LAKE COUNTY, TENNESSEE

INVITATION TO BID / CONSTRUCTION SOLICITATION

EECBG ENERGY EFFICIENCY IMPROVEMENTS

LAKE COUNTY COURTHOUSE & LAKE COUNTY EMS BUILDING

Funded in whole or in part through the Tennessee Department of Environment and Conservation Office of Energy Programs – Energy Efficiency and Conservation Block Grant (EECBG) Program

Issue Date	October 21, 2026
Pre-Bid Site Visit	Anytime Monday-Friday, 8:00 a.m.-4:00 p.m., during normal courthouse hours. Schedule with Tyler Douglas: tyler.douglas@lakecountytn.gov
Questions Due	October 30, 2026, 12:00 noon (Central Time) - Written questions by email to tyler.douglas@lakecountytn.gov or delivered to Lake County Mayor's Office, Lake County Courthouse, 229 Church Street, Tiptonville, TN 38079
Sealed Bids Due	November 4, 2026, 12:00 noon (Central Time)
Bid Opening	November 4, 2026, 12:00 noon (Central Time), immediately after bid receipt closes – Lake County Mayor's Office, Lake County Courthouse, 229 Church Street, Tiptonville, TN 38079
Submission Location	Lake County Mayor's Office, Lake County Courthouse, 229 Church Street, Tiptonville, TN 38079
Contract Time	All physical construction and installation work must be complete no later than April 30, 2027. A 60-calendar-day administrative closeout period follows completion.

IMPORTANT: Davis-Bacon Wage Determination General Decision TN20260166, Building Construction, Lake and Lauderdale Counties, Tennessee, Modification No. 2 dated May 18, 2026, is included as Attachment E.

1. INVITATION TO BID

Lake County, Tennessee (the "County") invites sealed bids from properly licensed and qualified contractors for energy-efficiency improvements at the Lake County Courthouse and Lake County EMS Building. The work is funded in whole or in part with federal financial assistance through TDEC OEP's EECBG Program and is subject to federal, state and local requirements, including Build America, Buy America (BABA) and the Davis-Bacon and Related Acts (DBRA) prevailing wage requirements.

Project Location – Courthouse	Lake County Courthouse, 229 Church Street, Tiptonville, Tennessee
Project Location – EMS	Lake County EMS Building, 333 Kentucky Street, Tiptonville, Tennessee
Technical Basis	Tennessee Tech Energy Conservation Audit TT-C-014 (Courthouse) and TT-C-15 (EMS), both revised February 13, 2026, together with this solicitation and addenda.

Bid Packages / Award Structure. Bidders may submit a bid for the Courthouse Package, the EMS Package, or both. The County may award the two building packages separately or to the same bidder. Line-item prices are required for transparency and contract administration; line items are not separate awards unless the County expressly states otherwise by addendum.

No Work Before Authorization. Advertisement, award, execution of a contract, and Notice to Proceed are subject to all required County and TDEC approvals. No contractor shall order non-cancellable materials, mobilize, demolish, install, or perform grant-funded construction until a written Notice to Proceed is issued by the County after required TDEC authorization.

FEDERAL COMPLIANCE NOTICE. This solicitation and resulting contract are subject to Build America, Buy America (BABA) and Davis-Bacon and Related Acts (DBRA) requirements. The TDEC-required BABA clause in Section 10 applies to the prime contract and must flow down to all lower-tier subcontracts and purchase orders. The full 29 CFR § 5.5 labor standards provisions and the current applicable U.S. Department of Labor wage determination must be included in the contract documents and flowed down to covered subcontracts. TDEC requires certified payroll reporting through LCPtracker.

2. PROCUREMENT SCHEDULE AND COMMUNICATIONS

Solicitation Issued	October 21, 2026
Site Visit / Pre-Bid	Anytime Monday-Friday, 8:00 a.m.-4:00 p.m., during normal courthouse hours. Schedule with Tyler Douglas: tyler.douglas@lakecountytn.gov
Deadline for Written Questions	October 30, 2026, 12:00 noon (Central Time)
Final Addendum, if any	November 2, 2026, 12:00 noon (Central Time)
Sealed Bid Deadline	November 4, 2026, 12:00 noon (Central Time)
Public Bid Opening	November 4, 2026, 12:00 noon (Central Time), immediately after bid receipt closes – Lake County Mayor's Office, Lake County Courthouse, 229 Church Street, Tiptonville, TN 38079
Anticipated Award	Following County/TDEC approvals and County Commission action, if applicable
Anticipated Notice to Proceed	After County/TDEC approvals and contract execution

All questions shall be submitted in writing and received no later than 12:00 noon (Central Time) on October 30, 2026. Questions may be submitted by email to tyler.douglas@lakecountytn.gov or delivered to the Lake County Mayor's Office, Lake County Courthouse, 229 Church Street, Tiptonville, TN 38079. Oral interpretations are not binding. Changes to the solicitation will be made only by written addendum.

3. BID SUBMISSION REQUIREMENTS

1. Submit one (1) original sealed bid and two (2) complete copies to the Lake County Mayor's Office, Lake County Courthouse, 229 Church Street, Tiptonville, TN 38079. Bids may be mailed or hand-delivered to this address and must be received no later than 12:00 noon (Central Time) on November 4, 2026. Bids received after the stated deadline will not be considered.

2. BID DELIVERY / MAILING ADDRESS AND PUBLIC OPENING LOCATION: Lake County Mayor's Office, Lake County Courthouse, 229 Church Street, Tiptonville, TN 38079. The public bid opening will occur at this location at 12:00 noon (Central Time) on November 4, 2026, immediately after bid receipt closes.
3. The outside of the sealed bid envelope must clearly identify the project and bidder and must contain all Tennessee contractor-license information required for the prime contractor and applicable subcontractors. At a minimum, bidders should confirm the envelope includes the licensed name, license number, classification and expiration date for the prime and any HVAC/mechanical, electrical, plumbing or other subcontractor information required by Tennessee law for the value of that work.
4. The bidder must hold a Tennessee contractor license before bidding when required by Tennessee law, and the license monetary limit/classification must be sufficient for the work bid. Required subcontractors must also be properly licensed.
5. Bid prices shall remain firm for 90 calendar days after bid opening unless a different period is stated by addendum.
6. The bid must include the completed Bid Form, Subcontractor/License Schedule, BABA Acknowledgment and Preliminary Product Schedule, Federal Certifications, Non-Collusion Certification, Addenda Acknowledgment, and bid security if required.
7. Bid Security: Each bid shall be accompanied by a bid guarantee equal to five percent (5%) of the total amount bid, in the form of a bid bond issued by a surety authorized to transact business in Tennessee, a certified check, or a cashier's check payable to Lake County, Tennessee.

