mounted photocell

Table 29: Facilities Included in Lighting Controls Measure

Affected Facility	Measure Details
911 Call Center	A detailed description of the occupancy sensor scope for each building can be found in Attachment B.
Ashland Pool	
Glenarm Rec Center	
Bear Valley Library	
Eugene Field Library	
Schlessman Family Library	

Impact on Facilities

The occupancy sensors have the potential to extend lamp and ballast life where installed. However, they will add another component and another layer of complexity to the existing systems, thus potentially adding to the maintenance burden of the staff. The new occupancy sensors will be fully compatible with the existing systems.

ECM #4 – Energy Management Controls System Optimization

Many of the present facilities have outdated or failing controls that are not optimizing their HVAC systems. Most of these on-site control systems cannot be accessed remotely; thus all monitoring and programming must currently be on-site. Ameresco recommends the installation of a web based building control system to help reduce energy use, provide a more comfortable environment, reduce service calls and reduce fuel used driving to and from the sites for service calls. Additionally changing how the system functions and including new conservation strategies will further reduce energy use. A list of strategies is provided below along with an explanation of what is recommended for each building.

- **Equipment Scheduling/Setback**: by utilizing an hour calendar to turn equipment on/off based on time of day, day of week, holidays and outdoor air conditions, equipment can be programmed to operate in an unoccupied mode. During unoccupied periods, supply and return fans can be turned off, outdoor air dampers closed and temperatures setback

- **Optimal start/stop:** this control will determine the length of time required to bring each zone from an unoccupied set point to the occupied set point temperature

- **Lockouts**: programing to ensure equipment doesn't turn on unless required

- **Demand Controlled Ventilation (DCV):** Fresh outside air is needed for proper indoor air quality. However, the amount required depends on the number of occupants at any given time. Typical systems use a fixed amount of ventilation air, which is sized for the maximum number of occupants. Conditioning this amount of air is energy intensive. Demand Controlled Ventilation provides only the precise amount of fresh air needed at any given time, thereby reducing energy use. A sensor will monitor the level of CO2 and adjust the amount of ventilation accordingly.

- **Exhaust Fan Controls**: Some restroom exhaust fans appear to be operating constantly. This uses excess electricity and causes an unnecessary load on the HVAC system providing the conditioned make-up air to these rooms. These exhaust fans will be interlocked with lighting occupancy sensors or placed on schedules to only operate when occupied.

- **Supply Air Temperature Reset**: This strategy resets the supply air temperature (SAT) set point for a VAV air handling unit. The intent of the control strategy is to adjust the discharge air temperature up and down in order to more effectively satisfy actual loads within the spaces. This control strategy has the potential to minimize the heating, cooling, and pumping energy associated with the conditioned air delivered to each zone during less-than-designed operating conditions.

- **Duct Pressure Reductions:** for VAV systems, there is an opportunity to reduce duct static pressure settings and thereby reduce the amount of fan energy being used. One way to do this is to implement a critical zone reset. The static pressure set point is continually adjusted (reset) so that at least one terminal unit in the system—the terminal unit serving the critical zone - is wide open. Another method is to simply reduce the set point during unoccupied modes.

- **Economizer:** An economizer provides free cooling any time the outdoor temperature is below the required system supply temperature. The outdoor air damper modulates to the 100% outdoor air position as the outdoor air temperature approaches the required supply air temperature.

- **Recommissioning**: Over time, HVAC systems become out of adjustment, resulting in improper operation and excess energy use. Re-commissioning of these systems can have benefits even after one year of operation. A Re-commissioning study will be performed and recommended equipment operation changes will be reported before any action is taken.

- **Conversion from Hot Deck/Cold Deck, Constant Volume (CV) to Variable Air Volume (VAV):** In a CV system, when the supply fan is on, a constant amount of air flows through; and there is no modulation of the fan power. Different zones are satisfied by providing both heated and cooled air to a mixing box where dampers will be modulated to meet the zone load. Alternatively, a VAV systems works by modulating the airflow through zone boxes with a single modulating damper. As loads in various zones of the building change; the amount of air changes meet the demand. For example, if more cooling in an area is required - the damper to that area is opened wider - increasing the flow of cold air until the desired temperature is reached. As the damper opens, static pressure in the duct drops, signaling the fan to increase air delivery. Conversely in this same example, if an area is too cool, the damper is slowly closed, reducing the flow of cold air. Used in combination with variable-speed drives (VSD), this reduction in flow results in a reduction in the fan power needed, thus saving energy. Converting an existing constant-volume system to a VAV system allows the system to turn itself down in response to changing demand. VAV strategies offer much more efficient designs that can handle changing load requirements, while avoiding simultaneous heating and cooling and reduces fan power requirements.

Set points

Although all devices shall have modifiable heating and cooling set points, the following guide shall be used to establish the initial temperature set points for all HVAC controls systems:

Occupied Heating Set point	72°F (Adjustable from 68°F to 74°F minimum)
Occupied Cooling Set point	75°F (Adjustable from 74°F to 78°F minimum)
Unoccupied Heating Set point	60°F (Adjustable from 55°F to 65°F minimum)
Unoccupied Cooling Set point**	90°F (Adjustable from 85°F to 100°F minimum)
Economizer Cooling Set point	65°F (Adjustable from 60°F to 70°F minimum)
Mechanical Cooling Set point	65°F (Adjustable from 85°F to 100°F minimum)
Unoccupied Cooling Lockout Set point	80°F (Adjustable from 75°F to 85°F minimum)
Electric Baseboard OAT Set point	40°F (Adjustable from 30°F to 50°F minimum)
Duct Static Supply Pressure	¾"WC (Adjustable from ½"WC to 1.5"WC minimum)
CO2 Set point	900PPM (Adjustable from 400PPM to 1,000PPM minimum)
Damper Minimum Position Set point	Fully Closed

** Unoccupied Cooling Set point is not applicable to server rooms or other areas were 24/7 cooling is required.

Table 30: Facilities Included in Energy Management Control System Upgrades Measure

Affected Facility	Measure Details
Fire Station #1 HQ	For the headquarters office space; Program the existing thermostats for setback during the unoccupied period (see set point table above).
Fire Station #8	For the hot deck, cold deck AHU; Convert to VAV system, and implement heating and cooling equipment lockout, DCV, and economizer. As part of this conversion a new DX system will be provided that will increase the efficacy of the cooling system.
Police District #1	For RTU-1 through 4; Recommissioning, DCV, and reset the duct pressure using critical zone reset. For the second floor; equipment scheduling will be implemented. For this to be fully implemented, this floor should remain unoccupied other than M-F from 6am to 6pm.
911 Call Center	For both RTU 1 and 2; Recommissioning, DCV, and resetting the duct pressure during unoccupied time. For the first floor; equipment scheduling with setbacks will be implemented. For this to be fully implemented, this floor should remain unoccupied other than M-F from 6am to 6pm.
Twentieth Street Rec Center	Installation of a new web based EMCS (hardware and software) would control and monitor one (1) multi-zone air handler, one (1) packaged rooftop unit, one (1) pool MAU unit, and four (4) exhaust fans. The equipment serves various areas at Twentieth Street Recreation Center. Wall mounted thermostats, and time clocks currently serving the HVAC units should be removed and a new remote web based EMCS will be installed. Additionally, DCV, economize, and more aggressive setback scheduling would be implemented.
Barnum Library	RTU 1: Convert the existing hot deck, cold deck system into a VAV system, This would include seasonal lockouts of the heating and cooling systems, supply temperature resets, optimal morning warm-up, temperature set-backs and DCV controls.
Bear Valley Library	For RTU 1; reset unoccupied set back temperatures and implement DCV.
Eugene Field Library	For RTU 1; Installation of a new web based EMCS (hardware and software) and convert the existing hot deck, cold deck system into a VAV system. This would include seasonal lockouts of the heating and cooling systems, supply temperature resets, optimal morning warm-up, scheduled with setback, and DCV.
Schlessman Family Library	For AHU 1: Recommission the existing VAV system to allow zone boxes to close to a minimum position and both return and supply fans ramp down when space conditioning requirements are met, in addition, DCV would be implemented. Also set economizer sequence to more aggressive set point.

ECM 5 - Pump Improvement Measures

The circulation pumps for commercial pools are sized to pump the required volume of water in a "worst case scenario." Typically this is when the filters are clogged. For the majority of its life, the pump is oversized and circulating more water than necessary. This leads to excessive filter use and wear.

Installing a variable frequency drive (VFD) controlled by a flow meter, will allow the speed of the motor to adjust to changes in the system pressure while maintaining a constant flow rate. This reduction in speed, when the filter is not clogged, will reduce energy use, filter wear and will reduce the frequency of filter maintenance. The VFD will include an alarm to indicate that the filter needs to be cleaned, further improving energy savings by reducing the amount of time the pump is at its maximum speed.

Ameresco recommends fully opening the manual hand valves and installing a variable frequency drive (VFD) on each of the pumps identified in this measure. The VFDs will be controlled by a flow sensor that will be placed at the proper distance downstream of the pump. The VFDs will modulate the pumps to maintain the proper flow rates through the systems. Opening the hand valves and reducing the speed of the pumps will result in the same flow rates through the systems but reduce energy consumption by the pumps and reduce stress on the pumps.

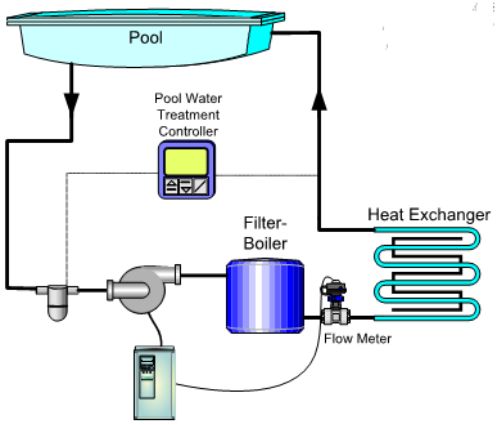


Diagram provided by Yorkland Controls, Environmental Solutions

Table 31: Facilities Included in Pump Improvement Measures

Affected Facility	Measure Details
Ashland Pool	Installation of two (2) VFDs, one on the leisure and one on the lap pool pump.
Glenarm Rec Center	Installation of one (1) VFD will control the lap pool pump.
Twentieth Street Rec Center	Installation of one (1) VFD will control the lap pool pump.

ECM #6 – Pipe and Equipment Insulation

Ameresco has identified, in several facilities, pipes and equipment that are not properly insulated. Uninsulated piping and equipment is a constant source of energy loss. The primary function of insulation is to reduce the loss of energy from a surface that is at a temperature other than ambient. Insulating piping on a hot water system is relatively inexpensive and can reduce energy losses by a range of 90% to 100%.

All new pipe insulation shall be installed on bare pipe and fittings, however, existing pipe insulation shall be replaced in several locations where past leaks have saturated and deteriorated the existing insulation. Insulation shall be Owens Corning Fiberglas SSL II pipe insulation or equal with thicknesses as follows:

- Pipe sizes 1" & smaller shall have 1" thick insulation (R-value 4.35 at 75*F mean temperature).
- Pipe sizes 1.25" to 3"shall have 1.5" thick insulation R-value 6.25 at 75*F mean temperature).
- Insulation shall be rigid, preformed fiberglass, (flame spread)/ (smoke developed) rating 25/50, with foil/scrim/kraft white all-service jacket (ASJ) having 25/35 rating.

Table 32: Facilities Included in Pipe and Equipment Insulation Measure

Affected Facility	Measure Details
Fire Station #1 HQ	Ameresco proposes to install new fiberglas insulation on domestic hot water, heating hot water and chilled water pipe and equipment that is not insulated or where the insulation is damaged. For triple duty valves, pump volutes, air separators, and expansion tanks, Ameresco will install an insulating blanket material having Velcro attachment strips.
Fire Station #8	Ameresco recommends installing new fiberglas insulation on domestic hot water, heating hot water and chilled water pipes and equipment that is not insulated or where the insulation is damaged; in Fire Station #8 this will apply to the 1.5" domestic hot water pipe.
Police District #1	Ameresco proposes to install new fiberglas insulation on domestic hot water, heating hot water and chilled water pipe and equipment that is not insulated or where the insulation is damaged for the 2" domestic hot water pipe. For triple duty valves, pump volutes, air separators, and expansion tanks, Ameresco will install an insulating blanket material having Velcro attachment strips. This will include the two hot water pumps, two chilled water pumps, hot water pump flex couplings, triple duty valves, and the suction fittings.
911 Call Center	Ameresco proposes to install new fiberglas insulation on domestic hot water, heating hot water and chilled water pipe and equipment that is not insulated or where the insulation is damaged. For triple duty valves, pump volutes, air separators, and expansion tanks, Ameresco will install an insulating blanket material having Velcro attachment strips. Insulation will be installed on the 1.5" domestic hot water pipe, and an insulating blanket on the heating hot water air separator, expansion tank, pump volute and flexible connection.
Glenarm Rec Center	Existing hot water pipe is missing insulation in mechanical rooms and will be insulated.
Schleitler Rec Center	Existing hot water pipe is missing insulation in mechanical rooms and will be insulated.

ECM #7 – Vending Machine Power Savers

Ameresco recommends installing occupancy sensors on existing vending machines. After a defined period of occupant inactivity in the vicinity of the machine, the controller sends the machine to a powered-down state which turns off the light and limits compressor use. Refrigerated vending machines are programmed to cycle the compressor regardless of detected motion to ensure that the products are kept at the desired temperature.

The vending machine occupancy sensors will reduce electricity consumption and utility costs by only cooling the product during periods of occupancy. Under this proposed measure, vending machine power savers would be installed in the following locations.

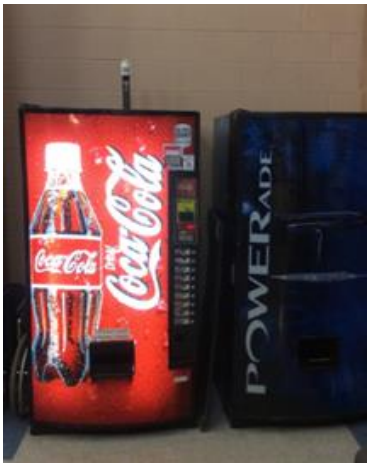
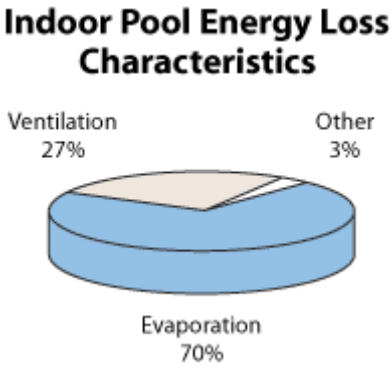


Table 33: Facilities Included in Vending Machine Controls Measure

Affected Facility	Measure Details
Police District #1	Installation will include (1) one vending machine controls for machines in the recreation room.
Ashland Pool	Installation will include (1) one vending machine control for the machine in the lobby.
Ashland Rec Center	Installation will include (2) two vending machine controls for machines in the recreation room.
Glenarm Rec Center	Installation will include (5) five vending machine controls for machines in the recreation room.
Twentieth Street Rec Center	Installation will include (1) one vending/arcade machine controls for machines in the recreation room.

ECM #8 – Pool Covers

Excerpt from http://energy.gov/energysaver/articles/swimming-pool-covers



Swimming pools lose energy in a variety of ways, but evaporation is by far the largest source of energy loss. Evaporating water requires tremendous amounts of energy. It only takes 1 Btu (British thermal unit) to raise 1 pound of water 1 degree, but each pound of 80ºF water that evaporates takes a whopping 1,048 Btu of heat out of the pool.

Indoor pools aren't subjected to the environment, but still lose a lot of energy from evaporation. Additionally, conditioned room ventilation to control indoor humidity caused by the large amount of evaporation, is necessary, which adds to the overall energy costs.

Pool covers minimize evaporation from indoor pools. Covering a pool when it is not in use is the single most effective means of reducing pool heating costs. Savings of 50%–70% are possible.

Pool covers on indoor pools not only can reduce evaporation but also the need to ventilate indoor air and replace it with unconditioned outdoor air. Exhaust fans may also be shut off when an indoor pool is covered, saving even more energy.

Other Pool Cover Benefits

Besides offering energy savings, pool covers also do the following:

- Conserve water by reducing the amount of make-up water needed by 30%–50%
- Reduce the pool's chemical consumption by 35%–60%
- Reduce cleaning time by keeping dirt and other debris out of the pool

Table 34: Facilities Included in Pool Covers Measure

Affected Facility	Measure Details
Ashland Pool	A new pool cover system will be installed on the lap pool. Additional equipment will be located in the pool space and includes cover, mounting hardware, motor, cables and electrical controller.
Glenarm Rec Center	The existing pool covers and associated systems will be replaced including the cover, mounting hardware, motor, cables and electrical controller.

ECM #10 – Building Envelope

Air leakage is defined as, "the uncontrolled migration of conditioned air through the building envelope". Caused by pressure differences due to wind, chimney (or stack) effect and mechanical systems, air leakage is the single largest source of heat loss or gain through the building envelopes of nearly all types of buildings. Beyond representing potential for energy savings; uncontrolled air leakage can affect thermal comfort of occupants, air quality through ingress of contaminants from outside and the imbalance of mechanical systems and the structural integrity of the building envelope through moisture migration.

Control of air leakage involves the sealing of gaps, cracks and holes using appropriate materials such as fire retardant, polyurethane foam, caulking materials and appropriate weather stripping materials. The goal is to create a continuous plane of "airtightness" to completely encompass the building envelope; including the need to "decouple" floor-to-floor and to "compartmentalize" components of the building in order to equalize pressure differences.

Additionally, Fire Station 8 and 20th Street Recreation Center do not have adequate insulation in their attic spaces. Blown cellulose insulation will be installed to achieve an insulation value of R-30.

Table 35: Facilities Included in Building Envelope Measures Measure

Facility	Measure Details
Fire Station #1 HQ	• Over-head door(s) to be sealed on 3 sides • Exterior door(s) to be weather-stripped & sealed • Interior isolation doors for equipment bay
Fire Station #8	• Over-head door(s) to be sealed on 3 sides • Exterior door(s) to be weather-stripped & sealed • Interior isolation doors for equipment bay • Attic insulated above conditioned space (not including equipment bay)
911 Call Center	• Exterior door(s) to be weather-stripped & sealed • Glass block windows sealed
Ashland Pool	• Exterior door(s) to be weather-stripped & sealed • Interior isolation doors for natatorium
Ashland Rec Center	• Exterior door(s) to be weather-stripped & sealed • Roof-Roof joint sealed • Interior isolation door for natatorium
Glenarm Rec Center	• Exterior door(s) to be weather-stripped & sealed • Interior isolation doors for natatorium
Schleitler Rec Center	• Exterior door(s) to be weather-stripped & sealed • Interior isolation doors for natatorium
Twentieth Street Rec Center	• Exterior door(s) to be weather-stripped & sealed • Seal interior isolation door for natatorium • Attic hatch to be sealed • Attic insulated above conditioned space (not including equipment bay)
Barnum Library	• Exterior door(s) to be weather-stripped & sealed
Bear Valley Library	• Exterior door(s) to be weather-stripped & sealed
Eugene Field Library	• Exterior door(s) to be weather-stripped & sealed
Schlessman Family Library	• Exterior door(s) to be weather-stripped & sealed

ECM #11 – Transport Gas

Presently CCD is receiving natural gas from Xcel Energy at their standard rate for most of the locations included in this report. Historically, this has not been the most advantageous rate. Ameresco recommends moving three of these buildings to transport gas using the existing umbrella contract with CenterPoint Energy, Inc and Internal Technical Services.

Table 36: Facilities Included in Transport Gas Measure

Facility	Measure Details
Police District #1	Ameresco proposes to make the needed changes to the gas meters and facilitate a contract for this building to purchase competitive gas
911 Call Center	
Ashland Pool	

The price and inclusion of the 911 Call Center, in this ECM, assumes that the needed phone line can be provided from the Denver Water building.

ECM #12 – Education Program and Live Energy Monitoring

Ameresco will partner with CCD to reduce its carbon footprint. As the Denver Public Library Energy Reduction Pilot has proven, the small things can make a big difference. To implement an appropriate plan per building, they have been grouped as follows:

- Libraries
- Recreation Centers
- First Responder Facilities

Developing a program for each group will also depend on the ECM's selected by CCD for their facilities. For example, if occupancy sensors and lighting controls are accepted, librarians bear little to no responsibility for turning on and off lights in rooms and areas of the building. While this includes a financial expenditure for installation, it is a failsafe system for reducing energy usage through excess lighting. However, energy-educated staff can still make changes to utilize day lighting or task lighting when appropriate, further reducing electrical loads.

Program Goals

There are many consultants and programs in the marketplace today to develop behavioral strategies. They include web-based dashboards, inter-building competitions, signage, newsletters, webinars, and engagement meetings. While all of these items have value, Ameresco feels there is only one solid way to incorporate and maintain a behavioral modification program—to **develop an owner-approved program that can easily be integrated into the facility staff's existing habits and behaviors. It is critical that no matter what behaviors are implemented, they be feasible and long-term.** To achieve the, Ameresco suggest the following steps:

Table 37: Facilities Included in Education Program & Live Energy Monitoring Measure

Task	Responsibility
Designate an energy champion overall and for each building group	CCD
Initial walkthrough of buildings	Ameresco
Develop questionnaires for each facility	Ameresco
Fill out questionnaires	CCD
Meeting with behavioral consultant, each building group champion, and one building representative to discuss survey information (2 hours per building)	Ameresco / CCD
Meeting with CCD to determine program publicity	Ameresco / CCD
Development of behavioral plan for each facility	Ameresco
Review plan with CCD representatives, energy champions, etc.	Ameresco / CCD
3 month follow-up	Ameresco / CCD
6 month follow-up	Ameresco / CCD
12 month follow-up	Ameresco / CCD
Program publicity, signage, materials, events, etc.	Ameresco / CCD

Example Modifications

Ameresco has found that the most successful measures are those that the staff is able to manage and implement in a logical, operational fashion. Our Behavioral Consultant will develop items *with* the occupants, in lieu of simply providing them with a list and reminders. These measures will become *business as usual* at the CCD facilities. Some examples include:

- Rec Center work out rooms: In addition to equipment used wiping down equipment after use, they must also unplug them
- After making coffee, coffee makers will be shut off and unplugged and insulated carafes used in break rooms
- Fire houses will utilize one device-charging station for each occupant to utilize at scheduled times (or when not utilized) this will be unplugged when not in use
- Librarians will schedule evening activities, such as meetings, in the same heating/cooling zone in one large block of time during peak heating and cooling season
- Each building will have evening "closers" also be responsible for unplugging large plug-load items. The facility staff will develop this procedure and schedule
- Firehouses will utilize power strips for large plug-load items that can easily be turned off by one switch when exiting for a call
- Energy Champions will evaluate any dashboard or other energy data for HVAC during peak seasons, and electricity during peak times each day, to determine where energy loss greatest and can be addressed

These are just examples of the items that can be discussed with the facility representatives to determine the feasibility and logistics of measures specific to their facility type and usage. Not simply one large list of "best practices" distributed to all buildings or posted signs.

Additional Considerations

As determined by CCD, Ameresco is available to discuss and possibly develop any of the following materials or provide support for the following activities (at cost):

- Program visibility (internally and externally)
- Kick off events
- Long-term momentum
- Signage, printed materials
- Inter-building competitions

Please note that these items are not included in the scope and cost of this measure.

Ameresco is confident that our "hands-on" approach to a partnership with each facility is the most effective way to create a program that will benefit the building as a non-depreciating measure, and also limit the amount of actual *change* to its occupants.

Seldera Building Dynamics (http://www.seldera.com/building-dynamics)

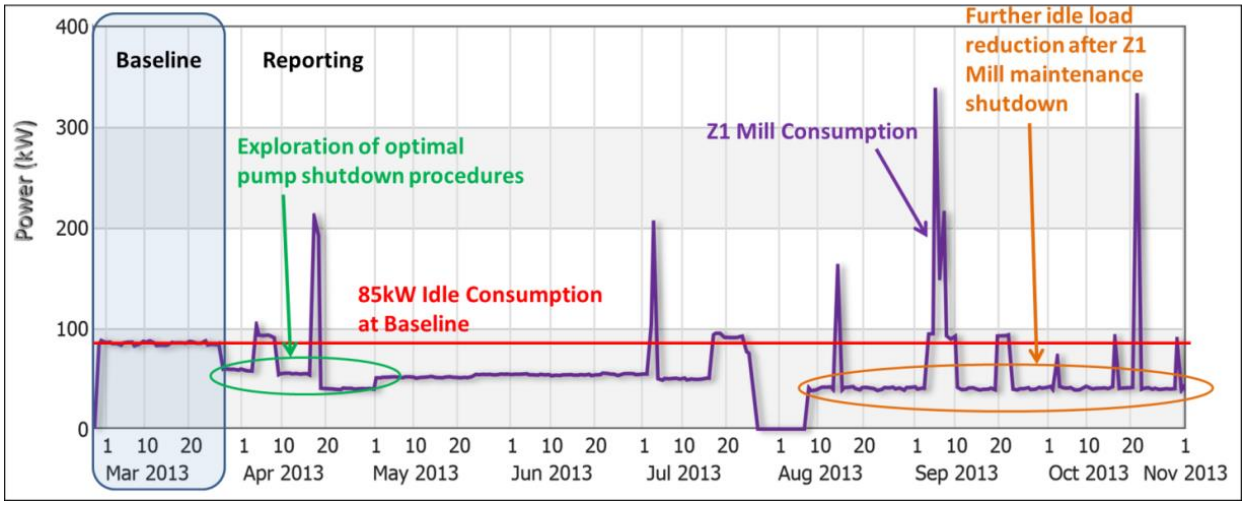
Seldera is a technology-oriented energy services company specializing in information-driven energy efficiency. Its technology focuses on the discovery of energy saving opportunities through the analysis of historical billing data, interval data and more detailed behind-the-meter data from building automation systems, sub-meters and sensors.

Building Dynamics, Seldera's core product, is based on a suite of online analytics also supported by a versatile wireless network of wireless sub-meters and sensors. Seldera's sensing and metering infrastructure can be quickly installed in buildings on a short-term or long term basis. It is used to identify savings using advanced analytics in load disaggregation, occupant behavior and correlative analysis between energy uses and load usage schedules. Seldera offers services to utilities and energy services companies including:

- Sub-metering and energy analysis
- Building automation system data-point analysis
- Software-driven retro-commissioning
- Alarms when pre-set thresholds are exceeded
- Energy analysis and measure identification in commercial, academic and industrial buildings

An example before/after summary plot from the characterization of ECMs in industrial processes is summarized below.

Sample summary plot from Building Dynamics
showing base lining on the first few days followed by ECM implementation



This service is not intended to be used for the verification of guaranteed savings associate with the performance contract. It is a tool for CCD to monitor and improve on energy use beyond the impact form the performance contract.

3-Year Plan for Education Program and Live Energy Monitoring

Each year, Ameresco will continue to provide behavioral support and live energy monitoring to CCD's facilities. This support is necessary for the following reasons:

- Staff and personnel changes can result in lack of knowledge for new employees
- Equipment changes can affect plug load and ultimately energy usage
- Schedules, occupancy flows and peak energy usage times can fluctuate
- Equipment can malfunction or control sequences can be overwritten

These and other factors can all cause behavioral practices to change, resulting in less effective practices for each facility. Ameresco has developed the following tasks to be implemented during the first three years, post implementation to maintain consistent and possibly increased levels of savings for CCD. Tasks during the post implementation period include:

- Walkthrough of each facility, documenting changes to equipment
- Interviews with building staff to document occupancy and schedule changes
- Re-training/updating key personnel regarding procedures and best practices
- Provision of training (as desired) for new personnel
- Introduction of new strategies and ideas
- Annual subscription to Building Dynamics
- Utilize Building Dynamics dashboard to analyze peak usage times and changes to peaks
- Summary document of the status of each facilities Behavioral Strategies bi-annually

ECMs Evaluated but Not Selected

In addition to the ECMs listed above, several energy conservation measures have been studied as part of this Technical Energy Audit effort. These measures have been evaluated, but are not recommended due to poor economic return, project size limitations or were removed from scope upon instruction from CCD. Below is a table identifying these measures by location and a more specific explanation of why they were excluded.

Table 38: Measures Evaluated but Not Selected

Facility / Measure	Lighting Controls	Energy Management Control System Upgrades	Energy Star Appliance	Fan VFDs	Pump Improvement Measures	Replace Heating Boilers	HVAC Unit Replacement	Premium Efficiency Transformers	Plug Load Control	Replace Pool Boilers	Pool Covers	Pool Ozone Water Treatment	Solar Pool Heating	Solar PV Array	DWH Replacement	Building Envelope Measures	Water Conservation Plumbing Measures	Electric to NG Conversion	Replace Windows	Transport Gas	Natatorium Airflow Reduction
Fire Station#1(HQ)	X					X	X							X	X					X	
Fire Station #8	X		X				X							X	X		X		X		
Fire Station #9	X		X											X		X	X	X			
Police District #1	X			X	X	X		X						X		X	X				
911 Call Center					X	X								X	X		X				
Ashland Pool		X										X	X	X							X
Ashland Rec Ctr	X						X							X							
Glenarm Rec Ctr		X				X	X			X		X	X	X						X	X
Scheitler Rec Ctr	X	X			X	X	X					X	X	X						X	X
Twentieth Street Rec Ctr	X						X			X	X	X	X	X							X
Barnum Library	X								X					X							
Bear Valley Library									X					X	X						
Eugene Field Library									X					X							
Schlessman Family Library						X			X					X							

Interior & Exterior Lighting System Improvements

Several solutions for this measure were considered including an all LED solution. The all LED solution was originally proposed because it provided substantial savings, consistency throughout the buildings, and demonstrated a clear dedication to energy efficiency that can be appreciated by the public. At final development the cost for this measure increased with the consideration of wage and manufacture requirements resulting is solutions that were not cost effective.

Lighting Controls

For the indicated locations, this measure was removed from scope because of expected longer payback and project size restrictions.

Energy Management Control System Upgrades

Excluded based on the ages of the equipment and its functionality (for example heating and ventilation units with no mechanical cooling), limited savings opportunity and long simple paybacks. Thus, these buildings were not included in the recommended project.

Energy Star Appliances

This measure was removed from the project because the department will self-implement through its routine replacement of existing washers and dryers with energy star products.

Fan VFDs

For the indicated locations, this measure was removed from scope because of longer payback and project size restrictions.

Pump Improvement Measures

For the indicated locations, this measure was removed from scope because of longer payback and project size restrictions.

Replace Heating Boilers

For the indicated locations, this measure was removed from scope because of longer payback and project size restrictions.

HVAC Unit Replacement

New HVAC units at the identified locations were removed from scope because of longer payback and project size restrictions. For Fire Station #8 the scope was changed from installing a new unit, to modifying the existing unit for the same financial reasons and for expected logistical difficulties with installing a new unit. This measure was re-evaluated as a renovation of the existing unit and included under energy management controls system upgrade.

Premium Efficiency Transformers

This measure was removed from scope because of longer payback and project size restrictions.

Plug Load Control

For the indicated locations, this measure was removed from scope because of longer payback and project size restrictions. This is primarily due to the hibernate mode for which the library copy machines are equipped.

Replace Pool Boilers

For the indicated locations, this measure was removed from scope because of longer payback and project size restrictions.

Pool Covers

For the indicated locations, this measure was removed from scope because of longer payback and project size restrictions.

Pool Ozone Water Treatment

This measure was removed from scope upon request from the CCD aquatic director. CCD has explored this technology in the past with less than desirable results.

Solar Pool Heating

This measure was removed from scope upon request from the CCD parks and recreation director. CCD has explored this technology in the past with less than desirable results. It was also determined that pool covers were a more desirable solution.

Solar PV Array

For the indicated locations, this measure was removed from scope because of longer payback and project size restrictions.

DWH Replacement

For the indicated locations, this measure was removed from scope because of longer payback and project size restrictions.

Building Envelope

For the indicated locations, this measure was removed from scope because of longer payback and project size restrictions.

Water Conservation Plumbing

For the indicated locations, this measure was removed from scope because of longer payback and project size restrictions.

Electric to NG Conversion

For the indicated locations, this measure was removed from scope because of longer payback and project size restrictions.

Replace Windows

For the indicated locations, this measure was removed from scope because of longer payback and project size restrictions.

Transport Gas

For the indicated locations, this measure was removed from scope because CCD does not feel that reliable savings will persist through the term of the contract.

Natatorium Airflow Reduction

For the indicated locations, this measure was removed from scope because humidity levels in these locations were an issue and reducing ventilation could exacerbate the problem.

Projected Energy Savings

Overview

For each energy conservation measure selected to be in the final project scope for CCD facilities, the associated reduction in energy consumption was determined using Whole Facility Energy Use models or individual spreadsheet-based energy calculations. TRACE® 700, an industry-accepted modeling program was used to create the whole building models. The overall reduction in energy consumption and corresponding cost savings for CCD is presented in this section of the report. The below utility rates were used to calculate cost savings.

Table 39: Electric Utility Rates Used in Savings Calculations

Electric	$/kW	$/kwh	Duration
Summer	$21.61	$0.041	June 1 - Sep 30
Winter	$18.17	$0.041	Oct 1 - May 31
Average	$19.32	$0.041	

All of these buildings are billed under the Xcel Energy Secondary General (SG) rate. The above rates were provided in the Public Service Company of Colorado, Electric Tariff Index, Sixty-fifth Revised, Sheet 20, July 25, 2014.

Demand is the maximum fifteen (15) minute integrated kilowatt demand used during the month. The Distribution Demand Charge is not less than fifty percent (50%) of the highest fifteen (15) minute measured demand occurring during the preceding eleven months. For simplicity, the average Demand rate was used in the savings calculation.

Table 40: Natural Gas & Water Utility Rates Used in Savings Calculations

Natural Gas	$/Therm	Provider
Twentieth Street Recreation Center	$0.549	CenterPoint
Glenarm & Scheitler Recreation Center	$0.583	CenterPoint
All Other Locations	$0.637	Xcel

Water & Sewer	Water $/kGal	Sewer $/kGal
Ashland Pool, Glenarm Recreation Center, and Scheitler Recreation Center	$1.84	$3.68
All Other Locations	$1.84	N/A

Natural gas, water & sewer rates were derived from historic use and costs. See the Utility Analysis section for more information.

Overall Energy Savings Summary

The tables below summarize the overall energy and cost savings for all buildings and all measures.

Table 41: Summary of Overall Energy Savings

#	ECM Savings - Units	kWh	kW	Therms	Water kGal	O&M
1	Interior Lighting System Improvements	325,601	1,283	(9,190)	-	$9,807
2	Exterior Lighting System Improvements	115,435	-	-	-	$3,408
3	Lighting Controls	10,645	-	-	-	$0
4	Energy Management Control System Upgrades	229,618	347	37,043	-	$3,240
5	Pump Improvement Measures	198,708	204	-	-	$0
6	Pipe and Equipment Insulation	-	-	2,298	-	$0
7	Vending Machine Controls	21,494	-	(578)	-	$0
8	Pool Covers	-	-	10,344	89.46	$3,813
9	Building Envelope Measures	10,585	-	5,344	-	$0
10	Transport Gas	-	-	-	-	$3,755
11	Education Program & Live Energy Monitoring	134,508	-	6,883	-	$0
	Total	**1,046,594**	**1,834**	**52,144**	**89**	**$24,023**

#	ECM Savings - Cost ($)	Elec	NG	Water/ Sewer	O&M	Total	Guaranteed
1	Interior Lighting System Improvements	$38,504	-$5,722	$0	$9,807	$42,590	$39,312
2	Exterior Lighting System Improvements	$4,864	$0	$0	$3,408	$8,272	$7,786
3	Lighting Controls	$449	$0	$0	$0	$449	$404
4	Energy Management Control System Upgrades	$16,386	$23,454	$0	$3,240	$43,080	$35,261
5	Pump Improvement Measures	$12,315	$0	$0	$0	$12,315	$11,084
6	Pipe and Equipment Insulation	$0	$1,408	$0	$0	$1,408	$1,408
7	Vending Machine Controls	$906	-$349	$0	$0	$556	$556
8	Pool Covers	$0	$6,228	$164	$3,813	$10,205	$9,911
9	Building Envelope Measures	$446	$3,192	$0	$0	$3,638	$3,638
10	Transport Gas	$0	$0	$0	$3,755	$3,755	$3,755
11	Education Program & Live Energy Monitoring	$5,668	$4,130	$0	$0	$9,799	$9,799
	Total	**$79,538**	**$32,342**	**$164**	**$24,023**	**$136,066**	**$122,913**

Whole Building Models

The whole facility models for CCD were calibrated to the utility bills received through December, 2014. The progressive whole building modeling process was performed by using each individual building's baseline model as the basis for calculating savings for the recommended energy conservation measures. All cost savings figures below were calculated using the utility rates listed above.

Hourly Model Details

Each building model was calibrated to the existing utility data as noted below. The baseline model was simulated to be within a MBE (Mean Based Error) of 5% of the annual electricity consumption (kWh), electrical demand (kW) gas consumption (therms) and within a 15% Coefficient of Variance as described in the FEMP (Federal Energy Management Program) M&V Guidelines: Measurement and Verification for Federal Energy Projects Version 3.0. In a few models, these calibration goals were not reached due to the limitations of the software to provide exact matches to baseline date. Further explanation on this topic is available upon request.

Baseline cooling and heating loads and existing energy usage were established using Trane Trace™ 700 building energy modeling software. Typical meteorological year weather data (TMY2) for Denver, CO was used, which was the closest available city. All equipment information and operating assumptions used to generate the building simulation models were collected through site visits, analysis of existing EMS systems including temperature set points and schedules, logger data, manufacturer specification documentation and interviews with facility personnel. The post-installation cooling and heating loads and energy usage for modeled ECMs were established by modifying the baseline building energy model with parameters listed in the descriptions below for each facility. The baseline calibration data and curves are shown in **Attachment C**.

An extensive TRACE® report listing the model inputs and settings is provided in **Attachment D**. In the process of analyzing the utility data, it was noted that the year 2013 has a similar Heating Degree Day (HDD) and Cooling Degree Day (CDD) profile to the 30-year weather data average. Although this year may be a good representation of a typical year, the utility baseline for most of the models was calculated from the 3-year average of the utility data and in some cases calendar year 2014. For a model comparison in Trace, a single year typically has variations in the utility consumption profile that creates difficulty in the model calibration. Some of these variations are caused by length of the utility billing cycle, facility operation and usage, operation and set points of the equipment, etc.

Also, in most of the cases, the year 2013 utility usage was higher than most of the other years. This may cause over estimations of savings calculated by Trace during the term of the project. The utility data used as a baseline for each model is noted below.

These models were used to calculate savings from ECM 4: Energy Management Control System (EMS) Upgrades and the insulation upgrades from ECM 9: Building Envelope Measures. Before these savings were calculated the baseline for the buildings were adjusted to account for change in interior load caused by ECM 1: Interior Lighting System Improvements and ECM 3: Lighting Controls. Following completion of the adjusted baseline model, each ECM's cost savings were calculated relative to the adjusted baseline model.

Listed below is a summary of modeling methods used for each ECM:

O&M Savings

The renovation of the Fire Station #8 AHU is included in this measure. This unit has been an ongoing and increasing cost for the fire department. Ameresco was provided three years of O&M cost. Based on this information, Ameresco estimated that 90% of the three year average, $3,240, would be avoided if the AHU was upgraded.

No other O&M savings were identified for the Energy Management Control System (EMS) Upgrades or Building Envelope Measures.

Utility Savings Calculations

Fire Station #1

Utility Baseline: Based on three year average.

ECM 4 – EMS Controls

- Template Tab / Thermostat / Office – revise unoccupied set points from 72°F heating and 72°F cooling to 60°F heating and 80°F cooling

Fire Station #8

Utility Baseline: Based on three year average.

ECM 4 – HVAC Upgrades

- Create Templates / Airflow / AHU-1: Apply ASHRAE Std62.1-2004-2010; Select type as Multi-purpose assembly; revise Clg Ez and Htg Ez to 100%
- Create Systems / Selection / AHU-1 / Advanced Options: Revise system ventilation flag to ASHRAE Std 62.1 – 2004-2010 w/ vent reset; provide single point CO2 based DCV
- Create Template / Thermostat / occupied and sleep: revise CO2 location to room
- Create System / Selection / AHU-1: Revise system type from double deck multi-zone to VAV w/ skin heat
- Create System / Fans / AHU-1: Revise primary fan type from FC Centr const vol to FC Centr VFD; maintain fan energy rate at 4.4 kW
- Create Plants / Cooling Equipment / AHU-1 Cooling: Revise cooling energy rate to 13 EER (compressor only)
- Create Systems / Options Tab / AHU-1: Enable dry-bulb economizer with a set point of 65°F

ECM 9 – Building Envelope Measures

- Room Tab / Roofs / 19-Locker Room / revise roof construction from Steel Sheet 1"Ins to Steel Sheet 6" insulation (increase to R30 with a U-Value of 0.03333)
- Room Tab / Roofs / 17-Sleeping Pods / revise roof construction from Steel Sheet 1"Ins to Steel Sheet 3.33" insulation (to account for approximately ½ of the space receiving insulation)

Police District #1

Utility Baseline: Based on year 2013 data.

ECM 4 – EMS Upgrades

- Template Tab / Airflow Tab / RTU-1: Revise schedule from available (100%) to DCV – Denver – PD1 1st(Available 100% of design from 6am to 6pm weekdays, then reduce quantity by 60% all other times, typ.)
- Template Tab / Airflow Tab / RTU-2: Revise schedule from available (100%) to DCV – Denver – PD1 2nd floor
- Template Tab / Airflow Tab / RTU-3: Revise schedule from available (100%) to DCV – Denver – PD1 1st
- Template Tab / Airflow Tab / RTU-4: Revise schedule from available (100%) to DCV – Denver – PD1 1st
- Template Tab / Thermostat / copy default description and rename 2nd floor. Revise heating unoccupied set points to 60 and cooling set points to 90°F.
- Create Rooms Tab / revise thermostat for all second floor spaces (typ.) to 2nd floor.
- Create Systems Tab / RTU-1, 2, 3, 4: Change primary fan to AF w/VFD Critical Zn Reset; maintain static pressure and kW.

911 Call Center

Utility Baseline: Based on three year average due to irregularities from year 2013 for kWh.

ECM 4 – EMS Upgrades

- Template Tab / Airflow Tab / RTU-2: Revise schedule from available (100%) to DCV – Denver – 911
- Template Tab / Thermostat Tab / Copy Default description and rename to Call.
- Create Room Tab / Revise all second floor Tstat templates to Call
- Template Tab / Thermostat Tab / For non Call area revise Default heating and cooling setbacks to 60 and 90°F
- Create Systems Tab / Fans / RTU-1: Revise supply static pressure from 2" @ 14.19 kW to 1.25" and 8.56 kW

- Create Systems Tab / Fans / RTU-2: Revise supply static pressure from 2" @ 8.51 kW to 1.25" and 5.31 kW

20th Street Recreation Center

Utility Baseline: Based on three year average.

ECM 4 – EMS Upgrades

- Template Tab / Airflow Tab / MZ-1: Revise schedule from available (100%) to People – Denver – 20th Rec
- Template Tab / Thermostat Tab / Default: Revise temperature cooling unoccupied to 90°F and heating unoccupied to 60°F
- Create Systems / MZ-1 / Options: add dry bulb economizer sequence with set point at 65°F
- Template Tab / Airflow Tab / RTU-1: Revise schedule from available (100%) to People – Denver – 20th Rec
- Create Systems / RTU-1 / Options: add dry bulb economizer sequence with set point at 65°F

ECM 9– Building Envelope Measures

- Template Tab / Construction / Default: copy default and rename as 2nd Floor. Revise roof construction to steel sheet w/ 6" ins. and change u-values to 0.03333 (R-30)
- Create Room Tab / 2nd floor spaces: revise construction template to 2nd Floor

Barnum Library

Utility Baseline: Based on year 2014 due to irregularities from year to year within data provided.

ECM 4 – EMS Upgrades

- Template Tab / Thermostat - Default: Revise heating and cooling unoccupied set points from 68 heating / 81 cooling to 60 heating / 90 cooling
- Template Tab / Airflow / MZU: Revise ventilation schedule from available (100%) to People – Denver – Barnum Library
- Create Systems / MZU-1 / Selection: Revise system type from rooftop multizone to VAV w/ skin heat
- Create Systems / MZU-1 / Fans: Revise supply fan from AF Const Vol to AF VFD at 8.75 kW, Revise return fan from AF Const Vol to AF VFD at 1.75 kW

Bear Valley Library

Utility Baseline: Based on year 2013 due to irregularities from year to year within data provided.

ECM 4 – EMS Upgrades

- Template Tab / Thermostat - Default: Revise heating and cooling unoccupied set points from 70 heating / 76 cooling to 60 heating / 90 cooling
- Create Systems Tab / Options Tab / Advanced options / RTU-1: Enable optimum start – available (100%)

Eugene Field Library

Utility Baseline: Based on year 2013 due to irregularities from year to year within data provided.

ECM 4 – EMS Upgrades

- Template Tab / Thermostat - Default: Revise heating and cooling unoccupied set points to 60 heating / 90 cooling
- Create System / RTU-1 / Fans: Revise supply fan type from AF const vol. to AF centrifugal var freq drv; keep energy rate at 15 hp
- Create Systems / Options / Advanced Options / RTU-1: enable optimum start – available (100%)
- Template Tab / Airflow / RTU-1: Revise ventilation schedule from available (100%) to People – Denver – Eugene Library
- Template Tab / Airflow / RTU-1: Revise vav cooling minimum to 50% and heating minimum to 50%

Schlessman Family Library

Utility Baseline: Based on year 2013 due to irregularities from year to year within the data provided.

ECM 4 – EMS Upgrades

- Template Tab / Thermostat / Default: unoccupied set point from 68 heating / 81 cooling to 60 heating / 90 cooling
- Template Tab / Airflow Tab / Default: Revise ventilation schedule from available (100%) to People – Denver – Schlessman Library
- Create Systems / Fans / AHU-1: Revise supply fan from AF Cent Const Vol to AF Cent vfd at 14.19 kW, revise return fan from AF Cent Const Vol to AF Cent vfd at 8.75 kW

Hourly Model Results

Hourly Model Results are included in **Attachment C**.

Measure Savings

Table 42: Energy Management Control System Upgrades

Location	kWh	kW	Therms
AP	0	0.00	0
BL	25,524	78.71	6,202
BVL	13,237	(0.96)	507
CCC	55,802	92.38	5,600
EFL	22,084	73.83	4,157
FS1	9,660	(0.81)	462
GRC	0	0.00	0
PD1	39,567	68.87	7,030
SRC	0	0.00	0
SFL	27,173	(91.59)	6,520
TSRC	6,788	84.99	1,610
FS8	29,782	41.92	4,955
Total	**229,618**	**347**	**37,043**

Table 43: Building Envelope Measures

Location	kWh	kW	Therms
TSRC	7,043	-	1,718
FS8	772	-	411
Total	**7,815**	-	**2,129**

Table 44: Savings Totals from Building Models

#	ECM Savings - Units	kWh	kW	Therms	Water kGal	O&M
4	Energy Management Control System Upgrades	229,618	347	37,043	-	$3,240
9	Building Envelope Measures	7,815	-	2,129	-	$0

Individual Calculations

Interior Lighting System Improvements

O & M Savings

The individual O&M savings are broken out by building in the Measure Saving Table. The operational savings for this measure were determined using an individual spreadsheet calculation. By calculating lamp replacement costs and required replacement intervals, the cost savings of longer lamp life LED can be averaged over the life of the equipment. Below is a sample of the lamps used:

Table 45: Rated Lamp Life

Rated Life (Hours)		
Type	**Lamp**	**Ballast/Driver**
Pulse Start Metal Halide	18,000	30,000
High Pressure Sodium	24,000	30,000
LED Exterior Lighting	50,000	55,000
Linear Fluorescent	24,000	40,000
Compact Fluorescent	12,000	20,000
Incandescent Light	1,000	N/A
LED Lamp Life	50,000	55,000

Table 46: Replacement Costs

Replacement Costs					
Lamp	**Type**	**Lamp**	**Ballast**	**Labor**	**Total Each**
Metal Halide	Ex	$18.00	$65.00	$0.00	$83.00
High Pressure Sodium	Ex	$18.00	$65.00	$0.00	$83.00
4' x 1L T12 Fluorescent	Ceiling	$3.00	$4.00	$0.00	$7.00
8' x 1L T12 Fluorescent	Ceiling	$3.00	$4.00	$0.00	$7.00
Compact Fluorescent	Ceiling	$5.00	$0.00	$0.00	$5.00
Halogen MR16	Misc.	$5.00	$0.00	$0.00	$5.00
Incandescent	Misc.	$1.00	$0.00	$0.00	$1.00

Assumptions

Retrofit fixture wattages are based on manufacturer's specifications

Methodology

Based on spreadsheet calculations

Utility Savings Calculations

Energy savings are based on estimated runtime hours, building operating hours, interviews with facility personnel and experience from past projects. The wattage reduction will be based upon the pre and post retrofit wattages. Annual dollar savings from each area retrofit will be calculated using the formulas listed below in conjunction with the utility rates described above.

$$kW_{Reduced/Month} = kW_{Existing} - kW_{Proposed}$$

$$kWh_{Reduced} = kW_{Reduced/Month} * Runtime$$

$$\sum_{Building} Annual\ \$\ Savings = kWh_{Reduced} * \frac{\$}{kWh} + 12_{Months} * kW_{Reduced/Month} * \frac{\$}{kW_{Average}}$$

$$\frac{\$}{kW_{Average}} = \frac{4_{Months} * \frac{\$}{kW_{Summer}} + 8_{Months} * \frac{\$}{kW_{Winter}}}{12_{Months}}$$

Definition of Variables:

$kW_{Existing}$ = The kilowatts of all of the interior lighting fixtures
$kW_{Proposed}$ = The kilowatts of all of the proposed lighting fixtures
$kWh_{Reduced}$ = The kilowatts per hour that is excepted to be reduced
Runtime = Stipulated operating hours per usage group

Table 47 – Stipulated Runtime Hours

Refer to Attachment B for detailed room by room for specific hours.

Description	Total
10 / 5 schedule	2608
15 / 5 schedule (911 admin)	3911
20th REC CENTER OP HOURS	4537
24/7	8760
Ashland Pool - General Area	3912
Ashland Rec - General Area	3912
Barnum Library - General Area	2660
Bear Valley Library - General Area	2660
Conference and Specialty Rooms in 911 center	1304
Controlled/managed Storage/utility	522
Eugene Library - General Area	2503
Exterior	4380
Fire Station 8 - Dispatch Area and Hall by Front Door	6570
Fire Station 8 - Day Room Around Corner	6570
Fire Station 8 - Garage	4380
Fire Station 8 - Locker Room at Top of Stairs	4380
Fire Station 8	2086/520
Fire Station 9 - Dispatch Area and Hall by Front Door	6570
Fire Station 9 - Day Room Around Corner	6570
Fire Station 9 - Garage	4380
Fire Station 9 - Locker Room at Top of Stairs	4380
Fire Station 9	2086/520
Garage	4380
Glenarm Rec - General Area	4460
Lockers	2847
Lounge	65% of building Burn Hours
RR	65% of building Burn Hours
Scheitler Rec - General Area	4460
Schlessman - General Area	3504
Study Room	65% of building Burn Hours
Typical Offices	2086
Uncontrolled Storage/utility	2190

HVAC Interaction Calculation

For every unique space that has heating and/or cooling, the impact of each individual lighting retrofit is analyzed for its annual impact on those heating and cooling systems.

The methodology used to calculate cooling savings and heating penalties in each facility follows the methods described in ASHRAE for the interaction between lighting and HVAC systems and is described in the following verbiage:

Demand savings generated through the installation of lighting retrofits impacts heating and cooling systems. Although operation of lighting systems during periods when the heating and cooling systems are not operating can impact the startup load of the HVAC systems, only hours of coincidental operation will be used in order to simplify the calculation. This coincidental operation is termed the HVAC Interaction Hours.

The source of HVAC Interaction Hours used in the calculation of cooling savings and heating penalties are derived using the seasonal operational hours of heating and cooling equipment combined with the average time that the lights would typically be turned "on" during those times.

HVAC Interaction Hours derived from the National Climatic Data Center (NCDC) using the following search criteria.

Cooling

Weather Station:	Denver Centennial Airport,
Weather Station #:	725650
Data Range:	July 1, 2011 – June 30, 2014
Sort Criteria:	Hours above cooling set point
Sort Result Diversity Factor:	75%
Hours:	928

Heating hours

Weather Station:	Denver Centennial Airport,
Weather Station #:	725650
Data Range:	July 1, 2011 – June 30, 2014
Sort Criteria:	Hours below heating set point
Sort Result Diversity Factor:	75%
Hours:	4,797

Upon determination of the HVAC Interaction Hours for the typical spaces being retrofitted, the values are input into cooling savings calculations and heating penalty calculations as follows:

Cooling Reduction Calculations

$$Cooling\ Tons_{Reduced} = \sum kW_{Reduced} * \frac{3{,}413\ BTU/_{Hr}}{kW} * \frac{Ton}{12{,}000 BTU/_{Hr}}$$

$$Cooling\ kWh_{Reduced} = Cooling\ Tons_{Reduced} * Hours_{Cooling} * Diversity\ Factor * Cooling\ System\ Eff$$

Heating Penalty Calculations

$$Heating\ Therms_{\ Reduced} = \sum kW_{Reduced} * Hours_{Heating} * \frac{.03413\ Therm/_{Hr}}{kW}$$

The following table is a summary, by building, of the HVAC interactions due to the recommended lighting retrofits.

Table 48 – Summary of HVAC Interactions

Building	kWh Cooling Savings	Therms Penalty
Fire Station 1	3,400	1,135
Fire Station 8	871	291
Fire Station 9	1,179	394
Police Station	3,125	1,043
911 Call Center	4,438	1,482
Ashland Pool	1,246	416
Ashland Rec Center	-	271
Glenarm Rec Center	1,748	584
Schleiter Rec Center	512	855
20th Street Recreation Center	1,851	618
Barnum Library	2,623	876
Bear Valley Library	1,284	429
Eugene Field Library	1,228	410
Schlessman Family Library	1,156	386
Total	**24,659**	**9,190**

Measure Savings

Table 49: Interior Lighting System Improvements Savings

#	ECM Savings - Units	kWh	kW	Therms	Water kGal	O&M
	AP	11,956	58.08	(416)	-	$700
	ARC	8,047	37.80	(271)	-	$291
	BL	23,630	122.28	(876)	-	$419
	BVL	11,996	59.88	(429)	-	$311
	CCC	69,447	206.93	(1,482)	-	$1,362
	EFL	15,645	57.24	(410)	-	$457
	FS8	9,047	40.61	(291)	-	$295
	FS9	11,530	54.96	(394)	-	$450
	FS1	30,285	158.52	(1,135)	-	$603
	GRC	19,819	81.48	(584)	-	$537
	PD1	31,395	145.68	(1,043)	-	$2,181
	SRC	39,904	119.40	(855)	-	$996
	SFL	11,140	53.88	(386)	-	$516
	TSRC	31,762	86.28	(618)	-	$690
1	**Interior Lighting System Improvements**	**325,601**	**1,283**	**(9,190)**	**-**	**$9,807**

Exterior Lighting System Improvements

O & M Savings

The individual O&M savings are broken out by building in the Measure Saving Table:

The operational savings for this measure were determined using an individual spreadsheet calculation. By calculating lamp replacement costs and required replacement intervals, the cost savings of longer lamp life LED can be averaged over the life of the equipment. Below is a sample of the lamps used:

Table 50: Rated Lamp Life

Rated Life (Hours)		
Type	**Lamp**	**Ballast/Driver**
Pulse Start Metal Halide	18,000	30,000
High Pressure Sodium	24,000	30,000
LED Exterior Lighting	50,000	55,000
Linear Fluorescent	24,000	40,000
Compact Fluorescent	12,000	20,000
Incandescent Light	1,000	N/A
LED Lamp Life	50,000	55,000

Table 51: Replacement Costs

Replacement Costs					
Lamp	**Type**	**Lamp**	**Ballast**	**Labor**	**Total Each**
Metal Halide	Ex	$18.00	$65.00	$0.00	$83.00
High Pressure Sodium	Ex	$18.00	$65.00	$0.00	$83.00
4' x 1L T12 Fluorescent	Ceiling	$3.00	$4.00	$0.00	$7.00
8' x 1L T12 Fluorescent	Ceiling	$3.00	$4.00	$0.00	$7.00
Compact Fluorescent	Ceiling	$5.00	$0.00	$0.00	$5.00
Halogen MR16	Misc.	$5.00	$0.00	$0.00	$5.00
Incandescent	Misc.	$1.00	$0.00	$0.00	$1.00

Assumptions

Retrofit fixture wattages are based on manufacturer's specifications

Methodology

Based on spreadsheet calculations

Utility Savings Calculations

Energy savings are based on estimated runtime hours, building operating hours, interviews with facility personnel and experience from past projects. The wattage reduction will be based upon the pre and post retrofit wattages. Annual dollar savings from each area retrofit will be calculated using the formulas listed below in conjunction with the utility rates described above.

$$kW_{Reduced/Month} = kW_{Existing} - kW_{Proposed}$$

$$kWh_{Reduced} = kW_{Reduced/Month} * Runtime$$

$$\sum_{Building} Annual\ \$\ Savings = kWh_{Reduced} * \frac{\$}{kWh}$$

Definition of Variables:

$kW_{Existing}$ = The kilowatts of all of the interior lighting fixtures
$kW_{Proposed}$ = The kilowatts of all of the proposed lighting fixtures
$kWh_{Reduced}$ = The kilowatts per hour that is excepted to be reduced
Runtime = Stipulated operating hours per usage group

Table 52 – Stipulated Runtime Hours

Description	Total
Exterior	4380

Measure Savings

Table 53: Exterior Lighting System Improvements Savings

#	ECM Savings - Units	kWh	kW	Therms	Water kGal	O&M
	AP	9,159	-	-	-	$250
	ARC	4,306	-	-	-	$166
	BL	8,929	-	-	-	$223
	BVL	3,322	-	-	-	$97
	CCC	8,629	-	-	-	$167
	EFL	4,879	-	-	-	$204
	FS8	1,415	-	-	-	$109
	FS9	10,275	-	-	-	$394
	FS1	7,188	-	-	-	$150
	GRC	11,581	-	-	-	$396
	PD1	36,214	-	-	-	$955
	SRC	2,225	-	-	-	$110
	SFL	6,386	-	-	-	$160
	TSRC	929	-	-	-	$26
2	**Exterior Lighting System Improvements**	**115,435**	**-**	**-**	**-**	**$3,408**

Lighting Controls

The energy savings for this measure was determined using an individual spreadsheet calculation. A detailed lighting audit was completed that identified which fixture would benefit from occupancy controls. The spreadsheet takes into account the proposed retrofit described in the interior lighting system improvements. Loggers were installed in a statistically significant number of locations to determine the number of hours of operation and occupancy. A sample calculation is shown below.

O & M Savings

N/A

Assumptions

- Retrofit fixture wattages are based on manufacturer's specifications
- Occupancy sensors will reduce the run hours by 25% (conservative estimation)
    - 21 data loggers were placed throughout the buildings in various different usage areas. The data collected showed a possible 43.8% reduction is usage with controls.

Methodology: Based on spreadsheet calculations

Utility Savings Calculations

Energy savings are based on estimated runtime hours based on building operating hours, interviews with facility personnel, and experience from past projects. The wattage reduction will be based upon the pre and post retrofit wattages. Annual dollar savings from each area retrofit will be calculated using the formulas listed below in conjunction with the utility rates described above.

$$kWh_{Reduced} = kW_{Reduced/Month} * (Hours_{Existing} - Hours_{Existing} * Reduction\ Factor)$$

$$\sum_{Building} Annual\ \$\ Savings = kWh_{Reduced} * \frac{\$}{kWh}$$

Definition of Variables:

Reduction Factor = 25%

Table 54 – Stipulated Runtime Hours

Description	Total
10 / 5 schedule	2608
15 / 5 schedule (911 admin)	3911
20th REC CENTER OP HOURS	4537
24/7	8760
Ashland Pool - General Area	3912
Ashland Rec - General Area	3912
Barnum Library - General Area	2660
Bear Valley Library - General Area	2660
Conference and Specialty Rooms in 911 center	1304
Controlled/managed Storage/utility	522
Eugene Library - General Area	2503
Exterior	4380
Fire Station 8 - Dispatch Area and Hall by Front Door	6570
Fire Station 8 - Day Room Around Corner	6570
Fire Station 8 - Garage	4380
Fire Station 8 - Locker Room at Top of Stairs	4380
Fire Station 8	2086/520
Fire Station 9 - Dispatch Area and Hall by Front Door	6570
Fire Station 9 - Day Room Around Corner	6570
Fire Station 9 - Garage	4380
Fire Station 9 - Locker Room at Top of Stairs	4380
Fire Station 9	2086/520
Garage	4380
Glenarm Rec - General Area	4460
Lockers	2847
Lounge	65% of building Burn Hours
RR	65% of building Burn Hours
Scheitler Rec - General Area	4460
Schlessman - General Area	3504
Study Room	65% of building Burn Hours
Typical Offices	2086
Uncontrolled Storage/utility	2190

Measure Savings

Table 55: Lighting Controls Savings

#	ECM Savings - Units	kWh	kW	Therms	Water kGal	O&M
	AP	4,213	-	-	-	-
	BVL	280	-	-	-	-
	CCC	1,456	-	-	-	-
	EFL	151	-	-	-	-
	GRC	2,614	-	-	-	-
	SFL	1,932	-	-	-	-
3	**Lighting Controls**	**10,645**	-	-	-	-

Pump Improvement Measures

Calculation

The energy savings for this measure was determined using an individual spreadsheet calculation. Name plate data was taken for each pump and used to calculate energy savings. A sample calculation is shown below:

O & M Savings

N/A

Assumptions

- Pool reduction valves are set and not adjusted
- Power Reduction Component (3 in Theory, 2.7 is typical): 2.7 used in calculations

Ashland Leisure Pool - Pump Data:

11.19	kW	Calculated
15	HP	Nameplate Data
89.5%	Efficiency	Nameplate Data
50%	Valve Position Open	Observed - Globe

Ashland Lap Pool - Pump Data:

7.46	kW	Calculated
10	HP	Nameplate Data
89.5%	Efficiency	Nameplate Data
55%	Valve Position Open	Observed - Globe

Glenarm Pool - Pump Data:

5.6	kW	Calculated
7.5	HP	Nameplate Data
86.5%	Efficiency	Nameplate Data
70%	Valve Position Open	Observed - Ball

20th St. Pool - Pump Data:

3.73	kW	Calculated
5	HP	Nameplate Data
87.5%	Efficiency	Nameplate Data
70%	Valve Position Open	Observed - Ball

Methodology

Based on spreadsheet calculations

Savings Calculations

The energy savings for this measure was determined using an individual spreadsheet calculation. Name plate data was taken for each pump and used to calculate energy savings. A sample calculation is shown below:

Table 56: Pool Pump VFD Sample Calculation

City and County of Denver at Ashland Pool - Lap Pool Pump											
Assumed Contaminate Profile	Bin Hours	Existing Pumping Power (kW)	Existing Pumping Power Consumption (kWh)	Existing Valve Position	Existing Flow % of Max	Increased Filter Resistance	Proposed VFD Profile	Proposed Pumping Power (kW)	Proposed Pumping Power Consumption (kWh)	kWh Reduction	kW Reduction
0%	461	8.34	3,843	55%	53%	0%	53%	1.51	696	3,147	7
5%	461	8.34	3,843	55%	53%	2%	55%	1.63	751	3,092	7
10%	461	8.34	3,843	55%	53%	3%	56%	1.75	807	3,035	7
15%	461	8.34	3,843	55%	53%	5%	58%	1.88	867	2,976	6
20%	461	8.34	3,843	55%	53%	6%	59%	2.02	929	2,914	6
25%	461	8.34	3,843	55%	53%	8%	61%	2.16	994	2,849	6
30%	461	8.34	3,843	55%	53%	9%	62%	2.30	1,062	2,781	6
35%	461	8.34	3,843	55%	53%	11%	64%	2.46	1,133	2,710	6
40%	461	8.34	3,843	55%	53%	12%	65%	2.62	1,207	2,636	6
45%	461	8.34	3,843	55%	53%	14%	67%	2.78	1,283	2,560	6
50%	461	8.34	3,843	55%	53%	15%	68%	2.96	1,363	2,480	5
55%	461	8.34	3,843	55%	53%	17%	70%	3.13	1,445	2,398	5
60%	461	8.34	3,843	55%	53%	18%	71%	3.32	1,531	2,312	5
65%	461	8.34	3,843	55%	53%	20%	73%	3.51	1,620	2,223	5
70%	461	8.34	3,843	55%	53%	21%	74%	3.71	1,711	2,131	5
75%	461	8.34	3,843	55%	53%	23%	76%	3.92	1,807	2,036	4
80%	461	8.34	3,843	55%	53%	24%	77%	4.13	1,905	1,938	4
85%	461	8.34	3,843	55%	53%	26%	79%	4.35	2,007	1,836	4
90%	461	8.34	3,843	55%	53%	27%	80%	4.58	2,112	1,731	4
	8,760	**73,016**							**25,230**	**47,786**	**4**

Detailed explanation of the spreadsheet is found below:

Assumed Contaminate Profile

The assumed partial buildup in the filters is on a 2 week cycle

Bin Hours

The annual count of hours the filters are in the associated condition

Existing Pumping Power (kW)

The pumps existing power is calculated by the following equation:

$$Existing\ Pumping\ Power\ (kW) = \frac{Motor\ HP}{Pump\ Efficiency} * \frac{746kW}{1000HP}$$

Existing Pumping Power Consumption (kWh)

The pumps existing power consumption is calculated by the following equation:

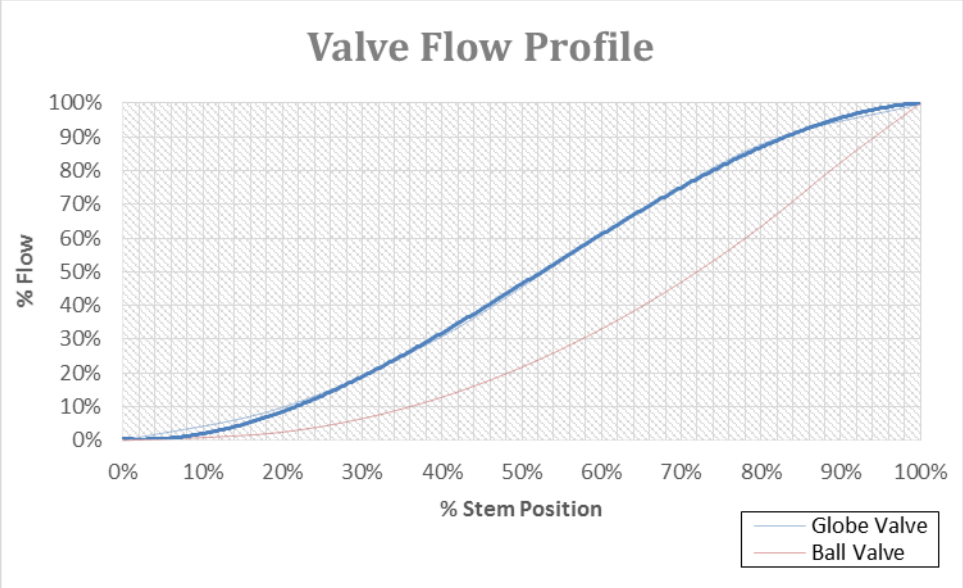
$$Existing\ Pumping\ Power\ Consumption\ (kWh) = \left(Existing\ Pump\ Power\ (kW)\right) * Bin\ Hours$$

Existing Valve Position

Observed flow reduction valve position

Existing Flow % of Max

Based on manufacturing standards, the flow was calculated based on the following graph using the flow reduction valve position:



Increased Filter Resistance

When the filters are dirty the resistance through the filter will increase

Proposed VFD Profile

The existing flow percentage plus the increased filer resistance

Proposed Pumping Power (kW)

The pumping power is calculated based on pumping affinity laws as shown in the following equation:

$$Proposed\ Pumping\ Power\ (kW) = \frac{Pump\ Power(kW) * \left(\frac{VFD\ Profile}{Existing\ Profile\ (100\%)}\right)^{2.7}}{Pump\ Efficiency}$$

Proposed Pumping Power Consumption (kWh)

The pumping power consumption is calculated based on the following equation:

$$Proposed\ Pumping\ Power\ Consumption\ (kWh) = \left(Proposed\ Pump\ Power\ (kW)\right) * Bin\ Hours$$

KWh Reduction

The power consumption reduction is calculated based on the following equation:

$$kWh\ Reduction = Existing\ Pumping\ Power\ Consumption - Proposed\ Pumping\ Power\ Consumption$$

KW Reduction

The power consumption reduction is calculated based on the following equation:

$$kW\ Reduction = Existing\ Pumping\ Power - Proposed\ Pumping\ Power$$

Measure Savings

Table 57: Pump Improvement Measures Savings

#	ECM Savings - Units	kWh	kW	Therms	Water kGal	O&M
	GRC	41,488	43	-	-	-
	AP	129,878	132	-	-	-
	TSRC	27,342	29	-	-	-
5	**Pump Improvement Measures**	**198,708**	**204**	-	-	-

Pipe and Equipment Insulation

Calculation

The energy savings for this measure was determined using an individual spreadsheet calculation. The energy saving from this measure is calculated by calculating the difference in heat loss from a bare pipe and an insulated pipe of similar length and diameter. Surface area of exposed pipe and equipment was measured at each location.

O & M Savings

N/A

Assumptions

The existing heating systems have an overall thermal efficiency of 80%

The room where the pipes are located has an annual average space temperature of 70°F

The surface temperature of the bare pipe is assumed to be based on usage type as represented below:

Table 58: Bare Pipe Surface Temperature (F)

Usage Type	Bare Pipe Surface Temp (F)
HW Supply	180
DHW Supply	120
HW Pump Flex Connections valve, suction	180
HW Supply Air Separator	180

Methodology

Based on spreadsheet calculations and 3E Plus v4.1 energy modeler

Utility Savings Calculations

Total Annual Dollars Saved

The total annual dollars saved will be the difference between the natural gas cost due to losses from the bare pipe and the natural cost due to losses from the pipe after insulation is added.

Equipment and Piping Losses

Using 3E Plus v4.1, a program by the North American Insulation Manufacturers Association that is supported by the U.S. Department of Energy, annual energy losses can be determined for the specific pipe and jacket materials that exist at the facilities.

The average space temperature of the mechanical rooms, where the pipe is located, is 70°F. Using the appropriate values for the existing piping, the existing and retrofit losses can be determined using the 3E Plus program.

The existing and retrofit system loss calculations for the pipe are shown on the screen shot below:

Picture 01.1 - Thickness and Surface Temperature Report

NAIMA 3EPlus V4.1

Ameresco
10650 E. Bethany Dr. Ste A
Aurora, CO 80014
(720) 971-5631

Item ID = CCC
Item Description = HW Supply
System Application = Pipe - Horizontal
Dimensional Standard = ASTM C 585 Rigid
Calculation Type = Heat Loss Per Year Report
Process Temperature = 180
Ambient Temperature = 70
Wind Speed = 0.0

Hours Per Year = 5509
Nominal Pipe Size = 2
Bare Metal = Steel
Bare Surface Emittance = 0.8
Insulation Layer 1 = 850F Mineral Fiber PIPE, Type I, C547-12

Outer Jacket Material = All Service Jacket
Outer Surface Emittance = 0.9

Variable Insulation Thickness	Surface Temp (°F)	Heat Loss (kBTU/ft/yr)	Efficiency (%)
Bare	179.9	849	
0.5	91.6	184	78.33
1.0	82.1	120	85.81
1.5	78.1	93	89.02
2.0	76.0	79	90.75
2.5	74.7	70	91.79
3.0	73.9	63	92.54
3.5	73.3	59	93.09
4.0	72.8	54	93.58
4.5	72.4	52	93.92
5.0	72.2	49	94.21
5.5	71.9	47	94.50
6.0	71.7	45	94.70
6.5	71.6	43	94.88
7.0	71.5	42	95.03
7.5	71.3	41	95.17
8.0	71.2	40	95.29
8.5	71.2	39	95.40
9.0	71.1	38	95.50
9.5	71.0	37	95.60
10.0	71.0	37	95.68

The following table presents the calculations that were performed for exposed steam pipes.

Table 59: Exposed Steam Pipe Calculations

Buildings	Location	Heating Hours	Ambient Temperature (F)	Pipe Diameter (in)	Length of Uninsulated Pipe (ft.)	Bare Pipe Surface Temp (F)	Bare Pipe Heat Loss (kBTU/ft./yr.)	Heat Lost (BTU)	Insulation Thickness (in)	Insulation Surface Temp (F)	Insulated Pipe Heat Loss (kBTU/ft./yr.)	Heat Lost (BTU)	Energy Savings (BTU)	Therms Saved
Combined Communication Center	HW Supply	5,509	70	2.00	34	180	849	28,866,000	1.50	78.10	93	3,162,000	25,704,000	321
Combined Communication Center	HW Supply Air Separator	5,509	70	2.00	3	180	750	2,250,000	0.50	98.60	230	690,000	1,560,000	20
Combined Communication Center	HW Pump Flex Connections valve, suction	5,509	70	4.00	12	180	1,537	18,444,000	0.50	97.10	389	4,668,000	13,776,000	172
Police District #1	DHW Supply	5,509	70	1.00	4	120	189	756,000	1.00	74.70	33	132,000	624,000	8
Police District #1	HW Supply	5,509	70	2.50	20	180	1,012	20,240,000	1.50	77.10	96	1,920,000	18,320,000	229
Police District #1	HW Pump Flex Connections valve, suction	5,509	70	4.00	12	180	1,537	18,444,000	0.50	97.10	389	4,668,000	13,776,000	172
Fire Station#1(HQ)	DHW Supply	5,509	70	1.50	40	120	263	10,520,000	1.50	73.60	35	1,400,000	9,120,000	114
Fire Station #8	HW Supply	5,509	70	1.50	30	180	692	20,760,000	1.50	77.80	82	2,460,000	18,300,000	229
Scheitler Rec Ctr	DHW Supply	5,509	70	1.00	30	120	189	5,670,000	1.00	74.70	33	990,000	4,680,000	59
Scheitler Rec Ctr	HW Supply	5,509	70	3.00	28	180	1,215	34,020,000	1.50	78.90	123	3,444,000	30,576,000	382
Scheitler Rec Ctr	HW Supply	5,509	70	1.00	35	180	497	17,395,000	1.00	80.30	79	2,765,000	14,630,000	183
Glenarm Rec Ctr	HW Supply	5,509	70	3.00	30	180	1,215	36,450,000	1.50	78.90	123	3,690,000	32,760,000	410

Each column in the table shown is defined as follows:

Location

The function of the hot water

Heating Hours

The annual hour count the pipe is in use

Ambient Temperature (°F)

The mechanical space temperature in which the pipe is located

Bare Pipe Heat Loss (kBTU/ft/yr.)

This column gives the heat transfer coefficient of the pipe with no insulation

Bare Pipe Heat Lost (BTU)

The annual heat loss is calculated based on the following equation:

$$Bare\ Pipe\ Heat\ Lost(BTU) = Heat\ Transer\ coefficient * Length * \frac{1000BTU}{1kBTU}$$

Insulation Surface Temperature (°F)

This column gives the estimated temperature of the insulation once the insulation is applied to the bare pipe

Bare Pipe Heat Loss (kBTU/ft/yr.)

This column gives the heat transfer coefficient of the pipe with no insulation

Insulated Pipe Heat Lost (BTU)

The annual heat loss is calculated based on the following equation:

$$Insulated\ Pipe\ Heat\ Lost(BTU) = New\ Heat\ Transer\ coefficient * Length * \frac{1000BTU}{1kBTU}$$

Energy Savings (BTU)

The annual energy savings are calculated based on the following equation:

$$Energy\ Savings\ (BTU) = Bare\ Pipe\ Heat\ Lost - Insulated\ pipe\ Heat\ Lost$$

Therms Saved

The annual therm savings are calculated based on the following equation:

$$Therms\ Saved = \frac{Energy\ Savings(BTU)}{Heating\ System\ Eff.} * \frac{1Therm}{100{,}000BTU}$$

Measure Savings

Table 60: Pipe and Equipment Insulation Savings

#	ECM Savings - Units	kWh	kW	Therms	Water kGal	O&M
	CCC	-	-	513	-	-
	FS1	-	-	114	-	-
	FS8	-	-	229	-	-
	PD1	-	-	409	-	-
	GRC	-	-	410	-	-
	SRC	-	-	624	-	-
6	**Pipe and Equipment Insulation**	-	-	**2,298**	-	-

Vending Machine Controls

O & M Savings

N/A

Assumptions

The following are assumptions for the VendMiser savings calculations:

- Average power requirements for cold beverage vending machine is 3.33 amps or 400 watts
- Average power requirements for snack vending machine is 0.7 amps or 80 watts
- Average power requirements for video game machine is 1.75 amps or 212 watts

Methodology

Based on spreadsheet calculations

Utility Savings Calculations

Savings result from turning off the unit during unoccupied periods. The following table shows the calculations for each facility:

Table 61: Vending Machine Controls Calculation

Building	Quantity of Snack Machines	Quantity of Refrigerated Drink Machines	Quantity of Video Game Machines	Total Connected Demand	Existing Hours of Operation	Existing Electric Consumption	Proposed Hours of Operation	Proposed Electric Consumption	Operating Months per Year	Annual Electric Savings
[A]	[B]	[C]	[D]	[E]	[F]	[G]	[H]	[I]	[J]	[K]
Ashland Pool	0	1	0	0.40	8,760	3,504	4,103	1,641	12	1,863
Ashland Rec Ctr	0	2	0	0.80	8,760	7,008	4,103	3,283	12	3,725
Glenarm Rec Ctr	1	2	2	1.30	8,760	11,419	3,741	4,877	12	6,542
Police District #1	0	1	0	0.40	8,760	3,504	2,800	1,120	12	2,384
Twentieth Street Rec Ctr	0	1	0	0.40	8,760	3,504	4,013	1,605	12	1,899
	1	7	2	3.30		28,939		12,526		16,413

Each column in the table shown is defined as follows:

Table 62: Calculation Definitions

Cell Ref.	Comment
A	Facility
B	Number of Snack Machines
C	Number of Drink Machines
D	Number of Video GameMachines
E	Total connected electric demand per building
F	= [C62]
G	= [col E] x [col F]
H	Building Occ. Hours
I	= [col G] x [col H]
J	Months per year the machine is powered on
K	= [col G] x [col I]

Table 63: Vending Machine Controls Heating Penalty and Cooling Benefit

	Savings		Heating Penalty				Cooling Benefit			
A	B	C	D	E	F	G	H	I	J	K
Facility	Annual kW	Annual kWh	Heat Gain to Space	Heating Months	Heating System Efficiency	Heating Penalty MMBtu	Total Space Cooled	Cooling Months	Cooling System COP	Cooling Benefit MMBtu
Ashland Pool	0.0	2,235	100.0%	8.0	76.0%	(6.7)	100.0%	4.0	2.93	0.9
Ashland Rec Ctr	0.0	4,470	100.0%	8.0	76.0%	(13.4)	100.0%	4.0	2.93	1.7
Glenarm Rec Ctr	0.0	7,850	100.0%	8.0	76.0%	(23.5)	100.0%	4.0	2.93	3.0
Police District #1	0.0	2,464	100.0%	8.0	76.0%	(7.4)	100.0%	4.0	2.93	1.0
Twentieth Street Rec Ctr	0.0	2,279	100.0%	8.0	76.0%	(6.8)	100.0%	4.0	2.93	0.9
Totals	**0.0**	**19,299**				**(57.8)**				**7.5**

Notes:	
A	Applicable building included in comprehensive energy audit
B	Measure demand savings {kW} associated with Measure retrofit measures
C	Measure energy savings {kWh} associated with Measure retrofit measures
D	Estimated percentage of Measure energy transmitted to conditioned space
E	Estimated length of heating season
F	Estimated heating system efficiency, interacted with other measures
G	Resulting heating penalty due to Measure upgrades = [col C] x [col D] x 3,413 x ([col E] / 12) / [col F] / 1,000,000
H	Estimated percentage of space cooled
I	Estimated Length of cooling season
J	Estimated cooling system efficiency, interacted with other measures
K	Resulting cooling benefit due to Measure upgrades = [col C] x [col D] x 3,413 x ([col I] / 12) / [col J] / 1,000,000

Measure Savings

Table 64: Vending Machine Controls Savings

#	ECM Savings - Units	kWh	kW	Therms	Water kGal	O&M
	AP	2,489	-	(67)	-	-
	ARC	4,979	-	(134)	-	-
	GRC	8,743	-	(235)	-	-
	TSRC	2,538	-	(68)	-	-
	PD1	2,744	-	(74)	-	-
7	**Vending Machine Controls**	**21,494**	-	**(578)**	-	-

Pool Covers

Pool cover savings are calculated using ASHRAE methodology for calculating evaporation from an indoor pool.

O & M Savings

Along with reducing the amount of energy the pool gives off; pool covers also reduce chemical evaporation. According to the U.S. Department of Energy pool covers reduce pool's chemical consumption by 35%-60%. Based on information from the customer Ashland Pool uses $9,174 in chemicals in a year, for both pools, and Glenarm Recreational Center uses $6,306. Ameresco is expecting to reduce Ashland Pools chemical cost by $1,605 and Glenarm Recreational Center chemical cost by $2,207.

Assumptions

Table 65: Pool Cover Calculation Assumptions

Assumption	Unit	AP	GRC
Hours Pool Can be Covered/yr	Hr.	5588	6022
Pool Area (length x width) (A)	Sqft.	2,250	2,625
Pool Length	Ft.	75	75
Pool Width	Ft.	30	35
Activity Factor (ASHRAE 1999 Applications p. 4.6) (Fa)		1	1
Un Occ Activity Factor (ASHRAE 1999 Applications p. 4.6) (Fa)		0.5	0.5
Air Temperature	°F	83	85
Relative Humidity	%	52.0%	44.0%
Water Temperature	°F	83	85
Sat Press at Room Air Dew Point (Psychrometrics) (Pa)	in. Hg	0.58	0.55
Sat Vapor Press at Surface Water Temp (ASHRAE, Psych., Table 3) (Pws)	in. Hg	1.14	1.21
Enthalpy of Evaporation (ASHRAE Fundamentals, Psych., Table 3)	Btu/lb	1,046	1,045
Heating Plant Overall Efficiency	%	85%	70%
Reduction in Pool Evaporation Due to Cover	%	85%	85%

Methodology

Based on spreadsheet calculations

Utility Savings Calculations

Pool cover savings are calculated using ASHRAE methodology for calculating evaporation from an indoor pool.

Equation 1: Rate of Evaporation- ASHRAE - Application 1999 - 4.6 - Equation (1)

$$w_p = \frac{A}{Y} \times (p_w - p_a) \times (95 + 0.425 \times V)$$

Equation 2: The Rate of Evaporation equation reduces to the following equation with the given assumptions: Y = 1000 btu/lb ; V = 10 to 40 ft./min

$$w_p = 0.1 \times A \times (p_w - p_a) \times F_a$$

W_p (LB/Hr) = Pounds of water evaporated per hour

Evaporation Load = LB/Hr * Enthalpy of Evaporation

Affected Existing Evaporation Heat Loss = Evaporative Load x Hr Pool Cover could be Engaged ÷ 1,000

Savings = Affected Existing Evaporation Heat Loss x Reduction in Pool Evaporation due to Cover

Measure Savings

Table 66: Pool Cover Savings

#	ECM Savings - Units	kWh	kW	Therms	Water kGal	O&M
	AP	-	-	3,677	36	$1,605
	GRC	-	-	6,668	54	$2,207
8	**Pool Covers**	**-**	**-**	**10,344**	**90**	**$3,813**

Building Envelope Measures

O & M Savings

N/A

Assumptions

Table 67: Building Envelope Measure Assumptions

Building K	130-140	K is a factor determining building style, ranging from 100 to 150. Low K is very efficient with central mass, high K is open ware house or many wings.
Total HDD (F)	7,401	
Total CDD (C)	776	
Bldg uses Heat Pump	N/A	
% of building cooled	0%-100%	
% mechanical EFF.	80%	This factor is the anticipated variation of a mechanical efficiently of 80%.
COP	2.5	Coefficient of Performance for Air Conditioning or Geo-Thermal.

Methodology

Based on spreadsheet calculations

Utility Savings Calculations

The energy savings for this measure was determined using an individual spreadsheet calculation. A sample calculation is shown below:

$$Non-Electric\ Heat\ Loss = \frac{\left((Bldg\ Leakage\ sq\ mtrs)x\ (bldg\ k\ factor)x\ (Wind\ P\ Factor)x\ (HDD)x\ \left(\frac{9}{5}\right)x\ 0.075\ x\ .243\ x\ 60\ x\ 24\right)}{(100{,}000\ x\ Eff\ \%)}$$

$$Cooling\ Loss = (Bldg\ Leakage\ sq\ mtrs)x\ (bldg\ k\ factor)x\ (Wind\ P\ Factor)x\ (CDD)x\ (.075\ x\ .243\ x\ 60\ x\ 24)x\ (conversion\ to\ kwh)$$

Table 68 Building Envelope Measures sample calculation

Monthly Savings Calculations												
	Jan	Feb	March	April	May	June	July	August	Sept	Oct	Nov	Dec
Wind Speeds averaged (MPH)	8.70	8.70	9.60	10.00	9.30	8.80	9.30	8.10	8.00	7.80	8.30	8.40
Wind Pressure Factor Calculated "dp^n" (Pa)	4.588	4.588	5.255	5.560	5.030	4.661	5.030	4.157	4.086	3.946	4.299	4.371
Areas	0.126	0.126	0.126	0.126	0.126	0.126	0.126	0.126	0.126	0.126	0.126	0.126
Flow calculation "Q" (Liters / sec)	75.0	75.0	86.0	90.9	82.3	76.2	82.3	68.0	66.8	64.5	70.3	71.5
Convert flow "Q" (CFM)	159.0	159.0	182.1	192.7	174.3	161.5	174.3	144.1	141.6	136.7	149.0	151.5
	Jan	Feb	March	April	May	June	July	August	Sept	Oct	Nov	Dec
Positive days only (Deg F)	1,264.8	1,030.4	942.4	672.0	396.8	72.0	0.0	0.0	228.0	589.0	975.0	1,230.7
HDD usage Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Final HDD used (F)	1,264.8	1,030.4	942.4	672.0	396.8	72.0	0.0	0.0	228.0	589.0	975.0	1,230.7
	Jan	Feb	March	April	May	June	July	August	Sept	Oct	Nov	Dec
CDD/Month (F)	-1,032.3	-820.4	-709.9	-447.0	-164.3	153.0	337.9	285.2	-3.0	-356.5	-750.0	-998.2
CDD/Month (C)	-573.5	-455.8	-394.4	-248.3	-91.3	85.0	187.7	158.4	-1.7	-198.1	-416.7	-554.6
Positive days only (Deg F)	0.0	0.0	0.0	0.0	0.0	153.0	337.9	285.2	0.0	0.0	0.0	0.0
Density of Air	0.065	0.065	0.065	0.065	0.065	0.065	0.065	0.065	0.065	0.065	0.065	0.065
Specific Gravity of Air	0.243	0.243	0.243	0.243	0.243	0.243	0.243	0.243	0.243	0.243	0.243	0.243
Heating system efficiency	0.800	0.800	0.800	0.800	0.800	0.800	0.800	0.800	0.800	0.800	0.800	0.800
Calc. for gas savings	57	47	49	37	20	3	0	0	9	23	41	53
% total savings to Nat Gas	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Total Gas Savings	57	47	49	37	20	3	0	0	9	23	41	53
Coefficient of Performance	2.500	2.500	2.500	2.500	2.500	2.500	2.500	2.500	2.500	2.500	2.500	2.500
cooling savings @ 100% bldg	0	0	0	0	0	76	181	126	0	0	0	0
% building for Air conditioning	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Total air conditioning savings	0	0	0	0	0	76	181	126	0	0	0	0

Measure Savings

Table 69: Building Envelope Measures Savings

#	ECM Savings - Units	kWh	kW	Therms	Water kGal	O&M
	AP	250	-	543	-	-
	ARC	221	-	261	-	-
	BL	321	-	314	-	-
	BVL	229	-	224	-	-
	CCC	271	-	239	-	-
	EFL	183	-	179	-	-
	FS1	283	-	313	-	-
	FS8	772	-	411	-	-
	FS9	0	-	0	-	-
	GRC	133	-	156	-	-
	PD1	0	-	0	-	-
	SFL	229	-	224	-	-
	SRC	398	-	469	-	-
	TSRC	7,292	-	2,011	-	-
9	**Building Envelope Measures**	**10,585**	-	**5,344**	-	-

Please note that savings in Table 43 associated with attic insulation in TSRC and FS8 are included in these savings numbers.

Transport Gas

The energy savings for this measure were determined using an individual spreadsheet calculation. The spreadsheet takes into account the existing conditions and utility rates and compares these to a bid from a transport gas provider. This evaluation was provided to CCD under separate cover for their approval.

The savings included in this measure were provided by General Services | Strategic Initiatives | Energy Mgmt (3/18/15 email). CCD identified these as "CCD Estimated Savings Based on 2014 Usage/Savings of similar size." These savings are being considered O&M savings because there is no associated Therm reduction.

Table 70: Transport Gas Savings

#	ECM Savings - Units	kWh	kW	Therms	Water kGal	O&M
	911 Call Center	-	-	-	-	$1,276
	Ashland Pool	-	-	-	-	$1,277
	Police District #1	-	-	-	-	$1,202
10	**Transport Gas**	-	-	-	-	**$3,755**

Education Program & Live Energy Monitoring

The energy savings for this measure were determined using an individual spreadsheet calculation. Ameresco's experience and industry case studies, demonstrate that a successful energy awareness educational program can reduced utility costs from 3% to 12% annually. Based on these examples and staying consistent with CCD's successes, we have calculated a 3% savings in natural gas and electric use associated with this measure.

Table 71: Education Program & Live Energy Monitoring Savings

#	ECM Savings - Units	kWh	kW	Therms	Water kGal	O&M
	AP	18,308	-	484	-	-
	ARC	1,293	-	181	-	-
	BL	2,970	-	170	-	-
	BVL	3,786	-	281	-	-
	CCC	30,789	-	438	-	-
	EFL	3,647	-	88	-	-
	FS8	2,577	-	227	-	-
	FS9	4,944	-	256	-	-
	FS1	9,809	-	394	-	-
	GRC	4,487	-	741	-	-
	PD1	25,043	-	489	-	-
	SRC	8,966	-	1,120	-	-
	SFL	6,576	-	278	-	-
	TSRC	11,312	-	1,737	-	-
11	**Education Program & Live Energy Monitoring**	**134,508**	-	**6,883**	-	-

Measurement & Verification Method

The long-term success of any comprehensive energy efficiency program depends on the development of an accurate and successful M&V plan. The main objective is to develop a cost-effective plan that quantifies and verifies the performance results of the ECMs. Ameresco subscribes to using industry standard M&V protocols that have been developed in response to the need for reliable and consistent measurement practices.

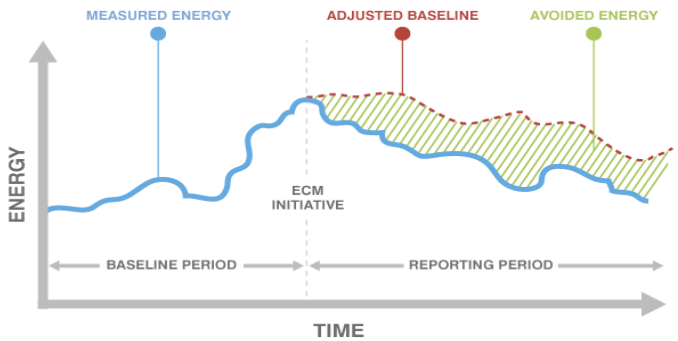
The following reference is used for the development of M&V procedures for this project:

- Efficiency Valuation Organization. 2012. International Performance Measurement & Verification Protocol (IPMVP).
- The protocols also help to allocate various risks associated with achieving energy cost savings and allowing risk reduction and better risk management. The M&V options description, provided herein, was developed by summarizing the International Performance Measurement and Verification Protocol and contains excerpts taken from that document.
- The benefits of the protocols are as follows:
  - Defines the role of verification in energy contracts and implementation
  - Discusses procedures, with varying levels of accuracy and cost, for verifying baseline and project installation conditions and long-term energy savings performance
  - Provides techniques for calculating "whole-facility" savings, individual technology savings, and stipulated savings
  - Provides procedures that are consistent, industry accepted, impartial, and reliable
  - Provides procedures for the investigation and resolution of disagreements related to performance issues

The general approach to determining energy savings in these plans involves comparing the energy use of the retrofitted system before installation of the ECM (baseline) and after installation of the ECM (post-retrofit). In general:

Energy Savings = Baseline Energy Use – Post Retrofit Energy Use

The IPMVP protocols have defined four M&V options (Options A through D) that meet the needs of a wide range of performance contracts and provide suggested procedures for baseline development and post-retrofit verification. In addition, Ameresco has defined another "Agreed Upon" or Option S for ECMs whose savings are not great enough to justify the expense of M&V techniques.



These M&V options are flexible and reflect the considerations previously mentioned. The options are summarized in the table included on the following page. Following that, a table summarizing the proposed M&V options for each ECM and tables including the details of the proposed M&V plan are included. All specific protocols in the plans must be understood and accepted by CCD before construction on the project can begin, in order to minimize the potential for disagreement once verification efforts begin.

Option A: Retrofit Isolation with Key Parameter Measurement
Savings are determined by field measurement of the key performance parameter(s) which define the energy use of the ECM's affected system(s). Estimates of the non-key parameter are used for the savings calculations
Option B: Retrofit Isolation with All Parameter Measurement
Savings are determined by field measurement of the energy use of the ECM-affected system
Option C: Whole Facility Energy Use
Savings are determined by measuring energy use at the whole facility or sub-facility level
Option D: Calibrated Simulation
Savings are determined through simulation of the energy use of the whole facility, or of a sub-facility. Simulation routines are demonstrated to adequately model actual energy performance measured in the facility. The model is closely calibrated with data collected for each ECM
Agreed Upon Savings: No M&V, Operational Verification
Used where cost to accurately calculate and/or measure savings would exceed anticipated savings

M&V Options Summary by ECM

ECM #	Description	M&V Method
1	Interior Lighting System Improvements	A
2	Exterior Lighting System Improvements	A
3	Lighting Controls	A
4	Energy Management Control System Upgrades	D
5	Pump Improvement Measures	A
6	Pipe and Equipment Insulation	S
7	Vending Machine Controls	S
8	Pool Covers	A
9	Building Envelope Measures	S
10	Transport Gas	S
11	Education Program & Live Energy Monitoring	S

Proposed M&V Plan Details

ECM #	ECM Name	M&V Method	M&V Description
1&2	Interior & Exterior Lighting System	A	1. M&V Method: The method for verification of savings associated with this ECM is based on IPMVP Option A 2. Measured Parameter: Fixture amperage post retrofit 3. Sample size: 30 interior and 35 exterior fixtures will be measured, yielding a confidence level of 90% and a precision level of 10% 4. Measurement process: Using a handheld ammeter, fixture current shall be measured at the fixture level or at the circuit level to include all ballasts, drivers and lamps associated with the fixture power draw. Meter and measured load shall be selected such that measurement error is less than 2% 5. Savings determination: Fixture wattage will be determined based upon the measured amperages. Savings will be deemed achieved if the average post-retrofit wattage is less than or equal to the average proposed post-retrofit wattage. If the above condition is not met, the determined fixture amperages will be used to recalculate the actual savings 6. Frequency of measurements: Pre-retrofit interior fixture wattages were measured during the IGA. Because of access issues, exterior lighting pre-retrofit wattages are based on industry standards. Post-retrofit amperages will be measured and wattages determined once, upon fixture installation. These measured wattages will then be stipulated throughout the term of the contract 7. Stipulated values: Pre and post-retrofit hours of operation are stipulated as presented in the lighting savings calculations. Pre-retrofit wattages are stipulated as set forth in the energy savings calculations Summary: Wattages, determined as previously described, and operating hours, as set forth in in the energy savings calculations, shall be used to determine savings

ECM #	ECM Name	M&V Method	M&V Description
3	Lighting Controls	A	1. M&V Method: The method for verification of savings associated with this ECM is based on IPMVP Option A 2. Measured Parameter: Correct operation of controls 3. Sample size: 3 occupancy sensors will be checked, yielding a confidence level of 90% and a precision level of 10% 4. Measurement process: Upon entering a room with a de-energized occupancy sensor, observe that the sensor becomes energized and de-energized within a pre-determined interval upon leaving the room. 5. Savings determination: If the observations conclude that the occupancy sensors are functioning properly, the operating hours assumptions in the energy savings calculations will be verified and the savings will be deemed achieved 6. Frequency of measurements: Post-retrofit observations will be conducted once, upon project completion. These observations will then be stipulated throughout the term of the contract 7. Stipulated values: Pre and post-retrofit fixture wattages are stipulated as presented in the lighting savings calculations Summary: Hours of operation, determined as previously described, and fixture wattages, as set forth in in the energy savings calculations, shall be used to determine savings

ECM #	ECM Name	M&V Method	M&V Description
4	Energy Management Control System Upgrades	D	1. M&V Method: The method for verification of savings associated with this ECM is based on IPMVP Option D 2. Simulation software used: Trane TRACE® 700 v6.3.1 3. Calibration data and accuracy: The simulations were calibrated to whole facility baseline energy bills and TMY weather data. The baseline utility bill year was selected as the year having the least divergence from TMY weather data out of the three years evaluated. The mean bias error and coefficient of variation for each model can be found in Projected Energy Savings, Whole Building Models, Hourly Model Details 4. Frequency of re-calculated: Monitored parameters will be inserted and simulations re-calculated once, following project completion, to determine any baseline adjustment amounts and actual savings 5. Parameters monitored post-retrofit: Parameters may include but are not limited to; Building schedules and set points, economizer set points, CO2 set points, mixed air set points, duct static pressure set points, outside air damper minimum positions, discharge air temperature set points or reset schedules, heating and cooling outside air temperature lockouts 6. Stipulated values: The baseline weather conditions shall be stipulated as those calibrated to in the TEA simulations Summary: Calibrated simulations of the whole facilities were made using industry accepted building energy simulation software. Savings and baseline adjustments will be determined by inserting post-retrofit measurements and observations into simulations once following project completion

ECM #	ECM Name	M&V Method	M&V Description
5	Pump Improvement Measures	A	1. M&V Method: The method for verification of savings associated with this ECM is based on IPMVP Option A 2. Measured Parameter: Pool pump electrical current 3. Sample size: The Ashland lap and leisure pool pumps, Glenarm, Scheitler and 20th Street Rec Center pool pumps will be data-logged for a period of two weeks 4. Measurement process: Using data-logging equipment, pump electric current and water flow rate will be measured 5. Savings determination: Electric power draw will be calculated using the measured electrical current. Savings will be deemed achieved if the pump power draw falls within the range of the proposed kW shown in the energy savings calculations, and filter status is not in the alarm state. If measured power draw falls outside of this range the measured power draw will be inserted into the savings calculation spreadsheet to determine actual savings 6. Frequency of measurements: Once, following ECM installation and commissioning 7. Stipulated values: The filter contamination profiles, baseline pool pump power draw and all other values except for the proposed kW in the savings calculations shall be stipulated Summary: Wattages, determined as previously described and values and calculations stipulated in the savings calculations, shall be used to determine savings
6	Pipe and Equipment Insulation	S	The Agreed Upon Option shall be utilized for this ECM. The costs associated with performing measurement and verification for this ECM would exceed the cost savings projected for this ECM. Savings will be stipulated based on industry standard calculations and assumptions, and all calculations will be thoroughly evaluated and documented in the contract. Complete installation will be confirmed as part of the commissioning process.
7	Vending Machine Controls	S	The Agreed Upon Option shall be utilized for this ECM. The costs associated with performing measurement and verification for this ECM would exceed the cost savings projected for this ECM. Savings will be stipulated based on industry standard calculations and assumptions, and all calculations will be thoroughly evaluated and documented in the contract Complete installation will be confirmed as part of the commissioning process.

ECM #	ECM Name	M&V Method	M&V Description
8	Pool Covers	A	1. M&V Method: The method for verification of savings associated with this ECM is based on IPMVP Option A 2. Measured Parameter: Proper operation and hours of operation of pool covers 3. Sample size: All pool covers installed as part of this project 4. Measurement process: The pool cover operation will be observed to confirm that pool covers deploy properly when activated. Hours of operation will be measured with data loggers 5. Savings determination: If the pool covers are found to be in proper working order, and the hours of operation are consistent with those used in the savings calculations, the savings for this ECM will be deemed achieved. If observed hours of operation are less than proposed, a baseline adjustment may be performed to compensate for savings lost due to less than proposed hours of operation. If observed hours of operation are greater than proposed, a savings recalculation may be performed in order to include the additional savings in the verified savings 6. Frequency of measurements: Once, following ECM installation and commissioning 7. Stipulated values: Pool water temperatures, pool space temperatures and humidity levels, outside weather conditions and all values and equations used in the energy savings calculations shall be stipulated as presented in the savings calculations Summary: Observations of proper ECM operation and operating hours, and stipulated savings calculations as stated above shall be used to determine savings
9	Building Envelope Measures	S	The Agreed Upon Option shall be utilized for this ECM. The costs associated with performing measurement and verification for this ECM would exceed the cost savings projected for this ECM. Savings will be stipulated based on industry standard calculations and assumptions, and all calculations will be thoroughly evaluated and documented in the contract. Complete installation will be confirmed as part of the commissioning process.

ECM #	ECM Name	M&V Method	M&V Description
10	Transport Gas	S	The Agreed Upon Option shall be utilized for this ECM. The costs associated with performing measurement and verification for this ECM would exceed the cost savings projected for this ECM. Savings will be stipulated based on industry standard calculations and assumptions, and all calculations will be thoroughly evaluated and documented in the contract. Complete installation will be confirmed as part of the commissioning process.
11	Education Program & Live Energy Monitoring	S	The Agreed Upon Option shall be utilized for this ECM. The costs associated with performing measurement and verification for this ECM would exceed the cost savings projected for this ECM. Savings will be stipulated based on industry standard calculations and assumptions, and all calculations will be thoroughly evaluated and documented in the contract.

Ongoing M&V Services

Costs associated with M&V Post-installation report (PIR) and development of the Education Program & Live Energy Monitoring plan has been incorporated in the price of the EPC.

Each year following project completion, for a total of 3 years, Ameresco will invoice CCD for the following ongoing services at the given prices.

Year 1 – $23,000

This cost includes subscription to Ameresco Building Dynamics for 14 buildings, ongoing administration of the Education Program and Live Energy Monitoring and quarterly M&V site visits to ensure proper equipment operation, to document any observed discrepancies, to make any required adjustments to baseline energy models Additionally, utility bill analyses will be performed as an aid to maintaining persistence of the verified savings

Year 2 - $18,900

All services above, with the exception that M&V site visits are reduced to annual visits rather than quarterly

Year 3 - $18,900

All services above, with the exception that M&V site visits are reduced to annual visits rather than quarterly

Commissioning Plan Overview

The purpose of the Commissioning (Cx) Plan is to provide a general description of the commissioning process including the goals, intent and requirements; as well as to provide direction for the commissioning process during construction, providing resolution for issues such as scheduling, roles and responsibilities, lines of communication and reporting, approvals and coordination.

Ameresco plans to commission all newly installed equipment and systems to ensure the proper and efficient operation of these systems. Throughout the commissioning process, the commissioning agent revises the specific commissioning procedures and forms as necessary to suit project field conditions and actual approved manufacturer's equipment, to incorporate test data and procedure results, and to provide detailed scheduling for all commissioning tasks. A master list of deficiencies shall be maintained throughout the testing process until all items are closed out. The completed Commissioning Report becomes CCD's commissioning record and provides a reference to system setup, test results, and operational data for the systems commissioned.

CCD shall be notified of, and have the right to be present during these commissioning procedures. Ameresco shall document CCD's acceptance of each test and certification that tests have met or exceeded expected results. A commissioning specification shall be developed prior to the implementation of the project.

Documentation that the training plan has been completed and documentation that the operation manuals have been provided will be referenced by the commissioning report. Ameresco intends on commissioning all equipment installed under this agreement. The minimum listed commissioning activities for each piece of equipment to be installed are shown below. A formal report listing all commissioned points shall be given to CCD upon completion of the project.

Commissioning Process Description

Commissioning is a systematic process of ensuring that the building systems perform according to the design intent and the CCD's operational requirements. All equipment and systems should be installed according to manufacturer's recommendations and the best practices and standards of the industry. A complete commissioning process begins at the design phase and continues through construction and acceptance phases, with actual verification of performance.

The commissioning process is intended to achieve the following main goals:

- Facilitate the final acceptance of the project at the earliest possible date
- Ensure that CCD's operating personnel are adequately trained on the operation and maintenance of building equipment
- Ensure that the comfort systems meet the requirements of the occupants

Construction phase commissioning is intended to achieve the following objectives:

- Observe and document that systems and equipment are installed according to the design requirements, manufacturer's recommendations, and receive adequate operational checkout by installing contractors

- Observe and document performance of the systems and equipment in compliance with design intent
- Observe and document that O&M documentation is complete, complies with the design intent and is provided to CCD
- Observe and document that CCD's operating personnel are adequately trained per the design intent and CCD's

The Commissioning Plan is a document that outlines the organization, schedule, allocation of resources and documentation requirements of the commissioning process. The contractor verifies installation, provides scheduling and coordination of commissioning activities, performs training, starts up equipment, conducts tests, corrects deficiencies, performs re-tests and provides documentation of the process. The Commissioning Authority (CxA) provides CCD an objective view of the systems installation, documentation, operation and performance. Commissioning procedures and results are observed by the CxA. The contractor and subcontractor are expected to verify the functional readiness of systems to be tested prior to performing the tests in the presence of the witnesses. A high rate of test failure will indicate that the contractor has not adequately verified the readiness of the systems.

This plan is the key means for the CxA to inform all parties as to how each system functions independently and with respect to other systems. Each building system to be commissioned is addressed, including commissioning requirements, and completion and start-up schedule.

Equipment and Systems to be Commissioned

The commissioning process involves a complete and thorough evaluation of the operation and performance of all components, systems and sub-systems. The following shows ECMs to be commissioned:

Interior and Exterior Lighting Upgrade

- Installation checkout
  - Functional testing - On/off control

Lighting Occupancy Sensors

- Installation checkout
  - Functional testing - Occupancy sensor operation

Energy Management Control System Upgrades

GENERAL PRE-FUNCTIONAL CHECKS:

- Submittal review
- Installation checkout
- Witness/review start-up reports

General Functional Tests:

- Control points and sensors
- End devices and integration
- Graphics
- Trending

Equipment Scheduling/Setback:

- Control points and sensors
  - Operation & observation of equipment on site and from workstation
  - Equipment move from occupied to unoccupied settings and back based on scheduling

Optimal Morning Warm-Up

- Functional testing
  - Operation & observation of equipment on site and from workstation
  - Warm-up start time adjusts to outdoor air temperature and historic data

Seasonal Equipment Lockouts

- Functional testing
  - Operation & observation of equipment on site and from workstation
  - Equipment is locked out based on outdoor air temperature

Demand Controlled Ventilation (DCV)

- CO2 sensor installation checkout
- Functional Testing
  - Operation & observation of equipment on site and from workstation
  - OA dampers move from minimum position to fully open based on CO2 readings

Exhaust Fan Controls

- Functional testing
  - Operation & observation of equipment on site and from workstation
  - Equipment move from occupied to unoccupied settings and back based on scheduling
- **Supply Air Temperature Reset**
- Functional testing
  - Operation & observation of equipment on site and from workstation
  - Supply Air Temperature Resets based on OA temp and programed set points

Duct Pressure Reductions

- Functional testing
  - Operation & observation of equipment on site and from workstation
  - Duct pressure adjusts based on programed algorithms or schedule

Economizer:

- Functional testing
  - Operation & observation of equipment on site and from workstation
  - System moves into and stays in economizer mode based on OA temp

CONVERSION FROM HOT DECK/COLD DECK, CONSTANT VOLUME (CV) TO VARIABLE AIR VOLUME (VAV):

- VFD and damper controls installation checkout
- Functional Testing
  - Operation & observation of equipment on site and from workstation
  - VFD and dampers adjust appropriately based on demand(s) in zones

HUMIDITY CONTROL:

- Humidity sensor installation checkout
- Functional testing
  - Operation & observation of equipment on site and from workstation
  - System controls appropriately based on humidity levels.

Pump Improvement Measures

- VFD and flow sensors installation checkout
- Functional testing
  - Operation & observation of equipment on site
  - Pump speed adjusts based on flow readings
  - Alarm activates at low flow set point

Pipe and Equipment Insulation

- Installation inspection

Vending Machine Controls

- Installation checkout
- Functional testing
  - Occupancy sensor operation

Pool Covers

- Installation inspection
  - Deploys and retracts correctly

Building Envelope Measures

- Installation inspection

Transport Gas

- Installation inspection
- Transport gas account has been activated

Financial Results

This section of the Technical Energy Audit summarizes the cost, savings and financial performance of the project. Utility and operational savings were all calculated for each applicable measure.

Saving Categories

Utility Cost Savings

Utility costs are defined as all metered electricity and natural gas consumption. Utility cost savings are defined as a reduction in the cost of energy from a base cost established through a methodology set forth in an energy savings performance contract. Ameresco is responsible for meeting or exceeding the energy savings guarantee associated with utility cost savings.

Operating Costs Savings

Most energy cost savings projects also result in operational cost reductions. These operating costs include non-utility costs that are being spent as a result of owning the existing equipment slated for replacement. Operating costs are defined as costs for parts, maintenance contracts and other consumable items used to maintain existing equipment that will be reduced upon installation of new equipment. CCD will benefit from the operational cost savings associated with this project (which will be noted as a stipulated savings).

Rebates

Ameresco researched rebate and grant opportunities for CCD within the proposed project scope. By implementing the measures suggested, there is a potential for utility provider rebates up to $98,000. This rebate is through Xcel Energy's Self Direct program and will need to be applied for before a performance contract is signed. See web site below for more information. Ameresco will work with your team to complete the applications for rebates.

http://www.xcelenergy.com/Energy_Solutions/Rebate_Finder_Tool/Self-Direct_Efficiency

Equipment Lifespan

The table below summarizes the expected lifespan of the equipment to be installed as compared to the respective simple paybacks of each item. Sources for this information include the American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE), vendor estimates, and manufacturing standards. The weighted average (based on the price of each measure and the worst case median service life) of the recommended measures is 16 years.

Table 105: Expected Lifespan of Installed Equipment

Energy Conservation Measure	Price	Life Expectancy
Interior Lighting System Improvements	$588,667	15
Exterior Lighting System Improvements	$179,877	15
Lighting Controls	$17,044	15
Energy Management Control System Upgrades	$664,806	18
Pump Improvement Measures	$92,496	17
Pipe and Equipment Insulation	$32,031	20
Vending Machine Controls	$6,305	15
Pool Covers	$235,291	12
Building Envelope Measures	$83,079	20
Transport Gas	$13,135	20
Education Program & Live Energy Monitoring	$79,910	15
Totals	**$1,992,641**	**16**
Price Weighted Life Expectancy (Sum of Life Expectancy Weighted Prices divided by Total Project Price)		

Financing Strategy

Ameresco has considered a variety of different energy conservation measures. At the direction of CCD, Ameresco explored all of the options identified during the preliminary review of the opportunities. The measures included in the recommend scope provide the best solution that meets the financial requirements for this project.

Table 106: ECM Costs and Savings

#	ECM Savings - Units	Guaranteed Savings	Price	Simple Payback
1	Interior Lighting System Improvements	$39,312	$588,667	15.0
2	Exterior Lighting System Improvements	$7,786	$179,877	23.1
3	Lighting Controls	$404	$17,044	42.2
4	Energy Management Control System Upgrades	$35,261	$664,806	18.9
5	Pump Improvement Measures	$11,084	$92,496	8.3
6	Pipe and Equipment Insulation	$1,408	$32,031	22.8
7	Vending Machine Controls	$556	$6,305	11.3
8	Pool Covers	$9,911	$235,291	23.7
9	Building Envelope Measures	$3,638	$83,079	22.8
10	Transport Gas	$3,755	$13,135	3.5
11	Education Program & Live Energy Monitoring	$9,799	$79,910	8.2
	Total	**122,913**	**1,992,641**	**16.2**

The annual cash flow for this project is outlined in the table below:

Cash Flow

Table 107: Annual Cash Flow

Pro-forma			Year									
		Initial Values	1	2	3	4	5	6	7	8	9	10
1	Annual energy costs without improvements	$ 681,647	$ 705,505	$ 730,197	$ 755,754	$ 782,205	$ 809,583	$ 837,918	$ 867,245	$ 897,599	$ 929,015	$ 961,530
2	Annual energy costs with improvements	$ 582,757	$ 603,153	$ 624,264	$ 646,113	$ 668,727	$ 692,132	$ 716,357	$ 741,429	$ 767,379	$ 794,238	$ 822,036
3	Annual energy cost savings (1-2)	$ 98,890	$ 102,351	$ 105,934	$ 109,641	$ 113,479	$ 117,450	$ 121,561	$ 125,816	$ 130,219	$ 134,777	$ 139,494
4	O&M Savings	$ 24,023	$ 24,863	$ 25,734	$ 26,634	$ 27,566	$ 28,531	$ 29,530	$ 30,563	$ 31,633	$ 32,740	$ 33,886
5	Total Project Savings	$ 122,913	$ 127,215	$ 131,667	$ 136,275	$ 141,045	$ 145,982	$ 151,091	$ 156,379	$ 161,852	$ 167,517	$ 173,380
6	Payments for financing equipment		$ 91,393	$ 100,765	$ 105,374	$ 132,823	$ 137,760	$ 142,869	$ 148,158	$ 153,631	$ 159,296	$ 165,159
7	Payments for Ongoing Services	$ -	$ 27,600	$ 22,680	$ 22,680	$ -	$ -	$ -	$ -	$ -	$ -	$ -
8	Net annual benefits		$ 8,222	$ 8,222	$ 8,222	$ 8,222	$ 8,222	$ 8,222	$ 8,222	$ 8,222	$ 8,222	$ 8,222
9	Cumulative cash flow	**$ 123,325**	$ 8,222	$ 16,443	$ 24,665	$ 32,887	$ 41,108	$ 49,330	$ 57,552	$ 65,773	$ 73,995	$ 82,216
10	**Net Present Value of cash flow**	**$ 104,856**										

Line #	11	12	13	14	15	Totals
1	$ 995,184	$ 1,030,015	$ 1,066,066	$ 1,103,378	$ 1,141,996	$ 13,613,190
2	$ 850,807	$ 880,586	$ 911,406	$ 943,305	$ 976,321	$ 11,638,253
3	$ 144,377	$ 149,430	$ 154,660	$ 160,073	$ 165,675	$ 1,974,937
4	$ 35,072	$ 36,300	$ 37,570	$ 38,885	$ 40,246	$ 479,754
5	$ 179,449	$ 185,729	$ 192,230	$ 198,958	$ 205,922	$ 2,454,692
6	$ 171,227	$ 177,508	$ 184,008	$ 190,736	$ 197,700	$ 2,258,407
7	$ -	$ -	$ -	$ -	$ -	$ 72,960
8	$ 8,222	$ 8,222	$ 8,222	$ 8,222	$ 8,222	$ 123,325
9	$ 90,438	$ 98,660	$ 106,881	$ 115,103	$ 123,325	

Financial Assumptions

The above project cash flow was analyzed with the following financial assumptions:

Project Size:	Max of $2,000,000
Finance Rate:	2.1% (with no construction period interest)
Savings Inflation Rate:	3.5%
Cost Inflation Rate:	3.5%
Lease-Purchase Term:	15-years
Annual Ongoing Services:	$23,000, $18,900, $18,900 (for years 1-3)

Annual Ongoing Services for 3-years only (As per Colorado Statutes)

CCD may make a change to financing terms as desired for a final Energy Performance Contract. All cost savings included in this project are guaranteed.

Attachment A – Three Years Utility Bills Summary

Attachment B – Lighting Audit

Attachment C – Trane Trace Baseline Inputs

- Fire Station#1(HQ)
- Fire Station #8
- Police District #1
- 911 Call Center
- Twentieth Street Rec Ctr
- Barnum Library
- Bear Valley Library
- Eugene Field Library
- Schlessman Family Library

Attachment D – Trane Trace Calibration & Results

- Fire Station#1(HQ)
- Fire Station #8
- Police District #1
- 911 Call Center
- Twentieth Street Rec Ctr
- Barnum Library
- Bear Valley Library
- Eugene Field Library
- Schlessman Family Library

Attachment E – Colorado Energy Office Q & A

This section is reserved for future Colorado Energy Office questions and Ameresco responses.

CONTACTS:

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Aurora, CO 80014

T: 720.627.8731 • F: 303.309.6228

Name of contact person in the firm:

Joel Asrael, PE Rocky Mountain Region

ameresco.com

Attachment A – Three Years Utility Bills Summary

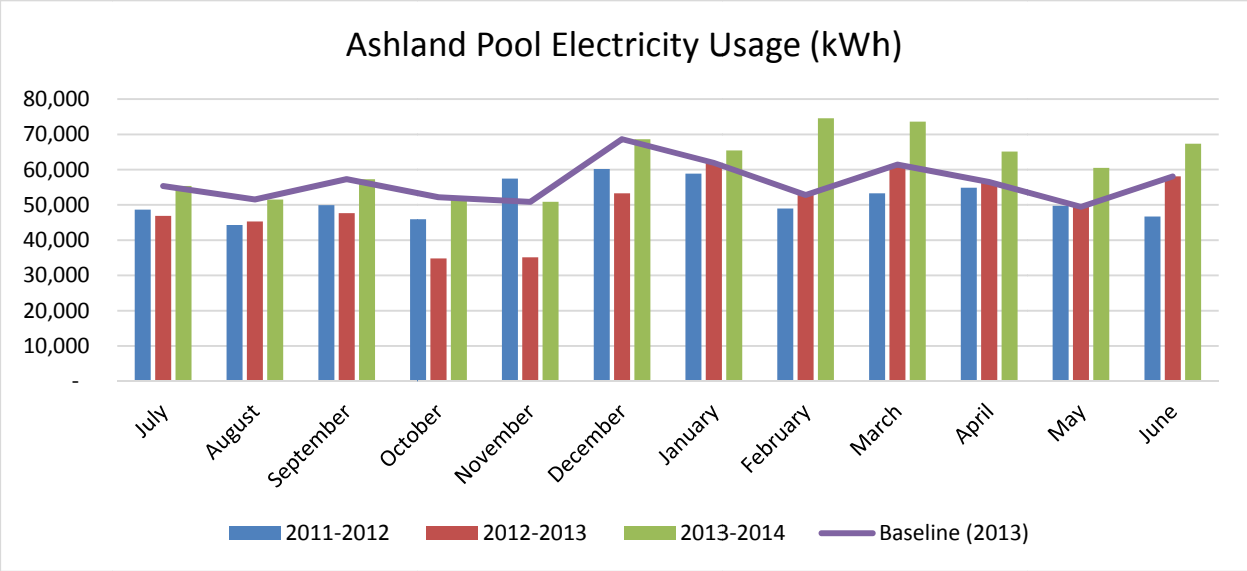
Following is a table of utility accounts and facilities served. Three years of electrical usage, demand and natural gas usage were charted for each facility in this appendix. The baseline year (calendar year 2013) in the charts is shown as a purple line. Only one year of water and sewer bills were evaluated.