4. BID EVALUATION AND AWARD

The County intends to award each building package to the lowest responsive and responsible bidder whose bid conforms to the solicitation and is in the County's best interest, subject to available grant funding and required TDEC approval. The County reserves the right, to the extent permitted by law and the grant, to reject any or all bids, waive minor informalities, request clarification, verify qualifications, and cancel or re-solicit the procurement.

Responsibility review may include licensing, financial capacity, relevant project experience, safety record, ability to comply with Davis-Bacon and Related Acts (DBRA) requirements and LCPtracker, ability to source BABA-compliant products, schedule, references and responsiveness to the technical requirements.

5. GENERAL SCOPE AND PERFORMANCE REQUIREMENTS

- Provide all labor, supervision, project management, materials, equipment, transportation, hoisting, temporary protection, demolition, disposal, permits, testing, commissioning, manufacturer start-up, documentation and incidental work necessary for complete and operational improvements.
- The Tennessee Tech audits are the energy-audit basis for the funded measures, but they are not construction drawings or sealed engineering designs. Bidders shall field-verify dimensions, quantities, existing conditions, electrical service, gas service, equipment connections, structural support, clearances and code requirements before ordering equipment or commencing work.
- Where professional engineering, sealed shop drawings, calculations, permits or design services are required by applicable code or law for the contractor's means, methods, equipment selection or delegated design, the bidder shall include those services in the bid unless an addendum states otherwise.
- All equipment shall be new, commercial grade, listed/labeled for its intended use, and meet or exceed applicable codes, manufacturer requirements and current minimum energy-efficiency requirements. Products permanently incorporated into the project must satisfy BABA unless an approved federal waiver applies.
- The contractor shall coordinate related measures so that work is not duplicated. In particular, ERV systems shall be designed and installed as part of or fully coordinated with the replacement heat-pump systems, and window sealing/glazing shall be integrated with window replacement to avoid duplicate payment.
- The Courthouse and EMS Building will remain occupied/operational during construction. The contractor shall phase work, protect occupants and property, maintain safe access and egress, and coordinate shutdowns with the County. EMS operations are 24/7; outages shall be minimized and scheduled in advance, and the contractor shall provide temporary measures when necessary to maintain essential building operations.
- All existing equipment/material removed and not designated for County salvage becomes the contractor's responsibility for lawful disposal. Refrigerants shall be recovered and handled in accordance with applicable requirements.
- Patch and restore surfaces disturbed by the work to a neat, finished condition compatible with adjacent construction. No exposed unfinished openings, abandoned wiring, piping, penetrations or unsafe conditions will be accepted.

6. PACKAGE A – LAKE COUNTY COURTHOUSE SCOPE OF WORK

Technical basis: Tennessee Tech Audit TT-C-014. The audit identifies approximately 63 double-pane window openings (about 41 openings approximately 7 ft x 3 ft and 22 openings approximately 5 ft x 3 ft), approximately 7,500 square feet of basement-ceiling/first-floor underside area for insulation, six nominal 5-ton HVAC systems, and remaining fluorescent T8 lighting.

6.1 Low-E Windows, Glazing and Weather-Tight Installation

- Field-verify all window openings and existing frame/sill conditions. The audit identifies approximately 63 existing double-pane window openings: approximately 41 at 7 ft x 3 ft and approximately 22 at 5 ft x 3 ft.
- Provide a complete low-emissivity (low-E) fenestration upgrade for the audited openings. The bidder shall state in its proposal which openings are proposed for full window-assembly replacement and which, if any, are proposed for glazing-only replacement in serviceable frames. The base bid shall address all audited openings unless modified by addendum.
- New glazing/window assemblies shall be insulating, low-E, commercial-grade units suitable for the existing openings and exposure. Provide safety glazing where required by code.
- Include removal of existing units/glazing as necessary; preparation of openings; normal blocking, shimming and anchorage; flashing; perimeter sealants; backer rod; interior and exterior trim/closure; glazing; weather seals; and all work required for a watertight and airtight installation.
- Visible conditions identified by the audit include drafts, poor sealing, water intrusion and some windows with stability/sill concerns. Bidder shall inspect these conditions before bidding. Concealed structural deterioration beyond normal window installation shall be reported before proceeding and addressed only by written change authorization.
- Coordinate this work with Section 6.5. Air sealing that is integral to a replaced window is included in the window item and shall not be billed again as infiltration work.

6.2 Basement Ceiling / Underside of First-Floor Insulation

- Install insulation at the separation between the unconditioned basement and the conditioned first floor. The audit uses approximately 7,500 square feet as the basis of quantity.
- Audit performance basis: approximately 4 inches of R-13 batt insulation, increasing the modeled assembly resistance from about R-3.45 to about R-16.45. Provide R-13 batt insulation or a code-compliant equivalent that meets or exceeds the audit-modeled thermal performance and is acceptable to the County/TDEC.
- Provide supports/fasteners, fitting around ducts, piping, wiring and obstructions, and maintain access to serviceable equipment. Comply with applicable flame-spread, smoke-development, fireblocking and exposed-insulation requirements.
- Protect existing basement HVAC equipment/ductwork and do not obstruct combustion-air, service clearances, access panels or required ventilation.

6.3 Courthouse Heat-Pump HVAC Replacement – Six Systems

- Replace the six existing split HVAC systems serving the Courthouse with six high-efficiency heat-pump systems. The audit identifies six nominal 5-ton Goodman outdoor AC units with six gas-furnace units and models six nominal 5-ton heat-pump systems.
- Nominal 5-ton capacity is the audit basis. Before purchase, contractor shall field-verify equipment capacities, duct conditions, electrical capacity and zone requirements. Equipment selection shall meet or exceed applicable code/DOE minimums and shall not reduce required heating/cooling capacity without written County approval.
- Audit modeling basis uses a proposed COP of approximately 3.61. Proposed equipment shall be high-efficiency commercial equipment and bidder shall submit manufacturer efficiency data with the submittal package.
- Provide complete conversion to operational heat-pump systems, including matched indoor/outdoor components as required, refrigerant piping, condensate management, thermostats/controls, electrical disconnects and circuit modifications, equipment pads/stands/curbs as applicable, duct transitions, vibration isolation, startup and commissioning.
- Remove or safely decommission replaced gas-furnace components and cap/secure abandoned gas piping in accordance with code where gas service is no longer used for those systems.
- Provide manufacturer warranties, startup sheets, test results, equipment schedules, O&M manuals and owner orientation.

6.4 Energy Recovery Ventilation (ERV) – Six HVAC Zones/Systems

- Provide energy recovery ventilation serving each of the six Courthouse HVAC zones/systems, coordinated with the new heat-pump systems.
- Audit modeling assumes ERV effectiveness in the 70%–80% range. Provide systems with published sensible/total energy-recovery performance appropriate to the application and not less than the audit basis unless approved by the County/TDEC.
- ERVs shall be sized for required outdoor-air ventilation and integrated with controls so operation does not defeat the energy-efficiency intent. Include ductwork, dampers, controls, penetrations, weatherproofing, electrical connections, condensate where applicable, balancing and commissioning.
- Do not install ERVs onto equipment scheduled for removal. The heat-pump and ERV submittals shall be coordinated as one mechanical system package.

6.5 Window Air-Infiltration Reduction

- The audit separately identifies approximately 10 window leakage locations and models approximately 95% reduction in measured infiltration.
- Inspect all window perimeters and known leakage locations. Seal remaining cracks, gaps and penetrations using compatible exterior/interior sealants, gaskets, weatherstripping and related materials.
- For windows replaced or reglazed under Section 6.1, complete perimeter air/water sealing is part of that window work. This line item is for supplemental sealing of remaining leakage and shall not duplicate Section 6.1 costs.
- Verify finished work is weather-tight and free of perceptible drafts under normal conditions.

6.6 Courthouse LED Lighting

- Replace remaining fluorescent T8 lighting identified by the audit with high-efficiency LED lighting. The audit counted approximately 38 existing 32-watt T8 lamps and modeled an LED case using approximately 30 12-watt lamps.
- Field-verify fixture and lamp quantities. Provide LED lamps, retrofit kits or fixtures compatible with the existing housings/ballasts/wiring, or rewire/bypass ballasts where permitted and manufacturer-listed.
- Maintain or improve existing useful illumination and lighting quality. Remove/dispose of replaced fluorescent lamps and ballasts in accordance with applicable requirements.
- Occupancy-sensor controls mentioned in the audit are not part of the base bid unless expressly authorized by addendum/TDEC-approved scope.

7. PACKAGE B – LAKE COUNTY EMS BUILDING SCOPE OF WORK

Technical basis: Tennessee Tech Audit TT-C-15. The audit identifies one existing 5-ton packaged gas/electric HVAC unit that is undersized for observed summer conditions, one ERV application, two existing 75 MBtu garage unit heaters, visible infiltration at approximately five windows and three bay doors, and approximately 44 fluorescent T8 lamps.

7.1 EMS Heat-Pump HVAC Replacement – One System

- Remove/replace the existing approximately 5-ton Rheem packaged gas/electric HVAC unit with one larger high-efficiency heat-pump system. The audit models a nominal 7.5-ton heat-pump system because the existing system does not provide adequate summer cooling and staff use supplemental window AC units.
- Nominal 7.5-ton capacity is the audit basis. Contractor shall verify building load, duct capacity, airflow, electrical service and equipment configuration before purchase and shall submit equipment data for County approval.
- Audit modeling basis uses a proposed COP of approximately 3.91. Proposed equipment shall meet or exceed current applicable efficiency requirements and provide performance consistent with the energy-audit intent.
- Provide all matched components, duct transitions, curb/pad modifications, electrical work, refrigerant, condensate, controls/thermostat, disconnect, startup, testing, balancing and commissioning required for a complete operating system.
- Safely disconnect/decommission gas components no longer required by the replacement HVAC system, while preserving gas service needed for the separate garage unit heaters unless the approved design states otherwise.

7.2 EMS Energy Recovery Ventilation – One System

- Provide one ERV system integrated with the replacement EMS heat-pump system.
- Audit modeling assumes approximately 70% ERV effectiveness. Provide published performance meeting or exceeding the audit basis, sized for required outdoor-air ventilation.
- Include all ductwork, dampers, controls, penetrations/weatherproofing, electrical, supports, condensate where applicable, balancing and commissioning. Coordinate the ERV and heat-pump system as a single mechanical package.

7.3 EMS Garage Unit Heaters – Two

- Replace the two existing natural-gas Reznor F75 garage heaters (approximately 75 MBtu each; one reported non-operational at audit) with two new high-efficiency natural-gas unit heaters.
- Audit basis: approximately 80 MBtu heating output/capacity per unit and approximately 94% efficiency. Provide equal or better efficiency and capacity suitable for the garage.
- Include removal/disposal of existing heaters; hanging/support; gas piping connections; shutoffs; venting/combustion air as required; electrical connections; thermostatic controls; startup and combustion/safety checks.

7.4 EMS Door and Window Infiltration Reduction

- Audit observations identify infiltration at approximately five windows and three bay doors. The audit models approximately 95% reduction in measured infiltration.
- Provide complete weather-sealing of the identified windows and bay doors, including compatible perimeter sealants, weatherstripping, gaskets, sweeps, jamb/header seals, threshold/bottom seals and adjustments needed to achieve a substantially weather-tight condition.