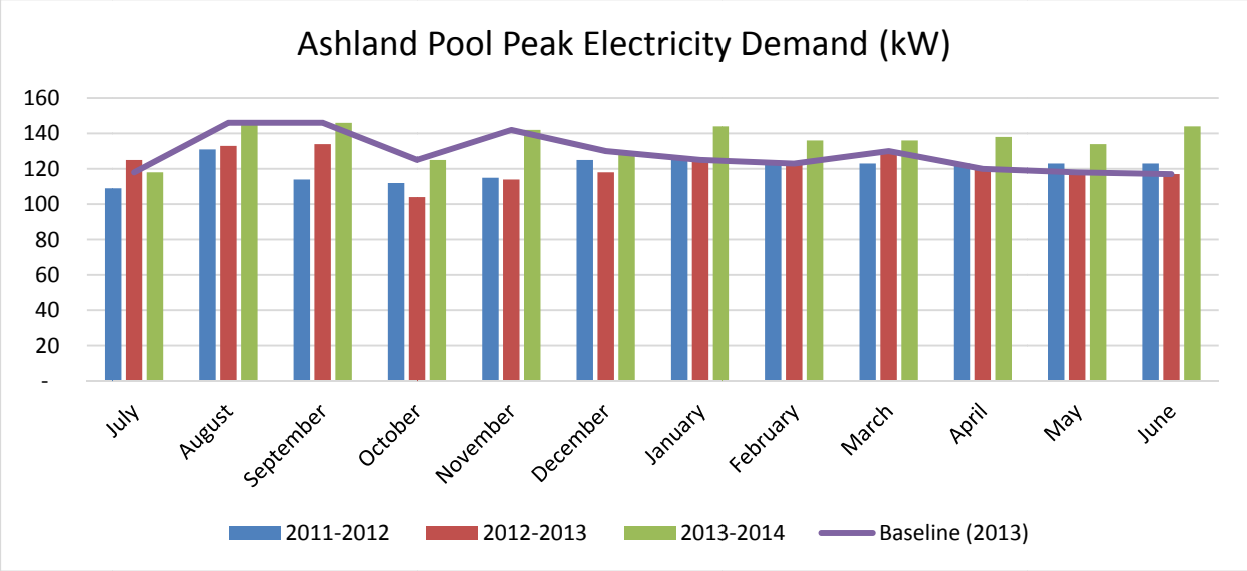
Summary of Accounts

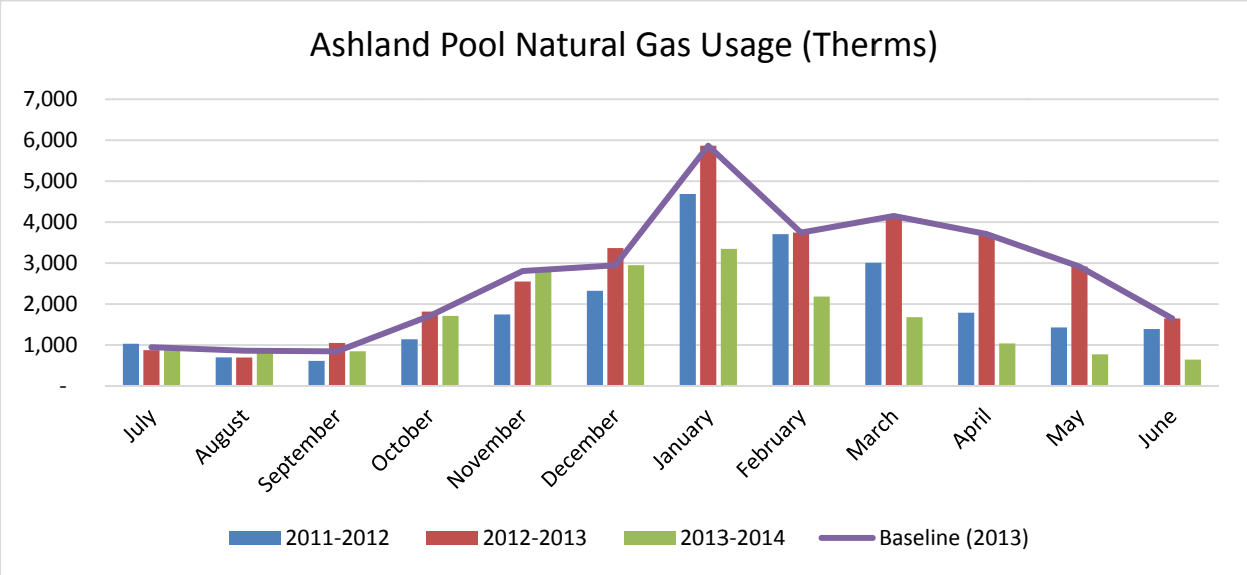
Building	Service Type	Account Number	Provider
Ashland Pool	Electric	5323809298	Xcel
	Natural Gas	5323809298	Xcel
	Water/Sewer	1975221111	Denver Water
Ashland Rec Ctr	Electric	5320097223	Xcel
	Natural Gas	5320097223	Xcel
	Water/Sewer	6681350963	Denver Water
Barnum Library	Electric	5319134453	Xcel
	Natural Gas	5319134453	Xcel
	Water/Sewer	4908050343	Denver Water
Bear Valley Library	Electric	5319134328	Xcel
	Natural Gas	5319134328	Xcel
	Water/Sewer	4908050377	Denver Water
Combined Communication Center	Electric	5320098826	Xcel
	Natural Gas	5320098882	Xcel
	Water/Sewer	n/a	Denver Water
Eugene Field Library	Electric	5319134351	Xcel
	Natural Gas	5319134486	Xcel
	Water/Sewer	4908050372	Denver Water
Fire Station #8	Electric	5320099021	Xcel
	Natural Gas	5320099021	Xcel
	Water/Sewer	0519250444	Denver Water
Fire Station #9	Electric	5320098871	Xcel
	Natural Gas	5320098871	Xcel
	Water/Sewer	0519250865	Denver Water
Fire Station#1(HQ)	Electric	5338234465	Xcel
	Natural Gas	5320098939	Xcel
	Water/Sewer	0519250435	Denver Water

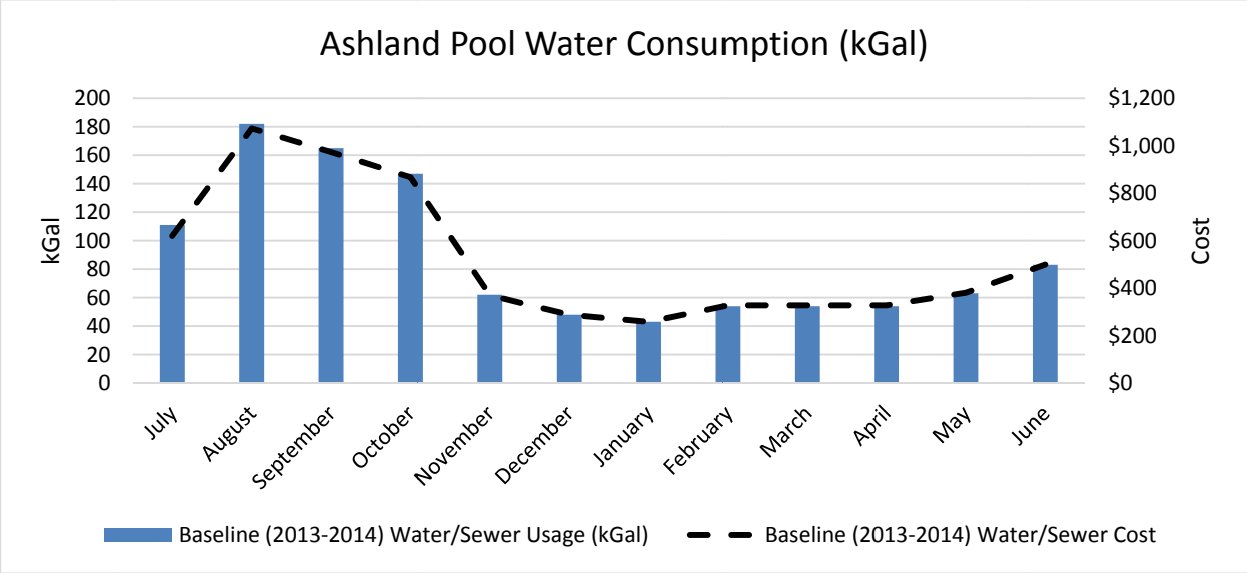
Glenarm Rec Ctr	Electric	301951826	Xcel
	Natural Gas	5320097416	CenterPoint Energy, Inc
	Water/Sewer	6681350917	Denver Water
Police District #1	Electric	5319132622	Xcel
	Natural Gas	5319132622	Xcel
	Water/Sewer	0519250033	Denver Water
Scheitler Rec Ctr	Electric	300672279	Xcel
	Natural Gas	5320096982	CenterPoint Energy, Inc
	Water/Sewer	6681350527	Denver Water
Schlessman Family Library	Electric	5319134431	Xcel
	Natural Gas	5319134431	Xcel
	Water/Sewer	4908050676	Denver Water
Twentieth Street Rec Ctr	Electric	300672542	Xcel
	Natural Gas	5320097289	CenterPoint Energy, Inc
	Water/Sewer	6681350327	Denver Water

Ashland Pool

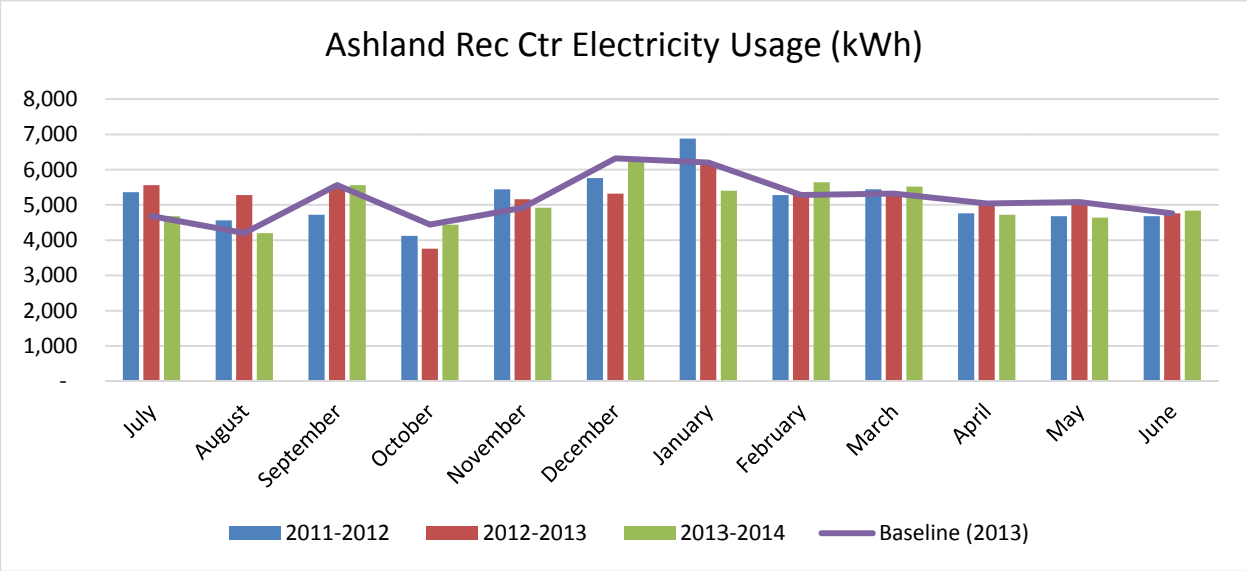


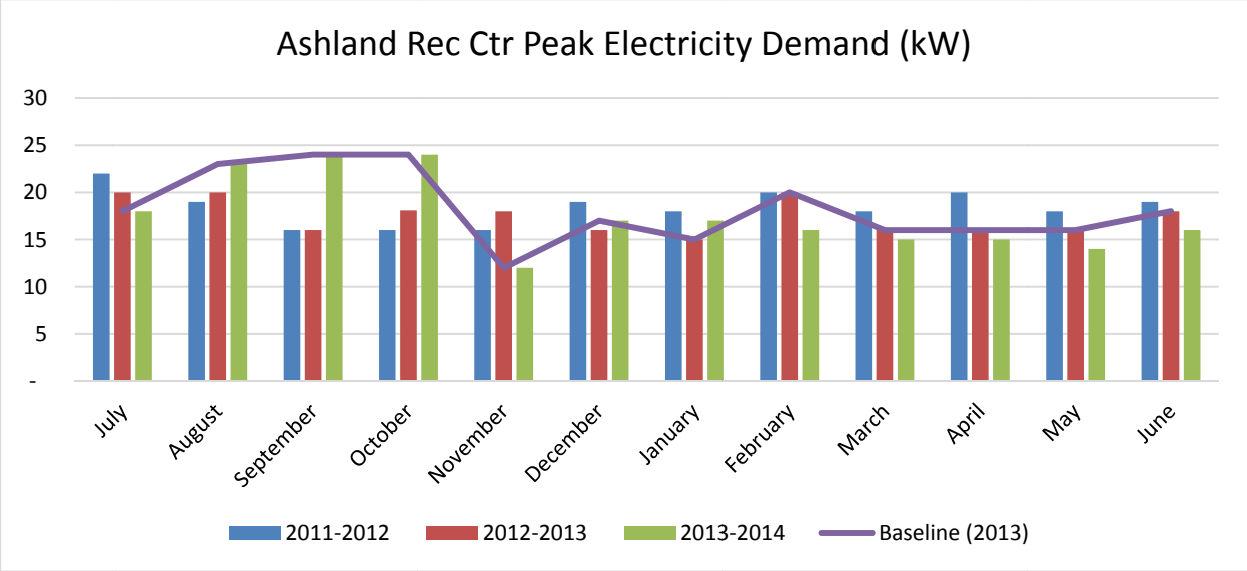


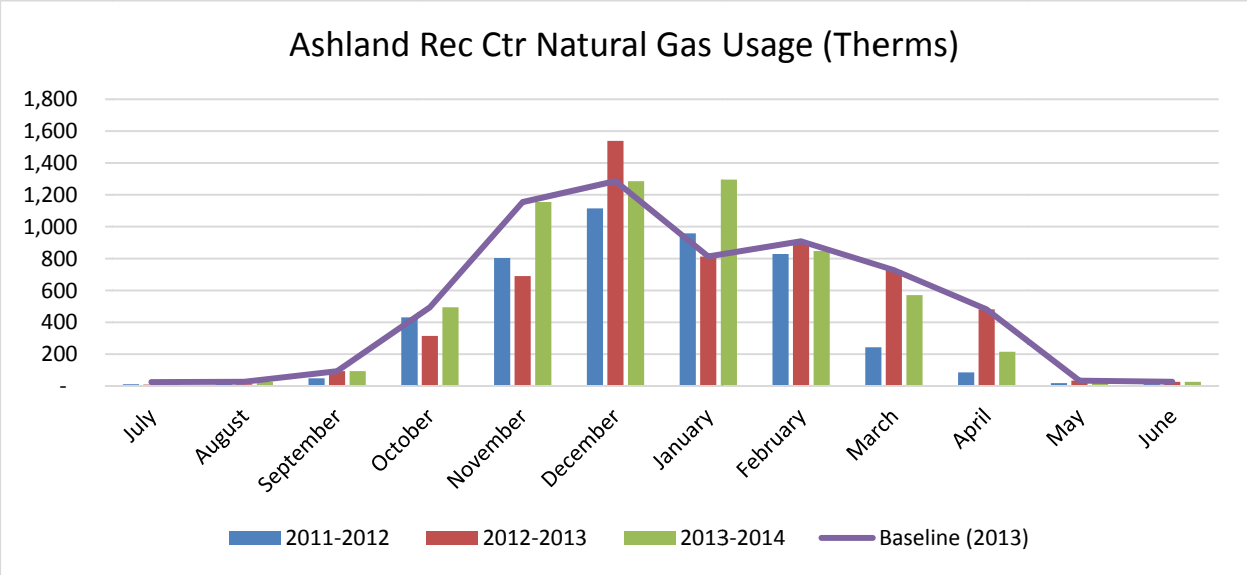

Ashland Pool Natural Gas Usage (Therms)
7,000
6,000
5,000
4,000
3,000
2,000
1,000
-
July
August
September
October
November
December
January
February
March
April
May
June
2011-2012
2012-2013
2013-2014
Baseline (2013)

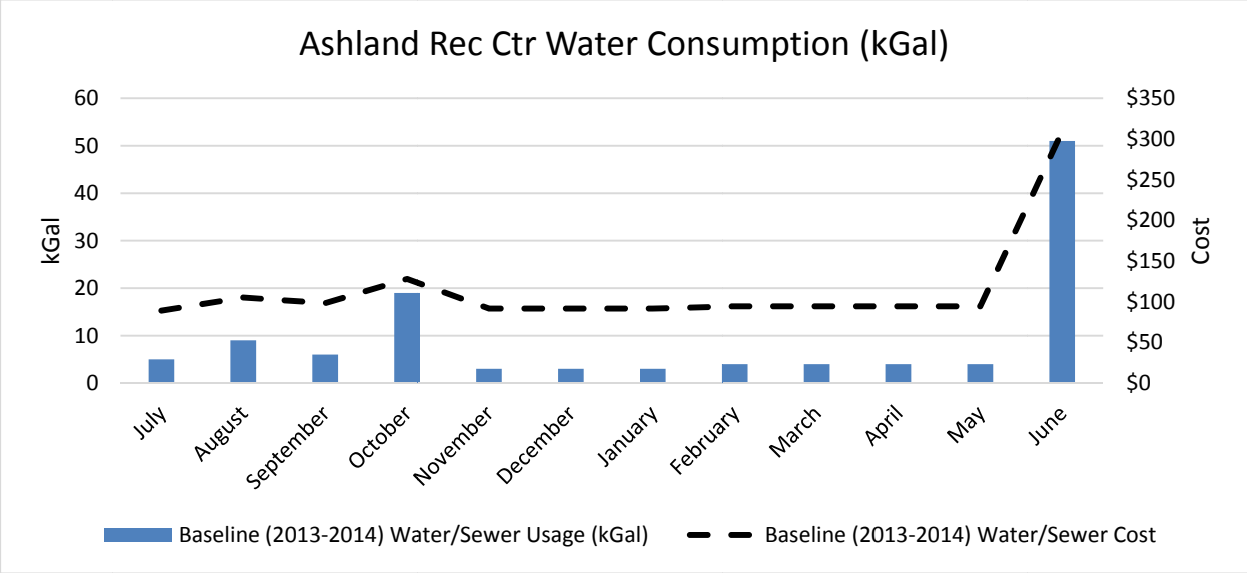

Ashland Pool Water Consumption (kGal)
kGal
200
180
160
140
120
100
80
60
40
20
0
$1,200
$1,000
$800
$600
$400
$200
$0
Cost
July
August
September
October
November
December
January
February
March
April
May
June
Baseline (2013-2014) Water/Sewer Usage (kGal)
Baseline (2013-2014) Water/Sewer Cost

Ashland Rec Center

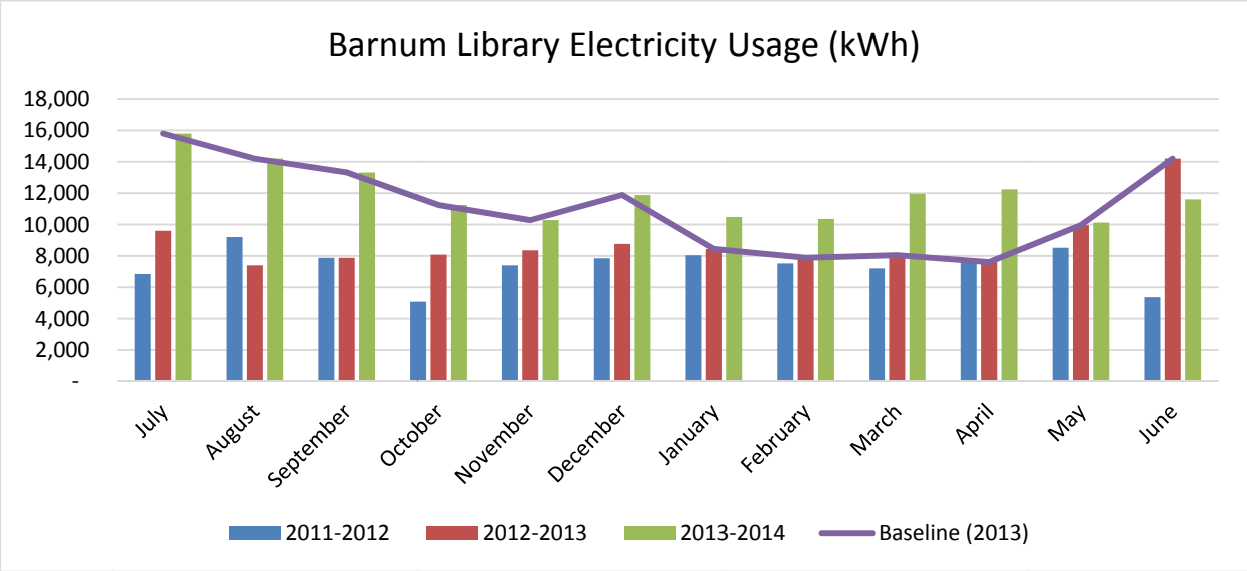


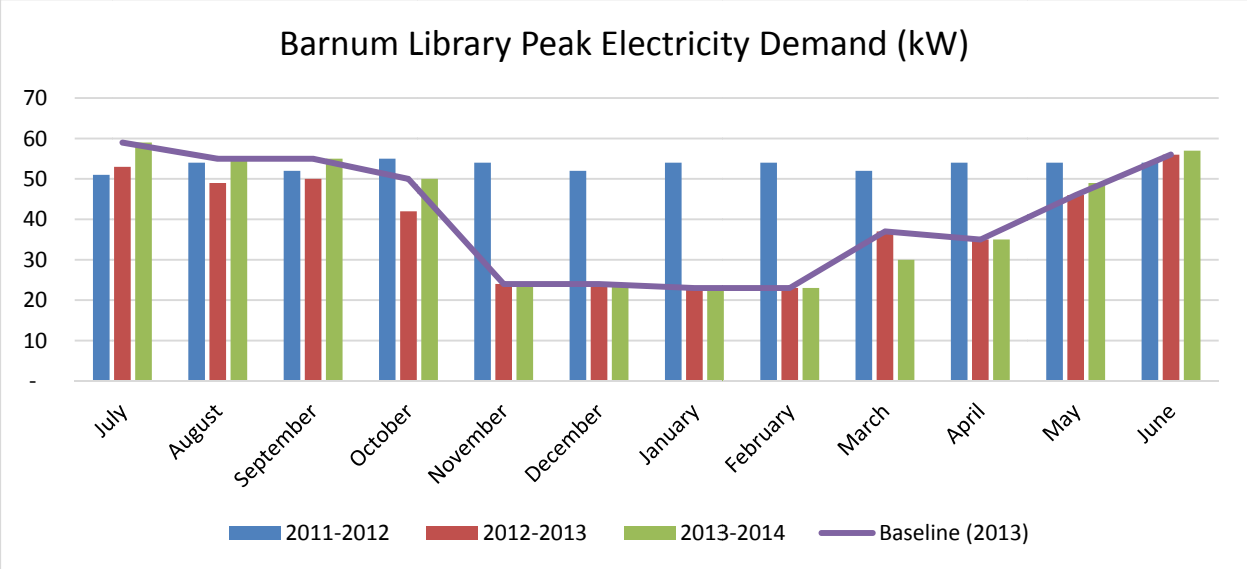


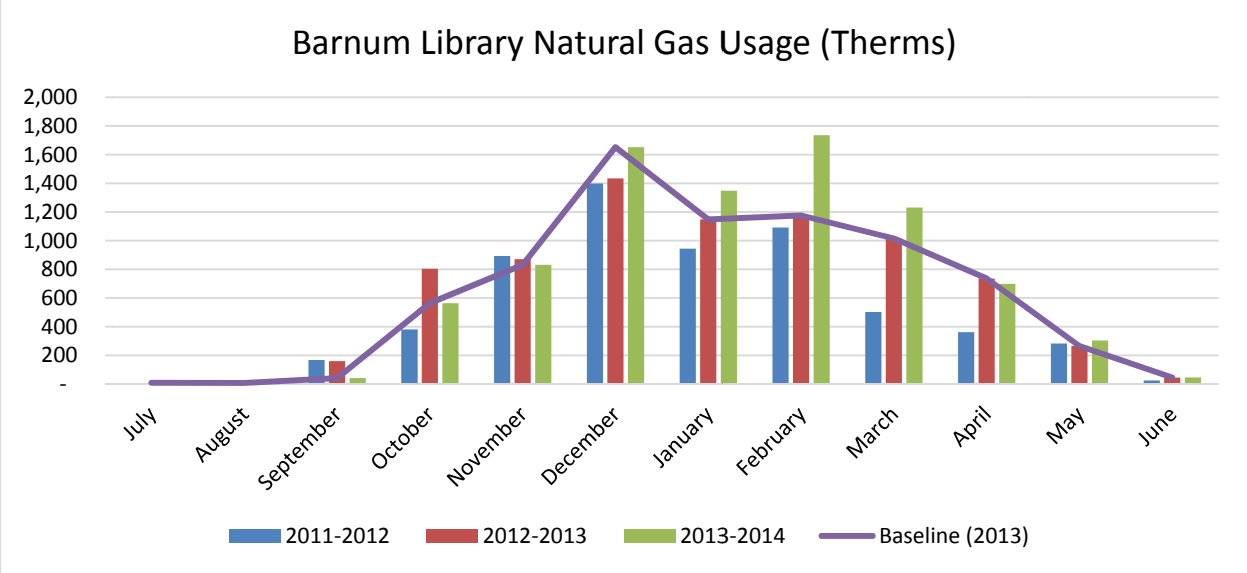

Ashland Rec Ctr Natural Gas Usage (Therms)
1,800
1,600
1,400
1,200
1,000
800
600
400
200
-
July
August
September
October
November
December
January
February
March
April
May
June
2011-2012
2012-2013
2013-2014
Baseline (2013)

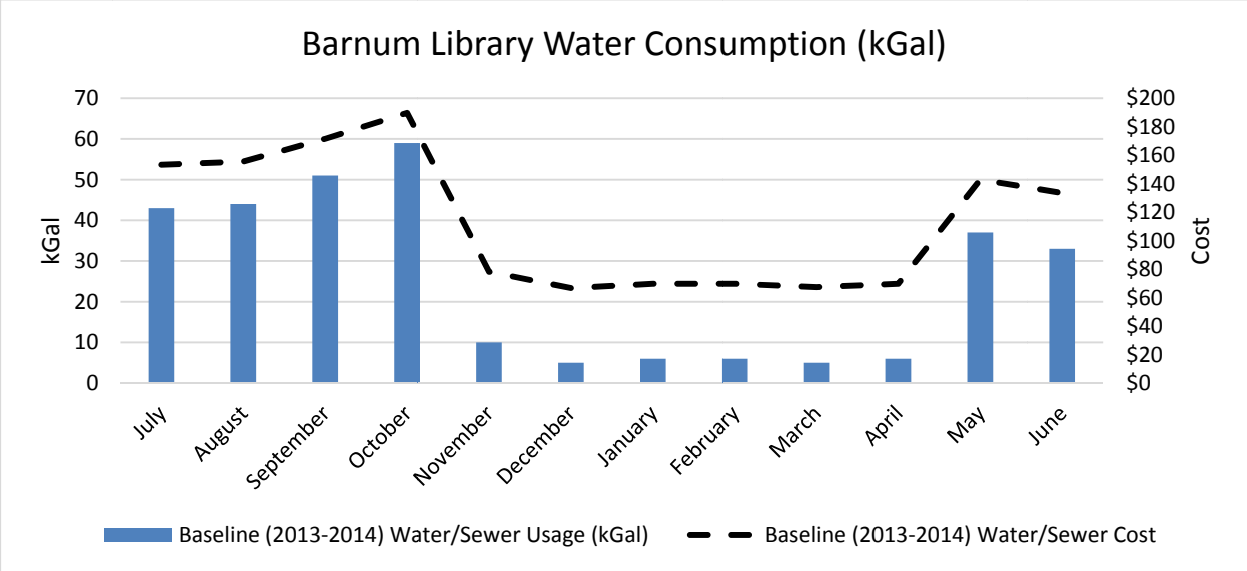

Ashland Rec Ctr Water Consumption (kGal)
kGal
60
50
40
30
20
10
0
$350
$300
$250
$200
$150
$100
$50
$0
Cost
July
August
September
October
November
December
January
February
March
April
May
June
Baseline (2013-2014) Water/Sewer Usage (kGal)
Baseline (2013-2014) Water/Sewer Cost

Barnum Library

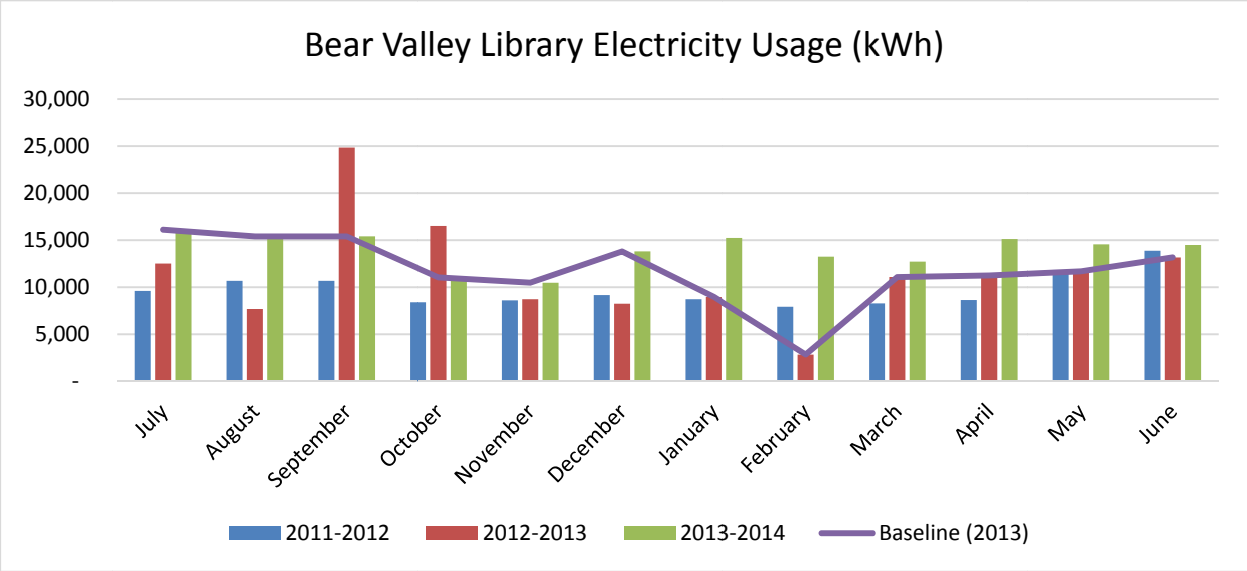


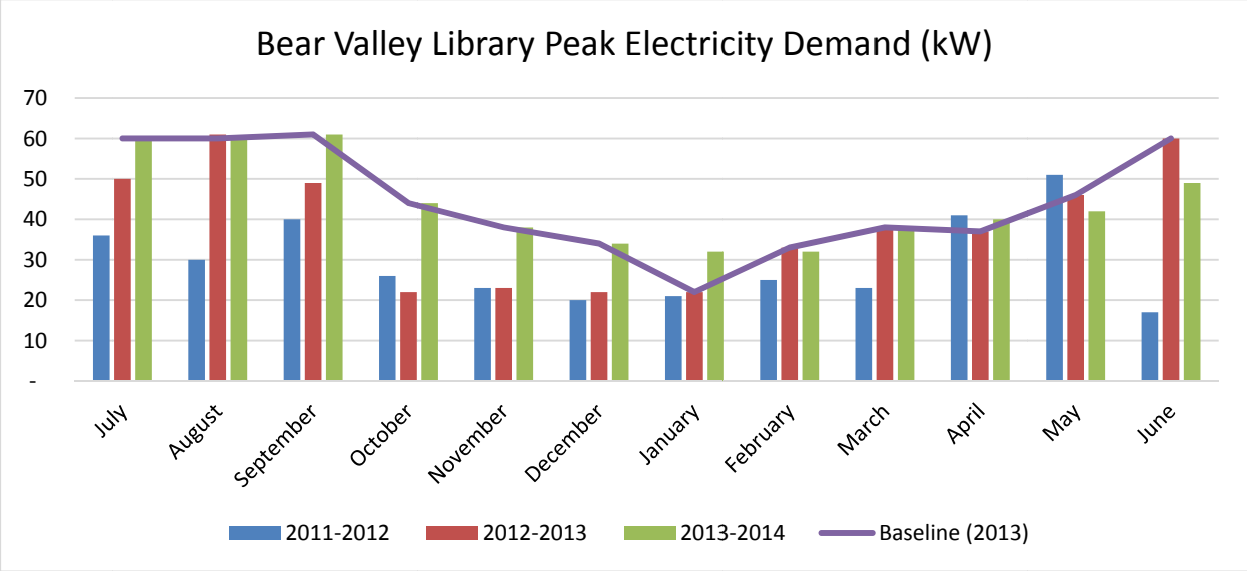


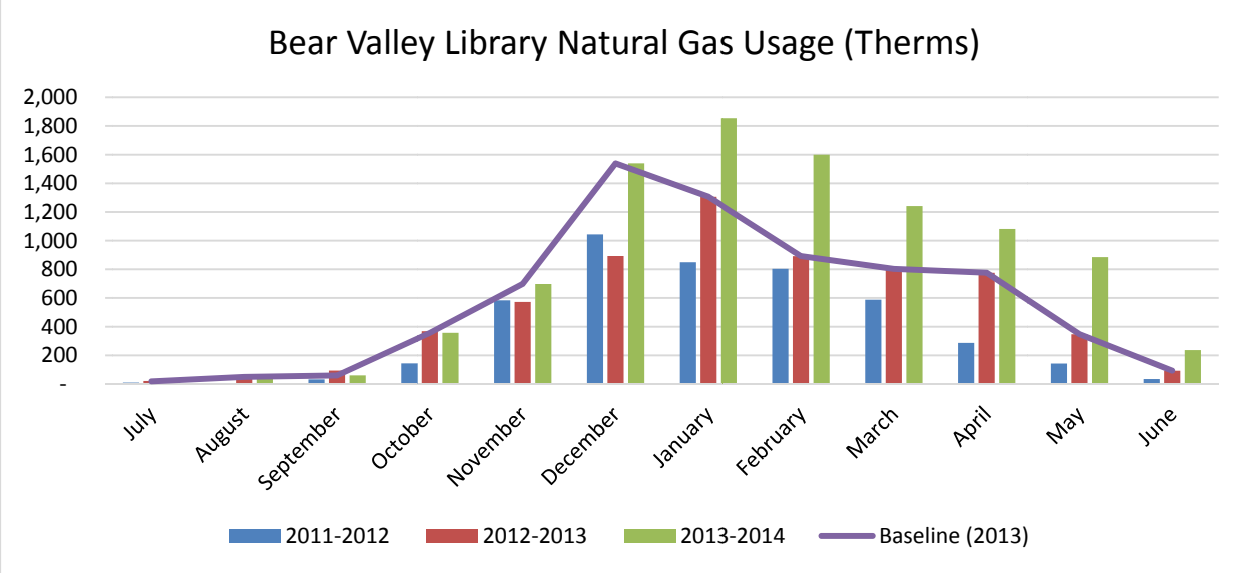

Barnum Library Natural Gas Usage (Therms)
2,000
1,800
1,600
1,400
1,200
1,000
800
600
400
200
-
July
August
September
October
November
December
January
February
March
April
May
June
2011-2012
2012-2013
2013-2014
Baseline (2013)

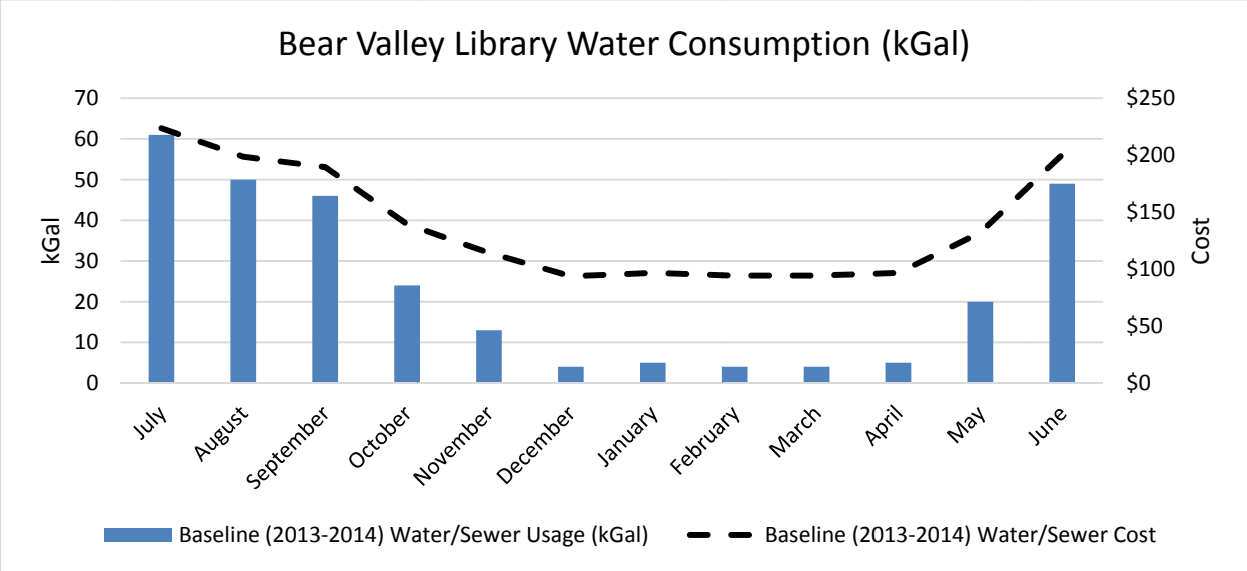

Barnum Library Water Consumption (kGal)
kGal
70
60
50
40
30
20
10
0
Cost
$200
$180
$160
$140
$120
$100
$80
$60
$40
$20
$0
July
August
September
October
November
December
January
February
March
April
May
June
Baseline (2013-2014) Water/Sewer Usage (kGal)
Baseline (2013-2014) Water/Sewer Cost

Bear Valley Library

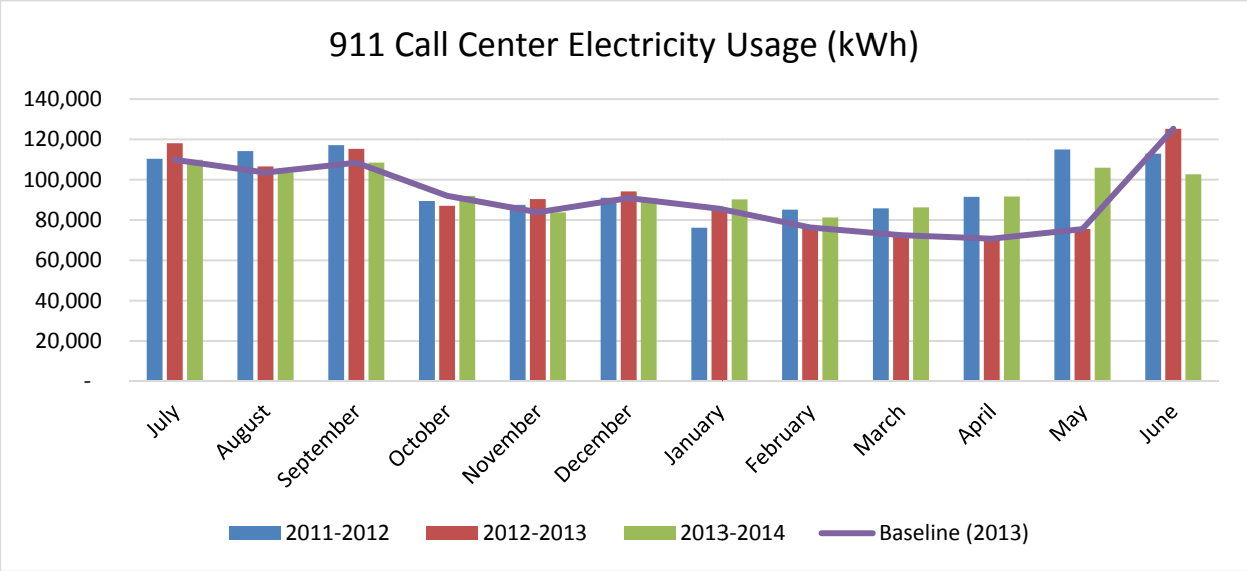


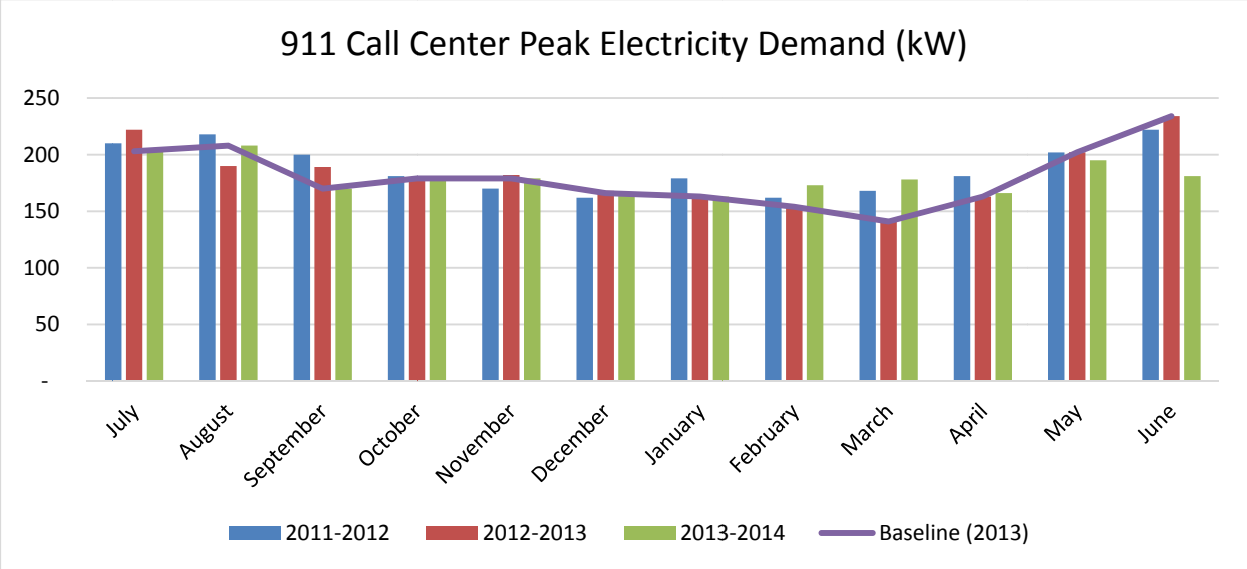


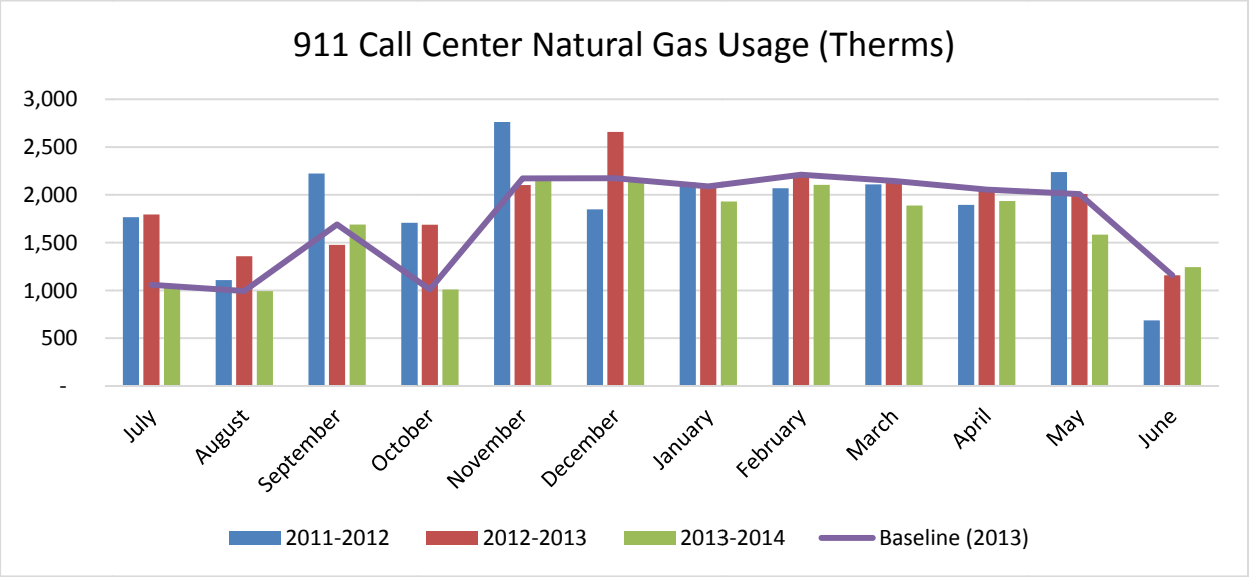

Bear Valley Library Natural Gas Usage (Therms)
2,000
1,800
1,600
1,400
1,200
1,000
800
600
400
200
-
July
August
September
October
November
December
January
February
March
April
May
June
2011-2012
2012-2013
2013-2014
Baseline (2013)

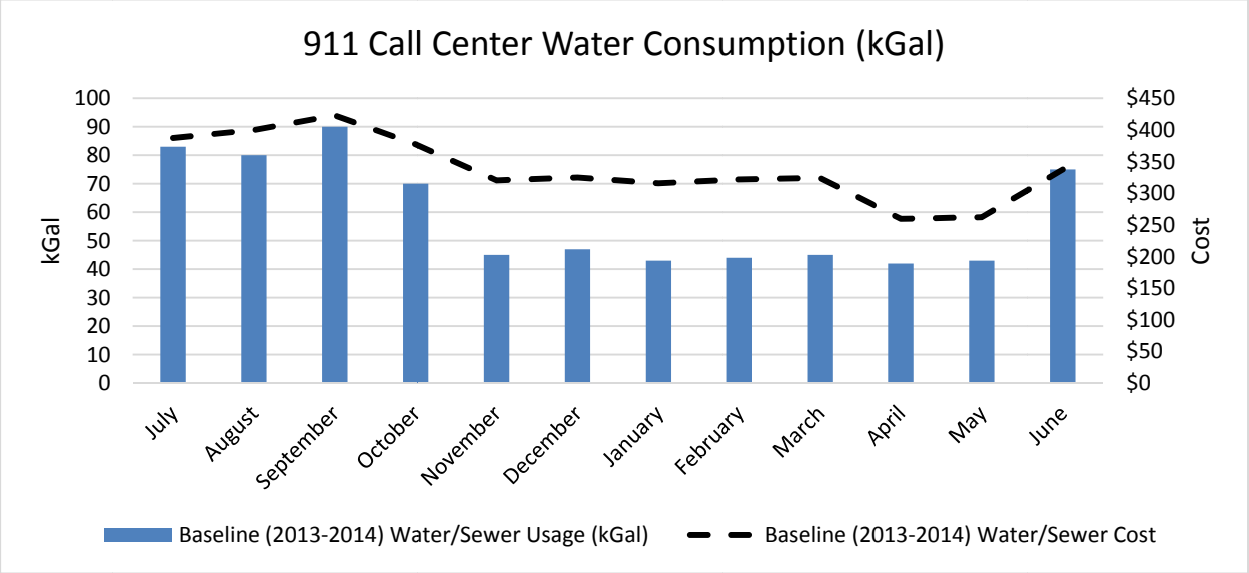

Bear Valley Library Water Consumption (kGal)
kGal
70
60
50
40
30
20
10
0
$250
$200
$150
$100
$50
$0
Cost
July
August
September
October
November
December
January
February
March
April
May
June
Baseline (2013-2014) Water/Sewer Usage (kGal)
Baseline (2013-2014) Water/Sewer Cost

911 Call Center

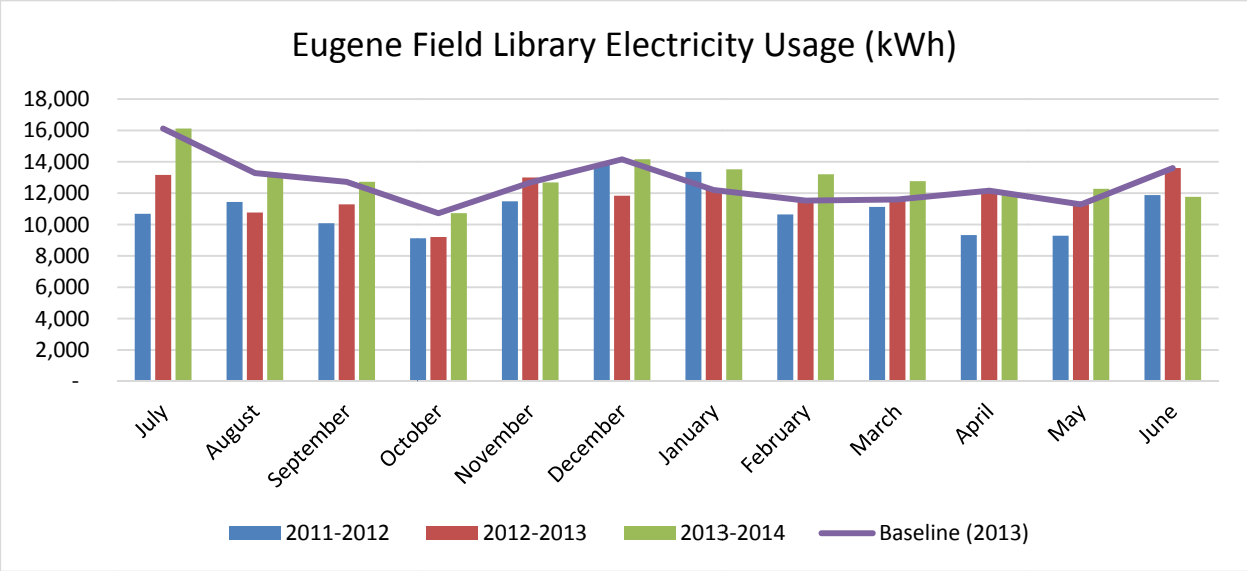


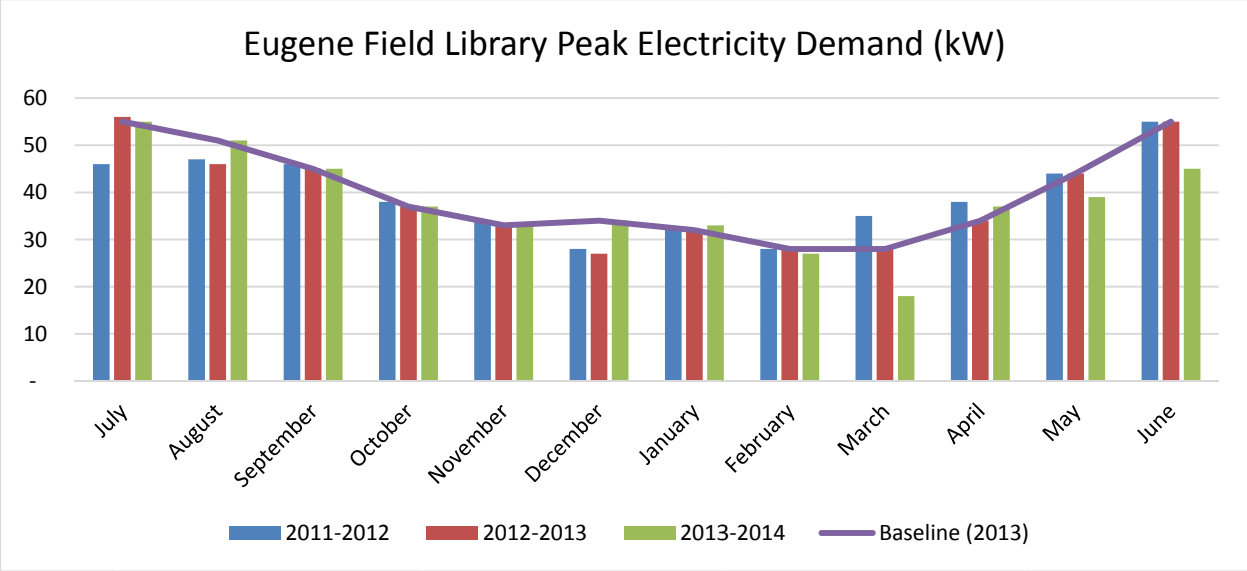


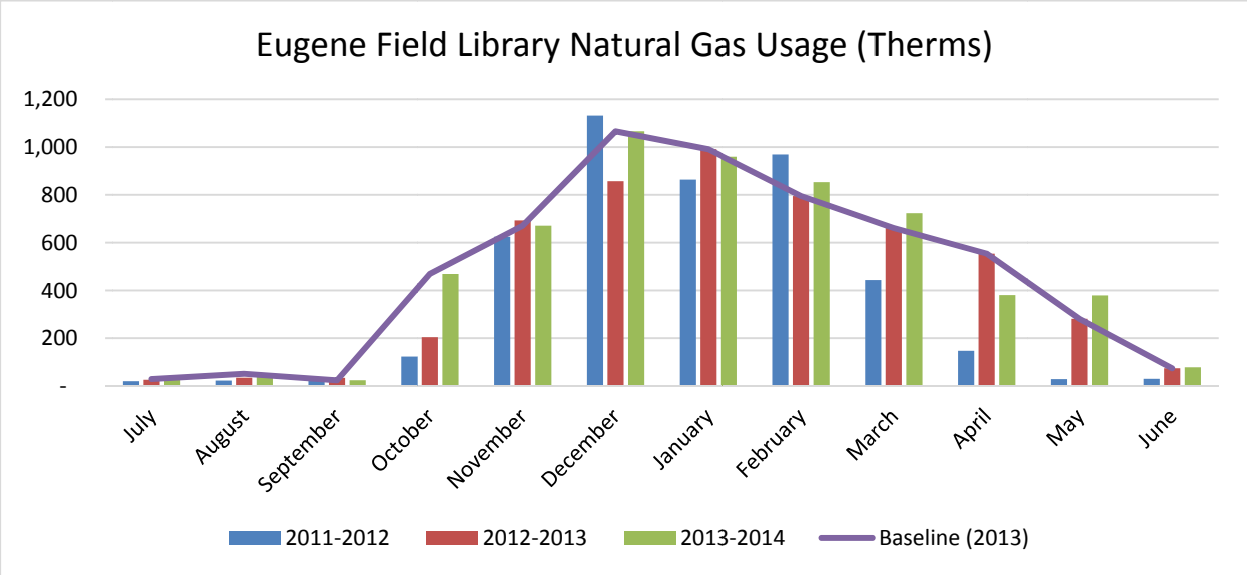

911 Call Center Natural Gas Usage (Therms)
3,000
2,500
2,000
1,500
1,000
500
-
July
August
September
October
November
December
January
February
March
April
May
June
2011-2012
2012-2013
2013-2014
Baseline (2013)

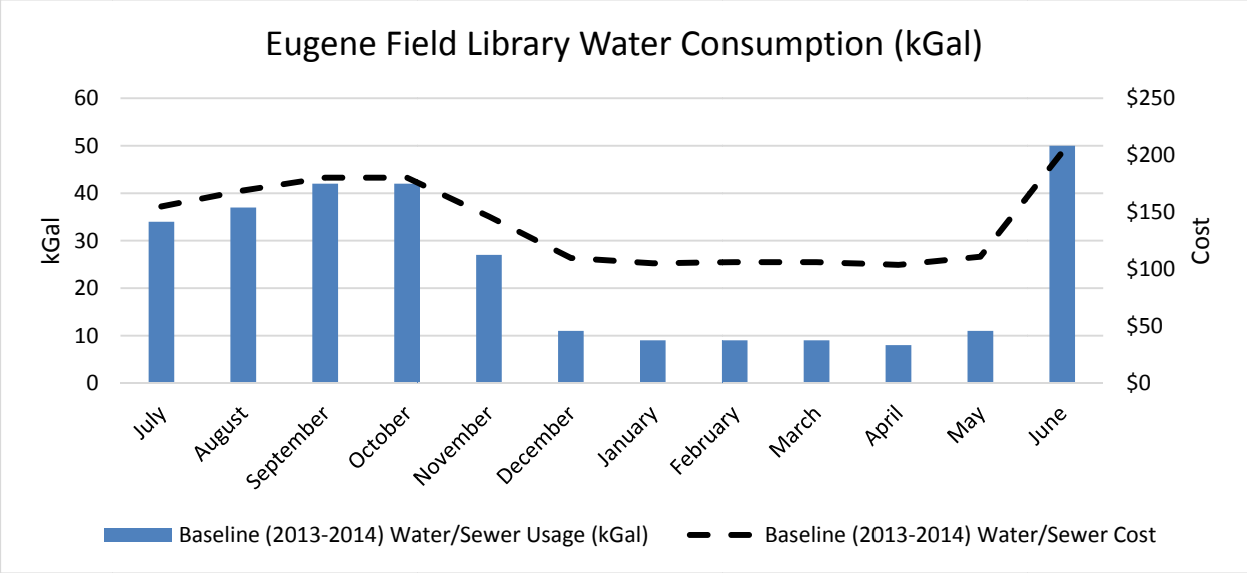

911 Call Center Water Consumption (kGal)
kGal
100
90
80
70
60
50
40
30
20
10
0
$450
$400
$350
$300
$250
$200
$150
$100
$50
$0
Cost
July
August
September
October
November
December
January
February
March
April
May
June
Baseline (2013-2014) Water/Sewer Usage (kGal)
Baseline (2013-2014) Water/Sewer Cost

Eugene Field Library

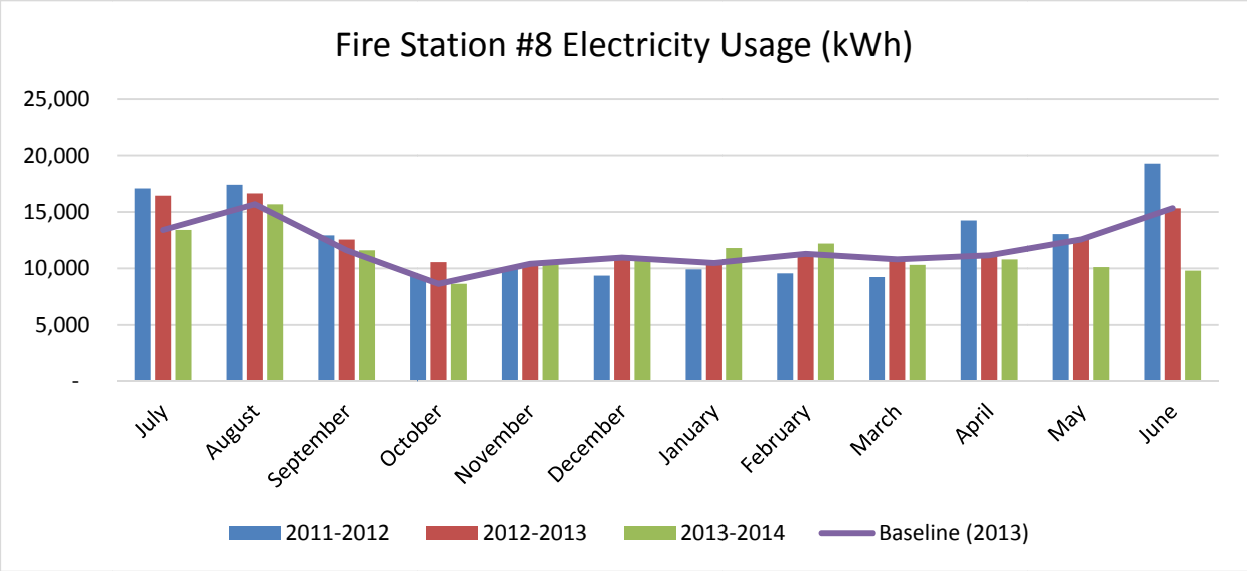


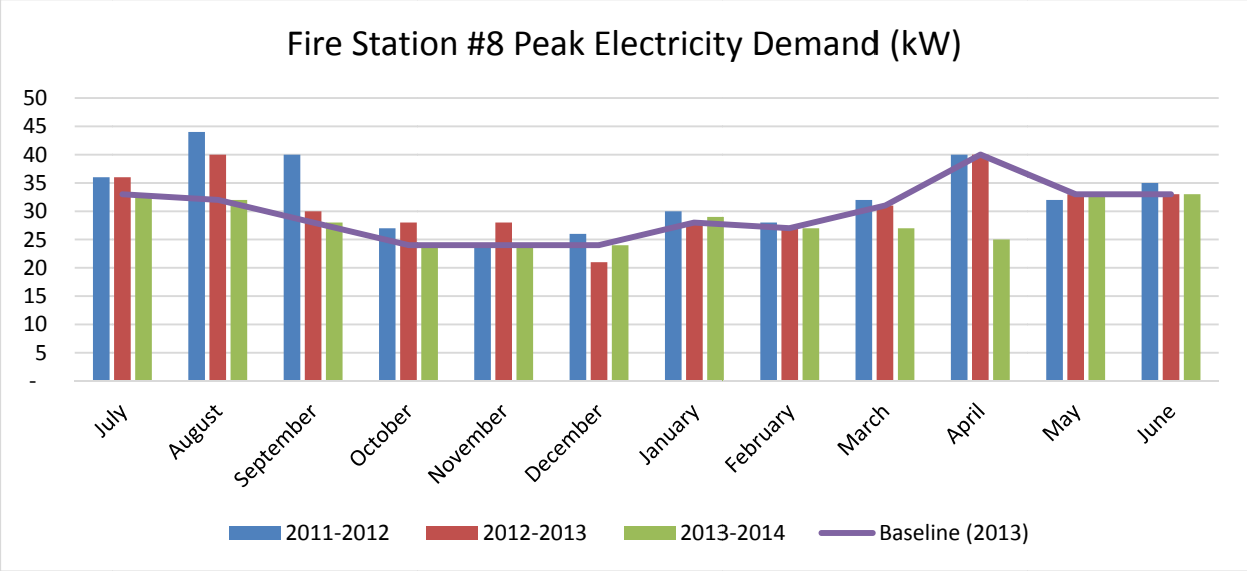


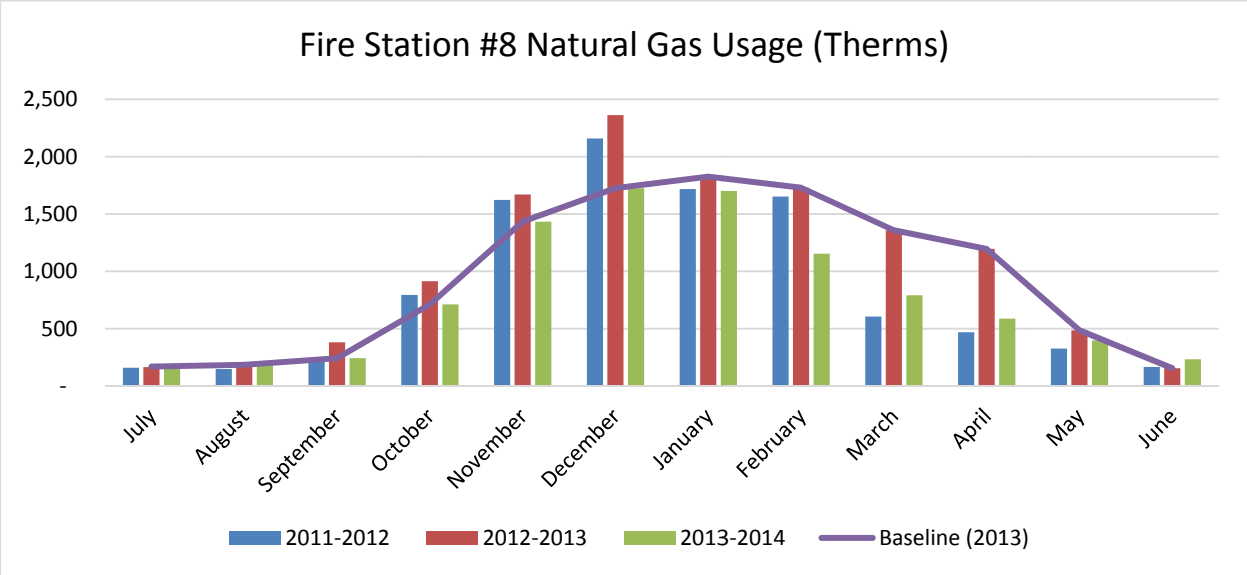

Eugene Field Library Natural Gas Usage (Therms)
1,200
1,000
800
600
400
200
-
July
August
September
October
November
December
January
February
March
April
May
June
2011-2012
2012-2013
2013-2014
Baseline (2013)

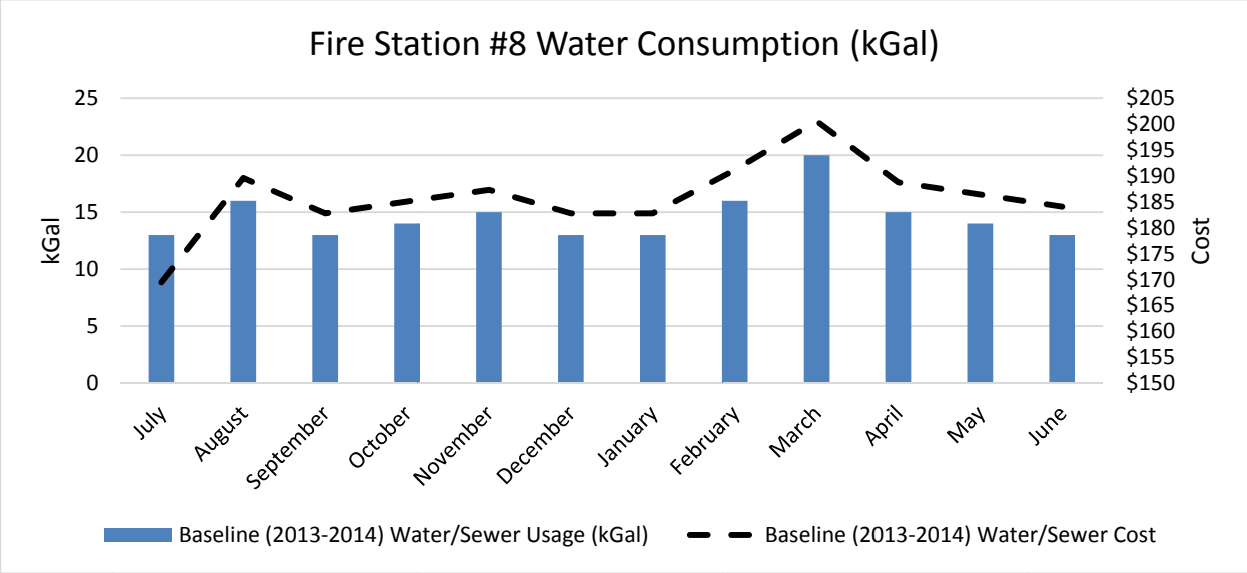

Eugene Field Library Water Consumption (kGal)
60
50
40
30
20
10
0
kGal
$250
$200
$150
$100
$50
$0
Cost
July
August
September
October
November
December
January
February
March
April
May
June
Baseline (2013-2014) Water/Sewer Usage (kGal)
Baseline (2013-2014) Water/Sewer Cost

Fire Station #8

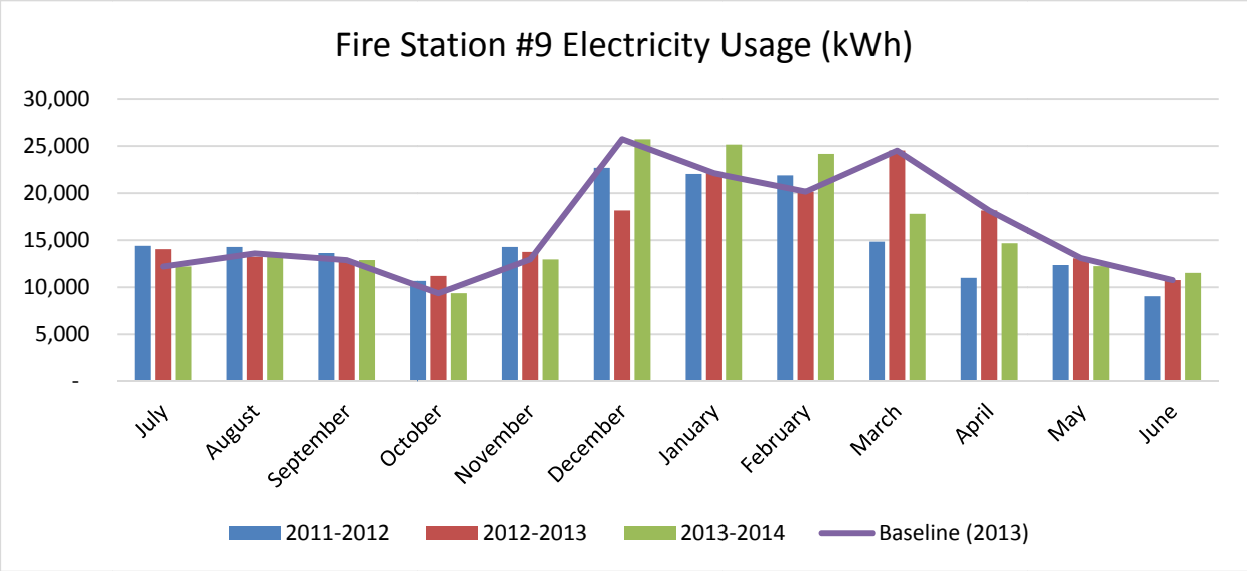


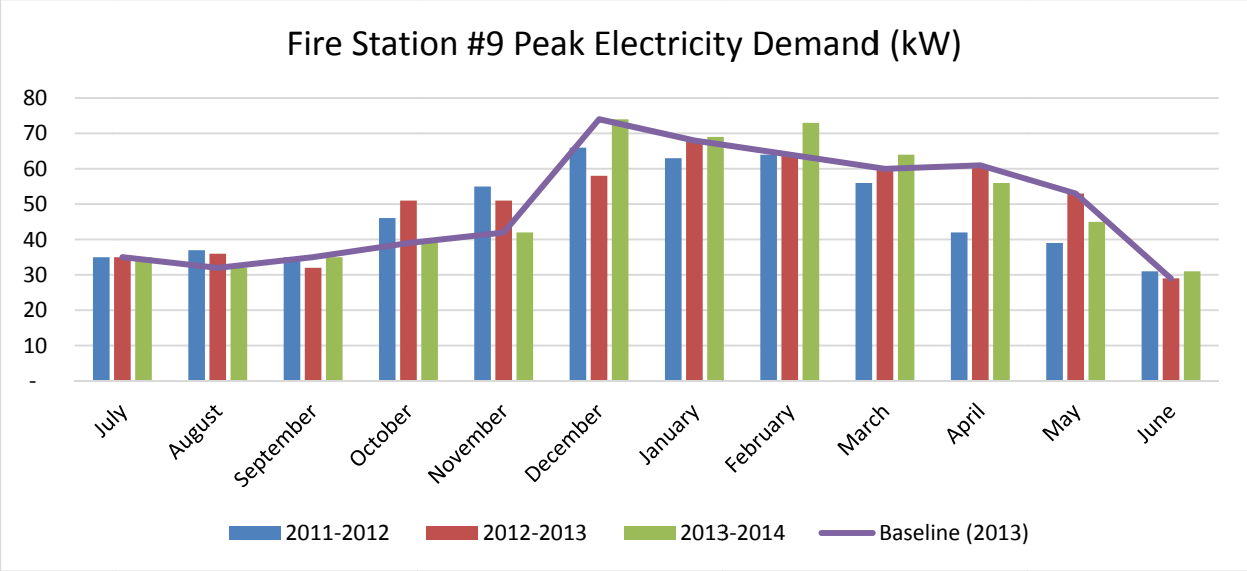


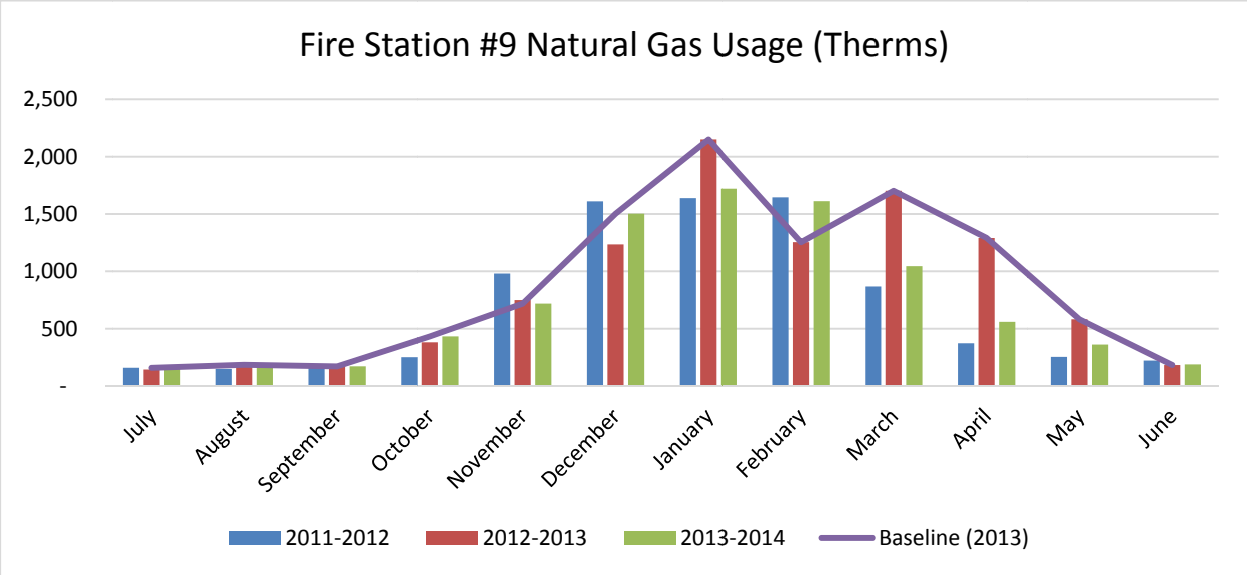

Fire Station #8 Natural Gas Usage (Therms)
2,500
2,000
1,500
1,000
500
-
July
August
September
October
November
December
January
February
March
April
May
June
2011-2012
2012-2013
2013-2014
Baseline (2013)

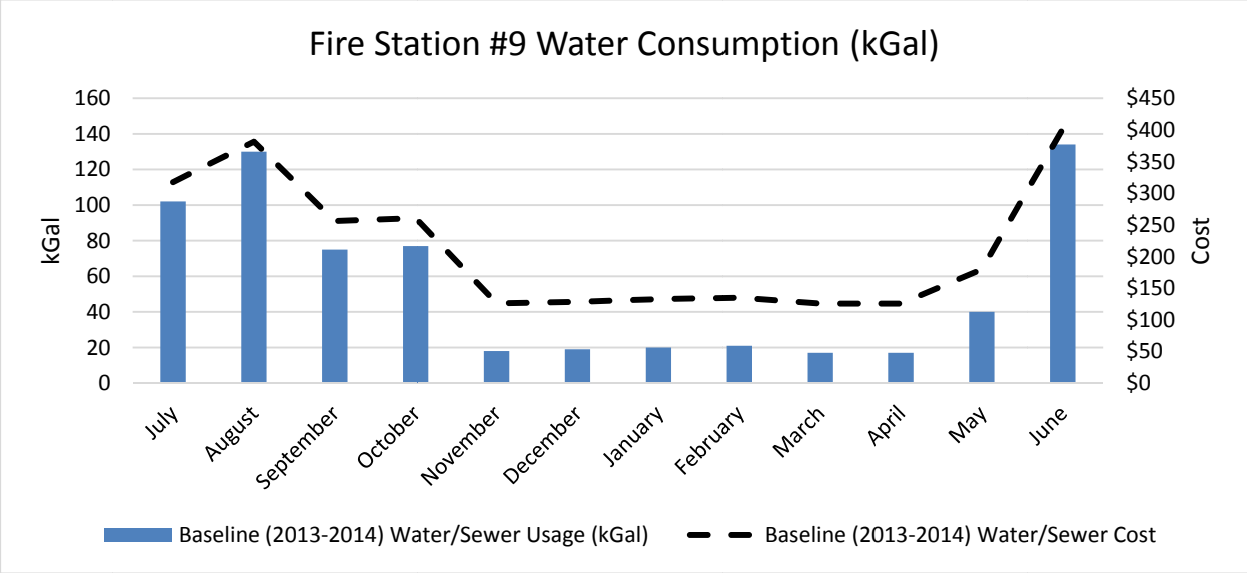

Fire Station #8 Water Consumption (kGal)
kGal
25
20
15
10
5
0
Cost
$205
$200
$195
$190
$185
$180
$175
$170
$165
$160
$155
$150
July
August
September
October
November
December
January
February
March
April
May
June
Baseline (2013-2014) Water/Sewer Usage (kGal)
Baseline (2013-2014) Water/Sewer Cost

Fire Station #9

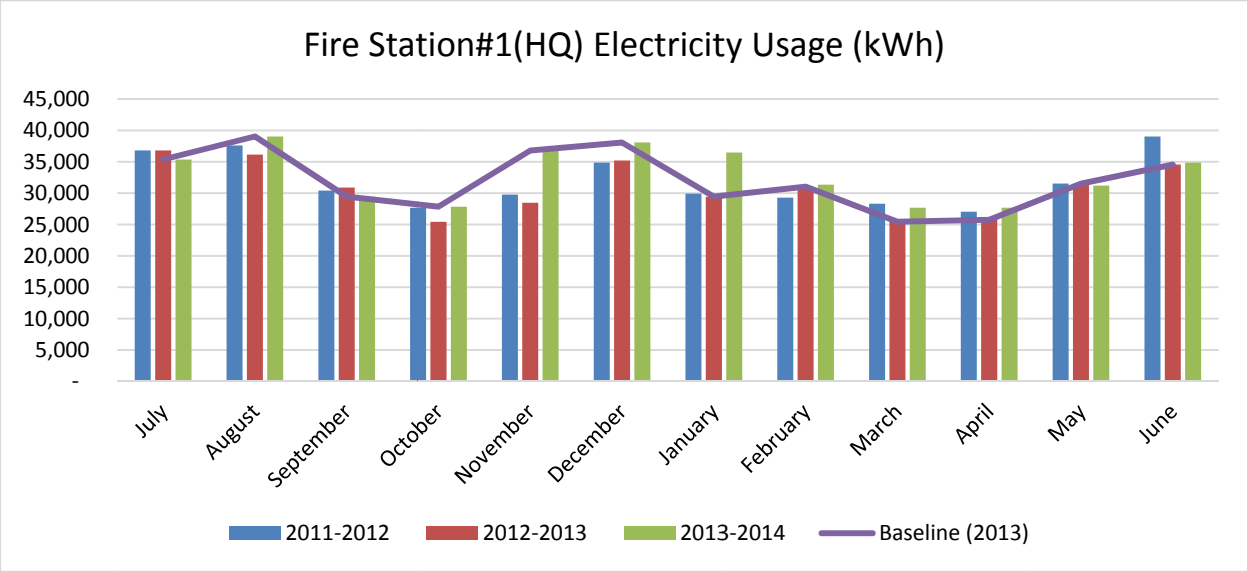


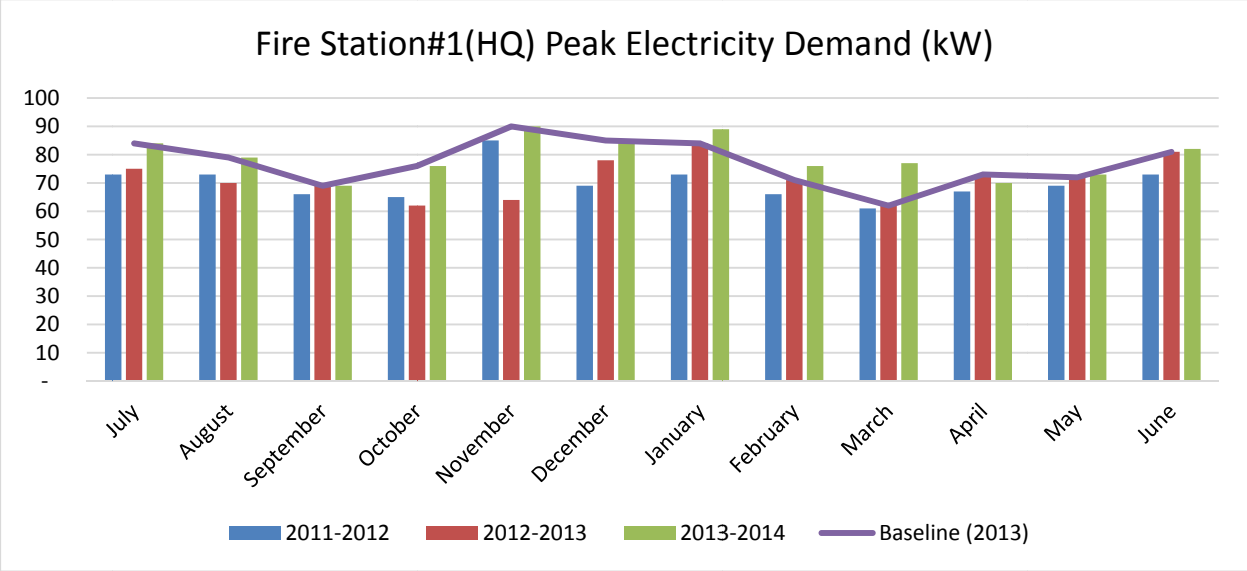


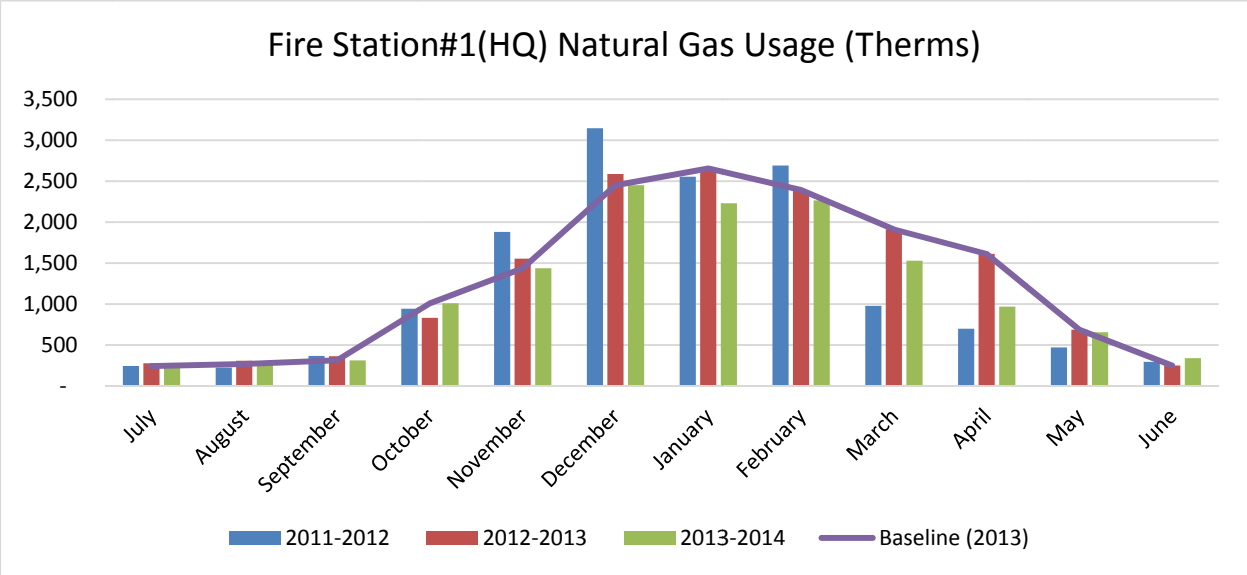

Fire Station #9 Natural Gas Usage (Therms)
2,500
2,000
1,500
1,000
500
-
July
August
September
October
November
December
January
February
March
April
May
June
2011-2012
2012-2013
2013-2014
Baseline (2013)

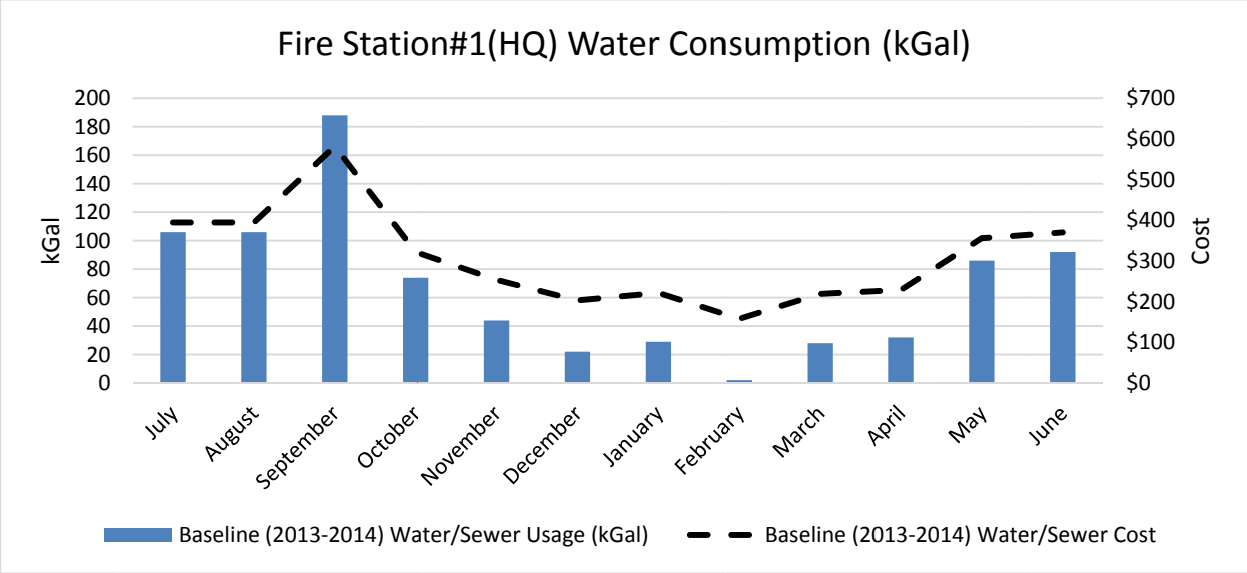

Fire Station #9 Water Consumption (kGal)
kGal
160
140
120
100
80
60
40
20
0
Cost
$450
$400
$350
$300
$250
$200
$150
$100
$50
$0
July
August
September
October
November
December
January
February
March
April
May
June
Baseline (2013-2014) Water/Sewer Usage (kGal)
Baseline (2013-2014) Water/Sewer Cost

Fire Station #1

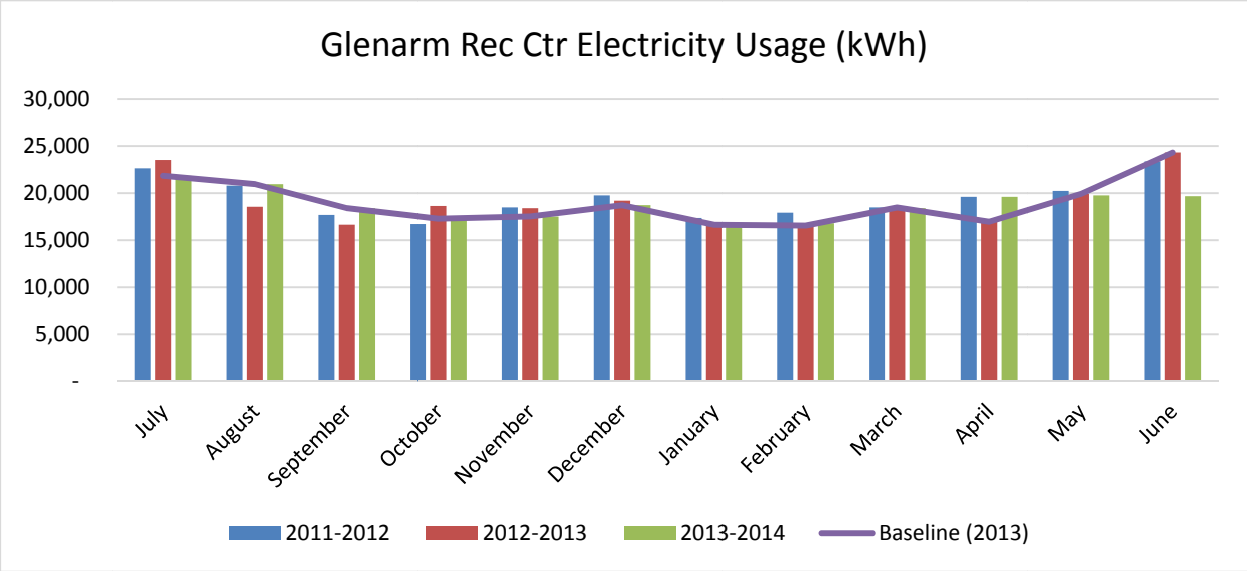


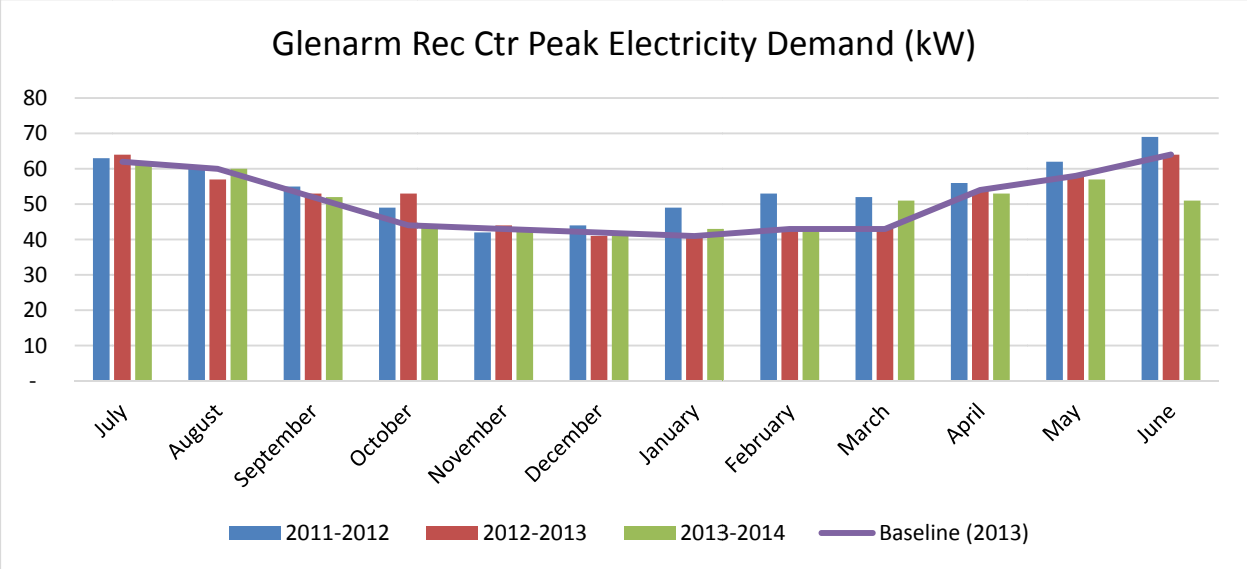


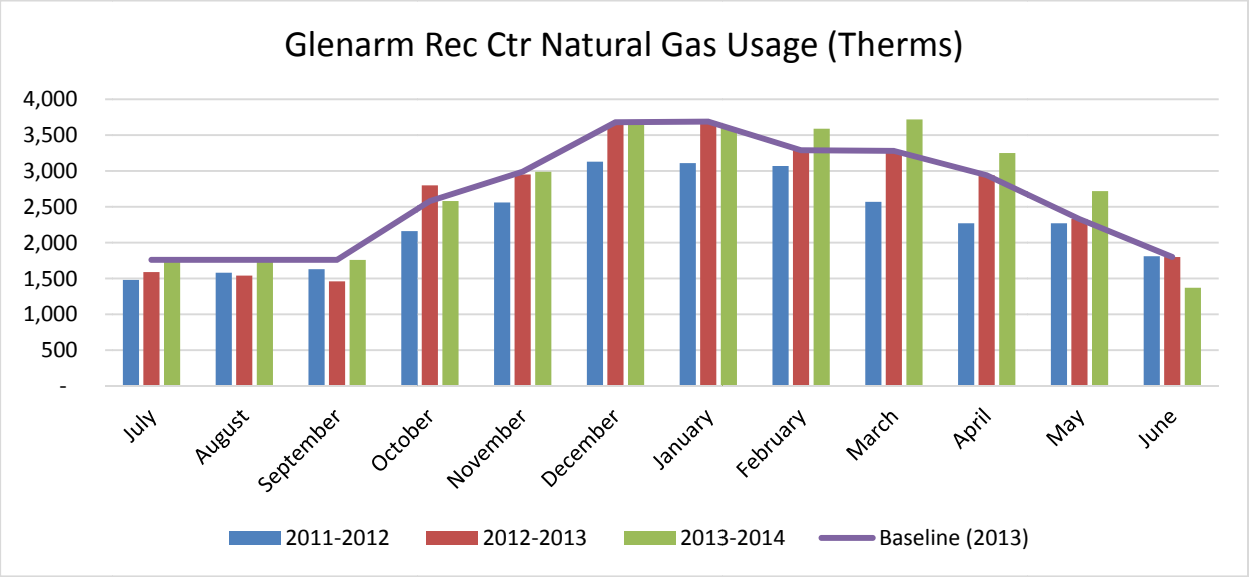

Fire Station#1(HQ) Natural Gas Usage (Therms)
3,500
3,000
2,500
2,000
1,500
1,000
500
-
July
August
September
October
November
December
January
February
March
April
May
June
2011-2012
2012-2013
2013-2014
Baseline (2013)

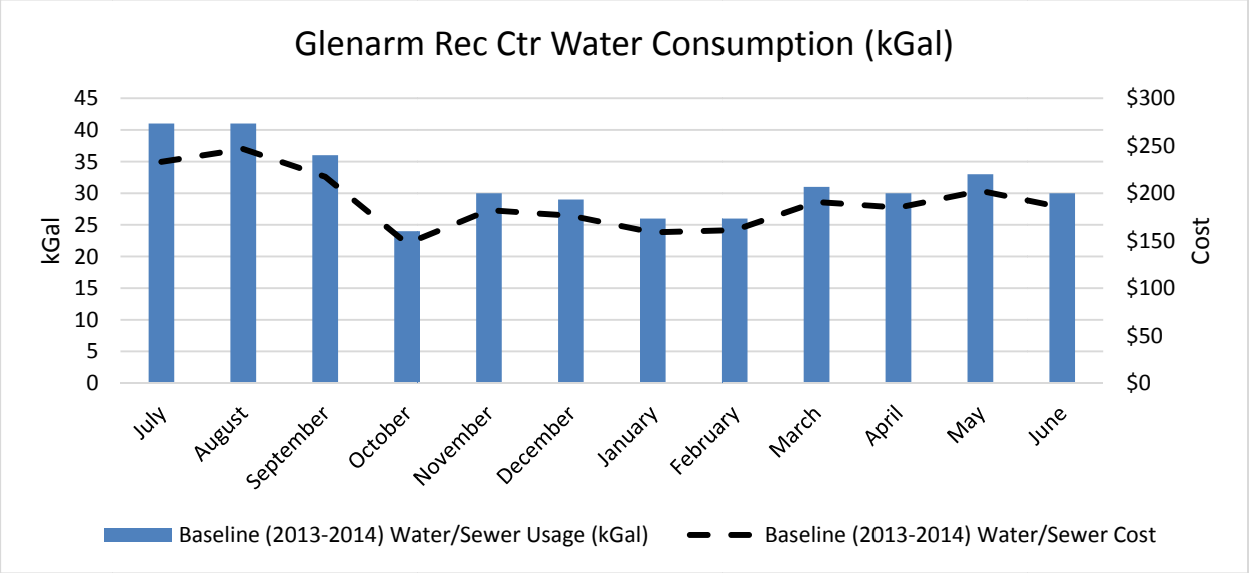

Fire Station#1(HQ) Water Consumption (kGal)
kGal
200
180
160
140
120
100
80
60
40
20
0
$700
$600
$500
$400
$300
$200
$100
$0
Cost
July
August
September
October
November
December
January
February
March
April
May
June
Baseline (2013-2014) Water/Sewer Usage (kGal)
Baseline (2013-2014) Water/Sewer Cost

Glenarm Rec Center

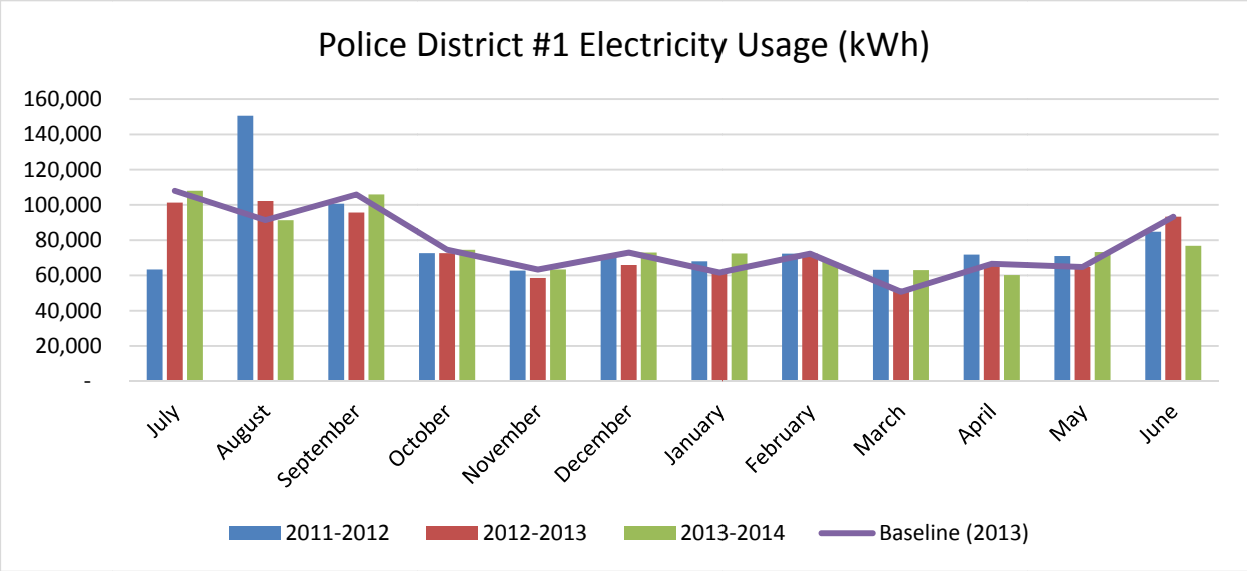


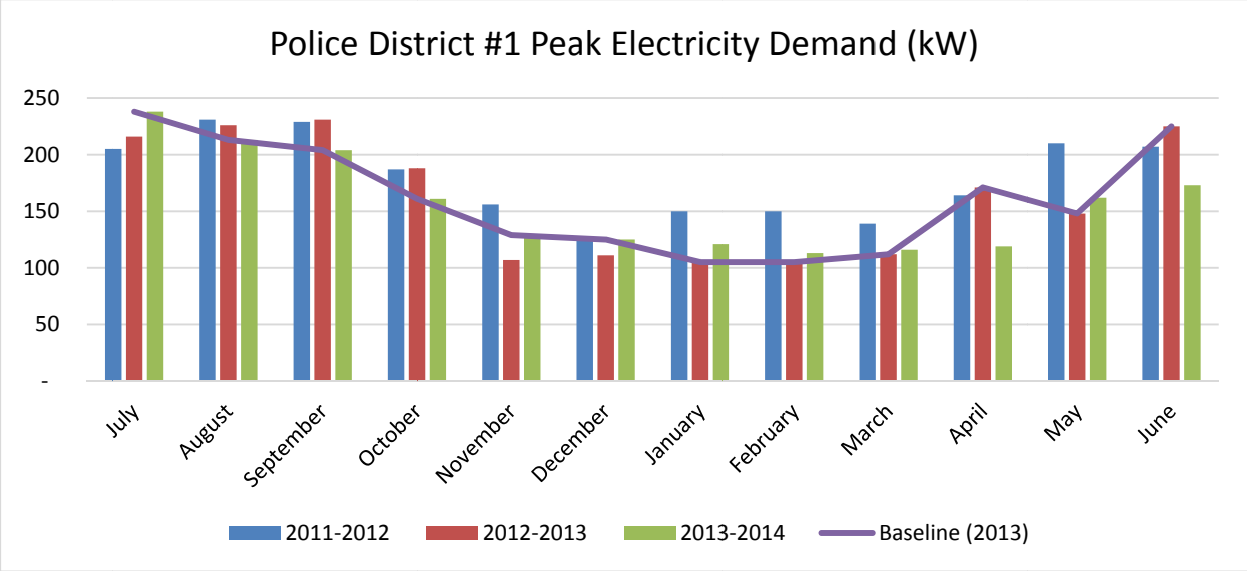


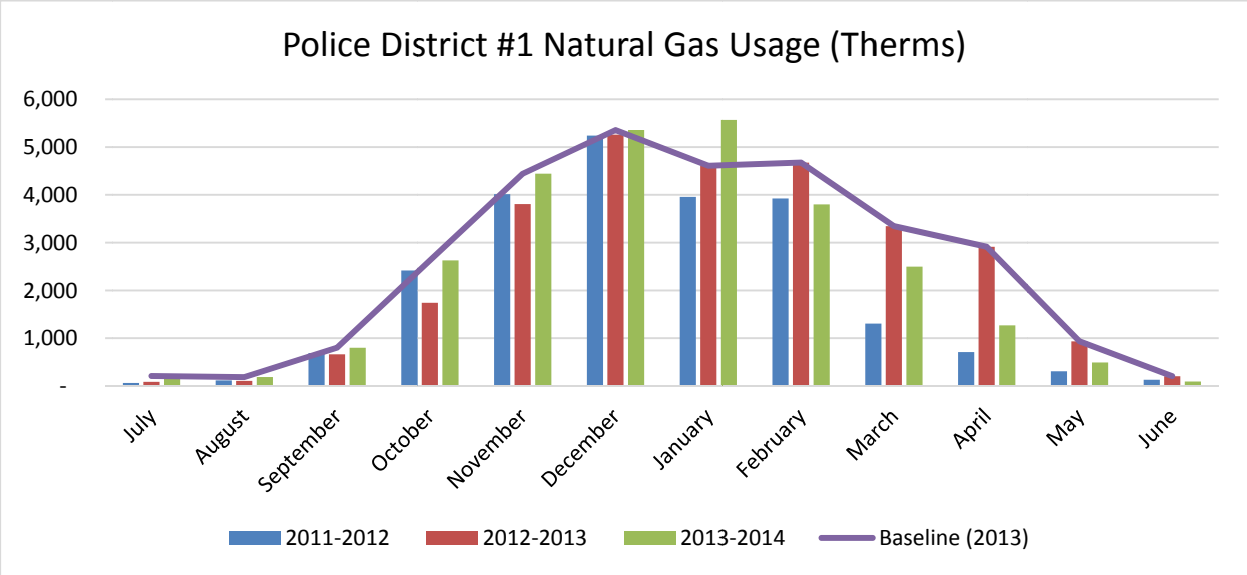

Glenarm Rec Ctr Natural Gas Usage (Therms)
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
-
July
August
September
October
November
December
January
February
March
April
May
June
2011-2012
2012-2013
2013-2014
Baseline (2013)

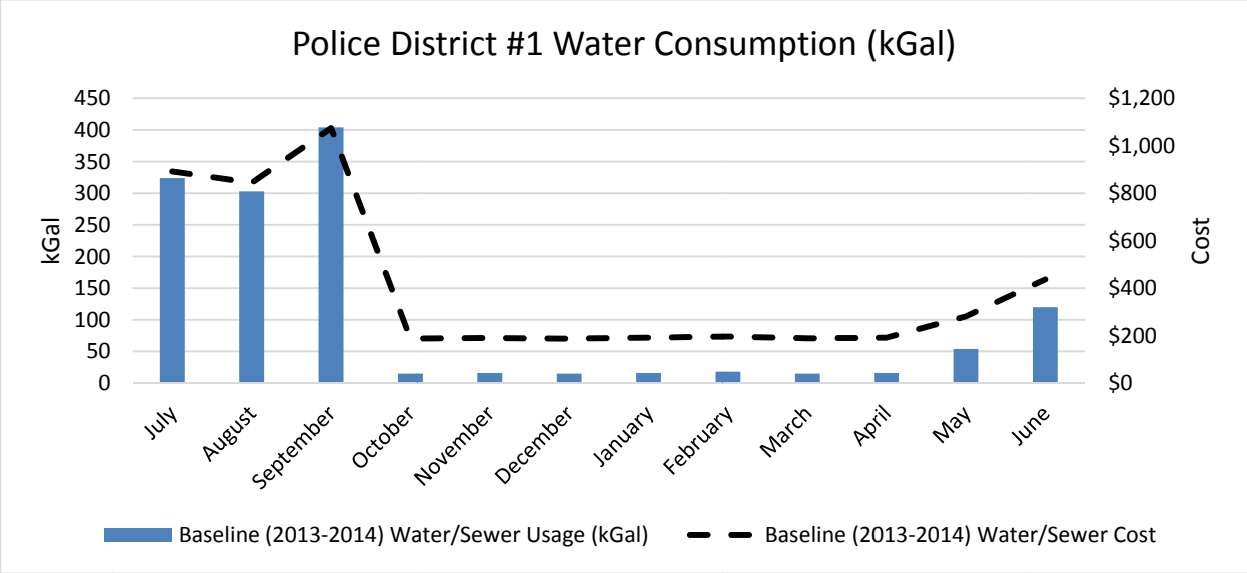

Glenarm Rec Ctr Water Consumption (kGal)
kGal
45
40
35
30
25
20
15
10
5
0
$300
$250
$200
$150
$100
$50
$0
Cost
July
August
September
October
November
December
January
February
March
April
May
June
Baseline (2013-2014) Water/Sewer Usage (kGal)
Baseline (2013-2014) Water/Sewer Cost

Police District #1

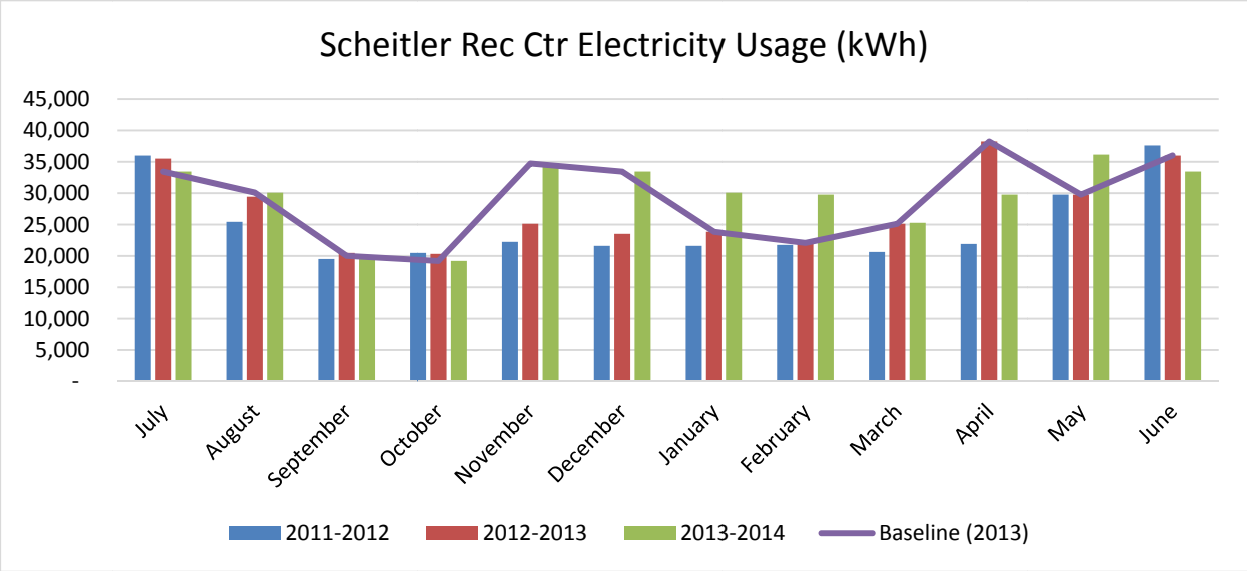


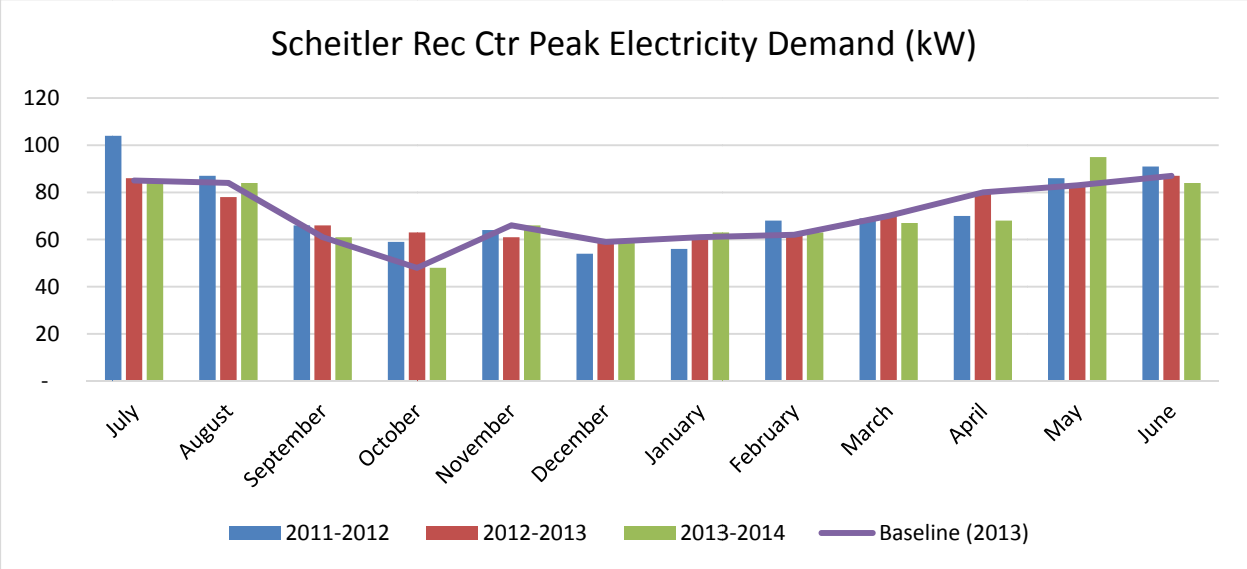


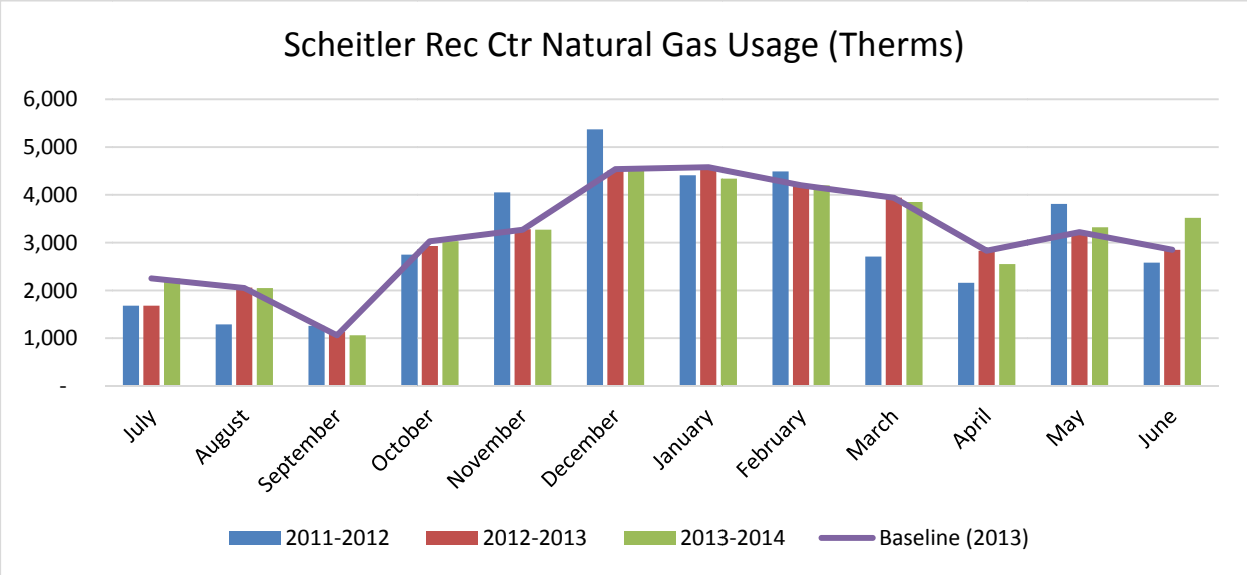

Police District #1 Natural Gas Usage (Therms)
6,000
5,000
4,000
3,000
2,000
1,000
-
July
August
September
October
November
December
January
February
March
April
May
June
2011-2012
2012-2013
2013-2014
Baseline (2013)

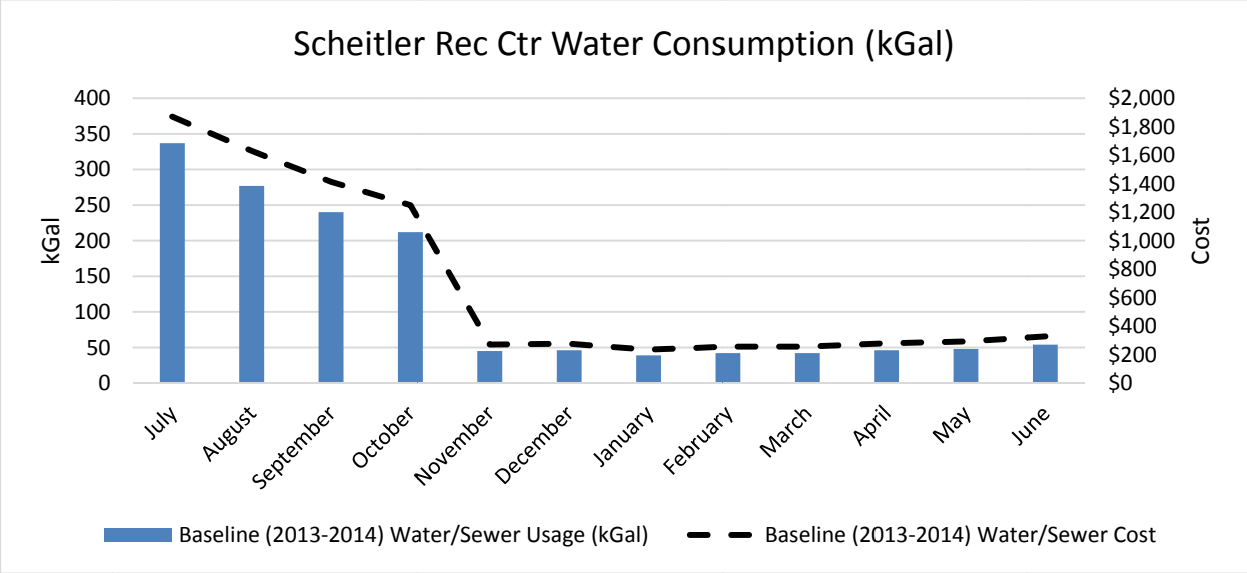

Police District #1 Water Consumption (kGal)
kGal
450
400
350
300
250
200
150
100
50
0
$1,200
$1,000
$800
$600
$400
$200
$0
Cost
July
August
September
October
November
December
January
February
March
April
May
June
Baseline (2013-2014) Water/Sewer Usage (kGal)
Baseline (2013-2014) Water/Sewer Cost