- Repair/replace deteriorated sealing components; maintain proper operation, egress and safety of doors. Do not impair automatic/manual bay-door operation.
- After installation, demonstrate doors/windows operate properly and that obvious daylight/draft gaps addressed by the scope are eliminated.

7.5 EMS LED Lighting

- Replace fluorescent T8 lighting with high-efficiency LED lighting. The audit counted approximately 44 existing 32-watt T8 lamps and modeled an LED case using approximately 35 12-watt lamps.
- Field-verify fixture/lamp quantities and provide LED lamps, retrofit kits or fixtures as appropriate. Maintain or improve existing useful illumination and lighting quality.
- Remove/dispose of replaced fluorescent lamps and ballasts in accordance with applicable requirements.

8. SUBMITTALS, TESTING, COMMISSIONING AND CLOSEOUT

- Within 10 business days after Notice of Intent to Award or as otherwise directed, submit a coordinated product/equipment schedule identifying manufacturer, model, country of manufacture, BABA category, required BABA certification status and lead time for each permanently incorporated product.
- Do not order permanently incorporated products until the County has accepted required submittals and BABA documentation and any necessary TDEC review/approval is complete.
- Mechanical submittals shall include capacities, efficiency ratings, electrical data, controls, ERV performance, ventilation airflow, warranty and installation requirements.
- Window submittals shall include frame/glazing system, low-E performance data, glass type, finish, anchorage/flashing/sealant approach and manufacturer warranty.
- Insulation submittals shall include product type, thickness, R-value, facing (if any), fire/smoke data and installation method.
- Lighting submittals shall include wattage, lumen output, color temperature, CRI, listing and any ballast-bypass/retrofit requirements.
- Commission all HVAC/ERV systems; verify controls, airflow, heating/cooling operation, condensate, safety controls and ventilation. Provide startup/commissioning forms and balancing data as applicable.
- Closeout deliverables: final BABA certifications, certified payroll compliance, warranties, O&M manuals, equipment serial numbers, startup reports, permits/inspection approvals, as-built markups where applicable, photos of completed work and contractor certification that work is complete and operational.

9. EECBG / FEDERAL GRANT COMPLIANCE

9.1. TDEC Approval / Environmental Review

No grant-funded work may commence before required TDEC OEP approval. The contractor acknowledges that federal environmental and historic-preservation review requirements may apply and shall provide product/site information reasonably requested by the County or TDEC. The contractor shall not begin work until the County issues written Notice to Proceed.

9.2. Competitive Procurement / No Unauthorized Changes

The procurement is conducted under applicable County procedures, Tennessee law and federal procurement requirements. No material change to the approved grant scope, equipment category, BABA status or contract amount may be made without written County authorization and any required TDEC approval.

9.3. Records / Audit Access

Contractor and subcontractors shall maintain complete project, procurement, product-origin, invoice, payment, payroll and compliance records for at least five years after final payment or longer if required by the grant, law, audit, litigation or written notice. Records shall be available to Lake County, TDEC OEP, U.S. DOE, U.S. Department of Labor, auditors and other authorized officials.

9.4. Debarment and Suspension

No award will be made to a party excluded or ineligible under the System for Award Management (SAM). The bidder certifies that it and its principals are not debarred, suspended or otherwise excluded and shall flow applicable restrictions to lower tiers.

9.5. Prohibition on Certain Telecommunications / Video Surveillance Equipment

Contractor shall comply with 2 CFR 200.216 and shall not provide or use covered telecommunications equipment or services as a substantial or essential component of any system funded under this contract.

9.6. Equal Opportunity / Nondiscrimination

The equal opportunity clause applicable to federally assisted construction at 41 CFR 60-1.4(b) is incorporated by reference to the extent applicable. Contractor shall also comply with Title VI and other nondiscrimination requirements applicable to the EECBG award and shall flow required clauses to subcontractors.

9.7. Clean Air Act / Federal Water Pollution Control Act

For any contract exceeding the applicable federal threshold, contractor agrees to comply with all applicable standards, orders and regulations issued under the Clean Air Act and Federal Water Pollution Control Act, as amended, and to report violations as required.

9.8. Byrd Anti-Lobbying Amendment

For any bid/contract exceeding $100,000, bidder shall execute the certification included in this solicitation concerning lobbying with federal appropriated funds and shall require the certification/disclosure at applicable lower tiers.

10. BUILD AMERICA, BUY AMERICA (BABA) – REQUIRED CONTRACT CLAUSE

The following language is supplied by TDEC OEP as "Required for All Contracts and Subcontracts" and is inserted in full. It must be flowed down to all lower-tier subcontracts and purchase orders.

Buy America Domestic Procurement Preference

As required by Section 70914 of the Infrastructure Investment and Jobs Act (IIJA), P.L. 117-58, and implementing regulations at 2 CFR part 184 and 2 CFR 200.322, none of the funds under a federal award that are part of a Federal financial assistance program for infrastructure may be obligated for a project unless all of the iron, steel, manufactured products, and construction materials used in the project are produced in the United States, unless subject to a waiver approved by the Federal awarding agency. This requirement must be included in all subawards, contracts, and purchase orders for work or products under this program.

Contractors acknowledges and agrees that none of the funds provided under this award may be used for a project for infrastructure unless all iron and steel used in the project are produced in the United States, meaning all manufacturing processes, from the initial melting stage through the application of coatings, occurred in the United States; all manufactured products used in the project are produced in the United States, meaning the product was manufactured in the United States and the cost of components mined, produced, or manufactured in the United States is greater than 55 percent of the total cost of all components (unless a higher standard applies); and all construction materials are manufactured in the United States, meaning all manufacturing processes for the construction material occurred in the United States.

This requirement applies only to articles, materials, and supplies that are consumed in, incorporated into, or affixed to an infrastructure project. It does not apply to tools, equipment, and supplies brought to the construction site and removed at or before completion of the project, nor to equipment and furnishings that are not permanently affixed to the infrastructure.

Contractors shall include this provision in all lower-tier subcontracts and purchase orders.

When applicable, waivers may be requested through the awarding entity and must be approved by the Federal awarding agency. Allowable waiver types include nonavailability, unreasonable cost, and public interest, and must be approved prior to the use of non-compliant materials.