Scheitler Rec Ctr

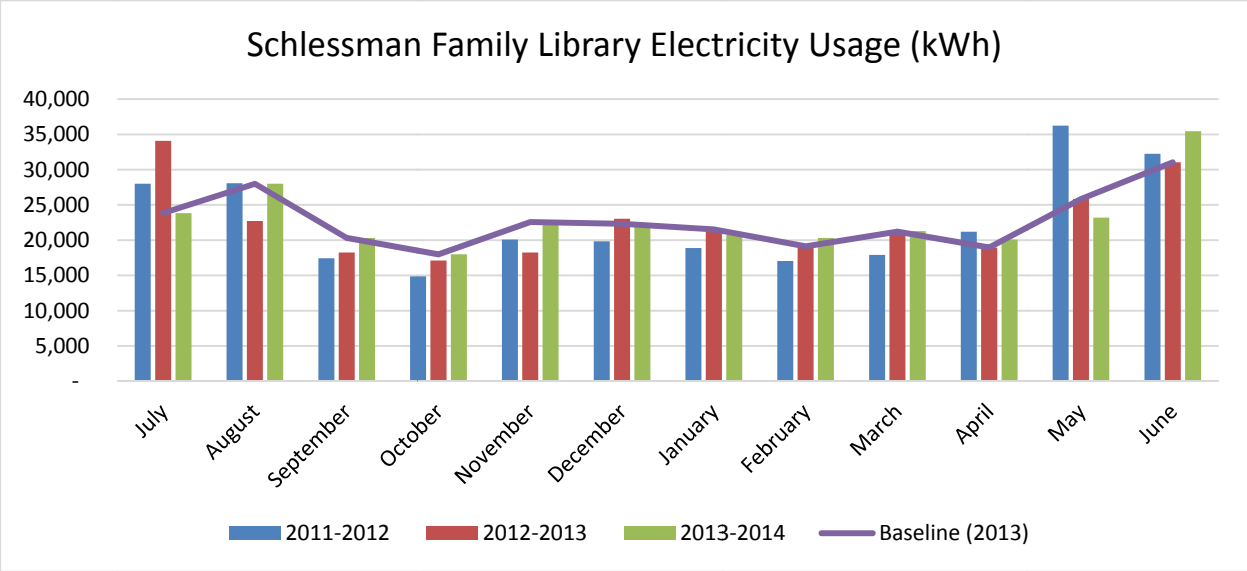


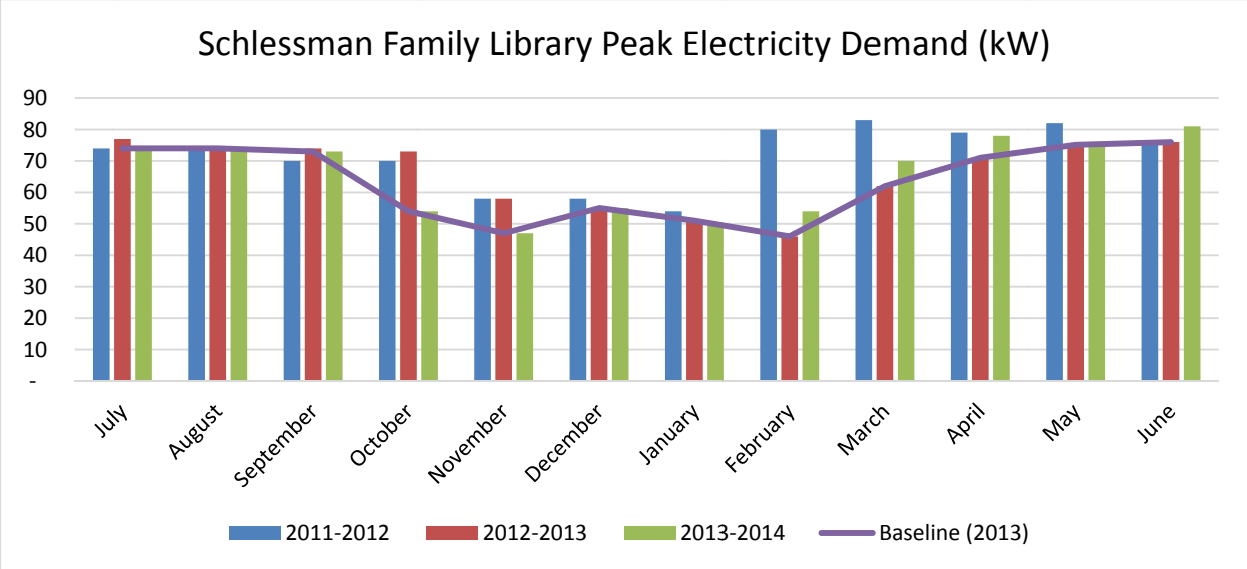


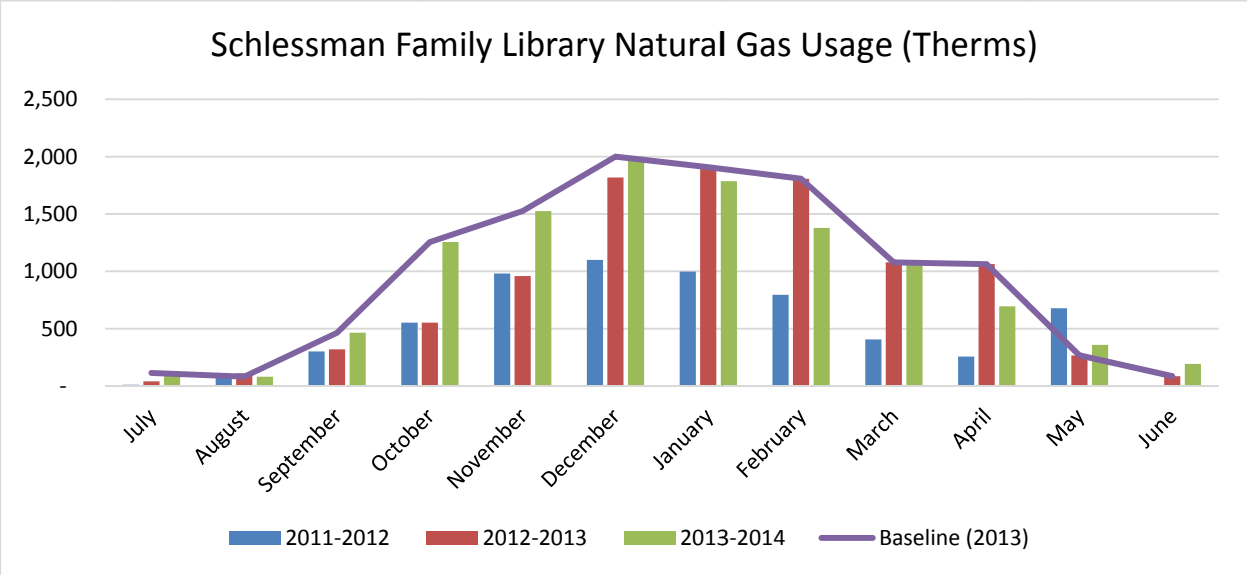

Scheitler Rec Ctr Natural Gas Usage (Therms)
6,000
5,000
4,000
3,000
2,000
1,000
-
July
August
September
October
November
December
January
February
March
April
May
June
2011-2012
2012-2013
2013-2014
Baseline (2013)

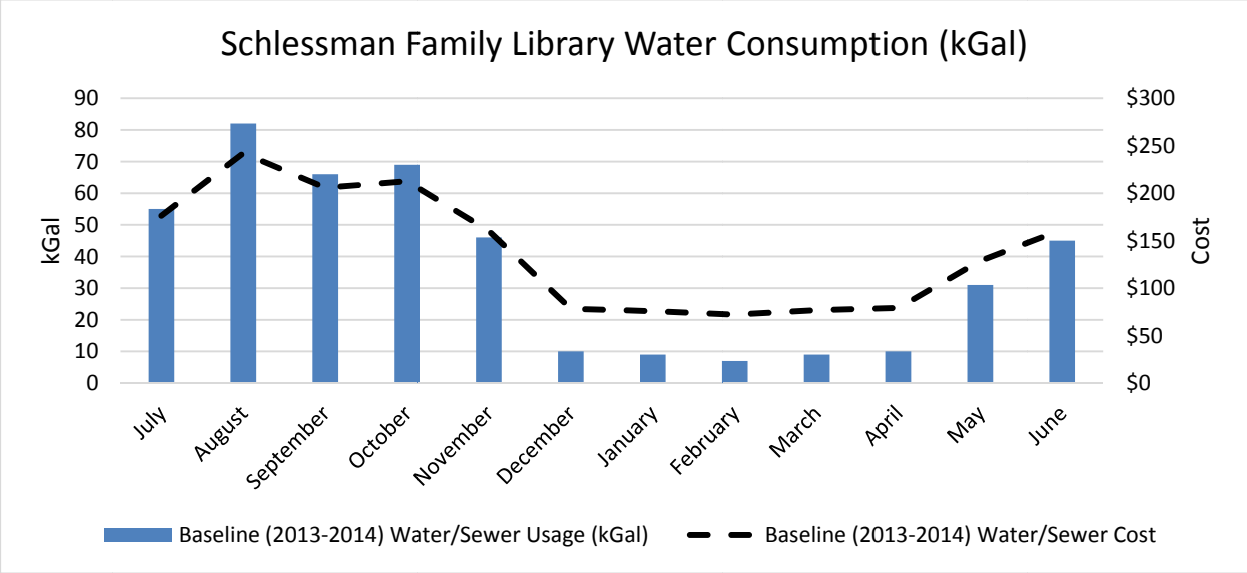

Scheitler Rec Ctr Water Consumption (kGal)
kGal
400
350
300
250
200
150
100
50
0
$2,000
$1,800
$1,600
$1,400
$1,200
$1,000
$800
$600
$400
$200
$0
Cost
July
August
September
October
November
December
January
February
March
April
May
June
Baseline (2013-2014) Water/Sewer Usage (kGal)
Baseline (2013-2014) Water/Sewer Cost

Schlessman Family Library

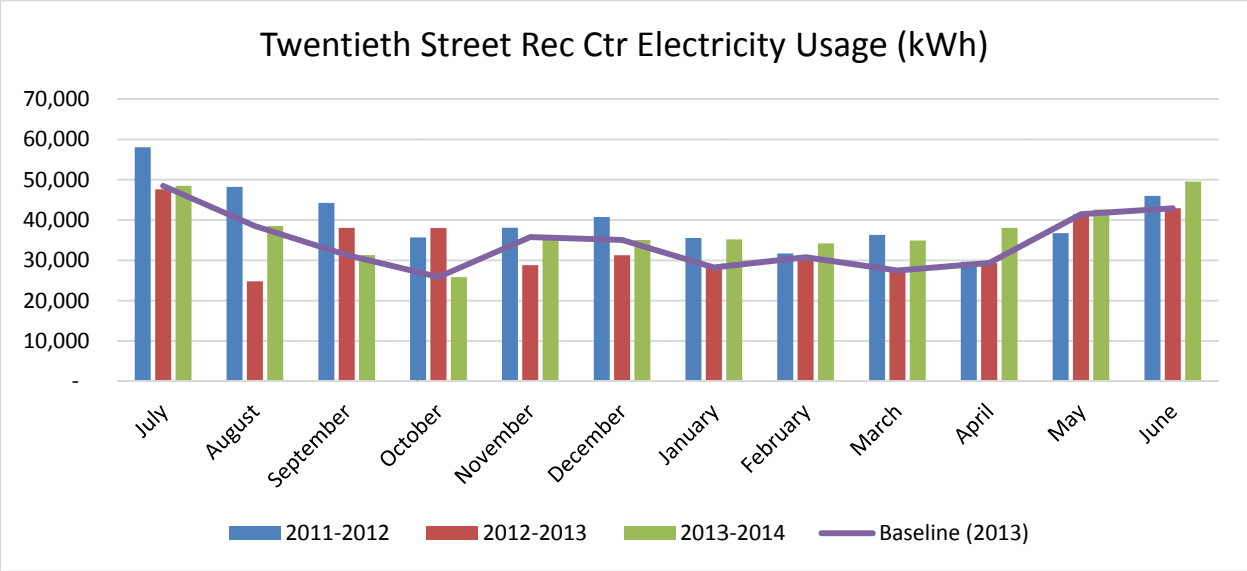


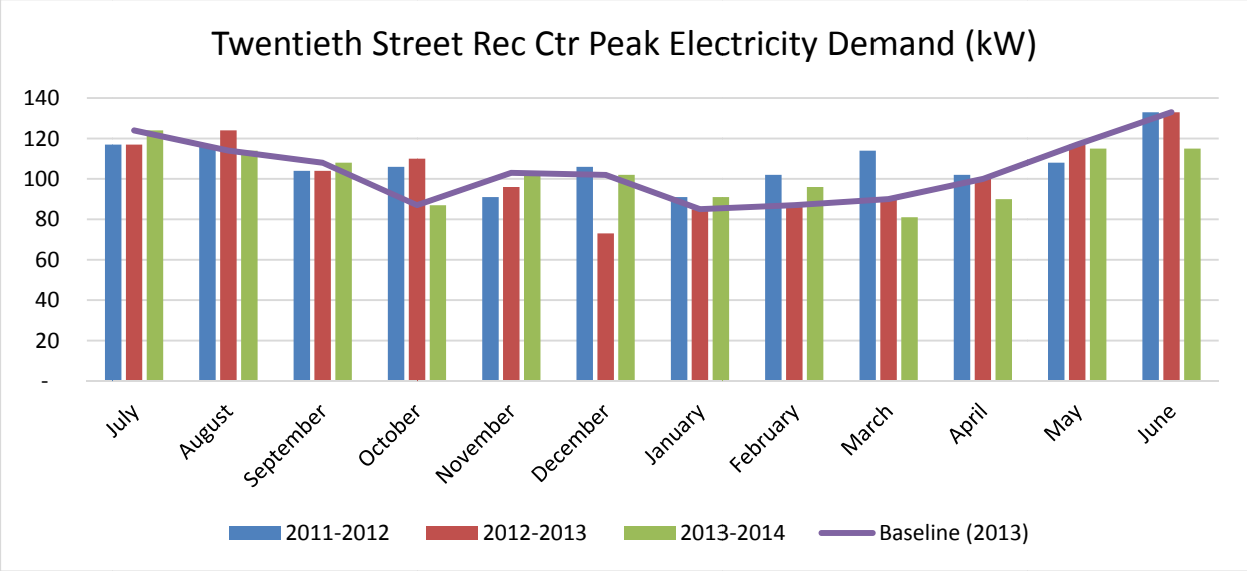


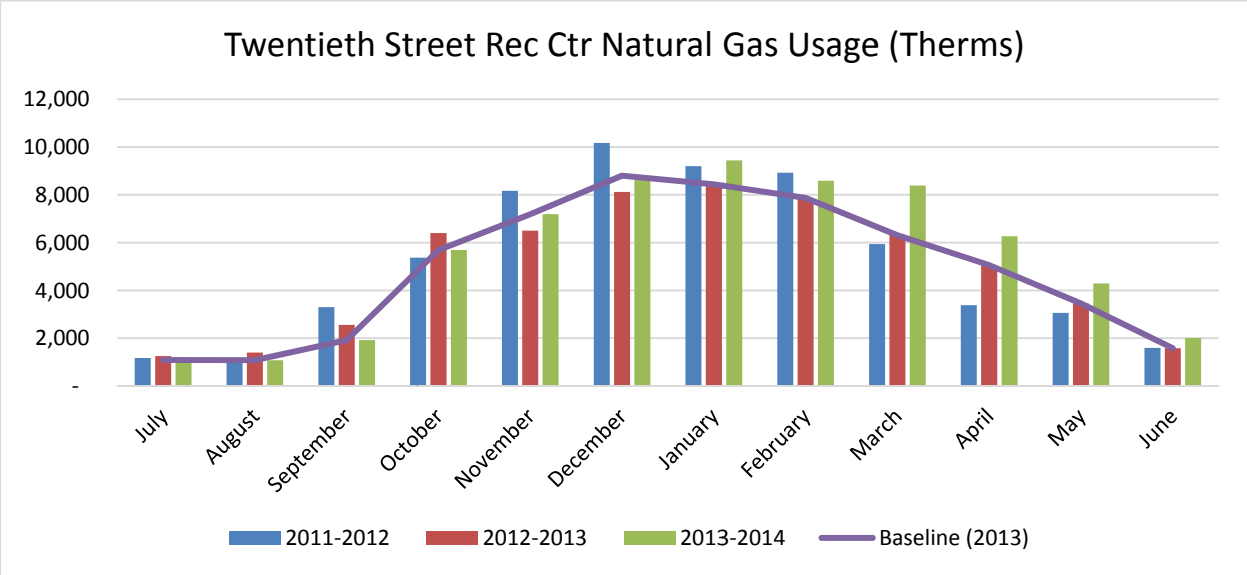

Schlessman Family Library Natural Gas Usage (Therms)
2,500
2,000
1,500
1,000
500
-
July
August
September
October
November
December
January
February
March
April
May
June
2011-2012
2012-2013
2013-2014
Baseline (2013)

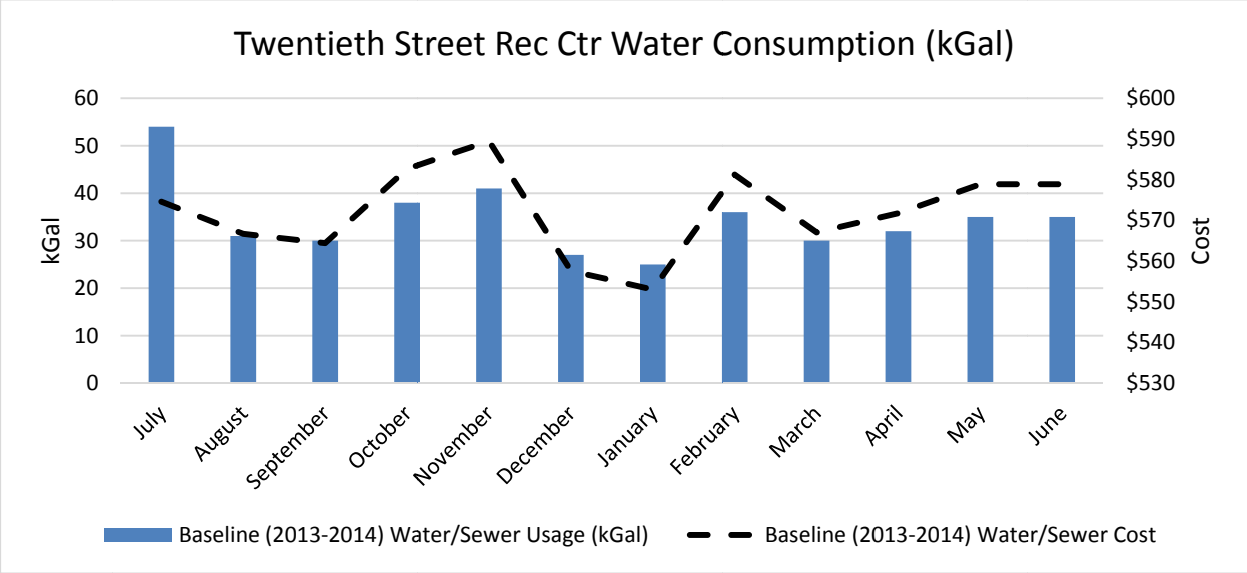

Schlessman Family Library Water Consumption (kGal)
kGal
90
80
70
60
50
40
30
20
10
0
$300
$250
$200
$150
$100
$50
$0
Cost
July
August
September
October
November
December
January
February
March
April
May
June
Baseline (2013-2014) Water/Sewer Usage (kGal)
Baseline (2013-2014) Water/Sewer Cost

Twentieth Street Rec Ctr






Twentieth Street Rec Ctr Natural Gas Usage (Therms)
12,000
10,000
8,000
6,000
4,000
2,000
-
July
August
September
October
November
December
January
February
March
April
May
June
2011-2012
2012-2013
2013-2014
Baseline (2013)


Twentieth Street Rec Ctr Water Consumption (kGal)
kGal
60
50
40
30
20
10
0
Cost
$600
$590
$580
$570
$560
$550
$540
$530
July
August
September
October
November
December
January
February
March
April
May
June
Baseline (2013-2014) Water/Sewer Usage (kGal)
Baseline (2013-2014) Water/Sewer Cost

Attachment B – Lighting Audit

City and County of Denver, CO - Fire Station 1 - Admin Bldg ~ OPTIMIZED OPTION: HYBRID

Line	Location	EX Hours	EX Code	EX Qty	EX Desc	Lamps	EX Watts/ Lamp	EX Input Watts	Mounting Height	EX FC	PR Code	PR Qty	PR Desc	PR Lamp Qty	PR Watts/ Lamp	PR Input Watts	Audit Notes	Lamp Color	ECM SPB	PR Hours	Existing kw	Proposed kw	Existing kWh / Year	Proposed kwH / Year	Annual Energy Saved	kWh $ Savings	kW $ Savings	Total Energy $ Savings	EX MX Cost	PR MX Cost	MX Savings	%age of job
1	Admin Bldg Entry	2,608	ECFLS14	3	Existing 14 watt Screw-in CFL Lamp	1	14	14		10	LAI	3	Leave existing fixture as is	1	14	14	par 30 can, 6". hard lid, vertical	4100	0.0	2,608	0.04	0.04	110	110	0	$0	$0	$0	$3	$0	$3	0.0%
2	Elevator	8,760	ES2120N	2	Existing Strip 2' 1 Lamp(s) F20 T12 Standard Ballast	1	20	28		5	LED10T82-1	2	Sylvania UltraLED 2' External Driver T8 LED - 1 lamp - 10w/ea	1	10	10		4100	5.8	8,760	0.06	0.02	491	175	315	$13	$8	$21	$6	$0	$6	0.2%
3	Open Office Area to Left of Public Entry	2,608	ET4232N	19	Existing Prismatic Troffer 2x4 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61		35-40	RTK31-24T	19	Retrofit Kit, LED, 2x4 Troffer, 31 watts, 3000 lm, Lithonia 2VTLT Prism.	1	31	31		4100	18.5	2,608	1.16	0.59	3,023	1,536	1,487	$61	$132	$193	$25	$0	$25	6.2%
4	Open Office Area to Left of Public Entry	2,608	ET2232N	13	Existing Prismatic Troffer 2x2 2L F32 T8 32 watt U-Tube Lamp(s), Normal Ballast Factor	2	32	61			RTK35-22T	13	Retrofit Kit, LED, 2x2 Troffer, 35 watts, 3300 lm, Lithonia 2VTLT Prism.	1	35	35		4100	17.2	2,608	0.79	0.46	2,068	1,187	882	$36	$78	$115	$42	$0	$42	4.2%
5	Open Office Area to Left of Public Entry	2,608	ECFLS14	1	Existing 14 watt Screw-in CFL Lamp	1	14	14			LAI	1	Leave existing fixture as is	1	14	14	BR30 in can	4100	0.0	2,608	0.01	0.01	37	37	0	$0	$0	$0	$1	$0	$1	0.0%
6	Flammables Unit Office	1,695	ET4232N	2	Existing Prismatic Troffer 2x4 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61		45	RTK31-24T	2	Retrofit Kit, LED, 2x4 Troffer, 31 watts, 3000 lm, Lithonia 2VTLT Prism.	1	31	31	already sensored	4100	21.4	1,695	0.12	0.06	207	105	102	$4	$14	$18	$2	$0	$2	0.7%
7	Flammables Unit Office	1,695	ET2232N	1	Existing Prismatic Troffer 2x2 2L F32 T8 32 watt U-Tube Lamp(s), Normal Ballast Factor	2	32	61			RTK35-22T	1	Retrofit Kit, LED, 2x2 Troffer, 35 watts, 3300 lm, Lithonia 2VTLT Prism.	1	35	35	already sensored	4100	20.9	1,695	0.06	0.04	103	59	44	$2	$6	$8	$2	$0	$2	0.3%
8	Marijuana Inspections Office	2,608	ET4232N	2	Existing Prismatic Troffer 2x4 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61		40	RTK31-24T	2	Retrofit Kit, LED, 2x4 Troffer, 31 watts, 3000 lm, Lithonia 2VTLT Prism.	1	31	31		4100	18.5	2,608	0.12	0.06	318	162	156	$6	$14	$20	$3	$0	$3	0.7%
9	Haz-Mat Office	1,695	ET4232N	4	Existing Prismatic Troffer 2x4 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61		80	LED19T84-2	4	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38	already sensored	4100	13.6	1,695	0.24	0.15	414	258	156	$6	$21	$28	$3	$0	$3	0.7%
10	Fitness Room	2,608	EW4232N	6	Existing Wrap 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61		30	LED19T84-2	6	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38		4100	11.6	2,608	0.37	0.23	955	595	360	$15	$32	$47	$8	$0	$8	1.0%
11	Fitness Room	2,608	EINC60	1	Existing Incandescent 60 watt Lamp(s)	1	60	60			7WLEDA19	1	7 watt A-19 Style LED Lamp	1	7	7	indicator light	4100	1.0	2,608	0.06	0.01	156	18	138	$6	$12	$18	$3	$0	$3	0.0%
12	Mens RR	1,695	ET4232N	1	Existing Prismatic Troffer 2x4 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61		75	LED19T84-2	1	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38	already sensored	4100	13.6	1,695	0.06	0.04	103	64	39	$2	$5	$7	$1	$0	$1	0.2%
13	Mens RR	1,695	EW4234N	1	Existing Wrap 4' 2 Lamp(s) F34 T12 Standard Ballast	2	34	82			LED19T84-2	1	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38	already sensored	4100	7.5	1,695	0.08	0.04	139	64	75	$3	$10	$13	$1	$0	$1	0.2%
14	Womens RR	1,695	ET4232N	1	Existing Prismatic Troffer 2x4 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61		15	LED19T84-2	1	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38	already sensored	4100	13.6	1,695	0.06	0.04	103	64	39	$2	$5	$7	$1	$0	$1	0.2%
15	Womens RR	1,695	EW4234N	1	Existing Wrap 4' 2 Lamp(s) F34 T12 Standard Ballast	2	34	82			LED19T84-2	1	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38	already sensored	4100	7.5	1,695	0.08	0.04	139	64	75	$3	$10	$13	$1	$0	$1	0.2%
16	Womens RR	2,608	EINC40	4	Existing Incandescent 40 watt Lamp(s)	1	40	40			7WLEDA19	4	7 watt A-19 Style LED Lamp	1	7	7	4L G25 vanity	4100	1.6	2,608	0.16	0.03	417	73	344	$14	$31	$45	$10	$0	$10	0.1%
17	Office	2,608	ET4232N	2	Existing Prismatic Troffer 2x4 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61		55	LED19T84-2	2	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38		4100	11.6	2,608	0.12	0.08	318	198	120	$5	$11	$16	$3	$0	$3	0.3%
18	Office	2,608	ET4232N	2	Existing Prismatic Troffer 2x4 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LED19T84-2	2	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38		4100	11.6	2,608	0.12	0.08	318	198	120	$5	$11	$16	$3	$0	$3	0.3%
19	Office	2,608	ET2232N	1	Existing Prismatic Troffer 2x2 2L F32 T8 32 watt U-Tube Lamp(s), Normal Ballast Factor	2	32	61			RTK35-22T	1	Retrofit Kit, LED, 2x2 Troffer, 35 watts, 3300 lm, Lithonia 2VTLT Prism.	1	35	35		4100	17.2	2,608	0.06	0.04	159	91	68	$3	$6	$9	$3	$0	$3	0.3%
20	Special Detail	1,695	ET4232N	2	Existing Prismatic Troffer 2x4 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LED19T84-2	2	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38	already sensored	4100	13.6	1,695	0.12	0.08	207	129	78	$3	$11	$14	$2	$0	$2	0.3%
21	Office	2,608	ET4232N	2	Existing Prismatic Troffer 2x4 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LED19T84-2	2	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38		4100	11.6	2,608	0.12	0.08	318	198	120	$5	$11	$16	$3	$0	$3	0.3%

City and County of Denver, CO - Fire Station 1 - Admin Bldg ~ OPTIMIZED OPTION: HYBRID

Line	Location	EX Hours	EX Code	EX Qty	EX Desc	Lamps	EX Watts/ Lamp	EX Input Watts	Mounting Height	EX FC	PR Code	PR Qty	PR Desc	PR Lamp Qty	PR Watts/ Lamp	PR Input Watts	Audit Notes	Lamp Color	ECM SPB	PR Hours	Existing kw	Proposed kw	Existing kWh / Year	Proposed kwH / Year	Annual Energy Saved	kWh $ Savings	kW $ Savings	Total Energy $ Savings	EX MX Cost	PR MX Cost	MX Savings	%age of job
22	Breakroom	2,608	ET4232N	4	Existing Prismatic Troffer 2x4 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61		40	LED19T84-2	4	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38		4100	11.6	2,608	0.24	0.15	636	396	240	$10	$21	$31	$5	$0	$5	0.7%
23	Restroom	2,608	EW4232N	2	Existing Wrap 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LED19T84-2	2	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38	1 missing cover	4100	11.6	2,608	0.12	0.08	318	198	120	$5	$11	$16	$3	$0	$3	0.3%
24	Storage	520	EINC40	1	Existing Incandescent 40 watt Lamp(s)	1	40	40			6WLEDG25	1	6 watt G25 Globe LED Lamp	1	6	6	G25 on porcelain base	4100	3.4	520	0.04	0.01	21	3	18	$1	$8	$9	$1	$0	$0	0.0%
25	Technician Office	1,695	ET4232N	3	Existing Prismatic Troffer 2x4 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61		50	LED19T84-2	3	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38	already sensored	4100	13.6	1,695	0.18	0.11	310	193	117	$5	$16	$21	$3	$0	$3	0.5%
26	Storage Closet by File Cabinet	520	ES4232N	1	Existing Strip 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LAI	1	Leave existing fixture as is	2	32	61	on pull chain	4100	0.0	520	0.06	0.06	32	32	0	$0	$0	$0	$0	$0	$0	0.0%
27	Stairwell	2,608	ECFLS15	4	Existing CFL Screw-in 15 watt Lamp(s)	1	15	15			8WLEDA19	4	8 watt A-19 Style LED Lamp - Slim	1	8	8	wall mount	4100	4.9	2,608	0.06	0.03	156	83	73	$3	$6	$9	$5	$0	$5	0.1%
28	Stairwell	2,608	EW4232N	4	Existing Wrap 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LED19T84-2	4	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38		4100	11.6	2,608	0.24	0.15	636	396	240	$10	$21	$31	$5	$0	$5	0.7%
29	Floor 2 Lobby Hall	2,608	ET4232N	6	Existing Prismatic Troffer 2x4 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			RTK31-24T	6	Retrofit Kit, LED, 2x4 Troffer, 31 watts, 3000 lm, Lithonia 2VTLT Prism.	1	31	31		4100	18.5	2,608	0.37	0.19	955	485	469	$19	$42	$61	$8	$0	$8	2.0%
30	Floor 2 Lobby Hall	2,608	ECFLS14	6	Existing 14 watt Screw-in CFL Lamp	1	14	14			LAI	6	Leave existing fixture as is	1	14	14	par 30 can	4100	0.0	2,608	0.08	0.08	219	219	0	$0	$0	$0	$6	$0	$6	0.0%
31	Floor 2 Lobby Hall	2,608	ET2232N	1	Existing Prismatic Troffer 2x2 2L F32 T8 32 watt U-Tube Lamp(s), Normal Ballast Factor	2	32	61			RTK35-22T	1	Retrofit Kit, LED, 2x2 Troffer, 35 watts, 3300 lm, Lithonia 2VTLT Prism.	1	35	35		4100	17.2	2,608	0.06	0.04	159	91	68	$3	$6	$9	$3	$0	$3	0.3%
32	Floor 2 Lobby Hall	2,608	ECFLS14	3	Existing 14 watt Screw-in CFL Lamp	1	14	14			LAI	3	Leave existing fixture as is	1	14	14	par 30 directional flood	4100	0.0	2,608	0.04	0.04	110	110	0	$0	$0	$0	$3	$0	$3	0.0%
33	Office	2,608	ET4232N	2	Existing Prismatic Troffer 2x4 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			RTK31-24T	2	Retrofit Kit, LED, 2x4 Troffer, 31 watts, 3000 lm, Lithonia 2VTLT Prism.	1	31	31		4100	18.5	2,608	0.12	0.06	318	162	156	$6	$14	$20	$3	$0	$3	0.7%
34	Office	1,695	ET4232N	2	Existing Prismatic Troffer 2x4 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61		55	RTK31-24T	2	Retrofit Kit, LED, 2x4 Troffer, 31 watts, 3000 lm, Lithonia 2VTLT Prism.	1	31	31	already sensored	4100	21.4	1,695	0.12	0.06	207	105	102	$4	$14	$18	$2	$0	$2	0.7%
35	Office	2,608	ET4232N	2	Existing Prismatic Troffer 2x4 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			RTK31-24T	2	Retrofit Kit, LED, 2x4 Troffer, 31 watts, 3000 lm, Lithonia 2VTLT Prism.	1	31	31		4100	18.5	2,608	0.12	0.06	318	162	156	$6	$14	$20	$3	$0	$3	0.7%
36	Room through Office	1,695	ET4232N	2	Existing Prismatic Troffer 2x4 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			RTK31-24T	2	Retrofit Kit, LED, 2x4 Troffer, 31 watts, 3000 lm, Lithonia 2VTLT Prism.	1	31	31	already sensored	4100	21.4	1,695	0.12	0.06	207	105	102	$4	$14	$18	$2	$0	$2	0.7%
37	Room through Office	1,695	ET2232N	2	Existing Prismatic Troffer 2x2 2L F32 T8 32 watt U-Tube Lamp(s), Normal Ballast Factor	2	32	61			RTK35-22T	2	Retrofit Kit, LED, 2x2 Troffer, 35 watts, 3300 lm, Lithonia 2VTLT Prism.	1	35	35	already sensored	4100	20.9	1,695	0.12	0.07	207	119	88	$4	$12	$16	$4	$0	$4	0.6%
38	Stairwell	2,608	ECFLS13	8	Existing CFL Screw-in 13 watt Lamp(s)	1	13	13			7WLEDA19	8	7 watt A-19 Style LED Lamp	1	7	7	2L wall mount	4100	6.4	2,608	0.10	0.06	271	146	125	$5	$11	$16	$10	$0	$10	0.3%
39	Fridge Space	2,608	ECFLS13	2	Existing CFL Screw-in 13 watt Lamp(s)	1	13	13			7WLEDA19	2	7 watt A-19 Style LED Lamp	1	7	7	wall mount	4100	6.4	2,608	0.03	0.01	68	37	31	$1	$3	$4	$3	$0	$3	0.1%
40	Institutions Unit	2,608	EW4232N	4	Existing Wrap 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LED19T84-2	4	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38		4100	11.6	2,608	0.24	0.15	636	396	240	$10	$21	$31	$5	$0	$5	0.7%
41	High Rise Unit	2,608	ET4232N	5	Existing Prismatic Troffer 2x4 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61		40-60	RTK31-24T	5	Retrofit Kit, LED, 2x4 Troffer, 31 watts, 3000 lm, Lithonia 2VTLT Prism.	1	31	31		4100	18.5	2,608	0.31	0.16	795	404	391	$16	$35	$51	$7	$0	$7	1.6%
42	High Rise Unit	2,608	ET2232N	1	Existing Prismatic Troffer 2x2 2L F32 T8 32 watt U-Tube Lamp(s), Normal Ballast Factor	2	32	61			RTK35-22T	1	Retrofit Kit, LED, 2x2 Troffer, 35 watts, 3300 lm, Lithonia 2VTLT Prism.	1	35	35		4100	17.2	2,608	0.06	0.04	159	91	68	$3	$6	$9	$3	$0	$3	0.3%
43	High Rise Unit	2,608	ES8260N	1	Existing Strip 8' 2 Lamp(s) F96 60 watt Lamp(s) T12 Standard Ballast	2	60	138			RSK18-40	1	Retrofit Strip Kit - 1x8 LED - 40 watts	1	40	40		4100	9.6	2,608	0.14	0.04	360	104	256	$10	$23	$33	$4	$0	$4	0.5%

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Line	Location	EX Hours	EX Code	EX Qty	EX Desc	Lamps	EX Watts/ Lamp	EX Input Watts	Mounting Height	EX FC	PR Code	PR Qty	PR Desc	PR Lamp Qty	PR Watts/ Lamp	PR Input Watts	Audit Notes	Lamp Color	ECM SPB	PR Hours	Existing kw	Proposed kw	Existing kWh / Year	Proposed kwH / Year	Annual Energy Saved	kWh $ Savings	kW $ Savings	Total Energy $ Savings	EX MX Cost	PR MX Cost	MX Savings	%age of job
44	Captains Office	2,608	ET4232N	3	Existing Prismatic Troffer 2x4 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61		60	RTK31-24T	3	Retrofit Kit, LED, 2x4 Troffer, 31 watts, 3000 lm, Lithonia 2VTLT Prism.	1	31	31		4100	18.5	2,608	0.18	0.09	477	243	235	$10	$21	$30	$4	$0	$4	1.0%
45	Mens RR	1,695	EW4232N	2	Existing Wrap 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61		50	LED19T84-2	2	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38	already sensored	4100	13.6	1,695	0.12	0.08	207	129	78	$3	$11	$14	$2	$0	$2	0.3%
46	Mens RR	1,695	ECFLS15	1	Existing CFL Screw-in 15 watt Lamp(s)	1	15	15			10WLEDBR30	1	9.5 watt BR30 Style LED Lamp - Philips	1	9.5	9.5	can. already sensored	4100	9.3	1,695	0.02	0.01	25	16	9	$0	$1	$2	$1	$0	$1	0.0%
47	Womens RR	1,695	EW4232N	2	Existing Wrap 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LED19T84-2	2	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38	already sensored	4100	13.6	1,695	0.12	0.08	207	129	78	$3	$11	$14	$2	$0	$2	0.3%
48	Womens RR	1,695	EINC40	4	Existing Incandescent 40 watt Lamp(s)	1	40	40			6WLEDG25	4	6 watt G25 Globe LED Lamp	1	6	6	4L G25 vanity. already sensored	4100	2.8	1,695	0.16	0.02	271	41	231	$9	$32	$41	$7	$4	$3	0.2%
49	Copy Room	2,608	ET4432N	2	Existing Prismatic Troffer 2x4 4L F32 T8 32 watt Lamp(s), Normal Ballast Factor	4	32	116		100	RTK31-24T	2	Retrofit Kit, LED, 2x4 Troffer, 31 watts, 3000 lm, Lithonia 2VTLT Prism.	1	31	31		4100	6.9	2,608	0.23	0.06	605	162	443	$18	$39	$58	$4	$0	$4	0.7%
50	Server / Electrical / Boiler Room	520	ES8260N	4	Existing Strip 8' 2 Lamp(s) F96 60 watt Lamp(s) T12 Standard Ballast	2	60	138		10	SKR8228L	4	Strip Kit with Reflector 1X8' 2, 4'L, F32 T8 28 watt Lamp(s), Low Ballast Factor	2	28	42		4100	5.5	520	0.55	0.17	287	87	200	$8	$89	$97	$3	$1	$3	0.8%
51	Server / Electrical / Boiler Room	520	ECFLS15	1	Existing CFL Screw-in 15 watt Lamp(s)	1	15	15			LAI	1	Leave existing fixture as is	1	15	15	porcelain base	4100	0.0	520	0.02	0.02	8	8	0	$0	$0	$0	$0	$0	$0	0.0%
52	Server / Electrical / Boiler Room	520	ES4232N	1	Existing Strip 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LAI	1	Leave existing fixture as is	2	32	61		4100	0.0	520	0.06	0.06	32	32	0	$0	$0	$0	$0	$0	$0	0.0%
53	Server / Electrical / Boiler Room	520	ES4234N	2	Existing Strip 4' 2 Lamp(s) F34 T12 Standard Ballast	2	34	82			LAI	2	Leave existing fixture as is	2	34	82		4100	0.0	520	0.16	0.16	85	85	0	$0	$0	$0	$1	$0	$1	0.0%
54	3rd Floor Lobby / Hall / Open Office	2,608	ET4232N	6	Existing Prismatic Troffer 2x4 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			RTK31-24T	6	Retrofit Kit, LED, 2x4 Troffer, 31 watts, 3000 lm, Lithonia 2VTLT Prism.	1	31	31		4100	18.5	2,608	0.37	0.19	955	485	469	$19	$42	$61	$8	$0	$8	2.0%
55	3rd Floor Lobby / Hall / Open Office	2,608	ECFLS14	13	Existing 14 watt Screw-in CFL Lamp	1	14	14			LAI	13	Leave existing fixture as is	1	14	14	par 30 can	4100	0.0	2,608	0.18	0.18	475	475	0	$0	$0	$0	$14	$0	$14	0.0%
56	3rd Floor Lobby / Hall / Open Office	1,695	ET4232N	32	Existing Prismatic Troffer 2x4 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			RTK31-24T	32	Retrofit Kit, LED, 2x4 Troffer, 31 watts, 3000 lm, Lithonia 2VTLT Prism.	1	31	31	already sensored	4100	21.4	1,695	1.95	0.99	3,309	1,682	1,627	$67	$223	$289	$27	$0	$27	10.4%
57	3rd Floor Lobby / Hall / Open Office	2,608	ET2232N	4	Existing Prismatic Troffer 2x2 2L F32 T8 32 watt U-Tube Lamp(s), Normal Ballast Factor	2	32	61			RTK20-22T	4	Retrofit Kit, LED, 2x2 Troffer, 20 watts, 2000 lm, Lithonia 2VTLT Prism	1	20	20		4100	12.1	2,608	0.24	0.08	636	209	428	$18	$38	$56	$13	$0	$13	1.3%
58	3rd Floor Lobby / Hall / Open Office	2,608	EW4232N	1	Existing Wrap 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LED19T84-2	1	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38		4100	11.6	2,608	0.06	0.04	159	99	60	$2	$5	$8	$1	$0	$1	0.2%
59	Systems Testing Office	2,608	ET4232N	4	Existing Prismatic Troffer 2x4 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61		40-60	RTK31-24T	4	Retrofit Kit, LED, 2x4 Troffer, 31 watts, 3000 lm, Lithonia 2VTLT Prism.	1	31	31		4100	18.5	2,608	0.24	0.12	636	323	313	$13	$28	$41	$5	$0	$5	1.3%
60	Technical Services	2,608	ET4232N	7	Existing Prismatic Troffer 2x4 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			RTK31-24T	7	Retrofit Kit, LED, 2x4 Troffer, 31 watts, 3000 lm, Lithonia 2VTLT Prism.	1	31	31		4100	18.5	2,608	0.43	0.22	1,114	566	548	$22	$49	$71	$9	$0	$9	2.3%
61	Technical Services	2,608	ET2232N	1	Existing Prismatic Troffer 2x2 2L F32 T8 32 watt U-Tube Lamp(s), Normal Ballast Factor	2	32	61			RTK20-22T	1	Retrofit Kit, LED, 2x2 Troffer, 20 watts, 2000 lm, Lithonia 2VTLT Prism	1	20	20		4100	12.1	2,608	0.06	0.02	159	52	107	$4	$10	$14	$3	$0	$3	0.3%
62	Janitor Closet across from Testing	520	ECFLS13	1	Existing CFL Screw-in 13 watt Lamp(s)	1	13	13			LAI	1	Leave existing fixture as is	1	13	13		4100	0.0	520	0.01	0.01	7	7	0	$0	$0	$0	$0	$0	$0	0.0%
63	Mens RR	1,695	EW4232N	4	Existing Wrap 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61		45	LED19T84-2	4	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38	already sensored	4100	13.6	1,695	0.24	0.15	414	258	156	$6	$21	$28	$3	$0	$3	0.7%
64	Womens RR	1,695	EW4232N	2	Existing Wrap 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LED19T84-2	2	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38	already sensored	4100	13.6	1,695	0.12	0.08	207	129	78	$3	$11	$14	$2	$0	$2	0.3%
65	Womens RR	1,695	EINC40	8	Existing Incandescent 40 watt Lamp(s)	1	40	40			6WLEDG25	8	6 watt G25 Globe LED Lamp	1	6	6	8L G25 vanity. already sensored	4100	2.8	1,695	0.32	0.05	542	81	461	$19	$63	$82	$14	$8	$5	0.4%
66	Kitchen	1,695	ET4232N	5	Existing Prismatic Troffer 2x4 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LED19T84-2	5	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38	already sensored	4100	13.6	1,695	0.31	0.19	517	322	195	$8	$27	$35	$4	$0	$4	0.8%

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Line	Location	EX Hours	EX Code	EX Qty	EX Desc	Lamps	EX Watts/ Lamp	EX Input Watts	Mounting Height	EX FC	PR Code	PR Qty	PR Desc	PR Lamp Qty	PR Watts/ Lamp	PR Input Watts	Audit Notes	Lamp Color	ECM SPB	PR Hours	Existing kw	Proposed kw	Existing kWh / Year	Proposed kwH / Year	Annual Energy Saved	kWh $ Savings	kW $ Savings	Total Energy $ Savings	EX MX Cost	PR MX Cost	MX Savings	%age of job
67	Conference Room	1,695	ET4232N	6	Existing Prismatic Troffer 2x4 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LED19T84-2	6	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38	already sensored	4100	13.6	1,695	0.37	0.23	620	387	234	$10	$32	$42	$5	$0	$5	1.0%
68	Assistant Chiefs Office	1,695	ET4232N	4	Existing Prismatic Troffer 2x4 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LED19T84-2	4	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38	already sensored	4100	13.6	1,695	0.24	0.15	414	258	156	$6	$21	$28	$3	$0	$3	0.7%
69	Office	2,608	ET4232N	3	Existing Prismatic Troffer 2x4 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			RTK31-24T	3	Retrofit Kit, LED, 2x4 Troffer, 31 watts, 3000 lm, Lithonia 2VTLT Prism.	1	31	31		4100	18.5	2,608	0.18	0.09	477	243	235	$10	$21	$30	$4	$0	$4	1.0%
70	Office	2,608	ET4232N	6	Existing Prismatic Troffer 2x4 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			RTK31-24T	6	Retrofit Kit, LED, 2x4 Troffer, 31 watts, 3000 lm, Lithonia 2VTLT Prism.	1	31	31		4100	18.5	2,608	0.37	0.19	955	485	469	$19	$42	$61	$8	$0	$8	2.0%
71	Office	1,695	EPT4232N	2	Existing Parabolic Troffer 2x4 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LED19T84-2	2	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38	already sensored	4100	13.6	1,695	0.12	0.08	207	129	78	$3	$11	$14	$2	$0	$2	0.3%
72	Office	1,695	EINC75	2	Existing Incandescent 75 watt Lamp(s)	1	75	75			19WLEDP38	2	19 watt Par 38 LED Lamp	1	19	19	can. need par 38. already sensored	4100	2.2	1,695	0.15	0.04	254	64	190	$8	$26	$34	$3	$1	$2	0.1%
73	Office	2,608	ET4232N	2	Existing Prismatic Troffer 2x4 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			RTK31-24T	2	Retrofit Kit, LED, 2x4 Troffer, 31 watts, 3000 lm, Lithonia 2VTLT Prism.	1	31	31		4100	18.5	2,608	0.12	0.06	318	162	156	$6	$14	$20	$3	$0	$3	0.7%
74	Office	2,608	ET4232N	2	Existing Prismatic Troffer 2x4 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			RTK31-24T	2	Retrofit Kit, LED, 2x4 Troffer, 31 watts, 3000 lm, Lithonia 2VTLT Prism.	1	31	31		4100	18.5	2,608	0.12	0.06	318	162	156	$6	$14	$20	$3	$0	$3	0.7%
75	Office	2,608	EINC60	2	Existing Incandescent 60 watt Lamp(s)	1	60	60			10WLEDBR30	2	9.5 watt BR30 Style LED Lamp - Philips	1	9.5	9.5	can	4100	1.2	2,608	0.12	0.02	313	50	263	$11	$23	$34	$5	$0	$5	0.1%
76	Chiefs Office Reception	2,608	EW4232N	2	Existing Wrap 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LED19T84-2	2	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38		4100	11.6	2,608	0.12	0.08	318	198	120	$5	$11	$16	$3	$0	$3	0.3%
77	Chiefs Office Reception	2,608	ECFLS13	2	Existing CFL Screw-in 13 watt Lamp(s)	1	13	13			7WLEDA19	2	7 watt A-19 Style LED Lamp	1	7	7	wall mount	4100	6.4	2,608	0.03	0.01	68	37	31	$1	$3	$4	$3	$0	$3	0.1%
78	Chiefs Office	2,608	ET4232N	9	Existing Prismatic Troffer 2x4 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			RTK31-24T	9	Retrofit Kit, LED, 2x4 Troffer, 31 watts, 3000 lm, Lithonia 2VTLT Prism.	1	31	31		4100	18.5	2,608	0.55	0.28	1,432	728	704	$29	$63	$91	$12	$0	$12	2.9%
79	Chiefs Office	2,608	EINC75	2	Existing Incandescent 75 watt Lamp(s)	1	75	75			19WLEDP38	2	19 watt Par 38 LED Lamp	1	19	19	par 38 can	4100	1.9	2,608	0.15	0.04	391	99	292	$12	$26	$38	$5	$2	$3	0.1%
80	Restroom	2,608	ET2232N	1	Existing Prismatic Troffer 2x2 2L F32 T8 32 watt U-Tube Lamp(s), Normal Ballast Factor	2	32	61			RTK35-22T	1	Retrofit Kit, LED, 2x2 Troffer, 35 watts, 3300 lm, Lithonia 2VTLT Prism.	1	35	35		4100	17.2	2,608	0.06	0.04	159	91	68	$3	$6	$9	$3	$0	$3	0.3%
81	Restroom	2,608	ECFLS13	2	Existing CFL Screw-in 13 watt Lamp(s)	1	13	13			7WLEDA19	2	7 watt A-19 Style LED Lamp	1	7	7	2L vanity	4100	6.4	2,608	0.03	0.01	68	37	31	$1	$3	$4	$3	$0	$3	0.1%
82	Office	2,608	ET2232N	2	Existing Prismatic Troffer 2x2 2L F32 T8 32 watt U-Tube Lamp(s), Normal Ballast Factor	2	32	61			RTK35-22T	2	Retrofit Kit, LED, 2x2 Troffer, 35 watts, 3300 lm, Lithonia 2VTLT Prism.	1	35	35		4100	17.2	2,608	0.12	0.07	318	183	136	$6	$12	$18	$7	$0	$7	0.6%
83	Division Chief Office	1,695	ET4232N	2	Existing Prismatic Troffer 2x4 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			RTK31-24T	2	Retrofit Kit, LED, 2x4 Troffer, 31 watts, 3000 lm, Lithonia 2VTLT Prism.	1	31	31	already sensored	4100	21.4	1,695	0.12	0.06	207	105	102	$4	$14	$18	$2	$0	$2	0.7%
84	Office	2,608	ET4232N	6	Existing Prismatic Troffer 2x4 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			RTK31-24T	6	Retrofit Kit, LED, 2x4 Troffer, 31 watts, 3000 lm, Lithonia 2VTLT Prism.	1	31	31		4100	18.5	2,608	0.37	0.19	955	485	469	$19	$42	$61	$8	$0	$8	2.0%
85	Office	2,608	ET4232N	2	Existing Prismatic Troffer 2x4 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			RTK31-24T	2	Retrofit Kit, LED, 2x4 Troffer, 31 watts, 3000 lm, Lithonia 2VTLT Prism.	1	31	31		4100	18.5	2,608	0.12	0.06	318	162	156	$6	$14	$20	$3	$0	$3	0.7%
86	Deputy Chief Office	2,608	ET4232N	3	Existing Prismatic Troffer 2x4 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			RTK31-24T	3	Retrofit Kit, LED, 2x4 Troffer, 31 watts, 3000 lm, Lithonia 2VTLT Prism.	1	31	31		4100	18.5	2,608	0.18	0.09	477	243	235	$10	$21	$30	$4	$0	$4	1.0%
87	Office across - Door 23	2,608	ET2232N	1	Existing Prismatic Troffer 2x2 2L F32 T8 32 watt U-Tube Lamp(s), Normal Ballast Factor	2	32	61			RTK35-22T	1	Retrofit Kit, LED, 2x2 Troffer, 35 watts, 3300 lm, Lithonia 2VTLT Prism.	1	35	35		4100	17.2	2,608	0.06	0.04	159	91	68	$3	$6	$9	$3	$0	$3	0.3%

City and County of Denver, CO - Fire Station 1 - Admin Bldg ~ OPTIMIZED OPTION: HYBRID

Line	Location	EX Hours	EX Code	EX Qty	EX Desc	Lamps	EX Watts/ Lamp	EX Input Watts	Mounting Height	EX FC	PR Code	PR Qty	PR Desc	PR Lamp Qty	PR Watts/ Lamp	PR Input Watts	Audit Notes	Lamp Color	ECM SPB	PR Hours	Existing kw	Proposed kw	Existing kWh / Year	Proposed kwH / Year	Annual Energy Saved	kWh $ Savings	kW $ Savings	Total Energy $ Savings	EX MX Cost	PR MX Cost	MX Savings	%age of job
88	Stairs	2,608	ECFLS13	5	Existing CFL Screw-in 13 watt Lamp(s)	1	13	13			7WLEDA19	5	7 watt A-19 Style LED Lamp	1	7	7		4100	6.4	2,608	0.07	0.04	170	91	78	$3	$7	$10	$7	$0	$7	0.2%
89	Firehouse Side - Garage	2,608	ET4432N	27	Existing Prismatic Troffer 2x4 4L F32 T8 32 watt Lamp(s), Normal Ballast Factor	4	32	116	24.00	15-20	RTK53-24T	27	Retrofit Kit, LED, 2x4 Troffer, 53 watts, 6000 lm, Lithonia 2VTLT Prism.	1	53	52.55		4100	11.4	2,608	3.13	1.42	8,168	3,700	4,468	$183	$397	$580	$53	$0	$53	11.1%
90	Firehouse Side - Garage	2,608	ES8296T8	2	Existing Strip 8' 2L F96 T8 59 watt Lamp(s), Magnetic Ballast	2	59	120			RSK18-60	2	Retrofit Strip Kit - 1x8 LED - 60 watts	1	60	60		4100	15.0	2,608	0.24	0.12	626	313	313	$13	$28	$41	$7	$0	$7	1.1%
91	Firehouse Side - Garage	2,608	EW4232N	2	Existing Wrap 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LED19T84-2	2	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38		4100	11.6	2,608	0.12	0.08	318	198	120	$5	$11	$16	$3	$0	$3	0.3%
92	Mens RR	2,608	EPT4232N	1	Existing Parabolic Troffer 2x4 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			RTK31-24D	1	Retrofit Kit, LED, 2x4 Troffer, 31 watts, 3000 lm, Lithonia 2VTL DCP	1	31	31		4100	18.5	2,608	0.06	0.03	159	81	78	$3	$7	$10	$1	$0	$1	0.3%
93	Mens RR	2,608	ECFLS15	18	Existing CFL Screw-in 15 watt Lamp(s)	1	15	15			8WLEDA19	18	8 watt A-19 Style LED Lamp - Slim	1	8	8	3L vanity	4100	4.9	2,608	0.27	0.14	704	376	329	$13	$29	$43	$23	$0	$23	0.5%
94	Mens RR	2,608	ECFLS15	3	Existing CFL Screw-in 15 watt Lamp(s)	1	15	15			10WLEDBR30	3	9.5 watt BR30 Style LED Lamp - Philips	1	9.5	9.5	can	4100	7.3	2,608	0.05	0.03	117	74	43	$2	$4	$6	$4	$0	$4	0.1%
95	Mens RR	2,608	ECFLS15	1	Existing CFL Screw-in 15 watt Lamp(s)	1	15	15			8WLEDA19	1	8 watt A-19 Style LED Lamp - Slim	1	8	8	porcelain base	4100	4.9	2,608	0.02	0.01	39	21	18	$1	$2	$2	$1	$0	$1	0.0%
96	Locker / Bunk Area	2,608	EW4232N	9	Existing Wrap 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LED19T84-2	9	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38		4100	11.6	2,608	0.55	0.34	1,432	892	540	$22	$48	$70	$12	$0	$12	1.5%
97	Locker / Bunk Area	2,608	ET4232N	2	Existing Prismatic Troffer 2x4 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			RTK31-24T	2	Retrofit Kit, LED, 2x4 Troffer, 31 watts, 3000 lm, Lithonia 2VTLT Prism.	1	31	31		4100	18.5	2,608	0.12	0.06	318	162	156	$6	$14	$20	$3	$0	$3	0.7%
98	Locker / Bunk Area	2,608	ECFLS15	4	Existing CFL Screw-in 15 watt Lamp(s)	1	15	15			8WLEDA19	4	8 watt A-19 Style LED Lamp - Slim	1	8	8	can. red filter	4100	4.9	2,608	0.06	0.03	156	83	73	$3	$6	$9	$5	$0	$5	0.1%
99	Locker / Bunk Area	2,608	EVAN2220N	1	Existing Vanity Fixture 2' 2 Lamp(s) F20 T12 Standard Ballast	2	20	36			LED10T82-2	1	Sylvania UltraLED 2' External Driver T8 LED - 2 lamp - 10w/ea	2	10	20		4100	15.8	2,608	0.04	0.02	94	52	42	$2	$4	$5	$1	$0	$1	0.2%
100	Womens RR	2,608	EW4232N	1	Existing Wrap 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LED19T84-2	1	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38		4100	11.6	2,608	0.06	0.04	159	99	60	$2	$5	$8	$1	$0	$1	0.2%
101	Womens RR	2,608	EINC60	1	Existing Incandescent 60 watt Lamp(s)	1	60	60			7WLEDA19	1	7 watt A-19 Style LED Lamp	1	7	7	existing has red filter	4100	1.0	2,608	0.06	0.01	156	18	138	$6	$12	$18	$3	$0	$3	0.0%
102	Laundry Room	2,608	EV4232N	4	Existing Vapor Tight 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	58			LED19T84-2	4	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38	no covers	4100	13.1	2,608	0.23	0.15	605	396	209	$9	$19	$27	$5	$0	$5	0.7%
103	Short Hall with Map	2,608	ET4232N	3	Existing Prismatic Troffer 2x4 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			RTK31-24T	3	Retrofit Kit, LED, 2x4 Troffer, 31 watts, 3000 lm, Lithonia 2VTLT Prism.	1	31	31		4100	18.5	2,608	0.18	0.09	477	243	235	$10	$21	$30	$4	$0	$4	1.0%
104	Short Hall with Map	2,608	ECFLS15	3	Existing CFL Screw-in 15 watt Lamp(s)	1	15	15			10WLEDBR30	3	9.5 watt BR30 Style LED Lamp - Philips	1	9.5	9.5	par 30 can	4100	7.3	2,608	0.05	0.03	117	74	43	$2	$4	$6	$4	$0	$4	0.1%
105	TV Room	2,608	EW4232N	6	Existing Wrap 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LED19T84-2	6	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38		4100	11.6	2,608	0.37	0.23	955	595	360	$15	$32	$47	$8	$0	$8	1.0%
106	Engine One Door	2,608	ECFLS15	4	Existing CFL Screw-in 15 watt Lamp(s)	1	15	15			8WLEDA19	4	8 watt A-19 Style LED Lamp - Slim	1	8	8	2L ceiling mount	4100	4.9	2,608	0.06	0.03	156	83	73	$3	$6	$9	$5	$0	$5	0.1%
107	Engine One Door	2,608	ECFLS15	6	Existing CFL Screw-in 15 watt Lamp(s)	1	15	15			8WLEDA19	6	8 watt A-19 Style LED Lamp - Slim	1	8	8	wall mount	4100	4.9	2,608	0.09	0.05	235	125	110	$4	$10	$14	$8	$0	$8	0.2%
108	Engine / Office	2,608	ET4232N	2	Existing Prismatic Troffer 2x4 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			RTK31-24T	2	Retrofit Kit, LED, 2x4 Troffer, 31 watts, 3000 lm, Lithonia 2VTLT Prism.	1	31	31		4100	18.5	2,608	0.12	0.06	318	162	156	$6	$14	$20	$3	$0	$3	0.7%
109	Restroom	2,608	EW4232N	1	Existing Wrap 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LED19T84-2	1	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38		4100	11.6	2,608	0.06	0.04	159	99	60	$2	$5	$8	$1	$0	$1	0.2%
110	Restroom	2,608	ECFLS15	1	Existing CFL Screw-in 15 watt Lamp(s)	1	15	15			10WLEDBR30	1	9.5 watt BR30 Style LED Lamp - Philips	1	9.5	9.5	can	4100	7.3	2,608	0.02	0.01	39	25	14	$1	$1	$2	$1	$0	$1	0.0%
111	Restroom	2,608	EVAN2217N	1	Existing Vanity Fixture 2' 2L F17 T8 Lamps, NBF Ballast	2	17	33			LAI	1	Leave existing fixture as is	2	17	33		4100	0.0	2,608	0.03	0.03	86	86	0	$0	$0	$0	$2	$0	$2	0.0%
112	Supply Closet	520	ECFLS15	1	Existing CFL Screw-in 15 watt Lamp(s)	1	15	15			LAI	1	Leave existing fixture as is	1	15	15		4100	0.0	520	0.02	0.02	8	8	0	$0	$0	$0	$0	$0	$0	0.0%
113	Chief 2 Office	2,608	ET4232N	3	Existing Prismatic Troffer 2x4 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			RTK31-24T	3	Retrofit Kit, LED, 2x4 Troffer, 31 watts, 3000 lm, Lithonia 2VTLT Prism.	1	31	31		4100	18.5	2,608	0.18	0.09	477	243	235	$10	$21	$30	$4	$0	$4	1.0%

City and County of Denver, CO - Fire Station 1 - Admin Bldg ~ OPTIMIZED OPTION: HYBRID

Line	Location	EX Hours	EX Code	EX Qty	EX Desc	Lamps	EX Watts/ Lamp	EX Input Watts	Mounting Height	EX FC	PR Code	PR Qty	PR Desc	PR Lamp Qty	PR Watts/ Lamp	PR Input Watts	Audit Notes	Lamp Color	ECM SPB	PR Hours	Existing kw	Proposed kw	Existing kWh / Year	Proposed kwH / Year	Annual Energy Saved	kWh $ Savings	kW $ Savings	Total Energy $ Savings	EX MX Cost	PR MX Cost	MX Savings	%age of job
114	Restroom	2,608	EW4232N	1	Existing Wrap 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LED19T84-2	1	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38		4100	11.6	2,608	0.06	0.04	159	99	60	$2	$5	$8	$1	$0	$1	0.2%
115	Restroom	2,608	ECFLS15	1	Existing CFL Screw-in 15 watt Lamp(s)	1	15	15			10WLEDBR30	1	9.5 watt BR30 Style LED Lamp - Philips	1	9.5	9.5	can	4100	7.3	2,608	0.02	0.01	39	25	14	$1	$1	$2	$1	$0	$1	0.0%
116	Restroom	2,608	EVAN2217 N	1	Existing Vanity Fixture 2' 2L F17 T8 Lamps, NBF Ballast	2	17	33			LAI	1	Leave existing fixture as is	2	17	33		4100	0.0	2,608	0.03	0.03	86	86	0	$0	$0	$0	$2	$0	$2	0.0%
117	Door 2	2,608	ET4232N	3	Existing Prismatic Troffer 2x4 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			RTK31-24T	3	Retrofit Kit, LED, 2x4 Troffer, 31 watts, 3000 lm, Lithonia 2VTLT Prism.	1	31	31		4100	18.5	2,608	0.18	0.09	477	243	235	$10	$21	$30	$4	$0	$4	1.0%
118	Kitchen / TV Room / Office	2,608	ET4232N	9	Existing Prismatic Troffer 2x4 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			RTK31-24T	9	Retrofit Kit, LED, 2x4 Troffer, 31 watts, 3000 lm, Lithonia 2VTLT Prism.	1	31	31		4100	18.5	2,608	0.55	0.28	1,432	728	704	$29	$63	$91	$12	$0	$12	2.9%
119	Kitchen / TV Room / Office	2,608	ECFLS23	1	Existing CFL Screw-in 23 watt Lamp(s)	1	23	23			15WLEDA21	1	15 watt A-21 Style LED Lamp	1	15	15		4100	8.5	2,608	0.02	0.02	60	39	21	$1	$2	$3	$2	$1	$0	0.0%
120	Line 1 Phone Room	2,608	ECFLS15	1	Existing CFL Screw-in 15 watt Lamp(s)	1	15	15			10WLEDBR30	1	9.5 watt BR30 Style LED Lamp - Philips	1	9.5	9.5	can	4100	7.3	2,608	0.02	0.01	39	25	14	$1	$1	$2	$1	$0	$1	0.0%
121	Line 2 Phone Room	2,608	ECFLS15	1	Existing CFL Screw-in 15 watt Lamp(s)	1	15	15			10WLEDBR30	1	9.5 watt BR30 Style LED Lamp - Philips	1	9.5	9.5	can	4100	7.3	2,608	0.02	0.01	39	25	14	$1	$1	$2	$1	$0	$1	0.0%
122	Drink Storage	520	EINC60	1	Existing Incandescent 60 watt Lamp(s)	1	60	60			7WLEDA19	1	7 watt A-19 Style LED Lamp	1	7	7		4100	1.5	520	0.06	0.01	31	4	28	$1	$12	$13	$1	$0	$1	0.0%
123	Electrical	520	ES4232N	2	Existing Strip 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LAI	2	Leave existing fixture as is	2	32	61		4100	0.0	520	0.12	0.12	63	63	0	$0	$0	$0	$1	$0	$1	0.0%
124	Exterior	4,380	EWMV175	2	Existing Wall Pack Mercury Vapor 175 watt Lamp	1	175	205	15.00		NXTWLED50 RL	2	New Cooper CrosstourMaxx LED Wallpack, 50 watts, RL Optics	1	50	50	forward	4100	11.5	4,380	0.41	0.10	1,796	438	1,358	$56		$56	$29	$0	$29	1.5%
125	Exterior	4,380	EFLMH400	2	Existing Flood Fixture Metal Halide 400 watt Lamp	1	400	458	20.00		NFLED150	2	New LED Flood, Rab FXLED150, 155 watts	1	150	155	slipfit with adj knuckle	4100	11.0	4,380	0.92	0.31	4,012	1,358	2,654	$109		$109	$39	$0	$39	2.5%
126	Exterior	4,380	ECFLS23	3	Existing CFL Screw-in 23 watt Lamp(s)	1	23	23	33.00		12WLEDBR40	3	12 watt BR40 Style LED Lamp - Philips	1	12	12	par 38 can	4100	10.1	4,380	0.07	0.04	302	158	145	$6		$6	$8	$6	$2	0.1%
127	Exterior	4,380	EWMH70	1	Existing Wall Pack Metal Halide 70 watt Lamp	1	70	90	15.00		NXTWLED30	1	New Cooper Crosstour LED Wallpack, 30 watts	1	30	30	forward	4100	15.2	4,380	0.09	0.03	394	131	263	$11		$11	$14	$0	$14	0.6%
128	Exterior	4,380	ECFLS16	6	Existing 16 watt Screw-in CFL Lamp	1	16	16			8WLEDA19	6	8 watt A-19 Style LED Lamp - Slim	1	8	8	can with lens over door	4100	4.0	4,380	0.10	0.05	420	210	210	$9		$9	$18	$0	$18	0.2%
129	Exterior	4,380	ECFLS23	6	Existing CFL Screw-in 23 watt Lamp(s)	1	23	23			19WLEDP38	6	19 watt Par 38 LED Lamp	1	19	19	2L directional flood	4100	26.2	4,380	0.14	0.11	604	499	105	$4		$4	$16	$11	$5	0.4%
130	Exterior	4,380	ELEDP38	5	Existing LED Par 38 Lamp	1	20	20	33.00		LAI	5	Leave existing fixture as is	1	20	20	over rollup	4100	0.0	4,380	0.10	0.10	438	438	0	$0		$0	$0	$0	$0	0.0%
131	Exterior	4,380	EFLMH175	1	Existing Flood Fixture Metal Halide 175 watt Lamp	1	175	210			NFLED52	1	New LED Flood, Rab FFLED52 Flood, 54 watts	1	54	54	on ground, wide distribution. 1/2" nip and adj knuckle	4100	13.5	4,380	0.21	0.05	920	237	683	$28		$28	$14	$0	$14	0.9%
132	Exterior	4,380	ECFLS23	4	Existing CFL Screw-in 23 watt Lamp(s)	1	23	23			19WLEDP38	4	19 watt Par 38 LED Lamp	1	19	19	flood on to flag. 1/2" nip and adj knuckle	4100	26.2	4,380	0.09	0.08	403	333	70	$3		$3	$11	$7	$3	0.2%
133	Exterior	4,380	EPLHPS250	2	Existing Pole Light Fixture High Pressure Sodium 250 watt Lamp	1	250	295	30.00		NCHLED101H E	2	New LED Cobrahead Cree XSP1C 101 watts, 8,224 Lm	1	101	101	shoebox. 2 bolt, bronze	4100	13.7	4,380	0.59	0.20	2,584	885	1,699	$70		$70	$26	$0	$26	2.0%
Total		2,452		475					33			475							15.9	2452.1	26.9	13.7	67833	33760	34072	$1,397	$2,682	$4,079	$796	$43	$753	1.0

City and County of Denver, CO - Fire Station 8 ~ OPTIMIZED OPTION: HYBRID

Line	Location	EX Hours	EX Code	EX Qty	EX Desc	Lamps	EX Watts/ Lamp	EX Input Watts	Mounting Height	EX FC	PR Code	PR Qty	PR Desc	PR Lamp Qty	PR Watts/ Lamp	PR Input Watts	Audit Notes	Lamp Color	ECM SPB	PR Hours	Existing kw	Proposed kw	Existing kWh / Year	Proposed kwH / Year	Annual Energy Saved	kWh $ Savings	kW $ Savings	Total Energy $ Savings	EX MX Cost	PR MX Cost	MX Savings	%age of job
1	Garage	4,380	ET4232N	24	Existing Prismatic Troffer 2x4 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61	20	5-10	RTK53-24T	24	Retrofit Kit, LED, 2x4 Troffer, 53 watts, 6000 lm, Lithonia 2VTLT Prism.	1	53	52.55	drop ceiling - **this will improve light levels and performance**	4100	50.4	4,380	1.46	1.26	6,412	5,524	888	$36	$47	$83	$53	$0	$53	46.3%
2	Garage	4,380	ES8296T8	1	Existing Strip 8' 2L F96 T8 59 watt Lamp(s), Magnetic Ballast	2	59	120			RSK18-40	1	Retrofit Strip Kit - 1x8 LED - 40 watts	1	40	40		4100	9.8	4,380	0.12	0.04	526	175	350	$14	$19	$33	$6	$0	$6	2.6%
3	Dispatch Area and Hall by Front Door	6,570	EW4232N	1	Existing Wrap 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61		25	LED19T84-2	1	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38		4100	7.6	6,570	0.06	0.04	401	250	151	$6	$5	$12	$3	$0	$3	0.8%
4	Dispatch Area and Hall by Front Door	6,570	ECFLS15	3	Existing CFL Screw-in 15 watt Lamp(s)	1	15	15			6WLEDA19	3	6.5 watt A-19 Style LED Lamp	1	6.5	6.5	recessed square with lens	4100	2.9	6,570	0.05	0.02	296	128	168	$7	$6	$13	$10	$0	$10	0.4%
5	Closet Door on Right	520	ECFLS15	1	Existing CFL Screw-in 15 watt Lamp(s)	1	15	15			8WLEDA19	1	8 watt A-19 Style LED Lamp - Slim	1	8	8	recessed square	4100	9.5	520	0.02	0.01	8	4	4	$0	$2	$2	$0	$0	$0	0.1%
6	Door to the Left	520	ECFLS15	1	Existing CFL Screw-in 15 watt Lamp(s)	1	15	15			8WLEDA19	1	8 watt A-19 Style LED Lamp - Slim	1	8	8	on porcelain base	4100	9.5	520	0.02	0.01	8	4	4	$0	$2	$2	$0	$0	$0	0.1%
7	Door to the Left	520	ECFLS15	1	Existing CFL Screw-in 15 watt Lamp(s)	1	15	15			8WLEDA19	1	8 watt A-19 Style LED Lamp - Slim	1	8	8		4100	9.5	520	0.02	0.01	8	4	4	$0	$2	$2	$0	$0	$0	0.1%
8	Day Room Around Corner	6,570	EW4232N	5	Existing Wrap 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61		25	LED19T84-2	5	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38		4100	7.6	6,570	0.31	0.19	2,004	1,248	756	$31	$27	$58	$16	$0	$16	3.8%
9	Day Room Around Corner	6,570	ECFLS15	9	Existing CFL Screw-in 15 watt Lamp(s)	1	15	15			6WLEDA19	9	6.5 watt A-19 Style LED Lamp	1	6.5	6.5	recessed squares	4100	2.9	6,570	0.14	0.06	887	384	503	$21	$18	$38	$30	$0	$30	1.3%
10	Pan Storage	520	ECFLS16	1	Existing 16 watt Screw-in CFL Lamp	1	16	16		15	10WLEDBR30	1	9.5 watt BR30 Style LED Lamp - Philips	1	9.5	9.5	par 30 can	4100	12.3	520	0.02	0.01	8	5	3	$0	$2	$2	$0	$0	$0	0.2%
11	Fridge Room	520	ECFLS16	1	Existing 16 watt Screw-in CFL Lamp	1	16	16		5-10	8WLEDA19	1	8 watt A-19 Style LED Lamp - Slim	1	8	8		4100	8.1	520	0.02	0.01	8	4	4	$0	$2	$2	$0	$0	$0	0.1%
12	Restroom in Garage next to Day Room	2,086	ECFLS15	2	Existing CFL Screw-in 15 watt Lamp(s)	1	15	15		15	8WLEDA19	2	8 watt A-19 Style LED Lamp - Slim	1	8	8	2L vanity, no cover	4100	5.9	2,086	0.03	0.02	63	33	29	$1	$3	$4	$2	$0	$2	0.3%
13	Area Next to Stairs	520	ECFLS15	1	Existing CFL Screw-in 15 watt Lamp(s)	1	15	15		10	6WLEDA19	1	6.5 watt A-19 Style LED Lamp	1	6.5	6.5	recessed square	4100	9.1	520	0.02	0.01	8	3	4	$0	$2	$2	$0	$0	$0	0.1%
14	Office past Stairs	2,086	EW4232N	4	Existing Wrap 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61		55	LED19T84-2	4	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38	pendant mount	4100	13.6	2,086	0.24	0.15	509	317	192	$8	$21	$29	$4	$0	$4	3.1%
15	Stairs	8,760	ECFLS15	3	Existing CFL Screw-in 15 watt Lamp(s)	1	15	15		30	8WLEDA19	3	8 watt A-19 Style LED Lamp - Slim	1	8	8		4100	2.3	8,760	0.05	0.02	394	210	184	$8	$5	$12	$13	$0	$13	0.4%
16	Stairs	8,760	EW4232N	1	Existing Wrap 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LED19T84-2	1	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38		4100	6.3	8,760	0.06	0.04	534	333	201	$8	$5	$14	$4	$0	$4	0.8%
17	Locker Room at Top of Stairs	4,380	EW4232N	4	Existing Wrap 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61		35	LED19T84-2	4	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38		4100	9.7	4,380	0.24	0.15	1,069	666	403	$17	$21	$38	$9	$0	$9	3.1%
18	Locker Room at Top of Stairs	4,380	EW4432N	1	Existing Wrap 4' 4L F32 T8 32 watt Lamp(s), Normal Ballast Factor	4	32	116			LED19T84-4	1	Sylvania UltraLED External Driver T8 LED - 4 lamp - 19w/ea	4	19	76		4100	9.6	4,380	0.12	0.08	508	333	175	$7	$9	$16	$3	$0	$3	1.3%
19	Locker Room at Top of Stairs	4,380	EVAN4232N	1	Existing Vanity Fixture 4' 2L F32 T8 Lamp, NBF Ballast	2	32	58			LED19T84-2	1	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38		4100	10.9	4,380	0.06	0.04	254	166	88	$4	$5	$8	$2	$0	$2	0.8%
20	Locker Room at Top of Stairs	4,380	ECFLS15	2	Existing CFL Screw-in 15 watt Lamp(s)	1	15	15			6WLEDA19	2	6.5 watt A-19 Style LED Lamp	1	6.5	6.5	recessed square	4100	3.9	4,380	0.03	0.01	131	57	74	$3	$4	$7	$4	$0	$4	0.3%
21	Bunk Rooms	520	ECFLS15	15	Existing CFL Screw-in 15 watt Lamp(s)	1	15	15		10-15	8WLEDA19	15	8 watt A-19 Style LED Lamp - Slim	1	8	8		4100	9.5	520	0.23	0.12	117	62	55	$2	$24	$27	$4	$0	$4	2.0%
22	Bunk Rooms	520	EW4232N	3	Existing Wrap 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LAI	3	Leave existing fixture as is	2	32	61		4100	0.0	520	0.18	0.18	95	95	0	$0	$0	$0	$1	$0	$1	0.0%
23	Hose Rack	520	EINC100	1	Existing Incandescent 100 watt Lamp(s)	1	100	100		5	13WLEDA21	1	13 watt A-21 Style LED Lamp - Slim	1	13	13	jelly jar at top	4100	1.0	520	0.10	0.01	52	7	45	$2	$20	$22	$1	$0	$1	0.2%
24	Hose Room	520	ES8432N	1	Existing Strip 1x8 Fixture 4L F32 T8 32 watt Lamp(s), Normal Ballast Factor	4	32	112	8	30	LAI	1	Leave existing fixture as is	4	32	112		4100	0.0	520	0.11	0.11	58	58	0	$0	$0	$0	$0	$0	$0	0.0%
25	Living Area Hall	8,760	EW4232N	4	Existing Wrap 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LED19T84-2	4	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38		4100	6.3	8,760	0.24	0.15	2,137	1,332	806	$33	$21	$54	$18	$0	$18	3.1%
26	Pool / TV Room	2,086	EW4232N	6	Existing Wrap 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LB228L	6	Lamp & Ballast Retrofit 2L F32 T8 28 watt Lamp(s), Low Ballast Factor	2	28	42		4100	9.4	2,086	0.37	0.25	763	526	238	$10	$26	$36	$6	$4	$2	2.5%
27	Jacket Storage	520	ECFLS15	2	Existing CFL Screw-in 15 watt Lamp(s)	1	15	15			6WLEDA19	2	6.5 watt A-19 Style LED Lamp	1	6.5	6.5	porcelain base	4100	9.1	520	0.03	0.01	16	7	9	$0	$4	$4	$1	$0	$1	0.3%

City and County of Denver, CO - Fire Station 8 ~ OPTIMIZED OPTION: HYBRID

Line	Location	EX Hours	EX Code	EX Qty	EX Desc	Lamps	EX Watts/ Lamp	EX Input Watts	Mounting Height	EX FC	PR Code	PR Qty	PR Desc	PR Lamp Qty	PR Watts/ Lamp	PR Input Watts	Audit Notes	Lamp Color	ECM SPB	PR Hours	Existing kw	Proposed kw	Existing kWh / Year	Proposed kwH / Year	Annual Energy Saved	kWh $ Savings	kW $ Savings	Total Energy $ Savings	EX MX Cost	PR MX Cost	MX Savings	%age of job
28	Larger Coat Rack Room	520	EW4232N	7	Existing Wrap 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LAI	7	Leave existing fixture as is	2	32	61		4100	0.0	520	0.43	0.43	222	222	0	$0	$0	$0	$2	$0	$2	0.0%
29	Supply Room	520	ES4232N	1	Existing Strip 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LAI	1	Leave existing fixture as is	2	32	61		4100	0.0	520	0.06	0.06	32	32	0	$0	$0	$0	$0	$0	$0	0.0%
30	Stairs Down	8,760	EW4232N	3	Existing Wrap 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LED19T84-2	3	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38		4100	6.3	8,760	0.18	0.11	1,603	999	604	$25	$16	$41	$13	$0	$13	2.3%
31	Downstairs TV Room	2,086	ET4232N	6	Existing Prismatic Troffer 2x4 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61		35	LB228L	6	Lamp & Ballast Retrofit 2L F32 T8 28 watt Lamp(s), Low Ballast Factor	2	28	42		4100	9.4	2,086	0.37	0.25	763	526	238	$10	$26	$36	$6	$4	$2	2.5%
32	Laundry	520	ES8432N	2	Existing Strip 1x8 Fixture 4L F32 T8 32 watt Lamp(s), Normal Ballast Factor	4	32	112		50	LAI	2	Leave existing fixture as is	4	32	112		4100	0.0	520	0.22	0.22	116	116	0	$0	$0	$0	$1	$0	$1	0.0%
33	Water Heater Room	520	ECFLS15	3	Existing CFL Screw-in 15 watt Lamp(s)	1	15	15			8WLEDA19	3	8 watt A-19 Style LED Lamp - Slim	1	8	8	porcelain base	4100	9.5	520	0.05	0.02	23	12	11	$0	$5	$5	$1	$0	$1	0.4%
34	Water Heater Room	520	ES4232N	1	Existing Strip 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LAI	1	Leave existing fixture as is	2	32	61		4100	0.0	520	0.06	0.06	32	32	0	$0	$0	$0	$0	$0	$0	0.0%
35	Fitness Area	2,086	ES8432N	6	Existing Strip 1x8 Fixture 4L F32 T8 32 watt Lamp(s), Normal Ballast Factor	4	32	112	9		SKR8228L	6	Strip Kit with Reflector 1X8' 2, 4'L, F32 T8 28 watt Lamp(s), Low Ballast Factor	2	28	42		4100	6.3	2,086	0.67	0.25	1,402	526	876	$36	$97	$133	$9	$4	$5	5.9%
36	Fitness Area	2,086	ECFLS15	7	Existing CFL Screw-in 15 watt Lamp(s)	1	15	15			8WLEDA19	7	8 watt A-19 Style LED Lamp - Slim	1	8	8	jelly jar	4100	5.9	2,086	0.11	0.06	219	117	102	$4	$11	$16	$7	$0	$7	0.9%
37	Fitness Area	2,086	ECFLS15	6	Existing CFL Screw-in 15 watt Lamp(s)	1	15	15			6WLEDA19	6	6.5 watt A-19 Style LED Lamp	1	6.5	6.5	recessed square	4100	5.9	2,086	0.09	0.04	188	81	106	$4	$12	$16	$6	$0	$6	0.9%
38	Back Upstairs to Womens RR	2,086	EW4232N	1	Existing Wrap 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LB228L	1	Lamp & Ballast Retrofit 2L F32 T8 28 watt Lamp(s), Low Ballast Factor	2	28	42		4100	9.4	2,086	0.06	0.04	127	88	40	$2	$4	$6	$1	$1	$0	0.4%
39	Janitor Closet	520	ECFLS15	2	Existing CFL Screw-in 15 watt Lamp(s)	1	15	15			8WLEDA19	2	8 watt A-19 Style LED Lamp - Slim	1	8	8	porcelain base	4100	9.5	520	0.03	0.02	16	8	7	$0	$3	$4	$1	$0	$1	0.3%
40	2nd Floor Hall	8,760	EW4232N	7	Existing Wrap 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LED19T84-2	7	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38		4100	6.3	8,760	0.43	0.27	3,741	2,330	1,410	$58	$37	$95	$31	$0	$31	5.4%
41	Bunk Room by Lockers	520	ECFLS15	6	Existing CFL Screw-in 15 watt Lamp(s)	1	15	15			6WLEDA19	6	6.5 watt A-19 Style LED Lamp	1	6.5	6.5	wall mount	4100	9.1	520	0.09	0.04	47	20	27	$1	$12	$13	$2	$0	$2	0.9%
42	Hatch - Mech Space	520	EINC90	12	Existing Incandescent 90 watt Lamp(s)	1	90	90			13WLEDA21	12	13 watt A-21 Style LED Lamp - Slim	1	13	13	porcelain base. maybe use 17w	4100	1.2	520	1.08	0.16	562	81	480	$20	$214	$234	$6	$2	$4	1.9%
43	Restroom Upstairs	2,086	EW4232N	3	Existing Wrap 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61		80	LB228L	3	Lamp & Ballast Retrofit 2L F32 T8 28 watt Lamp(s), Low Ballast Factor	2	28	42		4100	9.4	2,086	0.18	0.13	382	263	119	$5	$13	$18	$3	$2	$1	1.2%
44	Restroom Upstairs	2,086	EW4232N	1	Existing Wrap 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61		80	LB228L	1	Lamp & Ballast Retrofit 2L F32 T8 28 watt Lamp(s), Low Ballast Factor	2	28	42	1 missing cover	4100	16.6	2,086	0.06	0.04	127	88	40	$2	$4	$6	$1	$1	$0	0.7%
45	Restroom Upstairs	2,086	EVAN4232N	3	Existing Vanity Fixture 4' 2L F32 T8 Lamp, NBF Ballast	2	32	58			LB228L	3	Lamp & Ballast Retrofit 2L F32 T8 28 watt Lamp(s), Low Ballast Factor	2	28	42	angle mount	4100	11.1	2,086	0.17	0.13	363	263	100	$4	$11	$15	$3	$2	$1	1.2%
46	Restroom Upstairs	2,086	ECFLS15	1	Existing CFL Screw-in 15 watt Lamp(s)	1	15	15			LAI	1	Leave existing fixture as is	1	15	15	recessed square	4100	0.0	2,086	0.02	0.02	31	31	0	$0	$0	$0	$1	$0	$1	0.0%
47	Other Bunk Room	520	ECFLS15	6	Existing CFL Screw-in 15 watt Lamp(s)	1	15	15			6WLEDA19	6	6.5 watt A-19 Style LED Lamp	1	6.5	6.5	wall mount. maybe use 8w	4100	9.1	520	0.09	0.04	47	20	27	$1	$12	$13	$2	$0	$2	0.9%
48	Exterior	4,380	ECFLS15	1	Existing CFL Screw-in 15 watt Lamp(s)	1	15	15			6WLEDA19	1	6.5 watt A-19 Style LED Lamp	1	6.5	6.5	recessed square	4100	5.9	4,380	0.02	0.01	66	28	37	$2		$2	$2	$0	$2	0.1%
49	Exterior	4,380	ECFLS16	24	Existing 16 watt Screw-in CFL Lamp	1	16	16	20		LAI	24	Leave existing fixture as is	1	16	16	par 30 can	4100	0.0	4,380	0.38	0.38	1,682	1,682	0	$0		$0	$74	$0	$74	0.0%
50	Exterior	4,380	ECFLS16	1	Existing 16 watt Screw-in CFL Lamp	1	16	16			LAI	1	Leave existing fixture as is	1	16	16	par 30 directional flood	4100	0.0	4,380	0.02	0.02	70	70	0	$0		$0	$3	$0	$3	0.0%
51	Exterior	4,380	ECFLS16	18	Existing 16 watt Screw-in CFL Lamp	1	16	16			LAI	18	Leave existing fixture as is	1	16	16	2L par 30 directional flood	4100	0.0	4,380	0.29	0.29	1,261	1,261	0	$0		$0	$55	$0	$55	0.0%
52	Exterior	4,380	ECFLS13	1	Existing CFL Screw-in 13 watt Lamp(s)	1	13	13			6WLEDA19	1	6.5 watt A-19 Style LED Lamp	1	6.5	6.5	over door	4100	6.6	4,380	0.01	0.01	57	28	28	$1		$1	$2	$0	$2	0.1%
Total		2,956		228					20			228							**12.6**	2955.6	9.5	6.1	30453	20862	9591	$393	$781	$1,174	$424	$20	$405	1.0

City and County of Denver, CO - Fire Station 9 ~ OPTIMIZED OPTION: HYBRID

Line	Location	EX Hours	EX Code	EX Qty	EX Desc	Lamps	EX Watts/ Lamp	EX Input Watts	Mounting Height	EX FC	PR Code	PR Qty	PR Desc	PR Lamp Qty	PR Watts/ Lamp	PR Input Watts	Audit Notes	Lamp Color	ECM SPB	PR Hours	Existing kw	Proposed kw	Existing kWh / Year	Proposed kwH / Year	Annual Energy Saved	kWh $ Savings	kW $ Savings	Total Energy $ Savings	EX MX Cost	PR MX Cost	MX Savings	%age of job
1	Vehicle Garage	4,380	EV4232N	28	Existing Vapor Tight 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast	2	32	58	35	5-10	LED19T84-2	28	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38	mounted to strut	4100	11.0	4,380	1.62	1.06	7,113	4,660	2,453	$101	$130	$230	$61	$0	$61	16.0%
2	Tool Room in Garage	1,898	EV4232N	4	Existing Vapor Tight 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast	2	32	58	10	40	LED19T84-2	4	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38	already sensored	4100	16.0	1,898	0.23	0.15	440	288	152	$6	$19	$25	$4	$0	$4	2.3%
3	Compressor Room	250	EW4232N	2	Existing Wrap 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61		15	LAI	2	Leave existing fixture as is	2	32	61	already sensored	4100	0.0	250	0.12	0.12	31	31	0	$0	$0	$0	$0	$0	$0	0.0%
4	Hose Room	4,380	ES4232N	5	Existing Strip 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61		15	LED19T84-2	5	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38		4100	9.8	4,380	0.31	0.19	1,336	832	504	$21	$27	$47	$11	$0	$11	2.9%
5	Sink Room	4,380	EW4232N	2	Existing Wrap 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61		30	LED19T84-2	2	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38		4100	9.8	4,380	0.12	0.08	534	333	201	$8	$11	$19	$4	$0	$4	1.1%
6	Main Door on Left through Garage - Hall	6,570	ET4332N	14	Existing Prismatic Troffer 2x4 3L F32 T8 32 watt Lamp(s), Normal Ballast Factor	3	32	92		25-30	RTK40-24T	14	Retrofit Kit, LED, 2x4 Troffer, 40 watts, 4000 lm, Lithonia 2VTLT Prism.	1	40	40		4100	8.1	6,570	1.29	0.56	8,462	3,679	4,783	$196	$169	$365	$57	$0	$57	17.1%
7	Main Door on Left through Garage - Hall	6,570	ECFLP32	6	Existing CFL Pin Based 32 watt Lamp(s)	1	32	36	8		LAI	6	Leave existing fixture as is	1	32	36	can, 6", drop ceiling, vertical	4100	0.0	6,570	0.22	0.22	1,419	1,419	0	$0	$0	$0	$21	$0	$21	0.0%
8	Gym Equipment Storage	250	ET4332N	2	Existing Prismatic Troffer 2x4 3L F32 T8 32 watt Lamp(s), Normal Ballast Factor	3	32	92		30	LAI	2	Leave existing fixture as is	3	32	92	already sensored	4100	0.0	250	0.18	0.18	46	46	0	$0	$0	$0	$0	$0	$0	0.0%
9	Electrical	520	EW4232N	3	Existing Wrap 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LAI	3	Leave existing fixture as is	2	32	61		4100	0.0	520	0.18	0.18	95	95	0	$0	$0	$0	$1	$0	$1	0.0%
10	Lockers	2,847	ECFLP32	12	Existing CFL Pin Based 32 watt Lamp(s)	1	32	36			LAI	12	Leave existing fixture as is	1	32	36	can, recessed, hard lid, 8". already sensored	4100	0.0	2,847	0.43	0.43	1,230	1,230	0	$0	$0	$0	$18	$0	$18	0.0%
11	Lockers	2,847	ES4232N	3	Existing Strip 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LB228LP	3	Lamp & Ballast Retrofit 2L F32 T8 28 watt Lamp(s), PRS Low Ballast Factor	2	28	42	in cove. already sensored	4100	10.6	2,847	0.18	0.13	521	359	162	$7	$13	$20	$4	$3	$1	1.1%
12	Janitor Closet	250	EV4232N	1	Existing Vapor Tight 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast	2	32	58			LAI	1	Leave existing fixture as is	2	32	58	already sensored	4100	0.0	250	0.06	0.06	15	15	0	$0	$0	$0	$0	$0	$0	0.0%
13	Supply Storage	250	EW4232N	1	Existing Wrap 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LAI	1	Leave existing fixture as is	2	32	61	already sensored	4100	0.0	250	0.06	0.06	15	15	0	$0	$0	$0	$0	$0	$0	0.0%
14	Laundry	520	EW4232N	1	Existing Wrap 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LAI	1	Leave existing fixture as is	2	32	61		4100	0.0	520	0.06	0.06	32	32	0	$0	$0	$0	$0	$0	$0	0.0%
15	Female Lockers	4,380	ECFLP32	6	Existing CFL Pin Based 32 watt Lamp(s)	1	32	36		20	LAI	6	Leave existing fixture as is	1	32	36	can, 8", hard lid	4100	0.0	4,380	0.22	0.22	946	946	0	$0	$0	$0	$14	$0	$14	0.0%
16	Female Lockers	4,380	ES4232N	1	Existing Strip 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LED19T84-2	1	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38	in cove	4100	9.8	4,380	0.06	0.04	267	166	101	$4	$5	$9	$2	$0	$2	0.6%
17	Female Lockers	4,380	ES3225NNL	1	Existing Strip 3' 2L F25 T8 Lamps, NBF Ballast (No Lamps)	0	25	15			LAI	1	Leave existing fixture as is	0	25	15	in cove	4100	0.0	4,380	0.02	0.02	66	66	0	$0	$0	$0	$1	$0	$1	0.0%
18	Bunk Room 121	520	ECFLP32	2	Existing CFL Pin Based 32 watt Lamp(s)	1	32	36			LAI	2	Leave existing fixture as is	1	32	36	4", hard lid	4100	0.0	520	0.07	0.07	37	37	0	$0	$0	$0	$1	$0	$1	0.0%
19	Bunk Room 121	520	EWM4232N	3	Existing Wall Mount Fixture 4' 2L F32 T8 Lamps, NBF Ballast	2	32	58			LAI	3	Leave existing fixture as is	2	32	58		4100	0.0	520	0.17	0.17	90	90	0	$0	$0	$0	$1	$0	$1	0.0%
20	Bunk Room 120	520	ECFLP32	2	Existing CFL Pin Based 32 watt Lamp(s)	1	32	36			LAI	2	Leave existing fixture as is	1	32	36	4", hard lid	4100	0.0	520	0.07	0.07	37	37	0	$0	$0	$0	$1	$0	$1	0.0%
21	Bunk Room 120	520	EWM4232N	3	Existing Wall Mount Fixture 4' 2L F32 T8 Lamps, NBF Ballast	2	32	58			LAI	3	Leave existing fixture as is	2	32	58		4100	0.0	520	0.17	0.17	90	90	0	$0	$0	$0	$1	$0	$1	0.0%
22	Bunk Room 119	520	ECFLP32	2	Existing CFL Pin Based 32 watt Lamp(s)	1	32	36			LAI	2	Leave existing fixture as is	1	32	36	4", hard lid	4100	0.0	520	0.07	0.07	37	37	0	$0	$0	$0	$1	$0	$1	0.0%
23	Bunk Room 119	520	EWM4232N	3	Existing Wall Mount Fixture 4' 2L F32 T8 Lamps, NBF Ballast	2	32	58			LAI	3	Leave existing fixture as is	2	32	58		4100	0.0	520	0.17	0.17	90	90	0	$0	$0	$0	$1	$0	$1	0.0%
24	Bunk Room 118	520	ECFLP32	2	Existing CFL Pin Based 32 watt Lamp(s)	1	32	36			LAI	2	Leave existing fixture as is	1	32	36	4", hard lid	4100	0.0	520	0.07	0.07	37	37	0	$0	$0	$0	$1	$0	$1	0.0%

City and County of Denver, CO - Fire Station 9 ~ OPTIMIZED OPTION: HYBRID

Line	Location	EX Hours	EX Code	EX Qty	EX Desc	Lamps	EX Watts/ Lamp	EX Input Watts	Mounting Height	EX FC	PR Code	PR Qty	PR Desc	PR Lamp Qty	PR Watts/ Lamp	PR Input Watts	Audit Notes	Lamp Color	ECM SPB	PR Hours	Existing kw	Proposed kw	Existing kWh / Year	Proposed kwH / Year	Annual Energy Saved	kWh $ Savings	kW $ Savings	Total Energy $ Savings	EX MX Cost	PR MX Cost	MX Savings	%age of job
25	Bunk Room 118	520	EWM4232N	3	Existing Wall Mount Fixture 4' 2L F32 T8 Lamps, NBF Ballast	2	32	58			LAI	3	Leave existing fixture as is	2	32	58		4100	0.0	520	0.17	0.17	90	90	0	$0	$0	$0	$1	$0	$1	0.0%
26	Bunk Room 117	520	ECFLP32	2	Existing CFL Pin Based 32 watt Lamp(s)	1	32	36			LAI	2	Leave existing fixture as is	1	32	36	4", hard lid	4100	0.0	520	0.07	0.07	37	37	0	$0	$0	$0	$1	$0	$1	0.0%
27	Bunk Room 117	520	EWM4232N	3	Existing Wall Mount Fixture 4' 2L F32 T8 Lamps, NBF Ballast	2	32	58			LAI	3	Leave existing fixture as is	2	32	58		4100	0.0	520	0.17	0.17	90	90	0	$0	$0	$0	$1	$0	$1	0.0%
28	Bunk Room 116	520	ECFLP32	2	Existing CFL Pin Based 32 watt Lamp(s)	1	32	36			LAI	2	Leave existing fixture as is	1	32	36	4", hard lid	4100	0.0	520	0.07	0.07	37	37	0	$0	$0	$0	$1	$0	$1	0.0%
29	Bunk Room 116	520	EWM4232N	3	Existing Wall Mount Fixture 4' 2L F32 T8 Lamps, NBF Ballast	2	32	58			LAI	3	Leave existing fixture as is	2	32	58		4100	0.0	520	0.17	0.17	90	90	0	$0	$0	$0	$1	$0	$1	0.0%
30	Bunk Room 115	520	ECFLP32	2	Existing CFL Pin Based 32 watt Lamp(s)	1	32	36			LAI	2	Leave existing fixture as is	1	32	36	4", hard lid	4100	0.0	520	0.07	0.07	37	37	0	$0	$0	$0	$1	$0	$1	0.0%
31	Bunk Room 115	520	EWM4232N	3	Existing Wall Mount Fixture 4' 2L F32 T8 Lamps, NBF Ballast	2	32	58			LAI	3	Leave existing fixture as is	2	32	58		4100	0.0	520	0.17	0.17	90	90	0	$0	$0	$0	$1	$0	$1	0.0%
32	Bunk Room 114	520	ECFLP32	2	Existing CFL Pin Based 32 watt Lamp(s)	1	32	36			LAI	2	Leave existing fixture as is	1	32	36	4", hard lid	4100	0.0	520	0.07	0.07	37	37	0	$0	$0	$0	$1	$0	$1	0.0%
33	Bunk Room 114	520	EWM4232N	3	Existing Wall Mount Fixture 4' 2L F32 T8 Lamps, NBF Ballast	2	32	58			LAI	3	Leave existing fixture as is	2	32	58		4100	0.0	520	0.17	0.17	90	90	0	$0	$0	$0	$1	$0	$1	0.0%
34	Pumper Officers	520	ECFLP32	4	Existing CFL Pin Based 32 watt Lamp(s)	1	32	36			LAI	4	Leave existing fixture as is	1	32	36	4" can	4100	0.0	520	0.14	0.14	75	75	0	$0	$0	$0	$1	$0	$1	0.0%
35	Pumper Officers	520	ET4332N	4	Existing Prismatic Troffer 2x4 3L F32 T8 32 watt Lamp(s), Normal Ballast Factor	3	32	92			LAI	4	Leave existing fixture as is	3	32	92		4100	0.0	520	0.37	0.37	191	191	0	$0	$0	$0	$1	$0	$1	0.0%
36	Restroom	520	EVAN4232N	1	Existing Vanity Fixture 4' 2L F32 T8 Lamp, NBF Ballast	2	32	58			LAI	1	Leave existing fixture as is	2	32	58	wall mount	4100	0.0	520	0.06	0.06	30	30	0	$0	$0	$0	$0	$0	$0	0.0%
37	Restroom	520	ECFLP32	1	Existing CFL Pin Based 32 watt Lamp(s)	1	32	36			LAI	1	Leave existing fixture as is	1	32	36	7" can, hard lid	4100	0.0	520	0.04	0.04	19	19	0	$0	$0	$0	$0	$0	$0	0.0%
38	Truck Officers	520	ECFLP32	4	Existing CFL Pin Based 32 watt Lamp(s)	1	32	36			LAI	4	Leave existing fixture as is	1	32	36	4" can	4100	0.0	520	0.14	0.14	75	75	0	$0	$0	$0	$1	$0	$1	0.0%
39	Truck Officers	520	ET4332N	4	Existing Prismatic Troffer 2x4 3L F32 T8 32 watt Lamp(s), Normal Ballast Factor	3	32	92			LAI	4	Leave existing fixture as is	3	32	92		4100	0.0	520	0.37	0.37	191	191	0	$0	$0	$0	$1	$0	$1	0.0%
40	Restroom	520	EVAN4232N	1	Existing Vanity Fixture 4' 2L F32 T8 Lamp, NBF Ballast	2	32	58			LAI	1	Leave existing fixture as is	2	32	58	wall mount	4100	0.0	520	0.06	0.06	30	30	0	$0	$0	$0	$0	$0	$0	0.0%
41	Restroom	520	ECFLP32	1	Existing CFL Pin Based 32 watt Lamp(s)	1	32	36			LAI	1	Leave existing fixture as is	1	32	36	7" can, hard lid	4100	0.0	520	0.04	0.04	19	19	0	$0	$0	$0	$0	$0	$0	0.0%
42	Phone Room	520	ECFLP32	1	Existing CFL Pin Based 32 watt Lamp(s)	1	32	36			LAI	1	Leave existing fixture as is	1	32	36	can 8", hard lid, vertical	4100	0.0	520	0.04	0.04	19	19	0	$0	$0	$0	$0	$0	$0	0.0%
43	Closet	520	EW4232N	1	Existing Wrap 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LAI	1	Leave existing fixture as is	2	32	61	on wall	4100	0.0	520	0.06	0.06	32	32	0	$0	$0	$0	$0	$0	$0	0.0%
44	Day Room	6,570	ECFLP32	14	Existing CFL Pin Based 32 watt Lamp(s)	1	32	36			LAI	14	Leave existing fixture as is	1	32	36	7" can, hard lid, vertical	4100	0.0	6,570	0.50	0.50	3,311	3,311	0	$0	$0	$0	$49	$0	$49	0.0%
45	Day Room	6,570	ECFLP32	3	Existing CFL Pin Based 32 watt Lamp(s)	1	32	36			LAI	3	Leave existing fixture as is	1	32	36	6" can, hard lid	4100	0.0	6,570	0.11	0.11	710	710	0	$0	$0	$0	$11	$0	$11	0.0%
46	Day Room	6,570	ECFLP26	13	Existing CFL Pin Based 26 watt Lamp(s)	1	26	30			LAI	13	Leave existing fixture as is	1	26	30	4" can, hard lid	4100	0.0	6,570	0.39	0.39	2,562	2,562	0	$0	$0	$0	$46	$0	$46	0.0%
47	Day Room	6,570	EHAL50T4	5	Existing T4 Halogen, Bi-Pin, 50 watts	1	50	50			LAI	5	Leave existing fixture as is	1	50	50	bi-pin chandelier	4100	0.0	6,570	0.25	0.25	1,643	1,643	0	$0	$0	$0	$82	$0	$82	0.0%
48	Day Room	6,570	ES4232N	6	Existing Strip 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LED19T84-2	6	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38	in cove	4100	7.7	6,570	0.37	0.23	2,405	1,498	907	$37	$32	$69	$20	$0	$20	3.4%
49	Tele / Data in Day Room	520	EW4232N	1	Existing Wrap 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LAI	1	Leave existing fixture as is	2	32	61		4100	0.0	520	0.06	0.06	32	32	0	$0	$0	$0	$0	$0	$0	0.0%
50	Storage Recycle Room	250	EW4232N	1	Existing Wrap 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LAI	1	Leave existing fixture as is	2	32	61	already sensored	4100	0.0	250	0.06	0.06	15	15	0	$0	$0	$0	$0	$0	$0	0.0%
51	Community Room	2,086	ET4332N	8	Existing Prismatic Troffer 2x4 3L F32 T8 32 watt Lamp(s), Normal Ballast Factor	3	32	92			TK4228L	8	Troffer Kit with Reflector 4' 2L F32 T8 28 watt Lamp(s), Low Ballast Factor	2	28	42		4100	6.2	2,086	0.74	0.34	1,535	701	834	$34	$93	$127	$10	$5	$5	4.1%

City and County of Denver, CO - Fire Station 9 ~ OPTIMIZED OPTION: HYBRID

Line	Location	EX Hours	EX Code	EX Qty	EX Desc	Lamps	EX Watts/ Lamp	EX Input Watts	Mounting Height	EX FC	PR Code	PR Qty	PR Desc	PR Lamp Qty	PR Watts/ Lamp	PR Input Watts	Audit Notes	Lamp Color	ECM SPB	PR Hours	Existing kw	Proposed kw	Existing kWh / Year	Proposed kwH / Year	Annual Energy Saved	kWh $ Savings	kW $ Savings	Total Energy $ Savings	EX MX Cost	PR MX Cost	MX Savings	%age of job
52	Community Room	2,086	ECFLP26	3	Existing CFL Pin Based 26 watt Lamp(s)	1	26	30			LAI	3	Leave existing fixture as is	1	26	30	6" can	4100	**0.0**	2,086	0.09	0.09	188	188	0	$0	$0	$0	$3	$0	$3	0.0%
53	Storage Room	250	EW4232N	1	Existing Wrap 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LAI	1	Leave existing fixture as is	2	32	61	already sensored	4100	**0.0**	250	0.06	0.06	15	15	0	$0	$0	$0	$0	$0	$0	0.0%
54	Front Entry / Lobby	2,920	ECFLP32	6	Existing CFL Pin Based 32 watt Lamp(s)	1	32	36			LAI	6	Leave existing fixture as is	1	32	36	7" can	4100	**0.0**	2,920	0.22	0.22	631	631	0	$0	$0	$0	$9	$0	$9	0.0%
55	Front Entry / Lobby	2,920	E50MR16	2	Existing Halogen 50 watt MR16 Style Lamp	1	50	50			6WLEDMR16	2	6 watt MR16 Style LED Lamp	1	6.5	6.5	MR16 can, 4", bi-pin	4100	2.4	2,920	0.10	0.01	292	38	254	$10	$20	$31	$15	$5	$9	0.5%
56	Restroom	250	EVAN4232N	1	Existing Vanity Fixture 4' 2L F32 T8 Lamp, NBF Ballast	2	32	58			LAI	1	Leave existing fixture as is	2	32	58	wall mount. already sensored	4100	**0.0**	250	0.06	0.06	15	15	0	$0	$0	$0	$0	$0	$0	0.0%
57	Communication Room	520	EW4232N	1	Existing Wrap 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61		30	LAI	1	Leave existing fixture as is	2	32	61		4100	**0.0**	520	0.06	0.06	32	32	0	$0	$0	$0	$0	$0	$0	0.0%
58	Exterior	4,380	EFHPS70	12	Existing Fixture High Pressure Sodium 70 watt Lamp	1	70	91			LEDR24	12	24 watt HID Replacement Lamp-Light Efficient Design - bypass ballast	1	24	24	wall mount teardrop	4100	10.5	4,380	1.09	0.29	4,783	1,261	3,522	$144		$144	$153	$0	$153	15.6%
59	Exterior	4,380	EFHPS50	7	Existing Fixture High Pressure Sodium 50 watt Lamp	1	50	66			LEDR24	7	24 watt HID Replacement Lamp-Light Efficient Design - bypass ballast	1	24	24	recessed circular wall mount	4100	12.8	4,380	0.46	0.17	2,024	736	1,288	$53		$53	$89	$0	$89	9.1%
60	Exterior	4,380	EWCFL32	2	Existing Wallpack with 32 watt CFL Lamp	1	32	32			LAI	2	Leave existing fixture as is	1	32	32	round bulkhead look. red	4100	**0.0**	4,380	0.06	0.06	280	280	0	$0		$0	$7	$0	$7	0.0%
61	Exterior	4,380	ECLHPS70	2	Existing Can Light High Pressure Sodium 70 watt Lamp	1	70	91			LEDR24	2	24 watt HID Replacement Lamp-Light Efficient Design - bypass ballast	1	24	24	7" recessed can, vertical	4100	10.5	4,380	0.18	0.05	797	210	587	$24		$24	$26	$0	$26	2.6%
62	Exterior	4,380	EWMH70	2	Existing Wall Pack Metal Halide 70 watt Lamp	1	70	90			LEDR24	2	24 watt HID Replacement Lamp-Light Efficient Design - bypass ballast	1	24	24	wall mount. downlight. red. trunnion mount	4100	10.1	4,380	0.18	0.05	788	210	578	$24		$24	$28	$0	$28	2.6%
63	Exterior	4,380	ECFLS16	4	Existing 16 watt Screw-in CFL Lamp	1	16	16			LAI	4	Leave existing fixture as is	1	16	16	2L par 30 directional flood	4100	**0.0**	4,380	0.06	0.06	280	280	0	$0		$0	$12	$0	$12	0.0%
64	Exterior	4,380	EPLHPS250	4	Existing Pole Light Fixture High Pressure Sodium 250 watt Lamp	1	250	295	30.00		NCHLED101HE	4	New LED Cobrahead Cree XSP1C 101 watts, 8,224 Lm	1	101	101	shoebox. 2 bolt, bronze, type 3	4100	17.2	4,380	1.18	0.40	5,168	1,770	3,399	$139		$139	$51	$0	$51	16.4%
65	Exterior	4,380	EFLMH250	1	Existing Flood Fixture Metal Halide 250 watt Lamp	1	250	295			NFLED78	1	New LED Flood Rab FXLED78S, 89 watts	1	78	89	flood on flag. medium beam. slipfit with adj knuckle	4100	17.7	4,380	0.30	0.09	1,292	390	902	$37		$37	$14	$0	$14	4.5%
66	Exterior	4,380	ECFLP32	6	Existing CFL Pin Based 32 watt Lamp(s)	1	32	36	3.00		LAI	6	Leave existing fixture as is	1	32	36	wall mount fixture	4100	**0.0**	4,380	0.22	0.22	946	946	0	$0		$0	$14	$0	$14	0.0%
Total		2,222		259					35			259							**14.6**	2221.9	15.4	10.9	54016	33389	20626	$846	$518	$1,364	$857	$13	$844	1.0

City and County of Denver, CO - Police Station ~ OPTIMIZED OPTION: HYBRID

Line	Location	EX Hours	EX Code	EX Qty	EX Desc	Lamps	EX Watts/ Lamp	EX Input Watts	Mounting Height	EX FC	PR Code	PR Qty	PR Desc	PR Lamp Qty	PR Watts/ Lamp	PR Input Watts	Audit Notes	Lamp Color	ECM SPB	PR Hours	Existing kw	Proposed kw	Existing kWh / Year	Proposed kwH / Year	Annual Energy Saved	kWh $ Savings	kW $ Savings	Total Energy $ Savings	EX MX Cost	PR MX Cost	MX Savings	%age of job
1	Entry	8,760	ECFLP13	2	Existing CFL Pin Based 13 watt Lamp(s)	1	13	17			LAI	2	Leave existing fixture as is	1	13	17	twin tube wall sconce	4100	**0.0**	8,760	0.03	0.03	298	298	0	$0	$0	$0	$9	$0	$9	0.0%
2	Lobby	8,760	ECFLS65	5	Existing 65 watt Screw-in CFL Lamp	1	65	65			LRD10M	5	Retro RC - LED Module - 10" 28watts - LumenOptix	1	28	28	10-12" cans in tile ceiling	4100	5.3	8,760	0.33	0.14	2,847	1,226	1,621	$66	$43	$109	$329	$0	$329	3.9%
3	Lobby	8,760	ES2117N	1	Existing Strip 2' 1L F17 T8 Lamp, NBF Ballast	1	17	17			LED10T82-2	1	Sylvania UltraLED 2' External Driver T8 LED - 2 lamp - 10w/ea	2	10	20	cove light	4100	49.3	8,760	0.02	0.02	149	175	-26	-$1	-$1	-$2	$4	$0	$4	0.2%
4	Lobby	8,760	ES4132N	15	Existing Strip 4' 1L F32 T8 32 watt Lamp(s), Normal Ballast Factor	1	32	34			LED19T84-1	15	Sylvania UltraLED External Driver T8 LED - 1 lamp - 19w/ea	1	19	19	cove light	4100	6.6	8,760	0.51	0.29	4,468	2,497	1,971	$81	$52	$133	$49	$0	$49	2.0%
5	Lobby	8,760	ECFLP26	3	Existing CFL Pin Based 26 watt Lamp(s)	1	26	30			LAI	3	Leave existing fixture as is	1	26	30	6" recessed can, hard lid	4100	**0.0**	8,760	0.09	0.09	788	788	0	$0	$0	$0	$14	$0	$14	0.0%
6	Armory	2,086	EW4232N	7	Existing Wrap 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61		45	LED19T84-2	7	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38		4100	12.8	2,086	0.43	0.27	891	555	336	$14	$37	$51	$7	$0	$7	1.3%
7	Vehicle Processing	**4,818**	EW4232N	11	Existing Wrap 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61		40	LED19T84-2	11	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38	already sensored	4100	8.7	4,818	0.67	0.42	3,233	2,014	1,219	$50	$59	$109	$26	$0	$26	2.0%
8	Garage	8,760	ELB4632N	5	Existing Low Bay 4' 6L F32 T8 Lamps, NBF Ballast	6	32	170		60	LAI	5	Leave existing fixture as is	6	32	170	chain hung	4100	**0.0**	8,760	0.85	0.85	7,446	7,446	0	$0	$0	$0	$55	$0	$55	0.0%
9	Decon Room	8,760	ET14332N	1	Existing Prismatic Troffer 1x4 3L F32 T8 Lamps, NBF Ballast	3	32	85		60	LED19T84-3	1	Sylvania UltraLED External Driver T8 LED - 3 lamp - 19w/ea	3	19	57	gasketed fixture, tamp screws	4100	6.6	8,760	0.09	0.06	745	499	245	$10	$6	$17	$5	$0	$5	0.2%
10	Vestibule	8,760	EDI4232N	2	Existing Direct/Indirect Fixture 4' 2L F32 T8 Lamps, NBF Ballast	2	32	58		40	LED19T84-2	2	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38	wall mount	4100	6.6	8,760	0.12	0.08	1,016	666	350	$14	$9	$24	$9	$0	$9	0.4%
11	Vestibule	8,760	EDI2217N	1	Existing Direct/Indirect Fixture 2' 2L F17 T8 Lamps, NBF Ballast	2	17	33			LED10T82-2	1	Sylvania UltraLED 2' External Driver T8 LED - 2 lamp - 10w/ea	2	10	20	wall mount	4100	8.0	8,760	0.03	0.02	289	175	114	$5	$3	$8	$6	$0	$6	0.2%
12	Hall	8,760	EDI4232N	4	Existing Direct/Indirect Fixture 4' 2L F32 T8 Lamps, NBF Ballast	2	32	58			LED19T84-2	4	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38	wall mount	4100	6.6	8,760	0.23	0.15	2,032	1,332	701	$29	$19	$47	$18	$0	$18	0.7%
13	Hall	8,760	ECFLP213	2	Existing CFL Pin Based with 2 - 13 watt Lamp(s)	2	13	30			LAI	2	Leave existing fixture as is	2	13	30	wall mount	4100	**0.0**	8,760	0.06	0.06	526	526	0	$0	$0	$0	$15	$0	$15	0.0%
14	Hall	8,760	ECFLP26	1	Existing CFL Pin Based 26 watt Lamp(s)	1	26	30			LAI	1	Leave existing fixture as is	1	26	30	can 6", vertical, hard lid	4100	**0.0**	8,760	0.03	0.03	263	263	0	$0	$0	$0	$5	$0	$5	0.0%
15	Holding Cell Hall	8,760	ET14232N	10	Existing Prismatic Troffer 1x4 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LED19T84-2	10	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38	gasketed fixture	4100	6.0	8,760	0.61	0.38	5,344	3,329	2,015	$83	$53	$136	$44	$0	$44	1.8%
16	Holding Cells (8)	8,760	ET14232N	16	Existing Prismatic Troffer 1x4 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LED19T84-2	16	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38		4100	6.0	8,760	0.98	0.61	8,550	5,326	3,224	$132	$85	$217	$70	$0	$70	2.9%
17	2nd Door Left in Holding Cell Hall	8,760	ET14232N	3	Existing Prismatic Troffer 1x4 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LED19T84-2	3	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38		4100	6.0	8,760	0.18	0.11	1,603	999	604	$25	$16	$41	$13	$0	$13	0.5%
18	181 Custodian Closet	520	ES4154H	3	Existing Strip 4' 1L F54 T5 Lamp, HBF Ballast	1	54	60			LAI	3	Leave existing fixture as is	1	54	60	existing has cage	4100	**0.0**	390	0.18	0.18	94	70	23	$1	$0	$1	$1	$0	$1	0.0%
19	Juvenile Holding (2)	8,760	ET14332N	4	Existing Prismatic Troffer 1x4 3L F32 T8 Lamps, NBF Ballast	3	32	85			LED19T84-3	4	Sylvania UltraLED External Driver T8 LED - 3 lamp - 19w/ea	3	19	57	gasketed	4100	6.6	8,760	0.34	0.23	2,978	1,997	981	$40	$26	$66	$22	$0	$22	1.0%
20	180 Storage	520	ET4232N	1	Existing Prismatic Troffer 2x4 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LAI	1	Leave existing fixture as is	2	32	61		4100	**0.0**	520	0.06	0.06	32	32	0	$0	$0	$0	$0	$0	$0	0.0%
21	Main Hall on 1st	8,760	EDI4232N	42	Existing Direct/Indirect Fixture 4' 2L F32 T8 Lamps, NBF Ballast	2	32	58			LED19T84-2	42	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38	wall mount	4100	6.6	8,760	2.44	1.60	21,339	13,981	7,358	$302	$195	$496	$184	$0	$184	7.5%
22	Main Hall on 1st	8,760	ECFLP213	4	Existing CFL Pin Based with 2 - 13 watt Lamp(s)	2	13	30			LAI	4	Leave existing fixture as is	2	13	30	wall mount	4100	**0.0**	8,760	0.12	0.12	1,051	1,051	0	$0	$0	$0	$30	$0	$30	0.0%
23	Main Hall on 1st	8,760	EDI2217N	1	Existing Direct/Indirect Fixture 2' 2L F17 T8 Lamps, NBF Ballast	2	17	33			LED10T82-2	1	Sylvania UltraLED 2' External Driver T8 LED - 2 lamp - 10w/ea	2	10	20	wall mount	4100	8.0	8,760	0.03	0.02	289	175	114	$5	$3	$8	$6	$0	$6	0.2%
24	Main Hall on 1st	8,760	ECFLP26	25	Existing CFL Pin Based 26 watt Lamp(s)	1	26	30			LAI	25	Leave existing fixture as is	1	26	30	can 6", vertical, hard lid	4100	**0.0**	8,760	0.75	0.75	6,570	6,570	0	$0	$0	$0	$117	$0	$117	0.0%