Contractor and subcontractors must certify compliance with these requirements and provide supporting documentation upon request.

BABA administration for this project: Bidders shall not assume a waiver. Any known or anticipated nonavailability issue must be disclosed promptly. No noncompliant permanently incorporated article, material or supply may be installed unless the Federal awarding agency has approved a waiver through TDEC. Manufacturer/supplier certifications must be collected and submitted before installation and at closeout.

11. DAVIS-BACON AND RELATED ACTS (DBRA), CERTIFIED PAYROLL AND LABOR STANDARDS

- This project is subject to the Davis-Bacon and Related Acts (DBRA) labor standards. All covered laborers and mechanics employed by the contractor or subcontractors must be paid not less than the applicable prevailing wage and fringe-benefit rates for the classifications of work actually performed and must be paid at least weekly.
- The current applicable U.S. Department of Labor wage determination must be attached to this solicitation before advertisement and becomes part of the contract. Award is conditioned on acceptance of that wage determination and any legally applicable modification.

- The full required 29 CFR §5.5 contract provisions supplied with this solicitation are incorporated into the contract and must be flowed down to covered subcontracts. If a conflict exists between a summary in this solicitation and the full federal clause, the federal clause controls.
- Certified payrolls are required for each week in which covered work is performed. The prime contractor is responsible for complete, accurate and timely payroll submissions for itself and all subcontractors.
- TDEC requires use of LCPtracker. Contractor and applicable subcontractors shall complete required training, enter/upload certified payroll data, provide weekly sign-offs and correct deficiencies promptly. Payroll reports are due within seven days of the applicable pay period unless TDEC directs otherwise.
- The applicable wage determination and Davis-Bacon poster WH-1321 shall be posted prominently at the job site. Contractor shall cooperate with payroll reviews, employee interviews and audits.
- Contract Work Hours and Safety Standards Act requirements and the Copeland Anti-Kickback Act apply where required. Required clauses are contained in the federal labor-standards attachment and are incorporated into the contract.

12. TENNESSEE CONTRACTOR LICENSING, BONDS, INSURANCE AND PERMITS

- Bidders and subcontractors shall be properly licensed in Tennessee before bidding/contracting when required by law and shall maintain required licenses through completion.
- Bid-envelope and subcontractor listing information shall comply with Tennessee contractor-licensing requirements. Failure to provide required information may affect responsiveness.
- Payment Bond: The successful contractor shall furnish a payment bond in the amount of one hundred percent (100%) of the contract price, issued by a surety authorized to transact business in Tennessee. This County/federal procurement requirement is intended to satisfy applicable federal bonding requirements and exceeds the minimum bond amount required by Tenn. Code Ann. § 12-4-201 where that statute applies.
- Performance Bond: The successful contractor shall furnish a performance bond in the amount of one hundred percent (100%) of the contract price, issued by a surety authorized to transact business in Tennessee, conditioned upon faithful performance of all contract requirements.
- Bid Security: Five percent (5%) of the total amount bid, submitted with the bid as a bid bond, certified check, or cashier’s check payable to Lake County, Tennessee.
- Insurance: Before contract execution and Notice to Proceed, the successful contractor shall provide certificates of insurance evidencing at least the following coverage: (a) Commercial General Liability - $1,000,000 each occurrence and $2,000,000 general aggregate, with a $2,000,000 products/completed-operations aggregate; (b) Automobile Liability - $1,000,000 combined single limit per accident covering owned, hired, and non-owned vehicles; and (c) Workers’ Compensation - statutory Tennessee limits, together with Employer’s Liability of not less than $1,000,000 each accident, $1,000,000 disease policy limit, and $1,000,000 disease limit per employee. Lake County, Tennessee, including its elected officials, officers, employees, and agents, shall be named as additional insureds on the Commercial General Liability and Automobile Liability policies for work under the contract. Coverage shall be primary and non-contributory to the extent commercially available. Contractors and subcontractors shall maintain workers’ compensation coverage as required by Tennessee law and provide proof of coverage or lawful exemption upon request.
- Contractor shall obtain and pay for permits, inspections and trade permits required for its work unless the County expressly states otherwise. The contractor is responsible for code-compliant installation and final inspection approval.

13. CONTRACT ADMINISTRATION

13.1. Contract Time

All physical construction, installation, testing, commissioning, punch-list correction, and other field work for both the Courthouse and EMS packages must be fully complete no later than April 30, 2027. The County will then have a 60-calendar-day closeout period for administrative items, including final invoices, certified payroll reconciliation, BABA certifications, warranties, O&M manuals, as-built records, final reports, and other grant closeout documentation. The 60-day closeout period does not extend the April 30, 2027 deadline for physical project work. No work may begin before the written Notice to Proceed.

13.2. Progress Schedule

Within 10 days after Notice to Proceed, contractor shall submit a baseline schedule showing submittals, long-lead procurement, mobilization, work by building, outages, testing/commissioning and closeout. Schedule updates shall accompany progress invoices.

13.3. Invoices and Payment Documentation

Submit itemized progress invoices no more frequently than monthly unless the County authorizes otherwise. Invoices must identify work completed by bid line item and include supporting vendor invoices, proof of delivery/installation, payroll compliance status, BABA documentation as requested, and other grant documentation. Payment is subject to County verification, contract terms and applicable law.

13.4. Changes

No change in scope, materials, equipment, price or time is authorized without a written change order or written directive signed by the County's authorized representative and, where required, TDEC approval. Contractor proceeds with unauthorized work at its own risk.

13.5. Warranty

Contractor shall warrant workmanship for at least one year from final acceptance and shall pass through all manufacturer warranties. Longer manufacturer warranties remain in effect. Warranty work shall be completed promptly without additional cost for covered defects.

13.6. Termination

The County may terminate the contract for cause upon contractor default after applicable notice/opportunity to cure and may terminate for convenience when permitted, with payment limited to properly performed/accepted work and reasonable documented closeout obligations, subject to the contract and law. Federal remedies and withholding rights remain applicable.