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Line	Location	EX Hours	EX Code	EX Qty	EX Desc	Lamps	EX Watts/ Lamp	EX Input Watts	Mounting Height	EX FC	PR Code	PR Qty	PR Desc	PR Lamp Qty	PR Watts/ Lamp	PR Input Watts	Audit Notes	Lamp Color	ECM SPB	PR Hours	Existing kw	Proposed kw	Existing kWh / Year	Proposed kwH / Year	Annual Energy Saved	kWh $ Savings	kW $ Savings	Total Energy $ Savings	EX MX Cost	PR MX Cost	MX Savings	%age of job
25	Main Hall on 1st	8,760	ES4132N	21	Existing Strip 4' 1L F32 T8 32 watt Lamp(s), Normal Ballast Factor	1	32	34			LED19T84-1	21	Sylvania UltraLED External Driver T8 LED - 1 lamp - 19w/ea	1	19	19	in cove	4100	6.6	8,760	0.71	0.40	6,255	3,495	2,759	$113	$73	$186	$69	$0	$69	2.8%
26	Main Hall on 1st	8,760	ECFLS65	4	Existing 65 watt Screw-in CFL Lamp	1	65	65	28		LRD10M	4	Retro RC - LED Module - 10" 28watts - LumenOptix	1	28	28	can 10-12", tile ceiling	4100	5.3	8,760	0.26	0.11	2,278	981	1,296	$53	$34	$87	$263	$0	$263	3.1%
27	176 Patrol Sargeant	2,086	EDI8428N	13	Existing Direct/Indirect Fixture 8' 4L F32 T8 28 watt Lamps, NBF Ballast	4	28	96		45	LAI	13	Leave existing fixture as is	4	28	96		4100	0.0	2,086	1.25	1.25	2,603	2,603	0	$0	$0	$0	$20	$0	$20	0.0%
28	176 Patrol Sargeant	2,086	EDI4232N	1	Existing Direct/Indirect Fixture 4' 2L F32 T8 Lamps, NBF Ballast	2	32	58			LB228N	1	Lamp & Ballast Retrofit 2L F32 T8 28 watt Lamp(s), Normal Ballast Factor	2	28	48		4100	16.1	2,086	0.06	0.05	121	100	21	$1	$2	$3	$1	$1	$0	0.1%
29	177	2,086	ECFLP32	3	Existing CFL Pin Based 32 watt Lamp(s)	1	32	36			LAI	3	Leave existing fixture as is	1	32	36	6" can, vertical, drop ceiling	4100	0.0	2,086	0.11	0.11	225	225	0	$0	$0	$0	$3	$0	$3	0.0%
30	177	2,086	ECFLCHAN	3	Existing Pendant Mount CFL Chandelier	1	15	15			LAI	3	Leave existing fixture as is	1	15	15		4100	0.0	2,086	0.05	0.05	94	94	0	$0	$0	$0	$3	$0	$3	0.0%
31	Mens RR	**1,356**	EDI4128N	3	Existing Direct/Indirect 4' 1L F32 T8 28 watt Lamp, NBF Ballast	1	28	26		15	LAI	3	Leave existing fixture as is	1	28	26	wall mount. already sensored	4100	0.0	1,356	0.08	0.08	106	106	0	$0	$0	$0	$2	$0	$2	0.0%
32	Mens RR	**1,356**	ECFLP26	2	Existing CFL Pin Based 26 watt Lamp(s)	1	26	30			LAI	2	Leave existing fixture as is	1	26	30	6" can, vertical, hard lid. sensored	4100	0.0	1,356	0.06	0.06	81	81	0	$0	$0	$0	$1	$0	$1	0.0%
33	Mens RR	**1,356**	EDI3125N	1	Existing Direct/Indirect 3' 1L F25 T8 Lamp, NBF Ballast	1	25	25			LAI	1	Leave existing fixture as is	1	25	25	wall mount. already sensored	4100	0.0	1,356	0.03	0.03	34	34	0	$0	$0	$0	$1	$0	$1	0.0%
34	Womens RR	**1,356**	EDI4128N	3	Existing Direct/Indirect 4' 1L F32 T8 28 watt Lamp, NBF Ballast	1	28	26			LAI	3	Leave existing fixture as is	1	28	26	wall mount. already sensored	4100	0.0	1,356	0.08	0.08	106	106	0	$0	$0	$0	$2	$0	$2	0.0%
35	Womens RR	**1,356**	ECFLP26	2	Existing CFL Pin Based 26 watt Lamp(s)	1	26	30			LAI	2	Leave existing fixture as is	1	26	30	6" can, vertical, hard lid. sensored	4100	0.0	1,356	0.06	0.06	81	81	0	$0	$0	$0	$1	$0	$1	0.0%
36	Womens RR	**1,356**	EDI3125N	1	Existing Direct/Indirect 3' 1L F25 T8 Lamp, NBF Ballast	1	25	25			LAI	1	Leave existing fixture as is	1	25	25	wall mount. already sensored	4100	0.0	1,356	0.03	0.03	34	34	0	$0	$0	$0	$1	$0	$1	0.0%
37	169 Mech	**250**	ET4228N	2	Existing Prismatic Troffer 4' 2L F32 T8 28 watt Lamps, NBF Ballast	2	28	48			LAI	2	Leave existing fixture as is	2	28	48	already sensored	4100	0.0	250	0.10	0.10	24	24	0	$0	$0	$0	$0	$0	$0	0.0%
38	174 Conference	**1,356**	EDI8428N	1	Existing Direct/Indirect Fixture 8' 4L F32 T8 28 watt Lamps, NBF Ballast	4	28	96			LAI	1	Leave existing fixture as is	4	28	96	pendant mount. already sensored	4100	0.0	1,356	0.10	0.10	130	130	0	$0	$0	$0	$1	$0	$1	0.0%
39	175 Storage	520	EW4332N	1	Existing Wrap 4' 3L F32 T8 32 watt Lamp(s), Normal Ballast Factor	3	32	85			LAI	1	Leave existing fixture as is	3	32	85	wide	4100	0.0	520	0.09	0.09	44	44	0	$0	$0	$0	$0	$0	$0	0.0%
40	170 Conference	2,086	ECFLP32	5	Existing CFL Pin Based 32 watt Lamp(s)	1	32	36			LAI	5	Leave existing fixture as is	1	32	36	can 6", vertical, drop ceiling	4100	0.0	2,086	0.18	0.18	375	375	0	$0	$0	$0	$6	$0	$6	0.0%
41	170 Conference	2,086	ECFLCHAN	6	Existing Pendant Mount CFL Chandelier	1	15	15			LAI	6	Leave existing fixture as is	1	15	15		4100	0.0	2,086	0.09	0.09	188	188	0	$0	$0	$0	$5	$0	$5	0.0%
42	150 Roll Call	8,760	EDI8428N	6	Existing Direct/Indirect Fixture 8' 4L F32 T8 28 watt Lamps, NBF Ballast	4	28	96			LAI	6	Leave existing fixture as is	4	28	96	pendant mount	4100	0.0	8,760	0.58	0.58	5,046	5,046	0	$0	$0	$0	$39	$0	$39	0.0%
43	150 Roll Call	8,760	ECFLP32	3	Existing CFL Pin Based 32 watt Lamp(s)	1	32	36			LAI	3	Leave existing fixture as is	1	32	36	6" can, drop ceiling	4100	0.0	8,760	0.11	0.11	946	946	0	$0	$0	$0	$14	$0	$14	0.0%
44	150 Roll Call	8,760	ECFLP32	4	Existing CFL Pin Based 32 watt Lamp(s)	1	32	36			LAI	4	Leave existing fixture as is	1	32	36	6" can, hard lid	4100	0.0	8,760	0.14	0.14	1,261	1,261	0	$0	$0	$0	$19	$0	$19	0.0%
45	146 Mech	520	ES4232N	8	Existing Strip 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LAI	8	Leave existing fixture as is	2	32	61	existing has cage	4100	0.0	520	0.49	0.49	254	254	0	$0	$0	$0	$2	$0	$2	0.0%
46	145 Electrical	520	ES4232N	4	Existing Strip 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LAI	4	Leave existing fixture as is	2	32	61		4100	0.0	520	0.24	0.24	127	127	0	$0	$0	$0	$1	$0	$1	0.0%
47	144 Electrical	520	ES4232N	2	Existing Strip 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LAI	2	Leave existing fixture as is	2	32	61		4100	0.0	520	0.12	0.12	63	63	0	$0	$0	$0	$1	$0	$1	0.0%
48	142 Tele	520	ES4154H	2	Existing Strip 4' 1L F54 T5 Lamp, HBF Ballast	1	54	60			LAI	2	Leave existing fixture as is	1	54	60		4100	0.0	390	0.12	0.12	62	47	16	$1	$0	$1	$1	$0	$1	0.0%
49	Short Hall Past Vehicle Inspection	8,760	EDI4132N	5	Existing Direct/Indirect Fixture 4' 1L F32 T8 Lamp, NBF Ballast	1	32	32			LED19T84-1	5	Sylvania UltraLED External Driver T8 LED - 1 lamp - 19w/ea	1	19	19	wall mount	4100	7.3	8,760	0.16	0.10	1,402	832	569	$23	$15	$38	$16	$0	$16	0.7%
50	Short Hall Past Vehicle Inspection	8,760	ECFLP26	1	Existing CFL Pin Based 26 watt Lamp(s)	1	26	30			LAI	1	Leave existing fixture as is	1	26	30	6" can, vertical, drop ceiling	4100	0.0	8,760	0.03	0.03	263	263	0	$0	$0	$0	$5	$0	$5	0.0%

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Line	Location	EX Hours	EX Code	EX Qty	EX Desc	Lamps	EX Watts/ Lamp	EX Input Watts	Mounting Height	EX FC	PR Code	PR Qty	PR Desc	PR Lamp Qty	PR Watts/ Lamp	PR Input Watts	Audit Notes	Lamp Color	ECM SPB	PR Hours	Existing kw	Proposed kw	Existing kWh / Year	Proposed kwH / Year	Annual Energy Saved	kWh $ Savings	kW $ Savings	Total Energy $ Savings	EX MX Cost	PR MX Cost	MX Savings	%age of job
51	113 Mech	**250**	EW4228N	2	Existing Wrap 4' 2L F32 T8 28 watt Lamps, NBF Ballast	2	28	48			LAI	2	Leave existing fixture as is	2	28	48	already sensored	4100	**0.0**	250	0.10	0.10	24	24	0	$0	$0	$0	$0	$0	$0	0.0%
52	Gym	2,086	EDI4128N	5	Existing Direct/Indirect 4' 1L F32 T8 28 watt Lamp, NBF Ballast	1	28	26		25	LAI	5	Leave existing fixture as is	1	28	26	wall mount	4100	**0.0**	2,086	0.13	0.13	271	271	0	$0	$0	$0	$4	$0	$4	0.0%
53	Gym	2,086	EPT4228N	21	Existing Parabolic Troffer 4' 2L F32 T8 28 watt Lamps, NBF Ballast	2	28	48			LAI	21	Leave existing fixture as is	2	28	48	surface mount	4100	**0.0**	2,086	1.01	1.01	2,103	2,103	0	$0	$0	$0	$22	$0	$22	0.0%
54	Gym	2,086	ECFLP26	1	Existing CFL Pin Based 26 watt Lamp(s)	1	26	30			LAI	1	Leave existing fixture as is	1	26	30	6" can, vertical, drop ceiling	4100	**0.0**	2,086	0.03	0.03	63	63	0	$0	$0	$0	$1	$0	$1	0.0%
55	Mens Locker Room	**1,356**	EDI8428N	17	Existing Direct/Indirect Fixture 8' 4L F32 T8 28 watt Lamps, NBF Ballast	4	28	96		25-30	LAI	17	Leave existing fixture as is	4	28	96	pendant mount. already sensored	4100	**0.0**	1,356	1.63	1.63	2,213	2,213	0	$0	$0	$0	$17	$0	$17	0.0%
56	Mens Locker Room	**1,356**	EDI4228N	4	Existing Direct/Indirect 4' 2L F32 T8 28 watt Lamps, NBF Ballast	2	28	48			LAI	4	Leave existing fixture as is	2	28	48	already sensored	4100	**0.0**	1,356	0.19	0.19	260	260	0	$0	$0	$0	$3	$0	$3	0.0%
57	Mens Locker Room	**1,356**	EDI3125N	5	Existing Direct/Indirect 3' 1L F25 T8 Lamp, NBF Ballast	1	25	25			LAI	5	Leave existing fixture as is	1	25	25	wall mount. already sensored	4100	**0.0**	1,356	0.13	0.13	169	169	0	$0	$0	$0	$3	$0	$3	0.0%
58	Mens Locker Room	**1,356**	ES2117N	3	Existing Strip 2' 1L F17 T8 Lamp, NBF Ballast	1	17	17			LAI	3	Leave existing fixture as is	1	17	17	wall mount. already sensored	4100	**0.0**	1,356	0.05	0.05	69	69	0	$0	$0	$0	$2	$0	$2	0.0%
59	Mens Locker Room	**1,356**	ECFLP26	9	Existing CFL Pin Based 26 watt Lamp(s)	1	26	30			LAI	9	Leave existing fixture as is	1	26	30	can, vertical, hard lid. already sensored	4100	**0.0**	1,356	0.27	0.27	366	366	0	$0	$0	$0	$7	$0	$7	0.0%
60	122 Custodial	520	ES4154H	1	Existing Strip 4' 1L F54 T5 Lamp, HBF Ballast	1	54	60			LAI	1	Leave existing fixture as is	1	54	60		4100	**0.0**	390	0.06	0.06	31	23	8	$0	$0	$0	$0	$0	$0	0.0%
61	119 Storage in Gym	520	EW4228N	2	Existing Wrap 4' 2L F32 T8 28 watt Lamps, NBF Ballast	2	28	48			LAI	2	Leave existing fixture as is	2	28	48		4100	**0.0**	520	0.10	0.10	50	50	0	$0	$0	$0	$1	$0	$1	0.0%
62	Womens Locker	**1,356**	EDI4128N	3	Existing Direct/Indirect 4' 1L F32 T8 28 watt Lamp, NBF Ballast	1	28	26			LAI	3	Leave existing fixture as is	1	28	26	already sensored	4100	**0.0**	1,356	0.08	0.08	106	106	0	$0	$0	$0	$2	$0	$2	0.0%
63	Womens Locker	**1,356**	EDI3125N	5	Existing Direct/Indirect 3' 1L F25 T8 Lamp, NBF Ballast	1	25	25			LAI	5	Leave existing fixture as is	1	25	25	already sensored	4100	**0.0**	1,356	0.13	0.13	169	169	0	$0	$0	$0	$3	$0	$3	0.0%
64	Womens Locker	**1,356**	ES2117N	1	Existing Strip 2' 1L F17 T8 Lamp, NBF Ballast	1	17	17			LAI	1	Leave existing fixture as is	1	17	17	already sensored	4100	**0.0**	1,356	0.02	0.02	23	23	0	$0	$0	$0	$1	$0	$1	0.0%
65	Womens Locker	**1,356**	EPT4228N	10	Existing Parabolic Troffer 4' 2L F32 T8 28 watt Lamps, NBF Ballast	2	28	48			LAI	10	Leave existing fixture as is	2	28	48	surface mount. already sensored	4100	**0.0**	1,356	0.48	0.48	651	651	0	$0	$0	$0	$7	$0	$7	0.0%
66	Womens Locker	2,086	ECFLP26	1	Existing CFL Pin Based 26 watt Lamp(s)	1	26	30			LAI	1	Leave existing fixture as is	1	26	30	6" can, hard lid	4100	**0.0**	2,086	0.03	0.03	63	63	0	$0	$0	$0	$1	$0	$1	0.0%
67	Womens Locker	2,086	ECFLP26	2	Existing CFL Pin Based 26 watt Lamp(s)	1	26	30			LAI	2	Leave existing fixture as is	1	26	30	7" can, hard lid, over shower	4100	**0.0**	2,086	0.06	0.06	125	125	0	$0	$0	$0	$2	$0	$2	0.0%
68	138 Street Crimes	2,086	EDI4132N	4	Existing Direct/Indirect Fixture 4' 1L F32 T8 Lamp, NBF Ballast	1	32	32			LED19T84-1	4	Sylvania UltraLED External Driver T8 LED - 1 lamp - 19w/ea	1	19	19	wall mount	4100	**16.2**	2,086	0.13	0.08	267	159	108	$4	$12	$17	$3	$0	$3	0.5%
69	138 Street Crimes	2,086	EDI3125N	3	Existing Direct/Indirect 3' 1L F25 T8 Lamp, NBF Ballast	1	25	25			LAI	3	Leave existing fixture as is	1	25	25	wall mount	4100	**0.0**	2,086	0.08	0.08	156	156	0	$0	$0	$0	$3	$0	$3	0.0%
70	138 Street Crimes	2,086	EDI8428N	14	Existing Direct/Indirect Fixture 8' 4L F32 T8 28 watt Lamps, NBF Ballast	4	28	96			LAI	14	Leave existing fixture as is	4	28	96	pendant mount	4100	**0.0**	2,086	1.34	1.34	2,804	2,804	0	$0	$0	$0	$22	$0	$22	0.0%
71	138 Street Crimes	2,086	EDI4228N	3	Existing Direct/Indirect 4' 2L F32 T8 28 watt Lamps, NBF Ballast	2	28	48			LAI	3	Leave existing fixture as is	2	28	48	pendant mount	4100	**0.0**	2,086	0.14	0.14	300	300	0	$0	$0	$0	$3	$0	$3	0.0%
72	Short Hall	8,760	ECFLP26	2	Existing CFL Pin Based 26 watt Lamp(s)	1	26	30			LAI	2	Leave existing fixture as is	1	26	30	6" can, vertical, hard lid	4100	**0.0**	8,760	0.06	0.06	526	526	0	$0	$0	$0	$9	$0	$9	0.0%
73	Short Hall	8,760	ECFLP13	2	Existing CFL Pin Based 13 watt Lamp(s)	1	13	17			LAI	2	Leave existing fixture as is	1	13	17	twin tube wall mount	4100	**0.0**	8,760	0.03	0.03	298	298	0	$0	$0	$0	$9	$0	$9	0.0%
74	126 Storage	520	ES4154H	2	Existing Strip 4' 1L F54 T5 Lamp, HBF Ballast	1	54	60			LAI	2	Leave existing fixture as is	1	54	60	existing has cage	4100	**0.0**	390	0.12	0.12	62	47	16	$1	$0	$1	$1	$0	$1	0.0%
75	127 Storage	520	ES4154H	1	Existing Strip 4' 1L F54 T5 Lamp, HBF Ballast	1	54	60			LAI	1	Leave existing fixture as is	1	54	60	existing has cage	4100	**0.0**	390	0.06	0.06	31	23	8	$0	$0	$0	$0	$0	$0	0.0%
76	139 Conference	2,086	EINC75	3	Existing Incandescent 75 watt Lamp(s)	1	75	75			12WLEDP30	3	12 watt Par 30 LED Lamp	1	12	12	track	4100	**1.7**	2,086	0.23	0.04	469	75	394	$16	$44	$60	$6	$3	$3	0.2%
77	139 Conference	2,086	ECFLCHAN	3	Existing Pendant Mount CFL Chandelier	1	15	15			LAI	3	Leave existing fixture as is	1	15	15		4100	**0.0**	2,086	0.05	0.05	94	94	0	$0	$0	$0	$3	$0	$3	0.0%

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Line	Location	EX Hours	EX Code	EX Qty	EX Desc	Lamps	EX Watts/ Lamp	EX Input Watts	Mounting Height	EX FC	PR Code	PR Qty	PR Desc	PR Lamp Qty	PR Watts/ Lamp	PR Input Watts	Audit Notes	Lamp Color	ECM SPB	PR Hours	Existing kw	Proposed kw	Existing kWh / Year	Proposed kwH / Year	Annual Energy Saved	kWh $ Savings	kW $ Savings	Total Energy $ Savings	EX MX Cost	PR MX Cost	MX Savings	%age of job
78	140 Office	**1,356**	EDI4228N	3	Existing Direct/Indirect 4' 2L F32 T8 28 watt Lamps, NBF Ballast	2	28	48			LAI	3	Leave existing fixture as is	2	28	48	pendant mount. already sensored	4100	**0.0**	1,356	0.14	0.14	195	195	0	$0	$0	$0	$2	$0	$2	0.0%
79	141 Office	**1,356**	EDI4228N	3	Existing Direct/Indirect 4' 2L F32 T8 28 watt Lamps, NBF Ballast	2	28	48			LAI	3	Leave existing fixture as is	2	28	48	pendant mount. already sensored	4100	**0.0**	1,356	0.14	0.14	195	195	0	$0	$0	$0	$2	$0	$2	0.0%
80	Glass Storage by Main Lobby	520	ECFLP26	4	Existing CFL Pin Based 26 watt Lamp(s)	1	26	30			LAI	4	Leave existing fixture as is	1	26	30	6" can, vertical, hard lid	4100	**0.0**	520	0.12	0.12	62	62	0	$0	$0	$0	$1	$0	$1	0.0%
81	Workroom	2,086	EDI4228N	5	Existing Direct/Indirect 4' 2L F32 T8 28 watt Lamps, NBF Ballast	2	28	48			LAI	5	Leave existing fixture as is	2	28	48	pendant mount	4100	**0.0**	2,086	0.24	0.24	501	501	0	$0	$0	$0	$5	$0	$5	0.0%
82	Workroom	2,086	EDI8428N	3	Existing Direct/Indirect Fixture 8' 4L F32 T8 28 watt Lamps, NBF Ballast	4	28	96			LAI	3	Leave existing fixture as is	4	28	96	pendant mount	4100	**0.0**	2,086	0.29	0.29	601	601	0	$0	$0	$0	$5	$0	$5	0.0%
83	155 Office	2,086	EDI8428N	2	Existing Direct/Indirect Fixture 8' 4L F32 T8 28 watt Lamps, NBF Ballast	4	28	96			LAI	2	Leave existing fixture as is	4	28	96	pendant mount	4100	**0.0**	2,086	0.19	0.19	401	401	0	$0	$0	$0	$3	$0	$3	0.0%
84	155 Office	2,086	EPT4228N	5	Existing Parabolic Troffer 4' 2L F32 T8 28 watt Lamps, NBF Ballast	2	28	48			LAI	5	Leave existing fixture as is	2	28	48	surface mount	4100	**0.0**	2,086	0.24	0.24	501	501	0	$0	$0	$0	$5	$0	$5	0.0%
85	156 Office	2,086	EDI4228N	3	Existing Direct/Indirect 4' 2L F32 T8 28 watt Lamps, NBF Ballast	2	28	48			LAI	3	Leave existing fixture as is	2	28	48	pendant mount, possibly dimmed	4100	**0.0**	2,086	0.14	0.14	300	300	0	$0	$0	$0	$3	$0	$3	0.0%
86	157 Office	2,086	EDI4228N	6	Existing Direct/Indirect 4' 2L F32 T8 28 watt Lamps, NBF Ballast	2	28	48			LAI	6	Leave existing fixture as is	2	28	48	pendant mount, possibly dimmed	4100	**0.0**	2,086	0.29	0.29	601	601	0	$0	$0	$0	$6	$0	$6	0.0%
87	158 Office	2,086	EDI4228N	3	Existing Direct/Indirect 4' 2L F32 T8 28 watt Lamps, NBF Ballast	2	28	48			LAI	3	Leave existing fixture as is	2	28	48	possibly dimmed	4100	**0.0**	2,086	0.14	0.14	300	300	0	$0	$0	$0	$3	$0	$3	0.0%
88	159 Office	2,086	EDI4228N	3	Existing Direct/Indirect 4' 2L F32 T8 28 watt Lamps, NBF Ballast	2	28	48			LAI	3	Leave existing fixture as is	2	28	48	possibly dimmed	4100	**0.0**	2,086	0.14	0.14	300	300	0	$0	$0	$0	$3	$0	$3	0.0%
89	160 Office	2,086	EDI4228N	3	Existing Direct/Indirect 4' 2L F32 T8 28 watt Lamps, NBF Ballast	2	28	48			LAI	3	Leave existing fixture as is	2	28	48	possibly dimmed	4100	**0.0**	2,086	0.14	0.14	300	300	0	$0	$0	$0	$3	$0	$3	0.0%
90	Restroom	**1,356**	EDI4128N	1	Existing Direct/Indirect 4' 1L F32 T8 28 watt Lamp, NBF Ballast	1	28	26			LAI	1	Leave existing fixture as is	1	28	26	wall mount. already sensored	4100	**0.0**	1,356	0.03	0.03	35	35	0	$0	$0	$0	$1	$0	$1	0.0%
91	Restroom	**1,356**	ES2117N	1	Existing Strip 2' 1L F17 T8 Lamp, NBF Ballast	1	17	17			LAI	1	Leave existing fixture as is	1	17	17	direct/indirect. wall mount. already sensored	4100	**0.0**	1,356	0.02	0.02	23	23	0	$0	$0	$0	$1	$0	$1	0.0%
92	163 Electronics	2,086	EDI8428N	1	Existing Direct/Indirect Fixture 8' 4L F32 T8 28 watt Lamps, NBF Ballast	4	28	96			LAI	1	Leave existing fixture as is	4	28	96		4100	**0.0**	2,086	0.10	0.10	200	200	0	$0	$0	$0	$2	$0	$2	0.0%
93	Next Section - Report Writing Room	2,086	EDI4228N	6	Existing Direct/Indirect 4' 2L F32 T8 28 watt Lamps, NBF Ballast	2	28	48			LAI	6	Leave existing fixture as is	2	28	48	pendant mount	4100	**0.0**	2,086	0.29	0.29	601	601	0	$0	$0	$0	$6	$0	$6	0.0%
94	Main Stairwell	8,760	ECFLS65	3	Existing 65 watt Screw-in CFL Lamp	1	65	65			LRD10M	3	Retro RC - LED Module - 10" 28watts - LumenOptix	1	28	28	can 10-12", tile ceiling	4100	5.3	8,760	0.20	0.08	1,708	736	972	$40	$26	$66	$197	$0	$197	2.3%
95	Main Stairwell	8,760	ECFLP26	1	Existing CFL Pin Based 26 watt Lamp(s)	1	26	30			LAI	1	Leave existing fixture as is	1	26	30	6" can	4100	**0.0**	8,760	0.03	0.03	263	263	0	$0	$0	$0	$5	$0	$5	0.0%
96	Hall	8,760	ECFLP26	13	Existing CFL Pin Based 26 watt Lamp(s)	1	26	30			LAI	13	Leave existing fixture as is	1	26	30	6" can, vertical, drop ceiling	4100	**0.0**	8,760	0.39	0.39	3,416	3,416	0	$0	$0	$0	$61	$0	$61	0.0%
97	Hall	8,760	EDI4128N	22	Existing Direct/Indirect 4' 1L F32 T8 28 watt Lamp, NBF Ballast	1	28	26			LAI	22	Leave existing fixture as is	1	28	26	wall mount	4100	**0.0**	8,760	0.57	0.57	5,011	5,011	0	$0	$0	$0	$72	$0	$72	0.0%
98	Hall	8,760	ECFLP213	4	Existing CFL Pin Based with 2 - 13 watt Lamp(s)	2	13	30			LAI	4	Leave existing fixture as is	2	13	30	wall mount	4100	**0.0**	8,760	0.12	0.12	1,051	1,051	0	$0	$0	$0	$30	$0	$30	0.0%
99	207 Conference	2,086	ECFLP26	4	Existing CFL Pin Based 26 watt Lamp(s)	1	26	30			LAI	4	Leave existing fixture as is	1	26	30	can, vertical	4100	**0.0**	2,086	0.12	0.12	250	250	0	$0	$0	$0	$4	$0	$4	0.0%
100	Storage	520	EW4232N	1	Existing Wrap 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LAI	1	Leave existing fixture as is	2	32	61		4100	**0.0**	520	0.06	0.06	32	32	0	$0	$0	$0	$0	$0	$0	0.0%
101	208 Interview	2,086	EDI4232N	1	Existing Direct/Indirect Fixture 4' 2L F32 T8 Lamps, NBF Ballast	2	32	58			LED19T84-2	1	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38		4100	14.5	2,086	0.06	0.04	121	79	42	$2	$5	$6	$1	$0	$1	0.2%
102	210 Interview	2,086	EDI4232N	1	Existing Direct/Indirect Fixture 4' 2L F32 T8 Lamps, NBF Ballast	2	32	58			LED19T84-2	1	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38		4100	14.5	2,086	0.06	0.04	121	79	42	$2	$5	$6	$1	$0	$1	0.2%

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Line	Location	EX Hours	EX Code	EX Qty	EX Desc	Lamps	EX Watts/ Lamp	EX Input Watts	Mounting Height	EX FC	PR Code	PR Qty	PR Desc	PR Lamp Qty	PR Watts/ Lamp	PR Input Watts	Audit Notes	Lamp Color	ECM SPB	PR Hours	Existing kw	Proposed kw	Existing kWh / Year	Proposed kwH / Year	Annual Energy Saved	kWh $ Savings	kW $ Savings	Total Energy $ Savings	EX MX Cost	PR MX Cost	MX Savings	%age of job
103	213 Interview	2,086	EDI4232N	1	Existing Direct/Indirect Fixture 4' 2L F32 T8 Lamps, NBF Ballast	2	32	58			LED19T84-2	1	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38		4100	14.5	2,086	0.06	0.04	121	79	42	$2	$5	$6	$1	$0	$1	0.2%
104	214 Interview	2,086	EDI4232N	2	Existing Direct/Indirect Fixture 4' 2L F32 T8 Lamps, NBF Ballast	2	32	58			LED19T84-2	2	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38		4100	14.5	2,086	0.12	0.08	242	159	83	$3	$9	$13	$2	$0	$2	0.4%
105	212 Interview	2,086	EDI4232N	1	Existing Direct/Indirect Fixture 4' 2L F32 T8 Lamps, NBF Ballast	2	32	58			LED19T84-2	1	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38		4100	14.5	2,086	0.06	0.04	121	79	42	$2	$5	$6	$1	$0	$1	0.2%
106	211 Interview	2,086	EDI4232N	1	Existing Direct/Indirect Fixture 4' 2L F32 T8 Lamps, NBF Ballast	2	32	58			LED19T84-2	1	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38		4100	14.5	2,086	0.06	0.04	121	79	42	$2	$5	$6	$1	$0	$1	0.2%
107	Mens RR	2,086	EDI4128N	3	Existing Direct/Indirect 4' 1L F32 T8 28 watt Lamp, NBF Ballast	1	28	26			LAI	3	Leave existing fixture as is	1	28	26	wall mount	4100	0.0	2,086	0.08	0.08	163	163	0	$0	$0	$0	$2	$0	$2	0.0%
108	Mens RR	2,086	ECFLP26	1	Existing CFL Pin Based 26 watt Lamp(s)	1	26	30			LAI	1	Leave existing fixture as is	1	26	30	6" can, vertical, hard lid	4100	0.0	2,086	0.03	0.03	63	63	0	$0	$0	$0	$1	$0	$1	0.0%
109	Womens RR	2,086	EDI4128N	3	Existing Direct/Indirect 4' 1L F32 T8 28 watt Lamp, NBF Ballast	1	28	26			LAI	3	Leave existing fixture as is	1	28	26	wall mount	4100	0.0	2,086	0.08	0.08	163	163	0	$0	$0	$0	$2	$0	$2	0.0%
110	Womens RR	2,086	ECFLP26	1	Existing CFL Pin Based 26 watt Lamp(s)	1	26	30			LAI	1	Leave existing fixture as is	1	26	30	6" can, vertical, hard lid	4100	0.0	2,086	0.03	0.03	63	63	0	$0	$0	$0	$1	$0	$1	0.0%
111	221 Telecom	520	ES4228N	1	Existing Strip 4' 2L F32 T8 28 watt Lamps, NBF Ballast	2	28	48			LAI	1	Leave existing fixture as is	2	28	48		4100	0.0	520	0.05	0.05	25	25	0	$0	$0	$0	$0	$0	$0	0.0%
112	218 Vice / Narc	2,086	EDI8428N	8	Existing Direct/Indirect Fixture 8' 4L F32 T8 28 watt Lamps, NBF Ballast	4	28	96			LAI	8	Leave existing fixture as is	4	28	96	pendant mount	4100	0.0	2,086	0.77	0.77	1,602	1,602	0	$0	$0	$0	$13	$0	$13	0.0%
113	218 Vice / Narc	2,086	EDI4228N	1	Existing Direct/Indirect 4' 2L F32 T8 28 watt Lamps, NBF Ballast	2	28	48			LAI	1	Leave existing fixture as is	2	28	48	pendant mount	4100	0.0	2,086	0.05	0.05	100	100	0	$0	$0	$0	$1	$0	$1	0.0%
114	218 Vice / Narc	2,086	EPT4228N	1	Existing Parabolic Troffer 4' 2L F32 T8 28 watt Lamps, NBF Ballast	2	28	48			LAI	1	Leave existing fixture as is	2	28	48	surface mount	4100	0.0	2,086	0.05	0.05	100	100	0	$0	$0	$0	$1	$0	$1	0.0%
115	218 Vice / Narc	2,086	ECFLP26	2	Existing CFL Pin Based 26 watt Lamp(s)	1	26	30			LAI	2	Leave existing fixture as is	1	26	30	6" can, hard lid	4100	0.0	2,086	0.06	0.06	125	125	0	$0	$0	$0	$2	$0	$2	0.0%
116	218 Vice / Narc	2,086	ECFLP32	4	Existing CFL Pin Based 32 watt Lamp(s)	1	32	36			LAI	4	Leave existing fixture as is	1	32	36	6" can, vertical, drop ceiling	4100	0.0	2,086	0.14	0.14	300	300	0	$0	$0	$0	$4	$0	$4	0.0%
117	Stairwell	8,760	EW4232N	3	Existing Wrap 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LED19T84-2	3	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38	wall mount	4100	6.0	8,760	0.18	0.11	1,603	999	604	$25	$16	$41	$13	$0	$13	0.5%
118	Detectives	2,086	EDI8428N	19	Existing Direct/Indirect Fixture 8' 4L F32 T8 28 watt Lamps, NBF Ballast	4	28	96			LAI	19	Leave existing fixture as is	4	28	96	pendant mount	4100	0.0	2,086	1.82	1.82	3,805	3,805	0	$0	$0	$0	$30	$0	$30	0.0%
119	Detectives	2,086	EDI4228N	6	Existing Direct/Indirect 4' 2L F32 T8 28 watt Lamps, NBF Ballast	2	28	48			LAI	6	Leave existing fixture as is	2	28	48	pendant mount	4100	0.0	2,086	0.29	0.29	601	601	0	$0	$0	$0	$6	$0	$6	0.0%
120	Detectives	2,086	ECFLP26	4	Existing CFL Pin Based 26 watt Lamp(s)	1	26	30			LAI	4	Leave existing fixture as is	1	26	30	6" can, vertical, drop ceiling	4100	0.0	2,086	0.12	0.12	250	250	0	$0	$0	$0	$4	$0	$4	0.0%
121	224 Office	**1,356**	EDI8428N	2	Existing Direct/Indirect Fixture 8' 4L F32 T8 28 watt Lamps, NBF Ballast	4	28	96			LAI	2	Leave existing fixture as is	4	28	96	pendant mount. already sensored	4100	0.0	1,356	0.19	0.19	260	260	0	$0	$0	$0	$2	$0	$2	0.0%
122	223 Office	**1,356**	EDI4228N	2	Existing Direct/Indirect 4' 2L F32 T8 28 watt Lamps, NBF Ballast	2	28	48			LAI	2	Leave existing fixture as is	2	28	48	pendant mount. already sensored	4100	0.0	1,356	0.10	0.10	130	130	0	$0	$0	$0	$1	$0	$1	0.0%
123	225 Office	2,086	EDI8432N	1	Existing Direct/Indirect Fixture 8' 4L F32 T8 Lamps, NBF Ballast	4	32	112			LB428N	1	Lamp & Ballast Retrofit 4L F32 T8 28 watt Lamp(s), Normal Ballast Factor	4	28	96	pendant mount	4100	13.4	2,086	0.11	0.10	234	200	33	$1	$4	$5	$2	$1	$0	0.1%
124	Next Office Right	2,086	EDI8432N	1	Existing Direct/Indirect Fixture 8' 4L F32 T8 Lamps, NBF Ballast	4	32	112			LB428N	1	Lamp & Ballast Retrofit 4L F32 T8 28 watt Lamp(s), Normal Ballast Factor	4	28	96	pendant mount	4100	13.4	2,086	0.11	0.10	234	200	33	$1	$4	$5	$2	$1	$0	0.1%
125	235 Office	2,086	EDI4228N	1	Existing Direct/Indirect 4' 2L F32 T8 28 watt Lamps, NBF Ballast	2	28	48			LAI	1	Leave existing fixture as is	2	28	48	pendant mount	4100	0.0	2,086	0.05	0.05	100	100	0	$0	$0	$0	$1	$0	$1	0.0%
126	Door to Left	2,086	EPT4228N	1	Existing Parabolic Troffer 4' 2L F32 T8 28 watt Lamps, NBF Ballast	2	28	48			LAI	1	Leave existing fixture as is	2	28	48	surface mount	4100	0.0	2,086	0.05	0.05	100	100	0	$0	$0	$0	$1	$0	$1	0.0%

City and County of Denver, CO - Police Station ~ OPTIMIZED OPTION: HYBRID

Line	Location	EX Hours	EX Code	EX Qty	EX Desc	Lamps	EX Watts/ Lamp	EX Input Watts	Mounting Height	EX FC	PR Code	PR Qty	PR Desc	PR Lamp Qty	PR Watts/ Lamp	PR Input Watts	Audit Notes	Lamp Color	ECM SPB	PR Hours	Existing kw	Proposed kw	Existing kWh / Year	Proposed kwH / Year	Annual Energy Saved	kWh $ Savings	kW $ Savings	Total Energy $ Savings	EX MX Cost	PR MX Cost	MX Savings	%age of job
127	227 Custodial	520	ES4232N	1	Existing Strip 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LAI	1	Leave existing fixture as is	2	32	61		4100	**0.0**	520	0.06	0.06	32	32	0	$0	$0	$0	$0	$0	$0	0.0%
128	228 Electrical	520	ES4232N	1	Existing Strip 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LAI	1	Leave existing fixture as is	2	32	61		4100	**0.0**	520	0.06	0.06	32	32	0	$0	$0	$0	$0	$0	$0	0.0%
129	229 Electrical	520	ES4232N	1	Existing Strip 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LAI	1	Leave existing fixture as is	2	32	61		4100	**0.0**	520	0.06	0.06	32	32	0	$0	$0	$0	$0	$0	$0	0.0%
130	231 A/V Room	520	EDI8432N	1	Existing Direct/Indirect Fixture 8' 4L F32 T8 Lamps, NBF Ballast	4	32	112			LAI	1	Leave existing fixture as is	4	32	112	pendant mount	4100	**0.0**	520	0.11	0.11	58	58	0	$0	$0	$0	$0	$0	$0	0.0%
131	Restroom	2,086	EDI4132N	1	Existing Direct/Indirect Fixture 4' 1L F32 T8 Lamp, NBF Ballast	1	32	32			LED19T84-1	1	Sylvania UltraLED External Driver T8 LED - 1 lamp - 19w/ea	1	19	19	wall mount	4100	16.2	2,086	0.03	0.02	67	40	27	$1	$3	$4	$1	$0	$1	0.1%
132	Restroom	2,086	ES2117N	1	Existing Strip 2' 1L F17 T8 Lamp, NBF Ballast	1	17	17			LAI	1	Leave existing fixture as is	1	17	17	direct/indirect. wall mount	4100	**0.0**	2,086	0.02	0.02	35	35	0	$0	$0	$0	$1	$0	$1	0.0%
133	201 Victim Assist	2,086	EDI4232N	2	Existing Direct/Indirect Fixture 4' 2L F32 T8 Lamps, NBF Ballast	2	32	58			LED19T84-2	2	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38	pendant mount	4100	14.5	2,086	0.12	0.08	242	159	83	$3	$9	$13	$2	$0	$2	0.4%
134	Exterior	4,380	EWMH100	10	Existing Wall Pack Metal Halide 100 watt Lamp	1	100	129			NXTWLED30	10	New Cooper Crosstour LED Wallpack, 30 watts	1	30	30	cutoff. silver	4100	11.9	4,380	1.29	0.30	5,650	1,314	4,336	$178		$178	$139	$0	$139	6.3%
135	Exterior	4,380	ECFLP213	1	Existing CFL Pin Based with 2 - 13 watt Lamp(s)	2	13	30			LAI	1	Leave existing fixture as is	2	13	30	round ceiling mount	4100	**0.0**	4,380	0.03	0.03	131	131	0	$0		$0	$4	$0	$4	0.0%
136	Exterior	4,380	ECFLS20	3	Existing CFL Screw-in 20 watt Lamp(s)	1	20	20			LAI	3	Leave existing fixture as is	1	20	20	bollard	4100	**0.0**	4,380	0.06	0.06	263	263	0	$0		$0	$8	$0	$8	0.0%
137	Exterior	4,380	EPLMH175	51	Existing Pole Light Metal Halide 175 watt Lamp	1	175	210			NCHLED72	51	New LED Cobrahead AEL 72 watts	1	72	72	shoebox, round, silver, 2 bolt, type 3	4100	15.7	4,380	10.71	3.67	46,910	16,083	30,826	$1,264		$1,264	$707	$0	$707	51.7%
138	Exterior	4,380	ECFLP7	12	Existing CFL Pin Based 7 watt Lamp(s)	1	7	11			LAI	12	Leave existing fixture as is	1	7	11	bollard	4100	**0.0**	4,380	0.13	0.13	578	578	0	$0		$0	$28	$0	$28	0.0%
139	Exterior	4,380	EFLMH70	5	Existing Flood Fixture Metal Halide 70 watt Lamp	1	70	90			NFLED39	5	New LED Flood, Rab FFLED39 Flood, 42 watts	1	39	42	silver. slipfit with adj knuckle	4100	22.8	4,380	0.45	0.21	1,971	920	1,051	$43		$43	$69	$0	$69	4.3%
140	Mens RR in Lobby	2,086	EDI4132N	3	Existing Direct/Indirect Fixture 4' 1L F32 T8 Lamp, NBF Ballast	1	32	32			LED19T84-1	3	Sylvania UltraLED External Driver T8 LED - 1 lamp - 19w/ea	1	19	19	wall mount	4100	16.2	2,086	0.10	0.06	200	119	81	$3	$9	$12	$2	$0	$2	0.4%
141	Mens RR in Lobby	2,086	ES2117N	1	Existing Strip 2' 1L F17 T8 Lamp, NBF Ballast	1	17	17			LAI	1	Leave existing fixture as is	1	17	17	direct/indirect. wall mount	4100	**0.0**	2,086	0.02	0.02	35	35	0	$0	$0	$0	$1	$0	$1	0.0%
142	Mens RR in Lobby	2,086	ECFLP26	3	Existing CFL Pin Based 26 watt Lamp(s)	1	26	30			LAI	3	Leave existing fixture as is	1	26	30	6" can, vertical, hard lid	4100	**0.0**	2,086	0.09	0.09	188	188	0	$0	$0	$0	$3	$0	$3	0.0%
143	Womens RR in Lobby	2,086	EDI4132N	3	Existing Direct/Indirect Fixture 4' 1L F32 T8 Lamp, NBF Ballast	1	32	32			LED19T84-1	3	Sylvania UltraLED External Driver T8 LED - 1 lamp - 19w/ea	1	19	19	wall mount	4100	16.2	2,086	0.10	0.06	200	119	81	$3	$9	$12	$2	$0	$2	0.4%
144	Womens RR in Lobby	2,086	ES2117N	1	Existing Strip 2' 1L F17 T8 Lamp, NBF Ballast	1	17	17			LAI	1	Leave existing fixture as is	1	17	17	direct/indirect. wall mount	4100	**0.0**	2,086	0.02	0.02	35	35	0	$0	$0	$0	$1	$0	$1	0.0%
145	Womens RR in Lobby	2,086	ECFLP26	3	Existing CFL Pin Based 26 watt Lamp(s)	1	26	30			LAI	3	Leave existing fixture as is	1	26	30	6" can, vertical, hard lid	4100	**0.0**	2,086	0.09	0.09	188	188	0	$0	$0	$0	$3	$0	$3	0.0%
146	135 Custodial	520	ES4154H	2	Existing Strip 4' 1L F54 T5 Lamp, HBF Ballast	1	54	60			LAI	2	Leave existing fixture as is	1	54	60		4100	**0.0**	390	0.12	0.12	62	47	16	$1	$0	$1	$1	$0	$1	0.0%
Total		3,460		683					28			683							**16.9**	3454.6	43.7	31.6	191433	126949	64484	$2,644	$899	$3,542	$3,142	$6	$3,136	1.0

CITY AND COUNTY OF DENVER, CO - 911 CALL CENTER ~ OPTIMIZED OPTION: HYBRID HYBRID

Line	Location	EX Hours	EX Code	EX Qty	EX Desc	Lamps	EX Watts/ Lamp	EX Input Watts	Mounting Height	EX FC	PR Code	PR Qty	PR Desc	PR Lamp Qty	PR Watts/ Lamp	PR Input Watts	Sensor Type	Audit Notes	Sensor Saving %	Lamp Color	ECM SPB	PR Hours	Existing kw	Proposed kw	Existing kWh / Year	Proposed kwH / Year	Annual Energy Saved	KWh $ Savings	kW $ Savings	Total Energy $ Savings	EX MX Cost	PR MX Cost	MX Savings	%age of job
1	Visitor Entry	8,760	ECFLP15	3	Existing CFL Pin Based 15 watt Lamp(s)	1	15	19			LAI	3	Leave existing fixture as is	1	15	19		4 pin recessed can, 6", hard lid		4100	0.0	8,760	0.06	0.06	499	499	0	$0	$0	$0	$14	$0	$14	0.0%
2	Visitor Entry	8,760	EINC75	1	Existing Incandescent 75 watt Lamp(s)	1	75	75			10WLEDBR30	1	9.5 watt BR30 Style LED Lamp - Philips	1	9.5	9.5		par 30 can		4100	0.5	8,760	0.08	0.01	657	83	574	$24	$15	$39	$9	$0	$9	0.0%
3	Visitor Entry	8,760	ECFLS15	2	Existing CFL Screw-in 15 watt Lamp(s)	1	15	15			6WLEDA19	2	6.5 watt A-19 Style LED Lamp	1	6.5	6.5		can		4100	2.2	8,760	0.03	0.01	263	114	149	$6	$4	$10	$9	$0	$9	0.1%
4	5280 Conference Room	1,304	ES8432N	1	Existing Strip 1x8 Fixture 4L F32 T8 32 watt Lamp(s), Normal Ballast Factor	4	32	112		35	LED19T84-2	2	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38		direct/indirect. pendant mount. dual switched - 2 per		4100	18.8	1,304	0.11	0.08	146	99	47	$2	$8	$10	$1	$0	$1	0.4%
5	Hall	8,760	ECFLS15	5	Existing CFL Screw-in 15 watt Lamp(s)	1	15	15		30	6WLEDA19	5	6.5 watt A-19 Style LED Lamp	1	6.5	6.5		can		4100	2.2	8,760	0.08	0.03	657	285	372	$15	$10	$25	$22	$0	$22	0.2%
6	Hall	8,760	EINC75	1	Existing Incandescent 75 watt Lamp(s)	1	75	75			10WLEDBR30	1	9.5 watt BR30 Style LED Lamp - Philips	1	9.5	9.5		can		4100	0.5	8,760	0.08	0.01	657	83	574	$24	$15	$39	$9	$0	$9	0.0%
7	Hall	8,760	ECFLP13	5	Existing CFL Pin Based 13 watt Lamp(s)	1	13	17			LAI	5	Leave existing fixture as is	1	13	17		4 pin can. horizontal		4100	0.0	8,760	0.09	0.09	745	745	0	$0	$0	$0	$23	$0	$23	0.0%
8	Hall	8,760	ET2214H	13	Existing Troffer 2x2 2L F14 T5 Lamps, HBF Ballast	2	14	37			LAI	13	Leave existing fixture as is	2	14	37		verify existing wattage (photo of ballast)		4100	0.0	8,760	0.48	0.48	4,214	4,214	0	$0	$0	$0	$137	$0	$137	0.0%
9	Hall	8,760	LEDEXIT	4	Existing LED Exit Sign	2	3	6			LAI	4	Leave existing fixture as is	2	3	6				4100	0.0	8,760	0.02	0.02	210	210	0	$0	$0	$0	$0	$0	$0	0.0%
10	Fire Alarm Office	2,086	EPT4232N	4	Existing Parabolic Troffer 2x4 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61		30	RTK31-24D	4	Retrofit Kit, LED, 2x4 Troffer, 31 watts, 3000 lm, Lithonia 2VTL DCP	1	31	31	CM9	18 cell. 1 with battery backup	25%	4100	24.7	1,565	0.24	0.12	509	194	315	$13	$28	$41	$4	$0	$4	1.9%
11	Fire Alarm Office	2,086	E35MR16	3	Existing Halogen 35 watt MR16 Style Lamp	1	35	35			6WLEDMR16	3	6 watt MR16 Style LED Lamp	1	6.5	6.5		MR16 can. Mini bi-pin. 35K. on slide dimmer		4100	7.3	2,086	0.11	0.02	219	41	178	$7	$20	$27	$16	$6	$10	0.5%
12	Closet by Elevator	520	EINC75	2	Existing Incandescent 75 watt Lamp(s)	1	75	75			9WLEDA19	2	9.5 watt A-19 Style LED Lamp	1	9.5	9.5		recessed can		4100	1.3	520	0.15	0.02	78	10	68	$3	$30	$33	$1	$0	$1	0.1%
13	Computer Lab	2,086	EPT4332N	15	Existing Parabolic Troffer 2x4 3L F32 T8 32 watt Lamp(s), Normal Ballast Factor	3	32	92		30-40	RTK40-24D	15	Retrofit Kit, LED, 2x4 Troffer, 40 watts, 4000 lm, Lithonia 2VTL DCP	1	40	40	CM9	split room, dual switched	25%	4100	14.7	1,565	1.38	0.60	2,879	939	1,940	$80	$181	$260	$20	$0	$20	7.1%
14	Agency Trainers Office	2,086	EPT4334N	5	Existing Parabolic Troffer 2x4 3 Lamp(s) F34 T12 Standard Ballast	3	34	130			RTK40-24D	5	Retrofit Kit, LED, 2x4 Troffer, 40 watts, 4000 lm, Lithonia 2VTL DCP	1	40	40	CM9	dual switched	25%	4100	9.6	1,565	0.65	0.20	1,356	313	1,043	$43	$104	$147	$9	$0	$9	2.6%
15	Centennial Conference Room	1,304	EPT4334N	5	Existing Parabolic Troffer 2x4 3 Lamp(s) F34 T12 Standard Ballast	3	34	130			RTK40-24D	5	Retrofit Kit, LED, 2x4 Troffer, 40 watts, 4000 lm, Lithonia 2VTL DCP	1	40	40	CM9	dual switched	25%	4100	11.0	978	0.65	0.20	848	196	652	$27	$104	$131	$6	$0	$6	2.6%
16	1 Floor Server Room	520	EPT4334N	7	Existing Parabolic Troffer 2x4 3 Lamp(s) F34 T12 Standard Ballast	3	34	130		60	TK4228L	7	Troffer Kit with Reflector 4' 2L F32 T8 28 watt Lamp(s), Low Ballast	2	28	42		no sensor		4100	4.2	520	0.91	0.29	473	153	320	$13	$143	$156	$3	$1	$2	1.2%
17	Janitor Closet	520	ES4234N	1	Existing Strip 4' 2 Lamp(s) F34 T12 Standard Ballast	2	34	82			LB228L	1	Lamp & Ballast Retrofit 2L F32 T8 28 watt Lamp(s), Low Ballast	2	28	42				4100	5.5	520	0.08	0.04	43	22	21	$1	$9	$10	$0	$0	$0	0.1%
18	Restrooms	8,760	ET2214H	4	Existing Troffer 2x2 2L F14 T5 Lamps, HBF Ballast	2	14	37			LAI	4	Leave existing fixture as is	2	14	37				4100	0.0	8,760	0.15	0.15	1,296	1,296	0	$0	$0	$0	$42	$0	$42	0.0%
19	Shower 1	8,760	ECFLS15	1	Existing CFL Screw-in 15 watt Lamp(s)	1	15	15			6WLEDA19	1	6.5 watt A-19 Style LED Lamp	1	6.5	6.5		can		4100	2.2	8,760	0.02	0.01	131	57	74	$3	$2	$5	$4	$0	$4	0.0%
20	Shower 2	8,760	EINC100	1	Existing Incandescent 100 watt Lamp(s)	1	100	100			15WLEDA21	1	15 watt A-21 Style LED Lamp	1	15	15		can		4100	0.4	8,760	0.10	0.02	876	131	745	$31	$20	$50	$13	$4	$9	0.0%
21	Mens RR	8,760	ECFLS15	1	Existing CFL Screw-in 15 watt Lamp(s)	1	15	15			6WLEDA19	1	6.5 watt A-19 Style LED Lamp	1	6.5	6.5	WSDP DT	can	25%	4100	6.1	6,570	0.02	0.01	131	43	89	$4	$2	$6	$4	$0	$4	0.1%
22	Mens RR	8,760	ES4134N	3	Existing Strip 4' 1 Lamp(s) F34 T12 Standard Ballast	1	34	48			LED19T84-1	3	Sylvania UltraLED External Driver T8 LED - 1 lamp - 19w/ea	1	19	19	WSDP DT	in cove	25%	4100	4.2	6,570	0.14	0.06	1,261	374	887	$36	$20	$57	$9	$0	$9	0.5%
23	Mens RR	8,760	ES3130N	1	Existing Strip 3' 1 Lamp(s) F30 T12 Standard Ballast	1	30	33			LB3125L	1	Lamp & Ballast Retrofit 3' 1L F25 T8 25 watt Lamp(s), Low Ballast Factor	1	25	21	WSDP DT	in cove	25%	4100	9.5	6,570	0.03	0.02	289	138	151	$6	$3	$9	$3	$2	$1	0.2%
24	Womens RR	8,760	ECFLS15	1	Existing CFL Screw-in 15 watt Lamp(s)	1	15	15			6WLEDA19	1	6.5 watt A-19 Style LED Lamp	1	6.5	6.5	WSDP DT	can	25%	4100	6.1	6,570	0.02	0.01	131	43	89	$4	$2	$6	$4	$0	$4	0.1%
25	Womens RR	8,760	ES4134N	3	Existing Strip 4' 1 Lamp(s) F34 T12 Standard Ballast	1	34	48			LED19T84-1	3	Sylvania UltraLED External Driver T8 LED - 1 lamp - 19w/ea	1	19	19	WSDP DT	in cove	25%	4100	4.2	6,570	0.14	0.06	1,261	374	887	$36	$20	$57	$9	$0	$9	0.5%
26	Womens RR	8,760	ES3130N	1	Existing Strip 3' 1 Lamp(s) F30 T12 Standard Ballast	1	30	33			LB3125L	1	Lamp & Ballast Retrofit 3' 1L F25 T8 25 watt Lamp(s), Low Ballast Factor	1	25	21	WSDP DT	in cove	25%	4100	9.5	6,570	0.03	0.02	289	138	151	$6	$3	$9	$3	$2	$1	0.2%
27	Fitness Room through Restroom Lobby	1,304	EPT4334N	4	Existing Parabolic Troffer 2x4 3 Lamp(s) F34 T12 Standard Ballast	3	34	130		15	RTK40-24D	4	Retrofit Kit, LED, 2x4 Troffer, 40 watts, 4000 lm, Lithonia 2VTL DCP	1	40	40		dual switched		4100	8.4	1,304	0.52	0.16	678	209	469	$19	$83	$103	$4	$0	$4	1.6%

CITY AND COUNTY OF DENVER, CO - 911 CALL CENTER ~ OPTIMIZED OPTION: HYBRID HYBRID

Line	Location	EX Hours	EX Code	EX Qty	EX Desc	Lamps	EX Watts/ Lamp	EX Input Watts	Mounting Height	EX FC	PR Code	PR Qty	PR Desc	PR Lamp Qty	PR Watts/ Lamp	PR Input Watts	Sensor Type	Audit Notes	Sensor Saving %	Lamp Color	ECM SPB	PR Hours	Existing kw	Proposed kw	Existing kWh / Year	Proposed kwH / Year	Annual Energy Saved	KWh $ Savings	KW $ Savings	Total Energy $ Savings	EX MX Cost	PR MX Cost	MX Savings	%age of job
28	Mech Hall (first door on left from RR back to Entry)	8,760	EPT4234N	2	Existing Parabolic Troffer 2x4 2 Lamp(s) F34 T12 Standard Ballast	2	34	82			RTK31-24D	2	Retrofit Kit, LED, 2x4 Troffer, 31 watts, 3000 lm, Lithonia 2VTL DCP	1	31	31				4100	6.1	8,760	0.16	0.06	1,437	543	894	$37	$24	$60	$9	$0	$9	0.7%
29	Mech Hall (first door on left from RR back to Entry)	8,760	ET2234N	2	Existing Prismatic Troffer 2x2 2 Lamp(s) F34 T12 U Tube Standard Ballast	2	34	82			RTK20-22T	2	Retrofit Kit, LED, 2x2 Troffer, 20 watts, 2000 lm, Lithonia 2VTLT Prism	1	20	20				4100	4.6	8,760	0.16	0.04	1,437	350	1,086	$45	$29	$73	$16	$0	$16	0.7%
30	Equipment Area	8,760	ES8434N	5	Existing Strip 8' 4 Lamp(s) F34 T12 Standard Ballast	4	34	164		30	RSK18-60	5	Retrofit Strip Kit - 1x8 LED - 60 watts	1	60	60				4100	5.1	8,760	0.82	0.30	7,183	2,628	4,555	$187	$121	$307	$44	$0	$44	3.1%
31	Mech Space on Left	520	ES4234N	2	Existing Strip 4' 2 Lamp(s) F34 T12 Standard Ballast	2	34	82		35	LB228L	2	Lamp & Ballast Retrofit 2L F32 T8 28 watt Lamp(s), Low Ballast	2	28	42				4100	5.5	520	0.16	0.08	85	44	42	$2	$19	$20	$1	$0	$0	0.2%
32	Mech Space on Left	520	ES8260N	2	Existing Strip 8' 2 Lamp(s) F96 60 watt Lamp(s) T12 Standard Ballast	2	60	138			SKR8228N	2	Strip Kit with Reflector 1X8' 2, 4'L, F32 T8 28 watt Lamp(s), Normal Ballast Factor	2	28	48				4100	5.8	520	0.28	0.10	144	50	94	$4	$42	$46	$2	$0	$1	0.5%
33	Control Switch	8,760	EW4434N	2	Existing Wrap 4' 4 Lamp(s) F34 T12 Standard Ballast	4	34	164			LED19T84-4	2	Sylvania UltraLED External Driver T8 LED - 4 lamp - 19w/ea	4	19	76		wide		4100	2.9	8,760	0.33	0.15	2,873	1,332	1,542	$63	$41	$104	$18	$0	$18	0.6%
34	Control Switch	8,760	ES8260N	3	Existing Strip 8' 2 Lamp(s) F96 60 watt Lamp(s) T12 Standard Ballast	2	60	138			RSK18-40	3	Retrofit Strip Kit - 1x8 LED - 40 watts	1	40	40				4100	5.0	8,760	0.41	0.12	3,627	1,051	2,575	$106	$68	$174	$40	$0	$40	1.8%
35	Room 123	2,086	ES8434N	2	Existing Strip 8' 4 Lamp(s) F34 T12 Standard Ballast	4	34	164		60	SKR8228L	2	Strip Kit with Reflector 1X8' 2, 4'L, F32 T8 28 watt Lamp(s), Low	2	28	42				4100	3.4	2,086	0.33	0.08	684	175	509	$21	$57	$77	$4	$1	$3	0.5%
36	Room 124	2,086	ES8260N	4	Existing Strip 8' 2 Lamp(s) F96 60 watt Lamp(s) T12 Standard Ballast	2	60	138		60	SKN8428L	4	Strip Kit No Reflector 1x8' 4, 4'L, F32 T8 28 watt Lamp(s), Low Ballast Factor	4	28	84		2 on lid, 2 on wall		4100	7.1	2,086	0.55	0.34	1,151	701	451	$18	$50	$69	$13	$4	$8	0.9%
37	Storage to Right of Control Switch	520	ET4334N	1	Existing Prismatic Troffer 2x4 3 Lamp(s) F34 T12 Standard Ballast	3	34	130			TK4228L	1	Troffer Kit with Reflector 4' 2L F32 T8 28 watt Lamp(s), Low Ballast Factor	2	28	42		no cover		4100	4.2	520	0.13	0.04	68	22	46	$2	$20	$22	$0	$0	$0	0.2%
38	Storage to Right of Control Switch	520	ET4234N	1	Existing Prismatic Troffer 2x4 2 Lamp(s) F34 T12 Standard Ballast	2	34	82			LB228L	1	Lamp & Ballast Retrofit 2L F32 T8 28 watt Lamp(s), Low Ballast Factor	2	28	42		no cover		4100	5.5	520	0.08	0.04	43	22	21	$1	$9	$10	$0	$0	$0	0.1%
39	Server Room	1,304	ES8260N	3	Existing Strip 8' 2 Lamp(s) F96 60 watt Lamp(s) T12 Standard Ballast	2	60	138		25	SKN8428L	3	Strip Kit No Reflector 1x8' 4, 4'L, F32 T8 28 watt Lamp(s), Low Ballast Factor	4	28	84		on wall		4100	8.2	1,304	0.41	0.25	540	329	211	$9	$38	$46	$6	$2	$4	0.7%
40	Server Room	1,304	ES8434N	3	Existing Strip 8' 4 Lamp(s) F34 T12 Standard Ballast	4	34	164			SKR8228L	3	Strip Kit with Reflector 1X8' 2, 4'L, F32 T8 28 watt Lamp(s), Low	2	28	42		on lid		4100	3.8	1,304	0.49	0.13	642	164	477	$20	$85	$104	$4	$1	$3	0.7%
41	Fire Tech Specialists	2,608	EPT4334N2	13	Existing Parabolic Troffer 2x4 18 Cell 3 Lamp(s) F34 T12, 2 NBF Ballasts (Inboard/Outboard)	3	34	130		40	RTK40-24DB	13	Retrofit Kit, LED, 2x4 Troffer, bi-level, 40 watts, 4000 lm, Lithonia 2VTL DCP	1	40	40		dual switch, in/out		4100	7.2	2,608	1.69	0.52	4,408	1,356	3,051	$125	$271	$396	$29	$0	$29	5.3%
42	Office on Left	2,086	EPT4334N	2	Existing Parabolic Troffer 2x4 3 Lamp(s) F34 T12 Standard Ballast	3	34	130		35	RTK40-24D	2	Retrofit Kit, LED, 2x4 Troffer, 40 watts, 4000 lm, Lithonia 2VTL DCP	1	40	40	CM9	dual switched	25%	4100	10.2	1,565	0.26	0.08	542	125	417	$17	$42	$59	$4	$0	$4	1.1%
43	Office on Left	2,086	EPT4234N	1	Existing Parabolic Troffer 2x4 2 Lamp(s) F34 T12 Standard Ballast	2	34	82			RTK31-24D	1	Retrofit Kit, LED, 2x4 Troffer, 31 watts, 3000 lm, Lithonia 2VTL DCP	1	31	31	CM9		25%	4100	22.2	1,565	0.08	0.03	171	48	123	$5	$12	$17	$1	$0	$1	0.7%
44	Hall	8,760	EPT4234N	3	Existing Parabolic Troffer 2x4 2 Lamp(s) F34 T12 Standard Ballast	2	34	82			RTK31-24D	3	Retrofit Kit, LED, 2x4 Troffer, 31 watts, 3000 lm, Lithonia 2VTL DCP	1	31	31				4100	6.1	8,760	0.25	0.09	2,155	815	1,340	$55	$35	$90	$13	$0	$13	1.1%
45	Hall	8,760	LEDEXIT	1	Existing LED Exit Sign	2	3	6			LAI	1	Leave existing fixture as is	2	3	6				4100	0.0	8,760	0.01	0.01	53	53	0	$0	$0	$0	$0	$0	$0	0.0%
46	Battery Room	520	ES8260N	5	Existing Strip 8' 2 Lamp(s) F96 60 watt Lamp(s) T12 Standard Ballast	2	60	138		30	SKR8228N	5	Strip Kit with Reflector 1X8' 2, 4'L, F32 T8 28 watt Lamp(s), Normal Ballast Factor	2	28	48				4100	5.8	520	0.69	0.24	359	125	234	$10	$104	$114	$4	$1	$3	1.2%
47	The Continental	2,086	EPT4334N	3	Existing Parabolic Troffer 2x4 3 Lamp(s) F34 T12 Standard Ballast	3	34	130			RTK40-24D	3	Retrofit Kit, LED, 2x4 Troffer, 40 watts, 4000 lm, Lithonia 2VTL DCP	1	40	40		dual switched		4100	7.4	2,086	0.39	0.12	814	250	563	$23	$63	$86	$5	$0	$5	1.2%
48	Large Tech Support Office	2,086	EPT4232N	8	Existing Parabolic Troffer 2x4 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61		45	LB228N	8	Lamp & Ballast Retrofit 2L F32 T8 28 watt Lamp(s), Normal Ballast Factor	2	28	48		18 cell with 2L reflector		4100	12.5	2,086	0.49	0.38	1,018	801	217	$9	$24	$33	$8	$5	$3	0.8%

CITY AND COUNTY OF DENVER, CO - 911 CALL CENTER ~ OPTIMIZED OPTION: HYBRID (HYBRID)

Line	Location	EX Hours	EX Code	EX Qty	EX Desc	Lamps	EX Watts/ Lamp	EX Input Watts	Mounting Height	EX FC	PR Code	PR Qty	PR Desc	PR Lamp Qty	PR Watts/ Lamp	PR Input Watts	Sensor Type	Audit Notes	Sensor Saving %	Lamp Color	ECM SPB	PR Hours	Existing kw	Proposed kw	Existing kWh / Year	Proposed kwH / Year	Annual Energy Saved	kWh $ Savings	kW $ Savings	Total Energy $ Savings	EX MX Cost	PR MX Cost	MX Savings	%age of job
49	Office	2,086	EPT4334N	3	Existing Parabolic Troffer 2x4 3 Lamp(s) F34 T12 Standard Ballast	3	34	130		60	RTK40-24D	3	Retrofit Kit, LED, 2x4 Troffer, 40 watts, 4000 lm, Lithonia 2VTL DCP	1	40	40				4100	7.4	2,086	0.39	0.12	814	250	563	$23	$63	$86	$5	$0	$5	1.2%
50	Janitor Closet	520	ES8260N	4	Existing Strip 8' 2 Lamp(s) F96 60 watt Lamp(s) T12 Standard Ballast	2	60	138			SKR8228N	4	Strip Kit with Reflector 1X8' 2, 4'L, F32 T8 28 watt Lamp(s), Normal Ballast Factor	2	28	48				4100	5.8	520	0.55	0.19	287	100	187	$8	$83	$91	$3	$1	$3	0.9%
51	Office	2,086	EPT4334N2	3	Existing Parabolic Troffer 2x4 18 Cell 3 Lamp(s) F34 T12, 2 NBF Ballasts (Inboard/Outboard)	3	34	130		45	RTK40-24DB	3	Retrofit Kit, LED, 2x4 Troffer, bi-level, 40 watts, 4000 lm, Lithonia 2VTL DCP	1	40	40		dual switch, in/out		4100	7.8	2,086	0.39	0.12	814	250	563	$23	$63	$86	$5	$0	$5	1.2%
52	Stairwell	8,760	ES4232N	5	Existing Strip 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61		5-15	LED19T84-2	5	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38		wall mount up/down light		4100	5.9	8,760	0.31	0.19	2,672	1,664	1,007	$41	$27	$68	$22	$0	$22	0.9%
53	Stairwell	8,760	LEDEXIT	1	Existing LED Exit Sign	2	3	6			LAI	1	Leave existing fixture as is	2	3	6				4100	0.0	8,760	0.01	0.01	53	53	0	$0	$0	$0	$0	$0	$0	0.0%
54	Locker Area	2,086	ECFLS15	8	Existing CFL Screw-in 15 watt Lamp(s)	1	15	15		5-10	8WLEDA19	8	8 watt A-19 Style LED Lamp - Slim	1	8	8		can		4100	5.5	2,086	0.12	0.06	250	134	117	$5	$13	$18	$8	$0	$8	0.2%
55	Elevator Room	520	ES4234N	1	Existing Strip 4' 2 Lamp(s) F34 T12 Standard Ballast	2	34	82		25	LB228L	1	Lamp & Ballast Retrofit 2L F32 T8 28 watt Lamp(s), Low Ballast	2	28	42				4100	5.5	520	0.08	0.04	43	22	21	$1	$9	$10	$0	$0	$0	0.1%
56	Short Hall	8,760	EPT4234N	2	Existing Parabolic Troffer 2x4 2 Lamp(s) F34 T12 Standard Ballast	2	34	82		35	RTK31-24D	2	Retrofit Kit, LED, 2x4 Troffer, 31 watts, 3000 lm, Lithonia 2VTL DCP	1	31	31				4100	6.1	8,760	0.16	0.06	1,437	543	894	$37	$24	$60	$9	$0	$9	0.7%
57	Short Hall	8,760	LEDEXIT	1	Existing LED Exit Sign	2	3	6			LAI	1	Leave existing fixture as is	2	3	6				4100	0.0	8,760	0.01	0.01	53	53	0	$0	$0	$0	$0	$0	$0	0.0%
58	Restroom 1	2,086	ES4132N	2	Existing Strip 4' 1L F32 T8 32 watt Lamp(s), Normal Ballast Factor	1	32	34			LED19T84-1	2	Sylvania UltraLED External Driver T8 LED - 1 lamp - 19w/ea	1	19	19		in cove		4100	14.2	2,086	0.07	0.04	142	79	63	$3	$7	$10	$2	$0	$2	0.3%
59	Restroom 2	2,086	ES4132N	2	Existing Strip 4' 1L F32 T8 32 watt Lamp(s), Normal Ballast Factor	1	32	34			LED19T84-1	2	Sylvania UltraLED External Driver T8 LED - 1 lamp - 19w/ea	1	19	19		in cove		4100	14.2	2,086	0.07	0.04	142	79	63	$3	$7	$10	$2	$0	$2	0.3%
60	Breakroom	2,086	ECFLS15	12	Existing CFL Screw-in 15 watt Lamp(s)	1	15	15		40	6WLEDA19	12	6.5 watt A-19 Style LED Lamp	1	6.5	6.5		can		4100	5.5	2,086	0.18	0.08	375	163	213	$9	$24	$32	$13	$0	$13	0.4%
61	Breakroom	2,086	ECFLS15	1	Existing CFL Screw-in 15 watt Lamp(s)	1	15	15			6WLEDA19	1	6.5 watt A-19 Style LED Lamp	1	6.5	6.5		jelly jar over stove		4100	5.5	2,086	0.02	0.01	31	14	18	$1	$2	$3	$1	$0	$1	0.0%
62	Breakroom	2,086	EPT4334N	5	Existing Parabolic Troffer 2x4 3 Lamp(s) F34 T12 Standard Ballast	3	34	130			RTK40-24D	5	Retrofit Kit, LED, 2x4 Troffer, 40 watts, 4000 lm, Lithonia 2VTL DCP	1	40	40	CM9		25%	4100	9.6	1,565	0.65	0.20	1,356	313	1,043	$43	$104	$147	$9	$0	$9	2.6%
63	Main Call Center	8,760	ES4332N	24	Existing Strip 4' 3L F32 T8 32 watt Lamp(s), Normal Ballast Factor	3	32	85			LED19T84-3	24	Sylvania UltraLED External Driver T8 LED - 3 lamp - 19w/ea	3	19	57		6 - 16' sections. All uplights. Existing type needs confirmed		4100	6.5	8,760	2.04	1.37	17,870	11,984	5,887	$241	$156	$397	$131	$0	$131	5.9%
64	Main Call Center	8,760	ES4332N	30	Existing Strip 4' 3L F32 T8 32 watt Lamp(s), Normal Ballast Factor	3	32	85			LED19T84-3	30	Sylvania UltraLED External Driver T8 LED - 3 lamp - 19w/ea	3	19	57		10 - 12' sections. All uplights. Existing type needs confirmed		4100	6.5	8,760	2.55	1.71	22,338	14,980	7,358	$302	$195	$496	$164	$0	$164	7.4%
65	Main Call Center	8,760	ES4332N	40	Existing Strip 4' 3L F32 T8 32 watt Lamp(s), Normal Ballast Factor	3	32	85			LED19T84-3	40	Sylvania UltraLED External Driver T8 LED - 3 lamp - 19w/ea	3	19	57		8 - 20' sections. All uplights. Existing type needs confirmed		4100	6.5	8,760	3.40	2.28	29,784	19,973	9,811	$402	$260	$662	$219	$0	$219	9.9%
66	Hall to Supply Room	8,760	EPT4234N	3	Existing Parabolic Troffer 2x4 2 Lamp(s) F34 T12 Standard Ballast	2	34	82		30	RTK31-24D	3	Retrofit Kit, LED, 2x4 Troffer, 31 watts, 3000 lm, Lithonia 2VTL DCP	1	31	31				4100	6.1	8,760	0.25	0.09	2,155	815	1,340	$55	$35	$90	$13	$0	$13	1.1%
67	Hall to Supply Room	8,760	EPT4232N	1	Existing Parabolic Troffer 2x4 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			RTK31-24D	1	Retrofit Kit, LED, 2x4 Troffer, 31 watts, 3000 lm, Lithonia 2VTL DCP	1	31	31				4100	9.6	8,760	0.06	0.03	534	272	263	$11	$7	$18	$4	$0	$4	0.4%
68	Hall to Supply Room	8,760	LEDEXIT	1	Existing LED Exit Sign	2	3	6			LAI	1	Leave existing fixture as is	2	3	6				4100	0.0	8,760	0.01	0.01	53	53	0	$0	$0	$0	$0	$0	$0	0.0%
69	Supply Room	520	EPT4334N	3	Existing Parabolic Troffer 2x4 3 Lamp(s) F34 T12 Standard Ballast	3	34	130		30	TK4228LP	3	Troffer Kit with Reflector 4' 2L F32 T8 28 watt Lamp(s), PRS Low	2	28	42	WSD		25%	4100	6.5	390	0.39	0.13	203	49	154	$6	$61	$68	$1	$0	$1	0.8%
70	Janitor Closet	520	ES4234N	1	Existing Strip 4' 2 Lamp(s) F34 T12 Standard Ballast	2	34	82			LB228L	1	Lamp & Ballast Retrofit 2L F32 T8 28 watt Lamp(s), Low Ballast	2	28	42				4100	5.5	520	0.08	0.04	43	22	21	$1	$9	$10	$0	$0	$0	0.1%
71	Mens RR	8,760	ECFLS15	1	Existing CFL Screw-in 15 watt Lamp(s)	1	15	15			6WLEDA19	1	6.5 watt A-19 Style LED Lamp	1	6.5	6.5	WSDP DT	can	25%	4100	8.1	6,570	0.02	0.01	131	43	89	$4	$2	$6	$4	$0	$4	0.1%
72	Mens RR	8,760	ES4134N	4	Existing Strip 4' 1 Lamp(s) F34 T12 Standard Ballast	1	34	48			LED19T84-1	4	Sylvania UltraLED External Driver T8 LED - 1 lamp - 19w/ea	1	19	19	WSDP DT	in cove	25%	4100	4.3	6,570	0.19	0.08	1,682	499	1,183	$48	$27	$75	$12	$0	$12	0.6%
73	Womens RR	8,760	ECFLS15	1	Existing CFL Screw-in 15 watt Lamp(s)	1	15	15			6WLEDA19	1	6.5 watt A-19 Style LED Lamp	1	6.5	6.5	WSDP DT	can	25%	4100	8.1	6,570	0.02	0.01	131	43	89	$4	$2	$6	$4	$0	$4	0.1%

CITY AND COUNTY OF DENVER, CO - 911 CALL CENTER ~ OPTIMIZED — OPTION: HYBRID — HYBRID

Line	Location	EX Hours	EX Code	EX Qty	EX Desc	Lamps	EX Watts/ Lamp	EX Input Watts	Mounting Height	EX FC	PR Code	PR Qty	PR Desc	PR Lamp Qty	PR Watts/ Lamp	PR Input Watts	Sensor Type	Audit Notes	Sensor Saving %	Lamp Color	ECM SPB	PR Hours	Existing kw	Proposed kw	Existing kWh / Year	Proposed kwH / Year	Annual Energy Saved	KWh $ Savings	KW $ Savings	Total Energy $ Savings	EX MX Cost	PR MX Cost	MX Savings	%age of job
74	Womens RR	8,760	ES4134N	4	Existing Strip 4' 1 Lamp(s) F34 T12 Standard Ballast	1	34	48			LED19T84-1	4	Sylvania UltraLED External Driver T8 LED - 1 lamp - 19w/ea	1	19	19	WSDP DT	in cove	25%	4100	4.3	6,570	0.19	0.08	1,682	499	1,183	$48	$27	$75	$12	$0	$12	0.6%
75	210 Electronics	1,304	EPT4334N	6	Existing Parabolic Troffer 2x4 3 Lamp(s) F34 T12 Standard Ballast	3	34	130		30	RTK40-24D	6	Retrofit Kit, LED, 2x4 Troffer, 40 watts, 4000 lm, Lithonia 2VTL DCP	1	40	40		dual switched		4100	8.4	1,304	0.78	0.24	1,017	313	704	$29	$125	$154	$7	$0	$7	2.3%
76	Stairwell	8,760	ES4232N	3	Existing Strip 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LED19T84-2	3	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38		wall mount up/down		4100	5.9	8,760	0.18	0.11	1,603	999	604	$25	$16	$41	$13	$0	$13	0.5%
77	Stairwell	8,760	LEDEXIT	1	Existing LED Exit Sign	2	3	6			LAI	1	Leave existing fixture as is	2	3	6				4100	0.0	8,760	0.01	0.01	53	53	0	$0	$0	$0	$0	$0	$0	0.0%
78	Closet at Bottom of Stairs	520	ES4234N	1	Existing Strip 4' 2 Lamp(s) F34 T12 Standard Ballast	2	34	82			LB228L	1	Lamp & Ballast Retrofit 2L F32 T8 28 watt Lamp(s), Low Ballast	2	28	42				4100	5.5	520	0.08	0.04	43	22	21	$1	$9	$10	$0	$0	$0	0.1%
79	Directors Office (upstairs)	2,607	ET2214H	2	Existing Troffer 2x2 2L F14 T5 Lamps, HBF Ballast	2	14	37		45	LAI	2	Leave existing fixture as is	2	14	37		indirect		4100	0.0	2,607	0.07	0.07	193	193	0	$0	$0	$0	$6	$0	$6	0.0%
80	Quiet Room	520	ECFLP218	1	Existing CFL Pin Based with 2 - 18 watt Lamp(s)	2	18	40			LAI	1	Leave existing fixture as is	2	18	40		4 pin recessed can, horizontal		4100	0.0	520	0.04	0.04	21	21	0	$0	$0	$0	$0	$0	$0	0.0%
81	Admin Office on Left	3,911	ET2214H	3	Existing Troffer 2x2 2L F14 T5 Lamps, HBF Ballast	2	14	37			LAI	3	Leave existing fixture as is	2	14	37		indirect		4100	0.0	3,911	0.11	0.11	434	434	0	$0	$0	$0	$14	$0	$14	0.0%
82	Closet	520	ES4234N	1	Existing Strip 4' 2 Lamp(s) F34 T12 Standard Ballast	2	34	82			LB228L	1	Lamp & Ballast Retrofit 2L F32 T8 28 watt Lamp(s), Low Ballast	2	28	42				4100	5.5	520	0.08	0.04	43	22	21	$1	$9	$10	$0	$0	$0	0.1%
83	Admin Office	3,911	EPT4234N	6	Existing Parabolic Troffer 2x4 2 Lamp(s) F34 T12 Standard Ballast	2	34	82		55	RTK31-24D	6	Retrofit Kit, LED, 2x4 Troffer, 31 watts, 3000 lm, Lithonia 2VTL DCP	1	31	31		dual switched		4100	9.6	3,911	0.49	0.19	1,924	727	1,197	$49	$71	$120	$12	$0	$12	2.2%
84	Paramedics Office	8,760	EPT4334N	3	Existing Parabolic Troffer 2x4 3 Lamp(s) F34 T12 Standard Ballast	3	34	130		30	RTK40-24D	3	Retrofit Kit, LED, 2x4 Troffer, 40 watts, 4000 lm, Lithonia 2VTL DCP	1	40	40				4100	3.7	8,760	0.39	0.12	3,416	1,051	2,365	$97	$63	$160	$22	$0	$22	1.2%
85	Assistant Chiefs Office	4,380	EPT4334N	3	Existing Parabolic Troffer 2x4 3 Lamp(s) F34 T12 Standard Ballast	3	34	130			RTK40-24D	3	Retrofit Kit, LED, 2x4 Troffer, 40 watts, 4000 lm, Lithonia 2VTL DCP	1	40	40				4100	5.5	4,380	0.39	0.12	1,708	526	1,183	$48	$63	$111	$11	$0	$11	1.2%
86	DFD Personnel Only Door	3,911	ET2214H	5	Existing Troffer 2x2 2L F14 T5 Lamps, HBF Ballast	2	14	37		40	LAI	5	Leave existing fixture as is	2	14	37		indirect		4100	0.0	3,911	0.19	0.19	724	724	0	$0	$0	$0	$23	$0	$23	0.0%
87	DFD Personnel Only Door	3,911	ECFLP218	3	Existing CFL Pin Based with 2 - 18 watt Lamp(s)	2	18	40		25	LAI	3	Leave existing fixture as is	2	18	40		can, horizontal		4100	0.0	3,911	0.12	0.12	469	469	0	$0	$0	$0	$10	$0	$10	0.0%
88	Managers Office	3,120	ET2214H	8	Existing Troffer 2x2 2L F14 T5 Lamps, HBF Ballast	2	14	37		100	LAI	8	Leave existing fixture as is	2	14	37		indirect		4100	0.0	3,120	0.30	0.30	924	924	0	$0	$0	$0	$30	$0	$30	0.0%
89	Closet	520	ECFLP218	1	Existing CFL Pin Based with 2 - 18 watt Lamp(s)	2	18	40			LAI	1	Leave existing fixture as is	2	18	40		can, horizontal		4100	0.0	520	0.04	0.04	21	21	0	$0	$0	$0	$0	$0	$0	0.0%
90	Exterior	4,380	EWHPS70	1	Existing Wall Pack High Pressure Sodium 70 watt Lamp	1	70	91	8.00		NXTWLED20	1	New Cooper Crosstour LED Wallpack, 20 watts	1	20	21		forward		4100	12.2	4,380	0.09	0.02	399	92	307	$13		$13	$13	$0	$13	0.5%
91	Exterior	4,380	ES4432N	2	Existing Strip 4' 4L F32 T8 32 watt Lamp(s), Normal Ballast Factor	4	32	112			NXTWLED30	2	New Cooper Crosstour LED Wallpack, 30 watts	1	30	30		wall mount, shoebox look		4100	20.7	4,380	0.22	0.06	981	263	718	$29		$29	$7	$0	$7	1.3%
92	Exterior	4,380	EWHPS150	2	Existing Wall Pack High Pressure Sodium 150 watt Lamp	1	150	188			NXTWLED50 RL	2	New Cooper CrosstourMaxx LED Wallpack, 50 watts, RL Optics	1	50	50		shoebox on wall		4100	13.0	4,380	0.38	0.10	1,647	438	1,209	$50		$50	$26	$0	$26	1.7%
93	Exterior	4,380	EFLHPS400	1	Existing Flood Fixture High Pressure Sodium 400 watt Lamp	1	400	464	20.00		NFLED150	1	New LED Flood, Rab FXLED150, 155 watts	1	150	155	PH	trunnion mount, bronze	0%	4100	12.3	4,380	0.46	0.16	2,032	679	1,353	$55		$55	$13	$0	$13	1.5%
94	Exterior	4,380	EPLHPS150	7	Existing Pole Light Fixture High Pressure Sodium 150 watt Lamp	1	150	188			NCHLED53HE	7	New LED Cobrahead Cree XSP1 53 watts, 4,806 Lm	1	53	53	PH	shoebox in parking lot. 2 bolt, bronze, type 3		4100	18.3	4,380	1.32	0.37	5,764	1,625	4,139	$170		$170	$89	$0	$89	8.2%
95	Exterior	4,380	ECFLS20	6	Existing CFL Screw-in 20 watt Lamp(s)	1	20	20			8WLEDP20	6	8 watt Par 20 LED Lamp	1	8	8		par 30 2L directional flood		4100	8.3	4,380	0.12	0.05	526	210	315	$13		$13	$16	$9	$7	0.3%
96	Exterior	4,380	EFLHPS150	1	Existing Flood Fixture High Pressure Sodium 150 watt Lamp	1	150	188	15.00		NFLED52	1	New LED Flood, Rab FFLED52 Flood, 54 watts	1	54	54		trunnion mount		4100	15.3	4,380	0.19	0.05	823	237	587	$24		$24	$13	$0	$13	1.0%
Total		4,915		395					20			396							24%		8.7	4649.9	32.8	15.5	160066	84972	75093	$3,079	$3,541	$6,620	$1,570	$42	$1,529	1.0

City and County of Denver, CO - Ashland Pool Building ~ OPTIMIZED OPTION: HYBRID HYBRID

Line	Location	EX Hours	EX Code	EX Qty	EX Desc	Lamps	EX Watts/ Lamp	EX Input Watts	Mounting Height	EX FC	PR Code	PR Qty	PR Desc	PR Lamp Qty	PR Watts/ Lamp	PR Input Watts	Sensor Type	Sensor Qty	Switch Type	Switch Qty	Audit Notes	Sensor Saving %	Lamp Color	ECM SPB	PR Hours	Existing kw	Proposed kw	Existing kWh / Year	Proposed kwH / Year	Annual Energy Saved	kWh $ Savings	kW $ Savings	Total Energy $ Savings	EX MX Cost	PR MX Cost	MX Savings	%age of job
1	Entry	3,912	ECFLP18	2	Existing CFL Pin Based 18 watt Lamp(s)	1	18	22			LAI	2	Leave existing fixture as is	1	18	22					6" can, 4 pin, recessed, vertical, hard lid		4100	0.0	3,912	0.04	0.04	172	172	0	$0	$0	$0	$4	$0	$4	0.0%
2	Lobby / Hall	3,912	EFMH100	6	Existing Fixture Metal Halide 100 watt Lamp	1	100	129		40	LEDR38	6	38 watt HID Replacement Lamp (corncob/bollard/post top) - Light Efficient Design -bypass ballast	1	38	38					pendant mount Holophane PM10DMH27		4100	7.1	3,912	0.77	0.23	3,028	892	2,136	$88	$127	$214	$74	$0	$74	7.9%
3	Lobby / Hall	3,912	EBIAX227	2	Existing Fixture with 2L 27 watt Biax Lamps	2	27	54			LAI	2	Leave existing fixture as is	2	27	54					wall mount		4100	0.0	3,912	0.11	0.11	422	422	0	$0	$0	$0	$11	$0	$11	0.0%
4	Lobby / Hall	3,912	EPT2232N	7	Existing Parabolic Troffer 2x2 2L F32 T8 32 watt U-Tube Lamp(s), Normal Ballast Factor	2	32	61			RTK20-22T	7	Retrofit Kit, LED, 2x2 Troffer, 20 watts, 2000 lm, Lithonia 2VTLT Prism	1	20	20	PC	1.0			control 7 by windows in hall with PC. 7 have battery backup	25%	4100	11.0	2,934	0.43	0.14	1,670	411	1,260	$52	$67	$118	$34	$0	$34	6.6%
5	Lobby / Hall	3,912	EPT2232N	7	Existing Parabolic Troffer 2x2 2L F32 T8 32 watt U-Tube Lamp(s), Normal Ballast Factor	2	32	61			RTK20-22T	7	Retrofit Kit, LED, 2x2 Troffer, 20 watts, 2000 lm, Lithonia 2VTLT Prism	1	20	20							4100	10.3	3,912	0.43	0.14	1,670	548	1,123	$46	$67	$113	$34	$0	$34	5.9%
6	Lobby / Hall	3,912	ECFLP18	9	Existing CFL Pin Based 18 watt Lamp(s)	1	18	22			LAI	9	Leave existing fixture as is	1	18	22					6" can, 4 pin, recessed, vertical, hard lid		4100	0.0	3,912	0.20	0.20	775	775	0	$0	$0	$0	$19	$0	$19	0.0%
7	Lobby / Hall	3,912	EFMH150	2	Existing Fixture Metal Halide 150 watt Lamp	1	150	185	18		LEDR38	2	38 watt HID Replacement Lamp (corncob/bollard/post top) - Light Efficient Design -bypass ballast	1	38	38					uplight. trunnion mounted to wall Eliptipar M133150GSP1B00D		4100	4.8	3,912	0.37	0.08	1,447	297	1,150	$47	$68	$115	$25	$0	$25	2.6%
8	Lobby / Hall	3,912	ELEDMR16	4	Existing LED MR16 Lamp	1	6	6			LAI	4	Leave existing fixture as is	1	6	6							4100	0.0	3,912	0.02	0.02	94	94	0	$0	$0	$0	$0	$0	$0	0.0%
9	Lobby / Hall	3,912	EBIAX18	2	Existing Fixture with 18 watt Biax Lamp	1	18	18			LAI	2	Leave existing fixture as is	1	18	18					wall mount		4100	0.0	3,912	0.04	0.04	141	141	0	$0	$0	$0	$6	$0	$6	0.0%
10	109 Janitor	520	ES4232N	1	Existing Strip 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LAI	1	Leave existing fixture as is	2	32	61							4100	0.0	520	0.06	0.06	32	32	0	$0	$0	$0	$0	$0	$0	0.0%
11	125 Mens Lockers	3,912	ET2232N	11	Existing Prismatic Troffer 2x2 2L F32 T8 32 watt U-Tube Lamp(s), Normal Ballast Factor	2	32	61		35	RTK35-22T	11	Retrofit Kit, LED, 2x2 Troffer, 35 watts, 3300 lm, Lithonia 2VTLT Prism.	1	35	35	CMW	0.8	WRLSW	0.40	need 4 wireless cmdt and 2 switches for this area	25%	4100	14.8	2,934	0.67	0.39	2,625	1,130	1,495	$61	$66	$128	$54	$0	$54	10.4%
12	125 Mens Lockers	3,912	ET3225N	3	Existing Troffer 3' 2L F25 T8 Lamps, NBF Ballast	2	25	44			LAI	3	Leave existing fixture as is	2	25	44	CMW	0.8	WRLSW	0.40		25%	4100	20.4	2,934	0.13	0.13	516	387	129	$5	$0	$5	$8	$0	$8	1.0%
13	125 Mens Lockers	3,912	ET14232N	1	Existing Prismatic Troffer 1x4 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LED19T84-2	1	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38	CMW	0.8	WRLSW	0.40		25%	4100	33.4	2,934	0.06	0.04	239	111	127	$5	$5	$11	$2	$0	$2	1.6%
14	125 Mens Lockers	3,912	ECFLP26	4	Existing CFL Pin Based 26 watt Lamp(s)	1	26	30			LAI	4	Leave existing fixture as is	1	26	30	CMW	0.8	WRLSW	0.40	6" can, hard lid, vertical	25%	4100	20.0	2,934	0.12	0.12	469	352	117	$5	$0	$5	$8	$0	$8	1.0%
15	125 Mens Lockers	3,912	ECFLP32	3	Existing CFL Pin Based 32 watt Lamp(s)	1	32	36			LAI	3	Leave existing fixture as is	1	32	36	CMW	0.8	WRLSW	0.40	7" can, horizontal, lensed.	25%	4100	24.9	2,934	0.11	0.11	422	317	106	$4	$0	$4	$6	$0	$6	1.0%
16	122 Family Lockers	3,912	ET2232N	6	Existing Prismatic Troffer 2x2 2L F32 T8 32 watt U-Tube Lamp(s), Normal Ballast Factor	2	32	61		35	RTK35-22T	6	Retrofit Kit, LED, 2x2 Troffer, 35 watts, 3300 lm, Lithonia 2VTLT Prism.	1	35	35							4100	14.3	3,912	0.37	0.21	1,432	822	610	$25	$36	$61	$29	$0	$29	5.0%
17	122 Family Lockers	3,912	ET14232N	2	Existing Prismatic Troffer 1x4 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LED19T84-2	2	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38							4100	10.0	3,912	0.12	0.08	477	297	180	$7	$11	$18	$4	$0	$4	0.9%
18	122 Family Lockers	3,912	ECFLP26	2	Existing CFL Pin Based 26 watt Lamp(s)	1	26	30			LAI	2	Leave existing fixture as is	1	26	30					6" can, hard lid, vertical		4100	0.0	3,912	0.06	0.06	235	235	0	$0	$0	$0	$4	$0	$4	0.0%
19	122 Family Lockers	3,912	ECFLP32	2	Existing CFL Pin Based 32 watt Lamp(s)	1	32	36			LAI	2	Leave existing fixture as is	1	32	36					7" can, horizontal, lensed.		4100	0.0	3,912	0.07	0.07	282	282	0	$0	$0	$0	$4	$0	$4	0.0%
20	Womens Locker 121	3,912	ET2232N	10	Existing Prismatic Troffer 2x2 2L F32 T8 32 watt U-Tube Lamp(s), Normal Ballast Factor	2	32	61			RTK35-22T	10	Retrofit Kit, LED, 2x2 Troffer, 35 watts, 3300 lm, Lithonia 2VTLT Prism.	1	35	35	CMW	0.8	WRLSW	0.40	need 4 wireless cmdt and 2 switches for this area	25%	4100	14.9	2,934	0.61	0.35	2,386	1,027	1,359	$56	$60	$116	$49	$0	$49	9.6%
21	Womens Locker 121	3,912	ET3225N	3	Existing Troffer 3' 2L F25 T8 Lamps, NBF Ballast	2	25	44			LAI	3	Leave existing fixture as is	2	25	44	CMW	0.8	WRLSW	0.40		25%	4100	20.4	2,934	0.13	0.13	516	387	129	$5	$0	$5	$8	$0	$8	1.0%
22	Womens Locker 121	3,912	ET14232N	1	Existing Prismatic Troffer 1x4 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LED19T84-2	1	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38	CMW	0.8	WRLSW	0.40		25%	4100	33.4	2,934	0.06	0.04	239	111	127	$5	$5	$11	$2	$0	$2	1.6%
23	Womens Locker 121	3,912	ECFLP26	5	Existing CFL Pin Based 26 watt Lamp(s)	1	26	30			LAI	5	Leave existing fixture as is	1	26	30	CMW	0.8	WRLSW	0.40	6" can, hard lid, vertical	25%	4100	16.0	2,934	0.15	0.15	587	440	147	$6	$0	$6	$10	$0	$10	1.0%
24	Womens Locker 121	3,912	ECFLP32	5	Existing CFL Pin Based 32 watt Lamp(s)	1	32	36			LAI	5	Leave existing fixture as is	1	32	36	CMW	0.8	WRLSW	0.40	7" can, horizontal, lensed.	25%	4100	14.9	2,934	0.18	0.18	704	528	176	$7	$0	$7	$10	$0	$10	1.0%
25	Staff Offices 101	3,912	ET2232N	11	Existing Prismatic Troffer 2x2 2L F32 T8 32 watt U-Tube Lamp(s), Normal Ballast Factor	2	32	61		40	RTK35-22T	11	Retrofit Kit, LED, 2x2 Troffer, 35 watts, 3300 lm, Lithonia 2VTLT Prism.	1	35	35							4100	14.3	3,912	0.67	0.39	2,625	1,506	1,119	$46	$66	$112	$54	$0	$54	9.3%
26	107 Electrical	520	ES4232N	1	Existing Strip 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LAI	1	Leave existing fixture as is	2	32	61					on wall		4100	0.0	520	0.06	0.06	32	32	0	$0	$0	$0	$0	$0	$0	0.0%
27	108 Telephone / Data	520	ES4232N	1	Existing Strip 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LAI	1	Leave existing fixture as is	2	32	61							4100	0.0	520	0.06	0.06	32	32	0	$0	$0	$0	$0	$0	$0	0.0%

City and County of Denver, CO - Ashland Pool Building ~ OPTIMIZED OPTION: HYBRID HYBRID

Line	Location	EX Hours	EX Code	EX Qty	EX Desc	Lamps	EX Watts/ Lamp	EX Input Watts	Mounting Height	EX FC	PR Code	PR Qty	PR Desc	PR Lamp Qty	PR Watts/ Lamp	PR Input Watts	Sensor Type	Sensor Qty	Switch Type	Switch Qty	Audit Notes	Sensor Saving %	Lamp Color	ECM SPB	PR Hours	Existing kw	Proposed kw	Existing kWh / Year	Proposed kwH / Year	Annual Energy Saved	kWh $ Savings	kW $ Savings	Total Energy $ Savings	EX MX Cost	PR MX Cost	MX Savings	%age of job
28	103 Storage	520	ES4232N	2	Existing Strip 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LAI	2	Leave existing fixture as is	2	32	61							4100	**0.0**	520	0.12	0.12	63	63	0	$0	$0	$0	$1	$0	$1	0.0%
29	102 Office	3,912	ET2232N	3	Existing Prismatic Troffer 2x2 2L F32 T8 32 watt U-Tube Lamp(s), Normal Ballast Factor	2	32	61		45	RTK35-22T	3	Retrofit Kit, LED, 2x2 Troffer, 35 watts, 3300 lm, Lithonia 2VTLT Prism.	1	35	35							4100	14.3	3,912	0.18	0.11	716	411	305	$13	$18	$31	$15	$0	$15	2.5%
30	101 Pool	3,912	EPM4654H	7	Existing Pendant Mount Fixture 4' 6L F54 T5 Lamps, HBF Ballast	6	54	354	27	40-55	LAI	7	Leave existing fixture as is	6	54	354	PC	1.0			clear lens. lid is 32". control 7 by windows	25%	4100	0.9	2,934	2.48	2.48	9,694	7,270	2,423	$99	$0	$99	$68	$0	$68	0.6%
31	101 Pool	3,912	EPM4654H	3	Existing Pendant Mount Fixture 4' 6L F54 T5 Lamps, HBF Ballast	6	54	354	27		LAI	3	Leave existing fixture as is	6	54	354					clear lens. lid is 32'		4100	**0.0**	3,912	1.06	1.06	4,155	4,155	0	$0	$0	$0	$29	$0	$29	0.0%
32	101 Pool	3,912	EPM4454H	18	Existing Pendant Mount Fixture 4' 4L F54 T5 Lamps, HBF Ballast	4	54	234	26		LAI	18	Leave existing fixture as is	4	54	234					clear lens		4100	**0.0**	3,912	4.21	4.21	16,477	16,477	0	$0	$0	$0	$106	$0	$106	0.0%
33	101 Pool	3,912	EV4232N	9	Existing Vapor Tight 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	58	32		LED19T84-2	9	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38							4100	11.2	3,912	0.52	0.34	2,042	1,338	704	$29	$42	$71	$18	$0	$18	3.9%
34	132 Storage	520	ES4232N	2	Existing Strip 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61		30	LAI	2	Leave existing fixture as is	2	32	61							4100	**0.0**	520	0.12	0.12	63	63	0	$0	$0	$0	$1	$0	$1	0.0%
35	141 Mech / Elec / Chlorine / Acid	520	EV4232N	9	Existing Vapor Tight 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	58			LAI	9	Leave existing fixture as is	2	32	58							4100	**0.0**	520	0.52	0.52	271	271	0	$0	$0	$0	$2	$0	$2	0.0%
36	Exterior	4,380	ECLMH50	2	Existing Can Light Metal Halide 50 watt Lamp (6-8")	1	50	72			NSMBHLED12	2	New 12w Surface Mount Round Bulkhead, LED, Brownlee 7700	1	12	12					recessed can 7", hard lid. suggest 10w Amerilum canopy 12x12		4100	18.7	4,380	0.14	0.02	631	105	526	$22		$22	$28	$0	$28	3.6%
37	Exterior	4,380	EFMH100	7	Existing Fixture Metal Halide 100 watt Lamp	1	100	129			LEDR24	7	24 watt HID Replacement Lamp-Light Efficient Design - bypass ballast	1	24	24					teardrop		4100	7.6	4,380	0.90	0.17	3,955	736	3,219	$132		$132	$97	$0	$97	6.8%
38	Exterior	4,380	EFMH100	5	Existing Fixture Metal Halide 100 watt Lamp	1	100	129			LEDR24	5	24 watt HID Replacement Lamp-Light Efficient Design - bypass ballast	1	24	24					post top teardrop		4100	7.6	4,380	0.65	0.12	2,825	526	2,300	$94		$94	$69	$0	$69	4.9%
39	Exterior	4,380	EWMH50	1	Existing Wall Pack Metal Halide 50 watt Lamp	1	50	72			NXTWLED20	1	New Cooper Crosstour LED Wallpack, 20 watts	1	20	21					over door, silver		4100	13.9	4,380	0.07	0.02	315	92	223	$9		$9	$14	$0	$14	1.3%
40	Exterior	4,380	EFMH250	3	Existing Fixture Metal Halide 250 watt Lamp	1	250	295	22		GLTR-75	3	Globaltech Retrofit - Yoke - 75w LED	1	75	75					teardrop in parking lot		4100	14.2	4,380	0.89	0.23	3,876	986	2,891	$119		$119	$42	$0	$42	8.9%
Total		3,462		184					32			184						10.0		4.0		25%		**15.8**	3168.3	18.0	13.1	68355	44273	24082	$987	$638	$1,625	$950	$0	$950	1.0

City and County of Denver, CO - Ashland Rec Center ~ OPTIMIZED OPTION: HYBRID

Line	Location	EX Hours	EX Code	EX Qty	EX Desc	Lamps	EX Watts/ Lamp	EX Input Watts	Mounting Height	EX FC	PR Code	PR Qty	PR Desc	PR Lamp Qty	PR Watts/ Lamp	PR Input Watts	Audit Notes	Lamp Color	ECM SPB	PR Hours	Existing kw	Proposed kw	Existing kWh / Year	Proposed kwH / Year	Annual Energy Saved	kWh $ Savings	kW $ Savings	Total Energy $ Savings	EX MX Cost	PR MX Cost	MX Savings	%age of job
1	Entry	3,912	ECFLP213	1	Existing CFL Pin Based with 2 - 13 watt Lamp(s)	2	13	30			LAI	1	Leave existing fixture as is	2	13	30	canopy. suggest Amerilume canopy **JST: not doing pin cfls for this scope**	4100	**0.0**	3,912	0.03	0.03	117	117	0	$0	$0	$0	$3	$0	$3	0.0%
2	Reception Desk / Open Area	3,912	ET4232N	15	Existing Prismatic Troffer 2x4 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61		35	LED19T84-2	15	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38		4100	10.2	3,912	0.92	0.57	3,579	2,230	1,350	$55	$80	$135	$29	$0	$29	11.3%
3	Reception Desk / Open Area	3,912	ES4232N	1	Existing Strip 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LED19T84-2	1	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38		4100	10.2	3,912	0.06	0.04	239	149	90	$4	$5	$9	$2	$0	$2	0.8%
4	Lifting Area	3,912	ET4232N	14	Existing Prismatic Troffer 2x4 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61		40	LED19T84-2	14	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38		4100	10.2	3,912	0.85	0.53	3,341	2,081	1,260	$52	$75	$126	$27	$0	$27	10.5%
5	Reception Area	3,912	EW4432N	3	Existing Wrap 4' 4L F32 T8 32 watt Lamp(s), Normal Ballast Factor	4	32	116		50	LED19T84-4	3	Sylvania UltraLED External Driver T8 LED - 4 lamp - 19w/ea	4	19	76	wide	4100	10.0	3,912	0.35	0.23	1,361	892	469	$19	$28	$47	$9	$0	$9	3.8%
6	Office left behind Reception	3,912	EW4432N	1	Existing Wrap 4' 4L F32 T8 32 watt Lamp(s), Normal Ballast Factor	4	32	116		70	LED19T84-4	1	Sylvania UltraLED External Driver T8 LED - 4 lamp - 19w/ea	4	19	76	wide	4100	10.0	3,912	0.12	0.08	454	297	156	$6	$9	$16	$3	$0	$3	1.3%
7	Office right behind Reception	3,912	EW4232N	3	Existing Wrap 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61		40	LED19T84-2	3	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38		4100	10.2	3,912	0.18	0.11	716	446	270	$11	$16	$27	$6	$0	$6	2.3%
8	Gym	**2,543**	EPM4654H	12	Existing Pendant Mount Fixture 4' 6L F54 T5 Lamps, HBF Ballast	6	54	354		55-65	LAI	12	Leave existing fixture as is	6	54	354	existing has cage. already sensored - mounted at 26'	4100	**0.0**	2,543	4.25	4.25	10,802	10,802	0	$0	$0	$0	$76	$0	$76	0.0%
9	Gym	3,912	ET14232N	3	Existing Prismatic Troffer 1x4 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LED19T84-2	3	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38		4100	10.2	3,912	0.18	0.11	716	446	270	$11	$16	$27	$6	$0	$6	2.3%
10	Gym	3,912	EW4232N	1	Existing Wrap 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LED19T84-2	1	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38	on wall	4100	10.2	3,912	0.06	0.04	239	149	90	$4	$5	$9	$2	$0	$2	0.8%
11	Gym Storage	520	EW4232N	2	Existing Wrap 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LAI	2	Leave existing fixture as is	2	32	61		4100	**0.0**	520	0.12	0.12	63	63	0	$0	$0	$0	$1	$0	$1	0.0%
12	Room under Stairs	520	ECFLS23	1	Existing CFL Screw-in 23 watt Lamp(s)	1	23	23			9WLEDA19	1	9.5 watt A-19 Style LED Lamp	1	9.5	9.5		4100	6.1	520	0.02	0.01	12	5	7	$0	$3	$3	$0	$0	$0	0.2%
13	Womens RR	3,912	ECFLS23	5	Existing CFL Screw-in 23 watt Lamp(s)	1	23	23			9WLEDA19	5	9.5 watt A-19 Style LED Lamp	1	9.5	9.5	recessed square cans with lens	4100	3.0	3,912	0.12	0.05	450	186	264	$11	$16	$26	$12	$0	$12	0.8%
14	Mens RR by Pool Table	3,912	ECFLS23	9	Existing CFL Screw-in 23 watt Lamp(s)	1	23	23			9WLEDA19	9	9.5 watt A-19 Style LED Lamp	1	9.5	9.5	surface mount	4100	3.0	3,912	0.21	0.09	810	334	475	$19	$28	$48	$21	$0	$21	1.4%
15	Staff RR	3,912	ECFLS23	2	Existing CFL Screw-in 23 watt Lamp(s)	1	23	23			9WLEDA19	2	9.5 watt A-19 Style LED Lamp	1	9.5	9.5		4100	3.0	3,912	0.05	0.02	180	74	106	$4	$6	$11	$5	$0	$5	0.3%
16	Storage to Left	520	ECFLS23	1	Existing CFL Screw-in 23 watt Lamp(s)	1	23	23			9WLEDA19	1	9.5 watt A-19 Style LED Lamp	1	9.5	9.5		4100	6.1	520	0.02	0.01	12	5	7	$0	$3	$3	$0	$0	$0	0.2%
17	Upstairs in Gym	3,912	ECFLS23	2	Existing CFL Screw-in 23 watt Lamp(s)	1	23	23			9WLEDA19	2	9.5 watt A-19 Style LED Lamp	1	9.5	9.5	recessed square	4100	3.0	3,912	0.05	0.02	180	74	106	$4	$6	$11	$5	$0	$5	0.3%
18	Mens RR	3,912	ECFLS23	2	Existing CFL Screw-in 23 watt Lamp(s)	1	23	23			9WLEDA19	2	9.5 watt A-19 Style LED Lamp	1	9.5	9.5		4100	3.0	3,912	0.05	0.02	180	74	106	$4	$6	$11	$5	$0	$5	0.3%
19	Womens RR	3,912	ECFLS23	3	Existing CFL Screw-in 23 watt Lamp(s)	1	23	23			9WLEDA19	3	9.5 watt A-19 Style LED Lamp	1	9.5	9.5		4100	3.0	3,912	0.07	0.03	270	111	158	$6	$9	$16	$7	$0	$7	0.5%
20	Janitor Closet	520	EINC60	1	Existing Incandescent 60 watt Lamp(s)	1	60	60			9WLEDA19	1	9.5 watt A-19 Style LED Lamp	1	9.5	9.5		4100	1.7	520	0.06	0.01	31	5	26	$1	$12	$13	$1	$0	$1	0.2%
21	Upper Hall	3,912	ECFLS23	5	Existing CFL Screw-in 23 watt Lamp(s)	1	23	23			9WLEDA19	5	9.5 watt A-19 Style LED Lamp	1	9.5	9.5	recessed square cans	4100	3.0	3,912	0.12	0.05	450	186	264	$11	$16	$26	$12	$0	$12	0.8%
22	Upper Hall	3,912	EW4232N	3	Existing Wrap 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LED19T84-2	3	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38		4100	10.2	3,912	0.18	0.11	716	446	270	$11	$16	$27	$6	$0	$6	2.3%
23	Kitchen	3,912	ES8432N	7	Existing Strip 1x8 Fixture 4L F32 T8 32 watt Lamp(s), Normal Ballast Factor	4	32	112			LED19T84-4	7	Sylvania UltraLED External Driver T8 LED - 4 lamp - 19w/ea	4	19	76		4100	10.9	3,912	0.78	0.53	3,067	2,081	986	$40	$58	$99	$21	$0	$21	8.8%
24	Kitchen	3,912	ES4232N	1	Existing Strip 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LED19T84-2	1	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38		4100	10.2	3,912	0.06	0.04	239	149	90	$4	$5	$9	$2	$0	$2	0.8%
25	Kitchen	3,912	EW4232N	1	Existing Wrap 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LED19T84-2	1	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38		4100	10.2	3,912	0.06	0.04	239	149	90	$4	$5	$9	$2	$0	$2	0.8%

City and County of Denver, CO - Ashland Rec Center ~ OPTIMIZED OPTION: HYBRID

Line	Location	EX Hours	EX Code	EX Qty	EX Desc	Lamps	EX Watts/ Lamp	EX Input Watts	Mounting Height	EX FC	PR Code	PR Qty	PR Desc	PR Lamp Qty	PR Watts/ Lamp	PR Input Watts	Audit Notes	Lamp Color	ECM SPB	PR Hours	Existing kw	Proposed kw	Existing kWh / Year	Proposed kwH / Year	Annual Energy Saved	kWh $ Savings	kW $ Savings	Total Energy $ Savings	EX MX Cost	PR MX Cost	MX Savings	%age of job
26	Kiln Room	520	EW4232N	1	Existing Wrap 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LAI	1	Leave existing fixture as is	2	32	61		4100	**0.0**	520	0.06	0.06	32	32	0	$0	$0	$0	$0	$0	$0	0.0%
27	Storage Closet	520	EINC60	1	Existing Incandescent 60 watt Lamp(s)	1	60	60			9WLEDA19	1	9.5 watt A-19 Style LED Lamp	1	9.5	9.5		4100	1.7	520	0.06	0.01	31	5	26	$1	$12	$13	$1	$0	$1	0.2%
28	Office	3,912	EW4232N	3	Existing Wrap 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LED19T84-2	3	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38		4100	10.2	3,912	0.18	0.11	716	446	270	$11	$16	$27	$6	$0	$6	2.3%
29	Big Room Upstairs	3,912	EW4232N	7	Existing Wrap 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LED19T84-2	7	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38		4100	10.2	3,912	0.43	0.27	1,670	1,041	630	$26	$37	$63	$14	$0	$14	5.3%
30	Big Room Upstairs	3,912	ECFLS23	4	Existing CFL Screw-in 23 watt Lamp(s)	1	23	23			9WLEDA19	4	9.5 watt A-19 Style LED Lamp	1	9.5	9.5	recessed square	4100	3.0	3,912	0.09	0.04	360	149	211	$9	$13	$21	$9	$0	$9	0.6%
31	Exterior	4,380	ECNHPS70	3	Existing Canopy High Pressure Sodium 70 watt Lamp	1	70	91			NCLED30	3	New Alumen8 LED Canopy, 31 watts	1	31	30	suggest 20w Amerilume canopy	4100	14.1	4,380	0.27	0.09	1,196	394	802	$33		$33	$38	$0	$38	6.8%
32	Exterior	4,380	EWHPS100	10	Existing Wall Pack High Pressure Sodium 100 watt Lamp	1	100	130	16		NXTWLED50 RL	10	New Cooper CrosstourMaxx LED Wallpack, 50 watts, RL Optics	1	50	50	forward	4100	19.0	4,380	1.30	0.50	5,694	2,190	3,504	$144		$144	$128	$0	$128	34.7%
Total		3,262		128					16			128							**14.7**	3262.5	11.4	8.2	38161	25808	12353	$506	$503	$1,009	$457	$0	$457	1.0

City and County of Denver, CO - Glenarm Rec Center ~ OPTIMIZED OPTION: HYBRID HYBRID

Line	Location	EX Hours	EX Code	EX Qty	EX Desc	Lamps	EX Watts/ Lamp	EX Input Watts	Mounting Height	EX FC	PR Code	PR Qty	PR Desc	PR Lamp Qty	PR Watts/ Lamp	PR Input Watts	Sensor Type	Audit Notes	Sensor Saving %	Lamp Color	ECM SPB	PR Hours	Existing kw	Proposed kw	Existing kWh / Year	Proposed kwH / Year	Annual Energy Saved	kWh $ Savings	kW $ Savings	Total Energy $ Savings	EX MX Cost	PR MX Cost	MX Savings	%age of job
1	Entry / Lobby Area	4,460	ET4232N	13	Existing Prismatic Troffer 2x4 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61		15-22	RTK40-24T	13	Retrofit Kit, LED, 2x4 Troffer, 40 watts, 4000 lm, Lithonia 2VTLT Prism.	1	40	40				4100	20.7	4,460	0.79	0.52	3,537	2,319	1,218	$50	$63	$113	$29	$0	$29	9.0%
2	Freeweights Area	4,460	ET4232N	6	Existing Prismatic Troffer 2x4 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LED19T84-2	6	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38				4100	9.0	4,460	0.37	0.23	1,632	1,017	615	$25	$32	$57	$13	$0	$13	1.9%
3	Gym / Court	**2,899**	EF4654H	16	Existing Fixture 4' 6L F54 T5 Lamps, HBF Ballast	6	54	354	21	40-50	LAI	16	Leave existing fixture as is	6	54	354		**existing has cage. drop ceiling. already sensored**		4100	**0.0**	2,899	5.66	5.66	16,420	16,420	0	$0	$0	$0	$116	$0	$116	0.0%
4	Raquetball Court	4,460	EF22MH400	5	Existing 2x2 Fixture with 400 watt Metal Halide Lamp	1	400	458	21	115	NRBLED140	5	New 2x2 Lay-In LED Highbay - 140 watts, Xtralight	1	140	140	CIR-RB		25%	4100	10.7	3,345	2.29	0.70	10,213	2,342	7,872	$323	$369	$691	$48	$0	$48	24.2%
5	Gym / Pool Equipment	4,460	ES4232N	4	Existing Strip 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61	10	10	LED19T84-2	4	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38		on wall		4100	9.0	4,460	0.24	0.15	1,088	678	410	$17	$21	$38	$9	$0	$9	1.3%
6	Pool	4,460	ET4654H	12	Existing Lay-in Troffer 4' 6L F54 T5 Lamps, HBF Ballast	6	54	354		30	LAI	12	Leave existing fixture as is	6	54	354		clear lens. new with 35K		4100	**0.0**	4,460	4.25	4.25	18,946	18,946	0	$0	$0	$0	$134	$0	$134	0.0%
7	Mech	520	ES4232N	7	Existing Strip 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61	9	20	LAI	7	Leave existing fixture as is	2	32	61				4100	**0.0**	520	0.43	0.43	222	222	0	$0	$0	$0	$2	$0	$2	0.0%
8	Ext Only Chem Room	520	EINC100	1	Existing Incandescent 100 watt Lamp(s)	1	100	100			9WLEDA19	1	9.5 watt A-19 Style LED Lamp	1	9.5	9.5		explosion proof		4100	0.9	520	0.10	0.01	52	5	47	$2	$21	$23	$1	$0	$1	0.1%
9	Ext Only Elec	520	ES4234N	2	Existing Strip 4' 2 Lamp(s) F34 T12 Standard Ballast	2	34	82			LED19T84-2	2	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38				4100	9.3	520	0.16	0.08	85	40	46	$2	$20	$22	$1	$0	$1	0.6%
10	Pool Office	4,460	ET4232N	1	Existing Prismatic Troffer 2x4 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LED19T84-2	1	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38				4100	9.0	4,460	0.06	0.04	272	169	103	$4	$5	$10	$2	$0	$2	0.3%
11	Pool Office	4,460	ECFLS23	2	Existing CFL Screw-in 23 watt Lamp(s)	1	23	23			8WLEDA19	2	8 watt A-19 Style LED Lamp - Slim	1	8	8		2L vanity		4100	2.0	4,460	0.05	0.02	205	71	134	$5	$7	$12	$5	$0	$5	0.1%
12	Girls Locker Room	4,460	ECFLP13	3	Existing CFL Pin Based 13 watt Lamp(s)	1	13	17			LAI	3	Leave existing fixture as is	1	13	17	CMW	2 pin, wall mount. . use wireless CMDT with switch for area	25%	4100	10.2	3,345	0.05	0.05	227	171	57	$2	$0	$2	$7	$0	$7	0.3%
13	Girls Locker Room	4,460	EV4132N	4	Existing Vapor Tight 4' 1L F32 T8 32 watt Lamp(s), Normal Ballast Factor	1	32	32			LED19T84-1	4	Sylvania UltraLED External Driver T8 LED - 1 lamp - 19w/ea	1	19	19	CMW		25%	4100	13.3	3,345	0.13	0.08	571	254	317	$13	$12	$25	$7	$0	$7	1.3%
14	Girls Locker Room	4,460	ET4232N	3	Existing Prismatic Troffer 2x4 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61	10		LED19T84-2	3	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38	CMW		25%	4100	10.5	3,345	0.18	0.11	816	381	435	$18	$16	$34	$7	$0	$7	1.3%
15	Girls Locker Room	4,460	EVAN4132N	1	Existing Vanity Fixture 4' 1L F32 T8 Lamp, NBF Ballast	1	32	32			LED19T84-1	1	Sylvania UltraLED External Driver T8 LED - 1 lamp - 19w/ea	1	19	19	CMW		25%	4100	23.6	3,345	0.03	0.02	143	64	79	$3	$3	$6	$2	$0	$2	0.6%
16	Boys Locker Room	4,460	ECFLP13	1	Existing CFL Pin Based 13 watt Lamp(s)	1	13	17			LAI	1	Leave existing fixture as is	1	13	17	CMW	wall mount. use wireless CMDT with switch for area	25%	4100	30.7	3,345	0.02	0.02	76	57	19	$1	$0	$1	$2	$0	$2	0.3%
17	Boys Locker Room	4,460	EV4132N	4	Existing Vapor Tight 4' 1L F32 T8 32 watt Lamp(s), Normal Ballast Factor	1	32	32			LED19T84-1	4	Sylvania UltraLED External Driver T8 LED - 1 lamp - 19w/ea	1	19	19	CMW		25%	4100	13.3	3,345	0.13	0.08	571	254	317	$13	$12	$25	$7	$0	$7	1.3%
18	Boys Locker Room	4,460	ET4232N	3	Existing Prismatic Troffer 2x4 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LED19T84-2	3	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38	CMW		25%	4100	10.5	3,345	0.18	0.11	816	381	435	$18	$16	$34	$7	$0	$7	1.3%
19	Boys Locker Room	4,460	EVAN4132N	2	Existing Vanity Fixture 4' 1L F32 T8 Lamp, NBF Ballast	1	32	32			LED19T84-1	2	Sylvania UltraLED External Driver T8 LED - 1 lamp - 19w/ea	1	19	19	CMW		25%	4100	16.7	3,345	0.06	0.04	285	127	158	$6	$6	$13	$3	$0	$3	0.8%
20	Custodian Closet	520	ECFLS23	1	Existing CFL Screw-in 23 watt Lamp(s)	1	23	23			9WLEDA19	1	9.5 watt A-19 Style LED Lamp	1	9.5	9.5		wall mount		4100	5.8	520	0.02	0.01	12	5	7	$0	$3	$3	$0	$0	$0	0.1%
21	Storage Behind Reception	520	ET4234N	1	Existing Prismatic Troffer 2x4 2 Lamp(s) F34 T12 Standard Ballast	2	34	82			LED19T84-2	1	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38				4100	9.3	520	0.08	0.04	43	20	23	$1	$10	$11	$0	$0	$0	0.3%
22	Office	4,460	ET4234N	1	Existing Prismatic Troffer 2x4 2 Lamp(s) F34 T12 Standard Ballast	2	34	82			LED19T84-2	1	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38				4100	5.2	4,460	0.08	0.04	366	169	196	$8	$10	$18	$2	$0	$2	0.3%
23	Gaming Room	4,460	ET4234N	8	Existing Prismatic Troffer 2x4 2 Lamp(s) F34 T12 Standard Ballast	2	34	82			LED19T84-2	8	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38	CM9		25%	4100	6.9	3,345	0.66	0.30	2,926	1,017	1,909	$78	$82	$160	$18	$0	$18	3.7%
24	Storage	8,760	ET4234N	2	Existing Prismatic Troffer 2x4 2 Lamp(s) F34 T12 Standard Ballast	2	34	82			LED19T84-2	2	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38	CM9	no controls	98%	4100	5.5	175	0.16	0.08	1,437	13	1,423	$58	$20	$79	$9	$0	$9	1.5%
25	Dark Storage Room	520	ECFLS23	1	Existing CFL Screw-in 23 watt Lamp(s)	1	23	23			9WLEDA19	1	9.5 watt A-19 Style LED Lamp	1	9.5	9.5		ceiling mount		4100	5.8	520	0.02	0.01	12	5	7	$0	$3	$3	$0	$0	$0	0.1%

City and County of Denver, CO - Glenarm Rec Center ~ OPTIMIZED OPTION: HYBRID HYBRID

Line	Location	EX Hours	EX Code	EX Qty	EX Desc	Lamps	EX Watts/ Lamp	EX Input Watts	Mounting Height	EX FC	PR Code	PR Qty	PR Desc	PR Lamp Qty	PR Watts/ Lamp	PR Input Watts	Sensor Type	Audit Notes	Sensor Saving %	Lamp Color	ECM SPB	PR Hours	Existing kw	Proposed kw	Existing kWh / Year	Proposed kwH / Year	Annual Energy Saved	kWh $ Savings	kW $ Savings	Total Energy $ Savings	EX MX Cost	PR MX Cost	MX Savings	%age of job
26	Spray Room - Storage	520	ECFLS23	1	Existing CFL Screw-in 23 watt Lamp(s)	1	23	23			9WLEDA19	1	9.5 watt A-19 Style LED Lamp	1	9.5	9.5		explosion proof		4100	5.8	520	0.02	0.01	12	5	7	$0	$3	$3	$0	$0	$0	0.1%
27	Storage	520	ET4232N	1	Existing Prismatic Troffer 2x4 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LAI	1	Leave existing fixture as is	2	32	61				4100	0.0	520	0.06	0.06	32	32	0	$0	$0	$0	$0	$0	$0	0.0%
28	Office	4,460	ET4232N	2	Existing Prismatic Troffer 2x4 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LED19T84-2	2	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38				4100	9.0	4,460	0.12	0.08	544	339	205	$8	$11	$19	$4	$0	$4	0.6%
29	Hall through Double Doors	4,460	ET4232N	5	Existing Prismatic Troffer 2x4 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LED19T84-2	5	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38				4100	9.0	4,460	0.31	0.19	1,360	847	513	$21	$27	$48	$11	$0	$11	1.6%
30	Womens RR	4,460	ECFLP13	3	Existing CFL Pin Based 13 watt Lamp(s)	1	13	17		10	LAI	3	Leave existing fixture as is	1	13	17		wall mount		4100	0.0	4,460	0.05	0.05	227	227	0	$0	$0	$0	$7	$0	$7	0.0%
31	Mens RR	4,460	ECFLP13	2	Existing CFL Pin Based 13 watt Lamp(s)	1	13	17			LAI	2	Leave existing fixture as is	1	13	17		wall mount		4100	0.0	4,460	0.03	0.03	152	152	0	$0	$0	$0	$5	$0	$5	0.0%
32	Serving Room	4,460	ET4232N	2	Existing Prismatic Troffer 2x4 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61		55	LED19T84-2	2	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38				4100	9.0	4,460	0.12	0.08	544	339	205	$8	$11	$19	$4	$0	$4	0.6%
33	Meeting Room (door left)	**4,461**	ET4232N	9	Existing Prismatic Troffer 2x4 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61		45	LED19T84-2	9	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38		**already sensored**		4100	9.0	4,461	0.55	0.34	2,449	1,526	923	$38	$48	$86	$20	$0	$20	2.9%
34	Storage	8,760	ET4232N	1	Existing Prismatic Troffer 2x4 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LED19T84-2	1	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38	CM9	no controls	98%	4100	11.8	175	0.06	0.04	534	7	528	$22	$5	$27	$4	$0	$4	1.1%
35	Office by Meeting Room	4,460	ET4232N	2	Existing Prismatic Troffer 2x4 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61		40	LED19T84-2	2	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38				4100	9.0	4,460	0.12	0.08	544	339	205	$8	$11	$19	$4	$0	$4	0.6%
36	Office	4,460	ET4232N	2	Existing Prismatic Troffer 2x4 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LED19T84-2	2	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38				4100	9.0	4,460	0.12	0.08	544	339	205	$8	$11	$19	$4	$0	$4	0.6%
37	Ceramics / Classroom	4,460	ET4232N	7	Existing Prismatic Troffer 2x4 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61		60	LED19T84-2	7	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38	CM9		25%	4100	11.8	3,345	0.43	0.27	1,904	890	1,015	$42	$37	$79	$16	$0	$16	3.4%
38	Kiln Room	520	ET4232N	2	Existing Prismatic Troffer 2x4 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LAI	2	Leave existing fixture as is	2	32	61				4100	0.0	520	0.12	0.12	63	63	0	$0	$0	$0	$1	$0	$1	0.0%
39	Storage	520	EINC60	1	Existing Incandescent 60 watt Lamp(s)	1	60	60			9WLEDA19	1	9.5 watt A-19 Style LED Lamp	1	9.5	9.5				4100	1.6	520	0.06	0.01	31	5	26	$1	$12	$13	$1	$0	$1	0.1%
40	General Storage	520	ES8432N	2	Existing Strip 1x8 Fixture 4L F32 T8 32 watt Lamp(s), Normal Ballast Factor	4	32	112			LAI	2	Leave existing fixture as is	4	32	112				4100	0.0	520	0.22	0.22	116	116	0	$0	$0	$0	$1	$0	$1	0.0%
41	Cybex Lift Area to right of Reception	4,460	ET4232N	6	Existing Prismatic Troffer 2x4 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LED19T84-2	6	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38				4100	9.0	4,460	0.37	0.23	1,632	1,017	615	$25	$32	$57	$13	$0	$13	1.9%
42	Treadmill Area	4,460	ET4232N	4	Existing Prismatic Troffer 2x4 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LED19T84-2	4	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38				4100	9.0	4,460	0.24	0.15	1,088	678	410	$17	$21	$38	$9	$0	$9	1.3%
43	Exterior	4,380	ECNHPS70	2	Existing Canopy High Pressure Sodium 70 watt Lamp	1	70	91			NCLED30	2	New Alumen8 LED Canopy, 31 watts	1	31	30		existing 12x12. suggest 20w Amerilum **jst: 20w discontinued - went to DLC version 31w**		4100	13.4	4,380	0.18	0.06	797	263	534	$22		$22	$26	$0	$26	1.9%
44	Exterior	4,380	EWHPS100	20	Existing Wall Pack High Pressure Sodium 100 watt Lamp	1	100	130	18		NXTWLED30P	20	New Cooper Crosstour LED Wallpack, 30 watts + Photocell	1	30	30				4100	12.9	4,380	2.60	0.60	11,388	2,628	8,760	$359		$359	$256	$0	$256	24.3%
45	Exterior	4,380	EWHPS50	9	Existing Wall Pack High Pressure Sodium 50 watt Lamp	1	50	66	8		NXTWLED10P	9	New Cooper Crosstour LED Wallpack, 8 watts + Photocell	1	10	8				4100	12.1	4,380	0.59	0.07	2,602	315	2,286	$94		$94	$115	$0	$115	7.8%
Total		3,648		187					21			187							36%		**14.2**	2993.9	22.6	15.8	87539	55274	32265	$1,323	$961	$2,284	$933	$0	$933	1.0

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Line	Location	EX Hours	EX Code	EX Qty	EX Desc	Lamps	EX Watts/ Lamp	EX Input Watts	Mounting Height	EX FC	PR Code	PR Qty	PR Desc	PR Lamp Qty	PR Watts/ Lamp	PR Input Watts	Audit Notes	Lamp Color	ECM SPB	PR Hours	Existing kw	Proposed kw	Existing kWh / Year	Proposed kwH / Year	Annual Energy Saved	kWh $ Savings	kW $ Savings	Total Energy $ Savings	EX MX Cost	PR MX Cost	MX Savings	%age of job
1	Entry / Lobby Area	4,460	EFMH150	4	Existing Fixture Metal Halide 150 watt Lamp	1	150	185		40	GLTR-50	4	Globaltech Retrofit - Yoke - 50w LED	1	50	50	uplight.PSMH	4100	7.7	4,460	0.74	0.20	3,300	892	2,408	$99	$125	$224	$56	$0	$56	5.8%
2	Entry / Lobby Area	4,460	EW4232N	2	Existing Wrap 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LED19T84-2	2	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38	wall mount fixture	4100	8.8	4,460	0.12	0.08	544	339	205	$8	$11	$19	$4	$0	$4	0.6%
3	Floor / Core / TV Area	4,460	ES4232N	20	Existing Strip 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61	8	25	LED19T84-2	20	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38	in cove	4100	8.8	4,460	1.22	0.76	5,441	3,390	2,052	$84	$107	$191	$45	$0	$45	5.6%
4	Hall by Restroom	4,460	EW4232N	3	Existing Wrap 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61		35	LED19T84-2	3	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38	on wall	4100	8.8	4,460	0.18	0.11	816	508	308	$13	$16	$29	$7	$0	$7	0.8%
5	Multi Purpose Room	4,460	EW4232N	11	Existing Wrap 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61		40	LED19T84-2	11	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38	on wall	4100	8.8	4,460	0.67	0.42	2,993	1,864	1,128	$46	$59	$105	$25	$0	$25	3.1%
6	Storage	520	EW4232N	3	Existing Wrap 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61		25	LAI	3	Leave existing fixture as is	2	32	61		4100	0.0	520	0.18	0.18	95	95	0	$0	$0	$0	$1	$0	$1	0.0%
7	Mens RR	4,460	ES4232N	3	Existing Strip 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61		30	LED19T84-2	3	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38	in cove	4100	8.8	4,460	0.18	0.11	816	508	308	$13	$16	$29	$7	$0	$7	0.8%
8	Womens RR	4,460	ES4232N	3	Existing Strip 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61		30	LED19T84-2	3	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38	in cove	4100	8.8	4,460	0.18	0.11	816	508	308	$13	$16	$29	$7	$0	$7	0.8%
9	Office by TV Area	4,460	EW4432N	6	Existing Wrap 4' 4L F32 T8 32 watt Lamp(s), Normal Ballast Factor	4	32	116		60	LED19T84-4	6	Sylvania UltraLED External Driver T8 LED - 4 lamp - 19w/ea	4	19	76	wide	4100	8.7	4,460	0.70	0.46	3,104	2,034	1,070	$44	$56	$100	$20	$0	$20	2.8%
10	Office	4,460	EW4432N	1	Existing Wrap 4' 4L F32 T8 32 watt Lamp(s), Normal Ballast Factor	4	32	116		45	LED19T84-4	1	Sylvania UltraLED External Driver T8 LED - 4 lamp - 19w/ea	4	19	76	wide	4100	8.7	4,460	0.12	0.08	517	339	178	$7	$9	$17	$3	$0	$3	0.5%
11	Lockers to Left	4,460	ES4232N	1	Existing Strip 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61		20	LED19T84-2	1	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38		4100	8.8	4,460	0.06	0.04	272	169	103	$4	$5	$10	$2	$0	$2	0.3%
12	Poker Room	4,460	EW4232N	4	Existing Wrap 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61		35	LED19T84-2	4	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38		4100	8.8	4,460	0.24	0.15	1,088	678	410	$17	$21	$38	$9	$0	$9	1.1%
13	Room through Poker Room	4,460	EW4232N	6	Existing Wrap 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61		30	LED19T84-2	6	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38		4100	8.8	4,460	0.37	0.23	1,632	1,017	615	$25	$32	$57	$13	$0	$13	1.7%
14	New Kitchen Area	4,460	ECFLP26	9	Existing CFL Pin Based 26 watt Lamp(s)	1	26	30			LAI	9	Leave existing fixture as is	1	26	30	6" can, 4 pin, vertical, hard lid	4100	0.0	4,460	0.27	0.27	1,204	1,204	0	$0	$0	$0	$21	$0	$21	0.0%
15	Ballroom	4,460	ES8432N	14	Existing Strip 1x8 Fixture 4L F32 T8 32 watt Lamp(s), Normal Ballast Factor	4	32	112		45	LED19T84-4	14	Sylvania UltraLED External Driver T8 LED - 4 lamp - 19w/ea	4	19	76	in cove	4100	9.5	4,460	1.57	1.06	6,993	4,745	2,248	$92	$117	$209	$47	$0	$47	6.6%
16	Ballroom	4,460	EW8432N	16	Existing Wrap 1x8 Fixture 4L F32 T8 32 watt Lamp(s), Normal Ballast Factor	4	32	112			LED19T84-4	16	Sylvania UltraLED External Driver T8 LED - 4 lamp - 19w/ea	4	19	76		4100	9.5	4,460	1.79	1.22	7,992	5,423	2,569	$105	$134	$239	$54	$0	$54	7.5%
17	Ballroom	0	EINC75	2	Existing Incandescent 75 watt Lamp(s)	1	75	75			DECOM	2	Decommission / Remove Fixture	0		0	**par 38 directional flood. never used**	4100	4.5	0	0.15	0.00	0	0	0	$0	$35	$35	$0	$0	$0	0.4%
18	Weight Room Hall	4,460	ECFLP26	6	Existing CFL Pin Based 26 watt Lamp(s)	1	26	30			LAI	6	Leave existing fixture as is	1	26	30	6" can, 4 pin, vertical, hard lid	4100	0.0	4,460	0.18	0.18	803	803	0	$0	$0	$0	$14	$0	$14	0.0%
19	Weight Room	4,460	ECFLP26	2	Existing CFL Pin Based 26 watt Lamp(s)	1	26	30		45	LAI	2	Leave existing fixture as is	1	26	30	6" can, 4 pin, vertical, hard lid	4100	0.0	4,460	0.06	0.06	268	268	0	$0	$0	$0	$5	$0	$5	0.0%
20	Weight Room	4,460	ES8432N	16	Existing Strip 1x8 Fixture 4L F32 T8 32 watt Lamp(s), Normal Ballast Factor	4	32	112			LED19T84-4	16	Sylvania UltraLED External Driver T8 LED - 4 lamp - 19w/ea	4	19	76	pendant mount. direct/indirect	4100	9.5	4,460	1.79	1.22	7,992	5,423	2,569	$105	$134	$239	$54	$0	$54	7.5%
21	Weight Room	4,460	ES4232N	2	Existing Strip 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LED19T84-2	2	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38	pendant mount. direct/indirect	4100	8.8	4,460	0.12	0.08	544	339	205	$8	$11	$19	$4	$0	$4	0.6%
22	Janitor Closet	520	ECFLS13	1	Existing CFL Screw-in 13 watt Lamp(s)	1	13	13			LAI	1	Leave existing fixture as is	1	13	13		4100	0.0	520	0.01	0.01	7	7	0	$0	$0	$0	$0	$0	$0	0.0%
23	Upstairs	4,460	ES4232N	2	Existing Strip 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LED19T84-2	2	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38		4100	8.8	4,460	0.12	0.08	544	339	205	$8	$11	$19	$4	$0	$4	0.6%
24	Mech Room	520	ECFLS23	2	Existing CFL Screw-in 23 watt Lamp(s)	1	23	23			LAI	2	Leave existing fixture as is	1	23	23		4100	0.0	520	0.05	0.05	24	24	0	$0	$0	$0	$1	$0	$1	0.0%

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Line	Location	EX Hours	EX Code	EX Qty	EX Desc	Lamps	EX Watts/ Lamp	EX Input Watts	Mounting Height	EX FC	PR Code	PR Qty	PR Desc	PR Lamp Qty	PR Watts/ Lamp	PR Input Watts	Audit Notes	Lamp Color	ECM SPB	PR Hours	Existing kw	Proposed kw	Existing kWh / Year	Proposed kwH / Year	Annual Energy Saved	kWh $ Savings	kW $ Savings	Total Energy $ Savings	EX MX Cost	PR MX Cost	MX Savings	%age of job
25	Storage	520	ES4234N	2	Existing Strip 4' 2 Lamp(s) F34 T12 Standard Ballast	2	34	82			LAI	2	Leave existing fixture as is	2	34	82		4100	**0.0**	520	0.16	0.16	85	85	0	$0	$0	$0	$1	$0	$1	0.0%
26	Mech / Boiler	520	ECFLS23	3	Existing CFL Screw-in 23 watt Lamp(s)	1	23	23		20	8WLEDA19	3	8 watt A-19 Style LED Lamp - Slim	1	8	8		4100	4.3	520	0.07	0.02	36	12	23	$1	$10	$11	$1	$0	$1	0.1%
27	Mech / Boiler	520	EV4234N	3	Existing Vapor Tight 4' 2 Lamp(s) F34 T12 Standard Ballast	2	34	82			LED19T84-2	3	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38		4100	9.1	520	0.25	0.11	128	59	69	$3	$31	$33	$1	$0	$1	0.8%
28	Hall Area by Gym	4,460	EW4232N	11	Existing Wrap 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LED19T84-2	11	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38		4100	8.8	4,460	0.67	0.42	2,993	1,864	1,128	$46	$59	$105	$25	$0	$25	3.1%
29	Classroom	4,460	EW4232N	17	Existing Wrap 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61		60	LED19T84-2	17	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38		4100	8.8	4,460	1.04	0.65	4,625	2,881	1,744	$71	$91	$162	$38	$0	$38	4.8%
30	Arcade	4,460	EW4232N	12	Existing Wrap 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61		50	LED19T84-2	12	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38	already sensored	4100	8.8	4,460	0.73	0.46	3,265	2,034	1,231	$50	$64	$114	$27	$0	$27	3.4%
31	Gym	4,460	EPM4654H	11	Existing Pendant Mount Fixture 4' 6L F54 T5 Lamps, HBF Ballast	6	54	354	28	50	LAI	11	Leave existing fixture as is	6	54	354	**existing has cage. Lid is 32'. already sensored**	4100	**0.0**	4,460	3.89	3.89	17,367	17,367	0	$0	$0	$0	$123	$0	$123	0.0%
32	Ball Storage and Electrical	520	EW4232N	6	Existing Wrap 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61		55	LAI	6	Leave existing fixture as is	2	32	61		4100	**0.0**	520	0.37	0.37	190	190	0	$0	$0	$0	$2	$0	$2	0.0%
33	Danger Door	520	ECFLS23	1	Existing CFL Screw-in 23 watt Lamp(s)	1	23	23			8WLEDA19	1	8 watt A-19 Style LED Lamp - Slim	1	8	8		4100	4.3	520	0.02	0.01	12	4	8	$0	$3	$4	$0	$0	$0	0.0%
34	Pool Hall	4,460	ECFLP213	4	Existing CFL Pin Based with 2 - 13 watt Lamp(s)	2	13	30			LAI	4	Leave existing fixture as is	2	13	30	8" can, 2 pin, horizontal	4100	**0.0**	4,460	0.12	0.12	535	535	0	$0	$0	$0	$15	$0	$15	0.0%
35	Pool Hall	4,460	EFMH70	1	Existing Fixture Metal Halide 70 watt Lamp	1	70	90			NFLED39	1	New LED Flood, Rab FFLED39 Flood, 42 watts	1	39	42	uplight. trunnion mounted to wall	4100	14.6	4,460	0.09	0.04	401	187	214	$9	$11	$20	$14	$0	$14	1.3%
36	Womens Locker	4,460	EW4232N	3	Existing Wrap 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61		40	LED19T84-2	3	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38		4100	8.8	4,460	0.18	0.11	816	508	308	$13	$16	$29	$7	$0	$7	0.8%
37	Womens Locker	4,460	EW4232N	3	Existing Wrap 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LED19T84-2	3	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38	on wall	4100	8.8	4,460	0.18	0.11	816	508	308	$13	$16	$29	$7	$0	$7	0.8%
38	Womens Locker	4,460	EV4232N	4	Existing Vapor Tight 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast	2	32	58			LED19T84-2	4	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38		4100	9.9	4,460	0.23	0.15	1,035	678	357	$15	$19	$33	$9	$0	$9	1.1%
39	Mens Locker	4,460	EW4232N	3	Existing Wrap 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LED19T84-2	3	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38	on wall	4100	8.8	4,460	0.18	0.11	816	508	308	$13	$16	$29	$7	$0	$7	0.8%
40	Mens Locker	4,460	EV4232N	4	Existing Vapor Tight 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast	2	32	58			LED19T84-2	4	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38		4100	9.9	4,460	0.23	0.15	1,035	678	357	$15	$19	$33	$9	$0	$9	1.1%
41	Mens Locker	4,460	ECFLP213	1	Existing CFL Pin Based with 2 - 13 watt Lamp(s)	2	13	30			LAI	1	Leave existing fixture as is	2	13	30	can, 2 pin	4100	**0.0**	4,460	0.03	0.03	134	134	0	$0	$0	$0	$4	$0	$4	0.0%
42	Reception Desk by Pool	4,460	ECFLP213	5	Existing CFL Pin Based with 2 - 13 watt Lamp(s)	2	13	30			LAI	5	Leave existing fixture as is	2	13	30	can, 2 pin	4100	**0.0**	4,460	0.15	0.15	669	669	0	$0	$0	$0	$19	$0	$19	0.0%
43	Reception Desk by Pool	4,460	ECFLP26	5	Existing CFL Pin Based 26 watt Lamp(s)	1	26	30			LAI	5	Leave existing fixture as is	1	26	30	6" can, vertical, hard lid	4100	**0.0**	4,460	0.15	0.15	669	669	0	$0	$0	$0	$12	$0	$12	0.0%
44	Janitor Closet	520	ES4232N	1	Existing Strip 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LAI	1	Leave existing fixture as is	2	32	61		4100	**0.0**	520	0.06	0.06	32	32	0	$0	$0	$0	$0	$0	$0	0.0%
45	Pool	4,460	ECFLP213	2	Existing CFL Pin Based with 2 - 13 watt Lamp(s)	2	13	30		10-20	LAI	2	Leave existing fixture as is	2	13	30	can, 2 pin	4100	**0.0**	4,460	0.06	0.06	268	268	0	$0	$0	$0	$8	$0	$8	0.0%
46	Pool	4,460	EFMH400	10	Existing Fixture Metal Halide 400 watt Lamp	1	400	458			GLTR-95	10	Globaltech Retrofit - Yoke - 95w LED	1	95	95	pendant mount globe, remote ballast	4100	4.6	4,460	4.58	0.95	20,427	4,237	16,190	$664	$842	$1,505	$201	$0	$201	21.2%
47	Pool	4,460	EGBCFL105	2	Existing Pendant Mount Globe with 105 watt CFL	1	105	105			GLTR-95	2	Globaltech Retrofit - Yoke - 95w LED	1	95	95	remote ballast	4100	22.6	4,460	0.21	0.19	937	847	89	$4	$5	$8	$61	$0	$61	4.2%
48	Storage	520	ES4232N	3	Existing Strip 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LAI	3	Leave existing fixture as is	2	32	61		4100	**0.0**	520	0.18	0.18	95	95	0	$0	$0	$0	$1	$0	$1	0.0%
49	Up Hatch (remote ballasts from Pool are here)	520	ES4232N	2	Existing Strip 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LAI	2	Leave existing fixture as is	2	32	61		4100	**0.0**	520	0.12	0.12	63	63	0	$0	$0	$0	$1	$0	$1	0.0%
50	Ext Elec	520	ES4232N	1	Existing Strip 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LAI	1	Leave existing fixture as is	2	32	61		4100	**0.0**	520	0.06	0.06	32	32	0	$0	$0	$0	$0	$0	$0	0.0%

City and County of Denver, CO - Scheitler Rec Center – OPTIMIZED OPTION: HYBRID

Line	Location	EX Hours	EX Code	EX Qty	EX Desc	Lamps	EX Watts/ Lamp	EX Input Watts	Mounting Height	EX FC	PR Code	PR Qty	PR Desc	PR Lamp Qty	PR Watts/ Lamp	PR Input Watts	Audit Notes	Lamp Color	ECM SPB	PR Hours	Existing kw	Proposed kw	Existing kWh / Year	Proposed kwH / Year	Annual Energy Saved	kWh $ Savings	kW $ Savings	Total Energy $ Savings	EX MX Cost	PR MX Cost	MX Savings	%age of job
51	Ext Pool Boiler	520	ES4234N	1	Existing Strip 4' 2 Lamp(s) F34 T12 Standard Ballast	2	34	82			LED19T84-2	1	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38		4100	9.1	520	0.08	0.04	43	20	23	$1	$10	$11	$0	$0	$0	0.3%
52	Ext Acid Room	520	EV4234N	4	Existing Vapor Tight 4' 2 Lamp(s) F34 T12 Standard Ballast	2	34	82			LED19T84-2	4	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38		4100	9.1	520	0.33	0.15	171	79	92	$4	$41	$45	$1	$0	$1	1.1%
53	Ext Chem Room	520	EV4234N	1	Existing Vapor Tight 4' 2 Lamp(s) F34 T12 Standard Ballast	2	34	82			LED19T84-2	1	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38		4100	9.1	520	0.08	0.04	43	20	23	$1	$10	$11	$0	$0	$0	0.3%
54	Exterior	4,380	EWHPS100	2	Existing Wall Pack High Pressure Sodium 100 watt Lamp	1	100	130	12.00		NXTWLED50P	2	New Cooper CrosstourMaxx LED Wallpack, 50 watts + Photocell	1	50	50		4100	18.5	4,380	0.26	0.10	1,139	438	701	$29		$29	$26	$0	$26	2.7%
55	Exterior	4,380	EWHPS50	6	Existing Wall Pack High Pressure Sodium 50 watt Lamp	1	50	66	8.00		NXTWLED10P	6	New Cooper Crosstour LED Wallpack, 8 watts + Photocell	1	10	8		4100	11.9	4,380	0.40	0.05	1,734	210	1,524	$62		$62	$77	$0	$77	4.5%
56	Exterior	4,380	ECFLP213	2	Existing CFL Pin Based with 2 - 13 watt Lamp(s)	2	13	30			LAI	2	Leave existing fixture as is	2	13	30	can, 2 pin	4100	**0.0**	4,380	0.06	0.06	263	263	0	$0		$0	$8	$0	$8	0.0%
57	Exterior	4,380	EWLED	6	Existing LED Wallpack with PC	1	30	30			LAI	6	Leave existing fixture as is	1	30	30	RAB	4100	**0.0**	4,380	0.18	0.18	788	788	0	$0		$0	$0	$0	$0	0.0%
58	Ext Chem Room on Outside Pool Bldg	520	ECFLS23	4	Existing CFL Screw-in 23 watt Lamp(s)	1	23	23			8WLEDA19	4	8 watt A-19 Style LED Lamp - Slim	1	8	8		4100	4.3	520	0.09	0.03	48	17	31	$1	$14	$15	$1	$0	$1	0.2%
Total		3,291		285					28			285							**9.5**	3290.7	26.6	16.6	109516	67900	41616	$1,706	$2,188	$3,894	$1,106	$0	$1,106	1.0

City and County of Denver, CO - 20th Street Rec Center ~ OPTIMIZED OPTION: HYBRID

Line	Location	EX Hours	EX Code	EX Qty	EX Desc	Lamps	EX Watts/ Lamp	EX Input Watts	Mounting Height	EX FC	PR Code	PR Qty	PR Desc	PR Lamp Qty	PR Watts/ Lamp	PR Input Watts	Audit Notes	Lamp Color	ECM SPB	PR Hours	Existing kw	Proposed kw	Existing kWh / Year	Proposed kwH / Year	Annual Energy Saved	kWh $ Savings	kW $ Savings	Total Energy $ Savings	EX MX Cost	PR MX Cost	MX Savings	%age of job
1	Entry	4,537	ECFLS20	4	Existing CFL Screw-in 20 watt Lamp(s)	1	20	20			8WLEDA19	4	8 watt A-19 Style LED Lamp - Slim	1	8	8	4L chandelier	4100	2.4	4,537	0.08	0.03	363	145	218	$9	$11	$20	$11	$0	$11	0.3%
2	Elevator Lobby	4,537	ECFLS20	1	Existing CFL Screw-in 20 watt Lamp(s)	1	20	20			8WLEDA19	1	8 watt A-19 Style LED Lamp - Slim	1	8	8	wall mount	4100	2.4	4,537	0.02	0.01	91	36	54	$2	$3	$5	$3	$0	$3	0.1%
3	Door Left in Entry to Basement	4,537	ECFLS20	1	Existing CFL Screw-in 20 watt Lamp(s)	1	20	20		20-30	8WLEDA19	1	8 watt A-19 Style LED Lamp - Slim	1	8	8		4100	2.4	4,537	0.02	0.01	91	36	54	$2	$3	$5	$3	$0	$3	0.1%
4	Door Left in Entry to Basement	4,537	EW4232N	1	Existing Wrap 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LED19T84-2	1	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38		4100	9.0	4,537	0.06	0.04	277	172	104	$4	$5	$10	$2	$0	$2	0.4%
5	Door Left in Entry to Basement	4,537	EW4432N	3	Existing Wrap 4' 4L F32 T8 32 watt Lamp(s), Normal Ballast Factor	4	32	116			LED19T84-4	3	Sylvania UltraLED External Driver T8 LED - 4 lamp - 19w/ea	4	19	76	wide	4100	8.9	4,537	0.35	0.23	1,579	1,034	544	$22	$28	$50	$10	$0	$10	2.0%
6	Pool Staff Only Door	4,537	EINC60	1	Existing Incandescent 60 watt Lamp(s)	1	60	60		3	19WLEDA21	1	19 watt A-21 Style LED Lamp	1	19	19		4100	1.3	4,537	0.06	0.02	272	86	186	$8	$10	$17	$5	$0	$5	0.1%
7	Elevator Lobby	4,537	EW4232N	1	Existing Wrap 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LED19T84-2	1	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38		4100	9.0	4,537	0.06	0.04	277	172	104	$4	$5	$10	$2	$0	$2	0.4%
8	Elevator Machine Room	520	EINC40	1	Existing Incandescent 40 watt Lamp(s)	1	40	40			6WLEDA19	1	6.5 watt A-19 Style LED Lamp	1	6.5	6.5		4100	2.3	520	0.04	0.01	21	3	17	$1	$8	$8	$1	$0	$1	0.1%
9	Riser Room	520	EINC50	1	Existing Incandescent 50 watt Lamp(s)	1	50	50			6WLEDA19	1	6.5 watt A-19 Style LED Lamp	1	6.5	6.5		4100	1.8	520	0.05	0.01	26	3	23	$1	$10	$11	$1	$0	$1	0.1%
10	Short Hall to Meeting Room	4,537	EINC60	1	Existing Incandescent 60 watt Lamp(s)	1	60	60			8WLEDA19	1	8 watt A-19 Style LED Lamp - Slim	1	8	8		4100	0.7	4,537	0.06	0.01	272	36	236	$10	$12	$22	$5	$0	$5	0.1%
11	Meeting Room	4,537	EW8432N	1	Existing Wrap 1x8 Fixture 4L F32 T8 32 watt Lamp(s), Normal Ballast Factor	4	32	112			LED19T84-4	1	Sylvania UltraLED External Driver T8 LED - 4 lamp - 19w/ea	4	19	76		4100	9.7	4,537	0.11	0.08	508	345	163	$7	$8	$15	$3	$0	$3	0.7%
12	Employees Only	4,537	EINC50	1	Existing Incandescent 50 watt Lamp(s)	1	50	50			9WLEDA19	1	9.5 watt A-19 Style LED Lamp	1	9.5	9.5		4100	1.0	4,537	0.05	0.01	227	43	184	$8	$9	$17	$5	$0	$5	0.1%
13	Office Space	4,537	EW4232N	1	Existing Wrap 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LED19T84-2	1	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38		4100	9.0	4,537	0.06	0.04	277	172	104	$4	$5	$10	$2	$0	$2	0.4%
14	Next Room	4,537	EW4232N	1	Existing Wrap 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LED19T84-2	1	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38		4100	9.0	4,537	0.06	0.04	277	172	104	$4	$5	$10	$2	$0	$2	0.4%
15	Storage Area to Left	520	EW4232N	6	Existing Wrap 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LAI	6	Leave existing fixture as is	2	32	61		4100	0.0	520	0.37	0.37	190	190	0	$0	$0	$0	$2	$0	$2	0.0%
16	Door through Storage	520	EW4232N	1	Existing Wrap 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LAI	1	Leave existing fixture as is	2	32	61		4100	0.0	520	0.06	0.06	32	32	0	$0	$0	$0	$0	$0	$0	0.0%
17	Art Studio	4,537	EW4432N	13	Existing Wrap 4' 4L F32 T8 32 watt Lamp(s), Normal Ballast Factor	4	32	116			LED19T84-4	13	Sylvania UltraLED External Driver T8 LED - 4 lamp - 19w/ea	4	19	76	wide	4100	8.9	4,537	1.51	0.99	6,842	4,483	2,359	$97	$121	$217	$44	$0	$44	8.5%
18	Art Studio	4,537	ECFLS13	1	Existing CFL Screw-in 13 watt Lamp(s)	1	13	13			8WLEDA19	1	8 watt A-19 Style LED Lamp - Slim	1	8	8	wall mount	4100	4.2	4,537	0.01	0.01	59	36	23	$1	$1	$2	$2	$0	$2	0.1%
19	Art Studio	4,537	EWM2217N	3	Existing Wall Mount Fixture 2' 2L F17 T8 Lamps, NBF Ballast	2	17	33			LAI	3	Leave existing fixture as is	2	17	33		4100	0.0	4,537	0.10	0.10	449	449	0	$0	$0	$0	$9	$0	$9	0.0%
20	Next Room	4,537	ES4234N	7	Existing Strip 4' 2 Lamp(s) F34 T12 Standard Ballast	2	34	82	9.00		LED19T84-2	7	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38		4100	5.2	4,537	0.57	0.27	2,604	1,207	1,397	$57	$71	$129	$16	$0	$16	2.8%
21	Next Room	4,537	ES4134N	1	Existing Strip 4' 1 Lamp(s) F34 T12 Standard Ballast	1	34	48	9.00		LED19T84-1	1	Sylvania UltraLED External Driver T8 LED - 1 lamp - 19w/ea	1	19	19		4100	5.8	4,537	0.05	0.02	218	86	132	$5	$7	$12	$2	$0	$2	0.3%
22	Reception Area	4,537	ECFLS23	16	Existing CFL Screw-in 23 watt Lamp(s)	1	23	23			8WLEDA19	16	8 watt A-19 Style LED Lamp - Slim	1	8	8	4L chandeliers. historical, can't replace	4100	2.0	4,537	0.37	0.13	1,670	581	1,089	$45	$56	$100	$44	$0	$44	1.1%
23	Reception Area	4,537	ECFLS23	10	Existing CFL Screw-in 23 watt Lamp(s)	1	23	23			8WLEDA19	10	8 watt A-19 Style LED Lamp - Slim	1	8	8	2L wall mount fixtures. historical, can't replace	4100	2.0	4,537	0.23	0.08	1,044	363	681	$28	$35	$63	$27	$0	$27	0.7%
24	Spin Room	4,537	ES8296N	4	Existing Strip 8' 2 Lamp(s) F96 T12 Standard Ballast	2	75	173	12.00	45	RSK18-60	4	Retrofit Strip Kit - 1x8 LED - 60 watts	1	60	60	confirm existing lamp wattage	4100	6.6	4,537	0.69	0.24	3,140	1,089	2,051	$84	$105	$189	$28	$0	$28	5.3%
25	Weight Machine Area	4,537	ES8432N	15	Existing Strip 1x8 Fixture 4L F32 T8 32 watt Lamp(s), Normal Ballast Factor	4	32	112			LED19T84-4	15	Sylvania UltraLED External Driver T8 LED - 4 lamp - 19w/ea	4	19	76	direct/indirect, pendant mount	4100	9.7	4,537	1.68	1.14	7,622	5,172	2,450	$100	$125	$226	$51	$0	$51	9.9%
26	Office to Right of Reception	4,537	ET4232N	2	Existing Prismatic Troffer 2x4 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			RTK31-24T	2	Retrofit Kit, LED, 2x4 Troffer, 31 watts, 3000 lm, Lithonia 2VTLT Prism.	1	31	31	surface mount	4100	14.5	4,537	0.12	0.06	554	281	272	$11	$14	$25	$5	$0	$5	1.6%

City and County of Denver, CO - 20th Street Rec Center ~ OPTIMIZED OPTION: HYBRID

Line	Location	EX Hours	EX Code	EX Qty	EX Desc	Lamps	EX Watts/ Lamp	EX Input Watts	Mounting Height	EX FC	PR Code	PR Qty	PR Desc	PR Lamp Qty	PR Watts/ Lamp	PR Input Watts	Audit Notes	Lamp Color	ECM SPB	PR Hours	Existing kw	Proposed kw	Existing kWh / Year	Proposed kwH / Year	Annual Energy Saved	kWh $ Savings	kW $ Savings	Total Energy $ Savings	EX MX Cost	PR MX Cost	MX Savings	%age of job
27	Office Area	4,537	ET4232N	1	Existing Prismatic Troffer 2x4 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			RTK31-24T	1	Retrofit Kit, LED, 2x4 Troffer, 31 watts, 3000 lm, Lithonia 2VTLT Prism.	1	31	31	surface mount	4100	14.5	4,537	0.06	0.03	277	141	136	$6	$7	$13	$2	$0	$2	0.8%
28	Hall to Pool / Lockers	4,537	EW2217N	2	Existing Wrap 2' 2L F17 T8 Lamps, NBF Ballast	2	17	33			LAI	2	Leave existing fixture as is	2	17	33		4100	**0.0**	4,537	0.07	0.07	299	299	0	$0	$0	$0	$6	$0	$6	0.0%
29	Girls Locker	4,537	ECFLS23	5	Existing CFL Screw-in 23 watt Lamp(s)	1	23	23		30	10WLEDBR30	5	9.5 watt BR30 Style LED Lamp - Philips	1	9.5	9.5	can	4100	2.8	4,537	0.12	0.05	522	216	306	$13	$16	$28	$14	$0	$14	0.4%
30	Girls Locker	4,537	ET4232N	5	Existing Prismatic Troffer 2x4 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			RTK31-24T	5	Retrofit Kit, LED, 2x4 Troffer, 31 watts, 3000 lm, Lithonia 2VTLT Prism.	1	31	31		4100	14.5	4,537	0.31	0.16	1,384	703	681	$28	$35	$63	$11	$0	$11	3.9%
31	Girls Locker	4,537	EV8432N	1	Existing Vapor Tight 1x8 Fixture 4L F32 T8 32 watt Lamp(s), Normal Ballast Factor	4	32	112			LED19T84-4	1	Sylvania UltraLED External Driver T8 LED - 4 lamp - 19w/ea	4	19	76		4100	9.7	4,537	0.11	0.08	508	345	163	$7	$8	$15	$3	$0	$3	0.7%
32	Girls Locker	4,537	EW2217N	1	Existing Wrap 2' 2L F17 T8 Lamps, NBF Ballast	2	17	33			LAI	1	Leave existing fixture as is	2	17	33	on wall	4100	**0.0**	4,537	0.03	0.03	150	150	0	$0	$0	$0	$3	$0	$3	0.0%
33	Boys Locker	4,537	EW8432N	1	Existing Wrap 1x8 Fixture 4L F32 T8 32 watt Lamp(s), Normal Ballast Factor	4	32	112		25-30	LED19T84-4	1	Sylvania UltraLED External Driver T8 LED - 4 lamp - 19w/ea	4	19	76		4100	9.7	4,537	0.11	0.08	508	345	163	$7	$8	$15	$3	$0	$3	0.7%
34	Boys Locker	4,537	EW2217N	5	Existing Wrap 2' 2L F17 T8 Lamps, NBF Ballast	2	17	33			LAI	5	Leave existing fixture as is	2	17	33		4100	**0.0**	4,537	0.17	0.17	749	749	0	$0	$0	$0	$15	$0	$15	0.0%
35	Boys Locker	4,537	EV4232N	5	Existing Vapor Tight 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast	2	32	58	16.00		LED19T84-2	5	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38		4100	10.1	4,537	0.29	0.19	1,316	862	454	$19	$23	$42	$11	$0	$11	2.0%
36	Staff Only Door	4,537	ECFLP213	3	Existing CFL Pin Based with 2 - 13 watt Lamp(s)	2	13	30		15	LAI	3	Leave existing fixture as is	2	13	30	8x8, ceiling mount	4100	**0.0**	4,537	0.09	0.09	408	408	0	$0	$0	$0	$12	$0	$12	0.0%
37	Pool	4,537	EWMH250	8	Existing Wall Pack Metal Halide 250 watt Lamp	1	250	295	10.00	10-15	NWPLED104	8	New LED Wallpack Rab104 - 113 watts	1	104	113	forward. **JST: MOUNT UPWARDS TO LIGHT CEILING**	4100	7.5	4,537	2.36	0.90	10,707	4,101	6,606	$271	$338	$608	$115	$0	$115	20.0%
38	Pool	4,537	EAM4232N	6	Existing Angle Mount Fixture 4' 2L F32 T8 Lamps, NBF Ballast	2	32	58	12.00		LED19T84-2	6	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38		4100	10.1	4,537	0.35	0.23	1,579	1,034	544	$22	$28	$50	$14	$0	$14	2.4%
39	Stairs Up / Landing on 2	4,537	ECFLS23	8	Existing CFL Screw-in 23 watt Lamp(s)	1	23	23			8WLEDA19	8	8 watt A-19 Style LED Lamp - Slim	1	8	8	4L chandeliers	4100	2.0	4,537	0.18	0.06	835	290	544	$22	$28	$50	$22	$0	$22	0.5%
40	Gym	**2,949**	EF4654H	10	Existing Fixture 4' 6L F54 T5 Lamps, HBF Ballast	6	54	354	22.00	75-85	LAI	10	Leave existing fixture as is	6	54	354	existing has cage. surface mount. already sensored	4100	**0.0**	2,949	3.54	3.54	10,440	10,440	0	$0	$0	$0	$74	$0	$74	0.0%
41	Gym	4,537	EW4232N	10	Existing Wrap 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61	22.00		NVPLED32	10	New 1x4 LED VT LED 32W - P-2	1	32	32	need cages	4100	23.4	4,537	0.61	0.32	2,768	1,452	1,316	$54	$67	$121	$23	$0	$23	12.4%
42	Stairs	4,537	EW8432N	1	Existing Wrap 1x8 Fixture 4L F32 T8 32 watt Lamp(s), Normal Ballast Factor	4	32	112		35	LED19T84-4	1	Sylvania UltraLED External Driver T8 LED - 4 lamp - 19w/ea	4	19	76		4100	9.7	4,537	0.11	0.08	508	345	163	$7	$8	$15	$3	$0	$3	0.7%
43	Stairs	4,537	EW3225N	1	Existing Wrap 3' 2L F25 T8 Lamps, NBF Ballast	2	25	44			LAI	1	Leave existing fixture as is	2	25	44	on wall	4100	**0.0**	4,537	0.04	0.04	200	200	0	$0	$0	$0	$3	$0	$3	0.0%
44	Boxing Room	4,537	EW4232N	9	Existing Wrap 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			NVPLED32	9	New 1x4 LED VT LED 32W - P-2	1	32	32	no covers. lots of daylight	4100	23.4	4,537	0.55	0.29	2,491	1,307	1,184	$49	$61	$109	$20	$0	$20	11.1%
45	Boxing Room	4,537	ES8432N	3	Existing Strip 1x8 Fixture 4L F32 T8 32 watt Lamp(s), Normal Ballast Factor	4	32	112			LED19T84-4	3	Sylvania UltraLED External Driver T8 LED - 4 lamp - 19w/ea	4	19	76	lots of daylight	4100	9.7	4,537	0.34	0.23	1,524	1,034	490	$20	$25	$45	$10	$0	$10	2.0%
46	Storage in Boxing	520	ECFLS23	1	Existing CFL Screw-in 23 watt Lamp(s)	1	23	23			8WLEDA19	1	8 watt A-19 Style LED Lamp - Slim	1	8	8		4100	4.4	520	0.02	0.01	12	4	8	$0	$3	$4	$0	$0	$0	0.1%
47	Janitor Closet	520	EINC40	1	Existing Incandescent 40 watt Lamp(s)	1	40	40			6WLEDA19	1	6.5 watt A-19 Style LED Lamp	1	6.5	6.5		4100	2.3	520	0.04	0.01	21	3	17	$1	$8	$8	$1	$0	$1	0.1%
48	Up Hatch	520	ECFLS85	1	Existing 85 watt Screw-in CFL Lamp	1	85	85			19WLEDA21	1	19 watt A-21 Style LED Lamp	1	19	19		4100	1.3	520	0.09	0.02	44	10	34	$1	$15	$17	$5	$0	$5	0.1%
49	Up Hatch	520	EINC100	3	Existing Incandescent 100 watt Lamp(s)	1	100	100			19WLEDA21	3	19 watt A-21 Style LED Lamp	1	19	19		4100	1.3	520	0.30	0.06	156	30	126	$5	$56	$62	$2	$0	$2	0.3%
50	Yoga Room	4,537	ES8832N	6	Existing Strip 1x8 Fixture 8L F32 T8 32 watt Lamp(s), Normal Ballast Factor	8	32	224	14.00		SKR8428N	6	Strip Kit with Reflector 1X8' 4, 4'L, F32 T8 28 watt Lamp(s), Normal Ballast Factor	4	28	96	lots of daylight	4100	2.8	4,537	1.34	0.58	6,098	2,613	3,484	$143	$178	$321	$41	$14	$26	3.6%

City and County of Denver, CO - 20th Street Rec Center ~ OPTIMIZED OPTION: HYBRID

Line	Location	EX Hours	EX Code	EX Qty	EX Desc	Lamps	EX Watts/ Lamp	EX Input Watts	Mounting Height	EX FC	PR Code	PR Qty	PR Desc	PR Lamp Qty	PR Watts/ Lamp	PR Input Watts	Audit Notes	Lamp Color	ECM SPB	PR Hours	Existing kw	Proposed kw	Existing kWh / Year	Proposed kwH / Year	Annual Energy Saved	kWh $ Savings	kW $ Savings	Total Energy $ Savings	EX MX Cost	PR MX Cost	MX Savings	%age of job
51	Yoga Room	4,537	ES4432N	3	Existing Strip 4' 4L F32 T8 32 watt Lamp(s), Normal Ballast Factor	4	32	112			SKR4228N	3	Strip Kit with Reflector 4' 2L F32 T8 28 watt Lamp(s), Normal Ballast	2	28	48	lots of daylight	4100	4.2	4,537	0.34	0.14	1,524	653	871	$36	$45	$80	$10	$4	$6	1.3%
52	Elevator Lobby	4,537	ECFLS23	1	Existing CFL Screw-in 23 watt Lamp(s)	1	23	23			8WLEDA19	1	8 watt A-19 Style LED Lamp - Slim	1	8	8		4100	2.0	4,537	0.02	0.01	104	36	68	$3	$3	$6	$3	$0	$3	0.1%
53	Exterior	4,380	EFHPS100	2	Existing Fixture High Pressure Sodium 100 watt Lamp	1	100	130			LEDR24	2	24 watt HID Replacement Lamp-Light Efficient Design - bypass ballast	1	24	24	pendant mount acorn - Historic teardrop type	4100	7.6	4,380	0.26	0.05	1,139	210	929	$38		$38	$26	$0	$26	1.8%
Total		3,898		201					22			201							**9.4**	3897.7	18.7	11.5	75249	44409	30840	$1,264	$1,618	$2,882	$735	$19	$716	1.0

City and County of Denver, CO - Barnum Library ~ OPTIMIZED OPTION: HYBRID

Line	Location	EX Hours	EX Code	EX Qty	EX Desc	Lamps	EX Watts/ Lamp	EX Input Watts	Mounting Height	EX FC	PR Code	PR Qty	PR Desc	PR Lamp Qty	PR Watts/ Lamp	PR Input Watts	Audit Notes	Lamp Color	ECM SPB	PR Hours	Existing kw	Proposed kw	Existing kWh / Year	Proposed kwH / Year	Annual Energy Saved	kWh $ Savings	kW $ Savings	Total Energy $ Savings	EX MX Cost	PR MX Cost	MX Savings	%age of job
1	Entry / Hall	2,660	EINC65	2	Existing Incandescent 65 watt Lamp(s)	1	65	65		10-15	10WLEDBR30	2	9.5 watt BR30 Style LED Lamp - Philips	1	9.5	9.5	br30 can	4100	1.1	2,660	0.13	0.02	346	51	295	$12	$26	$38	$5	$0	$5	0.2%
2	Entry / Hall	2,660	ECFLS26	8	Existing CFL Screw-in 26 watt Lamp(s)	1	26	26			10WLEDBR30	8	9.5 watt BR30 Style LED Lamp - Philips	1	9.5	9.5	can	4100	3.4	2,660	0.21	0.08	553	202	351	$14	$31	$45	$13	$0	$13	0.6%
3	Entry / Hall	2,660	EINC75	1	Existing Incandescent 75 watt Lamp(s)	1	75	75			10WLEDBR30	1	9.5 watt BR30 Style LED Lamp - Philips	1	9.5	9.5	par 30 can	4100	1.0	2,660	0.08	0.01	200	25	174	$7	$15	$22	$3	$0	$3	0.1%
4	Entry / Hall	2,660	ECFLS23	2	Existing CFL Screw-in 23 watt Lamp(s)	1	23	23			10WLEDBR30	2	9.5 watt BR30 Style LED Lamp - Philips	1	9.5	9.5	can	4100	3.9	2,660	0.05	0.02	122	51	72	$3	$6	$9	$3	$0	$3	0.2%
5	Meeting Room	2,660	ECFLS23	1	Existing CFL Screw-in 23 watt Lamp(s)	1	23	23		5-10	10WLEDBR30	1	9.5 watt BR30 Style LED Lamp - Philips	1	9.5	9.5	can	4100	3.9	2,660	0.02	0.01	61	25	36	$1	$3	$5	$2	$0	$2	0.1%
6	Meeting Room	2,660	ECFLS26	1	Existing CFL Screw-in 26 watt Lamp(s)	1	26	26			10WLEDBR30	1	9.5 watt BR30 Style LED Lamp - Philips	1	9.5	9.5	can	4100	3.4	2,660	0.03	0.01	69	25	44	$2	$4	$6	$2	$0	$2	0.1%
7	Meeting Room	2,660	EINC65	1	Existing Incandescent 65 watt Lamp(s)	1	65	65			10WLEDBR30	1	9.5 watt BR30 Style LED Lamp - Philips	1	9.5	9.5	br30 can	4100	1.1	2,660	0.07	0.01	173	25	148	$6	$13	$19	$3	$0	$3	0.1%
8	Meeting Room	**1,729**	ET4232N	24	Existing Prismatic Troffer 2x4 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61		90	LED19T84-2	24	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38	surface mount. already sensored	4100	14.2	1,729	1.46	0.91	2,531	1,577	954	$39	$128	$167	$21	$0	$21	8.4%
9	Mens RR	2,660	EW4232N	3	Existing Wrap 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61		45	LED19T84-2	3	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38	in line cmdt?	4100	12.1	2,660	0.18	0.11	487	303	184	$8	$16	$24	$4	$0	$4	1.1%
10	Womens RR	2,660	EW4232N	3	Existing Wrap 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LED19T84-2	3	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38	in line cmdt?	4100	12.1	2,660	0.18	0.11	487	303	184	$8	$16	$24	$4	$0	$4	1.1%
11	Closet between RRs	520	ECFLS23	1	Existing CFL Screw-in 23 watt Lamp(s)	1	23	23			8WLEDA19	1	8 watt A-19 Style LED Lamp - Slim	1	8	8		4100	4.6	520	0.02	0.01	12	4	8	$0	$3	$4	$0	$0	$0	0.1%
12	Main Library Area	2,660	ECFLS26	26	Existing CFL Screw-in 26 watt Lamp(s)	1	26	26		75	10WLEDBR30	26	9.5 watt BR30 Style LED Lamp - Philips	1	9.5	9.5	can	4100	3.4	2,660	0.68	0.25	1,798	657	1,141	$47	$99	$146	$41	$0	$41	2.0%
13	Main Library Area	2,660	EINC75	4	Existing Incandescent 75 watt Lamp(s)	1	75	75			10WLEDBR30	4	9.5 watt BR30 Style LED Lamp - Philips	1	9.5	9.5	br30 can	4100	1.0	2,660	0.30	0.04	798	101	697	$29	$61	$89	$11	$0	$11	0.3%
14	Main Library Area	2,660	ECFLS32	1	Existing CFL Screw-in 32 watt Lamp(s)	1	32	32			10WLEDBR30	1	9.5 watt BR30 Style LED Lamp - Philips	1	9.5	9.5	can	4100	2.6	2,660	0.03	0.01	85	25	60	$2	$5	$8	$2	$0	$2	0.1%
15	Main Library Area	2,660	ECFLS23	7	Existing CFL Screw-in 23 watt Lamp(s)	1	23	23			10WLEDBR30	7	9.5 watt BR30 Style LED Lamp - Philips	1	9.5	9.5	can	4100	3.9	2,660	0.16	0.07	428	177	251	$10	$22	$32	$11	$0	$11	0.5%
16	Main Library Area	2,660	ET4232N	24	Existing Prismatic Troffer 2x4 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LED19T84-2	24	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38	surface mount	4100	12.1	2,660	1.46	0.91	3,894	2,426	1,468	$60	$128	$188	$32	$0	$32	8.4%
17	Main Library Area	2,660	ET14232N	6	Existing Prismatic Troffer 1x4 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LED19T84-2	6	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38	surface mount	4100	12.1	2,660	0.37	0.23	974	606	367	$15	$32	$47	$8	$0	$8	2.1%
18	Main Library Area	2,660	ET4232N	33	Existing Prismatic Troffer 2x4 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LED19T84-2	33	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38	recessed	4100	12.1	2,660	2.01	1.25	5,355	3,336	2,019	$83	$176	$259	$44	$0	$44	11.6%
19	Main Library Area	2,660	ECFLS26	4	Existing CFL Screw-in 26 watt Lamp(s)	1	26	26			10WLEDBR30	4	9.5 watt BR30 Style LED Lamp - Philips	1	9.5	9.5	surface mount drum	4100	3.4	2,660	0.10	0.04	277	101	176	$7	$15	$22	$6	$0	$6	0.3%
20	Reception Counter	2,660	ECFLP18	10	Existing CFL Pin Based 18 watt Lamp(s)	1	18	22		30	LAI	10	Leave existing fixture as is	1	18	22	4 pin, can, horizontal	4100	**0.0**	2,660	0.22	0.22	585	585	0	$0	$0	$0	$14	$0	$14	0.0%
21	Reception Counter	2,660	ECFLS26	3	Existing CFL Screw-in 26 watt Lamp(s)	1	26	26			10WLEDBR30	3	9.5 watt BR30 Style LED Lamp - Philips	1	9.5	9.5	can	4100	3.4	2,660	0.08	0.03	207	76	132	$5	$11	$17	$5	$0	$5	0.2%
22	Work Area behind Reception	2,660	EINC65	1	Existing Incandescent 65 watt Lamp(s)	1	65	65		45	10WLEDBR30	1	9.5 watt BR30 Style LED Lamp - Philips	1	9.5	9.5	br30 can	4100	1.1	2,660	0.07	0.01	173	25	148	$6	$13	$19	$3	$0	$3	0.1%
23	Work Area behind Reception	2,660	EW4232N	6	Existing Wrap 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LED19T84-2	6	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38		4100	12.1	2,660	0.37	0.23	974	606	367	$15	$32	$47	$8	$0	$8	2.1%
24	Work Area behind Reception	2,660	ECFLS23	2	Existing CFL Screw-in 23 watt Lamp(s)	1	23	23			10WLEDBR30	2	9.5 watt BR30 Style LED Lamp - Philips	1	9.5	9.5	can	4100	3.9	2,660	0.05	0.02	122	51	72	$3	$6	$9	$3	$0	$3	0.2%
25	Work Area behind Reception	2,660	ES4232N	3	Existing Strip 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LED19T84-2	3	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38	pendant mount	4100	12.1	2,660	0.18	0.11	487	303	184	$8	$16	$24	$4	$0	$4	1.1%
26	Janitor Closet	520	ECFLS65	1	Existing 65 watt Screw-in CFL Lamp	1	65	65			9WLEDA19	1	9.5 watt A-19 Style LED Lamp	1	9.5	9.5		4100	1.3	520	0.07	0.01	34	5	29	$1	$13	$14	$4	$0	$4	0.1%
27	Restroom	2,660	ECFLS23	2	Existing CFL Screw-in 23 watt Lamp(s)	1	23	23			8WLEDA19	2	8 watt A-19 Style LED Lamp - Slim	1	8	8	2L vanity	4100	2.8	2,660	0.05	0.02	122	43	80	$3	$7	$10	$3	$0	$3	0.1%

City and County of Denver, CO - Barnum Library ~ OPTIMIZED OPTION: HYBRID

Line	Location	EX Hours	EX Code	EX Qty	EX Desc	Lamps	EX Watts/ Lamp	EX Input Watts	Mounting Height	EX FC	PR Code	PR Qty	PR Desc	PR Lamp Qty	PR Watts/ Lamp	PR Input Watts	Audit Notes	Lamp Color	ECM SPB	PR Hours	Existing kw	Proposed kw	Existing kWh / Year	Proposed kwH / Year	Annual Energy Saved	kWh $ Savings	kW $ Savings	Total Energy $ Savings	EX MX Cost	PR MX Cost	MX Savings	%age of job
28	Breakroom	2,660	ET2217N	3	Existing Troffer 2x2 2L F17 T8 Lamps, NBF Ballast	2	17	33		30	LAI	3	Leave existing fixture as is	2	17	33	surface mount	4100	**0.0**	2,660	0.10	0.10	263	263	0	$0	$0	$0	$5	$0	$5	0.0%
29	Breakroom	2,660	ECFLS23	1	Existing CFL Screw-in 23 watt Lamp(s)	1	23	23			8WLEDA19	1	8 watt A-19 Style LED Lamp - Slim	1	8	8	wall mount	4100	2.8	2,660	0.02	0.01	61	21	40	$2	$3	$5	$2	$0	$2	0.1%
30	Employee Entry	2,660	ECFLS23	1	Existing CFL Screw-in 23 watt Lamp(s)	1	23	23			8WLEDA19	1	8 watt A-19 Style LED Lamp - Slim	1	8	8	square recessed can	4100	2.8	2,660	0.02	0.01	61	21	40	$2	$3	$5	$2	$0	$2	0.1%
31	Staff Room in Main Library (right of Reception)	**1,729**	ET4232N	1	Existing Prismatic Troffer 2x4 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LED19T84-2	1	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38	already sensored	4100	14.2	1,729	0.06	0.04	105	66	40	$2	$5	$7	$1	$0	$1	0.4%
32	Office to Right	2,660	ET4232N	1	Existing Prismatic Troffer 2x4 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LED19T84-2	1	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38		4100	12.1	2,660	0.06	0.04	162	101	61	$3	$5	$8	$1	$0	$1	0.4%
33	Stairs to Basement	2,660	EINC60	1	Existing Incandescent 60 watt Lamp(s)	1	60	60			8WLEDA19	1	8 watt A-19 Style LED Lamp - Slim	1	8	8		4100	0.9	2,660	0.06	0.01	160	21	138	$6	$12	$18	$3	$0	$3	0.1%
34	Stairs to Basement	2,660	ECFLS18	1	Existing CFL Screw-in 18 watt Lamp(s)	1	18	18			8WLEDA19	1	8 watt A-19 Style LED Lamp - Slim	1	8	8		4100	4.0	2,660	0.02	0.01	48	21	27	$1	$2	$3	$1	$0	$1	0.1%
35	Basement Door Right	2,660	ES4232N	6	Existing Strip 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LED19T84-2	6	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38		4100	12.1	2,660	0.37	0.23	974	606	367	$15	$32	$47	$8	$0	$8	2.1%
36	Basement Door Right	2,660	ES4234N	9	Existing Strip 4' 2 Lamp(s) F34 T12 Standard Ballast	2	34	82			LED19T84-2	9	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38		4100	6.8	2,660	0.74	0.34	1,963	910	1,053	$43	$92	$135	$12	$0	$12	3.2%
37	Basement Door Left	2,660	ES4232N	20	Existing Strip 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LED19T84-2	20	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38		4100	12.1	2,660	1.22	0.76	3,245	2,022	1,224	$50	$107	$157	$27	$0	$27	7.0%
38	Basement Door Left	2,660	ES4234N	67	Existing Strip 4' 2 Lamp(s) F34 T12 Standard Ballast	2	34	82			LED19T84-2	67	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38		4100	6.8	2,660	5.49	2.55	14,614	6,772	7,842	$322	$683	$1,005	$89	$0	$89	23.5%
39	Basement Door Left	2,660	EINC60	3	Existing Incandescent 60 watt Lamp(s)	1	60	60			8WLEDA19	3	8 watt A-19 Style LED Lamp - Slim	1	8	8		4100	0.9	2,660	0.18	0.02	479	64	415	$17	$36	$53	$8	$0	$8	0.2%
40	Basement Door Left	2,660	EW4232N	2	Existing Wrap 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LED19T84-2	2	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38		4100	12.1	2,660	0.12	0.08	325	202	122	$5	$11	$16	$3	$0	$3	0.7%
41	Exterior	4,380	EINC75	7	Existing Incandescent 75 watt Lamp(s)	1	75	75			10WLEDBR30	7	9.5 watt BR30 Style LED Lamp - Philips	1	9.5	9.5	br38	4100	1.5	4,380	0.53	0.07	2,300	291	2,008	$82		$82	$31	$0	$31	0.5%
42	Exterior	4,380	EWHPS100	2	Existing Wall Pack High Pressure Sodium 100 watt Lamp	1	100	130	12		NXTWLED30	2	New Cooper Crosstour LED Wallpack, 30 watts	1	30	30	forward	4100	12.7	4,380	0.26	0.06	1,139	263	876	$36		$36	$26	$0	$26	2.5%
43	Exterior	4,380	EWHPS70	8	Existing Wall Pack High Pressure Sodium 70 watt Lamp	1	70	91	12		NXTWLED30	8	New Cooper Crosstour LED Wallpack, 30 watts	1	30	30	semi	4100	16.5	4,380	0.73	0.24	3,189	1,051	2,137	$88		$88	$102	$0	$102	9.9%
44	Exterior	4,380	EINC300	3	Existing Incandescent 300 watt Lamp(s)	1	300	300			NFLED52	3	New LED Flood, Rab FFLED52 Flood, 54 watts	1	54	54	quartz halogen uplights, bronze, trunnion mount	4100	10.3	4,380	0.90	0.16	3,942	710	3,232	$133		$133	$39	$0	$39	5.6%
45	Exterior	4,380	ECHHPS100	2	Existing Cobra Head High Pressure Sodium 100 watt Lamp	1	100	130	30		NCHLED53	2	New LED Cobrahead Cree XSP1 53 watts	1	53	53	wood poles in parking lot	4100	17.4	4,380	0.26	0.11	1,139	464	675	$28		$28	$26	$0	$26	2.9%
Total		2,715		318					30			318							**10.1**	2714.6	19.7	9.6	55522	25586	29936	$1,227	$1,891	$3,118	$642	$0	$642	1.0

City and County of Denver, CO - Bear Valley Library – OPTIMIZED OPTION: HYBRID HYBRID

Line	Location	EX Hours	EX Code	EX Qty	EX Desc	Lamps	EX Watts/ Lamp	EX Input Watts	Mounting Height	EX FC	PR Code	PR Qty	PR Desc	PR Lamp Qty	PR Watts/ Lamp	PR Input Watts	Sensor Type	Sensor Qty	Audit Notes	Sensor Saving %	Lamp Color	ECM SPB	PR Hours	Existing kw	Proposed kw	Existing kWh / Year	Proposed kwH / Year	Annual Energy Saved	kWh $ Savings	kW $ Savings	Total Energy $ Savings	EX MX Cost	PR MX Cost	MX Savings	%age of job
1	Stairwell	2,660	EW4232N	2	Existing Wrap 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LED19T84-2	2	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38					4100	11.3	2,660	0.12	0.08	325	202	122	$5	$11	$16	$3	$0	$3	0.7%
2	Electrical Room in Childrens Area	520	ES4232N	1	Existing Strip 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LED19T84-2	1	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38					4100	17.1	520	0.06	0.04	32	20	12	$0	$5	$6	$0	$0	$0	0.4%
3	Elec Outside	520	ECFLS23	1	Existing CFL Screw-in 23 watt Lamp(s)	1	23	23			LAI	1	Leave existing fixture as is	1	23	23					4100	0.0	520	0.02	0.02	12	12	0	$0	$0	$0	$0	$0	$0	0.0%
4	Elec Upstairs	520	ES4232N	1	Existing Strip 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LED19T84-2	1	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38					4100	17.1	520	0.06	0.04	32	20	12	$0	$5	$6	$0	$0	$0	0.4%
5	Entry	2,660	ECFLP26	5	Existing CFL Pin Based 26 watt Lamp(s)	1	26	30			LAI	5	Leave existing fixture as is	1	26	30			6" can, 4 pin, horizontal		4100	0.0	2,660	0.15	0.15	399	399	0	$0	$0	$0	$7	$0	$7	0.0%
6	Main Library Area	2,660	ECFLP26	18	Existing CFL Pin Based 26 watt Lamp(s)	1	26	30		65-80	LAI	18	Leave existing fixture as is	1	26	30			6" can, 4 pin, horizontal		4100	0.0	2,660	0.54	0.54	1,436	1,436	0	$0	$0	$0	$26	$0	$26	0.0%
7	Main Library Area	2,660	ECFLP26	5	Existing CFL Pin Based 26 watt Lamp(s)	1	26	30			decom	5	Decommission / Remove Fixture	0		0			6" can, 4 pin, horizontal		4100	6.8	2,660	0.15	0.00	399	0	399	$16	$35	$51	$7	$0	$7	1.3%
8	Main Library Area	2,660	ES4132N	18	Existing Strip 4' 1L F32 T8 32 watt Lamp(s), Normal Ballast Factor	1	32	34			ReDeLED	1	Redesign with 12 New 2x4 39 watt LED Troffers, new ceiling tiles, removal of existing fixtures and tiles	12	39	468			above grid. See full layout and mock up		4100	109.8	2,660	0.61	0.47	1,628	1,245	383	$16	$33	$49	$18	$0	$18	25.0%
9	Main Library Area	2,660	ET14132N	12	Existing Prismatic Troffer 1x4 1L F32 T8 32 watt Lamp(s), Normal Ballast Factor	1	32	34			LED19T84-1	12	Sylvania UltraLED External Driver T8 LED - 1 lamp - 19w/ea	1	19	19					4100	12.7	2,660	0.41	0.23	1,085	606	479	$20	$42	$61	$12	$0	$12	3.2%
10	Main Library Area	2,660	ET4132N	4	Existing Prismatic Troffer 2x4 1L F32 T8 32 watt Lamp(s), Normal Ballast Factor	1	32	34			LED19T84-1	4	Sylvania UltraLED External Driver T8 LED - 1 lamp - 19w/ea	1	19	19			recessed wall wash		4100	12.7	2,660	0.14	0.08	362	202	160	$7	$14	$20	$4	$0	$4	1.1%
11	Main Library Area	2,660	ECFLP26	14	Existing CFL Pin Based 26 watt Lamp(s)	1	26	30			LAI	14	Leave existing fixture as is	1	26	30			6" can, 4 pin, horizontal		4100	0.0	2,660	0.42	0.42	1,117	1,117	0	$0	$0	$0	$20	$0	$20	0.0%
12	Main Library Area	2,660	ES8432N	11	Existing Strip 1x8 Fixture 4L F32 T8 32 watt Lamp(s), Normal Ballast Factor	4	32	112			LED19T84-4	11	Sylvania UltraLED External Driver T8 LED - 4 lamp - 19w/ea	4	19	76			pendant mount direct/indirect		4100	12.2	2,660	1.23	0.84	3,277	2,224	1,053	$43	$92	$135	$22	$0	$22	6.5%
13	Main Library Area	2,660	ES4232N	3	Existing Strip 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LED19T84-2	3	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38			pendant mount direct/indirect		4100	11.3	2,660	0.18	0.11	487	303	184	$8	$16	$24	$4	$0	$4	1.1%
14	Meeting Room to Right of Entry	2,660	ET14132N	11	Existing Prismatic Troffer 1x4 1L F32 T8 32 watt Lamp(s), Normal Ballast Factor	1	32	34		70	LED19T84-1	11	Sylvania UltraLED External Driver T8 LED - 1 lamp - 19w/ea	1	19	19	CM9	0.3		25%	4100	13.3	1,995	0.37	0.21	995	417	578	$24	$38	$62	$11	$0	$11	3.3%
15	Meeting Room to Right of Entry	2,660	ET14132N	3	Existing Prismatic Troffer 1x4 1L F32 T8 32 watt Lamp(s), Normal Ballast Factor	1	32	34		70	LED19T84-1	3	Sylvania UltraLED External Driver T8 LED - 1 lamp - 19w/ea	1	19	19	CM9	0.3	**3 with battery backup**	25%	4100	17.8	1,995	0.10	0.06	271	114	158	$6	$10	$17	$3	$0	$3	1.2%
16	Meeting Room to Right of Entry	2,660	ET4232N	5	Existing Prismatic Troffer 2x4 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			RTK31-24T	5	Retrofit Kit, LED, 2x4 Troffer, 31 watts, 3000 lm, Lithonia 2VTLT Prism.	1	31	31	CM9	0.3		25%	4100	18.8	1,995	0.31	0.16	811	309	502	$21	$35	$55	$7	$0	$7	3.9%
17	Janitor Closet	520	ES4232N	1	Existing Strip 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LED19T84-2	1	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38					4100	17.1	520	0.06	0.04	32	20	12	$0	$5	$6	$0	$0	$0	0.4%
18	Mens RR	1,729	ES8232N	1	Existing Strip 1x8 Fixture 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LED19T84-2	1	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38			**wall mount direct/indirect. already sensored**		4100	13.3	1,729	0.06	0.04	105	66	40	$2	$5	$7	$1	$0	$1	0.4%
19	Mens RR	1,729	ECFLP26	1	Existing CFL Pin Based 26 watt Lamp(s)	1	26	30			LAI	1	Leave existing fixture as is	1	26	30			**4 pin, 6" can, horizontal. already sensored**		4100	0.0	1,729	0.03	0.03	52	52	0	$0	$0	$0	$1	$0	$1	0.0%
20	Womens RR	1,729	ES4132N	3	Existing Strip 4' 1L F32 T8 32 watt Lamp(s), Normal Ballast Factor	1	32	34			LED19T84-1	3	Sylvania UltraLED External Driver T8 LED - 1 lamp - 19w/ea	1	19	19			**wall mount direct/indirect. already sensored**		4100	14.9	1,729	0.10	0.06	176	99	78	$3	$10	$14	$2	$0	$2	0.8%
21	Womens RR	1,729	ECFLP26	1	Existing CFL Pin Based 26 watt Lamp(s)	1	26	30			LAI	1	Leave existing fixture as is	1	26	30			**4 pin, 6" can, horizontal. already sensored**		4100	0.0	1,729	0.03	0.03	52	52	0	$0	$0	$0	$1	$0	$1	0.0%
22	Book Drop	2,660	ECFLS15	1	Existing CFL Screw-in 15 watt Lamp(s)	1	15	15			LAI	1	Leave existing fixture as is	1	15	15			ceiling mount		4100	0.0	2,660	0.02	0.02	40	40	0	$0	$0	$0	$1	$0	$1	0.0%
23	Reception Center	2,660	ECFLP26	4	Existing CFL Pin Based 26 watt Lamp(s)	1	26	30			LAI	4	Leave existing fixture as is	1	26	30			4 pin, 6" can, horizontal		4100	0.0	2,660	0.12	0.12	319	319	0	$0	$0	$0	$6	$0	$6	0.0%
24	Area Behind Reception	1,729	ET14132N	4	Existing Prismatic Troffer 1x4 1L F32 T8 32 watt Lamp(s), Normal Ballast Factor	1	32	34		55-60	LED19T84-1	4	Sylvania UltraLED External Driver T8 LED - 1 lamp - 19w/ea	1	19	19			**already sensored**		4100	14.9	1,729	0.14	0.08	235	131	104	$4	$14	$18	$3	$0	$3	1.1%

City and County of Denver, CO - Bear Valley Library – OPTIMIZED OPTION: HYBRID HYBRID

Line	Location	EX Hours	EX Code	EX Qty	EX Desc	Lamps	EX Watts/ Lamp	EX Input Watts	Mounting Height	EX FC	PR Code	PR Qty	PR Desc	PR Lamp Qty	PR Watts/ Lamp	PR Input Watts	Sensor Type	Sensor Qty	Audit Notes	Sensor Saving %	Lamp Color	ECM SPB	PR Hours	Existing kw	Proposed kw	Existing kWh / Year	Proposed kwH / Year	Annual Energy Saved	kWh $ Savings	kW $ Savings	Total Energy $ Savings	EX MX Cost	PR MX Cost	MX Savings	%age of job
25	Area Behind Reception	1,729	ET4232N	8	Existing Prismatic Troffer 2x4 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			RTK31-24T	8	Retrofit Kit, LED, 2x4 Troffer, 31 watts, 3000 lm, Lithonia 2VTLT Prism.	1	31	31			**already sensored**		4100	20.9	1,729	0.49	0.25	844	429	415	$17	$56	$73	$7	$0	$7	5.7%
26	Lounge	1,729	ET14132N	3	Existing Prismatic Troffer 1x4 1L F32 T8 32 watt Lamp(s), Normal Ballast Factor	1	32	34			LED19T84-1	3	Sylvania UltraLED External Driver T8 LED - 1 lamp - 19w/ea	1	19	19			**already sensored**		4100	14.9	1,729	0.10	0.06	176	99	78	$3	$10	$14	$2	$0	$2	0.8%
27	Upstairs Main	2,660	ECFLS23	12	Existing CFL Screw-in 23 watt Lamp(s)	1	23	23		55-65	12WLEDBR40	12	12 watt BR40 Style LED Lamp - Philips	1	12	12			screw-in can 7"		4100	6.1	2,660	0.28	0.14	734	383	351	$14	$31	$45	$19	$15	$4	1.0%
28	Upstairs Main	2,660	ECFLP18	9	Existing CFL Pin Based 18 watt Lamp(s)	1	18	22			LAI	9	Leave existing fixture as is	1	18	22			6" can, 4 pin, horizontal		4100	**0.0**	2,660	0.20	0.20	527	527	0	$0	$0	$0	$13	$0	$13	0.0%
29	Upstairs Main	2,660	EW4232N	76	Existing Wrap 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LED19T84-2	76	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38					4100	11.3	2,660	4.64	2.89	12,332	7,682	4,650	$191	$405	$596	$101	$0	$101	26.8%
30	Upstairs Main	2,660	ES4232N	12	Existing Strip 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LED19T84-2	12	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38			6 round fixtures with 2 - 2L strips each		4100	11.3	2,660	0.73	0.46	1,947	1,213	734	$30	$64	$94	$16	$0	$16	4.2%
31	Meeting Room A	2,660	EW4232N	3	Existing Wrap 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61		60	LED19T84-2	3	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38					4100	11.3	2,660	0.18	0.11	487	303	184	$8	$16	$24	$4	$0	$4	1.1%
32	Meeting B	2,660	EW4232N	5	Existing Wrap 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61		65	LED19T84-2	5	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38					4100	11.3	2,660	0.31	0.19	811	505	306	$13	$27	$39	$7	$0	$7	1.8%
33	Exterior	4,380	ECFLS27	8	Existing CFL Screw-in with 2 - 7 watt Lamp(s)	2	7	14			LAI	8	Leave existing fixture as is	2	7	14			ball lights		4100	**0.0**	4,380	0.11	0.11	491	491	0	$0		$0	$35	$0	$35	0.0%
34	Exterior	4,380	EWLED	2	Existing LED Wallpack with PC	1	30	30			LAI	2	Leave existing fixture as is	1	30	30					4100	**0.0**	4,380	0.06	0.06	263	263	0	$0		$0	$0	$0	$0	0.0%
35	Exterior	4,380	EINC75	3	Existing Incandescent 75 watt Lamp(s)	1	75	75			10WLEDBR30	3	9.5 watt BR30 Style LED Lamp - Philips	1	9.5	9.5			par 30 can		4100	1.4	4,380	0.23	0.03	986	125	861	$35		$35	$13	$0	$13	0.2%
36	Exterior	4,380	EINC75	2	Existing Incandescent 75 watt Lamp(s)	1	75	75			19WLEDP38	2	19 watt Par 38 LED Lamp	1	19	19			2L par directional flood		4100	3.1	4,380	0.15	0.04	657	166	491	$20		$20	$9	$4	$5	0.3%
37	Exterior	4,380	EFMV175	3	Existing Fixture Mercury Vapor 175 watt Lamp	1	175	205			RL55KITLED	3	Relume Acorn LED Retrofit 55w Deployable	1	55	55			post top		4100	18.1	4,380	0.62	0.17	2,694	723	1,971	$81		$81	$44	$0	$44	7.7%
Total		2,485		276					0			259						1.0		25%		**18.8**	2431.0	13.5	8.5	36627	22313	14314	$587	$980	$1,567	$428	$19	$409	1.0

City and County of Denver, CO - Eugene Field Library ~ OPTIMIZED OPTION: HYBRID HYBRID

Line	Location	EX Hours	EX Code	EX Qty	EX Desc	Lamps	EX Watts/ Lamp	EX Input Watts	Mounting Height	EX FC	PR Code	PR Qty	PR Desc	PR Lamp Qty	PR Watts/ Lamp	PR Input Watts	Sensor Type	Audit Notes	Sensor Saving %	Lamp Color	ECM SPB	PR Hours	Existing kw	Proposed kw	Existing kWh / Year	Proposed kwH / Year	Annual Energy Saved	kWh $ Savings	kW $ Savings	Total Energy $ Savings	EX MX Cost	PR MX Cost	MX Savings	%age of job
1	Entry	4,460	E8WLEDA19	5	Existing 8 watt A19 Style LED Lamp	1	8	8		25	LAI	5	Leave existing fixture as is	1	8	8				4100	**0.0**	4,460	0.04	0.04	178	178	0	$0	$0	$0	$0	$0	$0	0.0%
2	Entry	4,460	ECFLP213	2	Existing CFL Pin Based with 2 - 13 watt Lamp(s)	2	13	30			LAI	2	Leave existing fixture as is	2	13	30		can, horizontal		4100	**0.0**	4,460	0.06	0.06	268	268	0	$0	$0	$0	$8	$0	$8	0.0%
3	Meeting Room	**2,899**	EPT14232N	11	Existing Parabolic Troffer 1x4 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61		70	LED19T84-2	11	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38		**16 cell. already sensored**		4100	11.2	2,899	0.67	0.42	1,945	1,212	733	$30	$59	$89	$16	$0	$16	5.4%
4	Meeting Room with E ballast	**2,899**	EPT14232N	1	Existing Parabolic Troffer 1x4 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61		70	LED19T84-2	1	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38		**16 cell. already sensored, 1 with EB**		4100	11.2	2,899	0.06	0.04	177	110	67	$3	$5	$8	$1	$0	$1	0.5%
5	Meeting Room	4,460	E8WLEDA19	5	Existing 8 watt A19 Style LED Lamp	1	8	8			LAI	5	Leave existing fixture as is	1	8	8				4100	**0.0**	4,460	0.04	0.04	178	178	0	$0	$0	$0	$0	$0	$0	0.0%
6	Door in Meeting Room	4,460	ET2232N	3	Existing Prismatic Troffer 2x2 2L F32 T8 32 watt U-Tube Lamp(s), Normal Ballast Factor	2	32	61			RTK35-22T	3	Retrofit Kit, LED, 2x2 Troffer, 35 watts, 3300 lm, Lithonia 2VTLT Prism.	1	35	35				4100	12.7	4,460	0.18	0.11	816	468	348	$14	$18	$32	$17	$0	$17	2.9%
7	Womens RR	4,460	ECFLP213	1	Existing CFL Pin Based with 2 - 13 watt Lamp(s)	2	13	30			LAI	1	Leave existing fixture as is	2	13	30		can		4100	**0.0**	4,460	0.03	0.03	134	134	0	$0	$0	$0	$4	$0	$4	0.0%
8	Womens RR	4,460	ES4132N	3	Existing Strip 4' 1L F32 T8 32 watt Lamp(s), Normal Ballast Factor	1	32	34			LED19T84-1	3	Sylvania UltraLED External Driver T8 LED - 1 lamp - 19w/ea	1	19	19	WSDP DT	wall wash in cove	25%	4100	13.6	3,345	0.10	0.06	455	191	264	$11	$10	$21	$5	$0	$5	1.7%
9	Mens RR	4,460	ECFLP213	1	Existing CFL Pin Based with 2 - 13 watt Lamp(s)	2	13	30			LAI	1	Leave existing fixture as is	2	13	30	CMW	can	25%	4100	24.6	3,345	0.03	0.03	134	100	33	$1	$0	$1	$4	$0	$4	0.6%
10	Mens RR	4,460	ES4132N	2	Existing Strip 4' 1L F32 T8 32 watt Lamp(s), Normal Ballast Factor	1	32	34			LED19T84-1	2	Sylvania UltraLED External Driver T8 LED - 1 lamp - 19w/ea	1	19	19	CMW	wall wash in cove	25%	4100	17.3	3,345	0.07	0.04	303	127	176	$7	$7	$14	$3	$0	$3	1.4%
11	Mens RR	4,460	ES2117N	1	Existing Strip 2' 1L F17 T8 Lamp, NBF Ballast	1	17	17			LED10T82-1	1	Sylvania UltraLED 2' External Driver T8 LED - 1 lamp - 10w/ea	1	10	10	CMW	cove wall wash	25%	4100	41.7	3,345	0.02	0.01	76	33	42	$2	$2	$3	$2	$0	$2	1.0%
12	Main Library Area	4,460	E8WLEDA19	40	Existing 8 watt A19 Style LED Lamp	1	8	8			LAI	40	Leave existing fixture as is	1	8	8				4100	**0.0**	4,460	0.32	0.32	1,427	1,427	0	$0	$0	$0	$0	$0	$0	0.0%
13	Main Library Area	4,460	EPT14232N	90	Existing Parabolic Troffer 1x4 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61		80-95	LED19T84-2	90	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38		16 cell		4100	9.0	4,460	5.49	3.42	24,485	15,253	9,232	$379	$480	$858	$201	$0	$201	44.6%
14	Main Library Area with E ballast	4,460	EPT14232N	11	Existing Parabolic Troffer 1x4 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61		80-95	LED19T84-2	11	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38		16 cell, with EB		4100	9.0	4,460	0.67	0.42	2,993	1,864	1,128	$46	$59	$105	$25	$0	$25	5.4%
15	Main Library Area	4,460	ECFLP213	5	Existing CFL Pin Based with 2 - 13 watt Lamp(s)	2	13	30			LAI	5	Leave existing fixture as is	2	13	30		can, 2 pin, horizontal		4100	**0.0**	4,460	0.15	0.15	669	669	0	$0	$0	$0	$19	$0	$19	0.0%
16	Main Library Area	4,460	EBIAX346	5	Existing Fixture with 3L 46 watt Biax Lamps	3	46	138			LAI	5	Leave existing fixture as is	3	46	138		chandelier		4100	**0.0**	4,460	0.69	0.69	3,077	3,077	0	$0	$0	$0	$48	$0	$48	0.0%
17	Reception Counter	4,460	ES4232N	3	Existing Strip 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61		50	LED19T84-2	3	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38		pendant mount parabolic		4100	9.0	4,460	0.18	0.11	816	508	308	$13	$16	$29	$7	$0	$7	1.5%
18	Reception Counter	4,460	ES3225N	6	Existing Strip 3' 2L F25 T8 Lamps, NBF Ballast	2	25	44			LAI	6	Leave existing fixture as is	2	25	44		pendant mount parabolic		4100	**0.0**	4,460	0.26	0.26	1,177	1,177	0	$0	$0	$0	$11	$0	$11	0.0%
19	Behind Reception	4,460	ET2217N	14	Existing Troffer 2x2 2L F17 T8 Lamps, NBF Ballast	2	17	33		65-70	LED10T82-2	14	Sylvania UltraLED 2' External Driver T8 LED - 2 lamp - 10w/ea	2	10	20		surface mount		4100	12.8	4,460	0.46	0.28	2,061	1,249	812	$33	$42	$75	$41	$0	$41	6.9%
20	Kitchen	**2,899**	ET2217N	2	Existing Troffer 2x2 2L F17 T8 Lamps, NBF Ballast	2	17	33		50	LED10T82-2	2	Sylvania UltraLED 2' External Driver T8 LED - 2 lamp - 10w/ea	2	10	20		**already sensored**		4100	16.5	2,899	0.07	0.04	191	116	75	$3	$6	$9	$4	$0	$4	1.0%
21	Office	4,460	ET2217N	2	Existing Troffer 2x2 2L F17 T8 Lamps, NBF Ballast	2	17	33		45	LED10T82-2	2	Sylvania UltraLED 2' External Driver T8 LED - 2 lamp - 10w/ea	2	10	20				4100	12.8	4,460	0.07	0.04	294	178	116	$5	$6	$11	$6	$0	$6	1.0%
22	Upstairs	4,460	ES4232N	9	Existing Strip 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LED19T84-2	9	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38		parabolic		4100	9.0	4,460	0.55	0.34	2,449	1,525	923	$38	$48	$86	$20	$0	$20	4.5%
23	Storage	**250**	EW4232N	3	Existing Wrap 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LAI	3	Leave existing fixture as is	2	32	61		**already sensored**		4100	**0.0**	250	0.18	0.18	46	46	0	$0	$0	$0	$0	$0	$0	0.0%
24	Womens RR	**2,899**	EW4232N	1	Existing Wrap 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LED19T84-2	1	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38		**already sensored**		4100	11.2	2,899	0.06	0.04	177	110	67	$3	$5	$8	$1	$0	$1	0.5%
25	Womens RR	**2,899**	E8WLEDA19	1	Existing 8 watt A19 Style LED Lamp	1	8	8			LAI	1	Leave existing fixture as is	1	8	8		**already sensored**		4100	**0.0**	2,899	0.01	0.01	23	23	0	$0	$0	$0	$0	$0	$0	0.0%
26	Mens RR	**2,899**	EW4232N	1	Existing Wrap 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LED19T84-2	1	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38		**already sensored**		4100	11.2	2,899	0.06	0.04	177	110	67	$3	$5	$8	$1	$0	$1	0.5%
27	Mens RR	**2,899**	E8WLEDA19	1	Existing 8 watt A19 Style LED Lamp	1	8	8			LAI	1	Leave existing fixture as is	1	8	8		**already sensored**		4100	**0.0**	2,899	0.01	0.01	23	23	0	$0	$0	$0	$0	$0	$0	0.0%

City and County of Denver, CO - Eugene Field Library ~ OPTIMIZED OPTION: HYBRID HYBRID

Line	Location	EX Hours	EX Code	EX Qty	EX Desc	Lamps	EX Watts/ Lamp	EX Input Watts	Mounting Height	EX FC	PR Code	PR Qty	PR Desc	PR Lamp Qty	PR Watts/ Lamp	PR Input Watts	Sensor Type	Audit Notes	Sensor Saving %	Lamp Color	ECM SPB	PR Hours	Existing kw	Proposed kw	Existing kWh / Year	Proposed kwH / Year	Annual Energy Saved	kWh $ Savings	kW $ Savings	Total Energy $ Savings	EX MX Cost	PR MX Cost	MX Savings	%age of job
28	Water Heater Room Upstairs	**250**	ES4234N	1	Existing Strip 4' 2 Lamp(s) F34 T12 Standard Ballast	2	34	82			LAI	1	Leave existing fixture as is	2	34	82		**parabolic. already sensored**		4100	**0.0**	250	0.08	0.08	21	21	0	$0	$0	$0	$0	$0	$0	$0	0.0%
29	Study Room 1 on 1st Floor	4,460	EF6425N	1	Existing Fixture 1x6' with 4L F25 T8 Lamps, NBF Ballast	4	25	130			LAI	1	Leave existing fixture as is	4	25	130				4100	**0.0**	4,460	0.13	0.13	580	580	0	$0	$0	$0	$5	$0	$5	0.0%
30	Study Room 2 on 1st Floor	4,460	EF6425N	1	Existing Fixture 1x6' with 4L F25 T8 Lamps, NBF Ballast	4	25	130			LAI	1	Leave existing fixture as is	4	25	130				4100	**0.0**	4,460	0.13	0.13	580	580	0	$0	$0	$0	$5	$0	$5	0.0%
31	Roof	520	EINC100	4	Existing Incandescent 100 watt Lamp(s)	1	100	100			19WLEDA21	4	19 watt A-21 Style LED Lamp	1	19	19				4100	1.3	520	0.40	0.08	208	40	168	$7	$75	$82	$3	$0	$3	0.5%
32	Exit Only Door by Study Rooms	520	ET2217N	1	Existing Troffer 2x2 2L F17 T8 Lamps, NBF Ballast	2	17	33			LED10T82-2	1	Sylvania UltraLED 2' External Driver T8 LED - 2 lamp - 10w/ea	2	10	20				4100	29.3	520	0.03	0.02	17	10	7	$0	$3	$3	$0	$0	$0	0.5%
33	Ext Door to Janitor Storage	520	ES4232N	2	Existing Strip 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LAI	2	Leave existing fixture as is	2	32	61				4100	**0.0**	520	0.12	0.12	63	63	0	$0	$0	$0	$1	$0	$1	0.0%
34	Exterior	4,380	ECLHPS50	5	Existing Can Light High Pressure Sodium 50 watt Lamp	1	50	66			LEDR20	5	20 watt Mini HID Replacement Lamp-Light Efficient Design - bypass ballast	1	20	20		recessed can 6", vertical		4100	7.5	4,380	0.33	0.10	1,445	438	1,007	$41		$41	$64	$0	$64	3.7%
35	Exterior	4,380	EFHPS50	4	Existing Fixture High Pressure Sodium 50 watt Lamp	1	50	66			LEDR20	4	20 watt Mini HID Replacement Lamp-Light Efficient Design - bypass ballast	1	20	20		bollard, vertical		4100	7.5	4,380	0.26	0.08	1,156	350	806	$33		$33	$51	$0	$51	2.9%
36	Exterior	4,380	EWHPS100	7	Existing Wall Pack High Pressure Sodium 100 watt Lamp	1	100	130	10		NXTWLED30P	7	New Cooper Crosstour LED Wallpack, 30 watts + Photocell	1	30	30		forward		4100	12.9	4,380	0.91	0.21	3,986	920	3,066	$126		$126	$89	$0	$89	13.0%
Total		3,588		255					0			255							25%		**13.0**	3463.7	12.9	8.2	52806	33360	19447	$797	$847	$1,644	$661	$0	$661	1.0

City and County of Denver, CO - Schlessman Family Library ~ OPTIMIZED OPTION: HYBRID HYBRID

Line	Location	EX Hours	EX Code	EX Qty	EX Desc	Lamps	EX Watts/ Lamp	EX Input Watts	Mounting Height	EX FC	PR Code	PR Qty	PR Desc	PR Lamp Qty	PR Watts/ Lamp	PR Input Watts	Sensor Type	Audit Notes	Sensor Saving %	Lamp Color	ECM SPB	PR Hours	Existing kw	Proposed kw	Existing kWh / Year	Proposed kwH / Year	Annual Energy Saved	kWh $ Savings	kW $ Savings	Total Energy $ Savings	EX MX Cost	PR MX Cost	MX Savings	%age of job
1	Entry	3,504	ECFLP26	2	Existing CFL Pin Based 26 watt Lamp(s)	1	26	30			LAI	2	Leave existing fixture as is	1	26	30		6" can, vertical, hard lid		4100	0.0	3,504	0.06	0.06	210	210	0	$0	$0	$0	$4	$0	$4	0.0%
2	Main Library Area - 1st Floor	3,504	ECFLP26	16	Existing CFL Pin Based 26 watt Lamp(s)	1	26	30		95	LAI	16	Leave existing fixture as is	1	26	30		6" can, vertical, hard lid		4100	0.0	3,504	0.48	0.48	1,682	1,682	0	$0	$0	$0	$30	$0	$30	0.0%
3	Main Library Area - 1st Floor	3,504	ECFLP26	9	Existing CFL Pin Based 26 watt Lamp(s)	1	26	30			LAI	9	Leave existing fixture as is	1	26	30		6" can, horizontal, hard lid		4100	0.0	3,504	0.27	0.27	946	946	0	$0	$0	$0	$17	$0	$17	0.0%
4	Main Library Area - 1st Floor	3,504	ECFLP26	6	Existing CFL Pin Based 26 watt Lamp(s)	1	26	30			LAI	6	Leave existing fixture as is	1	26	30		4 pin, round, wall mount		4100	0.0	3,504	0.18	0.18	631	631	0	$0	$0	$0	$11	$0	$11	0.0%
5	Main Library Area - 1st Floor	3,504	ES12354H	10	Existing Direct/Indirect Strip 12' 3L F54 T5 Lamps, HBF Ballast	3	54	180	20		LAI	10	Leave existing fixture as is	3	54	180		pendant mount.		4100	0.0	3,504	1.80	1.80	6,307	6,307	0	$0	$0	$0	$44	$0	$44	0.0%
6	Main Library Area - 1st Floor NE CORNER	3,504	ES12354H	2	Existing Direct/Indirect Strip 12' 3L F54 T5 Lamps, HBF Ballast	3	54	180	20		LAI	2	Leave existing fixture as is	3	54	180	PC	pendant mount. control with PC	25%	4100	6.9	2,628	0.36	0.36	1,261	946	315	$13	$0	$13	$9	$0	$9	0.8%
7	Main Library Area - 1st Floor	3,504	ES8254H	35	Existing Direct/Indirect Strip 8' 2L F54 T5 Lamps, HBF Ballast	2	54	120	20		LAI	35	Leave existing fixture as is	2	54	120		pendant mount.		4100	0.0	3,504	4.20	4.20	14,717	14,717	0	$0	$0	$0	$123	$0	$123	0.0%
8	Main Library Area - 1st Floor NE CORNER	3,504	ES8254H	6	Existing Direct/Indirect Strip 8' 2L F54 T5 Lamps, HBF Ballast	2	54	120	20		LAI	6	Leave existing fixture as is	2	54	120	PC	pendant mount. control with PC	25%	4100	3.2	2,628	0.72	0.72	2,523	1,892	631	$26	$0	$26	$21	$0	$21	0.8%
9	Main Library Area - 1st Floor	3,504	EPT4332N	7	Existing Parabolic Troffer 2x4 3L F32 T8 32 watt Lamp(s), Normal Ballast Factor	3	32	92			RTK40-24D	7	Retrofit Kit, LED, 2x4 Troffer, 40 watts, 4000 lm, Lithonia 2VTL DCP	1	40	40		18 cell		4100	11.2	3,504	0.64	0.28	2,257	981	1,275	$52	$84	$137	$15	$0	$15	9.4%
10	Main Library Area - 1st Floor	3,504	ELEDMR16	11	Existing LED MR16 Lamp	1	6	6			LAI	11	Leave existing fixture as is	1	6	6				4100	0.0	3,504	0.07	0.07	231	231	0	$0	$0	$0	$0	$0	$0	0.0%
11	Main Library Area - 1st Floor	3,504	ECFLP26	4	Existing CFL Pin Based 26 watt Lamp(s)	1	26	30			LAI	4	Leave existing fixture as is	1	26	30		7" can, horizontal with lens		4100	0.0	3,504	0.12	0.12	420	420	0	$0	$0	$0	$7	$0	$7	0.0%
12	Main Library Area - 1st Floor	3,504	ES4132N	5	Existing Strip 4' 1L F32 T8 32 watt Lamp(s), Normal Ballast Factor	1	32	34			LED19T84-1	5	Sylvania UltraLED External Driver T8 LED - 1 lamp - 19w/ea	1	19	19		wall washer		4100	12.2	3,504	0.17	0.10	596	333	263	$11	$17	$28	$7	$0	$7	2.3%
13	Reception Counter	3,504	EPT4332N	4	Existing Parabolic Troffer 2x4 3L F32 T8 32 watt Lamp(s), Normal Ballast Factor	3	32	92			RTK40-24D	4	Retrofit Kit, LED, 2x4 Troffer, 40 watts, 4000 lm, Lithonia 2VTL DCP	1	40	40		18 cell		4100	11.2	3,504	0.37	0.16	1,289	561	729	$30	$48	$78	$9	$0	$9	5.4%
14	Book Sorting behind Reception	3,504	EPT4332N	13	Existing Parabolic Troffer 2x4 3L F32 T8 32 watt Lamp(s), Normal Ballast Factor	3	32	92	12	85	RTK31-24D	13	Retrofit Kit, LED, 2x4 Troffer, 31 watts, 3000 lm, Lithonia 2VTL DCP	1	31	31		18 cell		4100	9.1	3,504	1.20	0.40	4,191	1,412	2,779	$114	$184	$298	$28	$0	$28	16.3%
15	Book Sorting behind Reception	3,504	ECFLP26	1	Existing CFL Pin Based 26 watt Lamp(s)	1	26	30			LAI	1	Leave existing fixture as is	1	26	30		6" can, vertical, hard lid		4100	0.0	3,504	0.03	0.03	105	105	0	$0	$0	$0	$2	$0	$2	0.0%
16	Staff RR	3,504	ECFLP26	1	Existing CFL Pin Based 26 watt Lamp(s)	1	26	30			LAI	1	Leave existing fixture as is	1	26	30		6" can, vertical, hard lid		4100	0.0	3,504	0.03	0.03	105	105	0	$0	$0	$0	$2	$0	$2	0.0%
17	Staff RR	3,504	EVAN2217N	1	Existing Vanity Fixture 2' 2L F17 T8 Lamps, NBF Ballast	2	17	33			LAI	1	Leave existing fixture as is	2	17	33				4100	0.0	3,504	0.03	0.03	116	116	0	$0	$0	$0	$2	$0	$2	0.0%
18	Office	3,504	EPT4332N	4	Existing Parabolic Troffer 2x4 3L F32 T8 32 watt Lamp(s), Normal Ballast Factor	3	32	92		125	RTK31-24D	4	Retrofit Kit, LED, 2x4 Troffer, 31 watts, 3000 lm, Lithonia 2VTL DCP	1	31	31				4100	9.1	3,504	0.37	0.12	1,289	434	855	$35	$57	$92	$9	$0	$9	5.0%
19	Restroom behind "Ask" Desk	3,504	ECFLP26	1	Existing CFL Pin Based 26 watt Lamp(s)	1	26	30			LAI	1	Leave existing fixture as is	1	26	30		6" can, vertical, hard lid		4100	0.0	3,504	0.03	0.03	105	105	0	$0	$0	$0	$2	$0	$2	0.0%
20	Study Room	**2,278**	EPT4332N	2	Existing Parabolic Troffer 2x4 3L F32 T8 32 watt Lamp(s), Normal Ballast Factor	3	32	92		85	RTK31-24D	2	Retrofit Kit, LED, 2x4 Troffer, 31 watts, 3000 lm, Lithonia 2VTL DCP	1	31	31		18 cell, already sensored		4100	10.8	2,278	0.18	0.06	419	141	278	$11	$28	$40	$3	$0	$3	2.5%
21	Wall by Stairs and Both Stairwells	3,504	ECFLP13	13	Existing CFL Pin Based 13 watt Lamp(s)	1	13	17			LAI	13	Leave existing fixture as is	1	13	17		recessed round fixtures		4100	0.0	3,504	0.22	0.22	774	774	0	$0	$0	$0	$24	$0	$24	0.0%
22	Hall on 2	3,504	ECFLP26	12	Existing CFL Pin Based 26 watt Lamp(s)	1	26	30			LAI	12	Leave existing fixture as is	1	26	30		6" can, horizontal, hard lid		4100	0.0	3,504	0.36	0.36	1,261	1,261	0	$0	$0	$0	$22	$0	$22	0.0%
23	Hall on 2	3,504	ES4232N	6	Existing Strip 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61	25		LED19T84-2	6	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38		wall wash uplight		4100	11.0	3,504	0.37	0.23	1,282	799	484	$20	$32	$52	$11	$0	$11	3.8%
24	Librarian Office on 2	3,504	EINC40	12	Existing Incandescent 40 watt Lamp(s)	1	40	40			6WLEDP16GU	12	6 watt PAR16 GU10 Style LED Lamp & E14 to GU10 adapter	1	6.5	6		chandelier. base is between candelabra and edison. on dimmer - JST: E14 base		4100	3.8	3,504	0.48	0.07	1,682	252	1,430	$59	$95	$153	$42	$0	$42	4.1%
25	Librarian Office on 2	3,504	EINC60	4	Existing Incandescent 60 watt Lamp(s)	1	60	60			9WLEDA19	4	9.5 watt A-19 Style LED Lamp	1	9.5	9.5		cans on dimmer		4100	2.8	3,504	0.24	0.04	841	133	708	$29	$47	$76	$14	$0	$14	1.4%
26	Staff Lounge on 2	**2,278**	EPT4332N	4	Existing Parabolic Troffer 2x4 3L F32 T8 32 watt Lamp(s), Normal Ballast Factor	3	32	92			RTK31-24D	4	Retrofit Kit, LED, 2x4 Troffer, 31 watts, 3000 lm, Lithonia 2VTL DCP	1	31	31		18 cell. already sensored		4100	10.8	2,278	0.37	0.12	838	282	556	$23	$57	$79	$6	$0	$6	5.0%
27	Mens RR on 2	**2,278**	ECFLP26	1	Existing CFL Pin Based 26 watt Lamp(s)	1	26	30			LAI	1	Leave existing fixture as is	1	26	30		6" can, horizontal. already sensored		4100	0.0	2,278	0.03	0.03	68	68	0	$0	$0	$0	$1	$0	$1	0.0%

City and County of Denver, CO - Schlessman Family Library ~ OPTIMIZED OPTION: HYBRID HYBRID

Line	Location	EX Hours	EX Code	EX Qty	EX Desc	Lamps	EX Watts/ Lamp	EX Input Watts	Mounting Height	EX FC	PR Code	PR Qty	PR Desc	PR Lamp Qty	PR Watts/ Lamp	PR Input Watts	Sensor Type	Audit Notes	Sensor Saving %	Lamp Color	ECM SPB	PR Hours	Existing kw	Proposed kw	Existing kWh / Year	Proposed kwH / Year	Annual Energy Saved	KWh $ Savings	kW $ Savings	Total Energy $ Savings	EX MX Cost	PR MX Cost	MX Savings	%age of job
28	Mens RR on 2	**2,278**	ES3225N	2	Existing Strip 3' 2L F25 T8 Lamps, NBF Ballast	2	25	44			LAI	2	Leave existing fixture as is	2	25	44		cove. already sensored		4100	**0.0**	2,278	0.09	0.09	200	200	0	$0	$0	$0	$2	$0	$2	0.0%
29	Mens RR on 2	**2,278**	ES4232N	2	Existing Strip 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LED19T84-2	2	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38		cove. already sensored		4100	13.3	2,278	0.12	0.08	278	173	105	$4	$11	$15	$2	$0	$2	1.3%
30	Womens RR on 2	**2,278**	ECFLP26	1	Existing CFL Pin Based 26 watt Lamp(s)	1	26	30			LAI	1	Leave existing fixture as is	1	26	30		6" can, horizontal. already sensored		4100	**0.0**	2,278	0.03	0.03	68	68	0	$0	$0	$0	$1	$0	$1	0.0%
31	Womens RR on 2	**2,278**	ES4232N	5	Existing Strip 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LED19T84-2	5	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38		cove. already sensored		4100	13.3	2,278	0.31	0.19	695	433	262	$11	$27	$37	$6	$0	$6	3.1%
32	Community Room	3,504	ES12354H	3	Existing Direct/Indirect Strip 12' 3L F54 T5 Lamps, HBF Ballast	3	54	180		60	LAI	3	Leave existing fixture as is	3	54	180	CM9		25%	4100	3.6	2,628	0.54	0.54	1,892	1,419	473	$19	$0	$19	$13	$0	$13	0.7%
33	Community Room	3,504	ES8254H	4	Existing Direct/Indirect Strip 8' 2L F54 T5 Lamps, HBF Ballast	2	54	120			LAI	4	Leave existing fixture as is	2	54	120	CM9		25%	4100	3.8	2,628	0.48	0.48	1,682	1,261	420	$17	$0	$17	$14	$0	$14	0.7%
34	Community Room	3,504	ECFLP26	2	Existing CFL Pin Based 26 watt Lamp(s)	1	26	30			LAI	2	Leave existing fixture as is	1	26	30	CM9	can 6", horizontal	25%	4100	20.1	2,628	0.06	0.06	210	158	53	$2	$0	$2	$4	$0	$4	0.7%
35	Community Room	3,504	ELEDPAR30	3	Existing LED Par 30 Lamp	1	15	15			LAI	3	Leave existing fixture as is	1	15	15	CM9	on dimmer	25%	4100	73.5	2,628	0.05	0.05	158	118	39	$2	$0	$2	$0	$0	$0	0.7%
36	Storage	520	ES4232N	1	Existing Strip 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LAI	1	Leave existing fixture as is	2	32	61				4100	**0.0**	520	0.06	0.06	32	32	0	$0	$0	$0	$0	$0	$0	0.0%
37	Elevator	8,760	ELEDMR16	6	Existing LED MR16 Lamp	1	6	6			LAI	6	Leave existing fixture as is	1	6	6				4100	**0.0**	8,760	0.04	0.04	315	315	0	$0	$0	$0	$0	$0	$0	0.0%
38	Stairs to Basement	3,504	ECFLP13	2	Existing CFL Pin Based 13 watt Lamp(s)	1	13	17			LAI	2	Leave existing fixture as is	1	13	17		recessed round wall light		4100	**0.0**	3,504	0.03	0.03	119	119	0	$0	$0	$0	$4	$0	$4	0.0%
39	Stairs to Basement	3,504	ES4232N	1	Existing Strip 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LED19T84-2	1	Sylvania UltraLED External Driver T8 LED - 2 lamp - 19w/ea	2	19	38				4100	11.0	3,504	0.06	0.04	214	133	81	$3	$5	$9	$2	$0	$2	0.6%
40	Stairs to Basement	3,504	ET4332N	1	Existing Prismatic Troffer 2x4 3L F32 T8 32 watt Lamp(s), Normal Ballast Factor	3	32	92			RTK40-24T	1	Retrofit Kit, LED, 2x4 Troffer, 40 watts, 4000 lm, Lithonia 2VTLT Prism.	1	40	40				4100	11.2	3,504	0.09	0.04	322	140	182	$7	$12	$20	$2	$0	$2	1.3%
41	Boiler Room / Mech Room	**250**	ES4232N	9	Existing Strip 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LAI	9	Leave existing fixture as is	2	32	61		already sensored		4100	**0.0**	250	0.55	0.55	137	137	0	$0	$0	$0	$1	$0	$1	0.0%
42	Data / Electrical	**250**	ES4232N	5	Existing Strip 4' 2L F32 T8 32 watt Lamp(s), Normal Ballast Factor	2	32	61			LAI	5	Leave existing fixture as is	2	32	61		already sensored		4100	**0.0**	250	0.31	0.31	76	76	0	$0	$0	$0	$1	$0	$1	0.0%
43	Exterior	4,380	ECFLP26	4	Existing CFL Pin Based 26 watt Lamp(s)	1	26	30			LAI	4	Leave existing fixture as is	1	26	30		7" can, horizontal		4100	**0.0**	4,380	0.12	0.12	526	526	0	$0		$0	$9	$0	$9	0.0%
44	Exterior	4,380	EFMH50	4	Existing Fixture Metal Halide 50 watt Lamp	1	50	72			LEDR24	4	24 watt HID Replacement Lamp-Light Efficient Design - bypass ballast	1	24	24		bollard. vertical		4100	11.5	4,380	0.29	0.10	1,261	420	841	$34		$34	$55	$0	$55	5.7%
45	Exterior	4,380	EFMH175	4	Existing Fixture Metal Halide 175 watt Lamp	1	175	210			RL55KITLED	4	Relume Acorn LED Retrofit 55w Deployable	1	55	55		post top acorn		4100	19.9	4,380	0.84	0.22	3,679	964	2,716	$111		$111	$55	$0	$55	18.2%
46	Exterior	4,380	EPLMH400	2	Existing Pole Light Metal Halide 400 watt Lamp	1	400	458	33		GLTR-135	2	Globaltech Retrofit - Yoke - 135w LED	1	135	135		round shoebox. 2 bolt, charcoal gray?		4100	12.1	4,380	0.92	0.27	4,012	1,183	2,829	$116		$116	$39	$0	$39	10.4%
Total		3,301		253					33			253							25%		**12.5**	3187.2	18.3	13.9	62026	43724	18302	$750	$703	$1,454	$676	$0	$676	1.0

Attachment C – Trane Trace Baseline Inputs

Fire Station#1(HQ)

Fire Station #8

Police District #1

911 Call Center

Twentieth Street Rec Ctr

Barnum Library

Bear Valley Library

Eugene Field Library

Schlessman Family Library

Trane Trace
Baseline Inputs

Fire Station#1(HQ)

Library Members

Floor - Construction Types

6" HW Concrete — 6" heavyweight concrete

Layer	Code	Description	Thickness	Conductivity	Density	Specific Heat	Resistance
1	E0	Inside Surface Resist.					0.69 ft²·hr·°F/Btu
2	C7	6 in. HW Concrete	6.00 in.	1.00 Btu/hr·ft·°F	140.00 lb/cu ft	0.20 Btu/lb·°F	
3	E0	Inside Surface Resist.					0.69 ft²·hr·°F/Btu

Lamda = 0.57 Weight = 70.00 lb/ft² U-Value = 0.535 Btu/hr·ft²·°F Alpha = 0.90
Delta = 5 hours Heat Capacity = 14.00 Btu/ft²·lb·°F C-Coefficient = 0.0800 Btu/hr·ft²·°F

4" LW Concrete — 4" lightweight concrete

Layer	Code	Description	Thickness	Conductivity	Density	Specific Heat	Resistance
1	E0	Inside Surface Resist.					0.69 ft²·hr·°F/Btu
2	C1	4 in. LW Concrete	4.00 in.	0.10 Btu/hr·ft·°F	40.00 lb/cu ft	0.20 Btu/lb·°F	
3	E0	Inside Surface Resist.					0.69 ft²·hr·°F/Btu

Lamda = 0.89 Weight = 13.33 lb/ft² U-Value = 0.213 Btu/hr·ft²·°F Alpha = 0.90
Delta = 3 hours Heat Capacity = 2.67 Btu/ft²·lb·°F C-Coefficient = 0.0900 Btu/hr·ft²·°F

Partitions - Construction Types

0.75" Gyp Frame — 0.75" gypsum board frame wall

Layer	Code	Description	Thickness	Conductivity	Density	Specific Heat	Resistance
1	E0	Inside Surface Resist.					0.69 ft²·hr·°F/Btu
2	E1	0.75 in. Plaster	0.75 in.	0.42 Btu/hr·ft·°F	100.00 lb/cu ft	0.20 Btu/lb·°F	
3	B0	Air Space Resistance					0.91 ft²·hr·°F/Btu
4	E1	0.75 in. Plaster	0.75 in.	0.42 Btu/hr·ft·°F	100.00 lb/cu ft	0.20 Btu/lb·°F	
5	E0	Inside Surface Resist.					0.69 ft²·hr·°F/Btu

Lamda = 1.02 Weight = 12.50 lb/ft² U-Value = 0.388 Btu/hr·ft²·°F Alpha = 0.90
Delta = 1 hours Heat Capacity = 2.50 Btu/ft²·lb·°F C-Coefficient = 0.2400 Btu/hr·ft²·°F

Library Members

Roof - Construction Types

Steel Sheet, 2" Ins

Steel sheet, 2" insulation

Layer	Code	Description	Thickness	Conductivity	Density	Specific Heat	Resistance
1	A0	Outside Surface Resist.					0.33 ft²·hr·°F/Btu
2	E2	0.5 in. Slag or Stone	0.50 in.	0.83 Btu/hr·ft·°F	55.00 lb/cu ft	0.40 Btu/lb·°F	
3	E3	3/8 in. Felt & Membrane	0.38 in.	0.11 Btu/hr·ft·°F	70.00 lb/cu ft	0.40 Btu/lb·°F	
4	A3	Steel Siding	0.06 in.	26.00 Btu/hr·ft·°F	480.00 lb/cu ft	0.10 Btu/lb·°F	
5	B2	2 in. Insulation - High Dens	2.00 in.	0.03 Btu/hr·ft·°F	5.70 lb/cu ft	0.20 Btu/lb·°F	
6	E0	Inside Surface Resist.					0.69 ft²·hr·°F/Btu

Lamda = 0.97 Weight = 7.83 lb/ft² U-Value = 0.125 Btu/hr·ft²·°F Alpha = 0.90

Delta = 1 hours Heat Capacity = 2.22 Btu/ft²·lb·°F C-Coefficient = 0.0900 Btu/hr·ft²·°F

Steel Sheet, 1" Ins

Steel sheet, 1" insulation

Layer	Code	Description	Thickness	Conductivity	Density	Specific Heat	Resistance
1	A0	Outside Surface Resist.					0.33 ft²·hr·°F/Btu
2	E2	0.5 in. Slag or Stone	0.50 in.	0.83 Btu/hr·ft·°F	55.00 lb/cu ft	0.40 Btu/lb·°F	
3	E3	3/8 in. Felt & Membrane	0.38 in.	0.11 Btu/hr·ft·°F	70.00 lb/cu ft	0.40 Btu/lb·°F	
4	A3	Steel Siding	0.06 in.	26.00 Btu/hr·ft·°F	480.00 lb/cu ft	0.10 Btu/lb·°F	
5	B1	1 in. Insulation	1.00 in.	0.03 Btu/hr·ft·°F	2.00 lb/cu ft	0.20 Btu/lb·°F	
6	E0	Inside Surface Resist.					0.69 ft²·hr·°F/Btu

Lamda = 0.98 Weight = 7.05 lb/ft² U-Value = 0.214 Btu/hr·ft²·°F Alpha = 0.90

Delta = 1 hours Heat Capacity = 2.07 Btu/ft²·lb·°F C-Coefficient = 0.1600 Btu/hr·ft²·°F

Library Members

Wall - Construction Types

8" LW Block

8" lightweight concrete block

Layer	Code	Description	Thickness	Conductivity	Density	Specific Heat	Resistance
1	A0	Outside Surface Resist.					0.33 ft²·hr·°F/Btu
2	A1	1 in. Stucco	1.00 in.	0.40 Btu/hr·ft·°F	116.00 lb/cu ft	0.20 Btu/lb·°F	
3	C11	8 in. LW Concrete Block	8.00 in.	0.33 Btu/hr·ft·°F	38.00 lb/cu ft	0.20 Btu/lb·°F	
4	E1	0.75 in. Plaster	0.75 in.	0.42 Btu/hr·ft·°F	100.00 lb/cu ft	0.20 Btu/lb·°F	
5	E0	Inside Surface Resist.					0.69 ft²·hr·°F/Btu

Lamda = 0.73 Weight = 41.25 lb/ft² U-Value = 0.295 Btu/hr·ft²·°F Alpha = 0.90

Delta = 5 hours Heat Capacity = 8.25 Btu/ft²·lb·°F C-Coefficient = 0.0500 Btu/hr·ft²·°F

8" LW Block, 1" Ins

8" lightweight concrete block, 1" insulation

Layer	Code	Description	Thickness	Conductivity	Density	Specific Heat	Resistance
1	A0	Outside Surface Resist.					0.33 ft²·hr·°F/Btu
2	A1	1 in. Stucco	1.00 in.	0.40 Btu/hr·ft·°F	116.00 lb/cu ft	0.20 Btu/lb·°F	
3	C11	8 in. LW Concrete Block	8.00 in.	0.33 Btu/hr·ft·°F	38.00 lb/cu ft	0.20 Btu/lb·°F	
4	B1	1 in. Insulation	1.00 in.	0.03 Btu/hr·ft·°F	2.00 lb/cu ft	0.20 Btu/lb·°F	
5	E1	0.75 in. Plaster	0.75 in.	0.42 Btu/hr·ft·°F	100.00 lb/cu ft	0.20 Btu/lb·°F	
6	E0	Inside Surface Resist.					0.69 ft²·hr·°F/Btu

Lamda = 0.58 Weight = 41.42 lb/ft² U-Value = 0.149 Btu/hr·ft²·°F Alpha = 0.90

Delta = 6 hours Heat Capacity = 8.28 Btu/ft²·lb·°F C-Coefficient = 0.0100 Btu/hr·ft²·°F

Library Members

Glass types

Double Coated 1/4"

Properties based on Std DS Glass

Number of Panes	2		Visible Transmissivity	0.30	Inside Solar Reflectivity	0.17
Shading Coeff	0.55		Inside Visible Reflectivity	0.20	Outside Long Wave Emissivity	0.84
Glass U-Value	0.50	Btu/hr·ft²·°F	Solar Transmissivity	0.28	Inside Long Wave Emissivity	0.84

Double Clear 1/4"

Properties based on Std DS Glass

Number of Panes	2		Visible Transmissivity	0.68	Inside Solar Reflectivity	0.18
Shading Coeff	0.82		Inside Visible Reflectivity	0.23	Outside Long Wave Emissivity	0.84
Glass U-Value	0.60	Btu/hr·ft²·°F	Solar Transmissivity	0.50	Inside Long Wave Emissivity	0.84

Single Clear 1/4"

Properties based on Std DS Glass

Number of Panes	1		Visible Transmissivity	0.78	Inside Solar Reflectivity	0.13
Shading Coeff	0.95		Inside Visible Reflectivity	0.14	Outside Long Wave Emissivity	0.84
Glass U-Value	0.95	Btu/hr·ft²·°F	Solar Transmissivity	0.69	Inside Long Wave Emissivity	0.84

Infiltration

Neutral, Poor Const.