14. BID FORM

To: Lake County, Tennessee

Project: EECBG Energy Efficiency Improvements – Lake County Courthouse & Lake County EMS Building

The undersigned, having examined the solicitation, audits, federal clauses, addenda and site conditions, offers to furnish all labor, materials, equipment and services required for the following lump-sum prices.

14.1 Package A – Courthouse Price Breakdown

Item	Description	Basis Quantity / Note	Price
C-1	Low-E window / glazing package including complete weather-tight installation	Approx. 63 openings; field verify	$_____
C-2	Basement ceiling / underside-of-first-floor insulation	Approx. 7,500 SF; audit basis 4 in. R-13 batt	$_____
C-3	Heat-pump HVAC replacement	Six nominal 5-ton systems	$_____
C-4	ERV systems coordinated with new HVAC	Six zones/systems; audit basis ≥70% effectiveness	$_____
C-5	Window infiltration reduction / supplemental sealing	Approx. 10 known leaks plus field verification; no duplicate with C-1	$_____
C-6	LED lighting	Audit counted approx. 38 T8 lamps; final field verify	$_____
TOTAL PACKAGE A – COURTHOUSE BASE BID			**$_____**

14.2 Package B – EMS Price Breakdown

Item	Description	Basis Quantity / Note	Price
E-1	Heat-pump HVAC replacement	One nominal 7.5-ton system	$_____
E-2	ERV integrated with new HVAC	One system; audit basis ≥70% effectiveness	$_____
E-3	High-efficiency natural-gas garage unit heaters	Two units; audit basis approx. 80 MBtu / 94% efficiency	$_____
E-4	Door/window infiltration reduction	Approx. 3 bay doors + 5 windows; field verify	$_____
E-5	LED lighting	Audit counted approx. 44 T8 lamps; final field verify	$_____

Item	Description	Basis Quantity / Note	Price
TOTAL PACKAGE B – EMS BASE BID			**$_____**

14.3 Combined Bid (if bidding both packages)

Package A Courthouse Total	$_____
Package B EMS Total	$_____
Less Combined-Award Discount (if any)	$_____
TOTAL COMBINED BID	$_____

Amount written in words: _____ Dollars

14.4 Required Completion Schedule

Courthouse	All physical work complete no later than April 30, 2027
EMS	All physical work complete no later than April 30, 2027
Administrative Closeout	60 calendar days following April 30, 2027; administrative items only

14.5 Bidder Information and Signature

Legal Business Name	
Address	
City / State / ZIP	
Phone	
Email	
Tennessee Contractor License No.	
Classification(s)	
License Expiration	
License Monetary Limit	
Authorized Representative	
Title	

_____

Authorized Signature

_____

Date

15. SUBCONTRACTOR / LICENSE SCHEDULE

List the subcontractors proposed for major portions of the work. Complete all Tennessee-required information and ensure required information also appears on the bid envelope/electronic bid cover where applicable.

Trade	Firm	TN License No.	Classification	Expiration	Estimated $ Portion
HVAC / Mechanical					
Electrical					
Windows / Glazing					
Insulation					
Other: _____					

Trade	Firm	TN License No.	Classification	Expiration	Estimated $ Portion
Other: _____					

16. BABA ACKNOWLEDGMENT AND PRELIMINARY PRODUCT SCHEDULE

Bidder acknowledges that BABA applies to permanently incorporated iron/steel products, manufactured products and construction materials unless an approved waiver applies. Bidder shall identify its proposed basis-of-bid products below to the extent known. Final manufacturer certifications are required before installation.

Product / System	Proposed Manufacturer / Model	BABA Category	Certification Available?	Known Waiver Issue?
Courthouse windows/glazing				
Courthouse heat pumps				
Courthouse ERVs				
Courthouse insulation				
Courthouse LED products				
EMS heat pump				
EMS ERV				
EMS garage heaters				
EMS LED products				
Other permanently incorporated product				

By signing the Bid Form, bidder agrees not to purchase or install a noncompliant covered product unless a federal waiver has been approved through the required process.

17. FEDERAL AND BIDDER CERTIFICATIONS

17.1 Debarment / Suspension Certification

The bidder certifies, to the best of its knowledge and belief, that the bidder and its principals are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participation in this transaction by any federal department or agency. The bidder agrees to notify the County promptly of any change before award or during the contract.

_____

Authorized Signature / Date

17.2 Byrd Anti-Lobbying Certification (Required for Awards Exceeding $100,000)

The undersigned certifies, to the best of his or her knowledge and belief, that no Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of an agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, or the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement. If any funds other than Federal appropriated funds have been paid or will be paid for such influence, the undersigned shall complete and submit the required disclosure form. The undersigned shall require this certification from applicable lower tiers.

_____

Authorized Signature / Date

17.3 Non-Collusion Certification

The bidder certifies that this bid is genuine and not collusive or sham; that the bidder has not colluded, conspired, connived or agreed, directly or indirectly, with another bidder or person to fix the bid price or to secure an advantage

against Lake County or another bidder; and that the bidder has not offered or provided any improper gratuity or inducement in connection with this procurement.

_____

Authorized Signature / Date

17.4 Addenda Acknowledgment

Addendum No.	Date	Acknowledged by Initials
_____	_____	_____
_____	_____	_____
_____	_____	_____

18. CONTRACT DOCUMENTS / ATTACHMENTS TO ISSUE WITH SOLICITATION

Attachment	Description
Attachment A	Tennessee Tech Commercial Energy Conservation Audit Report TT-C-014 Revised – Lake County Courthouse.
Attachment B	Tennessee Tech Commercial Energy Conservation Audit Report TT-C-15 Revised – Lake County EMS Building.
Attachment C	TDEC OEP BABA Contract Language – required clause (also reproduced in Section 10).
Attachment D	29 CFR §5.5 – Contract Provisions and Related Matters (the user-supplied 10-page CFR excerpt).
Attachment E	Davis-Bacon Wage Determination – General Decision TN20260166, Building Construction, Lake and Lauderdale Counties, Tennessee, Modification No. 2, publication date May 18, 2026.
Attachment F	TDEC OEP EECBG Grant Program Manual, November 2025, or the current version directed by TDEC.
Attachment G	Any County/TDEC addenda, approved technical clarifications, permits, sketches or schedules issued before bid opening.