Cooling Design	**Heating Design**
1.00 air changes/hr	1.00 air changes/hr

Lights

Recessed fluorescent, not vented, 80% load to space

Fixture Type	RECFL-NV	Longwave Radiant Fraction	50 %
Percent Lights to RA	20 %	Shortwave Radiant Fraction	0 %
Ballast Factor	1.00		

Misc. loads

Std Office Equipment

Energy Consumption	0.50 W/ft²	Percent Sensible	100 %	**Radiant Fraction**	60 %
		Percent To Room	100 %	The energy meter is Electricity	
		Percent To RA	0 %		

Library Members

People

Member Name	People Density	Sensible Load	Latent Load	Longwave Radiant Fraction
Warehouse	200.00 ft²/person	275.00 Btuh	275.00 Btuh	70 %
Member Name	**People Density**	**Sensible Load**	**Latent Load**	Longwave Radiant Fraction
General Office Space	143.00 ft²/person	250.00 Btuh	200.00 Btuh	70 %
Member Name	**People Density**	**Sensible Load**	**Latent Load**	Longwave Radiant Fraction
Conference Room	20.00 ft²/person	245.00 Btuh	155.00 Btuh	70 %
Member Name	**People Density**	**Sensible Load**	**Latent Load**	Longwave Radiant Fraction
Hotel/Motel Room	200.00 ft²/person	245.00 Btuh	105.00 Btuh	70 %

Ventilation

Member Name	Cooling Design	Heating Design
Warehouse	0.0 cfm/ft²	0.1 cfm/ft²
Member Name	**Cooling Design**	Heating Design
Occupiable storage rooms for dry materia	5.0 cfm/person	0.1 cfm/ft²
Member Name	**Cooling Design**	Heating Design
General Office Space	20.0 cfm/person	20.0 cfm/person
Member Name	**Cooling Design**	Heating Design
Locker Room	1.0 cfm/ft²	0.5 cfm/ft²
Member Name	**Cooling Design**	Heating Design
Hotel/Motel Room	30.0 cfm	30.0 cfm

Library Members

Schedules

Off (0%)

Simulation type: Reduced year

January - December	Cooling design to Sunday	Start time	End time	Status	Equipment operation
		Midnight	Midnight	Off	

Lights - Denver - Fire 1 ECM 1

Simulation type: Reduced year

January - December	Cooling design to Sunday	Start time	End time	Percentage	Utilization
		Midnight	6 a.m.	10.0	
		6 a.m.	8 a.m.	70.0	
		8 a.m.	10 a.m.	80.0	
		10 a.m.	noon	100.0	
		noon	2 p.m.	100.0	
		2 p.m.	4 p.m.	100.0	
		4 p.m.	6 p.m.	80.0	
		6 p.m.	10 p.m.	70.0	
		10 p.m.	Midnight	10.0	

Heating Design	Start time	End time	Percentage	Utilization
	Midnight	Midnight	0.0	

Library Members

Schedules

Lights - Denver - Fire 1 ECM 3

Simulation type: Reduced year

Heating Design	**Start time**	**End time**	**Percentage**	Utilization
	Midnight	Midnight	0.0	

January - December **Cooling design to Sunday**	**Start time**	**End time**	**Percentage**	Utilization
	Midnight	6 a.m.	5.0	
	6 a.m.	8 a.m.	70.0	
	8 a.m.	10 a.m.	80.0	
	10 a.m.	noon	100.0	
	noon	2 p.m.	100.0	
	2 p.m.	4 p.m.	100.0	
	4 p.m.	6 p.m.	80.0	
	6 p.m.	10 p.m.	70.0	
	10 p.m.	Midnight	5.0	

Library Members

Schedules

Lights - Denver - Fire 1

Simulation type: Reduced year

January - December **Cooling design to Sunday**	**Start time**	**End time**	**Percentage**	Utilization
	Midnight	6 a.m.	5.0	
	6 a.m.	8 a.m.	60.0	
	8 a.m.	10 a.m.	75.0	
	10 a.m.	noon	100.0	
	noon	2 p.m.	100.0	
	2 p.m.	4 p.m.	100.0	
	4 p.m.	6 p.m.	80.0	
	6 p.m.	10 p.m.	60.0	
	10 p.m.	Midnight	5.0	

Heating Design	**Start time**	**End time**	**Percentage**	Utilization
	Midnight	Midnight	0.0	

Library Members

Schedules

Parking-Denver-Fire 1

Simulation type: Reduced year

January - December	**Sunday**	**Start time**	**End time**	**Percentage**	Utilization
		Midnight	8 a.m.	100.0	
		8 a.m.	8 p.m.	0.0	
		8 p.m.	Midnight	100.0	
January - December	**Saturday**	**Start time**	**End time**	**Percentage**	Utilization
		Midnight	9 a.m.	100.0	
		9 a.m.	8 p.m.	0.0	
		8 p.m.	Midnight	100.0	
January - December	**Cooling design to Weekday**	**Start time**	**End time**	**Percentage**	Utilization
		Midnight	7 a.m.	100.0	
		7 a.m.	8 p.m.	0.0	
		8 p.m.	Midnight	100.0	
Cooling design		**Start time**	**End time**	**Percentage**	Utilization
		Midnight	8 a.m.	100.0	
		8 a.m.	8 p.m.	0.0	
		8 p.m.	Midnight	100.0	

Heatpump

Simulation type: Reduced year

January - December	**Cooling design to Sunday**	**Start time**	**End time**	**Mode**	Thermal storage
		Midnight	Midnight	Satisfy load	

Library Members

Schedules

Available (100%)

Simulation type: Reduced year

January - December	**Cooling design to Sunday**	**Start time**	**End time**	**Percentage**	Utilization
		Midnight	Midnight	100.0	
Heating Design		**Start time**	**End time**	**Percentage**	Utilization
		Midnight	Midnight	100.0	

Library Members

Schedules

Hot Water - denver - FS1

Simulation type: Reduced year

October - October Cooling design to Sunday	**Start time**	**End time**	**Percentage**	Utilization
	Midnight	Midnight	30.0	
December - December Cooling design to Sunday	**Start time**	**End time**	**Percentage**	Utilization
	Midnight	Midnight	15.0	
January - January Cooling design to Sunday	**Start time**	**End time**	**Percentage**	Utilization
	Midnight	Midnight	0.0	
February - February Cooling design to Sunday	**Start time**	**End time**	**Percentage**	Utilization
	Midnight	Midnight	0.0	
April - April Cooling design to Sunday	**Start time**	**End time**	**Percentage**	Utilization
	Midnight	Midnight	30.0	
June - June Cooling design to Sunday	**Start time**	**End time**	**Percentage**	Utilization
	Midnight	Midnight	12.0	
September - September Cooling design to Sunday	**Start time**	**End time**	**Percentage**	Utilization
	Midnight	Midnight	13.0	
November - November Cooling design to Sunday	**Start time**	**End time**	**Percentage**	Utilization
	Midnight	Midnight	8.0	
Cooling design	**Start time**	**End time**	**Percentage**	Utilization
	Midnight	Midnight	0.0	
August - August Cooling design to Sunday	**Start time**	**End time**	**Percentage**	Utilization
	Midnight	Midnight	12.0	
March - March Cooling design to Sunday	**Start time**	**End time**	**Percentage**	Utilization
	Midnight	Midnight	0.0	
May - May Cooling design to Sunday	**Start time**	**End time**	**Percentage**	Utilization
	Midnight	Midnight	23.0	
July - July Cooling design to Sunday	**Start time**	**End time**	**Percentage**	Utilization
	Midnight	Midnight	12.0	

Library Members

Schedules

People - Denver - Fire 1 office

Simulation type: Reduced year

Heating Design		**Start time**	**End time**	**Percentage**	Utilization
		Midnight	Midnight	0.0	
January - December	**Saturday to Sunday**	**Start time**	**End time**	**Percentage**	Utilization
		Midnight	Midnight	0.0	
January - December	**Cooling design to Weekday**	**Start time**	**End time**	**Percentage**	Utilization
		Midnight	6 a.m.	0.0	
		6 a.m.	8 a.m.	75.0	
		8 a.m.	5 p.m.	100.0	
		5 p.m.	6 p.m.	75.0	
		6 p.m.	10 p.m.	0.0	
		10 p.m.	Midnight	0.0	

Library Members

Base Utilities

Domestic Hot Water Load - Gas

Comments	
Schedule	Available (100%)
Energy Type	Gas
Hourly demand	1.40 kW
Entering	°F
Leaving	°F

Parking lot lights

Comments	
Schedule	Parking lot lights
Energy Type	Electricity
Hourly demand	0.10 kW
Entering	°F
Leaving	°F

Cooling Equipment

TRACE® 700 Cooling Equipment Library

Water Source HP - Reg Effic — **Water source heat pump - Water source heat pump**

Comments: Hydronic heat pump reg eff. WSHPREG

Operating Mode	Capacity	Energy Rate
Cooling	tons	1.020 kW/ton
Heat Recovery	14.83 Mbh/ton	0.070 kW/Mbh
Tank Charging		
Tank Chrg. & Heat Rec.		

Pumps	Type	Full Load Consumption	Pump Head
Chilled water	Cnst vol chill water pump	0.000563kW/ton/ft water	
Condenser water	None	0.00000kW	
Ht Rec or aux cond.	None	kW	
Free cooling pump	None		

Unloading Curves	Primary	Secondary
Power consumed	WSHP	WSHP
Ambient modification	Wshphi - Amb Mod	Wshphi - Amb Mod 2nd
Capacity		

	Reset Based On	Reset Curve	Max Reset TD
Chilled water	None		
Condenser water	None		

Miscellaneous accessories: Wshpcntl - WS heat pump control

Load Shed Economizer	No
Evap Precooling	No
Fuel Source	Heating plant
Fuel type	Electric
Free cooling type	None
Fluid cooler type	None
Thermal Storage	Heat pump loop no storage
Tower/condenser	WSHP - Cooling tower

Chilled water temp Design leaving	44.00°F
Chilled water temp Difference	10.00°F
Condenser temp design temp entering	90.00°F
Condenser temp min. operating	55.00°F
Condenser temp Difference	10.00°F
Reject Cond heat to ref	Heat rejection equipment
Reject Cond heat at water temp	105.00°F

Library Members

Fans

FC Centrifugal const vol

Fan type	Constant volume
Comments	Forward curved Centrifugal fan constant volume
Full load energy	0.00032 kW/Cfm-in wg
Unloading curve	Fan Curve Straight Line

Heating Equipment

two stage heat

Comments	ROOFTOP GAS HEAT	
Category	Gas-fired heat exchanger	**Miscellaneous Accessories**
Heat Source	Utility	
Fuel Type	Gas	
Capacity	Mbh	
Energy Rate	77.000 Percent efficient	
Hot Water Pump	None	
Hot Water Pump Full Load	0.00 kW	
Hot Water Leaving temp	°F	
Storage tank	None	
Unloading Curve	gas heat - 2 stage	

Default Boiler

Comments	FIRE TUBE HOT H2O BOILER (GAS) EQ2001	
Category	Boiler	**Miscellaneous Accessories**
Heat Source	Utility	Boiler forced draft fan
Fuel Type	Gas	Cntl panel & interlocks - 0.5 KW
Capacity	Mbh	
Energy Rate	83.300 Percent efficient	
Hot Water Pump	Heating water circ pump	
Hot Water Pump Full Load	0.00 kW	
Hot Water Leaving temp	°F	
Storage tank	None	
Unloading Curve	Htg Straight Line	

Library Members

Misc. Equipment

Cnst vol chill water pump

Comments	Chilled water pump - constant volume	
Category	Water pump	
Energy type	0.00056	kW/ton-ft wg
Control type	Electricity	
Full load energy	With equipment	

Cooling coil assignments	Heating coil assignments
+ Main	+ Main
Direct evaporative	+ Preheat
Indirect evaporative	+ Reheat
+ Auxiliary	+ Mech. humidification
+ Optional ventilation	+ Auxiliary
+ System exhaust air	+ Optional ventilation
+ Room exhaust air	+ Misc heating load
+ Misc cooling load	+ Base utility htg load
+ Base utility clg load	+ Absorption Chiller load

Heating water circ pump

Comments	Heating water circulation pump	
Category	Water pump	
Energy type	0.00000	kW/Btu-ft wg
Control type	Electricity	
Full load energy	With equipment	

Cooling coil assignments	Heating coil assignments
+ Main	+ Main
Direct evaporative	+ Preheat
Indirect evaporative	+ Reheat
+ Auxiliary	+ Mech. humidification
+ Optional ventilation	+ Auxiliary
+ System exhaust air	+ Optional ventilation
+ Room exhaust air	+ Misc heating load
+ Misc cooling load	+ Base utility htg load
+ Base utility clg load	+ Absorption Chiller load

Thermal Storage

Heat pump loop no storage

Comments	Storage tank	
Schedule	Heatpump	
Capacity	12.0	gal/ton
Storage Type	Heat pump loop	
Losses	0	Percent
Warning level	0	Percent

Discharge Strategy

Control type	Optimize	
Limit	0.0	tons

Charging Strategy

Control type	Full charge	
Max loss	0.0	kW

SpecificHeat
1.0 Btu/lb-°F

Density
62.3 lb/cu ft

DesignDeltaT
30 °F

Library Members

Heat Rejection

WSHP - Cooling tower

Comments	Water Source Heat Pump Cooling Tower	
Capacity	100.00	Percent
Energy consumption	0.07	kW/ton
Low speed consumpt	0.00	Percent full load
Fluid type	Water	
Condenser type	Cooling tower (DOE)	
Number of cells	1	
% Air at low Speed	0.00	
Approach Temp	7.00	°F
Temp Range	10.00	°F
Wet bulb Temp	78.00	°F
Design water flow rate	3.00	gpm/ton
Makeup water flow rate	3.20	gal/ton-hr
Hourly Amb WB Offset		°F
Unloading curve	C-Tower on/off	

Coil load assignmer

+Main
Direct evaporator
+Indirect evaporator
+Auxiliary
+Optional ventilation
+Misc cooling load

Fire Station #8

Library Members

Floor - Construction Types

6" LW Concrete — 6" lightweight concrete

Layer	Code	Description	Thickness	Conductivity	Density	Specific Heat	Resistance
1	E0	Inside Surface Resist.					0.69 ft²·hr·°F/Btu
2	C2	6 in. LW Concrete	6.00 in.	0.10 Btu/hr·ft·°F	40.00 lb/cu ft	0.20 Btu/lb·°F	
3	E0	Inside Surface Resist.					0.69 ft²·hr·°F/Btu

Lamda = 0.73 Weight = 20.00 lb/ft² U-Value = 0.157 Btu/hr·ft²·°F Alpha = 0.90
Delta = 4 hours Heat Capacity = 4.00 Btu/ft²·lb·°F C-Coefficient = 0.0300 Btu/hr·ft²·°F

6" HW Concrete — 6" heavyweight concrete

Layer	Code	Description	Thickness	Conductivity	Density	Specific Heat	Resistance
1	E0	Inside Surface Resist.					0.69 ft²·hr·°F/Btu
2	C7	6 in. HW Concrete	6.00 in.	1.00 Btu/hr·ft·°F	140.00 lb/cu ft	0.20 Btu/lb·°F	
3	E0	Inside Surface Resist.					0.69 ft²·hr·°F/Btu

Lamda = 0.57 Weight = 70.00 lb/ft² U-Value = 0.535 Btu/hr·ft²·°F Alpha = 0.90
Delta = 5 hours Heat Capacity = 14.00 Btu/ft²·lb·°F C-Coefficient = 0.0800 Btu/hr·ft²·°F

Partitions - Construction Types

0.75" Gyp Frame — 0.75" gypsum board frame wall

Layer	Code	Description	Thickness	Conductivity	Density	Specific Heat	Resistance
1	E0	Inside Surface Resist.					0.69 ft²·hr·°F/Btu
2	E1	0.75 in. Plaster	0.75 in.	0.42 Btu/hr·ft·°F	100.00 lb/cu ft	0.20 Btu/lb·°F	
3	B0	Air Space Resistance					0.91 ft²·hr·°F/Btu
4	E1	0.75 in. Plaster	0.75 in.	0.42 Btu/hr·ft·°F	100.00 lb/cu ft	0.20 Btu/lb·°F	
5	E0	Inside Surface Resist.					0.69 ft²·hr·°F/Btu

Lamda = 1.02 Weight = 12.50 lb/ft² U-Value = 0.388 Btu/hr·ft²·°F Alpha = 0.90
Delta = 1 hours Heat Capacity = 2.50 Btu/ft²·lb·°F C-Coefficient = 0.2400 Btu/hr·ft²·°F

Library Members

Roof - Construction Types

Steel Sheet, 1" Ins

Steel sheet, 1" insulation

Layer	Code	Description	Thickness	Conductivity	Density	Specific Heat	Resistance
1	A0	Outside Surface Resist.					0.33 ft²·hr·°F/Btu
2	E2	0.5 in. Slag or Stone	0.50 in.	0.83 Btu/hr·ft·°F	55.00 lb/cu ft	0.40 Btu/lb·°F	
3	E3	3/8 in. Felt & Membrane	0.38 in.	0.11 Btu/hr·ft·°F	70.00 lb/cu ft	0.40 Btu/lb·°F	
4	A3	Steel Siding	0.06 in.	26.00 Btu/hr·ft·°F	480.00 lb/cu ft	0.10 Btu/lb·°F	
5	B1	1 in. Insulation	1.00 in.	0.03 Btu/hr·ft·°F	2.00 lb/cu ft	0.20 Btu/lb·°F	
6	E0	Inside Surface Resist.					0.69 ft²·hr·°F/Btu

Lamda = 0.98 Weight = 7.05 lb/ft² U-Value = 0.214 Btu/hr·ft²·°F Alpha = 0.90

Delta = 1 hours Heat Capacity = 2.07 Btu/ft²·lb·°F C-Coefficient = 0.1600 Btu/hr·ft²·°F

2" HW Conc, 2" Ins

2" heavyweight concrete, 2" insulation

Layer	Code	Description	Thickness	Conductivity	Density	Specific Heat	Resistance
1	A0	Outside Surface Resist.					0.33 ft²·hr·°F/Btu
2	E2	0.5 in. Slag or Stone	0.50 in.	0.83 Btu/hr·ft·°F	55.00 lb/cu ft	0.40 Btu/lb·°F	
3	E3	3/8 in. Felt & Membrane	0.38 in.	0.11 Btu/hr·ft·°F	70.00 lb/cu ft	0.40 Btu/lb·°F	
4	B2	2 in. Insulation - High Dens	2.00 in.	0.03 Btu/hr·ft·°F	5.70 lb/cu ft	0.20 Btu/lb·°F	
5	C5	2 in. HW Concrete	2.00 in.	1.00 Btu/hr·ft·°F	140.00 lb/cu ft	0.20 Btu/lb·°F	
6	E0	Inside Surface Resist.					0.69 ft²·hr·°F/Btu

Lamda = 0.75 Weight = 28.76 lb/ft² U-Value = 0.122 Btu/hr·ft²·°F Alpha = 0.90

Delta = 4 hours Heat Capacity = 6.65 Btu/ft²·lb·°F C-Coefficient = 0.0300 Btu/hr·ft²·°F

Wall - Construction Types

8" LW Block, 1" Ins

8" lightweight concrete block, 1" insulation

Layer	Code	Description	Thickness	Conductivity	Density	Specific Heat	Resistance
1	A0	Outside Surface Resist.					0.33 ft²·hr·°F/Btu
2	A1	1 in. Stucco	1.00 in.	0.40 Btu/hr·ft·°F	116.00 lb/cu ft	0.20 Btu/lb·°F	
3	C11	8 in. LW Concrete Block	8.00 in.	0.33 Btu/hr·ft·°F	38.00 lb/cu ft	0.20 Btu/lb·°F	
4	B1	1 in. Insulation	1.00 in.	0.03 Btu/hr·ft·°F	2.00 lb/cu ft	0.20 Btu/lb·°F	
5	E1	0.75 in. Plaster	0.75 in.	0.42 Btu/hr·ft·°F	100.00 lb/cu ft	0.20 Btu/lb·°F	
6	E0	Inside Surface Resist.					0.69 ft²·hr·°F/Btu

Lamda = 0.58 Weight = 41.42 lb/ft² U-Value = 0.149 Btu/hr·ft²·°F Alpha = 0.90

Delta = 6 hours Heat Capacity = 8.28 Btu/ft²·lb·°F C-Coefficient = 0.0100 Btu/hr·ft²·°F

Library Members

Glass types

Single Clear 1/4"

Properties based on Std DS Glass

Number of Panes	1		Visible Transmissivity	0.78		Inside Solar Reflectivity	0.13
Shading Coeff	0.95		Inside Visible Reflectivity	0.14		Outside Long Wave Emissivity	0.84
Glass U-Value	0.95	Btu/hr·ft²·°F	Solar Transmissivity	0.69		Inside Long Wave Emissivity	0.84

Infiltration

Neutral, Tight Const.

Cooling Design	Heating Design
0.30 air changes/hr	0.30 air changes/hr

Neutral, Poor Const.

Cooling Design	Heating Design
1.00 air changes/hr	1.00 air changes/hr

Lights

Recessed fluorescent, not vented, 80% load to space

Fixture Type	RECFL-NV	Longwave Radiant Fraction	50 %
Percent Lights to RA	20 %	Shortwave Radiant Fraction	0 %
Ballast Factor	1.00		

Misc. loads

Std Office Equipment

Energy Consumption	0.50 W/ft²	Percent Sensible	100 %	**Radiant Fraction**	60 %
		Percent To Room	100 %	The energy meter is Electricity	
		Percent To RA	0 %		

People

Member Name	People Density	Sensible Load	Latent Load	Longwave Radiant Fraction
Hotel/Motel Room	200.00 ft²/person	245.00 Btuh	105.00 Btuh	70 %
Member Name	**People Density**	**Sensible Load**	**Latent Load**	Longwave Radiant Fraction
Conference Room	20.00 ft²/person	245.00 Btuh	155.00 Btuh	70 %
Member Name	**People Density**	**Sensible Load**	**Latent Load**	Longwave Radiant Fraction
Warehouse	200.00 ft²/person	275.00 Btuh	275.00 Btuh	70 %
Member Name	**People Density**	**Sensible Load**	**Latent Load**	Longwave Radiant Fraction
General Office Space	143.00 ft²/person	250.00 Btuh	200.00 Btuh	70 %

Library Members

Ventilation

Member Name	Cooling Design	Heating Design
Hotel/Motel Room	30.0 cfm	30.0 cfm

Member Name	People-based Rate (Rp)	Area-based Rate (Ra)
Multi-purpose assembly	5.0 cfm/person	0.1 cfm/ft²

Member Name	Cooling Design	Heating Design
General Office Space	20.0 cfm/person	20.0 cfm/person

Member Name	Cooling Design	Heating Design
Locker Room	1.0 cfm/ft²	0.5 cfm/ft²

Member Name	Cooling Design	Heating Design
Warehouse	0.0 cfm/ft²	0.1 cfm/ft²

Member Name	Cooling Design	Heating Design
General manufacturing (excl. hvy indust)	10.0 cfm/person	0.2 cfm/ft²

Library Members

Schedules

Hot Water - denver - FS8

Simulation type: Reduced year

October - October Cooling design to Sunday	**Start time**	**End time**	**Percentage**	Utilization
	Midnight	Midnight	25.0	
September - September Cooling design to Sunday	**Start time**	**End time**	**Percentage**	Utilization
	Midnight	Midnight	5.0	
December - December Cooling design to Sunday	**Start time**	**End time**	**Percentage**	Utilization
	Midnight	Midnight	50.0	
January - January Cooling design to Sunday	**Start time**	**End time**	**Percentage**	Utilization
	Midnight	Midnight	12.0	
August - August Cooling design to Sunday	**Start time**	**End time**	**Percentage**	Utilization
	Midnight	Midnight	5.0	
May - May Cooling design to Sunday	**Start time**	**End time**	**Percentage**	Utilization
	Midnight	Midnight	10.0	
February - February Cooling design to Sunday	**Start time**	**End time**	**Percentage**	Utilization
	Midnight	Midnight	1.0	
April - April Cooling design to Sunday	**Start time**	**End time**	**Percentage**	Utilization
	Midnight	Midnight	12.0	
June - June Cooling design to Sunday	**Start time**	**End time**	**Percentage**	Utilization
	Midnight	Midnight	2.0	
November - November Cooling design to Sunday	**Start time**	**End time**	**Percentage**	Utilization
	Midnight	Midnight	50.0	
March - March Cooling design to Sunday	**Start time**	**End time**	**Percentage**	Utilization
	Midnight	Midnight	0.0	
July - July Cooling design to Sunday	**Start time**	**End time**	**Percentage**	Utilization
	Midnight	Midnight	10.0	
Heating Design	**Start time**	**End time**	**Percentage**	Utilization
	Midnight	Midnight	0.0	

Library Members

Schedules

Lights - Denver - Fire 8

Simulation type: Reduced year

Heating Design	**Start time**	**End time**	**Percentage**	Utilization
	Midnight	Midnight	0.0	

January - December **Cooling design to Sunday**	**Start time**	**End time**	**Percentage**	Utilization
	Midnight	6 a.m.	5.0	
	6 a.m.	8 a.m.	60.0	
	8 a.m.	10 a.m.	80.0	
	10 a.m.	noon	100.0	
	noon	2 p.m.	100.0	
	2 p.m.	4 p.m.	100.0	
	4 p.m.	6 p.m.	80.0	
	6 p.m.	10 p.m.	60.0	
	10 p.m.	Midnight	5.0	

Library Members

Schedules

Parking-Denver-Fire 8

Simulation type: Reduced year

January - December	**Saturday**	**Start time**	**End time**	**Percentage**	Utilization
		Midnight	9 a.m.	100.0	
		9 a.m.	8 p.m.	0.0	
		8 p.m.	Midnight	100.0	
Cooling design		**Start time**	**End time**	**Percentage**	Utilization
		Midnight	8 a.m.	100.0	
		8 a.m.	8 p.m.	0.0	
		8 p.m.	Midnight	100.0	
January - December	**Cooling design to Weekday**	**Start time**	**End time**	**Percentage**	Utilization
		Midnight	7 a.m.	100.0	
		7 a.m.	8 p.m.	0.0	
		8 p.m.	Midnight	100.0	
January - December	**Sunday**	**Start time**	**End time**	**Percentage**	Utilization
		Midnight	8 a.m.	100.0	
		8 a.m.	8 p.m.	0.0	
		8 p.m.	Midnight	100.0	

Library Members

Schedules

DCV - Denver - FD8

Simulation type: Reduced year

January - December	**Saturday to Sunday**	**Start time**	**End time**	**Percentage**	Utilization
		Midnight	Midnight	60.0	
Heating Design		**Start time**	**End time**	**Percentage**	Utilization
		Midnight	Midnight	0.0	
January - December	**Cooling design to Weekday**	**Start time**	**End time**	**Percentage**	Utilization
		Midnight	6 a.m.	60.0	
		6 a.m.	8 a.m.	100.0	
		8 a.m.	5 p.m.	100.0	
		5 p.m.	6 p.m.	100.0	
		6 p.m.	10 p.m.	100.0	
		10 p.m.	Midnight	60.0	

Available (100%)

Simulation type: Reduced year

January - December	**Cooling design to Sunday**	**Start time**	**End time**	**Percentage**	Utilization
		Midnight	Midnight	100.0	
Heating Design		**Start time**	**End time**	**Percentage**	Utilization
		Midnight	Midnight	100.0	

Library Members

Schedules

Lights - Denver - Fire 8 ECM 1

Simulation type: Reduced year

January - December	**Cooling design to Sunday**	**Start time**	**End time**	**Percentage**	Utilization
		Midnight	6 a.m.	10.0	
		6 a.m.	8 a.m.	65.0	
		8 a.m.	10 a.m.	75.0	
		10 a.m.	noon	100.0	
		noon	2 p.m.	100.0	
		2 p.m.	4 p.m.	100.0	
		4 p.m.	6 p.m.	80.0	
		6 p.m.	10 p.m.	70.0	
		10 p.m.	Midnight	10.0	

Heating Design	**Start time**	**End time**	**Percentage**	Utilization
	Midnight	Midnight	0.0	

Library Members

Schedules

Lights - Denver - Fire 8 ECM 3

Simulation type: Reduced year

Heating Design	**Start time**	**End time**	**Percentage**	Utilization
	Midnight	Midnight	0.0	

January - December **Cooling design to Sunday**	**Start time**	**End time**	**Percentage**	Utilization
	Midnight	6 a.m.	5.0	
	6 a.m.	8 a.m.	70.0	
	8 a.m.	10 a.m.	75.0	
	10 a.m.	noon	100.0	
	noon	2 p.m.	100.0	
	2 p.m.	4 p.m.	100.0	
	4 p.m.	6 p.m.	75.0	
	6 p.m.	10 p.m.	65.0	
	10 p.m.	Midnight	5.0	

Off (0%)

Simulation type: Reduced year

January - December **Cooling design to Sunday**	**Start time**	**End time**	**Status**	Equipment operation
	Midnight	Midnight	Off	

Library Members

Base Utilities

Sample

Comments	
Schedule	Available (100%)
Energy Type	Electricity
Hourly demand	5.00 kW
Entering	85.00 °F
Leaving	110.00 °F

Parking lot lights

Comments	
Schedule	Parking lot lights
Energy Type	Electricity
Hourly demand	0.10 kW
Entering	°F
Leaving	°F

Domestic Hot Water Load - Gas

Comments	
Schedule	Available (100%)
Energy Type	Gas
Hourly demand	1.40 kW
Entering	°F
Leaving	°F

Library Members

Cooling Equipment

TRACE® 700 Cooling Equipment Library

Default air-cooled unitary — **Air-cooled unitary - Reciprocating**

Comments: PACKAGED TERMINAL AIR CONDITIONER

Operating Mode	Capacity	Energy Rate
Cooling	tons	1.380 kW/ton
Heat Recovery		
Tank Charging		
Tank Chrg. & Heat Rec.		

Pumps	Type	Full Load Consumption	Pump Head
Chilled water	None	0.000000kW	
Condenser water	None	0.00000kW	
Ht Rec or aux cond.	None	kW	
Free cooling pump	None		

Unloading Curves	Primary	Secondary
Power consumed	EQ1307	EQ1307
Ambient modification	EQ1307 - Amb Mod	EQ1307 - Amb Mod
Capacity		

	Reset Based On	Reset Curve	Max Reset TD
Chilled water	None		
Condenser water	None		

Miscellaneous accessories: Cntl panel & interlocks - 0.1 KW

Load Shed Economizer	No
Evap Precooling	No
Fuel Source	Utility
Fuel type	Electric
Free cooling type	None
Fluid cooler type	None
Thermal Storage	None
Tower/condenser	Condenser fan for Heat Pump

Chilled water temp Design leaving	44.00°F
Chilled water temp Difference	10.00°F
Condenser temp design temp entering	95.00°F
Condenser temp min. operating	75.00°F
Condenser temp Difference	10.00°F
Reject Cond heat to ref	Heat rejection equipment
Reject Cond heat at water temp	

Fans

FC Centrifugal var freq drv

Fan type	Variable volume
Comments	
Full load energy	0.00035 kW/Cfm-in wg
Unloading curve	Fan Curve 9

FC Centrifugal const vol

Fan type	Constant volume
Comments	Forward curved Centrifugal fan constant volume
Full load energy	0.00032 kW/Cfm-in wg
Unloading curve	Fan Curve Straight Line

Library Members

Heating Equipment

Denver - Boiler - FS8

Comments	FIRE TUBE HOT H2O BOILER (GAS) EQ2001	
Category	Boiler	
Heat Source	Utility	
Fuel Type	Gas	
Capacity		Mbh
Energy Rate	83.300	Percent efficient
Hot Water Pump	Heating water circ pump	
Hot Water Pump Full Load	0.00	kW
Hot Water Leaving temp		°F
Storage tank	None	
Unloading Curve	Htg Straight Line	

Miscellaneous Accessories

Cntl panel & interlocks - 0.5 KW

Default gas-fired heat exchanger

Comments	ROOFTOP GAS HEAT	
Category	Gas-fired heat exchanger	
Heat Source	Utility	
Fuel Type	Gas	
Capacity		Mbh
Energy Rate	77.000	Percent efficient
Hot Water Pump	None	
Hot Water Pump Full Load	0.00	kW
Hot Water Leaving temp		°F
Storage tank	None	
Unloading Curve	Htg Straight Line	

Miscellaneous Accessories

Misc. Equipment

Heating water circ pump

Comments	Heating water circulation pump	
Category	Water pump	
Energy type	0.00000	kW/Btu-ft wg
Control type	Electricity	
Full load energy	With equipment	

Cooling coil assignments

+ Main
  Direct evaporative
  Indirect evaporative
+ Auxiliary
+ Optional ventilation
+ System exhaust air
+ Room exhaust air
+ Misc cooling load
+ Base utility clg load

Heating coil assignments

+ Main
+ Preheat
+ Reheat
+ Mech. humidification
+ Auxiliary
+ Optional ventilation
+ Misc heating load
+ Base utility htg load
+ Absorption Chiller load

Library Members

Heat Rejection

Condenser fan for Heat Pump

Comments	Heat Pump Condenser Fan	
Capacity	100.00	Percent
Energy consumption	0.12	kW/ton
Low speed consumpt	0.00	Percent full load
Fluid type	Water	
Condenser type	Air-cooled condenser	
Number of cells	1	
% Air at low Speed	0.00	
Approach Temp	10.00	°F
Temp Range	10.00	°F
Wet bulb Temp	78.00	°F
Design water flow rate	3.00	gpm/ton
Makeup water flow rate	0.00	gal/ton-hr
Hourly Amb WB Offset		°F
Unloading curve	C-Tower on/off	

Coil load assignmer

+Main
Direct evaporator
+Indirect evaporator
+Auxiliary
+Optional ventilation
+Misc cooling load

Police District #1

Library Members

Floor - Construction Types

6" HW Concrete — 6" heavyweight concrete

Layer	Code	Description	Thickness	Conductivity	Density	Specific Heat	Resistance
1	E0	Inside Surface Resist.					0.69 ft²·hr·°F/Btu
2	C7	6 in. HW Concrete	6.00 in.	1.00 Btu/hr·ft·°F	140.00 lb/cu ft	0.20 Btu/lb·°F	
3	E0	Inside Surface Resist.					0.69 ft²·hr·°F/Btu

Lamda = 0.57 Weight = 70.00 lb/ft² U-Value = 0.535 Btu/hr·ft²·°F Alpha = 0.90
Delta = 5 hours Heat Capacity = 14.00 Btu/ft²·lb·°F C-Coefficient = 0.0800 Btu/hr·ft²·°F

Partitions - Construction Types

0.75" Gyp Frame — 0.75" gypsum board frame wall

Layer	Code	Description	Thickness	Conductivity	Density	Specific Heat	Resistance
1	E0	Inside Surface Resist.					0.69 ft²·hr·°F/Btu
2	E1	0.75 in. Plaster	0.75 in.	0.42 Btu/hr·ft·°F	100.00 lb/cu ft	0.20 Btu/lb·°F	
3	B0	Air Space Resistance					0.91 ft²·hr·°F/Btu
4	E1	0.75 in. Plaster	0.75 in.	0.42 Btu/hr·ft·°F	100.00 lb/cu ft	0.20 Btu/lb·°F	
5	E0	Inside Surface Resist.					0.69 ft²·hr·°F/Btu

Lamda = 1.02 Weight = 12.50 lb/ft² U-Value = 0.388 Btu/hr·ft²·°F Alpha = 0.90
Delta = 1 hours Heat Capacity = 2.50 Btu/ft²·lb·°F C-Coefficient = 0.2400 Btu/hr·ft²·°F

Roof - Construction Types

4" HW Conc, 4" Ins — 4" heavyweight concrete, 4" insulation

Layer	Code	Description	Thickness	Conductivity	Density	Specific Heat	Resistance
1	A0	Outside Surface Resist.					0.33 ft²·hr·°F/Btu
2	E2	0.5 in. Slag or Stone	0.50 in.	0.83 Btu/hr·ft·°F	55.00 lb/cu ft	0.40 Btu/lb·°F	
3	E3	3/8 in. Felt & Membrane	0.38 in.	0.11 Btu/hr·ft·°F	70.00 lb/cu ft	0.40 Btu/lb·°F	
4	B4	4 in. Insulation	4.00 in.	0.03 Btu/hr·ft·°F	2.00 lb/cu ft	0.20 Btu/lb·°F	
5	C6	4 in. HW Concrete	4.00 in.	1.00 Btu/hr·ft·°F	140.00 lb/cu ft	0.20 Btu/lb·°F	
6	E0	Inside Surface Resist.					0.69 ft²·hr·°F/Btu

Lamda = 0.46 Weight = 51.81 lb/ft² U-Value = 0.067 Btu/hr·ft²·°F Alpha = 0.90
Delta = 6 hours Heat Capacity = 11.26 Btu/ft²·lb·°F C-Coefficient = 0.0100 Btu/hr·ft²·°F

Library Members

Wall - Construction Types

8" LW Block, 2" Ins — 8" lightweight concrete block, 2" insulation

Layer	Code	Description	Thickness	Conductivity	Density	Specific Heat	Resistance
1	A0	Outside Surface Resist.					0.33 ft²·hr·°F/Btu
2	A1	1 in. Stucco	1.00 in.	0.40 Btu/hr·ft·°F	116.00 lb/cu ft	0.20 Btu/lb·°F	
3	C11	8 in. LW Concrete Block	8.00 in.	0.33 Btu/hr·ft·°F	38.00 lb/cu ft	0.20 Btu/lb·°F	
4	B2	2 in. Insulation - High Dens	2.00 in.	0.03 Btu/hr·ft·°F	5.70 lb/cu ft	0.20 Btu/lb·°F	
5	E1	0.75 in. Plaster	0.75 in.	0.42 Btu/hr·ft·°F	100.00 lb/cu ft	0.20 Btu/lb·°F	
6	E0	Inside Surface Resist.					0.69 ft²·hr·°F/Btu

Lamda = 0.53 Weight = 42.20 lb/ft² U-Value = 0.099 Btu/hr·ft²·°F Alpha = 0.90
Delta = 7 hours Heat Capacity = 8.44 Btu/ft²·lb·°F C-Coefficient = 0.0100 Btu/hr·ft²·°F

Glass types

Double Coated 1/4"

Properties based on Std DS Glass

Number of Panes	2	Visible Transmissivity	0.30	Inside Solar Reflectivity	0.17
Shading Coeff	0.55	Inside Visible Reflectivity	0.20	Outside Long Wave Emissivity	0.84
Glass U-Value	0.50 Btu/hr·ft²·°F	Solar Transmissivity	0.28	Inside Long Wave Emissivity	0.84

Infiltration

Neutral, Average Const.

Cooling Design	Heating Design
0.60 air changes/hr	0.60 air changes/hr

Neutral, Poor Const.

Cooling Design	Heating Design
1.00 air changes/hr	1.00 air changes/hr

Lights

Recessed fluorescent, not vented, 80% load to space

Fixture Type	RECFL-NV	Longwave Radiant Fraction	50 %
Percent Lights to RA	20 %	Shortwave Radiant Fraction	0 %
Ballast Factor	1.00		

Library Members

Misc. loads

Std Office Equipment

Energy Consumption	0.50 W/ft²	Percent Sensible	100 %	**Radiant Fraction**	60 %
		Percent To Room	100 %	The energy meter is Electricity	
		Percent To RA	0 %		

People

Member Name	People Density	Sensible Load	Latent Load	Longwave Radiant Fraction
General Office Space	143.00 ft²/person	250.00 Btuh	200.00 Btuh	70 %

Library Members

Schedules

Hot Water - denver - pd1

Simulation type: Reduced year

May - May Cooling design to Sunday	**Start time**	**End time**	**Percentage**	Utilization
	Midnight	Midnight	20.0	
January - January Cooling design to Sunday	**Start time**	**End time**	**Percentage**	Utilization
	Midnight	Midnight	0.0	
April - April Cooling design to Sunday	**Start time**	**End time**	**Percentage**	Utilization
	Midnight	Midnight	60.0	
March - March Cooling design to Sunday	**Start time**	**End time**	**Percentage**	Utilization
	Midnight	Midnight	0.0	
July - July Cooling design to Sunday	**Start time**	**End time**	**Percentage**	Utilization
	Midnight	Midnight	5.0	
February - February Cooling design to Sunday	**Start time**	**End time**	**Percentage**	Utilization
	Midnight	Midnight	0.0	
June - June Cooling design to Sunday	**Start time**	**End time**	**Percentage**	Utilization
	Midnight	Midnight	5.0	
September - September Cooling design to Sunday	**Start time**	**End time**	**Percentage**	Utilization
	Midnight	Midnight	20.0	
October - October Cooling design to Sunday	**Start time**	**End time**	**Percentage**	Utilization
	Midnight	Midnight	65.0	
November - November Cooling design to Sunday	**Start time**	**End time**	**Percentage**	Utilization
	Midnight	Midnight	70.0	
December - December Cooling design to Sunday	**Start time**	**End time**	**Percentage**	Utilization
	Midnight	Midnight	15.0	
August - August Cooling design to Sunday	**Start time**	**End time**	**Percentage**	Utilization
	Midnight	Midnight	5.0	
Heating Design	**Start time**	**End time**	**Percentage**	Utilization
	Midnight	Midnight	0.0	

Library Members

Schedules

Available (100%)

Simulation type: Reduced year

January - December	**Cooling design to Sunday**	**Start time**	**End time**	**Percentage**	Utilization
		Midnight	Midnight	100.0	
Heating Design		**Start time**	**End time**	**Percentage**	Utilization
		Midnight	Midnight	100.0	

Parking-Denver-Police 1

Simulation type: Reduced year

January - December	**Cooling design to Weekday**	**Start time**	**End time**	**Percentage**	Utilization
		Midnight	7 a.m.	100.0	
		7 a.m.	8 p.m.	0.0	
		8 p.m.	Midnight	100.0	
January - December	**Sunday**	**Start time**	**End time**	**Percentage**	Utilization
		Midnight	8 a.m.	100.0	
		8 a.m.	8 p.m.	0.0	
		8 p.m.	Midnight	100.0	
Cooling design		**Start time**	**End time**	**Percentage**	Utilization
		Midnight	8 a.m.	100.0	
		8 a.m.	8 p.m.	0.0	
		8 p.m.	Midnight	100.0	
January - December	**Saturday**	**Start time**	**End time**	**Percentage**	Utilization
		Midnight	9 a.m.	100.0	
		9 a.m.	8 p.m.	0.0	
		8 p.m.	Midnight	100.0	

Library Members

Schedules

People - Denver - PD1 2nd floor

Simulation type: Reduced year

Heating Design		**Start time**	**End time**	**Percentage**	Utilization
		Midnight	Midnight	0.0	
January - December	**Cooling design to Weekday**	**Start time**	**End time**	**Percentage**	Utilization
		Midnight	6 a.m.	0.0	
		6 a.m.	8 a.m.	100.0	
		8 a.m.	5 p.m.	100.0	
		5 p.m.	6 p.m.	0.0	
		6 p.m.	10 p.m.	0.0	
		10 p.m.	Midnight	0.0	
January - December	**Saturday to Sunday**	**Start time**	**End time**	**Percentage**	Utilization
		Midnight	Midnight	0.0	

Library Members

Schedules

DCV - Denver - PD1 2nd floor

Simulation type: Reduced year

Heating Design		**Start time**	**End time**	**Percentage**	Utilization
		Midnight	Midnight	0.0	
January - December	**Cooling design to Weekday**	**Start time**	**End time**	**Percentage**	Utilization
		Midnight	6 a.m.	20.0	
		6 a.m.	8 a.m.	100.0	
		8 a.m.	5 p.m.	100.0	
		5 p.m.	6 p.m.	100.0	
		6 p.m.	10 p.m.	20.0	
		10 p.m.	Midnight	20.0	
January - December	**Saturday to Sunday**	**Start time**	**End time**	**Percentage**	Utilization
		Midnight	Midnight	20.0	

Library Members

Schedules

Lights - Denver - Police 1 ECM 1

Simulation type: Reduced year

January - December	**Cooling design to Sunday**	**Start time**	**End time**	**Percentage**	Utilization
		Midnight	6 a.m.	10.0	
		6 a.m.	8 a.m.	65.0	
		8 a.m.	10 a.m.	70.0	
		10 a.m.	noon	100.0	
		noon	2 p.m.	100.0	
		2 p.m.	4 p.m.	100.0	
		4 p.m.	6 p.m.	65.0	
		6 p.m.	8 p.m.	60.0	
		8 p.m.	Midnight	10.0	

Cooling design	**Start time**	**End time**	**Percentage**	Utilization
	Midnight	Midnight	0.0	

Library Members

Schedules

Lights - Denver - Police 1 ECM 3

Simulation type: Reduced year

January - December	**Cooling design to Sunday**	**Start time**	**End time**	**Percentage**	Utilization
		Midnight	6 a.m.	10.0	
		6 a.m.	8 a.m.	65.0	
		8 a.m.	10 a.m.	70.0	
		10 a.m.	noon	100.0	
		noon	2 p.m.	100.0	
		2 p.m.	4 p.m.	100.0	
		4 p.m.	6 p.m.	65.0	
		6 p.m.	8 p.m.	55.5	
		8 p.m.	Midnight	10.0	

Cooling design	**Start time**	**End time**	**Percentage**	Utilization
	Midnight	Midnight	0.0	

Library Members

Schedules

Lights - Denver - Police 1

Simulation type: Reduced year

Cooling design

Start time	End time	Percentage	Utilization
Midnight	Midnight	0.0	

January - December Cooling design to Sunday

Start time	End time	Percentage	Utilization
Midnight	6 a.m.	10.0	
6 a.m.	8 a.m.	50.0	
8 a.m.	10 a.m.	70.0	
10 a.m.	noon	100.0	
noon	2 p.m.	100.0	
2 p.m.	4 p.m.	100.0	
4 p.m.	6 p.m.	50.0	
6 p.m.	8 p.m.	50.0	
8 p.m.	Midnight	10.0	

Library Members

Schedules

DCV - Denver - PD1 1st

Simulation type: Reduced year

January - December	**Saturday to Sunday**	**Start time**	**End time**	**Percentage**	Utilization
		Midnight	Midnight	33.0	
Heating Design		**Start time**	**End time**	**Percentage**	Utilization
		Midnight	Midnight	0.0	
January - December	**Cooling design to Weekday**	**Start time**	**End time**	**Percentage**	Utilization
		Midnight	6 a.m.	33.0	
		6 a.m.	8 a.m.	100.0	
		8 a.m.	5 p.m.	100.0	
		5 p.m.	6 p.m.	33.0	
		6 p.m.	10 p.m.	33.0	
		10 p.m.	Midnight	33.0	

Off (0%)

Simulation type: Reduced year

January - December	**Cooling design to Sunday**	**Start time**	**End time**	**Status**	Equipment operation
		Midnight	Midnight	Off	

Library Members

Schedules

People - Denver - PD1

Simulation type: Reduced year

January - December	**Saturday to Sunday**	**Start time**	**End time**	**Percentage**	Utilization
		Midnight	Midnight	33.0	
Heating Design		**Start time**	**End time**	**Percentage**	Utilization
		Midnight	Midnight	0.0	
January - December	**Cooling design to Weekday**	**Start time**	**End time**	**Percentage**	Utilization
		Midnight	6 a.m.	33.0	
		6 a.m.	8 a.m.	100.0	
		8 a.m.	5 p.m.	100.0	
		5 p.m.	6 p.m.	33.0	
		6 p.m.	10 p.m.	33.0	
		10 p.m.	Midnight	33.0	

Base Utilities

Domestic Hot Water Load - Gas

Comments	
Schedule	Available (100%)
Energy Type	Gas
Hourly demand	1.40 kW
Entering	°F
Leaving	°F

Parking lot lights

Comments	
Schedule	Parking lot lights
Energy Type	Electricity
Hourly demand	0.10 kW
Entering	°F
Leaving	°F

Library Members

Cooling Equipment

TRACE® 700 Cooling Equipment Library

Default air-cooled chiller — **Air-cooled chiller - Helical rotary**

Comments: RTAA - AIR COOLED SERIES R CHILLER

Operating Mode	Capacity	Energy Rate
Cooling	tons	1.110 kW/ton
Heat Recovery		
Tank Charging		
Tank Chrg. & Heat Rec.		

Unloading Curves	Primary	Secondary
Power consumed	EQ1510	EQ1510
Ambient modification	EQ1510 - Amb Mod	None
Capacity		

Load Shed Economizer	No
Evap Precooling	No
Fuel Source	Utility
Fuel type	Electric
Free cooling type	None
Fluid cooler type	None
Thermal Storage	None
Tower/condenser	MZ packaged rooftop cond fan

Pumps	Type	Full Load Consumption	Pump Head
Chilled water	Cnst vol chill water pump	0.000563 kW/ton/ft water	
Condenser water	None	0.00000 kW	
Ht Rec or aux cond.	None	kW	
Free cooling pump	None		

	Reset Based On	Reset Curve	Max Reset TD
Chilled water	None		
Condenser water	None		

Chilled water temp Design leaving	44.00°F
Chilled water temp Difference	10.00°F
Condenser temp design temp entering	95.00°F
Condenser temp min. operating	65.00°F
Condenser temp Difference	10.00°F
Reject Cond heat to ref	Heat rejection equipment
Reject Cond heat at water temp	

Miscellaneous accessories

Cntl panel & interlocks - 0.1 KW

Library Members

Fans

FC Centrifugal var freq drv

Fan type	Variable volume
Comments	
Full load energy	0.00035 kW/Cfm-in wg
Unloading curve	Fan Curve 9

AF Centrifugal var freq drv

Fan type	Variable volume
Comments	Air foil Centrifugal with variable frequency drive
Full load energy	0.00022 kW/Cfm-in wg
Unloading curve	Fan Curve 9

AF w/VFD Crit Zn Reset

Fan type	Variable volume non SP
Comments	Air Foil with VFD and Critical Zone Reset
Full load energy	0.00022 kW/Cfm-in wg
Unloading curve	CZR-VFD

Fan coil supply fan

Fan type	Constant volume
Comments	Fan coil supply fan
Full load energy	0.00024 kW/Cfm
Unloading curve	Fan Curve On/Off

FC Centrifugal const vol

Fan type	Constant volume
Comments	Forward curved Centrifugal fan constant volume
Full load energy	0.00032 kW/Cfm-in wg
Unloading curve	Fan Curve Straight Line

BI Centrifugal var spd mtr

Fan type	Variable volume
Comments	Backward inclined Centrifugal with variable speed
Full load energy	0.00027 kW/Cfm-in wg
Unloading curve	Fan Curve 9

Library Members

Heating Equipment

Gas Fired Hot Water Boiler

Comments	FIRE TUBE HOT H2O BOILER (GAS) EQ2001	
Category	Boiler	
Heat Source	Utility	
Fuel Type	Gas	
Capacity		Mbh
Energy Rate	83.300	Percent efficient
Hot Water Pump	Heating water circ pump	
Hot Water Pump Full Load	0.00	kW
Hot Water Leaving temp		°F
Storage tank	None	
Unloading Curve	Htg Straight Line	

Miscellaneous Accessories

Boiler forced draft fan
Cntl panel & interlocks - 0.5 KW

Library Members

Misc. Equipment

Constant volume pump

Comments	Chilled water pump - constant volume	
Category	Water pump	
Energy type	0.00056	kW/ton-ft wg
Control type	Electricity	
Full load energy	With equipment	

Cooling coil assignments	Heating coil assignments
+ Main	+ Main
Direct evaporative	+ Preheat
Indirect evaporative	+ Reheat
+ Auxiliary	+ Mech. humidification
+ Optional ventilation	+ Auxiliary
+ System exhaust air	+ Optional ventilation
+ Room exhaust air	+ Misc heating load
+ Misc cooling load	+ Base utility htg load
+ Base utility clg load	+ Absorption Chiller load

Cnst vol chill water pump

Comments	Chilled water pump - constant volume	
Category	Water pump	
Energy type	0.00056	kW/ton-ft wg
Control type	Electricity	
Full load energy	With equipment	

Cooling coil assignments	Heating coil assignments
+ Main	+ Main
Direct evaporative	+ Preheat
Indirect evaporative	+ Reheat
+ Auxiliary	+ Mech. humidification
+ Optional ventilation	+ Auxiliary
+ System exhaust air	+ Optional ventilation
+ Room exhaust air	+ Misc heating load
+ Misc cooling load	+ Base utility htg load
+ Base utility clg load	+ Absorption Chiller load

Boiler controls

Comments	Boiler controls	
Category	Controls	
Energy type	2.00000	kW
Control type	Electricity	
Full load energy	With equipment	

Cooling coil assignments	Heating coil assignments
+ Main	+ Main
Direct evaporative	+ Preheat
Indirect evaporative	+ Reheat
+ Auxiliary	+ Mech. humidification
+ Optional ventilation	+ Auxiliary
System exhaust air	+ Optional ventilation
Room exhaust air	+ Misc heating load
+ Misc cooling load	+ Base utility htg load
+ Base utility clg load	+ Absorption Chiller load

Library Members

Misc. Equipment

Heating water circ pump

Comments	Heating water circulation pump	
Category	Water pump	
Energy type	0.00000	kW/Btu-ft wg
Control type	Electricity	
Full load energy	With equipment	

Cooling coil assignments	Heating coil assignments
+ Main	+ Main
Direct evaporative	+ Preheat
Indirect evaporative	+ Reheat
+ Auxiliary	+ Mech. humidification
+ Optional ventilation	+ Auxiliary
+ System exhaust air	+ Optional ventilation
+ Room exhaust air	+ Misc heating load
+ Misc cooling load	+ Base utility htg load
+ Base utility clg load	+ Absorption Chiller load

Heat Rejection

MZ packaged rooftop cond fan

Comments	Multizone packaged rooftop cond fan	
Capacity	100.00	Percent
Energy consumption	0.08	kW/ton
Low speed consumpt	0.00	Percent full load
Fluid type	Water	
Condenser type	Air-cooled condenser	
Number of cells	1	
% Air at low Speed	0.00	
Approach Temp	5.56	°C
Temp Range	5.56	°C
Wet bulb Temp	25.56	°C
Design water flow rate	3.00	gpm/ton
Makeup water flow rate	0.00	gal/ton-hr
Hourly Amb WB Offset		°C
Unloading curve	C-Tower on/off	

Coil load assignmer
+Main
Direct evaporator
+Indirect evaporator
+Auxiliary
+Optional ventilation
+Misc cooling load

911 Call Center

Library Members

Floor - Construction Types

4" LW Concrete — 4" lightweight concrete

Layer	Code	Description	Thickness	Conductivity	Density	Specific Heat	Resistance
1	E0	Inside Surface Resist.					0.69 ft²·hr·°F/Btu
2	C1	4 in. LW Concrete	4.00 in.	0.10 Btu/hr·ft·°F	40.00 lb/cu ft	0.20 Btu/lb·°F	
3	E0	Inside Surface Resist.					0.69 ft²·hr·°F/Btu

Lamda = 0.89 Weight = 13.33 lb/ft² U-Value = 0.213 Btu/hr·ft²·°F Alpha = 0.90
Delta = 3 hours Heat Capacity = 2.67 Btu/ft²·lb·°F C-Coefficient = 0.0900 Btu/hr·ft²·°F

Partitions - Construction Types

0.75" Gyp Frame — 0.75" gypsum board frame wall

Layer	Code	Description	Thickness	Conductivity	Density	Specific Heat	Resistance
1	E0	Inside Surface Resist.					0.69 ft²·hr·°F/Btu
2	E1	0.75 in. Plaster	0.75 in.	0.42 Btu/hr·ft·°F	100.00 lb/cu ft	0.20 Btu/lb·°F	
3	B0	Air Space Resistance					0.91 ft²·hr·°F/Btu
4	E1	0.75 in. Plaster	0.75 in.	0.42 Btu/hr·ft·°F	100.00 lb/cu ft	0.20 Btu/lb·°F	
5	E0	Inside Surface Resist.					0.69 ft²·hr·°F/Btu

Lamda = 1.02 Weight = 12.50 lb/ft² U-Value = 0.388 Btu/hr·ft²·°F Alpha = 0.90
Delta = 1 hours Heat Capacity = 2.50 Btu/ft²·lb·°F C-Coefficient = 0.2400 Btu/hr·ft²·°F

Roof - Construction Types

Attic Roof, 6" Ins

Layer	Code	Description	Thickness	Conductivity	Density	Specific Heat	Resistance
1	A0	Outside Surface Resist.					0.33 ft²·hr·°F/Btu
2	D1	1 in. Wood	1.00 in.	0.07 Btu/hr·ft·°F	37.00 lb/cu ft	0.60 Btu/lb·°F	
3	E4	Ceiling Air Space					1.00 ft²·hr·°F/Btu
4	M96	6 in. Insulation - High Dens	6.00 in.	0.03 Btu/hr·ft·°F	5.70 lb/cu ft	0.20 Btu/lb·°F	
5	E1	0.75 in. Plaster	0.75 in.	0.42 Btu/hr·ft·°F	100.00 lb/cu ft	0.20 Btu/lb·°F	
6	E0	Inside Surface Resist.					0.69 ft²·hr·°F/Btu

Lamda = 0.82 Weight = 12.18 lb/ft² U-Value = 0.043 Btu/hr·ft²·°F Alpha = 0.90
Delta = 5 hours Heat Capacity = 3.67 Btu/ft²·lb·°F C-Coefficient = 0.0100 Btu/hr·ft²·°F

Library Members

Wall - Construction Types

Face Brick, 6" LW Conc blk, 3" Ins

Layer	Code	Description	Thickness	Conductivity	Density	Specific Heat	Resistance
1	A0	Outside Surface Resist.					0.33 ft²·hr·°F/Btu
2	A4	Finish	0.50 in.	0.24 Btu/hr·ft·°F	78.00 lb/cu ft	0.26 Btu/lb·°F	
3	B3	3 in. Insulation	3.00 in.	0.03 Btu/hr·ft·°F	2.00 lb/cu ft	0.20 Btu/lb·°F	
4	C2	6 in. LW Concrete	6.00 in.	0.10 Btu/hr·ft·°F	40.00 lb/cu ft	0.20 Btu/lb·°F	
5	A2	4 in. Face Brick	4.00 in.	0.75 Btu/hr·ft·°F	130.00 lb/cu ft	0.22 Btu/lb·°F	
6	E0	Inside Surface Resist.					0.69 ft²·hr·°F/Btu

Lamda = 0.19 Weight = 67.08 lb/ft² U-Value = 0.060 Btu/hr·ft²·°F Alpha = 0.90

Delta = 11 hours Heat Capacity = 14.48 Btu/ft²·lb·°F C-Coefficient = 0.0000 Btu/hr·ft²·°F

Glass types

Single Clear 1/4" Properties based on Std DS Glass

Number of Panes	1		Visible Transmissivity	0.78	Inside Solar Reflectivity	0.13
Shading Coeff	0.95		Inside Visible Reflectivity	0.14	Outside Long Wave Emissivity	0.84
Glass U-Value	0.95	Btu/hr·ft²·°F	Solar Transmissivity	0.69	Inside Long Wave Emissivity	0.84

Double Clear 1/4" Properties based on Std DS Glass

Number of Panes	2		Visible Transmissivity	0.68	Inside Solar Reflectivity	0.18
Shading Coeff	0.82		Inside Visible Reflectivity	0.23	Outside Long Wave Emissivity	0.84
Glass U-Value	0.60	Btu/hr·ft²·°F	Solar Transmissivity	0.50	Inside Long Wave Emissivity	0.84

Infiltration

Neutral, Average Const.

Cooling Design	Heating Design
0.60 air changes/hr	0.60 air changes/hr

Lights

Recessed fluorescent, not vented, 80% load to space

Fixture Type	RECFL-NV	Longwave Radiant Fraction	50 %
Percent Lights to RA	20 %	Shortwave Radiant Fraction	0 %
Ballast Factor	1.00		

Library Members

Misc. loads

Std Office Equipment

Energy Consumption	0.50 W/ft²	Percent Sensible	100 %	**Radiant Fraction**	60 %
		Percent To Room	100 %	The energy meter is Electricity	
		Percent To RA	0 %		

People

Member Name	People Density	Sensible Load	Latent Load	Longwave Radiant Fraction
General Office Space	143.00 ft²/person	250.00 Btuh	200.00 Btuh	70 %

Ventilation

Member Name	Cooling Design	Heating Design
General Office Space	20.0 cfm/person	20.0 cfm/person

Library Members

Schedules

Lights - Denver - CCC ECM 3

Simulation type: Reduced year

Heating Design	**Start time**	**End time**	**Percentage**	Utilization
	Midnight	Midnight	0.0	

January - December **Saturday**	**Start time**	**End time**	**Percentage**	Utilization
	Midnight	9 a.m.	5.0	
	9 a.m.	11 a.m.	15.0	
	11 a.m.	3 p.m.	15.0	
	3 p.m.	5 p.m.	15.0	
	5 p.m.	Midnight	5.0	

January - December **Cooling design to Weekday**	**Start time**	**End time**	**Percentage**	Utilization
	Midnight	7 a.m.	5.0	
	7 a.m.	11 a.m.	65.0	
	11 a.m.	4 p.m.	100.0	
	4 p.m.	6 p.m.	65.0	
	6 p.m.	8 p.m.	65.0	
	8 p.m.	Midnight	5.0	

January - December **Sunday**	**Start time**	**End time**	**Percentage**	Utilization
	Midnight	Midnight	5.0	

Library Members

Schedules

Lights - Denver - CCC

Simulation type: Reduced year

Heating Design		**Start time**	**End time**	**Percentage**	Utilization
		Midnight	Midnight	0.0	
January - December	**Saturday**	**Start time**	**End time**	**Percentage**	Utilization
		Midnight	9 a.m.	5.0	
		9 a.m.	11 a.m.	25.0	
		11 a.m.	3 p.m.	25.0	
		3 p.m.	5 p.m.	25.0	
		5 p.m.	Midnight	5.0	
January - December	**Cooling design to Weekday**	**Start time**	**End time**	**Percentage**	Utilization
		Midnight	7 a.m.	5.0	
		7 a.m.	11 a.m.	100.0	
		11 a.m.	4 p.m.	80.0	
		4 p.m.	6 p.m.	70.0	
		6 p.m.	8 p.m.	5.0	
		8 p.m.	Midnight	5.0	
January - December	**Sunday**	**Start time**	**End time**	**Percentage**	Utilization
		Midnight	Midnight	5.0	

Available (100%)

Simulation type: Reduced year

January - December	**Cooling design to Sunday**	**Start time**	**End time**	**Percentage**	Utilization
		Midnight	Midnight	100.0	
Heating Design		**Start time**	**End time**	**Percentage**	Utilization
		Midnight	Midnight	100.0	

Library Members

Schedules

People - Denver - 911

Simulation type: Reduced year

January - December	**Saturday to Sunday**	**Start time**	**End time**	**Percentage**	Utilization
		Midnight	Midnight	0.0	
Heating Design		**Start time**	**End time**	**Percentage**	Utilization
		Midnight	Midnight	0.0	
January - December	**Cooling design to Weekday**	**Start time**	**End time**	**Percentage**	Utilization
		Midnight	6 a.m.	0.0	
		6 a.m.	8 a.m.	75.0	
		8 a.m.	5 p.m.	100.0	
		5 p.m.	6 p.m.	100.0	
		6 p.m.	10 p.m.	10.0	
		10 p.m.	Midnight	0.0	

Library Members

Schedules

DCV - Denver - 911

Simulation type: Reduced year

January - December	**Saturday to Sunday**	**Start time**	**End time**	**Percentage**	Utilization
		Midnight	Midnight	55.0	
Heating Design		**Start time**	**End time**	**Percentage**	Utilization
		Midnight	Midnight	0.0	
January - December	**Cooling design to Weekday**	**Start time**	**End time**	**Percentage**	Utilization
		Midnight	6 a.m.	55.0	
		6 a.m.	8 a.m.	100.0	
		8 a.m.	5 p.m.	100.0	
		5 p.m.	6 p.m.	100.0	
		6 p.m.	10 p.m.	100.0	
		10 p.m.	Midnight	55.0	

Library Members

Schedules

Parking-Denver-CCC

Simulation type: Reduced year

January - December	**Sunday**	**Start time**	**End time**	**Percentage**	Utilization
		Midnight	8 a.m.	100.0	
		8 a.m.	7 p.m.	0.0	
		7 p.m.	Midnight	100.0	
January - December	**Saturday**	**Start time**	**End time**	**Percentage**	Utilization
		Midnight	8 a.m.	100.0	
		8 a.m.	7 p.m.	0.0	
		7 p.m.	Midnight	100.0	
January - December	**Cooling design to Weekday**	**Start time**	**End time**	**Percentage**	Utilization
		Midnight	8 a.m.	100.0	
		8 a.m.	9 p.m.	0.0	
		9 p.m.	Midnight	100.0	
Cooling design		**Start time**	**End time**	**Percentage**	Utilization
		Midnight	Midnight	0.0	

Off (0%)

Simulation type: Reduced year

January - December	**Cooling design to Sunday**	**Start time**	**End time**	**Status**	Equipment operation
		Midnight	Midnight	Off	

Library Members

Schedules

Lights - Denver - CCC ECM 1

Simulation type: Reduced year

		Start time	End time	Percentage	
Heating Design					Utilization
		Midnight	Midnight	0.0	
January - December	**Saturday**	**Start time**	**End time**	**Percentage**	Utilization
		Midnight	9 a.m.	5.0	
		9 a.m.	11 a.m.	50.0	
		11 a.m.	3 p.m.	50.0	
		3 p.m.	5 p.m.	50.0	
		5 p.m.	Midnight	5.0	
January - December	**Cooling design to Weekday**	**Start time**	**End time**	**Percentage**	Utilization
		Midnight	7 a.m.	5.0	
		7 a.m.	11 a.m.	100.0	
		11 a.m.	4 p.m.	100.0	
		4 p.m.	6 p.m.	80.0	
		6 p.m.	8 p.m.	70.0	
		8 p.m.	Midnight	5.0	
January - December	**Sunday**	**Start time**	**End time**	**Percentage**	Utilization
		Midnight	Midnight	5.0	

Base Utilities

Parking lot lights

Comments	
Schedule	Parking lot lights
Energy Type	Electricity
Hourly demand	0.10 kW
Entering	°F
Leaving	°F

Library Members

Cooling Equipment

TRACE® 700 Cooling Equipment Library

Large Rooftop - Recip Compressor — **Air-cooled unitary - Direct expansion (DX)**

Comments: >22 Tons Single Zone Rooftop CV Eq1211L

Operating Mode	Capacity	Energy Rate
Cooling	tons	1.240 kW/ton
Heat Recovery		
Tank Charging		
Tank Chrg. & Heat Rec.		

Unloading Curves	Primary	Secondary
Power consumed	EQ1211	EQ1211
Ambient modification	EQ1211 - Amb Mod	None
Capacity		

Load Shed Economizer	No
Evap Precooling	No
Fuel Source	Utility
Fuel type	Electric
Free cooling type	None
Fluid cooler type	None
Thermal Storage	None
Tower/condenser	Condenser fan for MZ rooftop

Pumps	Type	Full Load Consumption	Pump Head
Chilled water	None	0.000000kW	
Condenser water	None	0.00000kW	
Ht Rec or aux cond.	None	kW	
Free cooling pump	None		

	Reset Based On	Reset Curve	Max Reset TD
Chilled water	None		
Condenser water	None		

Chilled water temp Design leaving	44.00°F
Chilled water temp Difference	10.00°F
Condenser temp design temp entering	95.00°F
Condenser temp min. operating	75.00°F
Condenser temp Difference	10.00°F
Reject Cond heat to ref	Heat rejection equipment
Reject Cond heat at water temp	

Miscellaneous accessories

Cntl panel & interlocks - 0.125 KW

TRACE® 700 Cooling Equipment Library

Default air-cooled unitary — **Air-cooled unitary - Reciprocating**

Comments: PACKAGED TERMINAL AIR CONDITIONER

Operating Mode	Capacity	Energy Rate
Cooling	tons	1.380 kW/ton
Heat Recovery		
Tank Charging		
Tank Chrg. & Heat Rec.		

Unloading Curves	Primary	Secondary
Power consumed	EQ1307	EQ1307
Ambient modification	EQ1307 - Amb Mod	EQ1307 - Amb Mod
Capacity		

Load Shed Economizer	No
Evap Precooling	No
Fuel Source	Utility
Fuel type	Electric
Free cooling type	None
Fluid cooler type	None
Thermal Storage	None
Tower/condenser	Condenser fan for Heat Pump

Pumps	Type	Full Load Consumption	Pump Head
Chilled water	None	0.000000kW	
Condenser water	None	0.00000kW	
Ht Rec or aux cond.	None	kW	
Free cooling pump	None		

	Reset Based On	Reset Curve	Max Reset TD
Chilled water	None		
Condenser water	None		

Chilled water temp Design leaving	44.00°F
Chilled water temp Difference	10.00°F
Condenser temp design temp entering	95.00°F
Condenser temp min. operating	75.00°F
Condenser temp Difference	10.00°F
Reject Cond heat to ref	Heat rejection equipment
Reject Cond heat at water temp	

Miscellaneous accessories

Cntl panel & interlocks - 0.1 KW

Library Members

Fans

AF Centrifugal var freq drv

Fan type	Variable volume
Comments	Air foil Centrifugal with variable frequency drive
Full load energy	0.00022 kW/Cfm-in wg
Unloading curve	Fan Curve 9

Fan coil supply fan

Fan type	Constant volume
Comments	Fan coil supply fan
Full load energy	0.00024 kW/Cfm
Unloading curve	Fan Curve On/Off

FC Centrifugal const vol

Fan type	Constant volume
Comments	Forward curved Centrifugal fan constant volume
Full load energy	0.00032 kW/Cfm-in wg
Unloading curve	Fan Curve Straight Line

Library Members

Heating Equipment

Default electric resistance

Comments	ROOFTOP ELECTRIC HEAT	
Category	Electric resistance	
Heat Source	Utility	
Fuel Type	Electric	
Capacity		Mbh
Energy Rate	100.000	Percent efficient
Hot Water Pump	None	
Hot Water Pump Full Load	0.00	kW
Hot Water Leaving temp		°F
Storage tank	None	
Unloading Curve	Htg Straight Line	

Miscellaneous Accessories

Denver-CCC-Boiler

Comments	FIRE TUBE HOT H2O BOILER (GAS) EQ2001	
Category	Boiler	
Heat Source	Utility	
Fuel Type	Gas	
Capacity		Mbh
Energy Rate	64.000	Percent efficient
Hot Water Pump	Heating water circ pump	
Hot Water Pump Full Load	0.00	kW
Hot Water Leaving temp		°F
Storage tank	None	
Unloading Curve	elec heat - 3 stage	

Miscellaneous Accessories

None

Cntl panel & interlocks - 0.5 KW

Misc. Equipment

Heating water circ pump

Comments	Heating water circulation pump	
Category	Water pump	
Energy type	0.00000	kW/Btu-ft wg
Control type	Electricity	
Full load energy	With equipment	

Cooling coil assignments

+ Main
  Direct evaporative
  Indirect evaporative
+ Auxiliary
+ Optional ventilation
+ System exhaust air
+ Room exhaust air
+ Misc cooling load
+ Base utility clg load

Heating coil assignments

+ Main
+ Preheat
+ Reheat
+ Mech. humidification
+ Auxiliary
+ Optional ventilation
+ Misc heating load
+ Base utility htg load
+ Absorption Chiller load

Library Members

Heat Rejection

Condenser fan for MZ rooftop

Comments	Multizone packaged rooftop cond fan	
Capacity	100.00	Percent
Energy consumption	0.08	kW/ton
Low speed consumpt	0.00	Percent full load
Fluid type	Water	
Condenser type	Air-cooled condenser	
Number of cells	1	
% Air at low Speed	0.00	
Approach Temp	5.56	°C
Temp Range	5.56	°C
Wet bulb Temp	25.56	°C
Design water flow rate	3.00	gpm/ton
Makeup water flow rate	0.00	gal/ton-hr
Hourly Amb WB Offset		°C
Unloading curve	C-Tower on/off	

Coil load assignmer
+Main
Direct evaporator
+Indirect evaporator
+Auxiliary
+Optional ventilation
+Misc cooling load

Condenser fan for Heat Pump

Comments	Heat Pump Condenser Fan	
Capacity	100.00	Percent
Energy consumption	0.12	kW/ton
Low speed consumpt	0.00	Percent full load
Fluid type	Water	
Condenser type	Air-cooled condenser	
Number of cells	1	
% Air at low Speed	0.00	
Approach Temp	10.00	°F
Temp Range	10.00	°F
Wet bulb Temp	78.00	°F
Design water flow rate	3.00	gpm/ton
Makeup water flow rate	0.00	gal/ton-hr
Hourly Amb WB Offset		°F
Unloading curve	C-Tower on/off	

Coil load assignmer
+Main
Direct evaporator
+Indirect evaporator
+Auxiliary
+Optional ventilation
+Misc cooling load

Twentieth Street Rec Ctr

Library Members

Floor - Construction Types

4" LW Concrete — 4" lightweight concrete

Layer	Code	Description	Thickness	Conductivity	Density	Specific Heat	Resistance
1	E0	Inside Surface Resist.					0.69 ft²·hr·°F/Btu
2	C1	4 in. LW Concrete	4.00 in.	0.10 Btu/hr·ft·°F	40.00 lb/cu ft	0.20 Btu/lb·°F	
3	E0	Inside Surface Resist.					0.69 ft²·hr·°F/Btu

Lamda = 0.89 Weight = 13.33 lb/ft² U-Value = 0.213 Btu/hr·ft²·°F Alpha = 0.90
Delta = 3 hours Heat Capacity = 2.67 Btu/ft²·lb·°F C-Coefficient = 0.0900 Btu/hr·ft²·°F

Partitions - Construction Types

0.75" Gyp Frame — 0.75" gypsum board frame wall

Layer	Code	Description	Thickness	Conductivity	Density	Specific Heat	Resistance
1	E0	Inside Surface Resist.					0.69 ft²·hr·°F/Btu
2	E1	0.75 in. Plaster	0.75 in.	0.42 Btu/hr·ft·°F	100.00 lb/cu ft	0.20 Btu/lb·°F	
3	B0	Air Space Resistance					0.91 ft²·hr·°F/Btu
4	E1	0.75 in. Plaster	0.75 in.	0.42 Btu/hr·ft·°F	100.00 lb/cu ft	0.20 Btu/lb·°F	
5	E0	Inside Surface Resist.					0.69 ft²·hr·°F/Btu

Lamda = 1.02 Weight = 12.50 lb/ft² U-Value = 0.388 Btu/hr·ft²·°F Alpha = 0.90
Delta = 1 hours Heat Capacity = 2.50 Btu/ft²·lb·°F C-Coefficient = 0.2400 Btu/hr·ft²·°F

Roof - Construction Types

Steel Sheet, 1" Ins — Steel sheet, 1" insulation

Layer	Code	Description	Thickness	Conductivity	Density	Specific Heat	Resistance
1	A0	Outside Surface Resist.					0.33 ft²·hr·°F/Btu
2	E2	0.5 in. Slag or Stone	0.50 in.	0.83 Btu/hr·ft·°F	55.00 lb/cu ft	0.40 Btu/lb·°F	
3	E3	3/8 in. Felt & Membrane	0.38 in.	0.11 Btu/hr·ft·°F	70.00 lb/cu ft	0.40 Btu/lb·°F	
4	A3	Steel Siding	0.06 in.	26.00 Btu/hr·ft·°F	480.00 lb/cu ft	0.10 Btu/lb·°F	
5	B1	1 in. Insulation	1.00 in.	0.03 Btu/hr·ft·°F	2.00 lb/cu ft	0.20 Btu/lb·°F	
6	E0	Inside Surface Resist.					0.69 ft²·hr·°F/Btu

Lamda = 0.98 Weight = 7.05 lb/ft² U-Value = 0.214 Btu/hr·ft²·°F Alpha = 0.90
Delta = 1 hours Heat Capacity = 2.07 Btu/ft²·lb·°F C-Coefficient = 0.1600 Btu/hr·ft²·°F

Library Members

Wall - Construction Types

8" LW Block, 2" Ins — 8" lightweight concrete block, 2" insulation

Layer	Code	Description	Thickness	Conductivity	Density	Specific Heat	Resistance
1	A0	Outside Surface Resist.					0.33 ft²·hr·°F/Btu
2	A1	1 in. Stucco	1.00 in.	0.40 Btu/hr·ft·°F	116.00 lb/cu ft	0.20 Btu/lb·°F	
3	C11	8 in. LW Concrete Block	8.00 in.	0.33 Btu/hr·ft·°F	38.00 lb/cu ft	0.20 Btu/lb·°F	
4	B2	2 in. Insulation - High Dens	2.00 in.	0.03 Btu/hr·ft·°F	5.70 lb/cu ft	0.20 Btu/lb·°F	
5	E1	0.75 in. Plaster	0.75 in.	0.42 Btu/hr·ft·°F	100.00 lb/cu ft	0.20 Btu/lb·°F	
6	E0	Inside Surface Resist.					0.69 ft²·hr·°F/Btu

Lamda = 0.53 | Weight = 42.20 lb/ft² | U-Value = 0.099 Btu/hr·ft²·°F | Alpha = 0.90

Delta = 7 hours | Heat Capacity = 8.44 Btu/ft²·lb·°F | C-Coefficient = 0.0100 Btu/hr·ft²·°F

Glass types

Double Coated 1/4" — Properties based on Std DS Glass

Number of Panes	2		Visible Transmissivity	0.30	Inside Solar Reflectivity	0.17
Shading Coeff	0.55		Inside Visible Reflectivity	0.20	Outside Long Wave Emissivity	0.84
Glass U-Value	0.50	Btu/hr·ft²·°F	Solar Transmissivity	0.28	Inside Long Wave Emissivity	0.84

Double Clear 1/4" — Properties based on Std DS Glass

Number of Panes	2		Visible Transmissivity	0.68	Inside Solar Reflectivity	0.18
Shading Coeff	0.82		Inside Visible Reflectivity	0.23	Outside Long Wave Emissivity	0.84
Glass U-Value	0.60	Btu/hr·ft²·°F	Solar Transmissivity	0.50	Inside Long Wave Emissivity	0.84

Single Clear 1/4" — Properties based on Std DS Glass

Number of Panes	1		Visible Transmissivity	0.78	Inside Solar Reflectivity	0.13
Shading Coeff	0.95		Inside Visible Reflectivity	0.14	Outside Long Wave Emissivity	0.84
Glass U-Value	0.95	Btu/hr·ft²·°F	Solar Transmissivity	0.69	Inside Long Wave Emissivity	0.84

Library Members

Infiltration

Neutral, Tight Const.

Cooling Design	Heating Design
0.30 air changes/hr	0.30 air changes/hr

Neutral, Poor Const.

Cooling Design	Heating Design
1.00 air changes/hr	1.00 air changes/hr

Lights

Recessed fluorescent, not vented, 80% load to space

Fixture Type	RECFL-NV	Longwave Radiant Fraction	50 %
Percent Lights to RA	20 %	Shortwave Radiant Fraction	0 %
Ballast Factor	1.00		

Misc. loads

TSRC Pool Occupied Evaporation Load -

Energy Consumption	137.00 Mbh	Percent Sensible	0 %	**Radiant Fraction** 100 %
		Percent To Room	100 %	The energy meter is Heating Load
		Percent To RA	0 %	The miscellaneous air path is Same Path As RA

Std Office Equipment

Energy Consumption	0.50 W/ft²	Percent Sensible	100 %	**Radiant Fraction** 60 %
		Percent To Room	100 %	The energy meter is Electricity
		Percent To RA	0 %	

People

Member Name	People Density	Sensible Load	Latent Load	Longwave Radiant Fraction
Auditorium	6.70 ft²/person	225.00 Btuh	105.00 Btuh	70 %
Member Name	**People Density**	**Sensible Load**	**Latent Load**	Longwave Radiant Fraction
General Office Space	143.00 ft²/person	250.00 Btuh	200.00 Btuh	70 %
Member Name	**People Density**	**Sensible Load**	**Latent Load**	Longwave Radiant Fraction
Conference Room	20.00 ft²/person	245.00 Btuh	155.00 Btuh	70 %

Library Members

Ventilation

Member Name	Cooling Design	Heating Design
Locker Room	1.0 cfm/ft²	0.5 cfm/ft²
Library	15.0 cfm/person	15.0 cfm/person
Classroom	15.0 cfm/person	15.0 cfm/person
General Office Space	20.0 cfm/person	20.0 cfm/person

Library Members

Schedules

Hot Water - denver - 20th pool

Simulation type: Reduced year

October - October Cooling design to Sunday	**Start time**	**End time**	**Percentage**	Utilization
	Midnight	Midnight	100.0	
May - May Cooling design to Sunday	**Start time**	**End time**	**Percentage**	Utilization
	Midnight	Midnight	100.0	
January - January Cooling design to Sunday	**Start time**	**End time**	**Percentage**	Utilization
	Midnight	Midnight	100.0	
July - July Cooling design to Sunday	**Start time**	**End time**	**Percentage**	Utilization
	Midnight	Midnight	100.0	
March - March Cooling design to Sunday	**Start time**	**End time**	**Percentage**	Utilization
	Midnight	Midnight	100.0	
November - November Cooling design to Sunday	**Start time**	**End time**	**Percentage**	Utilization
	Midnight	Midnight	100.0	
June - June Cooling design to Sunday	**Start time**	**End time**	**Percentage**	Utilization
	Midnight	Midnight	100.0	
April - April Cooling design to Sunday	**Start time**	**End time**	**Percentage**	Utilization
	Midnight	Midnight	100.0	
December - December Cooling design to Sunday	**Start time**	**End time**	**Percentage**	Utilization
	Midnight	Midnight	100.0	
September - September Cooling design to Sunday	**Start time**	**End time**	**Percentage**	Utilization
	Midnight	Midnight	100.0	
August - August Cooling design to Sunday	**Start time**	**End time**	**Percentage**	Utilization
	Midnight	Midnight	100.0	
Cooling design	**Start time**	**End time**	**Percentage**	Utilization
	Midnight	Midnight	100.0	
February - February Cooling design to Sunday	**Start time**	**End time**	**Percentage**	Utilization
	Midnight	Midnight	100.0	

Library Members

Schedules

Library Members

Schedules

amherst - goodwin

Simulation type: Reduced year

July - July	**Cooling design to Weekday**	**Start time**	**End time**	**Percentage**	Utilization
		Midnight	7 a.m.	0.0	
		7 a.m.	8 a.m.	6.0	
		8 a.m.	11 a.m.	50.0	
		11 a.m.	noon	20.0	
		noon	1 p.m.	20.0	
		1 p.m.	3 p.m.	50.0	
		3 p.m.	5 p.m.	50.0	
		5 p.m.	6 p.m.	30.0	
		6 p.m.	7 p.m.	6.0	
		7 p.m.	Midnight	0.0	

January - June	**Cooling design to Weekday**	**Start time**	**End time**	**Percentage**	Utilization
		Midnight	5 a.m.	0.0	
		5 a.m.	7 a.m.	6.0	
		7 a.m.	11 a.m.	80.0	
		11 a.m.	noon	30.0	
		noon	1 p.m.	30.0	
		1 p.m.	3 p.m.	80.0	
		3 p.m.	5 p.m.	70.0	
		5 p.m.	6 p.m.	30.0	
		6 p.m.	9 p.m.	6.0	
		9 p.m.	Midnight	0.0	

December - December	**Cooling design to Weekday**	**Start time**	**End time**	**Percentage**	Utilization
		Midnight	7 a.m.	0.0	
		7 a.m.	11 a.m.	50.0	
		8 a.m.	11 a.m.	50.0	
		11 a.m.	noon	20.0	
		noon	1 p.m.	20.0	

Library Members

Schedules

	1 p.m.	3 p.m.	50.0	
	3 p.m.	5 p.m.	50.0	
	5 p.m.	6 p.m.	30.0	
	6 p.m.	7 p.m.	6.0	
	7 p.m.	Midnight	0.0	

January - December **Saturday to Sunday**

Start time	**End time**	**Percentage**	Utilization
Midnight	Midnight	0.0	

Cooling design

Start time	**End time**	**Percentage**	Utilization
Midnight	Midnight	0.0	

August - November **Cooling design to Weekday**

Start time	**End time**	**Percentage**	Utilization
Midnight	7 a.m.	0.0	
7 a.m.	8 a.m.	6.0	
8 a.m.	11 a.m.	80.0	
11 a.m.	noon	30.0	
noon	1 p.m.	30.0	
1 p.m.	3 p.m.	80.0	
3 p.m.	5 p.m.	70.0	
5 p.m.	6 p.m.	30.0	
6 p.m.	7 p.m.	6.0	
7 p.m.	Midnight	0.0	

Library Members

Schedules

People - Denver - 20th rec

Simulation type: Reduced year

January - December	**Saturday**	**Start time**	**End time**	**Percentage**	Utilization
		Midnight	9 a.m.	0.0	
		9 a.m.	11 a.m.	50.0	
		11 a.m.	noon	80.0	
		noon	1 p.m.	100.0	
		1 p.m.	Midnight	0.0	
Cooling design		**Start time**	**End time**	**Percentage**	Utilization
		Midnight	Midnight	0.0	
January - December	**Cooling design to Weekday**	**Start time**	**End time**	**Percentage**	Utilization
		Midnight	6 a.m.	0.0	
		6 a.m.	8 a.m.	100.0	
		8 a.m.	10 a.m.	80.0	
		10 a.m.	noon	100.0	
		noon	2 p.m.	80.0	
		2 p.m.	4 p.m.	50.0	
		4 p.m.	6 p.m.	100.0	
		6 p.m.	8 p.m.	75.0	
		8 p.m.	Midnight	0.0	
January - December	**Sunday**	**Start time**	**End time**	**Percentage**	Utilization
		Midnight	Midnight	0.0	

Off (0%)

Simulation type: Reduced year

January - December	**Cooling design to Sunday**	**Start time**	**End time**	**Status**	Equipment operation
		Midnight	Midnight	Off	

Library Members

Schedules

CCD - TSRC - unknow

Simulation type: Reduced year

April - April Cooling design to Sunday	**Start time**	**End time**	**Percentage**	Utilization
	Midnight	Midnight	30.0	
December - December Cooling design to Sunday	**Start time**	**End time**	**Percentage**	Utilization
	Midnight	Midnight	100.0	
September - September Cooling design to Sunday	**Start time**	**End time**	**Percentage**	Utilization
	Midnight	Midnight	10.0	
August - August Cooling design to Sunday	**Start time**	**End time**	**Percentage**	Utilization
	Midnight	Midnight	0.0	
Cooling design	**Start time**	**End time**	**Percentage**	Utilization
	Midnight	Midnight	100.0	
February - February Cooling design to Sunday	**Start time**	**End time**	**Percentage**	Utilization
	Midnight	Midnight	88.0	
October - October Cooling design to Sunday	**Start time**	**End time**	**Percentage**	Utilization
	Midnight	Midnight	100.0	
May - May Cooling design to Sunday	**Start time**	**End time**	**Percentage**	Utilization
	Midnight	Midnight	40.0	
January - January Cooling design to Sunday	**Start time**	**End time**	**Percentage**	Utilization
	Midnight	Midnight	100.0	
July - July Cooling design to Sunday	**Start time**	**End time**	**Percentage**	Utilization
	Midnight	Midnight	0.0	
March - March Cooling design to Sunday	**Start time**	**End time**	**Percentage**	Utilization
	Midnight	Midnight	30.0	
November - November Cooling design to Sunday	**Start time**	**End time**	**Percentage**	Utilization
	Midnight	Midnight	100.0	
June - June Cooling design to Sunday	**Start time**	**End time**	**Percentage**	Utilization
	Midnight	Midnight	0.0	

Library Members

Schedules

Available (100%)

Simulation type: Reduced year

January - December	**Cooling design to Sunday**	**Start time**	**End time**	**Percentage**	Utilization
		Midnight	Midnight	100.0	
Heating Design		**Start time**	**End time**	**Percentage**	Utilization
		Midnight	Midnight	100.0	

Parking-Denver-20th St

Simulation type: Reduced year

January - December	**Cooling design to Weekday**	**Start time**	**End time**	**Percentage**	Utilization
		Midnight	7 a.m.	100.0	
		7 a.m.	8 p.m.	0.0	
		8 p.m.	Midnight	100.0	
January - December	**Sunday**	**Start time**	**End time**	**Percentage**	Utilization
		Midnight	8 a.m.	100.0	
		8 a.m.	8 p.m.	0.0	
		8 p.m.	Midnight	100.0	
Cooling design		**Start time**	**End time**	**Percentage**	Utilization
		Midnight	8 a.m.	100.0	
		8 a.m.	8 p.m.	0.0	
		8 p.m.	Midnight	100.0	
January - December	**Saturday**	**Start time**	**End time**	**Percentage**	Utilization
		Midnight	9 a.m.	100.0	
		9 a.m.	8 p.m.	0.0	
		8 p.m.	Midnight	100.0	

Library Members

Schedules

Lights - Denver - 20th St ECM 3

Simulation type: Reduced year

January - December	**Cooling design to Weekday**	**Start time**	**End time**	**Percentage**	Utilization
		Midnight	6 a.m.	1.0	
		6 a.m.	11 a.m.	80.0	
		11 a.m.	4 p.m.	75.0	
		4 p.m.	6 p.m.	75.0	
		6 p.m.	8 p.m.	50.0	
		8 p.m.	Midnight	1.0	
Heating Design		**Start time**	**End time**	**Percentage**	Utilization
		Midnight	Midnight	0.0	
January - December	**Sunday**	**Start time**	**End time**	**Percentage**	Utilization
		Midnight	Midnight	1.0	
January - December	**Saturday**	**Start time**	**End time**	**Percentage**	Utilization
		Midnight	9 a.m.	1.0	
		9 a.m.	11 a.m.	80.0	
		11 a.m.	2 p.m.	100.0	
		2 p.m.	4 p.m.	70.0	
		4 p.m.	Midnight	1.0	

Library Members

Schedules

Lights - Denver - 20th St ECM 1

Simulation type: Reduced year

January - December	**Saturday**	**Start time**	**End time**	**Percentage**	Utilization
		Midnight	9 a.m.	1.0	
		9 a.m.	11 a.m.	80.0	
		11 a.m.	2 p.m.	100.0	
		2 p.m.	4 p.m.	80.0	
		4 p.m.	Midnight	1.0	
January - December	**Sunday**	**Start time**	**End time**	**Percentage**	Utilization
		Midnight	Midnight	1.0	
Heating Design		**Start time**	**End time**	**Percentage**	Utilization
		Midnight	Midnight	0.0	
January - December	**Cooling design to Weekday**	**Start time**	**End time**	**Percentage**	Utilization
		Midnight	6 a.m.	1.0	
		6 a.m.	11 a.m.	80.0	
		11 a.m.	4 p.m.	75.0	
		4 p.m.	6 p.m.	75.0	
		6 p.m.	8 p.m.	55.0	
		8 p.m.	Midnight	1.0	

Library Members

Schedules

Misc - Denver - TSRC

Simulation type: Reduced year

January - December	**Sunday**	**Start time**	**End time**	**Percentage**	Utilization
		Midnight	Midnight	66.7	
January - December	**Cooling design to Weekday**	**Start time**	**End time**	**Percentage**	Utilization
		Midnight	6 a.m.	66.7	
		6 a.m.	8 a.m.	100.0	
		8 a.m.	10 a.m.	100.0	
		10 a.m.	noon	100.0	
		noon	2 p.m.	100.0	
		2 p.m.	4 p.m.	100.0	
		4 p.m.	6 p.m.	100.0	
		6 p.m.	7 p.m.	100.0	
		7 p.m.	8 p.m.	66.0	
		8 p.m.	Midnight	66.7	
January - December	**Saturday**	**Start time**	**End time**	**Percentage**	Utilization
		Midnight	9 a.m.	66.7	
		9 a.m.	11 a.m.	100.0	
		11 a.m.	1 p.m.	100.0	
		1 p.m.	3 p.m.	66.7	
		3 p.m.	4 p.m.	66.7	
		4 p.m.	5 p.m.	66.7	
		5 p.m.	Midnight	66.7	
Cooling design		**Start time**	**End time**	**Percentage**	Utilization
		Midnight	Midnight	0.0	

Library Members

Schedules

Lights - Denver - 20th St

Simulation type: Reduced year

Heating Design		**Start time**	**End time**	**Percentage**	Utilization
		Midnight	Midnight	0.0	
January - December	**Cooling design to Weekday**	**Start time**	**End time**	**Percentage**	Utilization
		Midnight	6 a.m.	1.0	
		6 a.m.	11 a.m.	75.0	
		11 a.m.	4 p.m.	65.0	
		4 p.m.	6 p.m.	65.0	
		6 p.m.	8 p.m.	50.0	
		8 p.m.	Midnight	1.0	
January - December	**Sunday**	**Start time**	**End time**	**Percentage**	Utilization
		Midnight	Midnight	1.0	
January - December	**Saturday**	**Start time**	**End time**	**Percentage**	Utilization
		Midnight	9 a.m.	1.0	
		9 a.m.	11 a.m.	65.0	
		11 a.m.	2 p.m.	75.0	
		2 p.m.	4 p.m.	65.0	
		4 p.m.	Midnight	1.0	

Library Members

Base Utilities

Parking lot lights

Comments	
Schedule	Parking lot lights
Energy Type	Electricity
Hourly demand	0.10 kW
Entering	°F
Leaving	°F

Sample

Comments	
Schedule	Available (100%)
Energy Type	Electricity
Hourly demand	5.00 kW
Entering	85.00 °F
Leaving	110.00 °F

Domestic Hot Water Load - Gas

Comments	
Schedule	Available (100%)
Energy Type	Gas
Hourly demand	1.40 kW
Entering	°F
Leaving	°F

Library Members

Cooling Equipment

TRACE® 700 Cooling Equipment Library

CCD-TSRC cooling — **Air-cooled unitary - Reciprocating**

Comments: PACKAGED TERMINAL AIR CONDITIONER

Operating Mode	Capacity	Energy Rate
Cooling	58.00 tons	60.000 kW
Heat Recovery		
Tank Charging		
Tank Chrg. & Heat Rec.		

Unloading Curves	Primary	Secondary
Power consumed	CCD - TSRC - cooling	CCD - TSRC - cooling
Ambient modification	EQ1307 - Amb Mod	EQ1307 - Amb Mod
Capacity		

Load Shed Economizer	No
Evap Precooling	No
Fuel Source	Utility
Fuel type	Electric
Free cooling type	None
Fluid cooler type	None
Thermal Storage	None
Tower/condenser	Condenser fan for Heat Pump

Pumps	Type	Full Load Consumption	Pump Head
Chilled water	None	0.000000kW	
Condenser water	None	0.00000kW	
Ht Rec or aux cond.	None	kW	
Free cooling pump	None		

	Reset Based On	Reset Curve	Max Reset TD
Chilled water	None		
Condenser water	None		

Chilled water temp Design leaving	44.00°F
Chilled water temp Difference	10.00°F
Condenser temp design temp entering	95.00°F
Condenser temp min. operating	75.00°F
Condenser temp Difference	10.00°F
Reject Cond heat to ref	Heat rejection equipment
Reject Cond heat at water temp	

Miscellaneous accessories

Cntl panel & interlocks - 0.1 KW

TRACE® 700 Cooling Equipment Library

CCD-TSRC-RTU — **Air-cooled unitary - Reciprocating**

Comments: PACKAGED TERMINAL AIR CONDITIONER

Operating Mode	Capacity	Energy Rate
Cooling	13.00 tons	10.000 kW
Heat Recovery		
Tank Charging		
Tank Chrg. & Heat Rec.		

Unloading Curves	Primary	Secondary
Power consumed	Air-cooled Rooftop	Air-cooled Rooftop
Ambient modification	EQ1307 - Amb Mod	EQ1307 - Amb Mod
Capacity		

Load Shed Economizer	No
Evap Precooling	No
Fuel Source	Utility
Fuel type	Electric
Free cooling type	None
Fluid cooler type	None
Thermal Storage	None
Tower/condenser	Condenser fan for Heat Pump

Pumps	Type	Full Load Consumption	Pump Head
Chilled water	None	0.000000kW	
Condenser water	None	0.00000kW	
Ht Rec or aux cond.	None	kW	
Free cooling pump	None		

	Reset Based On	Reset Curve	Max Reset TD
Chilled water	None		
Condenser water	None		

Chilled water temp Design leaving	44.00°F
Chilled water temp Difference	10.00°F
Condenser temp design temp entering	95.00°F
Condenser temp min. operating	75.00°F
Condenser temp Difference	10.00°F
Reject Cond heat to ref	Heat rejection equipment
Reject Cond heat at water temp	

Miscellaneous accessories

Cntl panel & interlocks - 0.1 KW

Library Members

Fans

FC Centrifugal const vol

Fan type	Constant volume
Comments	Forward curved Centrifugal fan constant volume
Full load energy	0.00032 kW/Cfm-in wg
Unloading curve	Fan Curve Straight Line

No fan energy consumed

Fan type	Constant volume
Comments	No fan energy consumed
Full load energy	0.00000 kW/Cfm-in wg
Unloading curve	Fan Curve On/Off

Heating Equipment

Default Boiler

Comments	FIRE TUBE HOT H2O BOILER (GAS) EQ2001	
Category	Boiler	**Miscellaneous Accessories**
Heat Source	Utility	Boiler forced draft fan
Fuel Type	Gas	Cntl panel & interlocks - 0.5 KW
Capacity	Mbh	
Energy Rate	83.300 Percent efficient	
Hot Water Pump	Heating water circ pump	
Hot Water Pump Full Load	0.00 kW	
Hot Water Leaving temp	°F	
Storage tank	None	
Unloading Curve	Htg Straight Line	

Default gas-fired heat exchanger

Comments	ROOFTOP GAS HEAT	
Category	Gas-fired heat exchanger	**Miscellaneous Accessories**
Heat Source	Utility	
Fuel Type	Gas	
Capacity	Mbh	
Energy Rate	77.000 Percent efficient	
Hot Water Pump	None	
Hot Water Pump Full Load	0.00 kW	
Hot Water Leaving temp	°F	
Storage tank	None	
Unloading Curve	Htg Straight Line	

Library Members

Misc. Equipment

Pool Heater

Comments		
Category	Ancillary	
Energy type	2.20000	therms
Control type	Gas	
Full load energy	Always on	

Cooling coil assignments	Heating coil assignments
+ Main	+ Main
Direct evaporative	+ Preheat
Indirect evaporative	+ Reheat
+ Auxiliary	Mech. humidification
+ Optional ventilation	+ Auxiliary
System exhaust air	+ Optional ventilation
Room exhaust air	+ Misc heating load
+ Misc cooling load	+ Base utility htg load
+ Base utility clg load	+ Absorption Chiller load

Heating water circ pump

Comments	Heating water circulation pump	
Category	Water pump	
Energy type	0.00000	kW/Btu-ft wg
Control type	Electricity	
Full load energy	With equipment	

Cooling coil assignments	Heating coil assignments
+ Main	+ Main
Direct evaporative	+ Preheat
Indirect evaporative	+ Reheat
+ Auxiliary	+ Mech. humidification
+ Optional ventilation	+ Auxiliary
+ System exhaust air	+ Optional ventilation
+ Room exhaust air	+ Misc heating load
+ Misc cooling load	+ Base utility htg load
+ Base utility clg load	+ Absorption Chiller load

Library Members

Heat Rejection

Condenser fan for Heat Pump

Comments	Heat Pump Condenser Fan	
Capacity	100.00	Percent
Energy consumption	0.12	kW/ton
Low speed consumpt	0.00	Percent full load
Fluid type	Water	
Condenser type	Air-cooled condenser	
Number of cells	1	
% Air at low Speed	0.00	
Approach Temp	10.00	°F
Temp Range	10.00	°F
Wet bulb Temp	78.00	°F
Design water flow rate	3.00	gpm/ton
Makeup water flow rate	0.00	gal/ton-hr
Hourly Amb WB Offset		°F
Unloading curve	C-Tower on/off	

Coil load assignmer

+Main
Direct evaporator
+Indirect evaporator
+Auxiliary
+Optional ventilation
+Misc cooling load

Heat Recovery

Barnum Library

Library Members

Floor - Construction Types

4" LW Concrete — 4" lightweight concrete

Layer	Code	Description	Thickness	Conductivity	Density	Specific Heat	Resistance
1	E0	Inside Surface Resist.					0.69 ft²·hr·°F/Btu
2	C1	4 in. LW Concrete	4.00 in.	0.10 Btu/hr·ft·°F	40.00 lb/cu ft	0.20 Btu/lb·°F	
3	E0	Inside Surface Resist.					0.69 ft²·hr·°F/Btu

Lamda = 0.89 Weight = 13.33 lb/ft² U-Value = 0.213 Btu/hr·ft²·°F Alpha = 0.90
Delta = 3 hours Heat Capacity = 2.67 Btu/ft²·lb·°F C-Coefficient = 0.0900 Btu/hr·ft²·°F

Partitions - Construction Types

0.75" Gyp Frame — 0.75" gypsum board frame wall

Layer	Code	Description	Thickness	Conductivity	Density	Specific Heat	Resistance
1	E0	Inside Surface Resist.					0.69 ft²·hr·°F/Btu
2	E1	0.75 in. Plaster	0.75 in.	0.42 Btu/hr·ft·°F	100.00 lb/cu ft	0.20 Btu/lb·°F	
3	B0	Air Space Resistance					0.91 ft²·hr·°F/Btu
4	E1	0.75 in. Plaster	0.75 in.	0.42 Btu/hr·ft·°F	100.00 lb/cu ft	0.20 Btu/lb·°F	
5	E0	Inside Surface Resist.					0.69 ft²·hr·°F/Btu

Lamda = 1.02 Weight = 12.50 lb/ft² U-Value = 0.388 Btu/hr·ft²·°F Alpha = 0.90
Delta = 1 hours Heat Capacity = 2.50 Btu/ft²·lb·°F C-Coefficient = 0.2400 Btu/hr·ft²·°F

Roof - Construction Types

Steel Sheet, 3.33" Ins — Steel sheet, 3.33" insulation

Layer	Code	Description	Thickness	Conductivity	Density	Specific Heat	Resistance
1	A0	Outside Surface Resist.					0.33 ft²·hr·°F/Btu
2	E2	0.5 in. Slag or Stone	0.50 in.	0.83 Btu/hr·ft·°F	55.00 lb/cu ft	0.40 Btu/lb·°F	
3	E3	3/8 in. Felt & Membrane	0.38 in.	0.11 Btu/hr·ft·°F	70.00 lb/cu ft	0.40 Btu/lb·°F	
4	M12	3.33 in. Insulation	3.33 in.	0.03 Btu/hr·ft·°F	2.00 lb/cu ft	0.20 Btu/lb·°F	
5	A3	Steel Siding	0.06 in.	26.00 Btu/hr·ft·°F	480.00 lb/cu ft	0.10 Btu/lb·°F	
6	E0	Inside Surface Resist.					0.69 ft²·hr·°F/Btu

Lamda = 0.98 Weight = 7.43 lb/ft² U-Value = 0.080 Btu/hr·ft²·°F Alpha = 0.90
Delta = 1 hours Heat Capacity = 2.14 Btu/ft²·lb·°F C-Coefficient = 0.0600 Btu/hr·ft²·°F

Library Members

Wall - Construction Types

8" LW Block, 1" Ins — 8" lightweight concrete block, 1" insulation

Layer	Code	Description	Thickness	Conductivity	Density	Specific Heat	Resistance
1	A0	Outside Surface Resist.					0.33 ft²·hr·°F/Btu
2	A1	1 in. Stucco	1.00 in.	0.40 Btu/hr·ft·°F	116.00 lb/cu ft	0.20 Btu/lb·°F	
3	C11	8 in. LW Concrete Block	8.00 in.	0.33 Btu/hr·ft·°F	38.00 lb/cu ft	0.20 Btu/lb·°F	
4	B1	1 in. Insulation	1.00 in.	0.03 Btu/hr·ft·°F	2.00 lb/cu ft	0.20 Btu/lb·°F	
5	E1	0.75 in. Plaster	0.75 in.	0.42 Btu/hr·ft·°F	100.00 lb/cu ft	0.20 Btu/lb·°F	
6	E0	Inside Surface Resist.					0.69 ft²·hr·°F/Btu

Lamda = 0.58 Weight = 41.42 lb/ft² U-Value = 0.149 Btu/hr·ft²·°F Alpha = 0.90
Delta = 6 hours Heat Capacity = 8.28 Btu/ft²·lb·°F C-Coefficient = 0.0100 Btu/hr·ft²·°F

Glass types

Single Clear 1/2" — Properties based on Std DS Glass

Number of Panes	1		Visible Transmissivity	0.72	Inside Solar Reflectivity	0.16
Shading Coeff	0.88		Inside Visible Reflectivity	0.18	Outside Long Wave Emissivity	0.84
Glass U-Value	1.04	Btu/hr·ft²·°F	Solar Transmissivity	0.61	Inside Long Wave Emissivity	0.84

Single Clear 1/4" — Properties based on Std DS Glass

Number of Panes	1		Visible Transmissivity	0.78	Inside Solar Reflectivity	0.13
Shading Coeff	0.95		Inside Visible Reflectivity	0.14	Outside Long Wave Emissivity	0.84
Glass U-Value	0.95	Btu/hr·ft²·°F	Solar Transmissivity	0.69	Inside Long Wave Emissivity	0.84

Infiltration

Neutral, Average Const.

Cooling Design	Heating Design
0.60 air changes/hr	0.60 air changes/hr

Neutral, Poor Const.

Cooling Design	Heating Design
1.00 air changes/hr	1.00 air changes/hr

Library Members

Lights

Fluorescent, hung below ceiling, 100% load to space

Fixture Type	SUSFLUOR	Longwave Radiant Fraction	67 %
Percent Lights to RA	0 %	Shortwave Radiant Fraction	0 %
Ballast Factor	1.00		

Misc. loads

Std Office Equipment

Energy Consumption	0.50 W/ft²	Percent Sensible	100 %	**Radiant Fraction**	60 %
		Percent To Room	100 %	The energy meter is Electricity	
		Percent To RA	0 %		

People

Member Name	People Density	Sensible Load	Latent Load	Longwave Radiant Fraction
Library	50.00 ft²/person	245.00 Btuh	155.00 Btuh	70 %

Member Name	People Density	Sensible Load	Latent Load	Longwave Radiant Fraction
General Office Space	143.00 ft²/person	250.00 Btuh	200.00 Btuh	70 %

Ventilation

Member Name	Cooling Design	Heating Design
Classroom	15.0 cfm/person	15.0 cfm/person

Library Members

Schedules

Off (0%)

Simulation type: Reduced year

January - December Cooling design to Sunday	**Start time**	**End time**	**Status**	Equipment operation
	Midnight	Midnight	Off	

Denver - Heat -SFL

Simulation type: Full year

June - September Cooling design to Sunday	**Start time**	**End time**	**Status**	Equipment operation
	Midnight	Midnight	Off	
October - December Cooling design to Sunday	**Start time**	**End time**	**Status**	Equipment operation
	Midnight	Midnight	Normal	
January - May Cooling design to Sunday	**Start time**	**End time**	**Status**	Equipment operation
	Midnight	Midnight	Normal	
January - December Holiday	**Start time**	**End time**	**Status**	Equipment operation
	Midnight	Midnight	Off	

Library Members

Schedules

People - Denver - Barnum Library

Simulation type: Reduced year

January - December	**Saturday**	**Start time**	**End time**	**Percentage**	Utilization
		Midnight	8 a.m.	0.0	
		8 a.m.	9 a.m.	15.0	
		9 a.m.	10 a.m.	50.0	
		10 a.m.	11 a.m.	80.0	
		11 a.m.	noon	100.0	
		noon	1 p.m.	100.0	
		1 p.m.	2 p.m.	100.0	
		2 p.m.	3 p.m.	100.0	
		3 p.m.	4 p.m.	80.0	
		4 p.m.	5 p.m.	50.0	
		5 p.m.	6 p.m.	0.0	
		6 p.m.	7 p.m.	0.0	
		7 p.m.	8 p.m.	0.0	
		8 p.m.	Midnight	0.0	
Heating Design		**Start time**	**End time**	**Percentage**	Utilization
		Midnight	Midnight	0.0	
January - December	**Sunday**	**Start time**	**End time**	**Percentage**	Utilization
		Midnight	Midnight	0.0	
January - December	**Cooling design to Weekday**	**Start time**	**End time**	**Percentage**	Utilization
		Midnight	8 a.m.	0.0	
		8 a.m.	9 a.m.	8.0	
		9 a.m.	10 a.m.	8.0	
		10 a.m.	11 a.m.	31.0	
		11 a.m.	noon	46.0	
		noon	1 p.m.	70.0	
		1 p.m.	2 p.m.	82.0	

Schedules

2 p.m.	3 p.m.	90.0
3 p.m.	4 p.m.	90.0
4 p.m.	5 p.m.	80.0
5 p.m.	6 p.m.	67.0
6 p.m.	7 p.m.	32.0
7 p.m.	8 p.m.	20.0
8 p.m.	Midnight	0.0

Lights - Denver - Barnum Library ECM 1

Simulation type: Reduced year

Heating Design

Start time	End time	Percentage	Utilization
Midnight	Midnight	0.0	

January - December Saturday

Start time	End time	Percentage	Utilization
Midnight	9 a.m.	5.0	
9 a.m.	11 a.m.	60.0	
11 a.m.	5 p.m.	60.0	
5 p.m.	Midnight	5.0	

January - December Cooling design to Weekday

Start time	End time	Percentage	Utilization
Midnight	10 a.m.	5.0	
10 a.m.	11 a.m.	60.0	
11 a.m.	4 p.m.	60.0	
4 p.m.	6 p.m.	85.0	
6 p.m.	8 p.m.	85.0	
8 p.m.	Midnight	5.0	

January - December Sunday

Start time	End time	Percentage	Utilization
Midnight	Midnight	5.0	

Library Members

Schedules

Available (100%)

Simulation type: Reduced year

January - December	**Cooling design to Sunday**	**Start time**	**End time**	**Percentage**	Utilization
		Midnight	Midnight	100.0	
Heating Design		**Start time**	**End time**	**Percentage**	Utilization
		Midnight	Midnight	100.0	

Lights - Denver - Barnum Library ECM 3

Simulation type: Reduced year

January - December	**Cooling design to Weekday**	**Start time**	**End time**	**Percentage**	Utilization
		Midnight	10 a.m.	5.0	
		10 a.m.	11 a.m.	60.0	
		11 a.m.	4 p.m.	60.0	
		4 p.m.	6 p.m.	62.0	
		6 p.m.	8 p.m.	62.0	
		8 p.m.	Midnight	5.0	
Heating Design		**Start time**	**End time**	**Percentage**	Utilization
		Midnight	Midnight	0.0	
January - December	**Sunday**	**Start time**	**End time**	**Percentage**	Utilization
		Midnight	Midnight	5.0	
January - December	**Saturday**	**Start time**	**End time**	**Percentage**	Utilization
		Midnight	9 a.m.	5.0	
		9 a.m.	11 a.m.	60.0	
		11 a.m.	5 p.m.	60.0	
		5 p.m.	Midnight	5.0	

Library Members

Schedules

Parking-Denver-Barnum

Simulation type: Reduced year

January - December	**Saturday**	**Start time**	**End time**	**Percentage**	Utilization
		Midnight	9 a.m.	100.0	
		9 a.m.	8 p.m.	0.0	
		8 p.m.	Midnight	100.0	
Cooling design		**Start time**	**End time**	**Percentage**	Utilization
		Midnight	8 a.m.	100.0	
		8 a.m.	8 p.m.	0.0	
		8 p.m.	Midnight	100.0	
January - December	**Sunday**	**Start time**	**End time**	**Percentage**	Utilization
		Midnight	8 a.m.	100.0	
		8 a.m.	8 p.m.	0.0	
		8 p.m.	Midnight	100.0	
January - December	**Cooling design to Weekday**	**Start time**	**End time**	**Percentage**	Utilization
		Midnight	7 a.m.	100.0	
		7 a.m.	8 p.m.	0.0	
		8 p.m.	Midnight	100.0	

Library Members

Schedules

Hot Water - denver - Barnum

Simulation type: Reduced year

	Start time	End time	Percentage	
May - May Cooling design to Sunday				Utilization
	Midnight	Midnight	1.0	
June - June Cooling design to Sunday				Utilization
	Midnight	Midnight	16.0	
October - October Cooling design to Sunday				Utilization
	Midnight	Midnight	12.0	
December - December Cooling design to Sunday				Utilization
	Midnight	Midnight	15.0	
March - March Cooling design to Sunday				Utilization
	Midnight	Midnight	0.0	
April - April Cooling design to Sunday				Utilization
	Midnight	Midnight	71.0	
Heating Design				Utilization
	Midnight	Midnight	0.0	
February - February Cooling design to Sunday				Utilization
	Midnight	Midnight	0.0	
September - September Cooling design to Sunday				Utilization
	Midnight	Midnight	14.0	
November - November Cooling design to Sunday				Utilization
	Midnight	Midnight	0.0	
August - August Cooling design to Sunday				Utilization
	Midnight	Midnight	2.0	
January - January Cooling design to Sunday				Utilization
	Midnight	Midnight	0.0	
July - July Cooling design to Sunday				Utilization
	Midnight	Midnight	3.0	

Library Members

Schedules

Lights - Denver - Barnum Library

Simulation type: Reduced year

January - December	**Sunday**	**Start time**	**End time**	**Percentage**	Utilization
		Midnight	Midnight	5.0	
January - December	**Cooling design to Weekday**	**Start time**	**End time**	**Percentage**	Utilization
		Midnight	10 a.m.	5.0	
		10 a.m.	11 a.m.	60.0	
		11 a.m.	4 p.m.	60.0	
		4 p.m.	6 p.m.	85.0	
		6 p.m.	8 p.m.	85.0	
		8 p.m.	Midnight	5.0	
Heating Design		**Start time**	**End time**	**Percentage**	Utilization
		Midnight	Midnight	0.0	
January - December	**Saturday**	**Start time**	**End time**	**Percentage**	Utilization
		Midnight	9 a.m.	5.0	
		9 a.m.	11 a.m.	60.0	
		11 a.m.	5 p.m.	60.0	
		5 p.m.	Midnight	5.0	

Library Members

Base Utilities

Domestic Hot Water Load - Gas

Comments	
Schedule	Available (100%)
Energy Type	Gas
Hourly demand	1.40 kW
Entering	°F
Leaving	°F

Parking lot lights

Comments	
Schedule	Parking lot lights
Energy Type	Electricity
Hourly demand	0.10 kW
Entering	°F
Leaving	°F

Cooling Equipment

TRACE® 700 Cooling Equipment Library

CCD-BL cooling — **Air-cooled unitary - Reciprocating**

Comments: PACKAGED TERMINAL AIR CONDITIONER

Operating Mode	Capacity	Energy Rate
Cooling	150.00 Mbh	30.000 kW
Heat Recovery		
Tank Charging		
Tank Chrg. & Heat Rec.		