END OF BID SOLICITATION

ATTACHMENT A

Tennessee Tech Commercial Energy Conservation Audit Report

TT-C-014 Revised - Lake County Courthouse

Commercial Energy Conservation Audit Report

Conducted by
Industrial Training and Assessment Center Team
Tennessee Technological University

for
Tennessee Department of Environment and Conservation

Energy Conservation Audit Report: TT-C-014

Assessment Date:	12/9/25
Location:	229 Church St # 11, Tiptonville, TN
Building:	Lake County Courthouse
Building Type:	Courthouse and Office
Report Date:	1/09/26
Revision Date:	2/13/26

Sponsored by The Tennessee Department of Environment and Conservation
under the contract of the
U.S. Department of Energy Office of State and Community Energy Programs

Ethan Languri, Ph.D., P.E.
Director of ITAC, PI of the Project, Principal Auditor

Patrick Swiecichowski, Ph.D.
Principal Auditor

Mazen Hussein, Ph.D.,
Co-PI of the Project

Tennessee Technological University
Center for Manufacturing Research
TN 3-Star Industrial Training and Assessment Center
Cookeville, TN | (931) 372-6386

PREFACE AND DISCLAIMER

The work described in this report was performed under the direction of the project team from Industrial Training and Assessment Center (ITAC) at Tennessee Technological University. Recommendations are based on observations and measurements made during a one-day site visit. Although time limitations prohibit the examination of every aspect of a building's operation, an effort is made to identify the major "Audit Recommendations" and to offer specific and quantitative recommendations for energy and cost savings. Under this program, Tennessee Technological University does not prepare engineering designs or perform services normally offered by an engineering firm, vendor, or a facility's representative. When the need for such assistance arises, it is suggested the participating facility contact these specialists directly. If, however, the recommendations and conclusions offered in this report require further clarification or explanation, the participating building is encouraged to contact the team members listed below.

The contents of this report are offered as guidance. Tennessee Technological University, Tennessee Department of Environment and Conservation, the U.S. Department of Energy, and all technical sources referenced in this report do not (a) make any warranty or representation, expressed or implied, with respect to the accuracy, completeness, or usefulness of the information contained in this report, or that the use of any information, apparatus, method, or process disclosed in this report may not infringe on privately owned rights; (b) assume liabilities with respect to the use of, or for damages resulting from use of, any information, apparatus, method, or process disclosed in this report. This report does not reflect official views or the policy of the above-mentioned institutions. Mention of trade names or commercial products does not constitute endorsement or recommendation of use.

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Other Team Members	Rajendra Tadakhe Neal Patel

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I. Executive Summary:

Briefly goes over the energy consumption of the facility and the proposed amount of savings.

Table 1: Yearly Use

Energy	Usage/Year	Total Cost/Year
Electricity	93,640 kWh	$11,147
Natural Gas	3,851 Therms	$6,241
Total	93,640 kWh 3,851 Therms	$17,388

Table 2: Utility Rates

Energy Source	Units	Rate
Electric Consumption	**All kWh**	$0.1136
Natural Gas	**All Therm**	$1.6204

Conservation measures described below would reduce energy usage by an estimated 58,962.93 kWh/yr. Along with energy demand, natural gas, and water savings, these conservation measures amount to a total estimated savings of $17,416.36. This represents around 62.97% of the total annual energy cost based on the Courthouse's operation of 2,250 hours each year. The initial cost of implementation is estimated to be $174,175, giving an overall Simple Payback Period of 120 months. Analyses and technical information to support the recommendations are contained in section III of this report. The proposed energy conservation measures are summarized in Table 3.

Table 3: Summary of Audit Recommendations

Recommendation	Recommended Action	Energy Savings (-/yr)	Carbon Dioxide Reduction (lbs. CO_2/yr)	Cost Savings ($/yr)	Implementation Cost	SPP
Install Low-E Windows	It is recommended to replace/install low-E windows in place of regular windows.	3,609.99 kWh 419.44 Therms	14,282.05	1,089.76	94,500	1,040.6 Months
Add Insulation to the Basement Roof	It is recommended to add roof insulation to the courthouse basement.	30,490.92 kWh 1,037.09 Therms	54,680.74	5,144.27	9,075	21.17 Months
Install ERV Systems on the HVAC Systems	It is recommended to install energy recovery ventilation, ERV, systems on the rooftop HVAC units.	41,074.20 kWh 2,113.76 Therms	92,524.21	8,091.17	33,000	48.94 Months
Replace Current HVAC Systems with Higher Efficient Heat Pump Units	It is recommended to replace the current HVAC units with ones utilizing heat pumps.	-18,170.08 kWh 3,019.66 Therms	63,160.76	2,828.93	36,000	152.71 Months
Install Higher Efficiency Lighting	It is recommended to replace the old Fluorescent T8 bulbs with higher efficiency LED bulbs.	1,780.48 kWh	672.5	202.27	300	17.8 Months

Reduce Infiltration	It is recommended to reduce the amount of infiltration through the windows.	177.42 kWh 24.57 Therms	806.04	59.96	1,300	260.17 Months
Totals[1]		**58,962.93 kWh 6,6142.52 Therms**	**226,126.30**	**17,416.36**	**174,175**	**120 Months**

All these recommendations provide some form of energy savings during the peak energy hours of the day. There are a few however that also recommend controls or management systems that allow for the building or county to have more control over the energy usage of the building. These recommendations have been highlighted above with a * and are also shown at the bottom of *Appendix B: Audit Template Report*.