Pumps	Type	Full Load Consumption	Pump Head
Chilled water	None	0.000000 kW	
Condenser water	None	0.00000 kW	
Ht Rec or aux cond.	None	kW	
Free cooling pump	None		

Unloading Curves	Primary	Secondary
Power consumed	CCD BL Cooling	None 2nd
Ambient modification	None	None
Capacity		

	Reset Based On	Reset Curve	Max Reset TD
Chilled water	None		
Condenser water	None		

Miscellaneous accessories: Cntl panel & interlocks - 0.1 KW

Load Shed Economizer	No
Evap Precooling	No
Fuel Source	Utility
Fuel type	Electric
Free cooling type	None
Fluid cooler type	None
Thermal Storage	None
Tower/condenser	Condenser fan for Heat Pump

Chilled water temp Design leaving	44.00°F
Chilled water temp Difference	10.00°F
Condenser temp design temp entering	95.00°F
Condenser temp min. operating	75.00°F
Condenser temp Difference	10.00°F
Reject Cond heat to ref	Heat rejection equipment
Reject Cond heat at water temp	

Library Members

Fans

FC Centrifugal const vol

Fan type	Constant volume
Comments	Forward curved Centrifugal fan constant volume
Full load energy	0.00032 kW/Cfm-in wg
Unloading curve	Fan Curve Straight Line

AF Centrifugal var freq drv

Fan type	Variable volume
Comments	Air foil Centrifugal with variable frequency drive
Full load energy	0.00022 kW/Cfm-in wg
Unloading curve	Fan Curve 9

AF Centrifugal const vol

Fan type	Constant volume
Comments	Air foil Centrifugal fan constant volume
Full load energy	0.00020 kW/Cfm-in wg
Unloading curve	Fan Curve Straight Line

Heating Equipment

Boiler - Denver - SFL

Comments	FIRE TUBE HOT H2O BOILER (GAS) EQ2001	
Category	Boiler	
Heat Source	Utility	
Fuel Type	Gas	
Capacity		Mbh
Energy Rate	83.300	Percent efficient
Hot Water Pump	Heating water circ pump	
Hot Water Pump Full Load	0.00	kW
Hot Water Leaving temp		°F
Storage tank	None	
Unloading Curve	Htg Straight Line	

Miscellaneous Accessories

None

Cntl panel & interlocks - 0.5 KW

Library Members

Misc. Equipment

Heating water circ pump

Comments	Heating water circulation pump	
Category	Water pump	
Energy type	0.00000	kW/Btu-ft wg
Control type	Electricity	
Full load energy	With equipment	

Cooling coil assignments	Heating coil assignments
+ Main	+ Main
Direct evaporative	+ Preheat
Indirect evaporative	+ Reheat
+ Auxiliary	+ Mech. humidification
+ Optional ventilation	+ Auxiliary
+ System exhaust air	+ Optional ventilation
+ Room exhaust air	+ Misc heating load
+ Misc cooling load	+ Base utility htg load
+ Base utility clg load	+ Absorption Chiller load

90.1 Min CV Hot Water Pump

Comments	Hot water pump - constant volume	
Category	Water pump	
Energy type	19.00000	Watt/gpm
Control type	Electricity	
Full load energy	With equipment	

Cooling coil assignments	Heating coil assignments
+ Main	+ Main
Direct evaporative	+ Preheat
Indirect evaporative	+ Reheat
+ Auxiliary	+ Mech. humidification
+ Optional ventilation	+ Auxiliary
+ System exhaust air	+ Optional ventilation
+ Room exhaust air	+ Misc heating load
+ Misc cooling load	+ Base utility htg load
+ Base utility clg load	+ Absorption Chiller load

Library Members

Heat Rejection

Condenser fan for Heat Pump

Comments	Heat Pump Condenser Fan	
Capacity	100.00	Percent
Energy consumption	0.12	kW/ton
Low speed consumpt	0.00	Percent full load
Fluid type	Water	
Condenser type	Air-cooled condenser	
Number of cells	1	
% Air at low Speed	0.00	
Approach Temp	10.00	°F
Temp Range	10.00	°F
Wet bulb Temp	78.00	°F
Design water flow rate	3.00	gpm/ton
Makeup water flow rate	0.00	gal/ton-hr
Hourly Amb WB Offset		°F
Unloading curve	C-Tower on/off	

Coil load assignmer

+Main
Direct evaporator
+Indirect evaporator
+Auxiliary
+Optional ventilation
+Misc cooling load

Bear Valley Library

Library Members

Floor - Construction Types

4" LW Concrete — 4" lightweight concrete

Layer	Code	Description	Thickness	Conductivity	Density	Specific Heat	Resistance
1	E0	Inside Surface Resist.					0.69 ft²·hr·°F/Btu
2	C1	4 in. LW Concrete	4.00 in.	0.10 Btu/hr·ft·°F	40.00 lb/cu ft	0.20 Btu/lb·°F	
3	E0	Inside Surface Resist.					0.69 ft²·hr·°F/Btu

Lamda = 0.89 Weight = 13.33 lb/ft² U-Value = 0.213 Btu/hr·ft²·°F Alpha = 0.90
Delta = 3 hours Heat Capacity = 2.67 Btu/ft²·lb·°F C-Coefficient = 0.0900 Btu/hr·ft²·°F

Partitions - Construction Types

0.75" Gyp Frame — 0.75" gypsum board frame wall

Layer	Code	Description	Thickness	Conductivity	Density	Specific Heat	Resistance
1	E0	Inside Surface Resist.					0.69 ft²·hr·°F/Btu
2	E1	0.75 in. Plaster	0.75 in.	0.42 Btu/hr·ft·°F	100.00 lb/cu ft	0.20 Btu/lb·°F	
3	B0	Air Space Resistance					0.91 ft²·hr·°F/Btu
4	E1	0.75 in. Plaster	0.75 in.	0.42 Btu/hr·ft·°F	100.00 lb/cu ft	0.20 Btu/lb·°F	
5	E0	Inside Surface Resist.					0.69 ft²·hr·°F/Btu

Lamda = 1.02 Weight = 12.50 lb/ft² U-Value = 0.388 Btu/hr·ft²·°F Alpha = 0.90
Delta = 1 hours Heat Capacity = 2.50 Btu/ft²·lb·°F C-Coefficient = 0.2400 Btu/hr·ft²·°F

Roof - Construction Types

Steel Sheet, 2" Ins — Steel sheet, 2" insulation

Layer	Code	Description	Thickness	Conductivity	Density	Specific Heat	Resistance
1	A0	Outside Surface Resist.					0.33 ft²·hr·°F/Btu
2	E2	0.5 in. Slag or Stone	0.50 in.	0.83 Btu/hr·ft·°F	55.00 lb/cu ft	0.40 Btu/lb·°F	
3	E3	3/8 in. Felt & Membrane	0.38 in.	0.11 Btu/hr·ft·°F	70.00 lb/cu ft	0.40 Btu/lb·°F	
4	A3	Steel Siding	0.06 in.	26.00 Btu/hr·ft·°F	480.00 lb/cu ft	0.10 Btu/lb·°F	
5	B2	2 in. Insulation - High Dens	2.00 in.	0.03 Btu/hr·ft·°F	5.70 lb/cu ft	0.20 Btu/lb·°F	
6	E0	Inside Surface Resist.					0.69 ft²·hr·°F/Btu

Lamda = 0.97 Weight = 7.83 lb/ft² U-Value = 0.125 Btu/hr·ft²·°F Alpha = 0.90
Delta = 1 hours Heat Capacity = 2.22 Btu/ft²·lb·°F C-Coefficient = 0.0900 Btu/hr·ft²·°F

Library Members

Wall - Construction Types

8" LW Block — 8" lightweight concrete block

Layer	Code	Description	Thickness	Conductivity	Density	Specific Heat	Resistance
1	A0	Outside Surface Resist.					0.33 ft²·hr·°F/Btu
2	A1	1 in. Stucco	1.00 in.	0.40 Btu/hr·ft·°F	116.00 lb/cu ft	0.20 Btu/lb·°F	
3	C11	8 in. LW Concrete Block	8.00 in.	0.33 Btu/hr·ft·°F	38.00 lb/cu ft	0.20 Btu/lb·°F	
4	E1	0.75 in. Plaster	0.75 in.	0.42 Btu/hr·ft·°F	100.00 lb/cu ft	0.20 Btu/lb·°F	
5	E0	Inside Surface Resist.					0.69 ft²·hr·°F/Btu

Lamda = 0.73 | Weight = 41.25 lb/ft² | U-Value = 0.295 Btu/hr·ft²·°F | Alpha = 0.90

Delta = 5 hours | Heat Capacity = 8.25 Btu/ft²·lb·°F | C-Coefficient = 0.0500 Btu/hr·ft²·°F

Glass types

Single Clear 1/4"

Properties based on Std DS Glass

Number of Panes	1	Visible Transmissivity	0.78	Inside Solar Reflectivity	0.13
Shading Coeff	0.95	Inside Visible Reflectivity	0.14	Outside Long Wave Emissivity	0.84
Glass U-Value	0.95 Btu/hr·ft²·°F	Solar Transmissivity	0.69	Inside Long Wave Emissivity	0.84

Double Coated 1/4"

Properties based on Std DS Glass

Number of Panes	2	Visible Transmissivity	0.30	Inside Solar Reflectivity	0.17
Shading Coeff	0.55	Inside Visible Reflectivity	0.20	Outside Long Wave Emissivity	0.84
Glass U-Value	0.50 Btu/hr·ft²·°F	Solar Transmissivity	0.28	Inside Long Wave Emissivity	0.84

Infiltration

Neutral, Average Const.

Cooling Design	Heating Design
0.60 air changes/hr	0.60 air changes/hr

Lights

Fluorescent, hung below ceiling, 100% load to space

Fixture Type	SUSFLUOR	Longwave Radiant Fraction	67 %
Percent Lights to RA	0 %	Shortwave Radiant Fraction	0 %
Ballast Factor	1.00		

Library Members

Misc. loads

Std Office Equipment

Energy Consumption	0.50 W/ft²	Percent Sensible	100 %	**Radiant Fraction**	60 %
		Percent To Room	100 %	The energy meter is Electricity	
		Percent To RA	0 %		

People

Member Name	People Density	Sensible Load	Latent Load	Longwave Radiant Fraction
General Office Space	143.00 ft²/person	250.00 Btuh	200.00 Btuh	70 %
Member Name	**People Density**	**Sensible Load**	**Latent Load**	Longwave Radiant Fraction
Library	50.00 ft²/person	245.00 Btuh	155.00 Btuh	70 %

Ventilation

Member Name	Cooling Design	Heating Design
General Office Space	20.0 cfm/person	20.0 cfm/person

Library Members

Schedules

Lights - Denver - Bear Valley ECM 1

Simulation type: Reduced year

January - December	**Cooling design to Weekday**	**Start time**	**End time**	**Percentage**	Utilization
		Midnight	10 a.m.	5.0	
		10 a.m.	11 a.m.	65.0	
		11 a.m.	4 p.m.	65.0	
		4 p.m.	6 p.m.	60.0	
		6 p.m.	8 p.m.	15.0	
		8 p.m.	Midnight	5.0	
Heating Design		**Start time**	**End time**	**Percentage**	Utilization
		Midnight	Midnight	0.0	
January - December	**Saturday**	**Start time**	**End time**	**Percentage**	Utilization
		Midnight	9 a.m.	5.0	
		9 a.m.	11 a.m.	65.0	
		11 a.m.	3 p.m.	100.0	
		3 p.m.	5 p.m.	60.0	
		5 p.m.	Midnight	5.0	
January - December	**Sunday**	**Start time**	**End time**	**Percentage**	Utilization
		Midnight	Midnight	5.0	

Available (100%)

Simulation type: Reduced year

January - December	**Cooling design to Sunday**	**Start time**	**End time**	**Percentage**	Utilization
		Midnight	Midnight	100.0	
Heating Design		**Start time**	**End time**	**Percentage**	Utilization
		Midnight	Midnight	100.0	

Library Members

Schedules

Denver - Heat - EFL

Simulation type: Full year

January - May Cooling design to Sunday	**Start time**	**End time**	**Status**	Equipment operation
	Midnight	Midnight	Normal	
October - December Cooling design to Sunday	**Start time**	**End time**	**Status**	Equipment operation
	Midnight	Midnight	Normal	
June - September Cooling design to Sunday	**Start time**	**End time**	**Status**	Equipment operation
	Midnight	Midnight	Off	
January - December Holiday	**Start time**	**End time**	**Status**	Equipment operation
	Midnight	Midnight	Off	

Library Members

Schedules

Parking-Denver-Bear Valley

Simulation type: Reduced year

January - December	**Saturday**	**Start time**	**End time**	**Percentage**	Utilization
		Midnight	9 a.m.	100.0	
		9 a.m.	8 p.m.	0.0	
		8 p.m.	Midnight	100.0	
Cooling design		**Start time**	**End time**	**Percentage**	Utilization
		Midnight	8 a.m.	100.0	
		8 a.m.	8 p.m.	0.0	
		8 p.m.	Midnight	100.0	
January - December	**Sunday**	**Start time**	**End time**	**Percentage**	Utilization
		Midnight	8 a.m.	100.0	
		8 a.m.	8 p.m.	0.0	
		8 p.m.	Midnight	100.0	
January - December	**Cooling design to Weekday**	**Start time**	**End time**	**Percentage**	Utilization
		Midnight	7 a.m.	100.0	
		7 a.m.	8 p.m.	0.0	
		8 p.m.	Midnight	100.0	

Library Members

Schedules

People - Denver - Bear Valley

Simulation type: Reduced year

Heating Design	**Start time**	**End time**	**Percentage**	Utilization
	Midnight	Midnight	0.0	

January - December **Saturday**	**Start time**	**End time**	**Percentage**	Utilization
	Midnight	8 a.m.	0.0	
	8 a.m.	9 a.m.	15.0	
	9 a.m.	10 a.m.	50.0	
	10 a.m.	11 a.m.	80.0	
	11 a.m.	noon	100.0	
	noon	1 p.m.	100.0	
	1 p.m.	2 p.m.	100.0	
	2 p.m.	3 p.m.	100.0	
	3 p.m.	4 p.m.	80.0	
	4 p.m.	5 p.m.	50.0	
	5 p.m.	6 p.m.	0.0	
	6 p.m.	7 p.m.	0.0	
	7 p.m.	8 p.m.	0.0	
	8 p.m.	Midnight	0.0	

January - December **Cooling design to Weekday**	**Start time**	**End time**	**Percentage**	Utilization
	Midnight	8 a.m.	0.0	
	8 a.m.	9 a.m.	9.0	
	9 a.m.	10 a.m.	9.0	
	10 a.m.	11 a.m.	36.0	
	11 a.m.	noon	54.0	
	noon	1 p.m.	80.0	
	1 p.m.	2 p.m.	100.0	
	2 p.m.	3 p.m.	100.0	
	3 p.m.	4 p.m.	100.0	
	4 p.m.	5 p.m.	88.0	

Library Members

Schedules

		5 p.m.	6 p.m.	70.0	
		6 p.m.	7 p.m.	32.0	
		7 p.m.	8 p.m.	20.0	
		8 p.m.	Midnight	0.0	
January - December	**Sunday**	**Start time**	**End time**	**Percentage**	Utilization
		Midnight	Midnight	0.0	

Library Members

Schedules

Hot Water - denver - BVL

Simulation type: Reduced year

Heating Design	**Start time**	**End time**	**Percentage**	Utilization
	Midnight	Midnight	0.0	
March - March Cooling design to Sunday	**Start time**	**End time**	**Percentage**	Utilization
	Midnight	Midnight	0.0	
April - April Cooling design to Sunday	**Start time**	**End time**	**Percentage**	Utilization
	Midnight	Midnight	27.0	
October - October Cooling design to Sunday	**Start time**	**End time**	**Percentage**	Utilization
	Midnight	Midnight	0.0	
August - August Cooling design to Sunday	**Start time**	**End time**	**Percentage**	Utilization
	Midnight	Midnight	17.0	
June - June Cooling design to Sunday	**Start time**	**End time**	**Percentage**	Utilization
	Midnight	Midnight	32.0	
November - November Cooling design to Sunday	**Start time**	**End time**	**Percentage**	Utilization
	Midnight	Midnight	0.0	
May - May Cooling design to Sunday	**Start time**	**End time**	**Percentage**	Utilization
	Midnight	Midnight	25.0	
January - January Cooling design to Sunday	**Start time**	**End time**	**Percentage**	Utilization
	Midnight	Midnight	56.0	
July - July Cooling design to Sunday	**Start time**	**End time**	**Percentage**	Utilization
	Midnight	Midnight	6.0	
December - December Cooling design to Sunday	**Start time**	**End time**	**Percentage**	Utilization
	Midnight	Midnight	100.0	
February - February Cooling design to Sunday	**Start time**	**End time**	**Percentage**	Utilization
	Midnight	Midnight	0.0	
September - September Cooling design to Sunday	**Start time**	**End time**	**Percentage**	Utilization
	Midnight	Midnight	21.0	

Library Members

Schedules

Lights - Denver - Bear Valley

Simulation type: Reduced year

Heating Design		**Start time**	**End time**	**Percentage**	Utilization
		Midnight	Midnight	0.0	
January - December	**Saturday**	**Start time**	**End time**	**Percentage**	Utilization
		Midnight	9 a.m.	5.0	
		9 a.m.	11 a.m.	70.0	
		11 a.m.	3 p.m.	100.0	
		3 p.m.	5 p.m.	70.0	
		5 p.m.	Midnight	5.0	
January - December	**Cooling design to Weekday**	**Start time**	**End time**	**Percentage**	Utilization
		Midnight	10 a.m.	5.0	
		10 a.m.	11 a.m.	75.0	
		11 a.m.	4 p.m.	80.0	
		4 p.m.	6 p.m.	75.0	
		6 p.m.	8 p.m.	15.0	
		8 p.m.	Midnight	5.0	
January - December	**Sunday**	**Start time**	**End time**	**Percentage**	Utilization
		Midnight	Midnight	5.0	

Off (0%)

Simulation type: Reduced year

January - December	**Cooling design to Sunday**	**Start time**	**End time**	**Status**	Equipment operation
		Midnight	Midnight	Off	

Library Members

Base Utilities

Domestic Hot Water Load - Gas

Comments	
Schedule	Available (100%)
Energy Type	Gas
Hourly demand	1.40 kW
Entering	°F
Leaving	°F

Parking lot lights

Comments	
Schedule	Parking lot lights
Energy Type	Electricity
Hourly demand	0.10 kW
Entering	°F
Leaving	°F

Cooling Equipment

TRACE® 700 Cooling Equipment Library

Default air-cooled unitary — **Air-cooled unitary - Reciprocating**

Comments: PACKAGED TERMINAL AIR CONDITIONER

Operating Mode	Capacity	Energy Rate
Cooling	tons	1.380 kW/ton
Heat Recovery		
Tank Charging		
Tank Chrg. & Heat Rec.		

Pumps	Type	Full Load Consumption	Pump Head
Chilled water	None	0.000000 kW	
Condenser water	None	0.00000 kW	
Ht Rec or aux cond.	None	kW	
Free cooling pump	None		

Unloading Curves	Primary	Secondary
Power consumed	EQ1307	EQ1307
Ambient modification	EQ1307 - Amb Mod	EQ1307 - Amb Mod
Capacity		

	Reset Based On	Reset Curve	Max Reset TD
Chilled water	None		
Condenser water	None		

Miscellaneous accessories: Cntl panel & interlocks - 0.1 KW

Load Shed Economizer	No
Evap Precooling	No
Fuel Source	Utility
Fuel type	Electric
Free cooling type	None
Fluid cooler type	None
Thermal Storage	None
Tower/condenser	Condenser fan for Heat Pump

Chilled water temp Design leaving	44.00°F
Chilled water temp Difference	10.00°F
Condenser temp design temp entering	95.00°F
Condenser temp min. operating	75.00°F
Condenser temp Difference	10.00°F
Reject Cond heat to ref	Heat rejection equipment
Reject Cond heat at water temp	

Library Members

Fans

FC Centrifugal const vol

Fan type	Constant volume
Comments	Forward curved Centrifugal fan constant volume
Full load energy	0.00032 kW/Cfm-in wg
Unloading curve	Fan Curve Straight Line

Heating Equipment

Default electric resistance

Comments	ROOFTOP ELECTRIC HEAT	
Category	Electric resistance	**Miscellaneous Accessories**
Heat Source	Utility	
Fuel Type	Electric	
Capacity		Mbh
Energy Rate	100.000	Percent efficient
Hot Water Pump	None	
Hot Water Pump Full Load	0.00	kW
Hot Water Leaving temp		°F
Storage tank	None	
Unloading Curve	Htg Straight Line	

Default gas-fired heat exchanger

Comments	ROOFTOP GAS HEAT	
Category	Gas-fired heat exchanger	**Miscellaneous Accessories**
Heat Source	Utility	
Fuel Type	Gas	
Capacity		Mbh
Energy Rate	77.000	Percent efficient
Hot Water Pump	None	
Hot Water Pump Full Load	0.00	kW
Hot Water Leaving temp		°F
Storage tank	None	
Unloading Curve	Htg Straight Line	

Library Members

Heat Rejection

Condenser fan for Heat Pump

Comments	Heat Pump Condenser Fan	
Capacity	100.00	Percent
Energy consumption	0.12	kW/ton
Low speed consumpt	0.00	Percent full load
Fluid type	Water	
Condenser type	Air-cooled condenser	
Number of cells	1	
% Air at low Speed	0.00	
Approach Temp	10.00	°F
Temp Range	10.00	°F
Wet bulb Temp	78.00	°F
Design water flow rate	3.00	gpm/ton
Makeup water flow rate	0.00	gal/ton-hr
Hourly Amb WB Offset		°F
Unloading curve	C-Tower on/off	

Coil load assignmer

+Main
Direct evaporator
+Indirect evaporator
+Auxiliary
+Optional ventilation
+Misc cooling load

Eugene Field Library

Library Members

Floor - Construction Types

4" LW Concrete — 4" lightweight concrete

Layer	Code	Description	Thickness	Conductivity	Density	Specific Heat	Resistance
1	E0	Inside Surface Resist.					0.69 ft²·hr·°F/Btu
2	C1	4 in. LW Concrete	4.00 in.	0.10 Btu/hr·ft·°F	40.00 lb/cu ft	0.20 Btu/lb·°F	
3	E0	Inside Surface Resist.					0.69 ft²·hr·°F/Btu

Lamda = 0.89 Weight = 13.33 lb/ft² U-Value = 0.213 Btu/hr·ft²·°F Alpha = 0.90
Delta = 3 hours Heat Capacity = 2.67 Btu/ft²·lb·°F C-Coefficient = 0.0900 Btu/hr·ft²·°F

Partitions - Construction Types

0.75" Gyp Frame — 0.75" gypsum board frame wall

Layer	Code	Description	Thickness	Conductivity	Density	Specific Heat	Resistance
1	E0	Inside Surface Resist.					0.69 ft²·hr·°F/Btu
2	E1	0.75 in. Plaster	0.75 in.	0.42 Btu/hr·ft·°F	100.00 lb/cu ft	0.20 Btu/lb·°F	
3	B0	Air Space Resistance					0.91 ft²·hr·°F/Btu
4	E1	0.75 in. Plaster	0.75 in.	0.42 Btu/hr·ft·°F	100.00 lb/cu ft	0.20 Btu/lb·°F	
5	E0	Inside Surface Resist.					0.69 ft²·hr·°F/Btu

Lamda = 1.02 Weight = 12.50 lb/ft² U-Value = 0.388 Btu/hr·ft²·°F Alpha = 0.90
Delta = 1 hours Heat Capacity = 2.50 Btu/ft²·lb·°F C-Coefficient = 0.2400 Btu/hr·ft²·°F

Roof - Construction Types

Steel Sheet, 6" Ins — Steel sheet, 6" insulation

Layer	Code	Description	Thickness	Conductivity	Density	Specific Heat	Resistance
1	A0	Outside Surface Resist.					0.33 ft²·hr·°F/Btu
2	E2	0.5 in. Slag or Stone	0.50 in.	0.83 Btu/hr·ft·°F	55.00 lb/cu ft	0.40 Btu/lb·°F	
3	E3	3/8 in. Felt & Membrane	0.38 in.	0.11 Btu/hr·ft·°F	70.00 lb/cu ft	0.40 Btu/lb·°F	
4	A3	Steel Siding	0.06 in.	26.00 Btu/hr·ft·°F	480.00 lb/cu ft	0.10 Btu/lb·°F	
5	B6	6 in. Insulation	6.00 in.	0.03 Btu/hr·ft·°F	2.00 lb/cu ft	0.20 Btu/lb·°F	
6	E0	Inside Surface Resist.					0.69 ft²·hr·°F/Btu

Lamda = 0.96 Weight = 7.88 lb/ft² U-Value = 0.047 Btu/hr·ft²·°F Alpha = 0.90
Delta = 2 hours Heat Capacity = 2.23 Btu/ft²·lb·°F C-Coefficient = 0.0300 Btu/hr·ft²·°F

Library Members

Wall - Construction Types

8" HW Block, 3" Ins — 8" heavyweight concrete block, 3" insulation

Layer	Code	Description	Thickness	Conductivity	Density	Specific Heat	Resistance
1	A0	Outside Surface Resist.					0.33 ft²·hr·°F/Btu
2	A1	1 in. Stucco	1.00 in.	0.40 Btu/hr·ft·°F	116.00 lb/cu ft	0.20 Btu/lb·°F	
3	C14	8 in. HW Concrete Block	8.00 in.	0.60 Btu/hr·ft·°F	61.00 lb/cu ft	0.20 Btu/lb·°F	
4	B3	3 in. Insulation	3.00 in.	0.03 Btu/hr·ft·°F	2.00 lb/cu ft	0.20 Btu/lb·°F	
5	E1	0.75 in. Plaster	0.75 in.	0.42 Btu/hr·ft·°F	100.00 lb/cu ft	0.20 Btu/lb·°F	
6	E0	Inside Surface Resist.					0.69 ft²·hr·°F/Btu

Lamda = 0.44 Weight = 57.08 lb/ft² U-Value = 0.080 Btu/hr·ft²·°F Alpha = 0.90
Delta = 7 hours Heat Capacity = 11.42 Btu/ft²·lb·°F C-Coefficient = 0.0000 Btu/hr·ft²·°F

Glass types

Single Clear 1/4" — Properties based on Std DS Glass

Number of Panes	1		Visible Transmissivity	0.78	Inside Solar Reflectivity	0.13
Shading Coeff	0.95		Inside Visible Reflectivity	0.14	Outside Long Wave Emissivity	0.84
Glass U-Value	0.95	Btu/hr·ft²·°F	Solar Transmissivity	0.69	Inside Long Wave Emissivity	0.84

Double Coated 1/4" — Properties based on Std DS Glass

Number of Panes	2		Visible Transmissivity	0.30	Inside Solar Reflectivity	0.17
Shading Coeff	0.55		Inside Visible Reflectivity	0.20	Outside Long Wave Emissivity	0.84
Glass U-Value	0.50	Btu/hr·ft²·°F	Solar Transmissivity	0.28	Inside Long Wave Emissivity	0.84

Infiltration

Neutral, Poor Const.

Cooling Design	Heating Design
1.00 air changes/hr	1.00 air changes/hr

Lights

Recessed fluorescent, not vented, 80% load to space

Fixture Type	RECFL-NV	Longwave Radiant Fraction	50 %
Percent Lights to RA	20 %	Shortwave Radiant Fraction	0 %
Ballast Factor	1.00		

Library Members

Misc. loads

Std Office Equipment

Energy Consumption	0.50 W/ft²	Percent Sensible	100 %	**Radiant Fraction**	60 %
		Percent To Room	100 %	The energy meter is Electricity	
		Percent To RA	0 %		

People

Member Name	People Density	Sensible Load	Latent Load	Longwave Radiant Fraction
General Office Space	143.00 ft²/person	250.00 Btuh	200.00 Btuh	70 %

Ventilation

Member Name	Cooling Design	Heating Design
General Office Space	20.0 cfm/person	20.0 cfm/person

Library Members

Schedules

Denver - Heat - EFL

Simulation type: Full year

January - May Cooling design to Sunday	**Start time**	**End time**	**Status**	Equipment operation
	Midnight	Midnight	Normal	
October - December Cooling design to Sunday	**Start time**	**End time**	**Status**	Equipment operation
	Midnight	Midnight	Normal	
June - September Cooling design to Sunday	**Start time**	**End time**	**Status**	Equipment operation
	Midnight	Midnight	Off	
January - December Holiday	**Start time**	**End time**	**Status**	Equipment operation
	Midnight	Midnight	Off	

Library Members

Schedules

Lights - Denver - Eugene Library

Simulation type: Reduced year

January - December	**Sunday**	**Start time**	**End time**	**Percentage**	Utilization
		Midnight	Midnight	5.0	
January - December	**Cooling design to Weekday**	**Start time**	**End time**	**Percentage**	Utilization
		Midnight	10 a.m.	5.0	
		10 a.m.	11 a.m.	85.0	
		11 a.m.	4 p.m.	85.0	
		4 p.m.	6 p.m.	85.0	
		6 p.m.	8 p.m.	65.0	
		8 p.m.	Midnight	5.0	
January - December	**Saturday**	**Start time**	**End time**	**Percentage**	Utilization
		Midnight	9 a.m.	5.0	
		9 a.m.	11 a.m.	85.0	
		11 a.m.	2 p.m.	85.0	
		2 p.m.	5 p.m.	85.0	
		5 p.m.	Midnight	5.0	
Heating Design		**Start time**	**End time**	**Percentage**	Utilization
		Midnight	Midnight	0.0	

Library Members

Schedules

Parking-Denver-Eugene

Simulation type: Reduced year

		Start time	End time	Percentage	Utilization
Cooling design					
		Midnight	8 a.m.	100.0	
		8 a.m.	8 p.m.	0.0	
		8 p.m.	Midnight	100.0	
January - December	**Sunday**	**Start time**	**End time**	**Percentage**	Utilization
		Midnight	8 a.m.	100.0	
		8 a.m.	8 p.m.	0.0	
		8 p.m.	Midnight	100.0	
January - December	**Saturday**	**Start time**	**End time**	**Percentage**	Utilization
		Midnight	9 a.m.	100.0	
		9 a.m.	8 p.m.	0.0	
		8 p.m.	Midnight	100.0	
January - December	**Cooling design to Weekday**	**Start time**	**End time**	**Percentage**	Utilization
		Midnight	7 a.m.	100.0	
		7 a.m.	8 p.m.	0.0	
		8 p.m.	Midnight	100.0	

Library Members

Schedules

Hot Water - denver - EFL DHW

Simulation type: Reduced year

Heating Design	**Start time**	**End time**	**Percentage**	Utilization
	Midnight	Midnight	0.0	
September - September Cooling design to Sunday	**Start time**	**End time**	**Percentage**	Utilization
	Midnight	Midnight	13.0	
July - July Cooling design to Sunday	**Start time**	**End time**	**Percentage**	Utilization
	Midnight	Midnight	10.0	
May - May Cooling design to Sunday	**Start time**	**End time**	**Percentage**	Utilization
	Midnight	Midnight	7.0	
December - December Cooling design to Sunday	**Start time**	**End time**	**Percentage**	Utilization
	Midnight	Midnight	0.0	
March - March Cooling design to Sunday	**Start time**	**End time**	**Percentage**	Utilization
	Midnight	Midnight	0.0	
October - October Cooling design to Sunday	**Start time**	**End time**	**Percentage**	Utilization
	Midnight	Midnight	0.0	
November - November Cooling design to Sunday	**Start time**	**End time**	**Percentage**	Utilization
	Midnight	Midnight	0.0	
February - February Cooling design to Sunday	**Start time**	**End time**	**Percentage**	Utilization
	Midnight	Midnight	0.0	
June - June Cooling design to Sunday	**Start time**	**End time**	**Percentage**	Utilization
	Midnight	Midnight	25.0	
April - April Cooling design to Sunday	**Start time**	**End time**	**Percentage**	Utilization
	Midnight	Midnight	0.0	
January - January Cooling design to Sunday	**Start time**	**End time**	**Percentage**	Utilization
	Midnight	Midnight	0.0	
August - August Cooling design to Sunday	**Start time**	**End time**	**Percentage**	Utilization
	Midnight	Midnight	15.0	

Library Members

Schedules

Available (100%)

Simulation type: Reduced year

January - December	**Cooling design to Sunday**	**Start time**	**End time**	**Percentage**	Utilization
		Midnight	Midnight	100.0	
Heating Design		**Start time**	**End time**	**Percentage**	Utilization
		Midnight	Midnight	100.0	

Library Members

Schedules

People - Denver - Eugene Library

Simulation type: Reduced year

Heating Design	**Start time**	**End time**	**Percentage**	Utilization
	Midnight	Midnight	0.0	

January - December **Saturday**	**Start time**	**End time**	**Percentage**	Utilization
	Midnight	8 a.m.	0.0	
	8 a.m.	9 a.m.	15.0	
	9 a.m.	10 a.m.	50.0	
	10 a.m.	11 a.m.	80.0	
	11 a.m.	noon	100.0	
	noon	1 p.m.	100.0	
	1 p.m.	2 p.m.	100.0	
	2 p.m.	3 p.m.	100.0	
	3 p.m.	4 p.m.	80.0	
	4 p.m.	5 p.m.	50.0	
	5 p.m.	6 p.m.	0.0	
	6 p.m.	7 p.m.	0.0	
	7 p.m.	8 p.m.	0.0	
	8 p.m.	Midnight	0.0	

January - December **Cooling design to Weekday**	**Start time**	**End time**	**Percentage**	Utilization
	Midnight	8 a.m.	0.0	
	8 a.m.	9 a.m.	9.0	
	9 a.m.	10 a.m.	9.0	
	10 a.m.	11 a.m.	36.0	
	11 a.m.	noon	54.0	
	noon	1 p.m.	80.0	
	1 p.m.	2 p.m.	92.0	
	2 p.m.	3 p.m.	100.0	
	3 p.m.	4 p.m.	100.0	
	4 p.m.	5 p.m.	88.0	

Schedules

		5 p.m.	6 p.m.	70.0	
		6 p.m.	7 p.m.	32.0	
		7 p.m.	8 p.m.	20.0	
		8 p.m.	Midnight	0.0	
January - December	**Sunday**	**Start time**	**End time**	**Percentage**	Utilization
		Midnight	Midnight	0.0	

Lights - Denver - Eugene Library ECM 1

Simulation type: Reduced year

Heating Design		**Start time**	**End time**	**Percentage**	Utilization
		Midnight	Midnight	0.0	
January - December	**Saturday**	**Start time**	**End time**	**Percentage**	Utilization
		Midnight	9 a.m.	5.0	
		9 a.m.	11 a.m.	55.0	
		11 a.m.	2 p.m.	100.0	
		2 p.m.	5 p.m.	50.0	
		5 p.m.	Midnight	5.0	
January - December	**Sunday**	**Start time**	**End time**	**Percentage**	Utilization
		Midnight	Midnight	5.0	
January - December	**Cooling design to Weekday**	**Start time**	**End time**	**Percentage**	Utilization
		Midnight	10 a.m.	5.0	
		10 a.m.	11 a.m.	55.0	
		11 a.m.	4 p.m.	55.0	
		4 p.m.	6 p.m.	55.0	
		6 p.m.	8 p.m.	20.0	
		8 p.m.	Midnight	5.0	

Library Members

Schedules

Lights - Denver - Eugene Library ECM 3

Simulation type: Reduced year

January - December	**Sunday**	**Start time**	**End time**	**Percentage**	Utilization
		Midnight	Midnight	5.0	
Heating Design		**Start time**	**End time**	**Percentage**	Utilization
		Midnight	Midnight	0.0	
January - December	**Saturday**	**Start time**	**End time**	**Percentage**	Utilization
		Midnight	9 a.m.	5.0	
		9 a.m.	11 a.m.	55.0	
		11 a.m.	2 p.m.	100.0	
		2 p.m.	5 p.m.	50.0	
		5 p.m.	Midnight	5.0	
January - December	**Cooling design to Weekday**	**Start time**	**End time**	**Percentage**	Utilization
		Midnight	10 a.m.	5.0	
		10 a.m.	11 a.m.	55.0	
		11 a.m.	4 p.m.	50.0	
		4 p.m.	6 p.m.	55.0	
		6 p.m.	8 p.m.	17.5	
		8 p.m.	Midnight	5.0	

Off (0%)

Simulation type: Reduced year

January - December	**Cooling design to Sunday**	**Start time**	**End time**	**Status**	Equipment operation
		Midnight	Midnight	Off	

Library Members

Base Utilities

Domestic Hot Water Load - Gas

Comments	
Schedule	Available (100%)
Energy Type	Gas
Hourly demand	1.40 kW
Entering	°F
Leaving	°F

Parking lot lights

Comments	
Schedule	Parking lot lights
Energy Type	Electricity
Hourly demand	0.10 kW
Entering	°F
Leaving	°F

Cooling Equipment

TRACE® 700 Cooling Equipment Library

CCC-EF cooling — **Air-cooled unitary - Reciprocating**

Comments: PACKAGED TERMINAL AIR CONDITIONER

Operating Mode	Capacity	Energy Rate
Cooling	30.00 tons	27.000 kW
Heat Recovery		
Tank Charging		
Tank Chrg. & Heat Rec.		

Pumps	Type	Full Load Consumption	Pump Head
Chilled water	None	0.000000 kW	
Condenser water	None	0.00000 kW	
Ht Rec or aux cond.	None	kW	
Free cooling pump	None		

Unloading Curves	Primary	Secondary
Power consumed	CCD-EF cooling	CCD-EF cooling
Ambient modification	EQ1307 - Amb Mod	EQ1307 - Amb Mod
Capacity		

	Reset Based On	Reset Curve	Max Reset TD
Chilled water	None		
Condenser water	None		

Miscellaneous accessories: Cntl panel & interlocks - 0.1 KW

Load Shed Economizer	No
Evap Precooling	No
Fuel Source	Utility
Fuel type	Electric
Free cooling type	None
Fluid cooler type	None
Thermal Storage	None
Tower/condenser	Condenser fan for Heat Pump

Chilled water temp Design leaving	44.00°F
Chilled water temp Difference	10.00°F
Condenser temp design temp entering	95.00°F
Condenser temp min. operating	75.00°F
Condenser temp Difference	10.00°F
Reject Cond heat to ref	Heat rejection equipment
Reject Cond heat at water temp	

Library Members

Fans

AF Centrifugal var freq drv

Fan type	Variable volume
Comments	Air foil Centrifugal with variable frequency drive
Full load energy	0.00022 kW/Cfm-in wg
Unloading curve	Fan Curve 9

FC Centrifugal const vol

Fan type	Constant volume
Comments	Forward curved Centrifugal fan constant volume
Full load energy	0.00032 kW/Cfm-in wg
Unloading curve	Fan Curve Straight Line

AF Centrifugal const vol

Fan type	Constant volume
Comments	Air foil Centrifugal fan constant volume
Full load energy	0.00020 kW/Cfm-in wg
Unloading curve	Fan Curve Straight Line

Library Members

Heating Equipment

Default electric resistance

Comments	ROOFTOP ELECTRIC HEAT	
Category	Electric resistance	
Heat Source	Utility	
Fuel Type	Electric	
Capacity		Mbh
Energy Rate	100.000	Percent efficient
Hot Water Pump	None	
Hot Water Pump Full Load	0.00	kW
Hot Water Leaving temp		°F
Storage tank	None	
Unloading Curve	Htg Straight Line	

Miscellaneous Accessories

Default gas-fired heat exchanger

Comments	ROOFTOP GAS HEAT	
Category	Gas-fired heat exchanger	
Heat Source	Utility	
Fuel Type	Gas	
Capacity		Mbh
Energy Rate	77.000	Percent efficient
Hot Water Pump	None	
Hot Water Pump Full Load	0.00	kW
Hot Water Leaving temp		°F
Storage tank	None	
Unloading Curve	Htg Straight Line	

Miscellaneous Accessories

Misc. Equipment

Cntl panel & interlocks - 1 KW

Comments	Control panel and interlocks	
Category	Controls	
Energy type	1.00000	kW
Control type	Electricity	
Full load energy	With equipment	

Cooling coil assignments

+ Main
Direct evaporative
Indirect evaporative
+ Auxiliary
+ Optional ventilation
System exhaust air
Room exhaust air
+ Misc cooling load
+ Base utility clg load

Heating coil assignments

+ Main
+ Preheat
+ Reheat
+ Mech. humidification
+ Auxiliary
+ Optional ventilation
+ Misc heating load
+ Base utility htg load
+ Absorption Chiller load

Library Members

Heat Rejection

Condenser fan for Heat Pump

Comments	Heat Pump Condenser Fan	
Capacity	100.00	Percent
Energy consumption	0.12	kW/ton
Low speed consumpt	0.00	Percent full load
Fluid type	Water	
Condenser type	Air-cooled condenser	
Number of cells	1	
% Air at low Speed	0.00	
Approach Temp	10.00	°F
Temp Range	10.00	°F
Wet bulb Temp	78.00	°F
Design water flow rate	3.00	gpm/ton
Makeup water flow rate	0.00	gal/ton-hr
Hourly Amb WB Offset		°F
Unloading curve	C-Tower on/off	

Coil load assignmer

+Main
Direct evaporator
+Indirect evaporator
+Auxiliary
+Optional ventilation
+Misc cooling load

Library Members

Floor - Construction Types

4" LW Concrete — 4" lightweight concrete

Layer	Code	Description	Thickness	Conductivity	Density	Specific Heat	Resistance
1	E0	Inside Surface Resist.					0.69 ft²·hr·°F/Btu
2	C1	4 in. LW Concrete	4.00 in.	0.10 Btu/hr·ft·°F	40.00 lb/cu ft	0.20 Btu/lb·°F	
3	E0	Inside Surface Resist.					0.69 ft²·hr·°F/Btu

Lamda = 0.89 Weight = 13.33 lb/ft² U-Value = 0.213 Btu/hr·ft²·°F Alpha = 0.90
Delta = 3 hours Heat Capacity = 2.67 Btu/ft²·lb·°F C-Coefficient = 0.0900 Btu/hr·ft²·°F

Partitions - Construction Types

0.75" Gyp Frame — 0.75" gypsum board frame wall

Layer	Code	Description	Thickness	Conductivity	Density	Specific Heat	Resistance
1	E0	Inside Surface Resist.					0.69 ft²·hr·°F/Btu
2	E1	0.75 in. Plaster	0.75 in.	0.42 Btu/hr·ft·°F	100.00 lb/cu ft	0.20 Btu/lb·°F	
3	B0	Air Space Resistance					0.91 ft²·hr·°F/Btu
4	E1	0.75 in. Plaster	0.75 in.	0.42 Btu/hr·ft·°F	100.00 lb/cu ft	0.20 Btu/lb·°F	
5	E0	Inside Surface Resist.					0.69 ft²·hr·°F/Btu

Lamda = 1.02 Weight = 12.50 lb/ft² U-Value = 0.388 Btu/hr·ft²·°F Alpha = 0.90
Delta = 1 hours Heat Capacity = 2.50 Btu/ft²·lb·°F C-Coefficient = 0.2400 Btu/hr·ft²·°F

Roof - Construction Types

Steel Sheet, 6" Ins — Steel sheet, 6" insulation

Layer	Code	Description	Thickness	Conductivity	Density	Specific Heat	Resistance
1	A0	Outside Surface Resist.					0.33 ft²·hr·°F/Btu
2	E2	0.5 in. Slag or Stone	0.50 in.	0.83 Btu/hr·ft·°F	55.00 lb/cu ft	0.40 Btu/lb·°F	
3	E3	3/8 in. Felt & Membrane	0.38 in.	0.11 Btu/hr·ft·°F	70.00 lb/cu ft	0.40 Btu/lb·°F	
4	A3	Steel Siding	0.06 in.	26.00 Btu/hr·ft·°F	480.00 lb/cu ft	0.10 Btu/lb·°F	
5	B6	6 in. Insulation	6.00 in.	0.03 Btu/hr·ft·°F	2.00 lb/cu ft	0.20 Btu/lb·°F	
6	E0	Inside Surface Resist.					0.69 ft²·hr·°F/Btu

Lamda = 0.96 Weight = 7.88 lb/ft² U-Value = 0.047 Btu/hr·ft²·°F Alpha = 0.90
Delta = 2 hours Heat Capacity = 2.23 Btu/ft²·lb·°F C-Coefficient = 0.0300 Btu/hr·ft²·°F

Library Members

Wall - Construction Types

8" LW Block, 2" Ins — 8" lightweight concrete block, 2" insulation

Layer	Code	Description	Thickness	Conductivity	Density	Specific Heat	Resistance
1	A0	Outside Surface Resist.					0.33 ft²·hr·°F/Btu
2	A1	1 in. Stucco	1.00 in.	0.40 Btu/hr·ft·°F	116.00 lb/cu ft	0.20 Btu/lb·°F	
3	C11	8 in. LW Concrete Block	8.00 in.	0.33 Btu/hr·ft·°F	38.00 lb/cu ft	0.20 Btu/lb·°F	
4	B2	2 in. Insulation - High Dens	2.00 in.	0.03 Btu/hr·ft·°F	5.70 lb/cu ft	0.20 Btu/lb·°F	
5	E1	0.75 in. Plaster	0.75 in.	0.42 Btu/hr·ft·°F	100.00 lb/cu ft	0.20 Btu/lb·°F	
6	E0	Inside Surface Resist.					0.69 ft²·hr·°F/Btu

Lamda = 0.53 Weight = 42.20 lb/ft² U-Value = 0.099 Btu/hr·ft²·°F Alpha = 0.90
Delta = 7 hours Heat Capacity = 8.44 Btu/ft²·lb·°F C-Coefficient = 0.0100 Btu/hr·ft²·°F

Glass types

Single Clear 1/4" — Properties based on Std DS Glass

Number of Panes	1		Visible Transmissivity	0.78	Inside Solar Reflectivity	0.13
Shading Coeff	0.95		Inside Visible Reflectivity	0.14	Outside Long Wave Emissivity	0.84
Glass U-Value	0.95	Btu/hr·ft²·°F	Solar Transmissivity	0.69	Inside Long Wave Emissivity	0.84

Double Clear 1/4" — Properties based on Std DS Glass

Number of Panes	2		Visible Transmissivity	0.68	Inside Solar Reflectivity	0.18
Shading Coeff	0.82		Inside Visible Reflectivity	0.23	Outside Long Wave Emissivity	0.84
Glass U-Value	0.60	Btu/hr·ft²·°F	Solar Transmissivity	0.50	Inside Long Wave Emissivity	0.84

Infiltration

Neutral, Average Const.

Cooling Design	Heating Design
0.60 air changes/hr	0.60 air changes/hr

Lights

Fluorescent, hung below ceiling, 100% load to space

Fixture Type	SUSFLUOR	Longwave Radiant Fraction	67 %
Percent Lights to RA	0 %	Shortwave Radiant Fraction	0 %
Ballast Factor	1.00		

Library Members

Misc. loads

Std Office Equipment

Energy Consumption	0.50 W/ft²	Percent Sensible	100 %	**Radiant Fraction**	60 %
		Percent To Room	100 %	The energy meter is Electricity	
		Percent To RA	0 %		

People

Member Name	People Density	Sensible Load	Latent Load	Longwave Radiant Fraction
Library	50.00 ft²/person	245.00 Btuh	155.00 Btuh	70 %

Member Name	People Density	Sensible Load	Latent Load	Longwave Radiant Fraction
General Office Space	143.00 ft²/person	250.00 Btuh	200.00 Btuh	70 %

Ventilation

Member Name	Cooling Design	Heating Design
Classroom	15.0 cfm/person	15.0 cfm/person

Library Members

Schedules

Hot Water - denver - shlessman

Simulation type: Reduced year

	Start time	End time	Percentage	Utilization
December - December Cooling design to Sunday				
	Midnight	Midnight	67.0	
January - January Cooling design to Sunday				
	Midnight	Midnight	0.0	
September - September Cooling design to Sunday				
	Midnight	Midnight	94.0	
May - May Cooling design to Sunday				
	Midnight	Midnight	42.0	
Heating Design				
	Midnight	Midnight	0.0	
June - June Cooling design to Sunday				
	Midnight	Midnight	12.0	
March - March Cooling design to Sunday				
	Midnight	Midnight	0.0	
April - April Cooling design to Sunday				
	Midnight	Midnight	96.0	
August - August Cooling design to Sunday				
	Midnight	Midnight	19.0	
October - October Cooling design to Sunday				
	Midnight	Midnight	100.0	
February - February Cooling design to Sunday				
	Midnight	Midnight	0.0	
November - November Cooling design to Sunday				
	Midnight	Midnight	85.0	
July - July Cooling design to Sunday				
	Midnight	Midnight	26.0	

Library Members

Schedules

Lights - Denver - Schlessman ECM 1

Simulation type: Reduced year

January - December	**Cooling design to Weekday**	**Start time**	**End time**	**Percentage**	Utilization
		Midnight	10 a.m.	5.0	
		10 a.m.	11 a.m.	55.0	
		11 a.m.	4 p.m.	80.0	
		4 p.m.	6 p.m.	60.0	
		6 p.m.	8 p.m.	25.0	
		8 p.m.	Midnight	5.0	
January - December	**Sunday**	**Start time**	**End time**	**Percentage**	Utilization
		Midnight	9 a.m.	5.0	
		9 a.m.	11 a.m.	60.0	
		11 a.m.	noon	100.0	
		noon	1 p.m.	60.0	
		1 p.m.	Midnight	5.0	
Heating Design		**Start time**	**End time**	**Percentage**	Utilization
		Midnight	Midnight	0.0	
January - December	**Saturday**	**Start time**	**End time**	**Percentage**	Utilization
		Midnight	9 a.m.	5.0	
		9 a.m.	11 a.m.	60.0	
		11 a.m.	2 p.m.	100.0	
		2 p.m.	5 p.m.	60.0	
		5 p.m.	Midnight	5.0	

Library Members

Schedules

People - Denver - Schlessman Library

Simulation type: Reduced year

Heating Design	**Start time**	**End time**	**Percentage**	Utilization
	Midnight	Midnight	0.0	

January - December **Saturday**	**Start time**	**End time**	**Percentage**	Utilization
	Midnight	8 a.m.	0.0	
	8 a.m.	9 a.m.	15.0	
	9 a.m.	10 a.m.	50.0	
	10 a.m.	11 a.m.	80.0	
	11 a.m.	noon	100.0	
	noon	1 p.m.	100.0	
	1 p.m.	2 p.m.	100.0	
	2 p.m.	3 p.m.	100.0	
	3 p.m.	4 p.m.	80.0	
	4 p.m.	5 p.m.	50.0	
	5 p.m.	6 p.m.	0.0	
	6 p.m.	7 p.m.	0.0	
	7 p.m.	8 p.m.	0.0	
	8 p.m.	Midnight	0.0	

January - December **Cooling design to Weekday**	**Start time**	**End time**	**Percentage**	Utilization
	Midnight	8 a.m.	0.0	
	8 a.m.	9 a.m.	9.0	
	9 a.m.	10 a.m.	9.0	
	10 a.m.	11 a.m.	36.0	
	11 a.m.	noon	54.0	
	noon	1 p.m.	80.0	
	1 p.m.	2 p.m.	92.0	
	2 p.m.	3 p.m.	100.0	
	3 p.m.	4 p.m.	100.0	

Schedules

	4 p.m.	5 p.m.	88.0	
	5 p.m.	6 p.m.	70.0	
	6 p.m.	7 p.m.	32.0	
	7 p.m.	8 p.m.	20.0	
	8 p.m.	Midnight	0.0	
January - December Sunday	**Start time**	**End time**	**Percentage**	Utilization
	Midnight	8 a.m.	0.0	
	8 a.m.	9 a.m.	0.0	
	9 a.m.	10 a.m.	0.0	
	10 a.m.	11 a.m.	0.0	
	11 a.m.	noon	0.0	
	noon	1 p.m.	15.0	
	1 p.m.	2 p.m.	50.0	
	2 p.m.	3 p.m.	80.0	
	3 p.m.	4 p.m.	80.0	
	4 p.m.	5 p.m.	50.0	
	5 p.m.	6 p.m.	0.0	
	6 p.m.	7 p.m.	0.0	
	7 p.m.	8 p.m.	0.0	
	8 p.m.	Midnight	0.0	

Available (100%)

Simulation type: Reduced year

January - December Cooling design to Sunday	**Start time**	**End time**	**Percentage**	Utilization
	Midnight	Midnight	100.0	
Heating Design	**Start time**	**End time**	**Percentage**	Utilization
	Midnight	Midnight	100.0	

Library Members

Schedules

Lights - Denver - Schlessman

Simulation type: Reduced year

January - December	**Sunday**	**Start time**	**End time**	**Percentage**	Utilization
		Midnight	9 a.m.	5.0	
		9 a.m.	11 a.m.	60.0	
		11 a.m.	noon	100.0	
		noon	1 p.m.	60.0	
		1 p.m.	Midnight	5.0	
January - December	**Cooling design to Weekday**	**Start time**	**End time**	**Percentage**	Utilization
		Midnight	10 a.m.	5.0	
		10 a.m.	11 a.m.	60.0	
		11 a.m.	4 p.m.	80.0	
		4 p.m.	6 p.m.	60.0	
		6 p.m.	8 p.m.	30.0	
		8 p.m.	Midnight	5.0	
January - December	**Saturday**	**Start time**	**End time**	**Percentage**	Utilization
		Midnight	9 a.m.	5.0	
		9 a.m.	11 a.m.	60.0	
		11 a.m.	2 p.m.	100.0	
		2 p.m.	5 p.m.	60.0	
		5 p.m.	Midnight	5.0	
Heating Design		**Start time**	**End time**	**Percentage**	Utilization
		Midnight	Midnight	0.0	

Library Members

Schedules

Off (0%)

Simulation type: Reduced year

January - December	**Cooling design to Sunday**	**Start time**	**End time**	**Status**	Equipment operation
		Midnight	Midnight	Off	

Parking-Denver-Schlessman

Simulation type: Reduced year

January - December	**Cooling design to Weekday**	**Start time**	**End time**	**Percentage**	Utilization
		Midnight	7 a.m.	100.0	
		7 a.m.	8 p.m.	0.0	
		8 p.m.	Midnight	100.0	
Cooling design		**Start time**	**End time**	**Percentage**	Utilization
		Midnight	8 a.m.	100.0	
		8 a.m.	8 p.m.	0.0	
		8 p.m.	Midnight	100.0	
January - December	**Sunday**	**Start time**	**End time**	**Percentage**	Utilization
		Midnight	8 a.m.	100.0	
		8 a.m.	8 p.m.	0.0	
		8 p.m.	Midnight	100.0	
January - December	**Saturday**	**Start time**	**End time**	**Percentage**	Utilization
		Midnight	9 a.m.	100.0	
		9 a.m.	8 p.m.	0.0	
		8 p.m.	Midnight	100.0	

Library Members

Schedules

Lights - Denver - Schlessman ECM 3

Simulation type: Reduced year

January - December	**Cooling design to Weekday**	**Start time**	**End time**	**Percentage**	Utilization
		Midnight	10 a.m.	5.0	
		10 a.m.	11 a.m.	55.0	
		11 a.m.	4 p.m.	74.0	
		4 p.m.	6 p.m.	60.0	
		6 p.m.	8 p.m.	24.0	
		8 p.m.	Midnight	5.0	
Heating Design		**Start time**	**End time**	**Percentage**	Utilization
		Midnight	Midnight	0.0	
January - December	**Sunday**	**Start time**	**End time**	**Percentage**	Utilization
		Midnight	9 a.m.	5.0	
		9 a.m.	11 a.m.	60.0	
		11 a.m.	noon	100.0	
		noon	1 p.m.	54.0	
		1 p.m.	Midnight	5.0	
January - December	**Saturday**	**Start time**	**End time**	**Percentage**	Utilization
		Midnight	9 a.m.	5.0	
		9 a.m.	11 a.m.	60.0	
		11 a.m.	2 p.m.	100.0	
		2 p.m.	5 p.m.	55.0	
		5 p.m.	Midnight	5.0	

Library Members

Schedules

Denver - Boiler

Simulation type: Full year

September - December	**Cooling design to Holiday**	**Start time**	**End time**	**Status**	Equipment operation
		Midnight	Midnight	Normal	
June - August	**Cooling design to Holiday**	**Start time**	**End time**	**Status**	Equipment operation
		Midnight	Midnight	Off	
January - May	**Cooling design to Holiday**	**Start time**	**End time**	**Status**	Equipment operation
		Midnight	Midnight	Normal	

Base Utilities

Parking lot lights

Comments	
Schedule	Parking lot lights
Energy Type	Electricity
Hourly demand	0.10 kW
Entering	°F
Leaving	°F

Domestic Hot Water Load - Gas

Comments	
Schedule	Available (100%)
Energy Type	Gas
Hourly demand	1.40 kW
Entering	°F
Leaving	°F

Library Members

Cooling Equipment

TRACE® 700 Cooling Equipment Library

Default air-cooled unitary — **Air-cooled unitary - Reciprocating**

Comments: PACKAGED TERMINAL AIR CONDITIONER

Operating Mode	Capacity	Energy Rate
Cooling	tons	1.380 kW/ton
Heat Recovery		
Tank Charging		
Tank Chrg. & Heat Rec.		

Unloading Curves	Primary	Secondary
Power consumed	EQ1307	EQ1307
Ambient modification	EQ1307 - Amb Mod	EQ1307 - Amb Mod
Capacity		

Load Shed Economizer	No
Evap Precooling	No
Fuel Source	Utility
Fuel type	Electric
Free cooling type	None
Fluid cooler type	None
Thermal Storage	None
Tower/condenser	Condenser fan for Heat Pump

Pumps	Type	Full Load Consumption	Pump Head
Chilled water	None	0.000000kW	
Condenser water	None	0.00000kW	
Ht Rec or aux cond.	None	kW	
Free cooling pump	None		

	Reset Based On	Reset Curve	Max Reset TD
Chilled water	None		
Condenser water	None		

Chilled water temp Design leaving	44.00°F
Chilled water temp Difference	10.00°F
Condenser temp design temp entering	95.00°F
Condenser temp min. operating	75.00°F
Condenser temp Difference	10.00°F
Reject Cond heat to ref	Heat rejection equipment
Reject Cond heat at water temp	

Miscellaneous accessories

Cntl panel & interlocks - 0.1 KW

Library Members

Fans

Fan coil supply fan

Fan type	Constant volume
Comments	Fan coil supply fan
Full load energy	0.00024 kW/Cfm
Unloading curve	Fan Curve On/Off

AF Centrifugal const vol

Fan type	Constant volume
Comments	Air foil Centrifugal fan constant volume
Full load energy	0.00020 kW/Cfm-in wg
Unloading curve	Fan Curve Straight Line

FC Centrifugal const vol

Fan type	Constant volume
Comments	Forward curved Centrifugal fan constant volume
Full load energy	0.00032 kW/Cfm-in wg
Unloading curve	Fan Curve Straight Line

AF Centrifugal var freq drv

Fan type	Variable volume
Comments	Air foil Centrifugal with variable frequency drive
Full load energy	0.00022 kW/Cfm-in wg
Unloading curve	Fan Curve 9

Heating Equipment

Gas Fired Hot Water Boiler

Comments	FIRE TUBE HOT H2O BOILER (GAS) EQ2001	
Category	Boiler	
Heat Source	Utility	
Fuel Type	Gas	
Capacity		Mbh
Energy Rate	83.300	Percent efficient
Hot Water Pump	Heating water circ pump	
Hot Water Pump Full Load	0.00	kW
Hot Water Leaving temp		°F
Storage tank	None	
Unloading Curve	Htg Straight Line	

Miscellaneous Accessories

Boiler forced draft fan

Cntl panel & interlocks - 0.5 KW

Library Members

Misc. Equipment

Boiler controls

Comments	Boiler controls	
Category	Controls	
Energy type	2.00000	kW
Control type	Electricity	
Full load energy	With equipment	

Cooling coil assignments	Heating coil assignments
+ Main	+ Main
Direct evaporative	+ Preheat
Indirect evaporative	+ Reheat
+ Auxiliary	+ Mech. humidification
+ Optional ventilation	+ Auxiliary
System exhaust air	+ Optional ventilation
Room exhaust air	+ Misc heating load
+ Misc cooling load	+ Base utility htg load
+ Base utility clg load	+ Absorption Chiller load

90.1 Min CV Hot Water Pump

Comments	Hot water pump - constant volume	
Category	Water pump	
Energy type	19.00000	Watt/gpm
Control type	Electricity	
Full load energy	With equipment	

Cooling coil assignments	Heating coil assignments
+ Main	+ Main
Direct evaporative	+ Preheat
Indirect evaporative	+ Reheat
+ Auxiliary	+ Mech. humidification
+ Optional ventilation	+ Auxiliary
+ System exhaust air	+ Optional ventilation
+ Room exhaust air	+ Misc heating load
+ Misc cooling load	+ Base utility htg load
+ Base utility clg load	+ Absorption Chiller load

Heating water circ pump

Comments	Heating water circulation pump	
Category	Water pump	
Energy type	0.00000	kW/Btu-ft wg
Control type	Electricity	
Full load energy	With equipment	

Cooling coil assignments	Heating coil assignments
+ Main	+ Main
Direct evaporative	+ Preheat
Indirect evaporative	+ Reheat
+ Auxiliary	+ Mech. humidification
+ Optional ventilation	+ Auxiliary
+ System exhaust air	+ Optional ventilation
+ Room exhaust air	+ Misc heating load
+ Misc cooling load	+ Base utility htg load
+ Base utility clg load	+ Absorption Chiller load

Library Members

Heat Rejection

Condenser fan for Heat Pump

Comments	Heat Pump Condenser Fan	
Capacity	100.00	Percent
Energy consumption	0.12	kW/ton
Low speed consumpt	0.00	Percent full load
Fluid type	Water	
Condenser type	Air-cooled condenser	
Number of cells	1	
% Air at low Speed	0.00	
Approach Temp	10.00	°F
Temp Range	10.00	°F
Wet bulb Temp	78.00	°F
Design water flow rate	3.00	gpm/ton
Makeup water flow rate	0.00	gal/ton-hr
Hourly Amb WB Offset		°F
Unloading curve	C-Tower on/off	

Coil load assignmer

+Main
Direct evaporator
+Indirect evaporator
+Auxiliary
+Optional ventilation
+Misc cooling load

Attachment D – Trane Trace Calibration & Results

Fire Station#1(HQ)

Fire Station #8

Police District #1

911 Call Center

Twentieth Street Rec Ctr

Barnum Library

Bear Valley Library

Eugene Field Library

Schlessman Family Library

Hourly Model Results

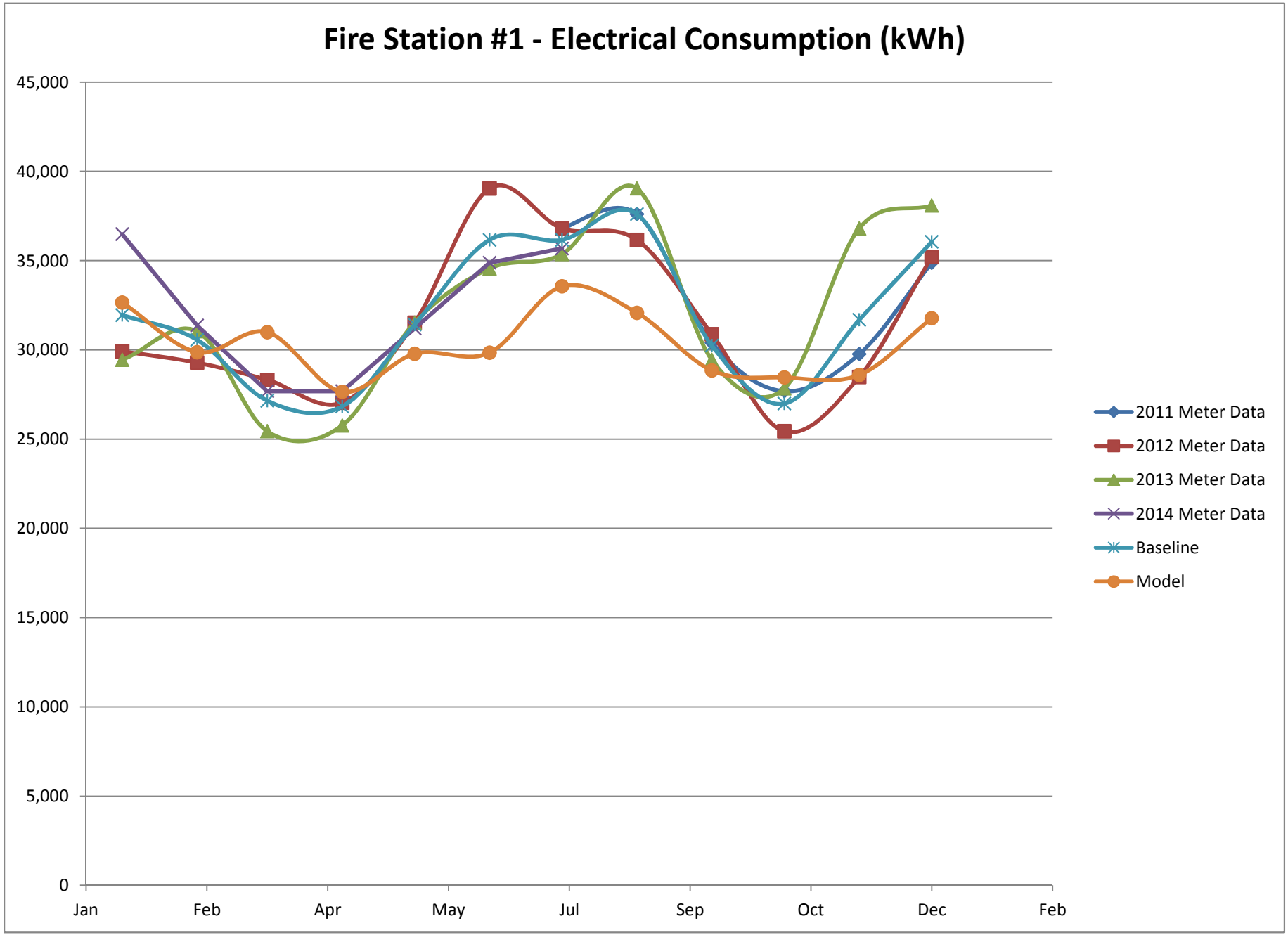
Fire Station#1(HQ)

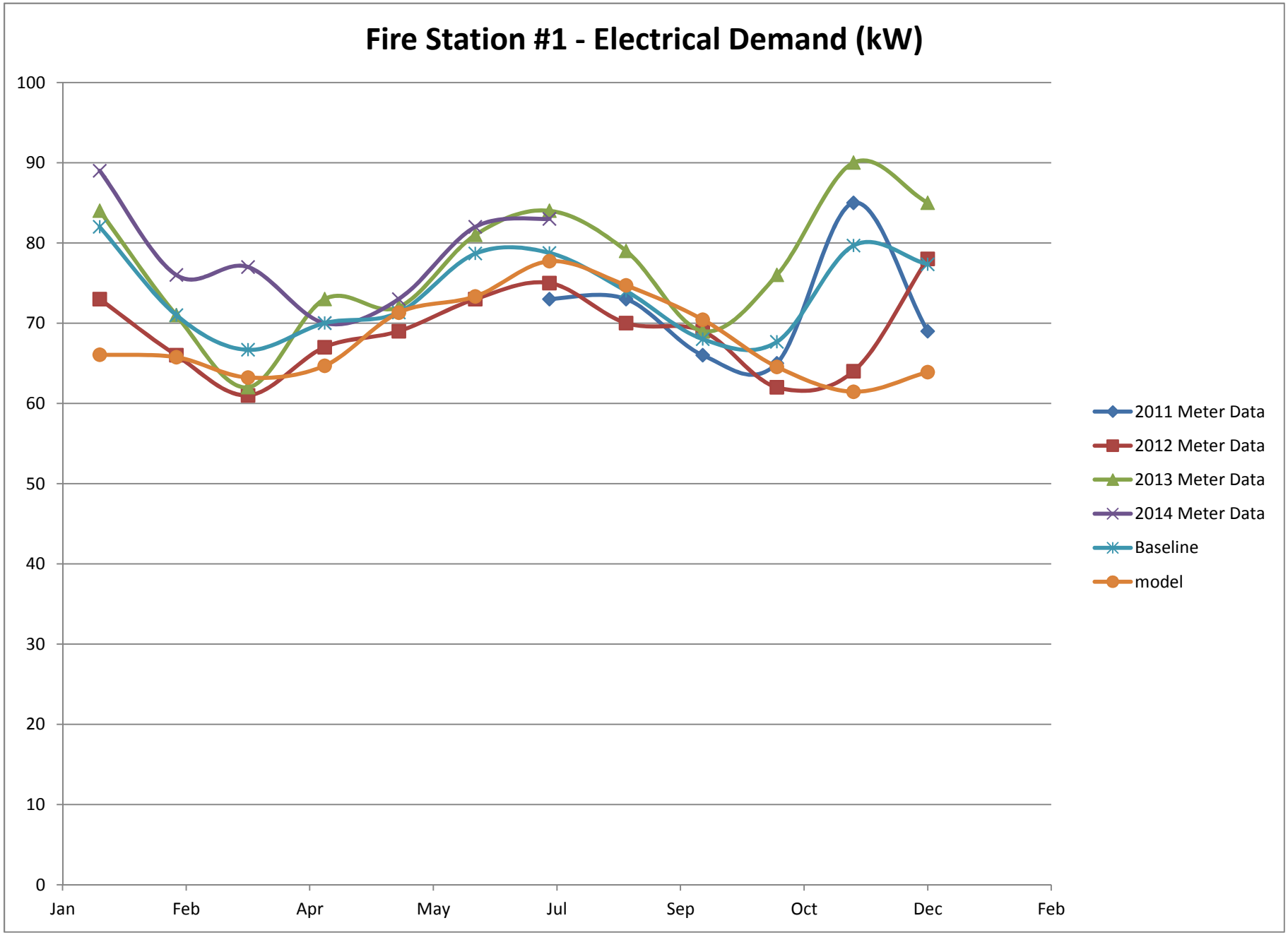
Baseline Model Calibration
Modeling Results – Electric Consumption
Modeling Results – Electric Demand
Model Results – Natural Gas Consumption

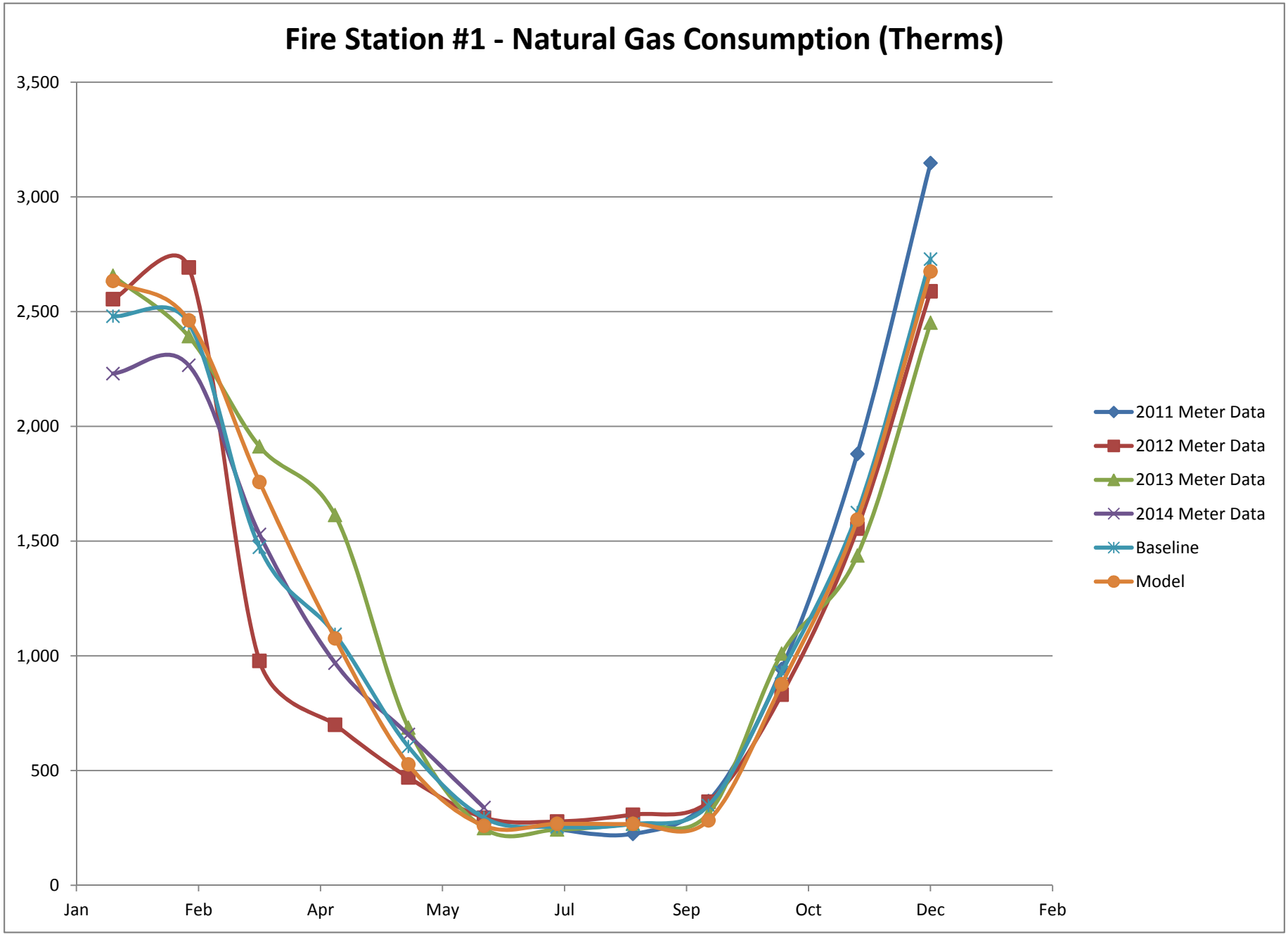
	Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total		
Baseline	kWh	31,947	30,560	27,147	26,827	31,413	36,160	36,160	37,600	30,240	26,987	31,680	36,053	382,773		
Model	kWh	32,653	29,871	30,989	27,651	29,778	29,840	33,553	32,077	28,843	28,452	28,590	31,766	364,064		
Difference	kWh	-706	689	-3,843	-824	1,635	6,320	2,607	5,523	1,397	-1,465	3,090	4,287	18,710		
RMS Error		498,766	474,942	14,765,524	679,608	2,673,498	39,943,158	6,794,103	30,507,837	1,952,280	2,146,879	9,546,926	18,377,026	128,360,545		
MBE		-2.2%	2.3%	-14.2%	-3.1%	5.2%	17.5%	7.2%	14.7%	4.6%	-5.4%	9.8%	11.9%	4.9%	MBE =	4.9%
Cv															Cv =	10.3%
Baseline	kW	82	71	67	70	71	79	79	74	68	68	80	77	885		
Model	kW	66	66	63	65	71	73	78	75	70	65	61	64	817		
Difference	kW	16	5	3	5	0	5	1	-1	-2	3	18	13	68		
RMS Error		254	28	12	28	0	28	1	0	6	10	332	181	880		
MBE		19.4%	7.4%	5.2%	7.6%	0.0%	6.8%	1.3%	-0.9%	-3.6%	4.6%	22.9%	17.4%	7.7%	MBE =	7.7%
Cv															Cv =	11.6%
Baseline	therms	2,480	2,450	1,473	1,094	605	294	255	267	348	928	1,624	2,729	14,546		
Model	therms	2,634	2,463	1,758	1,076	527	259	268	268	283	876	1,593	2,674	14,678		
Difference	therms	-154	-13	-285	18	78	35	-13	-1	65	52	31	55	-132		
RMS Error		23,630	158	81,037	312	6,032	1,234	165	1	4,229	2,691	933	2,992	123,414		
MBE		-6.2%	-0.5%	-19.3%	1.6%	12.8%	11.9%	-5.0%	-0.4%	18.7%	5.6%	1.9%	2.0%	-0.9%	MBE =	-0.9%
Cv															Cv =	8.4%

33,442 sq-ft

ECM 1 - Lighting System Upgrades																Cumulative	
Model	kWh	28,821	26,418	27,207	23,153	24,734	24,998	28,483	26,993	24,098	23,705	25,017	27,956	311,583			
Model	kW	55	55	52	51	58	60	64	61	57	54	51	54	673			
Model	therms	2,798	2,505	2,203	1,130	538	259	268	268	294	933	1,994	3,095	16,284			
Savings	kWh	3,832	3,453	3,782	4,499	5,044	4,842	5,071	5,084	4,745	4,747	3,573	3,811	52,480		52,480	kWh
		12%	11%	14%	17%	16%	13%	14%	14%	16%	18%	11%	11%	14%		14%	
Savings	kW	11	11	11	13	13	13	13	13	14	11	10	10	144		144	kW
		14%	15%	16%	19%	19%	17%	17%	18%	20%	16%	13%	12%	16%		16%	
Savings	therms	-164	-42	-445	-54	-11	0	0	0	-11	-57	-401	-420	-1,606		-1,606	therms
		-7%	-2%	-30%	-5%	-2%	0%	0%	0%	-3%	-6%	-25%	-15%	-11%		-11%	
ECM 3 - Lighting Controls																	
Model	kWh	28,687	26,293	27,096	23,034	24,579	24,832	28,305	26,822	23,938	23,574	24,871	27,800	309,829			
Model	kW	56	55	52	51	58	60	64	61	57	54	52	54	674			
Model	therms	2,875	2,687	2,275	1,171	539	259	268	268	295	937	1,877	2,778	16,229			
Savings	kWh	134	125	112	119	156	166	177	171	160	132	146	156	1,754		54,234	kWh
		0%	0%	0%	0%	0%	0%	0%	0%	1%	0%	0%	0%	0%		14%	
Savings	kW	(1)	(0)	1	-	-	(0)	-	-	-	(0)	(0)	1	0		144	kW
		-1%	0%	1%	0%	0%	0%	0%	0%	0%	0%	0%	1%	0%		16%	
Savings	therms	-77	-183	-72	-41	-1	0	0	0	-1	-4	117	316	55		-1,551	therms
		-3%	-7%	-5%	-4%	0%	0%	0%	0%	0%	0%	7%	12%	0%		-11%	
ECM 4 - EMS Upgrades																	
Model	kWh	28,231	26,136	26,478	22,201	23,290	23,835	27,415	25,767	22,591	22,609	24,391	27,223	300,169			
Model	kW	56	55	52	51	58	60	64	61	57	54	52	54	674			
Model	therms	2,817	2,672	2,195	1,110	513	259	268	268	281	869	1,810	2,704	15,767			
Savings	kWh	456	157	617	832	1,288	997	890	1,055	1,347	965	480	576	9,660		63,895	kWh
		1%	1%	2%	3%	4%	3%	2%	3%	4%	4%	2%	2%	3%		17%	
Savings	kW	(0)	(0)	(1)	(0)	-	-	-	-	-	-	-	(0)	-1		143	kW
		0%	0%	-1%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%		16%	
Savings	therms	58	15	79	61	26	0	0	0	14	67	67	74	462		-1,089	therms
		2%	1%	5%	6%	4%	0%	0%	0%	4%	7%	4%	3%	3%		-7%	


Fire Station #1 - Electrical Consumption (kWh)
45,000
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
Jan
Feb
Apr
May
Jul
Sep
Oct
Dec
Feb
2011 Meter Data
2012 Meter Data
2013 Meter Data
2014 Meter Data
Baseline
Model


Fire Station #1 - Electrical Demand (kW)
100
90
80
70
60
50
40
30
20
10
0
Jan
Feb
Apr
May
Jul
Sep
Oct
Dec
Feb
2011 Meter Data
2012 Meter Data
2013 Meter Data
2014 Meter Data
Baseline
model


Fire Station #1 - Natural Gas Consumption (Therms)
3,500
3,000
2,500
2,000
1,500
1,000
500
0
Jan
Feb
Apr
May
Jul
Sep
Oct
Dec
Feb
2011 Meter Data
2012 Meter Data
2013 Meter Data
2014 Meter Data
Baseline
Model

Hourly Model Results

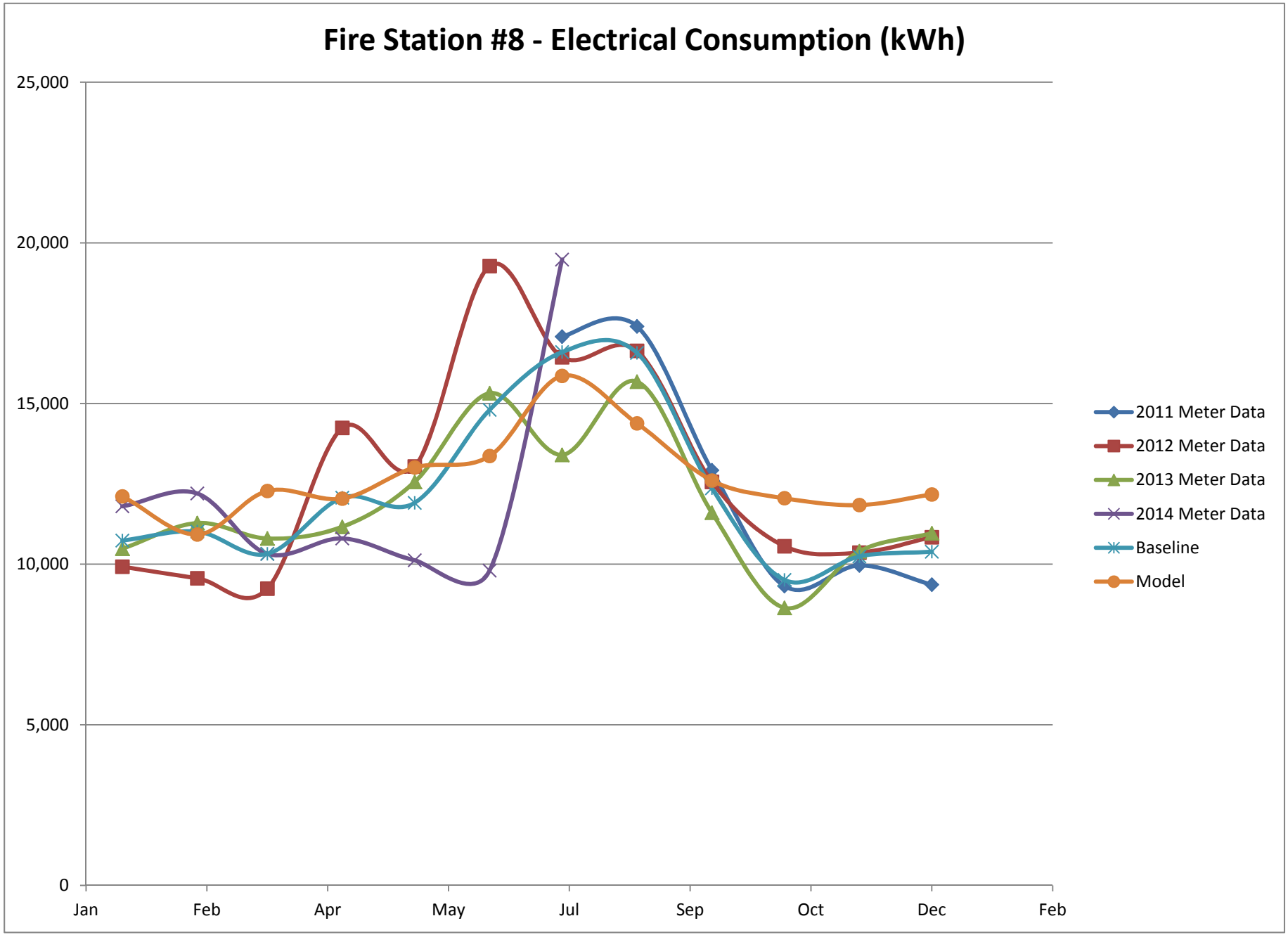
Fire Station #8

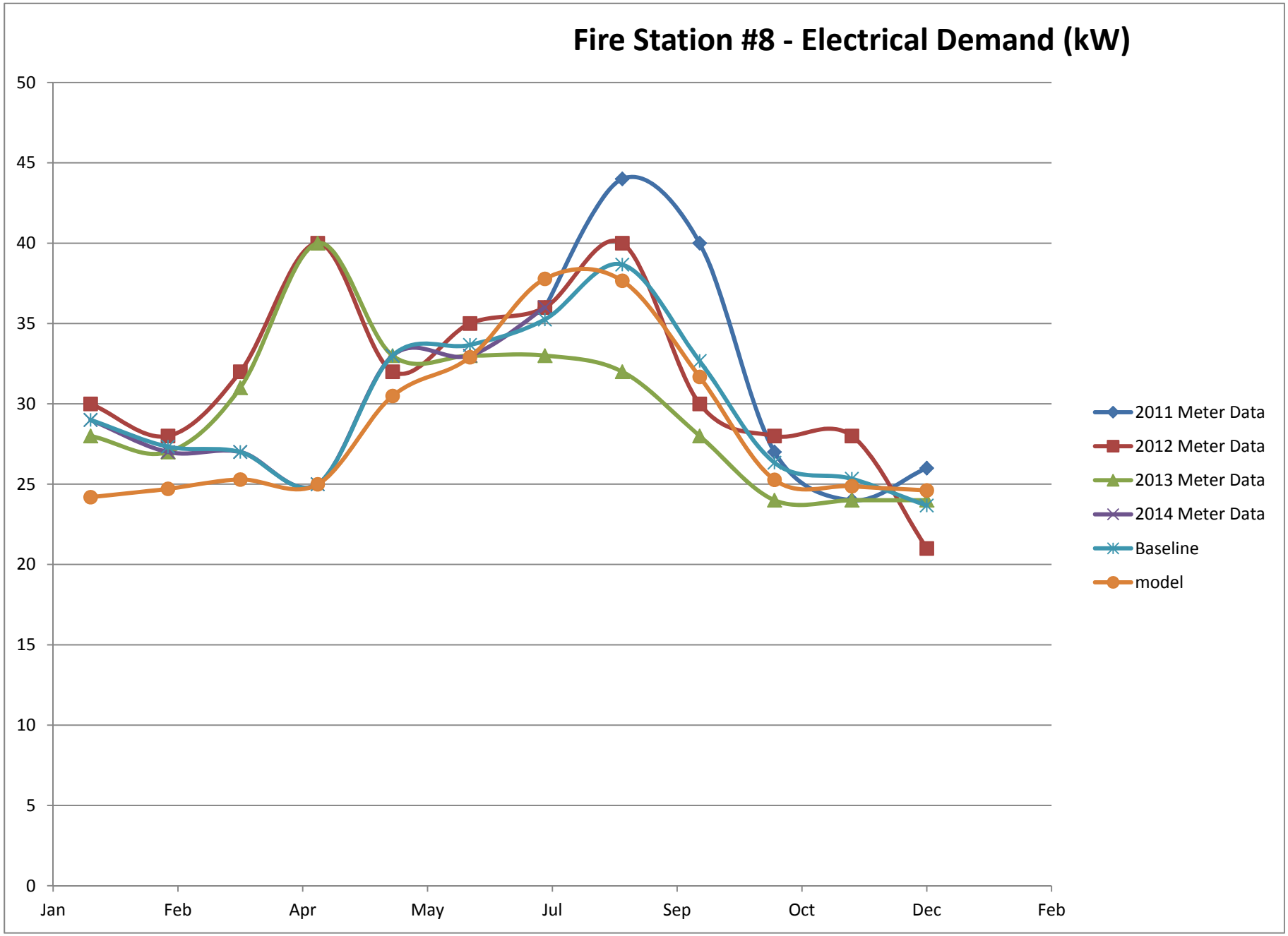
Baseline Model Calibration
Modeling Results – Electric Consumption
Modeling Results – Electric Demand
Model Results – Natural Gas Consumption

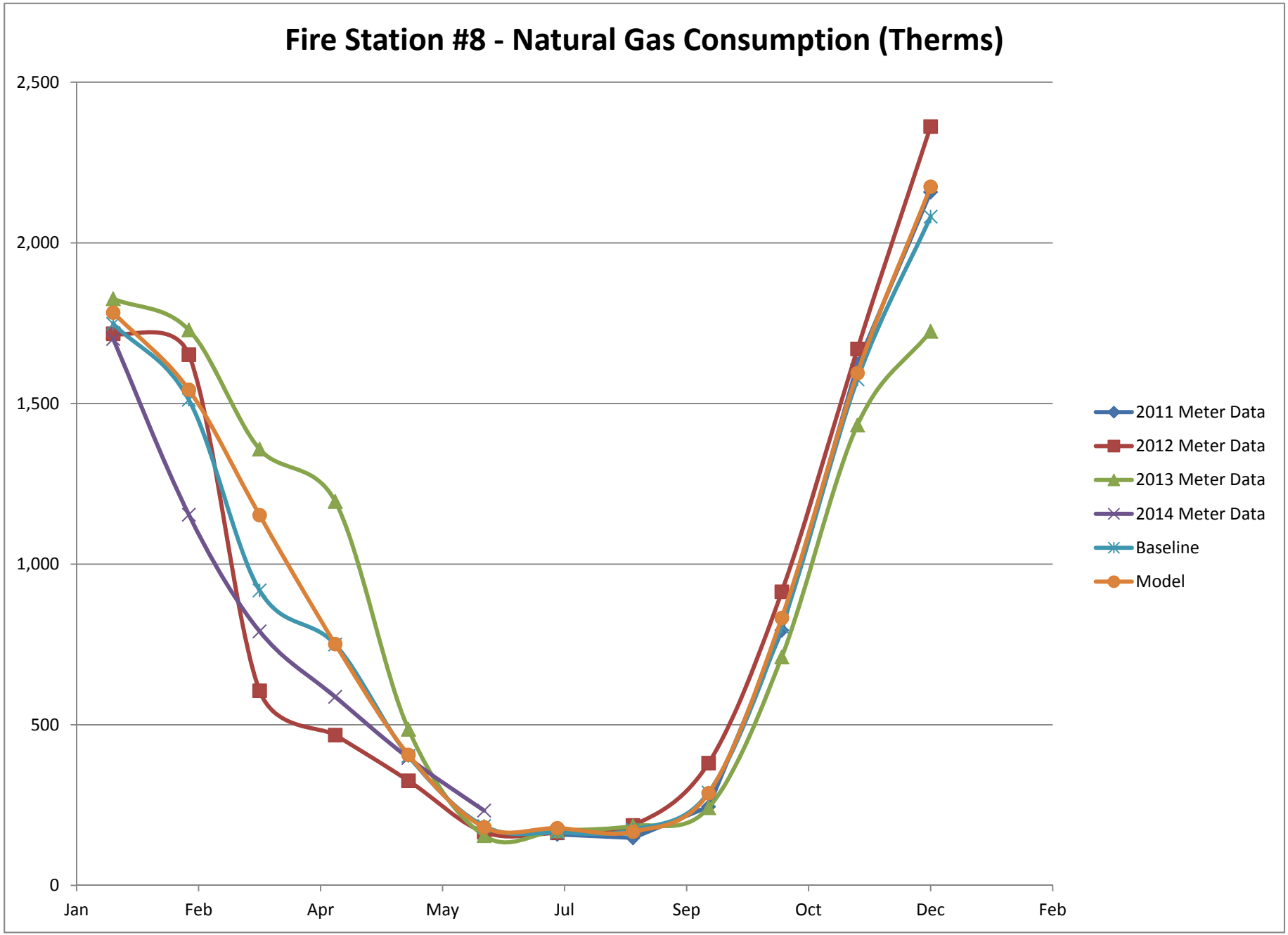
	Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total		
Baseline	kWh	10,733	11,013	10,320	12,067	11,907	14,800	16,600	16,573	12,360	9,507	10,240	10,387	146,507		
Model	kWh	12,109	10,921	12,276	12,039	13,008	13,364	15,859	14,380	12,602	12,052	11,839	12,170	152,619		
Difference	kWh	-1,375	92	-1,956	27	-1,101	1,436	741	2,193	-242	-2,545	-1,599	-1,783	-6,112		
RMS Error		1,891,523	8,435	3,825,193	748	1,212,362	2,060,833	549,778	4,810,229	58,729	6,477,755	2,555,490	3,180,492	26,631,566		
MBE		-12.8%	0.8%	-19.0%	0.2%	-9.2%	9.7%	4.5%	13.2%	-2.0%	-26.8%	-15.6%	-17.2%	-4.2%	MBE =	-4.2%
Cv															Cv =	12.2%
Baseline	kW	29	27	27	25	33	34	35	39	33	26	25	24	357		
Model	kW	24	25	25	25	30	33	38	38	32	25	25	25	344		
Difference	kW	5	3	2	0	3	1	-3	1	1	1	0	-1	12		
RMS Error		23	7	3	0	6	1	6	1	1	1	0	1	50		
MBE		16.6%	9.6%	6.3%	0.0%	7.6%	2.3%	-7.2%	2.6%	3.0%	4.0%	1.8%	-4.0%	3.5%	MBE =	3.5%
Cv															Cv =	6.9%
Baseline	therms	1,748	1,512	918	750	403	185	164	173	289	806	1,575	2,082	10,606		
Model	therms	1,783	1,543	1,152	751	407	181	178	167	287	833	1,595	2,175	11,052		
Difference	therms	-35	-31	-234	-1	-4	3	-14	6	2	-26	-20	-93	-446		
RMS Error		1,229	971	54,736	2	12	12	193	38	5	692	392	8,625	66,905		
MBE		-2.0%	-2.1%	-25.5%	-0.2%	-0.9%	1.8%	-8.5%	3.5%	0.8%	-3.3%	-1.3%	-4.5%	-4.2%	MBE =	-4.2%
Cv															Cv =	8.4%

11,112 sq-ft

ECM 1 - Lighting System Improvements																Cumulative	
Model	kWh	10,864	9,806	11,020	10,782	11,610	12,013	14,424	12,964	11,243	10,732	10,605	10,917	136,980			
Model	kW	21	21	22	22	27	29	34	34	28	22	21	21	301			
Model	therms	1,879	1,639	1,225	766	409	183	179	168	289	844	1,632	2,253	11,466			
Savings	kWh	1,244	1,115	1,256	1,257	1,398	1,351	1,435	1,416	1,359	1,320	1,234	1,253	15,639		15,639	kWh
		12%	10%	12%	10%	12%	9%	9%	9%	11%	14%	12%	12%	11%		11%	
Savings	kW	3	4	3	3	4	4	4	4	4	4	3	4	44		44	kW
		12%	14%	13%	14%	11%	11%	10%	10%	12%	14%	14%	16%	12%		12%	
Savings	therms	-96	-96	-72	-15	-2	-2	-1	-1	-2	-11	-38	-78	-415		-415	therms
		-5%	-6%	-8%	-2%	-1%	-1%	0%	-1%	-1%	-1%	-2%	-4%	-4%		-4%	
ECM 3 - Lighting Controls																	
Model	kWh	10,763	9,714	10,919	10,680	11,498	11,904	14,307	12,849	11,134	10,627	10,503	10,815	135,712			
Model	kW	21	21	22	22	27	29	34	34	28	22	21	21	301			
Model	therms	1,886	1,644	1,236	768	409	184	179	169	289	845	1,636	2,260	11,505			
Savings	kWh	102	92	101	103	112	109	117	115	109	104	101	103	1,268		16,907	kWh
		1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%		12%	
Savings	kW	-	0	-	-	-	0	-	(0)	0	-	-	0	0		44	kW
		0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%		12%	
Savings	therms	-7	-5	-12	-1	0	0	0	0	0	-1	-3	-7	-39		-454	therms
		0%	0%	-1%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%		-4%	
ECM 10 - HVAC Upgrades																	
Model	kWh	8,081	7,349	8,054	7,711	8,233	8,647	10,840	9,488	7,974	8,269	7,624	8,020	100,289			
Model	kW	16	17	17	17	25	27	29	29	24	21	16	16	255			
Model	therms	1,688	1,457	1,069	713	256	62	173	94	160	804	1,462	2,044	9,982			
Savings	kWh	2,681	2,365	2,865	2,969	3,265	3,257	3,467	3,361	3,159	2,358	2,879	2,795	35,422		52,330	kWh
		25%	21%	28%	25%	27%	22%	21%	20%	26%	25%	28%	27%	24%		36%	
Savings	kW	4	4	5	5	2	2	5	5	4	0	5	4	45		89	kW
		15%	16%	20%	19%	6%	6%	13%	12%	13%	1%	20%	18%	13%		25%	
Savings	therms	198	187	167	55	153	122	6	75	130	41	174	216	1,524		1,070	therms
		11%	12%	18%	7%	38%	66%	4%	43%	45%	5%	11%	10%	14%		10%	


Fire Station #8 - Electrical Consumption (kWh)
25,000
20,000
15,000
10,000
5,000
0
Jan
Feb
Apr
May
Jul
Sep
Oct
Dec
Feb
2011 Meter Data
2012 Meter Data
2013 Meter Data
2014 Meter Data
Baseline
Model


Fire Station #8 - Electrical Demand (kW)
50
45
40
35
30
25
20
15
10
5
0
Jan
Feb
Apr
May
Jul
Sep
Oct
Dec
Feb
2011 Meter Data
2012 Meter Data
2013 Meter Data
2014 Meter Data
Baseline
model


Fire Station #8 - Natural Gas Consumption (Therms)
2,500
2,000
1,500
1,000
500
0
Jan
Feb
Apr
May
Jul
Sep
Oct
Dec
Feb
2011 Meter Data
2012 Meter Data
2013 Meter Data
2014 Meter Data
Baseline
Model

Hourly Model Results

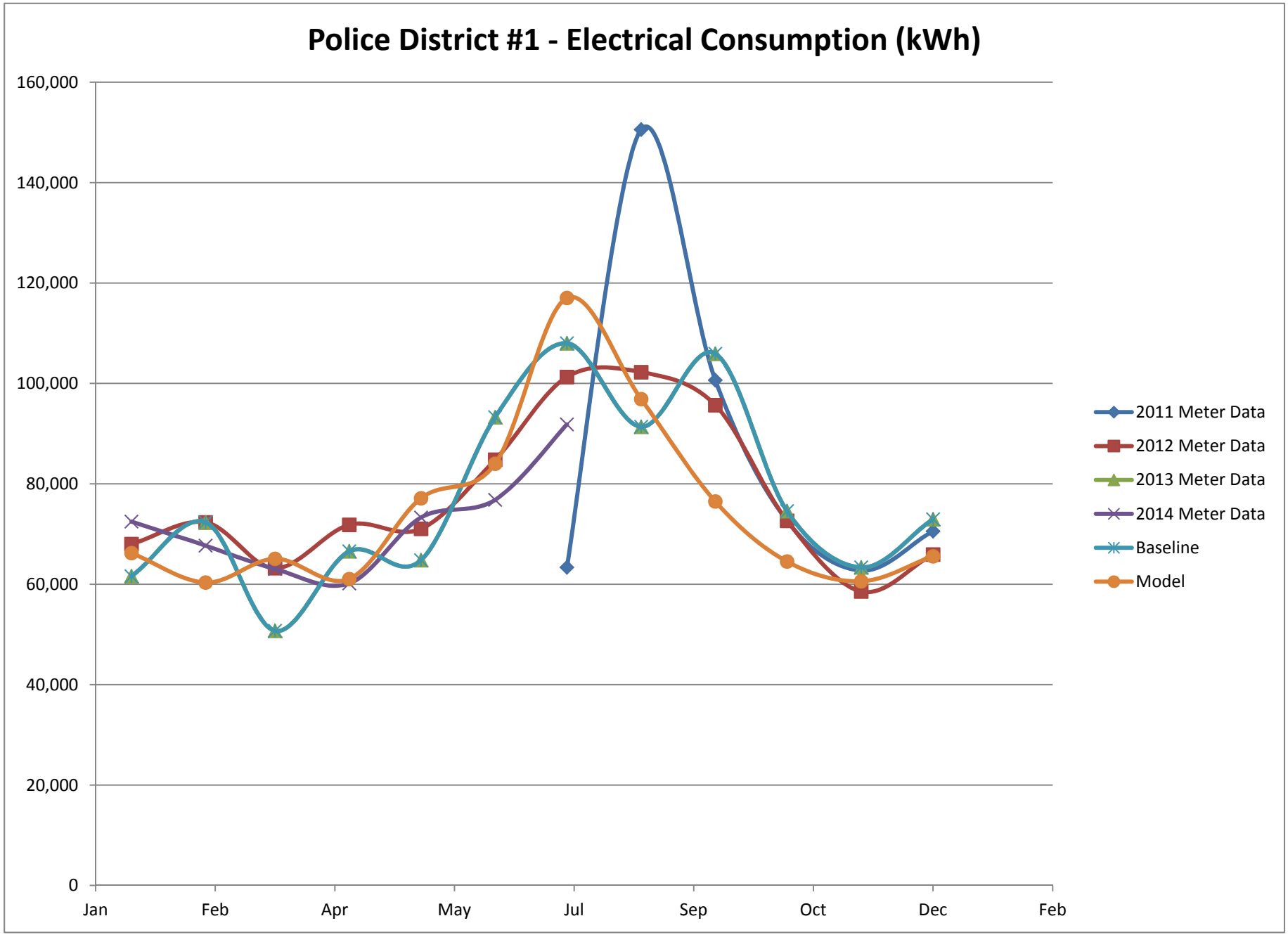
Police District #1

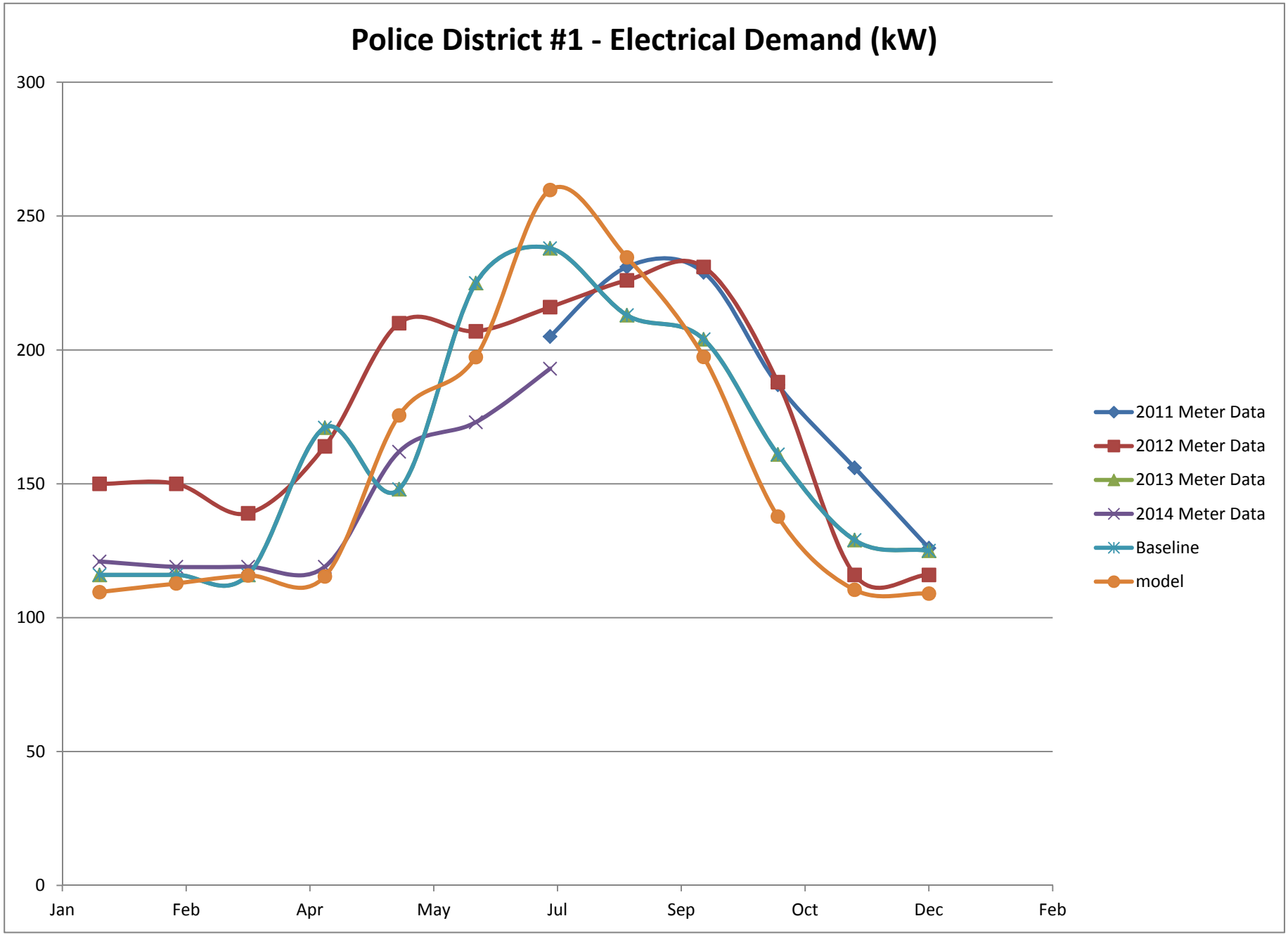
Baseline Model Calibration
Modeling Results – Electric Consumption
Modeling Results – Electric Demand
Model Results – Natural Gas Consumption

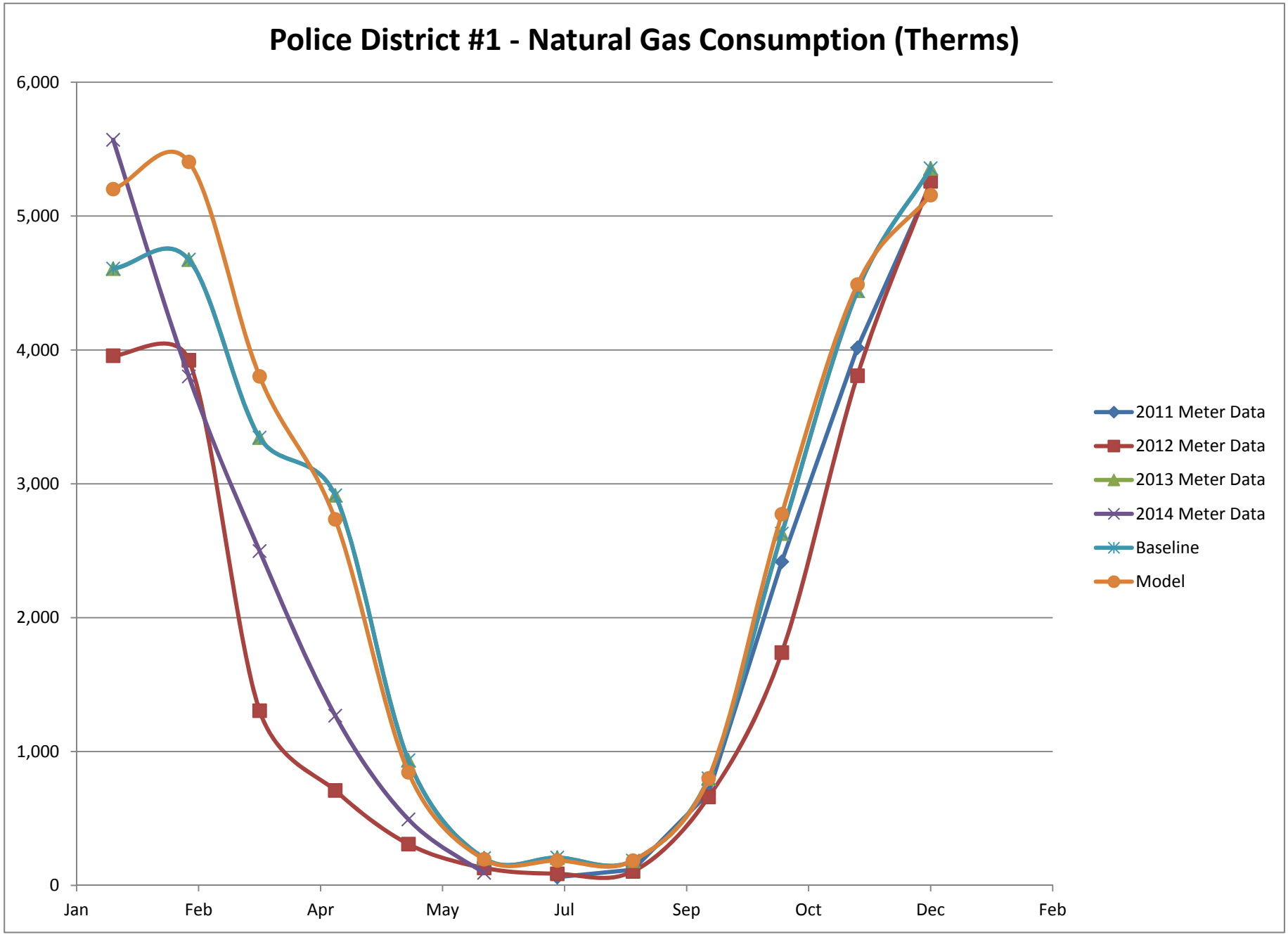
	Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total		
Baseline	kWh	61,600	72,320	50,720	66,560	64,800	93,280	108,000	91,360	105,920	74,560	63,360	72,960	925,440		
Model	kWh	66,200	60,329	65,063	61,042	77,125	83,991	117,014	96,887	76,488	64,517	60,592	65,567	894,816		
Difference	kWh	-4,600	11,991	-14,343	5,518	-12,325	9,289	-9,014	-5,527	29,432	10,043	2,768	7,393	30,624		
RMS Error		21,158,896	143,794,393	205,732,837	30,450,090	151,915,485	86,279,762	81,252,196	30,544,192	866,235,560	100,863,858	7,660,219	54,650,091	1,780,537,579		
MBE		-7.5%	16.6%	-28.3%	8.3%	-19.0%	10.0%	-8.3%	-6.0%	27.8%	13.5%	4.4%	10.1%	3.3%	MBE =	3.3%
Cv															Cv =	15.8%
Baseline	kW	116	116	116	171	148	225	238	213	204	161	129	125	1,962		
Model	kW	110	113	116	115	176	197	260	235	197	138	110	109	1,875		
Difference	kW	6	3	0	56	-28	28	-22	-22	7	23	19	16	87		
RMS Error		41	10	0	3,091	760	765	473	466	44	539	344	256	6,790		
MBE		5.5%	2.8%	0.2%	32.5%	-18.6%	12.3%	-9.1%	-10.1%	3.2%	14.4%	14.4%	12.8%	4.4%	MBE =	4.4%
Cv															Cv =	14.5%
Baseline	therms	4,608	4,675	3,346	2,914	935	204	208	186	800	2,628	4,442	5,357	30,303		
Model	therms	5,202	5,405	3,802	2,735	845	196	186	186	800	2,773	4,489	5,156	31,775		
Difference	therms	-594	-730	-456	179	90	8	22	0	0	-145	-47	201	-1,472		
RMS Error		352,397	532,593	208,219	32,145	8,051	71	484	0	0	21,054	2,242	40,373	1,197,629		
MBE		-12.9%	-15.6%	-13.6%	6.2%	9.6%	4.1%	10.6%	0.0%	0.0%	-5.5%	-1.1%	3.8%	-4.9%	MBE =	-4.9%
Cv															Cv =	12.5%

40,431 sq-ft

ECM 1 - Lighting System Upgrades																	
Model	kWh	62,553	57,379	61,890	57,216	72,655	78,929	111,368	91,514	71,047	60,214	56,764	61,969	843,499			
Model	kW	103	101	104	100	155	177	245	224	182	124	98	96	1,709			
Model	therms	5,453	5,730	4,403	2,845	856	205	186	186	808	2,778	4,756	5,430	33,636			
Savings	kWh	3,647	2,950	3,173	3,826	4,470	5,062	5,646	5,373	5,441	4,303	3,828	3,598	51,317		51,317	kWh
		6%	4%	6%	6%	7%	5%	5%	6%	5%	6%	6%	5%	6%		6%	
Savings	kW	7	12	12	16	20	20	14	11	16	14	12	13	167		167	kW
		6%	10%	10%	9%	14%	9%	6%	5%	8%	9%	10%	11%	8%		8%	
Savings	therms	-252	-325	-601	-110	-11	-10	0	0	-8	-5	-266	-274	-1,861		-1,861	therms
		-5%	-7%	-18%	-4%	-1%	-5%	0%	0%	-1%	0%	-6%	-5%	-6%		-6%	
ECM 3 - Lighting Controls																	
Model	kWh	62,488	57,296	61,762	57,174	72,608	78,889	111,285	91,165	71,193	60,178	56,666	62,130	842,835			
Model	kW	103	101	104	100	156	176	251	228	173	119	98	96	1,704			
Model	therms	5,483	5,721	4,390	2,853	855	206	186	186	806	2,813	4,728	5,573	33,801			
Savings	kWh	65	83	128	42	47	40	83	348	-145	36	98	-161	663		51,981	kWh
		0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%		6%	
Savings	kW	-	1	0	(1)	(0)	1	(5)	(4)	9	5	(0)	(0)	4		171	kW
		0%	0%	0%	0%	0%	0%	-2%	-2%	4%	3%	0%	0%	0%		9%	
Savings	therms	-30	9	13	-9	1	-1	0	0	2	-36	27	-143	-166		-2,027	therms
		-1%	0%	0%	0%	0%	0%	0%	0%	0%	-1%	1%	-3%	-1%		-7%	
ECM 4 - EMS Upgrades																	
Model	kWh	57,532	52,037	56,726	59,434	70,823	77,869	99,790	87,671	69,267	61,738	54,961	56,912	804,761			
Model	kW	92	92	95	116	153	172	202	190	165	124	93	90	1,584			
Model	therms	2,811	2,751	1,853	2,606	747	180	186	186	720	2,715	3,769	2,954	21,478			
Savings	kWh	4,956	5,259	5,036	-2,260	1,786	1,021	11,495	3,494	1,925	-1,560	1,705	5,217	38,074		90,055	kWh
		8%	7%	10%	-3%	3%	1%	11%	4%	2%	-2%	3%	7%	4%		10%	
Savings	kW	11	9	9	(16)	3	5	48	38	7	(4)	5	6	121		292	kW
		9%	8%	8%	-9%	2%	2%	20%	18%	4%	-3%	4%	5%	6%		15%	
Savings	therms	2,672	2,970	2,537	247	108	26	0	0	86	98	960	2,619	12,323		10,296	therms
		58%	64%	76%	8%	12%	13%	0%	0%	11%	4%	22%	49%	41%		34%	


Police District #1 - Electrical Consumption (kWh)
160,000
140,000
120,000
100,000
80,000
60,000
40,000
20,000
0
Jan
Feb
Apr
May
Jul
Sep
Oct
Dec
Feb
2011 Meter Data
2012 Meter Data
2013 Meter Data
2014 Meter Data
Baseline
Model


Police District #1 - Electrical Demand (kW)
300
250
200
150
100
50
0
Jan
Feb
Apr
May
Jul
Sep
Oct
Dec
Feb
2011 Meter Data
2012 Meter Data
2013 Meter Data
2014 Meter Data
Baseline
model


Police District #1 - Natural Gas Consumption (Therms)
6,000
5,000
4,000
3,000
2,000
1,000
0
Jan
Feb
Apr
May
Jul
Sep
Oct
Dec
Feb
2011 Meter Data
2012 Meter Data
2013 Meter Data
2014 Meter Data
Baseline
Model

Hourly Model Results

911 Call Center

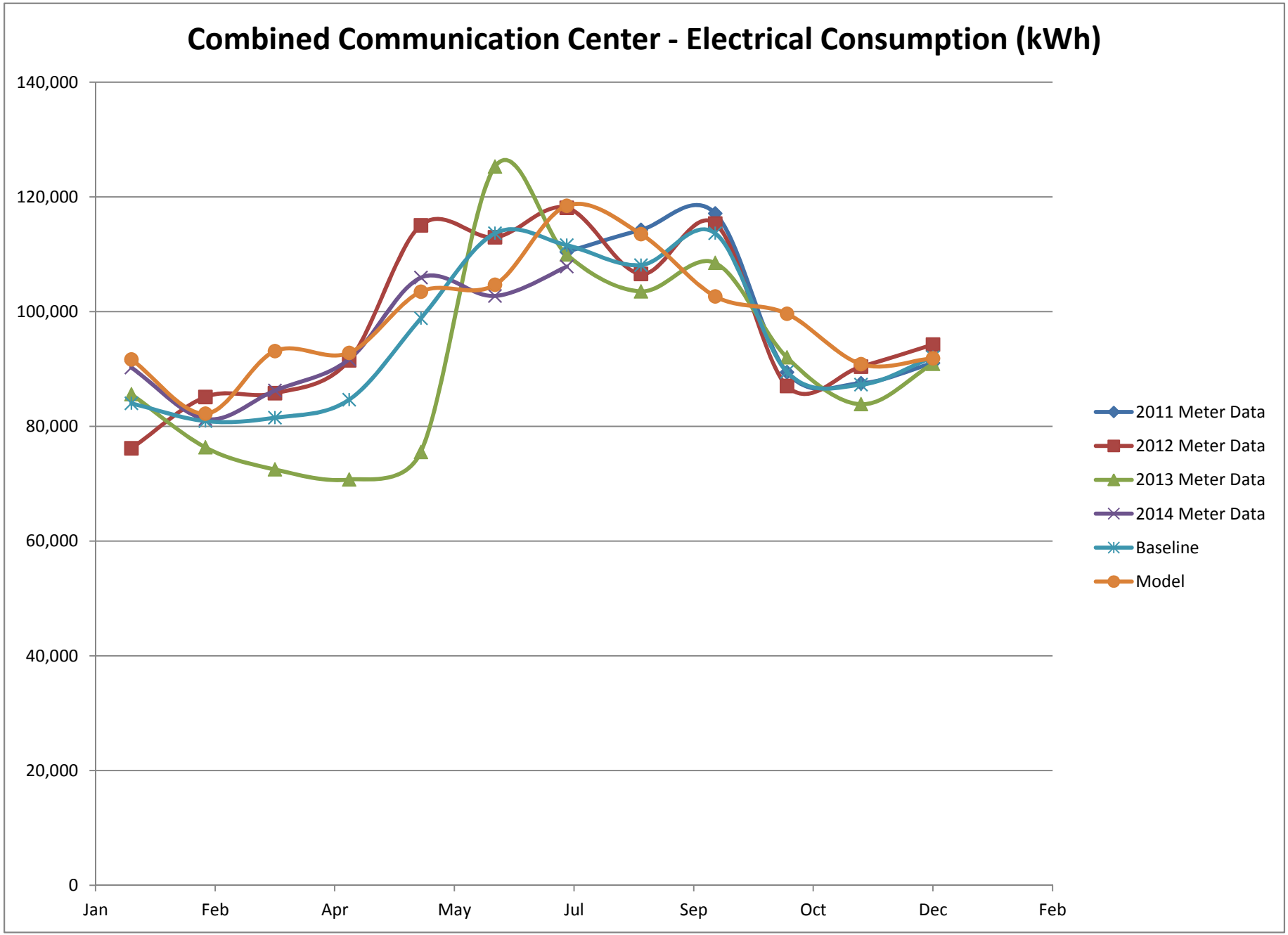
Baseline Model Calibration
Modeling Results – Electric Consumption
Modeling Results – Electric Demand
Model Results – Natural Gas Consumption

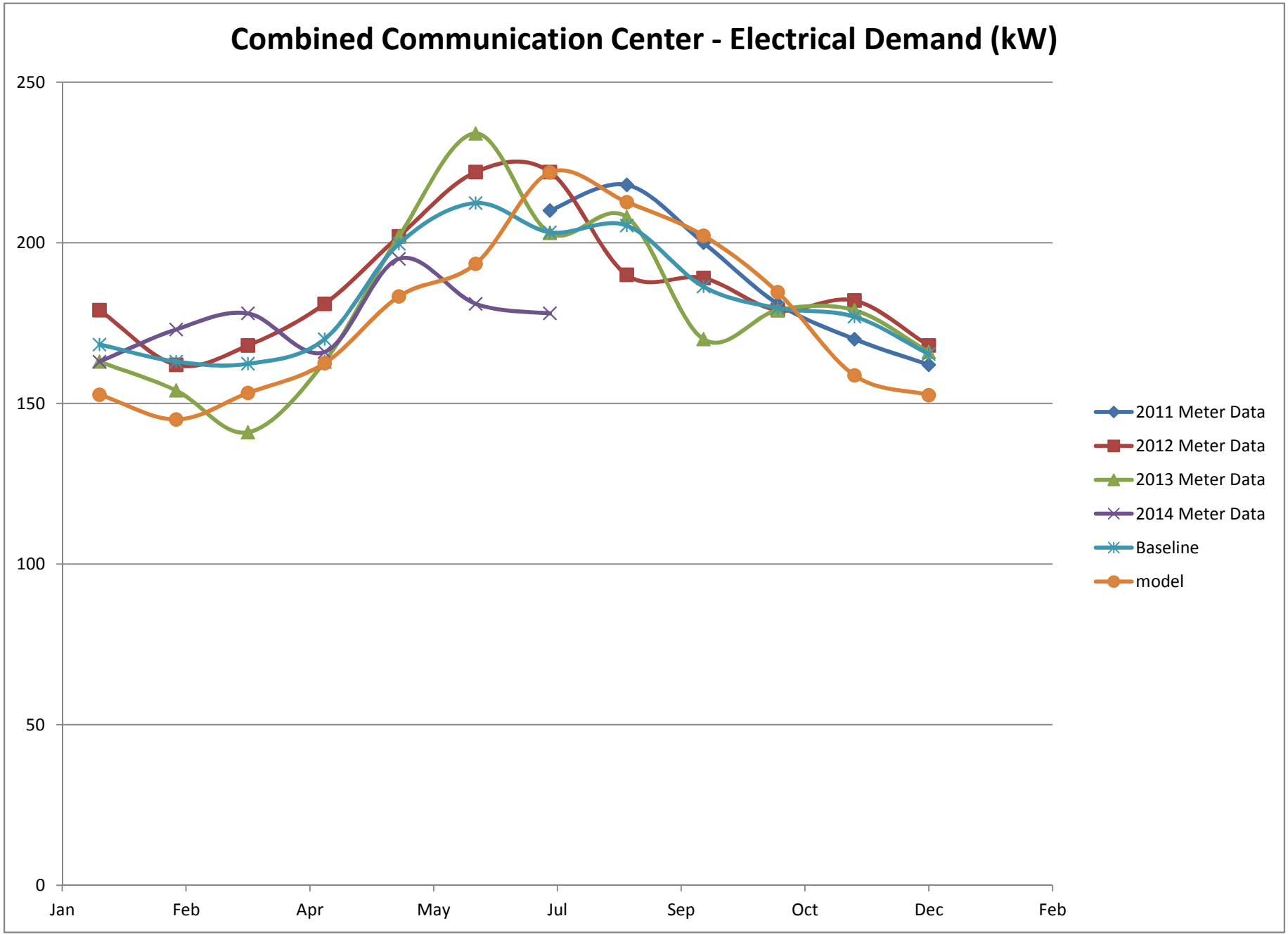
911 Call Center

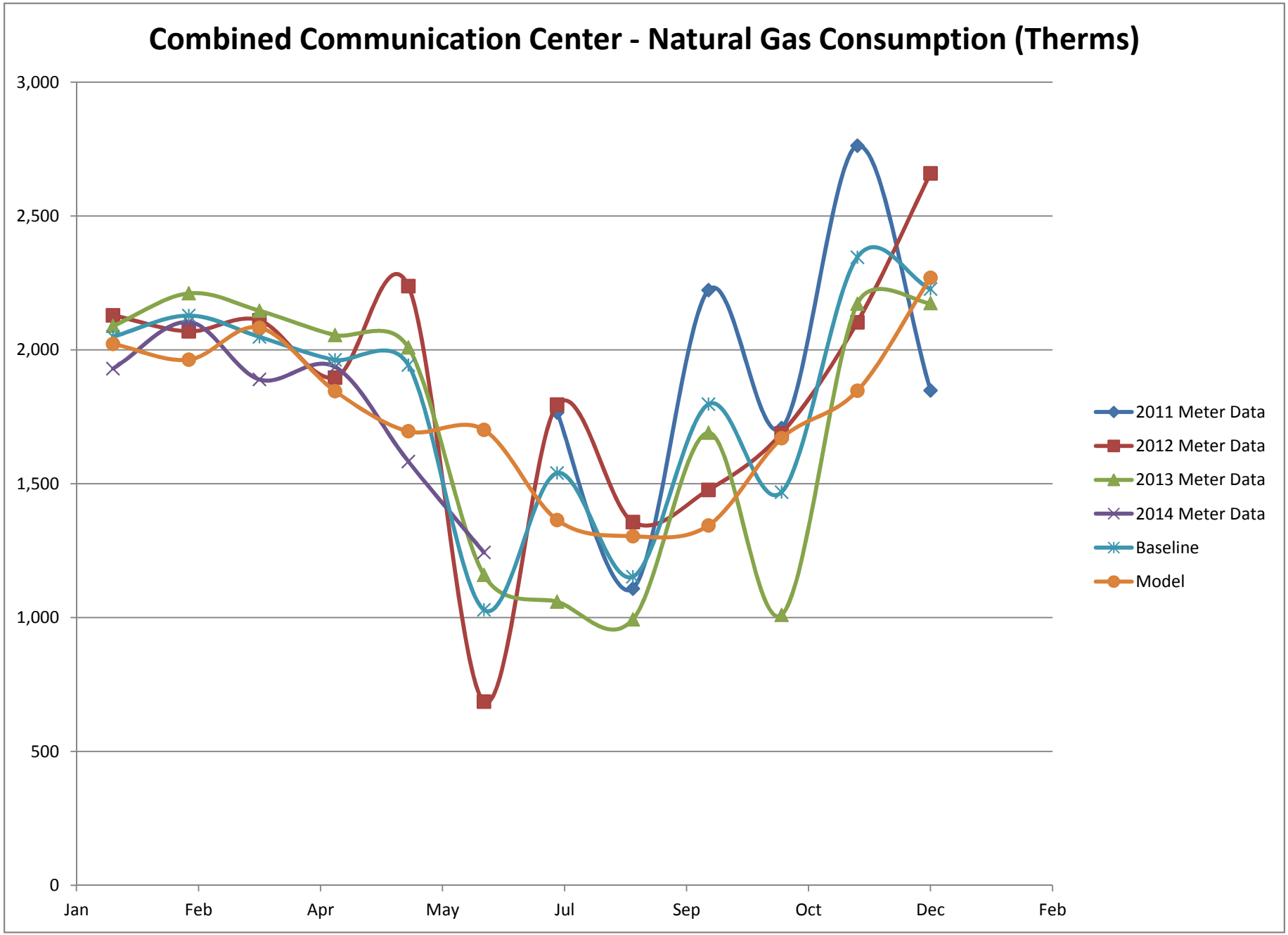
	Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total		
Baseline	kWh	84,000	80,907	81,493	84,640	98,827	113,653	111,560	108,107	113,653	89,493	87,253	92,053	1,145,640		
Model	kWh	91,668	82,215	93,120	92,812	103,469	104,673	118,445	113,507	102,657	99,627	90,845	91,839	1,184,879		
Difference	kWh	-7,668	-1,309	-11,627	-8,172	-4,643	8,981	-6,885	-5,401	10,996	-10,134	-3,592	214	-39,239		
RMS Error		58,798,224	1,712,207	135,188,214	66,789,266	21,553,673	80,653,751	47,408,045	29,168,245	120,916,928	102,688,768	12,900,141	45,960	677,823,421		
MBE		-9.1%	-1.6%	-14.3%	-9.7%	-4.7%	7.9%	-6.2%	-5.0%	9.7%	-11.3%	-4.1%	0.2%	-3.4%	MBE =	-3.4%
Cv															Cv =	7.9%
Baseline	kW	168	163	162	170	200	212	203	205	186	180	177	165	2,193		
Model	kW	153	145	153	163	183	193	222	213	202	185	159	153	2,123		
Difference	kW	16	18	9	7	16	19	-19	-7	-16	-5	18	13	70		
RMS Error		244	324	83	56	269	357	346	54	252	24	333	163	2,504		
MBE		9.3%	11.0%	5.6%	4.4%	8.2%	8.9%	-9.2%	-3.6%	-8.5%	-2.7%	10.3%	7.7%	3.2%	MBE =	3.2%
Cv															Cv =	7.9%
Baseline	therms	2,049	2,128	2,048	1,962	1,943	1,029	1,540	1,153	1,797	1,469	2,346	2,227	21,691		
Model	therms	2,022	1,963	2,083	1,846	1,696	1,701	1,365	1,304	1,344	1,670	1,847	2,269	21,110		
Difference	therms	27	165	-35	117	248	-672	175	-151	453	-201	499	-42	581		
RMS Error		726	27,169	1,199	13,589	61,278	451,217	30,751	22,935	204,817	40,507	248,629	1,784	1,104,601		
MBE		1.3%	7.7%	-1.7%	5.9%	12.7%	-65.3%	11.4%	-13.1%	25.2%	-13.7%	21.3%	-1.9%	2.7%	MBE =	2.7%
Cv															Cv =	16.8%

21,518 sq-ft

ECM 1 - Lighting System Upgrades																Cumulative	
Model	kWh	86,364	77,372	87,386	87,423	97,291	98,482	111,882	107,220	96,641	93,811	85,389	86,401	1,115,661			
Model	kW	144	133	139	151	169	179	207	198	189	170	148	139	1,965			
Model	therms	2,188	2,092	1,995	1,808	1,791	1,520	1,128	1,219	1,212	1,570	1,832	2,155	20,509			
Savings	kWh	5,304	4,844	5,735	5,390	6,178	6,191	6,563	6,288	6,016	5,816	5,456	5,438	69,217		69,217	kWh
		6%	6%	7%	6%	6%	5%	6%	6%	5%	6%	6%	6%	6%		6%	
Savings	kW	9	12	14	12	14	14	15	14	14	15	11	14	158		158	kW
		5%	7%	8%	7%	7%	7%	7%	7%	7%	8%	6%	8%	7%		7%	
Savings	therms	-166	-129	88	38	-96	181	237	86	132	100	16	115	601		601	therms
		-8%	-6%	4%	2%	-5%	18%	15%	7%	7%	7%	1%	5%	3%		3%	
ECM 3 - Lighting Controls																	
Model	kWh	85,772	76,954	86,799	86,733	96,426	97,651	111,020	106,352	95,888	92,935	84,773	85,821	1,107,122			
Model	kW	140	135	139	151	169	179	207	198	188	172	151	144	1,974			
Model	therms	2,228	2,095	2,119	1,793	1,595	1,535	1,098	1,241	1,233	1,435	1,887	2,183	20,441			
Savings	kWh	592	417	587	690	865	831	863	868	753	876	617	580	8,539		77,756	kWh
		1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%		7%	
Savings	kW	4	(2)	0	0	(0)	(0)	(0)	(0)	0	(2)	(4)	(5)	-9		148	kW
		2%	-1%	0%	0%	0%	0%	0%	0%	0%	-1%	-2%	-3%	0%		7%	
Savings	therms	-39	-3	-124	15	196	-14	29	-22	-21	135	-56	-28	68		669	therms
		-2%	0%	-6%	1%	10%	-1%	2%	-2%	-1%	9%	-2%	-1%	0%		3%	
ECM 4 - EMS Upgrades																	
Model	kWh	81,603	73,177	82,749	82,547	91,961	92,707	104,179	100,611	90,568	88,566	80,966	81,686	1,051,321			
Model	kW	132	130	131	143	165	172	198	190	180	163	143	136	1,882			
Model	therms	2,153	1,963	2,113	1,138	729	726	439	435	577	963	1,604	1,999	14,841			
Savings	kWh	4,169	3,777	4,050	4,185	4,465	4,943	6,841	5,741	5,319	4,369	3,806	4,136	55,802		133,558	kWh
		5%	5%	5%	5%	5%	4%	6%	5%	5%	5%	4%	4%	5%		12%	
Savings	kW	7	6	8	8	5	8	9	9	9	8	8	8	92		241	kW
		4%	4%	5%	5%	2%	4%	4%	4%	5%	5%	5%	5%	4%		11%	
Savings	therms	74	132	5	655	867	809	659	806	656	472	283	183	5,600		6,269	therms
		4%	6%	0%	33%	45%	79%	43%	70%	37%	32%	12%	8%	26%		29%	


Combined Communication Center - Electrical Consumption (kWh)
140,000
120,000
100,000
80,000
60,000
40,000
20,000
0
Jan
Feb
Apr
May
Jul
Sep
Oct
Dec
Feb
2011 Meter Data
2012 Meter Data
2013 Meter Data
2014 Meter Data
Baseline
Model


Combined Communication Center - Electrical Demand (kW)
250
200
150
100
50
0
Jan
Feb
Apr
May
Jul
Sep
Oct
Dec
Feb
2011 Meter Data
2012 Meter Data
2013 Meter Data
2014 Meter Data
Baseline
model


Combined Communication Center - Natural Gas Consumption (Therms)
3,000
2,500
2,000
1,500
1,000
500
0
Jan
Feb
Apr
May
Jul
Sep
Oct
Dec
Feb
2011 Meter Data
2012 Meter Data
2013 Meter Data
2014 Meter Data
Baseline
Model

Hourly Model Results

Twentieth Street Rec Ctr

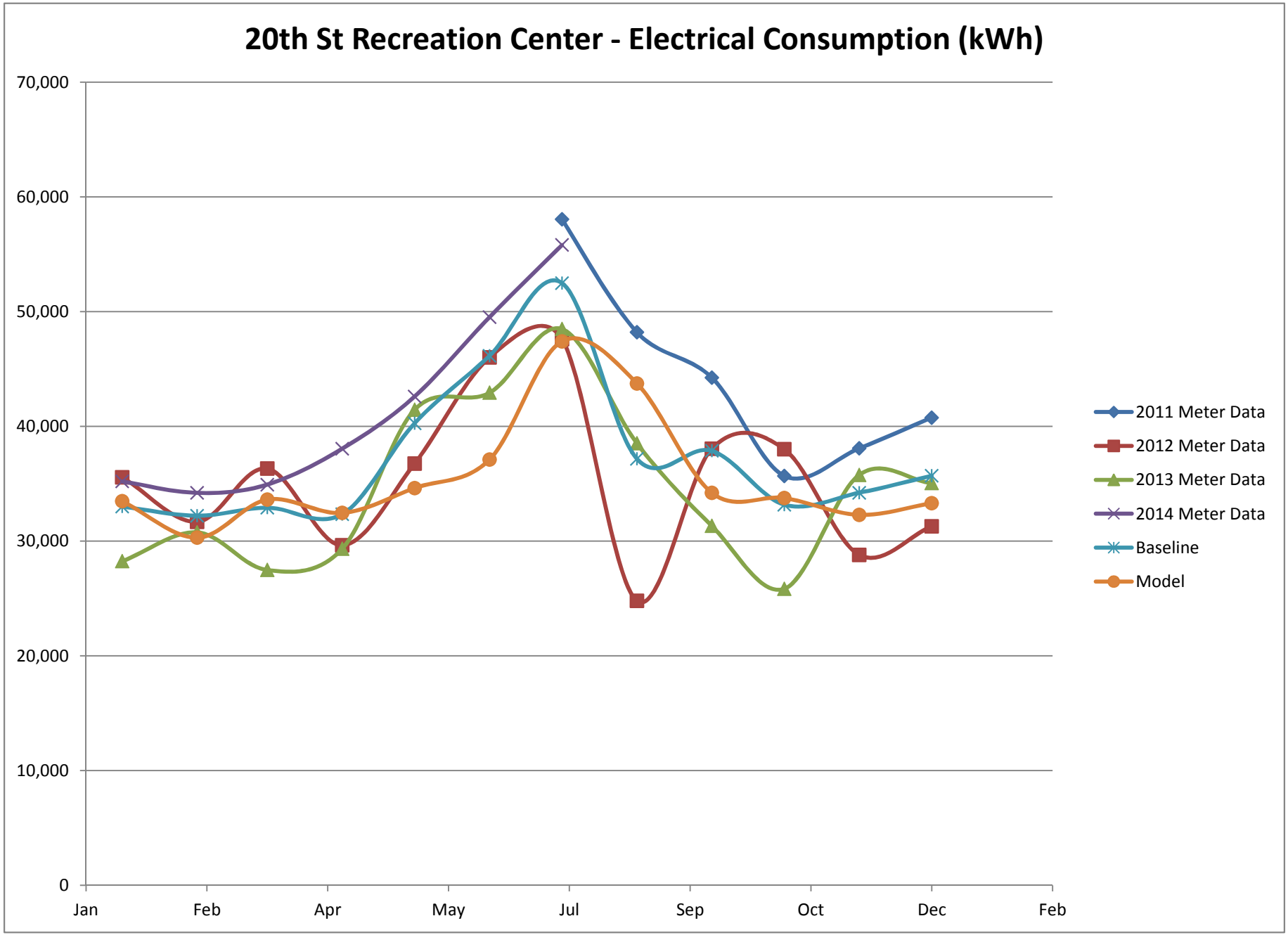
Baseline Model Calibration
Modeling Results – Electric Consumption
Modeling Results – Electric Demand
Model Results – Natural Gas Consumption

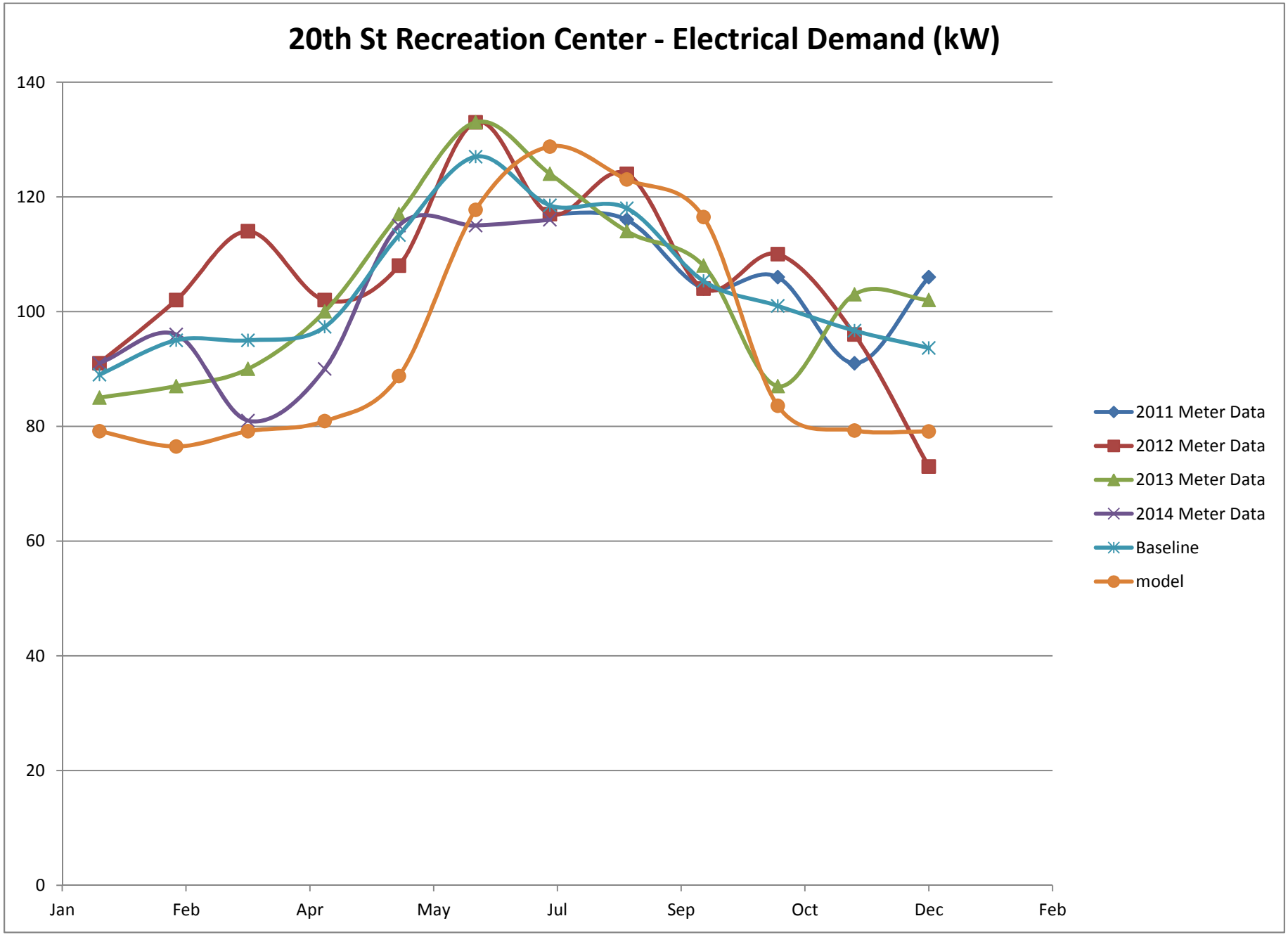
	Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	
Baseline	kWh	33,000	32,213	32,907	32,333	40,267	46,147	52,480	37,173	37,867	33,173	34,213	35,693	447,467	
Model	kWh	33,470	30,297	33,617	32,452	34,621	37,100	47,407	43,737	34,207	33,749	32,286	33,299	426,241	
Difference	kWh	-470	1,917	-710	-119	5,646	9,047	5,073	-6,564	3,660	-576	1,927	2,394	21,225	
RMS Error		221,097	3,674,173	504,005	14,163	31,878,408	81,849,053	25,734,822	43,080,407	13,392,135	331,231	3,712,725	5,733,119	210,125,340	
MBE		-1.4%	6.0%	-2.2%	-0.4%	14.0%	19.6%	9.7%	-17.7%	9.7%	-1.7%	5.6%	6.7%	4.7%	MBE =
Cv															Cv =
Baseline	kW	89	95	95	97	113	127	119	118	105	101	97	94	1,250	
Model	kW	79	77	79	81	89	118	129	123	116	84	79	79	1,132	
Difference	kW	10	19	16	16	25	9	-10	-5	-11	17	17	15	117	
RMS Error		97	342	252	270	604	86	105	25	124	303	302	212	2,722	
MBE		11.1%	19.5%	16.7%	16.9%	21.7%	7.3%	-8.7%	-4.3%	-10.6%	17.2%	18.0%	15.5%	9.4%	MBE =
Cv															Cv =
Baseline	therms	9,027	8,463	6,880	4,903	3,600	1,727	1,170	1,193	2,593	5,820	7,287	9,030	61,693	
Model	therms	9,134	8,347	6,831	4,639	3,464	2,023	1,439	1,767	2,507	5,712	7,338	8,629	61,831	
Difference	therms	-108	116	49	264	136	-297	-269	-574	86	108	-52	401	-138	
RMS Error		11,606	13,571	2,362	69,803	18,542	88,003	72,135	329,197	7,443	11,573	2,678	161,066	787,981	
MBE		-1.2%	1.4%	0.7%	5.4%	3.8%	-17.2%	-23.0%	-48.1%	3.3%	1.8%	-0.7%	4.4%	-0.2%	MBE =
Cv															Cv =

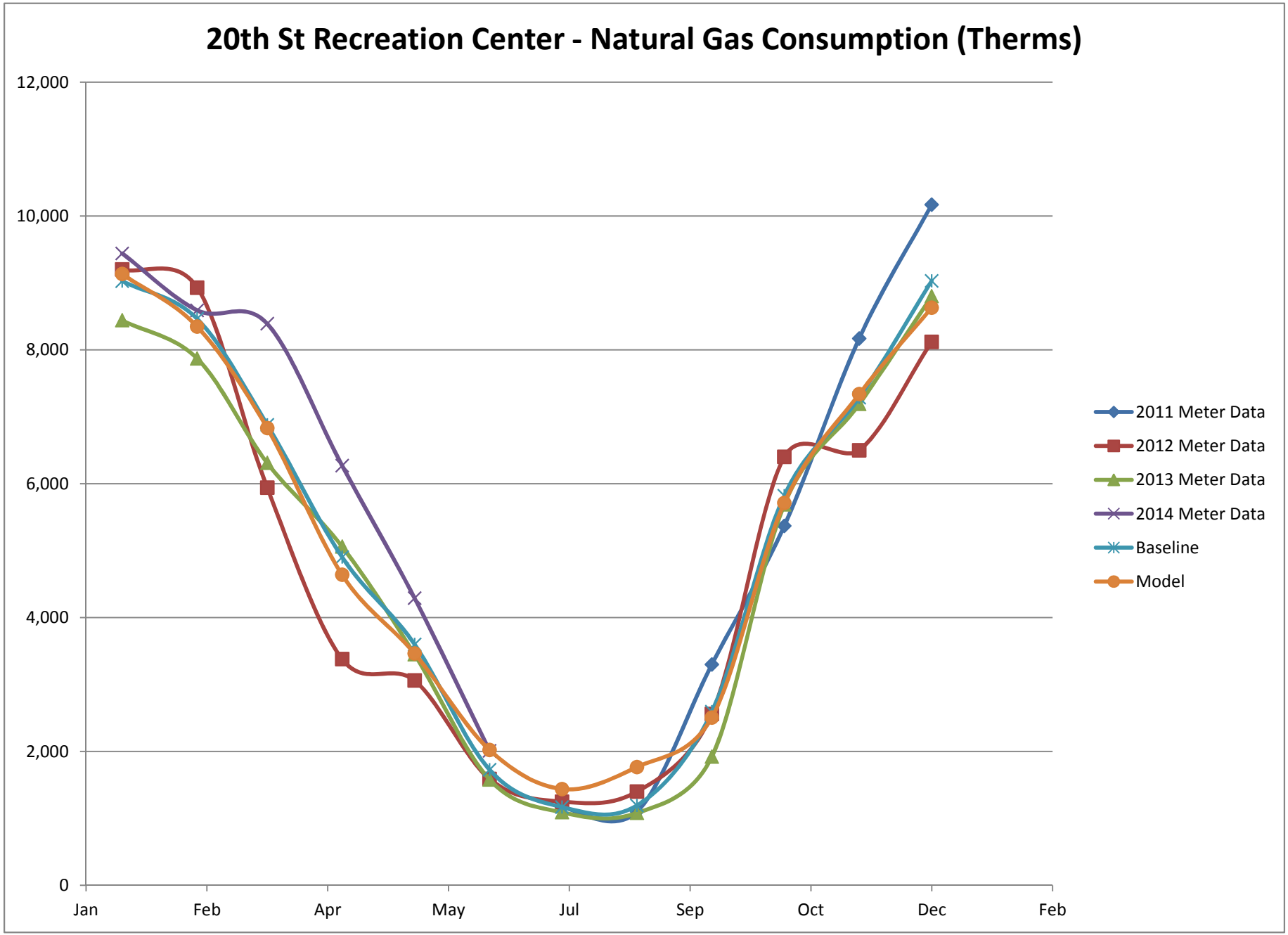
32,395 sq-ft

ECM 1 - Lighting System Upgrades																Cumulative
Model	kWh	32,608	29,513	32,657	31,570	33,644	36,181	45,683	42,215	32,940	32,787	31,419	32,454	413,670		
Model	kW	78	75	78	79	85	115	126	121	114	81	78	78	1,109		
Model	therms	9,166	8,375	6,858	4,656	3,469	2,026	1,439	1,769	2,512	5,721	7,361	8,659	62,012		
Savings	kWh	862	783	960	882	976	919	1,724	1,522	1,267	962	867	845	12,571		12,571
		3%	2%	3%	3%	2%	2%	3%	4%	3%	3%	3%	2%	3%		3%
Savings	kW	1	2	1	2	4	3	3	3	3	3	1	1	24		24
		1%	2%	1%	2%	3%	2%	2%	2%	2%	2%	1%	1%	2%		2%
Savings	therms	-32	-28	-27	-17	-5	-3	-1	-2	-5	-9	-23	-30	-181		-181
		0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%		0%
ECM 3 - Lighting Controls																
Model	kWh	32,569	29,477	32,614	31,528	33,602	36,109	45,607	42,171	32,897	32,745	31,383	32,413	413,113		
Model	kW	78	73	78	79	85	115	126	121	114	81	78	78	1,107		
Model	therms	9,168	8,376	6,859	4,657	3,469	2,026	1,439	1,770	2,512	5,722	7,362	8,660	62,021		
Savings	kWh	39	37	42	42	43	72	76	45	43	42	37	41	557		13,128
		0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%		3%
Savings	kW	-	1	-	-	-	-	-	-	-	-	-	-	1		25
		0%	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%		2%
Savings	therms	-1	-1	-1	-1	0	0	0	0	0	0	-1	-2	-9		-190
		0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%		0%
ECM 4 - EMS Upgrades																
Model	kWh	32,541	29,504	32,580	31,215	33,466	36,166	41,986	40,312	32,301	32,664	31,217	32,374	406,325		
Model	kW	55	55	55	77	112	115	125	120	114	82	55	55	1,022		
Model	therms	7,518	6,726	5,943	5,295	4,224	2,756	1,713	2,318	3,194	6,220	7,055	7,448	60,410		
Savings	kWh	27	-27	35	313	136	-57	3,621	1,859	597	81	165	39	6,788		19,916
		0%	0%	0%	1%	0%	0%	7%	5%	2%	0%	0%	0%	2%		4%
Savings	kW	23	18	23	1	(26)	(0)	1	0	0	(0)	23	23	85		110
		26%	19%	24%	1%	-23%	0%	1%	0%	0%	0%	24%	24%	7%		9%
Savings	therms	1,650	1,651	916	-639	-755	-730	-274	-549	-682	-498	307	1,213	1,610		1,421
		18%	20%	13%	-13%	-21%	-42%	-23%	-46%	-26%	-9%	4%	13%	3%		2%

ECM 24 - Building Envelope Measures																
Model	kWh	32,261	29,198	32,452	31,149	33,256	32,952	40,747	39,267	32,183	32,609	31,101	32,108	399,282		
Model	kW	55	55	55	77	82	86	121	117	111	80	55	55	951		
Model	therms	7,205	6,387	5,723	5,174	4,159	2,712	1,700	2,289	3,140	6,096	6,918	7,190	58,693		
Savings	kWh	281	306	128	65	210	3,214	1,240	1,044	117	56	116	266	7,043		26,960
		1%	1%	0%	0%	1%	7%	2%	3%	0%	0%	0%	1%	2%		6%
Savings	kW	(0)	(0)	(0)	0	29	30	4	3	3	1	(0)	(0)	71		181
		0%	0%	0%	0%	26%	23%	4%	3%	3%	1%	0%	0%	6%		14%
Savings	therms	313	339	220	121	65	44	13	29	55	124	137	258	1,718		3,138
		3%	4%	3%	2%	2%	3%	1%	2%	2%	2%	2%	3%	3%		5%


20th St Recreation Center - Electrical Consumption (kWh)
70,000
60,000
50,000
40,000
30,000
20,000
10,000
0
Jan
Feb
Apr
May
Jul
Sep
Oct
Dec
Feb
2011 Meter Data
2012 Meter Data
2013 Meter Data
2014 Meter Data
Baseline
Model


20th St Recreation Center - Electrical Demand (kW)
140
120
100
80
60
40
20
0
Jan
Feb
Apr
May
Jul
Sep
Oct
Dec
Feb
2011 Meter Data
2012 Meter Data
2013 Meter Data
2014 Meter Data
Baseline
model


20th St Recreation Center - Natural Gas Consumption (Therms)
12,000
10,000
8,000
6,000
4,000
2,000
0
Jan
Feb
Apr
May
Jul
Sep
Oct
Dec
Feb
2011 Meter Data
2012 Meter Data
2013 Meter Data
2014 Meter Data
Baseline
Model

Hourly Model Results

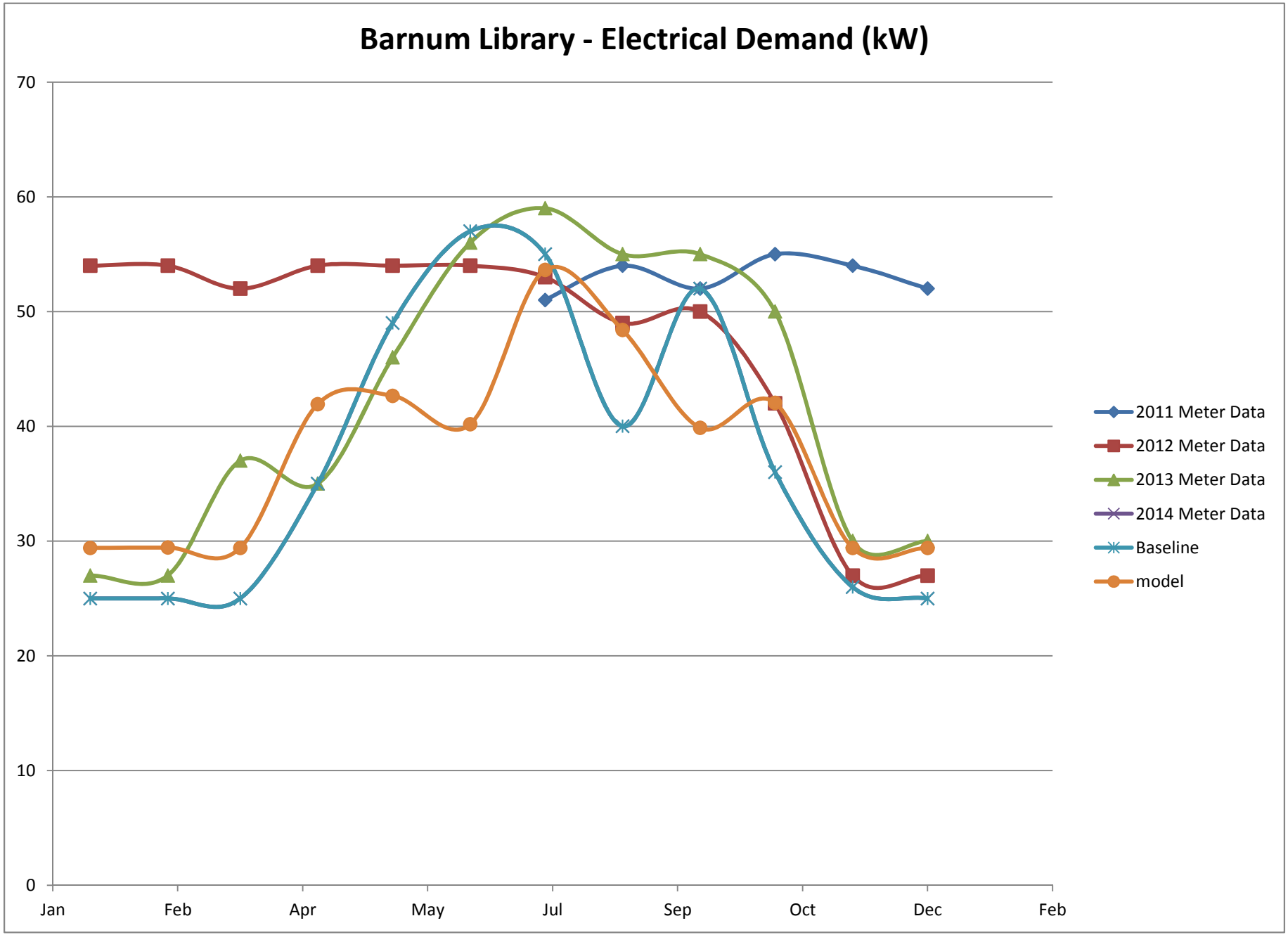
Barnum Library

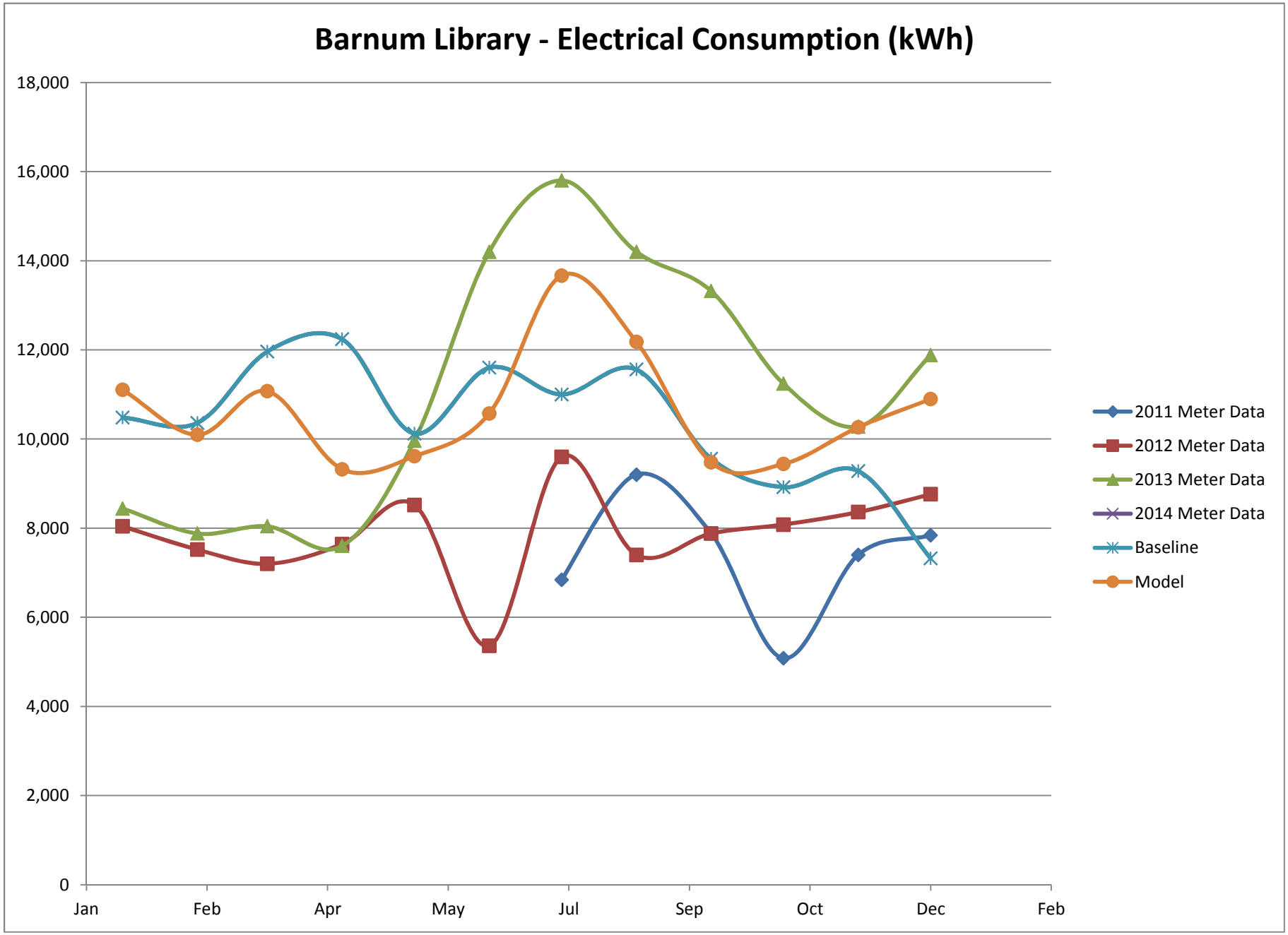
Baseline Model Calibration
Modeling Results – Electric Consumption
Modeling Results – Electric Demand
Model Results – Natural Gas Consumption

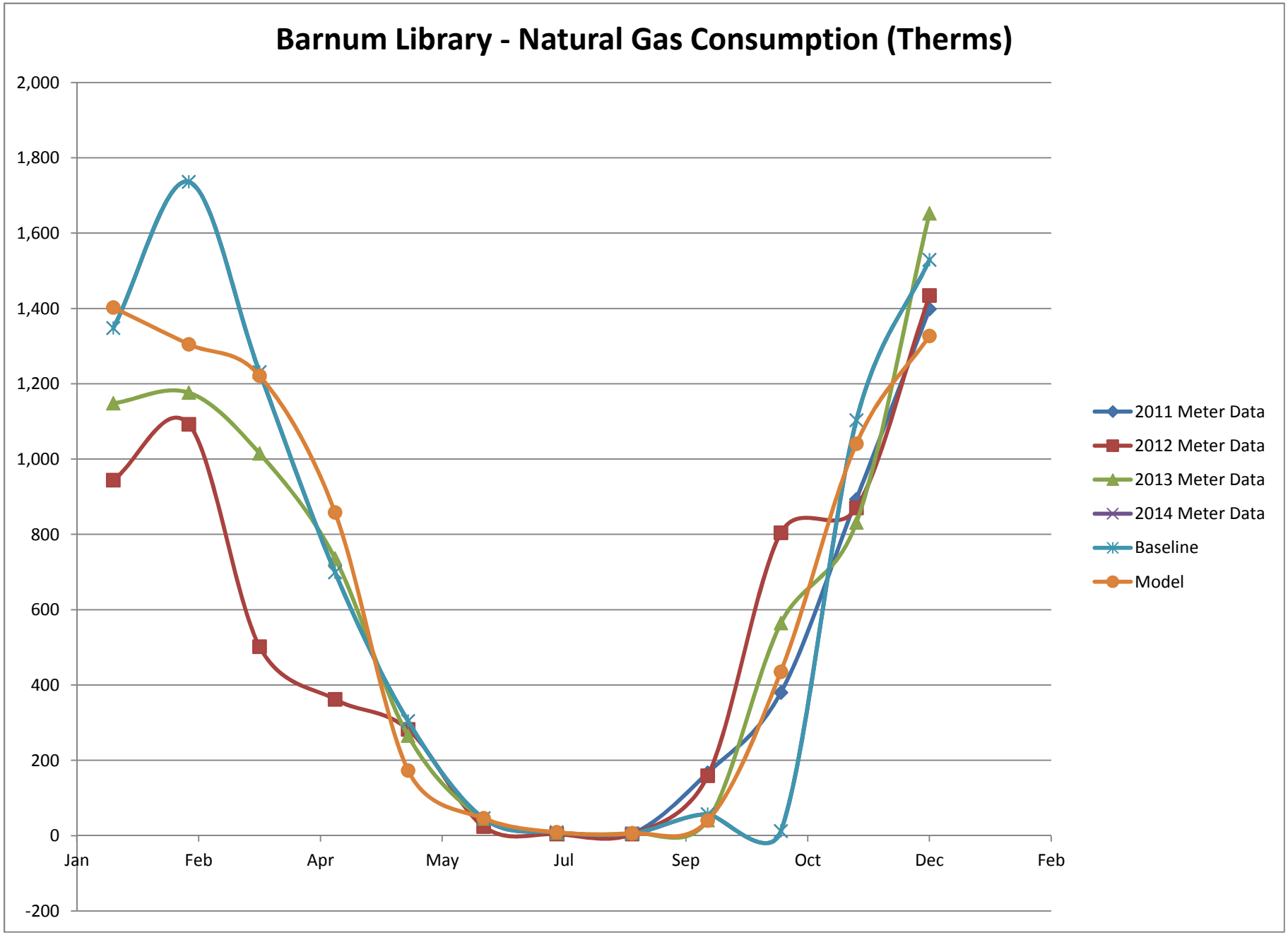
	Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Baseline	kWh	10,480	10,360	11,960	12,240	10,120	11,600	11,000	11,560	9,560	8,920	9,280	7,320	124,400
Model	kWh	11,104	10,095	11,074	9,322	9,612	10,572	13,665	12,181	9,477	9,440	10,263	10,896	127,701
Difference	kWh	-624	265	886	2,918	508	1,028	-2,665	-621	83	-520	-983	-3,576	-3,301
RMS Error		389,164	70,273	784,606	8,515,016	257,780	1,057,709	7,100,946	385,256	6,824	270,691	966,702	12,787,132	32,592,099
MBE		-6.0%	2.6%	7.4%	23.8%	5.0%	8.9%	-24.2%	-5.4%	0.9%	-5.8%	-10.6%	-48.9%	-2.7%
Cv														
Baseline	kW	25	25	25	35	49	57	55	40	52	36	26	25	450
Model	kW	29	29	29	42	43	40	54	48	40	42	29	29	456
Difference	kW	-4	-4	-4	-7	6	17	1	-8	12	-6	-3	-4	-6
RMS Error		19	20	19	48	40	283	2	70	147	37	12	19	717
MBE		-17.6%	-17.8%	-17.6%	-19.8%	12.9%	29.5%	2.5%	-21.0%	23.3%	-16.8%	-13.1%	-17.6%	-1.3%
Cv														
Baseline	therms	1,348	1,736	1,231	699	304	46	9	6	57	12	1,103	1,529	8,080
Model	therms	1,402	1,305	1,221	858	173	46	9	6	40	435	1,041	1,327	7,864
Difference	therms	-54	431	10	-159	131	0	0	0	17	-423	62	202	216
RMS Error		2,947	185,847	97	25,338	17,177	0	0	0	278	179,208	3,903	40,792	455,587
MBE		-4.0%	24.8%	0.8%	-22.8%	43.1%	-0.2%	0.8%	0.8%	29.3%	-3527.8%	5.7%	13.2%	2.7%
Cv														

13,230 sq-ft

ECM 1 - Lighting System Upgrades															
Model	kWh	9,624	8,746	9,626	8,068	7,699	8,740	11,069	10,446	7,681	7,984	9,028	9,517	108,227	
Model	kW	22	22	22	35	35	33	46	33	33	35	22	22	362	
Model	therms	1,473	1,368	1,280	919	170	46	9	6	40	477	1,093	1,398	8,278	
Savings	kWh	1,479	1,349	1,448	1,254	1,914	1,831	2,596	1,735	1,796	1,456	1,236	1,379	19,474	
		14%	13%	12%	10%	19%	16%	24%	15%	19%	16%	13%	19%	16%	
Savings	kW	7	7	7	7	8	7	7	15	7	7	7	7	94	
		28%	28%	28%	20%	16%	13%	13%	38%	14%	20%	27%	28%	21%	
Savings	therms	-70	-63	-58	-61	3	0	0	0	0	-42	-52	-71	-415	
		-5%	-4%	-5%	-9%	1%	0%	0%	0%	0%	-347%	-5%	-5%	-5%	
ECM 3 - Lighting Controls															
Model	kWh	9,493	8,631	9,481	7,957	7,264	8,303	10,932	10,289	7,545	7,904	8,971	9,393	106,164	
Model	kW	21	21	21	33	33	31	45	32	31	33	21	21	342	
Model	therms	1,480	1,376	1,286	925	170	46	9	6	40	482	1,099	1,404	8,322	
Savings	kWh	131	115	145	110	435	437	137	157	136	80	57	124	2,063	
		1%	1%	1%	1%	4%	4%	1%	1%	1%	1%	1%	2%	2%	
Savings	kW	2	2	2	2	2	2	2	2	2	2	2	2	20	
		7%	7%	7%	5%	3%	3%	3%	4%	3%	5%	6%	7%	4%	
Savings	therms	-7	-8	-6	-5	0	0	0	0	0	-5	-6	-6	-43	
		-1%	0%	0%	-1%	0%	0%	0%	0%	0%	-39%	-1%	0%	-1%	
ECM 4 - EMS Upgrades															
Model	kWh	6,631	6,030	6,790	5,604	6,702	7,578	9,002	8,208	6,415	4,613	6,476	6,591	80,640	
Model	kW	14	14	14	14	25	27	45	29	27	24	14	14	263	
Model	therms	372	390	314	290	3	46	9	6	40	54	211	384	2,120	
Savings	kWh	2,863	2,601	2,691	2,354	562	725	1,930	2,081	1,131	3,291	2,495	2,801	25,524	
		27%	25%	23%	19%	6%	6%	18%	18%	12%	37%	27%	38%	21%	
Savings	kW	6	6	6	19	8	5	(0)	2	4	10	6	6	79	
		25%	25%	25%	54%	17%	8%	-1%	5%	8%	26%	24%	25%	17%	
Savings	therms	1,108	985	971	635	167	0	0	0	0	428	888	1,020	6,202	
		82%	57%	79%	91%	55%	0%	0%	0%	0%	3566%	80%	67%	77%	


Barnum Library - Electrical Demand (kW)
70
60
50
40
30
20
10
0
Jan
Feb
Apr
May
Jul
Sep
Oct
Dec
Feb
2011 Meter Data
2012 Meter Data
2013 Meter Data
2014 Meter Data
Baseline
model


Barnum Library - Electrical Consumption (kWh)
18,000
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
Jan
Feb
Apr
May
Jul
Sep
Oct
Dec
Feb
2011 Meter Data
2012 Meter Data
2013 Meter Data
2014 Meter Data
Baseline
Model


Barnum Library - Natural Gas Consumption (Therms)
2,000
1,800
1,600
1,400
1,200
1,000
800
600
400
200
0
-200
Jan
Feb
Apr
May
Jul
Sep
Oct
Dec
Feb
2011 Meter Data
2012 Meter Data
2013 Meter Data
2014 Meter Data
Baseline
Model

Hourly Model Results

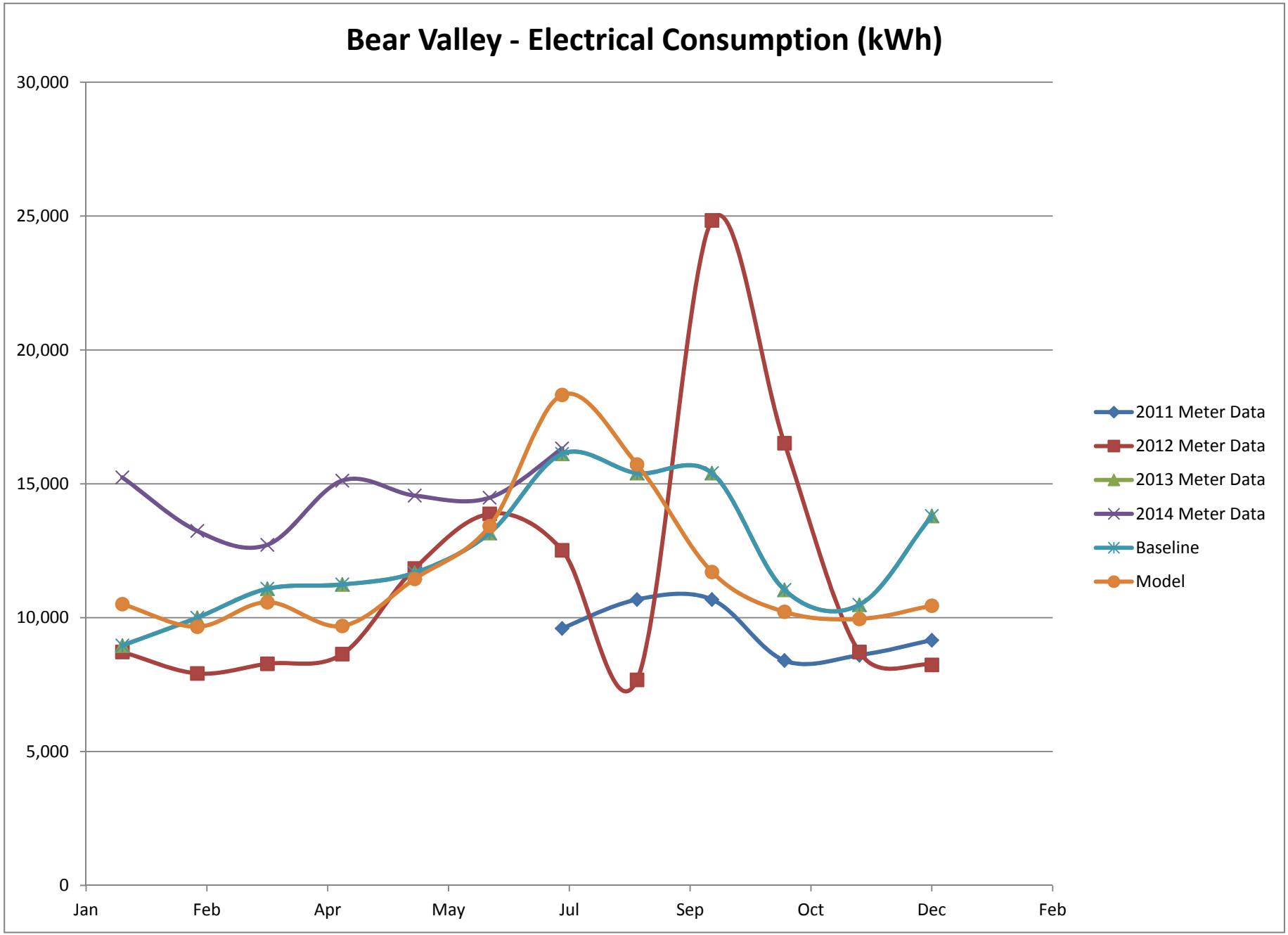
Bear Valley Library

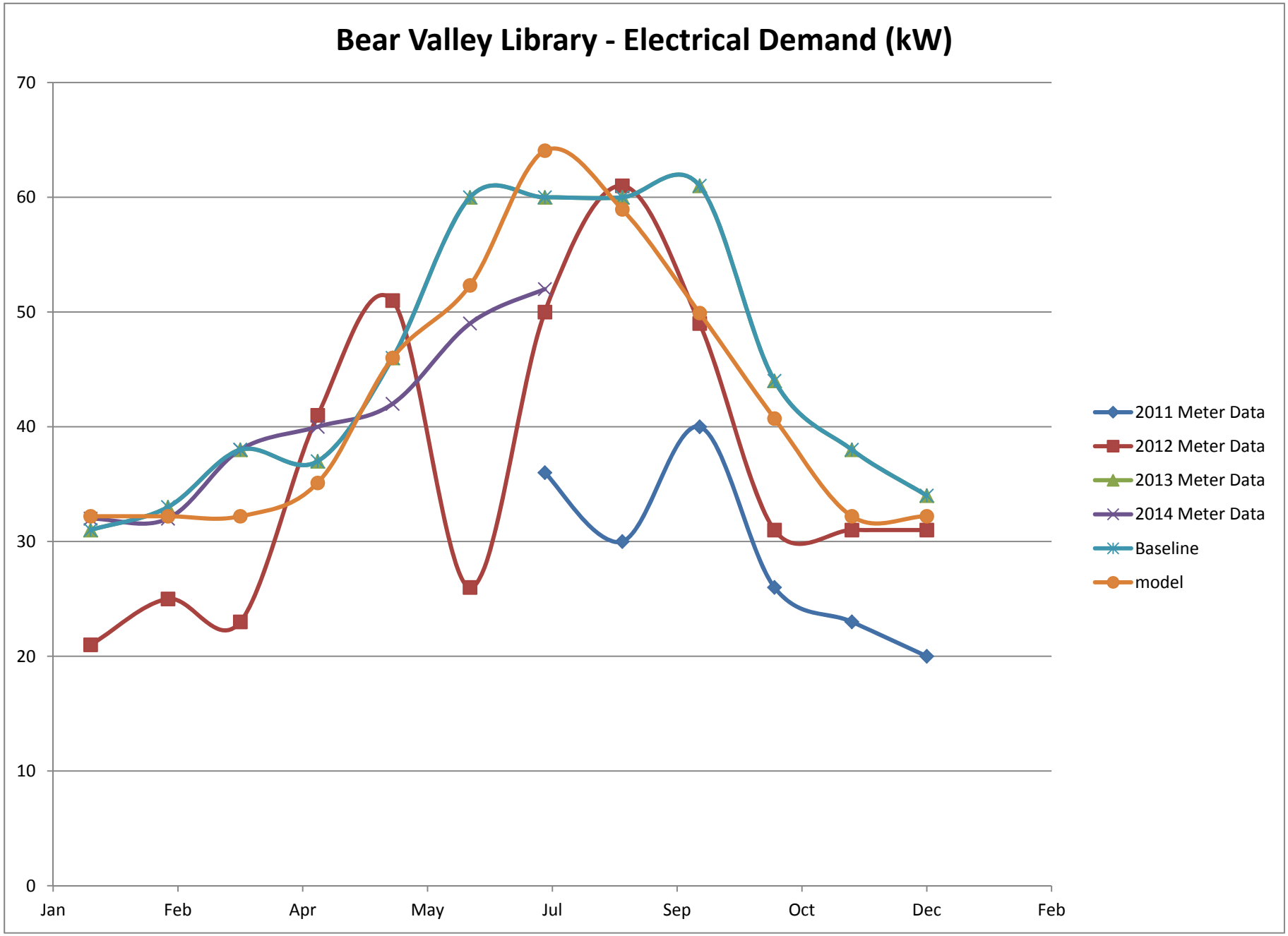
Baseline Model Calibration
Modeling Results – Electric Consumption
Modeling Results – Electric Demand
Model Results – Natural Gas Consumption

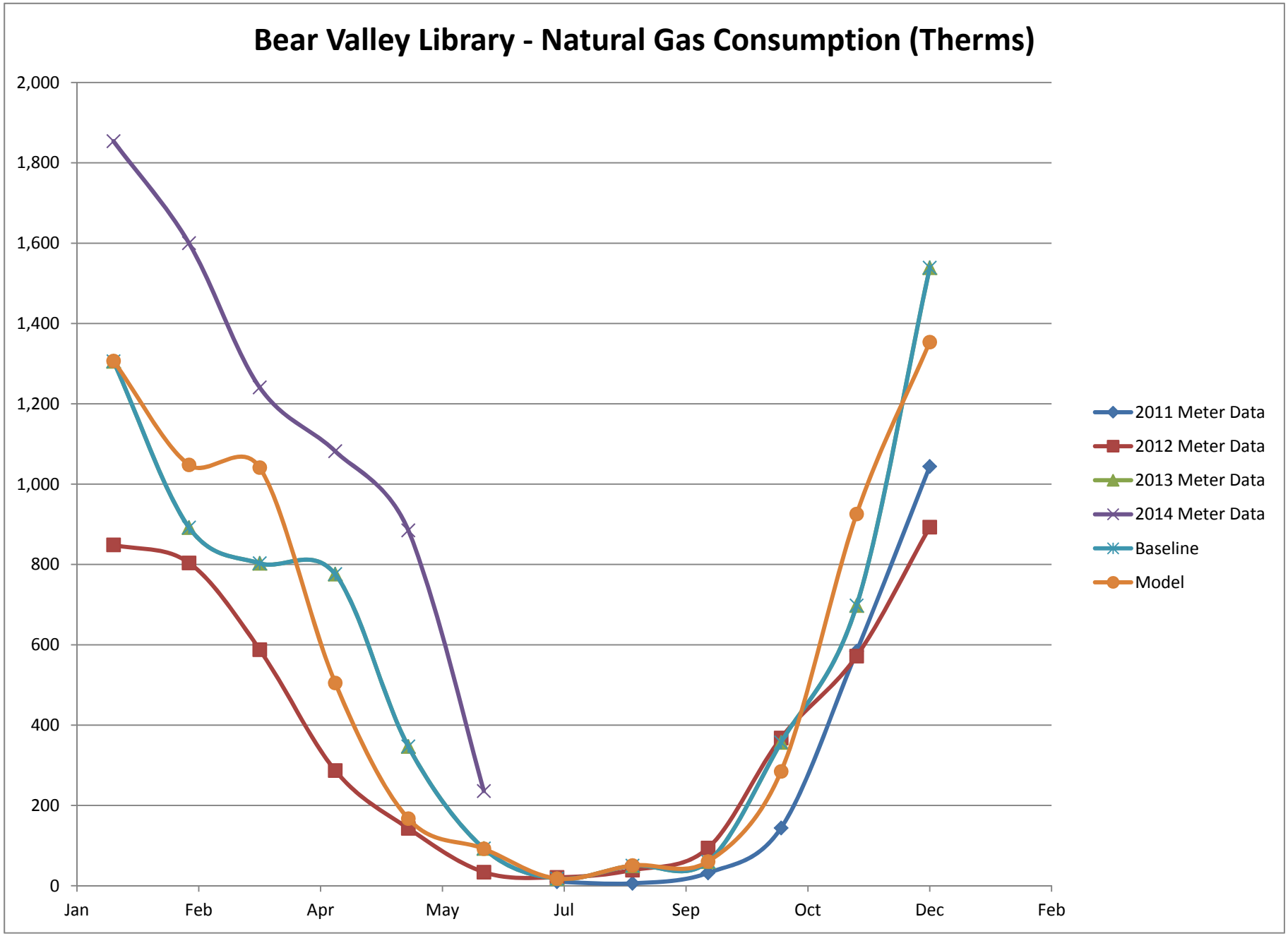
	Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	
Baseline	kWh	8,960	10,000	11,080	11,240	11,680	13,160	16,120	15,400	15,400	11,040	10,480	13,800	148,360	
Model	kWh	10,508	9,662	10,579	9,690	11,446	13,422	18,318	15,725	11,710	10,219	9,953	10,447	141,679	
Difference	kWh	-1,548	338	501	1,550	234	-262	-2,198	-325	3,690	821	527	3,353	6,681	
RMS Error		2,395,004	114,359	251,101	2,402,934	54,751	68,775	4,833,314	105,710	13,619,495	673,844	277,371	11,243,816	36,040,474	
MBE		-17.3%	3.4%	4.5%	13.8%	2.0%	-2.0%	-13.6%	-2.1%	24.0%	7.4%	5.0%	24.3%	4.5%	MBE =
Cv															Cv =
Baseline	kW	31	33	38	37	46	60	60	60	61	44	38	34	542	
Model	kW	32	32	32	35	46	52	64	59	50	41	32	32	508	
Difference	kW	-1	1	6	2	0	8	-4	1	11	3	6	2	34	
RMS Error		1	1	34	4	0	59	16	1	123	11	34	3	287	
MBE		-3.9%	2.4%	15.3%	5.1%	0.0%	12.8%	-6.8%	1.8%	18.2%	7.5%	15.3%	5.3%	6.3%	MBE =
Cv															Cv =
Baseline	therms	1,306	892	803	776	347	93	18	50	60	357	698	1,539	6,939	
Model	therms	1,307	1,048	1,041	505	167	92	18	51	60	285	926	1,354	6,854	
Difference	therms	-1	-156	-238	271	180	1	0	-1	0	72	-228	185	85	
RMS Error		1	24,370	56,835	73,376	32,317	1	0	0	0	5,198	51,802	34,288	278,188	
MBE		-0.1%	-17.5%	-29.7%	34.9%	51.8%	0.9%	0.8%	-1.2%	-0.8%	20.2%	-32.6%	12.0%	1.2%	MBE =
Cv															Cv =

10,644 sq-ft

ECM 1 - Lighting System Upgrades																Cumulative
Model	kWh	9,374	8,626	9,387	8,398	9,624	11,433	16,433	13,758	9,848	8,635	8,841	9,340	123,696		
Model	kW	26	26	26	28	36	44	56	50	42	30	26	26	419		
Model	therms	1,332	1,074	1,067	527	166	92	18	51	60	295	945	1,380	7,007		
Savings	kWh	1,133	1,036	1,192	1,291	1,822	1,990	1,886	1,967	1,861	1,584	1,113	1,107	17,983		17,983
		13%	10%	11%	11%	16%	15%	12%	13%	12%	14%	11%	8%	12%		12%
Savings	kW	6	6	6	7	10	9	8	9	8	11	6	6	89		89
		18%	17%	15%	18%	21%	14%	13%	14%	13%	25%	15%	17%	16%		16%
Savings	therms	-26	-26	-25	-22	1	0	0	0	0	-10	-19	-27	-153		-153
		-2%	-3%	-3%	-3%	0%	0%	0%	0%	0%	-3%	-3%	-2%	-2%		-2%
ECM 4 - EMS Upgrades																
Model	kWh	8,418	7,668	8,549	7,779	9,048	10,198	13,569	11,953	8,922	8,118	7,929	8,309	110,458		
Model	kW	26	26	26	29	36	44	56	51	42	30	26	26	420		
Model	therms	1,231	985	1,008	480	147	92	18	51	60	266	877	1,285	6,500		
Savings	kWh	956	958	838	620	576	1,235	2,863	1,805	927	517	912	1,031	13,237		31,221
		11%	10%	8%	6%	5%	9%	18%	12%	6%	5%	9%	7%	9%		21%
Savings	kW	-	-	-	(0)	-	(0)	(0)	(0)	0	(0)	-	-	-1		88
		0%	0%	0%	-1%	0%	0%	0%	0%	0%	-1%	0%	0%	0%		16%
Savings	therms	101	89	59	47	19	0	0	0	0	29	68	96	507		354
		8%	10%	7%	6%	5%	0%	0%	0%	0%	8%	10%	6%	7%		5%


Bear Valley - Electrical Consumption (kWh)
30,000
25,000
20,000
15,000
10,000
5,000
0
Jan
Feb
Apr
May
Jul
Sep
Oct
Dec
Feb
2011 Meter Data
2012 Meter Data
2013 Meter Data
2014 Meter Data
Baseline
Model


Bear Valley Library - Electrical Demand (kW)
70
60
50
40
30
20
10
0
Jan
Feb
Apr
May
Jul
Sep
Oct
Dec
Feb
2011 Meter Data
2012 Meter Data
2013 Meter Data
2014 Meter Data
Baseline
model


Bear Valley Library - Natural Gas Consumption (Therms)
2,000
1,800
1,600
1,400
1,200
1,000
800
600
400
200
0
Jan
Feb
Apr
May
Jul
Sep
Oct
Dec
Feb
2011 Meter Data
2012 Meter Data
2013 Meter Data
2014 Meter Data
Baseline
Model

Hourly Model Results

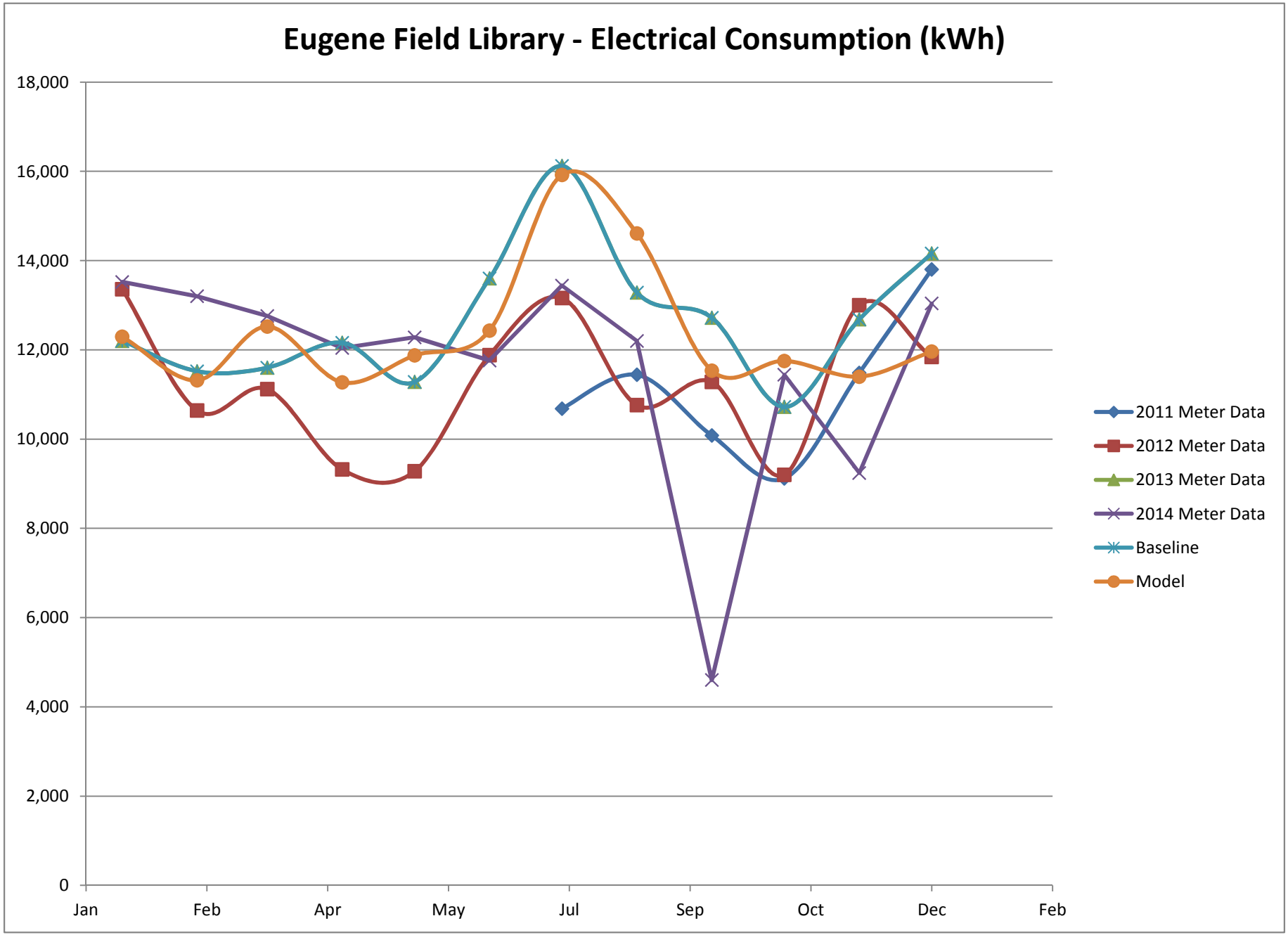
Eugene Field Library

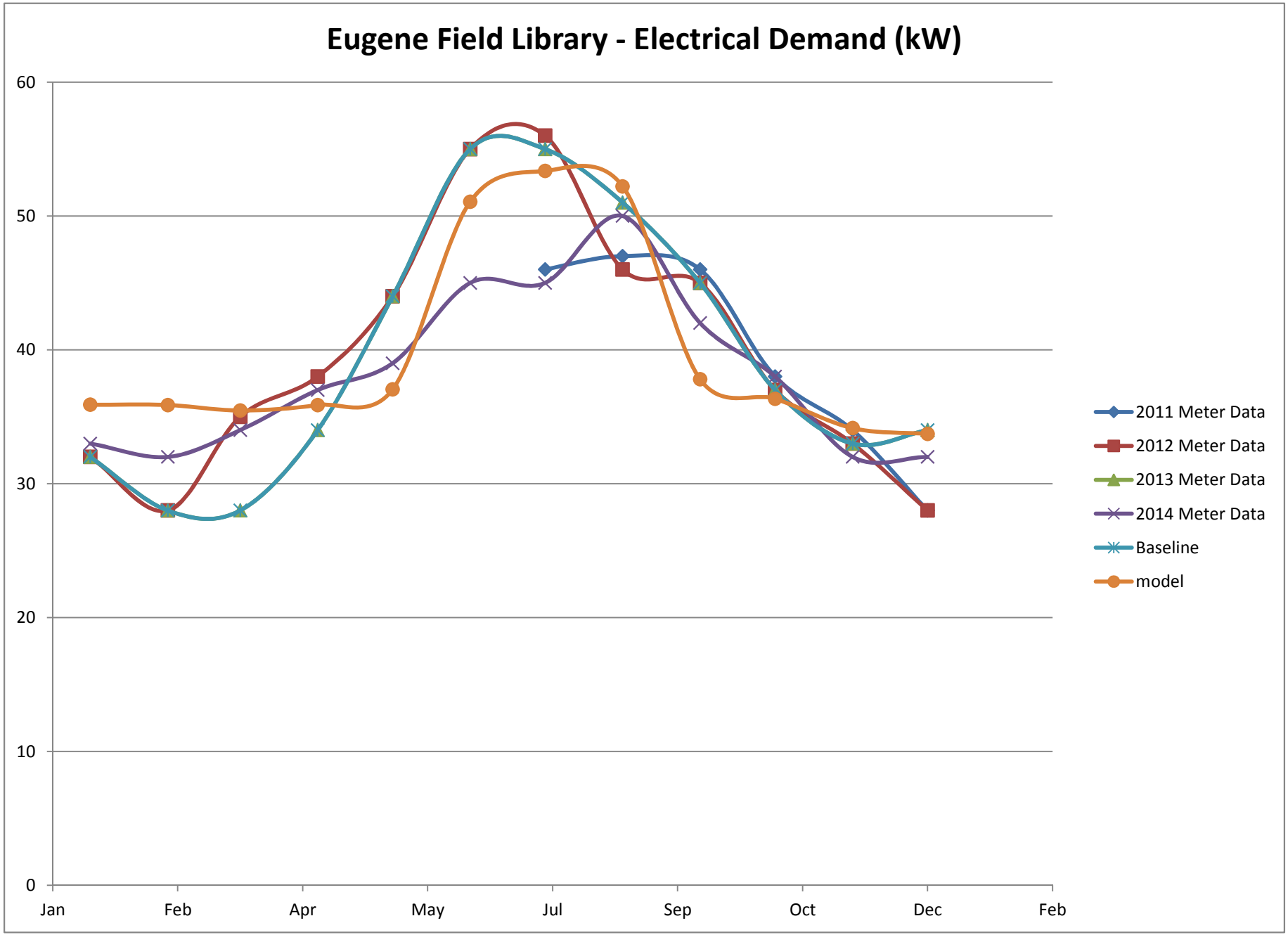
Baseline Model Calibration
Modeling Results – Electric Consumption
Modeling Results – Electric Demand
Model Results – Natural Gas Consumption

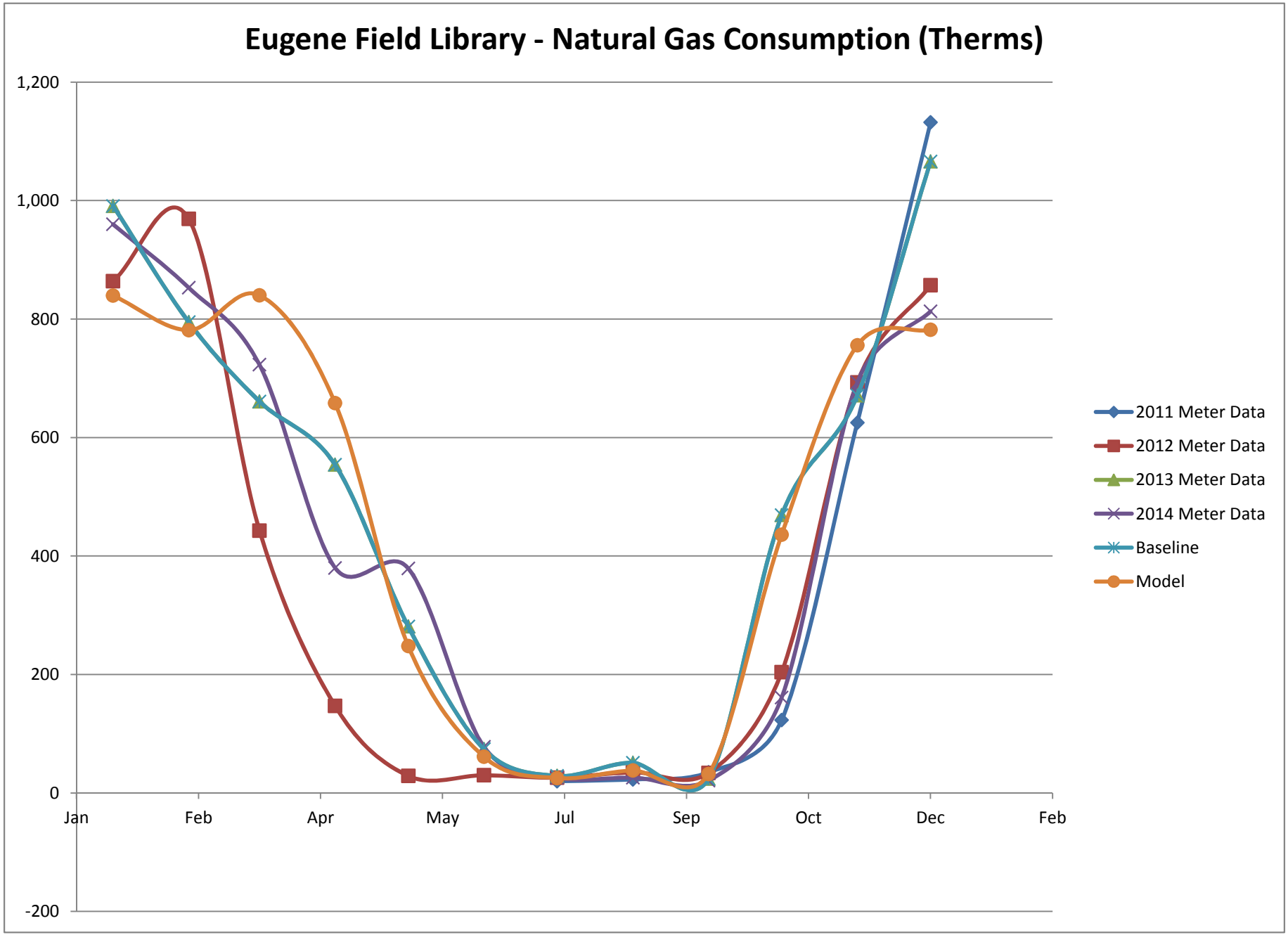
	Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total		
Baseline	kWh	12,200	11,520	11,600	12,160	11,280	13,600	16,120	13,280	12,720	10,720	12,680	14,160	152,040		
Model	kWh	12,293	11,317	12,523	11,273	11,875	12,432	15,921	14,609	11,533	11,752	11,399	11,960	148,888		
Difference	kWh	-93	203	-923	887	-595	1,168	199	-1,329	1,187	-1,032	1,281	2,200	3,152		
RMS Error		8,647	41,104	852,464	787,319	354,418	1,363,290	39,609	1,766,188	1,409,016	1,064,178	1,640,602	4,840,484	14,167,319		
MBE		-0.8%	1.8%	-8.0%	7.3%	-5.3%	8.6%	1.2%	-10.0%	9.3%	-9.6%	10.1%	15.5%	2.1%	MBE =	2.1%
Cv															Cv =	8.6%
Baseline	kW	32	28	28	34	44	55	55	51	45	37	33	34	476		
Model	kW	36	36	35	36	37	51	53	52	38	36	34	34	479		
Difference	kW	-3.9	-7.9	-7.5	-1.9	7.0	3.9	1.6	-1.2	7.2	0.7	-1.2	0.3	-3		
RMS Error		15	62	56	4	48	16	3	1	52	0	1	0	258		
MBE		-12.2%	-28.1%	-26.7%	-5.5%	15.8%	7.2%	3.0%	-2.4%	16.0%	1.8%	-3.5%	0.8%	-0.6%	MBE =	-0.6%
Cv															Cv =	11.7%
Baseline	therms	991	795	661	554	281	74	29	51	24	469	671	1,066	5,666		
Model	therms	840	781	840	658	248	61	25	38	32	436	756	782	5,497		
Difference	therms	151	14	-179	-104	33	13	4	13	-8	33	-85	284	169		
RMS Error		22,852	191	32,091	10,868	1,093	164	14	171	61	1,094	7,172	80,684	156,456		
MBE		15.3%	1.7%	-27.1%	-18.8%	11.8%	17.3%	12.8%	25.6%	-32.6%	7.1%	-12.6%	26.6%	3.0%	MBE =	3.0%
Cv															Cv =	24.2%

9,142 sq-ft

ECM 1 - Lighting System Upgrades																Cumulative	
Model	kWh	10,629	9,669	10,492	9,279	9,690	9,798	12,965	11,292	9,445	9,613	9,703	10,161	122,735			
Model	kW	33	32	32	31	31	32	48	47	32	31	28	31	408			
Model	therms	898	836	865	701	257	61	25	38	32	462	783	814	5,773			
Savings	kWh	1,664	1,648	2,032	1,993	2,186	2,635	2,956	3,317	2,088	2,139	1,696	1,799	26,152		26,152	kWh
		14%	14%	18%	16%	19%	19%	18%	25%	16%	20%	13%	13%	17%		17%	
Savings	kW	3	4	3	5	6	19	5	5	6	5	7	2	71		71	kW
		9%	15%	12%	15%	13%	34%	10%	11%	13%	14%	20%	7%	15%		15%	
Savings	therms	-58	-55	-25	-43	-9	0	0	0	0	-26	-27	-32	-276		-276	therms
		-6%	-7%	-4%	-8%	-3%	0%	0%	0%	0%	-6%	-4%	-3%	-5%		-5%	
ECM 3 - Lighting Controls																	
Model	kWh	10,594	9,637	10,452	9,241	9,647	9,754	12,892	10,901	9,406	9,570	9,667	10,127	121,887			
Model	kW	33	32	32	31	31	32	48	47	32	31	28	31	408			
Model	therms	899	837	864	702	257	61	25	38	32	462	783	814	5,775			
Savings	kWh	35	32	40	38	43	43	73	392	39	42	36	35	848		27,001	kWh
		0%	0%	0%	0%	0%	0%	0%	3%	0%	0%	0%	0%	1%		18%	
Savings	kW	-	(0)	(0)	-	-	-	-	-	-	-	(0)	-	0		71	kW
		0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%		15%	
Savings	therms	-1	-1	1	-1	0	0	0	0	0	0	0	0	-1		-278	therms
		0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%		-5%	
ECM 4 - EMS Upgrades																	
Model	kWh	7,039	6,510	6,880	7,377	8,925	9,670	11,871	10,971	9,077	8,087	6,501	6,896	99,803			
Model	kW	18	18	18	26	31	32	48	47	32	30	17	17	334			
Model	therms	168	168	88	349	184	61	25	38	32	273	114	118	1,618			
Savings	kWh	3,556	3,127	3,571	1,863	721	85	1,021	-70	329	1,484	3,166	3,231	22,084		49,084	kWh
		29%	27%	31%	15%	6%	1%	6%	-1%	3%	14%	25%	23%	15%		32%	
Savings	kW	15	14	14	4	(0)	(0)	(0)	(0)	(0)	1	11	14	74		145	kW
		47%	50%	51%	13%	0%	0%	0%	0%	0%	4%	34%	41%	16%		30%	
Savings	therms	731	669	776	353	74	0	0	0	0	189	669	695	4,157		3,879	therms
		74%	84%	117%	64%	26%	0%	0%	0%	0%	40%	100%	65%	73%		68%	


Eugene Field Library - Electrical Consumption (kWh)
18,000
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
Jan
Feb
Apr
May
Jul
Sep
Oct
Dec
Feb
2011 Meter Data
2012 Meter Data
2013 Meter Data
2014 Meter Data
Baseline
Model


Eugene Field Library - Electrical Demand (kW)
60
50
40
30
20
10
0
Jan
Feb
Apr
May
Jul
Sep
Oct
Dec
Feb
2011 Meter Data
2012 Meter Data
2013 Meter Data
2014 Meter Data
Baseline
model


Eugene Field Library - Natural Gas Consumption (Therms)
1,200
1,000
800
600
400
200
0
-200
Jan
Feb
Apr
May
Jul
Sep
Oct
Dec
Feb
2011 Meter Data
2012 Meter Data
2013 Meter Data
2014 Meter Data
Baseline
Model

Hourly Model Results

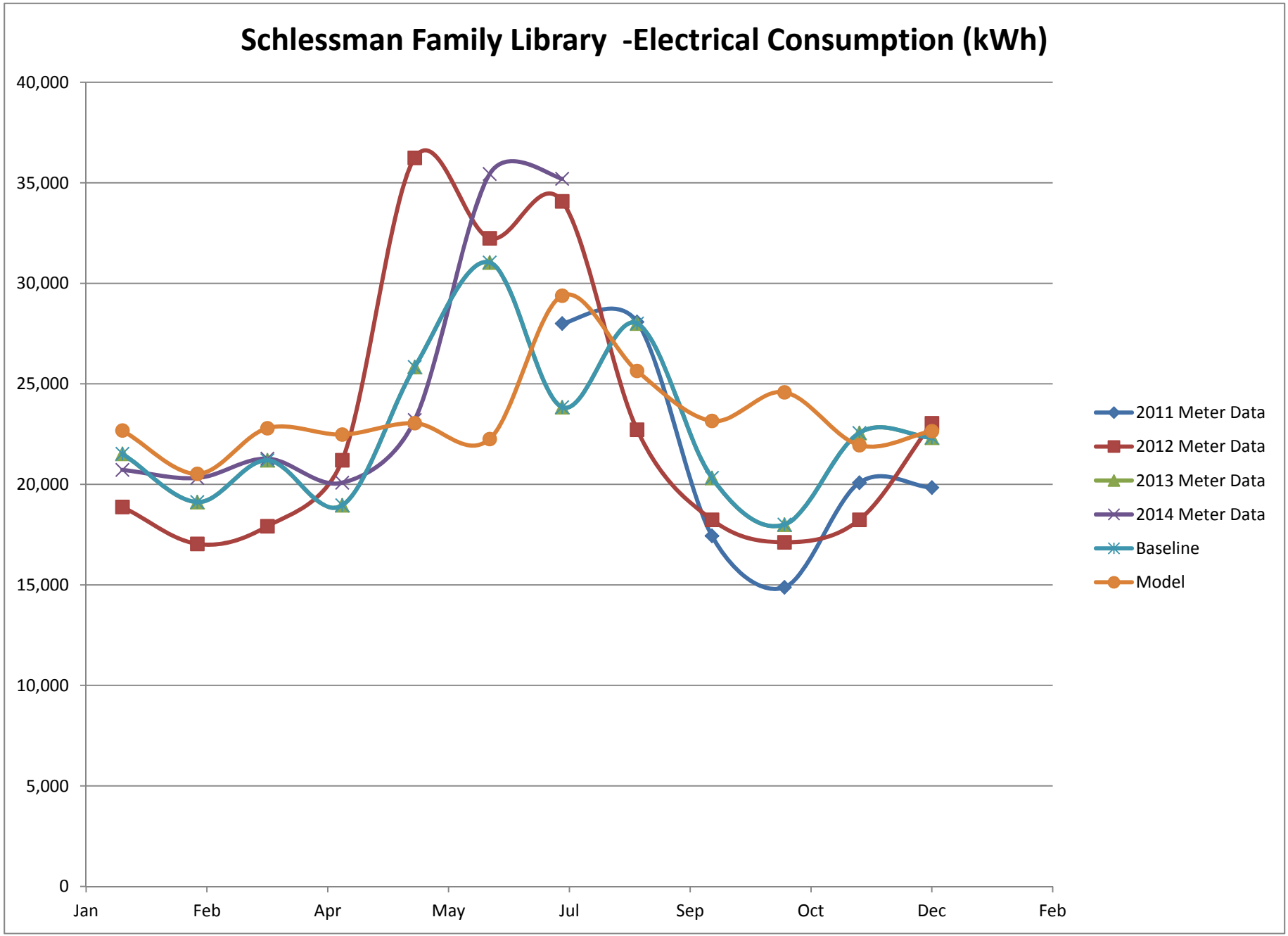
Schlessman Family Library

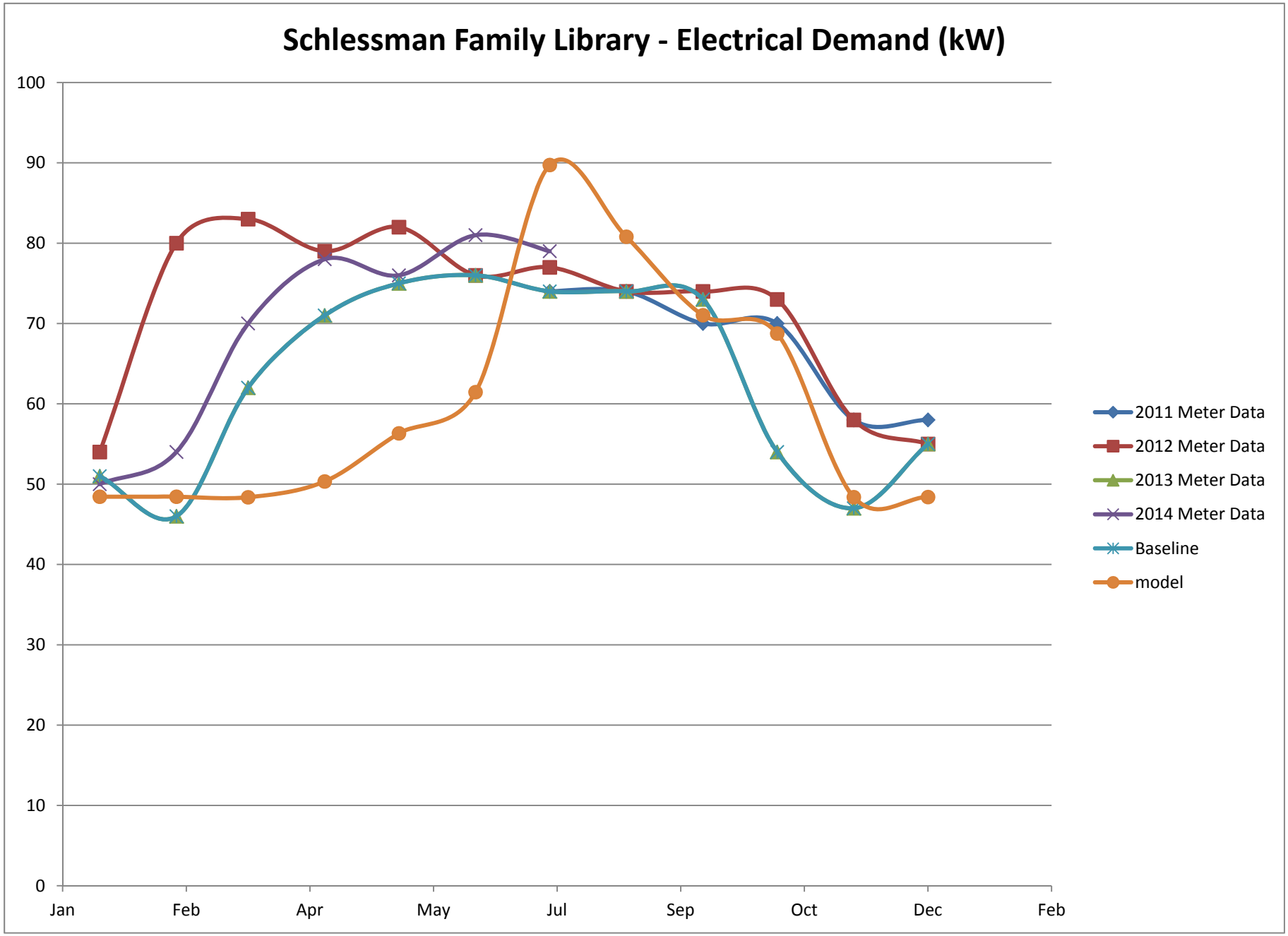
Baseline Model Calibration
Modeling Results – Electric Consumption
Modeling Results – Electric Demand
Model Results – Natural Gas Consumption

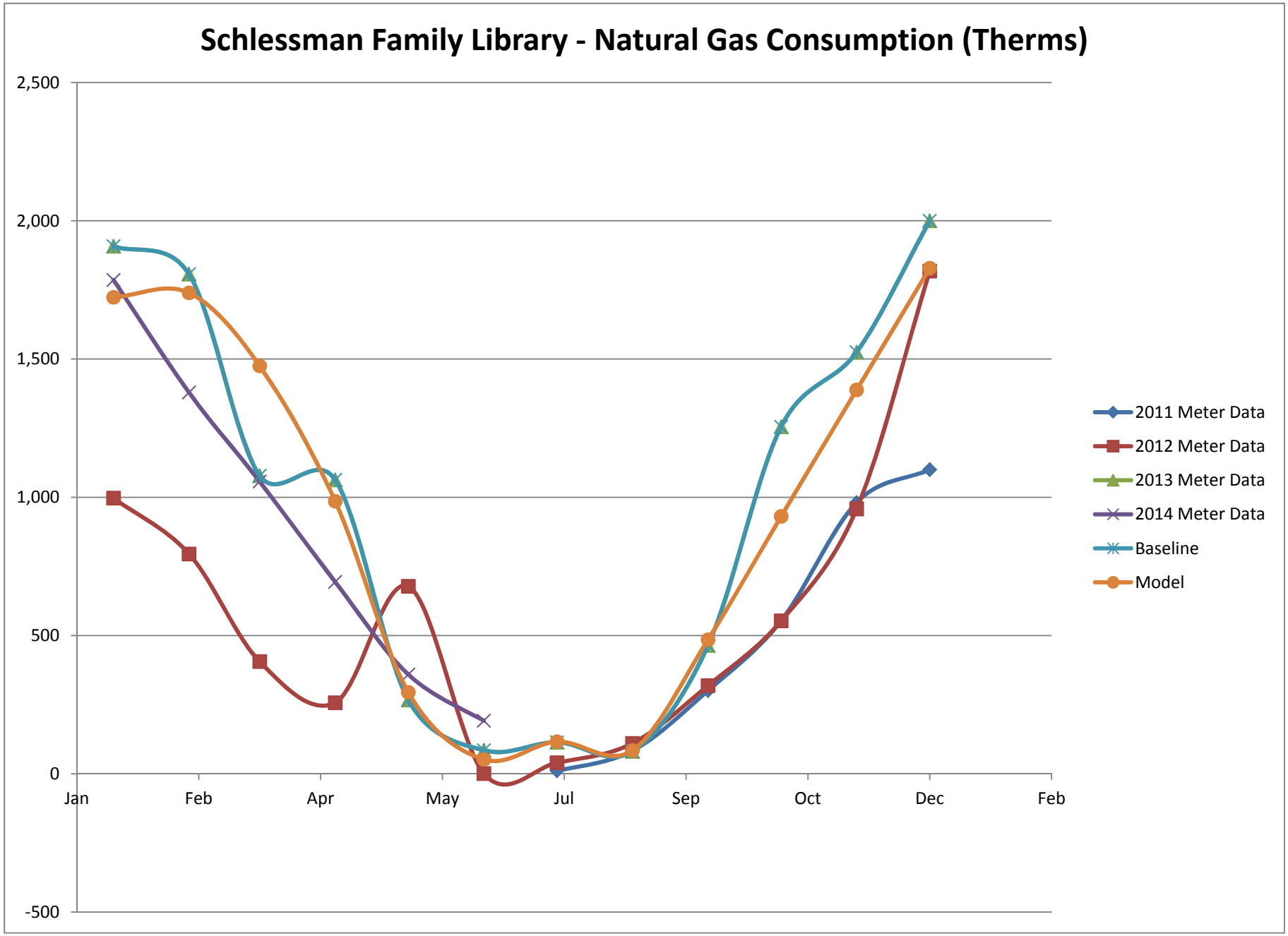
	Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total		
Baseline	kWh	21,520	19,120	21,200	18,960	25,840	31,040	23,840	28,000	20,320	18,000	22,560	22,320	272,720		
Model	kWh	22,683	20,522	22,794	22,477	23,047	22,257	29,384	25,644	23,156	24,581	21,949	22,648	281,142		
Difference	kWh	-1,163	-1,402	-1,594	-3,517	2,793	8,783	-5,544	2,356	-2,836	-6,581	611	-328	-8,422		
RMS Error		1,352,895	1,966,950	2,540,613	12,370,274	7,801,184	77,135,117	30,733,940	5,553,045	8,042,556	43,307,982	372,893	107,446	191,284,895		
MBE		-5.4%	-7.3%	-7.5%	-18.6%	10.8%	28.3%	-23.3%	8.4%	-14.0%	-36.6%	2.7%	-1.5%	-3.1%	MBE =	-3.1%
Cv															Cv =	17.6%
Baseline	kW	51	46	62	71	75	76	74	74	73	54	47	55	758		
Model	kW	48	48	48	50	56	61	90	81	71	69	48	48	720		
Difference	kW	3	-2	14	21	19	15	-16	-7	2	-15	-1	7	38		
RMS Error		7	6	186	427	349	212	247	46	4	218	2	44	1,746		
MBE		5.0%	-5.3%	22.0%	29.1%	24.9%	19.1%	-21.3%	-9.2%	2.7%	-27.3%	-2.9%	12.0%	5.0%	MBE =	5.0%
Cv															Cv =	19.1%
Baseline	therms	1,908	1,807	1,078	1,063	267	85	114	81	464	1,255	1,525	2,000	11,647		
Model	therms	1,723	1,739	1,475	986	294	52	116	85	485	931	1,388	1,829	11,104		
Difference	therms	185	68	-397	77	-27	33	-2	-4	-21	324	137	171	543		
RMS Error		34,125	4,578	157,736	5,954	749	1,100	4	15	442	104,982	18,698	29,296	357,678		
MBE		9.7%	3.7%	-36.8%	7.3%	-10.3%	39.0%	-1.8%	-4.7%	-4.5%	25.8%	9.0%	8.6%	4.7%	MBE =	4.7%
Cv															Cv =	17.8%

16,548 sq-ft

ECM 1 - Lighting Upgrades																Cumulative	
Model	kWh	21,736	19,660	21,805	21,546	22,069	21,289	28,235	24,712	22,127	23,653	21,016	21,705	269,553			
Model	kW	43	43	43	45	51	56	82	74	66	64	43	43	654			
Model	therms	1,733	1,746	1,481	988	286	52	116	85	487	929	1,395	1,835	11,132			
Savings	kWh	947	863	989	931	978	968	1,149	931	1,029	928	934	943	11,589		11,589	kWh
		4%	5%	5%	5%	4%	3%	5%	3%	5%	5%	4%	4%	4%		4%	
Savings	kW	5	5	5	5	6	6	8	7	5	5	5	5	66		66	kW
		10%	11%	8%	7%	8%	7%	11%	9%	7%	10%	11%	9%	9%		9%	
Savings	therms	-10	-6	-6	-3	8	0	0	0	-2	2	-7	-6	-29		-29	therms
		-1%	0%	-1%	0%	3%	0%	0%	0%	0%	0%	0%	0%	0%		0%	
ECM 3 - Lighting Controls																	
Model	kWh	21,632	19,565	21,691	21,443	21,972	21,157	28,080	24,584	22,009	23,543	20,911	21,604	268,191			
Model	kW	43	43	43	45	51	56	81	73	65	62	43	43	650			
Model	therms	1,734	1,746	1,482	989	284	52	116	85	487	929	1,396	1,836	11,136			
Savings	kWh	104	95	115	102	97	132	155	128	119	111	105	101	1,362		12,951	kWh
		0%	0%	1%	1%	0%	0%	1%	0%	1%	1%	0%	0%	0%		5%	
Savings	kW	(0)	(0)	(0)	(0)	(0)	(0)	1	2	1	1	(0)	(0)	4		71	kW
		0%	0%	0%	0%	0%	0%	1%	2%	2%	3%	0%	0%	1%		9%	
Savings	therms	-1	-1	-1	0	2	0	0	0	0	0	-1	-1	-4		-32	therms
		0%	0%	0%	0%	1%	0%	0%	0%	0%	0%	0%	0%	0%		0%	
ECM 4 - EMS Upgrades																	
Model	kWh	19,561	17,421	19,489	18,764	18,175	20,156	25,707	23,317	18,128	21,697	19,266	19,336	241,018			
Model	kW	49	49	49	49	62	68	90	82	74	69	49	49	741			
Model	therms	462	539	348	552	187	52	116	85	406	556	592	721	4,617			
Savings	kWh	2,071	2,144	2,202	2,679	3,797	1,001	2,373	1,267	3,881	1,845	1,645	2,268	27,173		40,124	kWh
		10%	11%	10%	14%	15%	3%	10%	5%	19%	10%	7%	10%	10%		15%	
Savings	kW	(6)	(6)	(6)	(4)	(11)	(12)	(9)	(10)	(9)	(7)	(6)	(6)	-92		-21	kW
		-12%	-13%	-9%	-6%	-15%	-16%	-12%	-13%	-13%	-13%	-13%	-11%	-12%		-3%	
Savings	therms	1,272	1,207	1,134	437	97	0	0	0	81	373	804	1,115	6,520		6,487	therms
		67%	67%	105%	41%	36%	0%	0%	0%	17%	30%	53%	56%	56%		56%	


Schlessman Family Library -Electrical Consumption (kWh)
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
Jan
Feb
Apr
May
Jul
Sep
Oct
Dec
Feb
2011 Meter Data
2012 Meter Data
2013 Meter Data
2014 Meter Data
Baseline
Model


Schlessman Family Library - Electrical Demand (kW)
100
90
80
70
60
50
40
30
20
10
0
Jan
Feb
Apr
May
Jul
Sep
Oct
Dec
Feb
2011 Meter Data
2012 Meter Data
2013 Meter Data
2014 Meter Data
Baseline
model


Schlessman Family Library - Natural Gas Consumption (Therms)
2,500
2,000
1,500
1,000
500
0
-500
Jan
Feb
Apr
May
Jul
Sep
Oct
Dec
Feb
2011 Meter Data
2012 Meter Data
2013 Meter Data
2014 Meter Data
Baseline
Model

Client#: 2793 AMERESCO

ACORD™ CERTIFICATE OF LIABILITY INSURANCE

DATE (MM/DD/YYYY) 12/04/2015

THIS CERTIFICATE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFERS NO RIGHTS UPON THE CERTIFICATE HOLDER. THIS CERTIFICATE DOES NOT AFFIRMATIVELY OR NEGATIVELY AMEND, EXTEND OR ALTER THE COVERAGE AFFORDED BY THE POLICIES BELOW. THIS CERTIFICATE OF INSURANCE DOES NOT CONSTITUTE A CONTRACT BETWEEN THE ISSUING INSURER(S), AUTHORIZED REPRESENTATIVE OR PRODUCER, AND THE CERTIFICATE HOLDER.

IMPORTANT: If the certificate holder is an ADDITIONAL INSURED, the policy(ies) must be endorsed. If SUBROGATION IS WAIVED, subject to the terms and conditions of the policy, certain policies may require an endorsement. A statement on this certificate does not confer rights to the certificate holder in lieu of such endorsement(s).

PRODUCER	CONTACT NAME:	
Arthur J. Gallagher Risk Management Services 470 Atlantic Avenue Boston, MA 02210	PHONE (A/C, No, Ext): 617 261-6700	FAX (A/C, No): 617-646-0400
	E-MAIL ADDRESS:	

INSURER(S) AFFORDING COVERAGE	NAIC #
INSURER A : Zurich-American Insurance Compa	27855
INSURER B : Steadfast Insurance Company	26387
INSURER C :	
INSURER D :	
INSURER E :	
INSURER F :	

INSURED
Ameresco, Inc.
111 Speen Street
Suite 410
Framingham, MA 01701

COVERAGES **CERTIFICATE NUMBER:** **REVISION NUMBER:**

THIS IS TO CERTIFY THAT THE POLICIES OF INSURANCE LISTED BELOW HAVE BEEN ISSUED TO THE INSURED NAMED ABOVE FOR THE POLICY PERIOD INDICATED. NOTWITHSTANDING ANY REQUIREMENT, TERM OR CONDITION OF ANY CONTRACT OR OTHER DOCUMENT WITH RESPECT TO WHICH THIS CERTIFICATE MAY BE ISSUED OR MAY PERTAIN, THE INSURANCE AFFORDED BY THE POLICIES DESCRIBED HEREIN IS SUBJECT TO ALL THE TERMS, EXCLUSIONS AND CONDITIONS OF SUCH POLICIES. LIMITS SHOWN MAY HAVE BEEN REDUCED BY PAID CLAIMS.

INSR LTR	TYPE OF INSURANCE	ADDL INSR	SUBR WVD	POLICY NUMBER	POLICY EFF (MM/DD/YYYY)	POLICY EXP (MM/DD/YYYY)	LIMITS	
A	GENERAL LIABILITY			GLO585238803	11/30/2015	11/30/2016	EACH OCCURRENCE	$2,000,000
	X COMMERCIAL GENERAL LIABILITY						DAMAGE TO RENTED PREMISES (Ea occurrence)	$500,000
	CLAIMS-MADE X OCCUR						MED EXP (Any one person)	$10,000
							PERSONAL & ADV INJURY	$2,000,000
							GENERAL AGGREGATE	$4,000,000
	GEN'L AGGREGATE LIMIT APPLIES PER:						PRODUCTS - COMP/OP AGG	$4,000,000
	POLICY X PRO-JECT X LOC							$
A	AUTOMOBILE LIABILITY			BAP585238703	11/30/2015	11/30/2016	COMBINED SINGLE LIMIT (Ea accident)	$1,000,000
	X ANY AUTO						BODILY INJURY (Per person)	$
	ALL OWNED AUTOS / SCHEDULED AUTOS						BODILY INJURY (Per accident)	$
	X HIRED AUTOS / X NON-OWNED AUTOS						PROPERTY DAMAGE (Per accident)	$
								$
	UMBRELLA LIAB OCCUR						EACH OCCURRENCE	$
	EXCESS LIAB CLAIMS-MADE						AGGREGATE	$
	DED RETENTION $							$
A	WORKERS COMPENSATION AND EMPLOYERS' LIABILITY			WC595394502	11/30/2015	11/30/2016	X WC STATU-TORY LIMITS / OTH-ER	
	ANY PROPRIETOR/PARTNER/EXECUTIVE OFFICER/MEMBER EXCLUDED? Y/N: N	N / A					E.L. EACH ACCIDENT	$1,000,000
	(Mandatory in NH) If yes, describe under DESCRIPTION OF OPERATIONS below						E.L. DISEASE - EA EMPLOYEE	$1,000,000
							E.L. DISEASE - POLICY LIMIT	$1,000,000
B	Professional Liability			EOC669274305	11/30/2015	11/30/2016	$1,000,000 Each Claim $2,000,000 Aggregate	

DESCRIPTION OF OPERATIONS / LOCATIONS / VEHICLES (Attach ACORD 101, Additional Remarks Schedule, if more space is required)

City & County of Denver, its elected and appointed officials, employees and volunteers are included as additional insured and provided with a waiver of subrogation where required by written contract.

CERTIFICATE HOLDER

City & County of Denver
Executive Director of General Services
or Designee
201 W. Colfax Avenue, Dept. 1110
Denver, CO 80202

CANCELLATION

SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED BEFORE THE EXPIRATION DATE THEREOF, NOTICE WILL BE DELIVERED IN ACCORDANCE WITH THE POLICY PROVISIONS.

AUTHORIZED REPRESENTATIVE

PAYMENT BOND

Western Surety Bond #_____
Liberty Mutual Bond #_____

KNOW ALL MEN BY THESE PRESENTS, that Ameresco, Inc., (Principal) a corporation organized under the laws of the State of Delaware with its principal place of business at Suite 410, 111 Speen Street, Framingham, MA. 01701 as Principal, and Western Surety Company a corporation organized under the laws of the State of South Dakota with its office located at 101 South Phillips Street, Sioux Falls, South Dakota, and Liberty Mutual Insurance Company, a corporation organized under the laws of the State of Massachusetts with its office located at 175 Berkeley Street, Boston, MA. 02116, as Co-Sureties, each being authorized to transact business in the State of _____, are held and firmly bound unto _____ ("Obligee"), in the penal sum of _____ for the payment of which Principal and Co-Sureties bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents. It is understood among the parties hereto that in no event shall the surety be liable for a greater sum than the penalty of this bond.

WHEREAS, Principal has by written agreement dated _____ entered into a Contract with Obligee for:

_____

hereinafter referred to as the Contract, and

WHEREAS, this Payment Bond applies only to the installation portion of the Contract and does not apply in any way to energy savings guarantees, payments or maintenance provisions thereof.

NOW, THEREFORE, the condition of this obligation is such that, if the Principal shall promptly make payment to all claimants as hereinafter defined, for all labor and material used in the performance of the installation portion of the Contract, then this obligation shall be null and void, otherwise to remain in full force and virtue, subject, however, to the following conditions: A claimant is defined as one having a direct contract with the Principal or with a subcontractor of the Principal for labor, materials or both, used or reasonably required for use in the performance of the installation portion of the Contract.

No suit or action shall be commenced hereunder by any claimant;
(a) Unless claimant, other than one having a direct contract with the Principal, shall have given written notice to any two of the following: the Principal, the Obligee or Co-Sureties above named within ninety (90) days after such claimant did or performed the last of the work or furnished the last of the materials for which said claim is made, stating with substantial accuracy the amount claimed and the name of the party to whom the materials were furnished or for whom the work or labor was done or performed. Such notice shall be served by mailing the same by registered mail or certified mail, postage prepaid, in an envelope addressed to the Principal, Obligee, or Co-Sureties, at any place where an office is regularly maintained for the transaction of business, or served in any manner in which the legal process may be served in the state in which the aforesaid project is located, save that such service need not be made by a public officer.
(b) After the expiration of one (1) year following the date on which claimant performed labor or last furnished materials on the installation portion of said Contract, it being understood, however, that if any limitation embodied in this bond is prohibited by any law controlling the construction hereof such limitation shall be deemed to be amended so as to be equal to the minimum period of limitation permitted by such law.

IN WITNESS, WHEREOF, we have hereunto set our hands and seals this ____ day of _____, 2012.

AMERESCO, INC.

BY: _____
Andrew B. Spence, Treasurer

WESTERN SURETY COMPANY

BY: _____
, Attorney-in-Fact

LIBERTY MUTUAL INSURANCE COMPANY

BY: _____
, Attorney-in-Fact

PERFORMANCE BOND

Western Surety Bond #_____
Liberty Mutual Bond #_____

KNOW ALL MEN BY THESE PRESENTS, that Ameresco, Inc., (Principal) a corporation organized under the laws of the State of Delaware with its principal place of business at Suite 410, 111 Speen Street, Framingham, MA. 01701 as Principal, and Western Surety Company a corporation organized under the laws of the State of South Dakota with its office located at 101 South Phillips Street, Sioux Falls, South Dakota, and Liberty Mutual Insurance Company, a corporation organized under the laws of the State of Massachusetts with its office located at 175 Berkeley Street, Boston, MA. 02116, as Co-Sureties, each being authorized to transact business in the State of _____, are held and firmly bound unto_____ ("Obligee"), in the penal sum of _____ for the payment of which Principal and Co-Sureties bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents. It is understood among the parties hereto that in no event shall the surety be liable for a greater sum than the penalty of this bond.

WHEREAS, Principal has by written agreement dated _____ entered into a Contract with Obligee for:

_____

hereinafter referred to as the Contract, and

WHEREAS, this Performance Bond applies only to the installation portion of the Contract and does not apply in any way to energy savings guarantees, payments or maintenance provisions, except that this Performance Bond shall guarantee that the installation will be free of defective materials and workmanship for a period of twelve (12) months following completion and acceptance of the Contract.

NOW, THEREFORE, the condition of this obligation is such that, if the Principal shall promptly and faithfully perform the installation pursuant to the undertakings, covenants, agreements, terms and conditions of said Contract, and any extension thereof that may be granted by the Obligee, with or without notice to the Co-Sureties, and truly keep and perform all the undertakings, covenants, agreements, terms and conditions of any and all duly authorized modifications, alterations, changes or additions to said Contract that may hereafter be made, notice to the co-Sureties of such modifications, alterations, changes or additions being hereby waived, then this obligation shall become void, otherwise to remain in full force and virtue.

PROVIDED, HOWEVER, that no right of action shall accrue upon or by reason hereof to or for the use or benefit of anyone other than the Obligee(s) named herein; and that any suit, action or proceeding by the Obligee to recover on this Performance Bond shall be instituted within two years from the date of acceptance of the installation of the equipment by the Obligee, and

PROVIDED FURTHER, that whenever the Principal shall be and declared by the Obligee to be in default of the obligations under the Contract for equipment installation, the Obligee having performed its obligations under the Contract, the Co-Sureties shall: (a) arrange for the Principal, with the consent of the Obligee, to perform and complete the Contract; or (b) undertake to perform and complete the Contract itself through its agents or through Independent contractors; or (c) after investigation, determine the amount for which it may be liable to the Obligee and, as soon as practical after the amount is determined, tender payment therefore to the Obligee.

IN WITNESS, WHEREOF, we have hereunto set our hands and seals this _____ day of _____, 2014.

AMERESCO, INC.

BY:_____
Andrew B. Spence, Treasurer

WESTERN SURETY COMPANY

BY:_____
, Attorney-in-Fact

LIBERTY MUTUAL INSURANCE COMPANY

BY:_____
, Attorney-in-Fact

Office of Human Resources
Denver's Human Resource Agency

201 W. Colfax, Department 412
Denver, CO 80202
p: 720.913.5751
f: 720.913.5720
www.denvergov.org/csa

TO: All Users of the City of Denver Prevailing Wage Schedules

FROM: Alena Duran, Associate Human Resources Professional

DATE: Friday October 23, 2015

SUBJECT: Latest Change to Prevailing Wage Schedules

Please be advised, prevailing wage rates for some building, heavy, and highway construction trades have not been updated by the United States Department of Labor (DOL) since March 1, 2002. The Career Service Board, in their meeting held on April 21, 2011, approved the use of the attached supplemental wage rates until prevailing wage rates for these classifications of work are again published by the United States Department of Labor.

The attached Prevailing Wage Schedule is effective as of **Friday October 16, 2015** and applies to the City and County of Denver for **BUILDING CONSTRUCTION PROJECTS** (does not include residential construction consisting of single family homes and apartments up to and including 4 stories) in accordance with the Denver Revised Municipal Code, Section 20-76(c).

General Wage Decision No. CO150030
Superseded General Decision No. CO150004
Modification No.0
Publication Date: 10/09/2015
(4 pages)

Unless otherwise specified in this document, apprentices shall be permitted only if they are employed pursuant to, and individually registered in, a bona fide apprenticeship program registered with the U.S. Department of Labor (DOL). The employer and the individual apprentice must be registered in a program, which has received prior approval, by the DOL. Any employer, who employs an apprentice and is found to be in violation of this provision, shall be required to pay said apprentice the full journeyman scale.

For questions call (720) 913-5018

Attachments as listed above.

General Decision Number: CO150030 10/09/2015 CO30

State: Colorado

Construction Type: Building

County: Denver County in Colorado.

BUILDING CONSTRUCTION PROJECTS (does not include single family homes or apartments up to and including 4 stories).

Note: Executive Order (EO) 13658 establishes an hourly minimum wage of $10.10 for 2015 that applies to all contracts subject to the Davis-Bacon Act for which the solicitation is issued on or after January 1, 2015. If this contract is covered by the EO, the contractor must pay all workers in any classification listed on this wage determination at least $10.10 (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract. The EO minimum wage rate will be adjusted annually. Additional information on contractor requirements and worker protections under the EO is available at www.dol.gov/whd/govcontracts.

Modification Number	Publication Date
0	10/09/2015

ASBE0028-002 10/01/2012

	Rates	Fringes
ASBESTOS WORKER/HEAT & FROST INSULATOR - MECHANICAL (Duct, Pipe & Mechanical System Insulation)	$ 28.98	13.03

CARP0055-002 05/01/2015

	Rates	Fringes
CARPENTER (Drywall Hanging Only)	$ 25.00	6.19

CARP1607-001 06/01/2015

	Rates	Fringes
MILLWRIGHT	$ 31.00	11.88

ELEC0068-012 06/01/2014

	Rates	Fringes
ELECTRICIAN (Includes Low Voltage Wiring)	$ 32.65	12.70

ELEV0025-001 01/01/2015

	Rates	Fringes
ELEVATOR MECHANIC	$ 40.68	28.385+a+b

FOOTNOTE:
a.Vacation: 6%/under 5 years based on regular hourly rate for all hours worked. 8%/over 5 years based on regular hourly rate for all hours worked.
b. PAID HOLIDAYS: New Year's Day; Memorial Day; Independence Day; Labor Day; Veterans' Day; Thanksgiving Day; the Friday after Thanksgiving Day; and Christmas Day.

ENGI0009-017 10/23/2013

	Rates	Fringes
POWER EQUIPMENT OPERATOR (Crane)		
141 tons and over	$ 25.97	9.15
50 tons and under	$ 24.88	9.15
51 to 90 tons	$ 25.04	9.15
91 to 140 tons	$ 25.19	9.15

IRON0024-009 06/01/2015

	Rates	Fringes
IRONWORKER, ORNAMENTAL	$ 25.05	11.14

IRON0024-010 06/01/2015

	Rates	Fringes
IRONWORKER, STRUCTURAL	$ 25.05	11.14

PAIN0079-006 03/01/2015

	Rates	Fringes
PAINTER (Brush, Roller and Spray; Excludes Drywall Finishing/Taping)	$ 19.45	6.91

PAIN0079-007 03/01/2015

	Rates	Fringes
DRYWALL FINISHER/TAPER	$ 20.15	6.91

PAIN0419-001 07/01/2015

	Rates	Fringes
SOFT FLOOR LAYER (Vinyl and Carpet)	$ 16.70	10.09

PAIN0930-002 07/01/2015

	Rates	Fringes
GLAZIER	$ 30.52	8.12

PLUM0003-009 06/01/2015

	Rates	Fringes
PLUMBER (Excludes HVAC Duct, Pipe and Unit Installation)	$ 36.93	13.10

PLUM0208-008 07/01/2013

	Rates	Fringes
PIPEFITTER (Includes HVAC Pipe and Unit Installation; Excludes HVAC Duct Installation)	$ 33.35	12.27

SFCO0669-002 04/01/2015

	Rates	Fringes
SPRINKLER FITTER (Fire Sprinklers)	$ 34.43	19.09

SHEE0009-004 07/01/2015

	Rates	Fringes
SHEET METAL WORKER (Includes HVAC Duct Installation; Excludes HVAC Pipe and Unit Installation)	$ 32.85	14.63

SUCO2013-006 07/31/2015

	Rates	Fringes
BRICKLAYER	$ 21.96	0.00
CARPENTER (Acoustical Ceiling Installation Only)	$ 22.40	4.85
CARPENTER (Metal Stud Installation Only)	$ 17.68	0.00
CARPENTER, Excludes Acoustical Ceiling Installation, Drywall Hanging, and Metal Stud Installation	$ 21.09	6.31

CEMENT MASON/CONCRETE FINISHER...$ 20.09 7.03

LABORER: Common or General.....$ 14.49 5.22

LABORER: Mason Tender - Brick...$ 15.99 0.00

LABORER: Mason Tender - Cement/Concrete.....$ 16.00 0.00

LABORER: Pipelayer.....$ 16.96 3.68

OPERATOR: Backhoe/Excavator/Trackhoe.....$ 20.78 5.78

OPERATOR: Bobcat/Skid Steer/Skid Loader.....$ 19.10 3.89

OPERATOR: Grader/Blade.....$ 21.50 0.00

ROOFER.....$ 16.56 0.00

TRUCK DRIVER: Dump Truck.....$ 17.34 0.00

WATERPROOFER.....$ 12.71 0.00

WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

Office of Human Resources
Supplemental rates
(Specific to the Denver projects)
Supp #101, Date: 11-19-2015

Classification		Base	Fringe
Boilermakers		$30.97	$21.45
Iron Worker, Reinforcing		$18.49	$3.87
Paper Hanger		$20.15	$6.91
Power Equipment Operators (Concrete Mixers):			
	Less than 1 yd	$23.67	$10.67
	1 yd and over	$23.82	$10.68
	Drillers	$23.97	$10.70
	Loaders over 6 cu yd	$23.82	$10.68
	Oilers	$22.97	$10.70
Plasters		$24.60	$12.11
Plaster Tenders		$10.79	-
Laborers: Concrete Saw		$13.89	-
Tile Setter-Tile Finisher-Floor Grinder-Base Grinder		$20.24	$8.14
Power Equipment Operators:			
	Loader up to and incl 6 cu yd	$23.67	$10.67
	Motor Grader	$23.97	$10.70
	Roller	$23.67	$10.67
Truck Drivers (Dump Trucks):	Flatbed	$19.14	$10.07
	Semi	$19.48	$10.11

- Caulkers—Receive rate prescribed for craft performing operation to which caulking is incidental .i.e. glazier, painter, brick layer, cement mason.
- Use the “Carpenters, Excludes Acoustical Ceiling Installation, Drywall Hanging, and Metal Stud Installation” rates published by the Federal Davis-Bacon rates for batt insulation, pre-stress concrete and tilt up concrete walls.
- Use the “Laborer—Common”, for General Housekeeping, Demolition, Final Cleanup and Indoor Fence Installer.
- Cleanup incidental to the craft performing work can’t be classified as Laborer-Common.
- See Denver City Auditor’s Office Prevailing Wage Clarification of Determinations 2015 Prevailing Wage Section Clarification of Determinations for list of complete classification uses at Denvergov.org/Auditor.