[1] These totals include all recommendations, even conflicting recommendations that cannot be implemented together

II. General Building Information

2.1 Building Information

Location	Lake County, Tiptonville, TN
Use Type	Courthouse and Office Space
Building Size (ft^2)	~19,150 (3 floors)
Floors	3
Operation Schedule	8:00 am – 5:00 pm, 2,250 hrs./yr
Is the Building Historic	No
Main HVAC Type	Split Furnace and AC units
Main Lighting Type	Fluorescent T8 Bulbs and LEDs

2.2 Building Layout



Figure 1: Lake County Courthouse (Top)



Figure 2: Lake County Courthouse (Front)

2.4 Energy Asset Score Report:

This section goes over the highlights of the attached energy asset score that was performed using the Department of Energy's Asset Score/Audit Template online reporting tool. This energy asset score report takes into account the current systems of the building and provides possible energy efficiency recommendations along with projections on current energy usage and the possible energy usage after the suggested recommendations are implemented. There might be some discrepancies in the report compared to reality due to the limitations of the program to use more than one HVAC system per building, due to this the audit team used the most prominent HVAC system. To see the energy asset score report please see *Appendix A: Energy Asset Score Report.*

2.5 Energy Audit Template Report:

This section goes over the highlights of the attached audit template report that was performed using the Department of Energy's Asset Score/Audit Template online reporting tool. This audit template report takes the input specification data of the building's energy systems and provides an overview of them. This report also includes the relevant utility charges over the last 12 months. The report also includes the recommendations outlined in this audit report and splits them into separate different recommendation packages that the building can choose from based on the estimated life of the project, cost, and savings. These savings are then compared to the current energy usage of the facility to show a difference in energy usage after implementation. To see the audit template report please see *Appendix B: Audit Template Report*

III. Audit Recommendations

This section provides detailed descriptions of audit recommendations identified at the subject facility. The documentation of each recommendation summarizes the action to be taken, the cost savings, the implementation cost, and the estimated payback period. Calculations are included to show how energy and cost savings were determined. Each recommendation is self-contained. The cost savings for a given recommendation do not depend on the implementation of other recommendations, unless otherwise noted.

Recommendation 1: Install Low-Emissivity Windows

Est. Electrical Consumption Savings	= ***3,609.99 kWh/yr***
Est. Natural Gas Savings	= ***419.44 Therms/yr***
Est. Electrical Consumption Cost Savings	= ***$410.09/yr***
Est. Natural Gas Cost Savings	= ***$679.66/yr***
Est. Total Cost Savings	= ***$1,089.76/yr***
Est. Carbon Dioxide Reduction	= ***14,282.05 lbs. CO_2/yr***
Implementation Cost	= ***$94,500***
Simple Payback Period	= ***1,040.6 Months***

Recommended Action:

It is recommended to replace/install low-E windows in place of regular windows.

Background Information:

The energy savings of this recommendation stem from the increased thermal resistance that the low-E windows provide. These windows work by reducing the infrared and ultraviolet light that is permitted to pass through the glass, without heavily impacting the amount of light that comes through the window. This means that during the summer months the glass will reflect more solar heat rather than absorbing it into the building, keeping the building cooler. In the winter these windows would reflect more heat inside the building allowing which can help alleviate some of the thermal load that the HVAC system(s) have to cover.

Currently the Lake County Courthouse has around 41 double paned 7' by 3' windows and ~22 double paned 5' by 3' windows across the sides of the building, an example of each are shown in Figure 3 below. In particular the audit team was notified that the larger windows have noticeable temperature drops in the winter and ***some even have structural issues that cause the windows themselves to fall out of their sills. The windows also have sealing issues that the employees have tried fixing using tape and other means, but can still feel drafts through the windows, especially during times of high wind. Another issue with the windows that the current state of the windows seem to have is that due to poor sealing water leaks into the building through them during times of heavy rainfall.*** The building pays an average utility rate of $0.1136/kWh and $1.6204/therm.



Figure 3: Window Types

Anticipated Savings:

As stated above the anticipated savings of this recommendation stem from the reduction in load the HVAC system(s) would see when having the low-E windows installed. To determine the estimated savings of installing these low-E windows, the first step is the current amount heat loss/gain the building sees through these windows.

This data is usually collected at the nearest airport and/or large city, which in this case is the Memphis area. Using the monthly local Heating Degree Day, HDD, and Cooling Degree Day, CDD, data provided by the National Weather Service for the area near the Perry County Courthouse as seen in Figure 4 below. One can get an idea of how often the HVAC system would run and how loaded it might need to be. For example, the peak summer months of June, and July had average CDD values of 473 and 615 respectively for the 2025-2026 year. This means that on average every day in June and July had an average temperature of ~15.77°F, and ~19.84°F above 65°F respectively. With these CDD values being this high means that the HVAC system would typically run at a higher load or more often during these months to provide adequate cooling. A similar situation can be seen for the HDD values for the peak winter months of December and January, the only difference is that HDD is related to the temperature below 65°F. This means that during the months of December and January one would typically see the most use of their HVAC heating.

NOWData - NOAA Online Weather Data — Enlarge results — Print

Monthly Total HDD for Memphis Area, TN (ThreadEx)

Click column heading to sort ascending, click again to sort descending.

Year	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Season
2022-2023	0	0	3	102	397	619	510	381	323	120	18	0	2473
2023-2024	0	0	0	88	313	486	838	363	260	93	0	0	2441
2024-2025	0	0	0	47	240	528	844	532	227	88	10	0	2516
2025-2026	0	0	0	82	286	613	M	M	M	M	M	M	M
Mean	0	0	1	80	309	562	731	425	270	100	9	0	2477
Max	0 2025	0 2025	3 2022	102 2022	397 2022	619 2022	844 2025	532 2025	323 2023	120 2023	18 2023	0 2025	2516 2025
Min	0 2025	0 2025	0 2025	47 2024	240 2024	486 2023	510 2023	363 2024	227 2025	88 2025	0 2024	0 2025	2441 2024

NOWData - NOAA Online Weather Data — Enlarge results — Print

Monthly Total CDD for Memphis Area, TN (ThreadEx)

Click column heading to sort ascending, click again to sort descending.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2023	2	9	20	32	260	439	543	552	388	158	22	0	2425
2024	0	7	19	102	305	476	528	553	312	147	41	0	2490
2025	0	0	33	132	183	473	615	517	401	145	17	8	2524
2026	M	M	M	M	M	M	M	M	M	M	M	M	M
Mean	1	5	24	89	249	463	562	541	367	150	27	3	2480
Max	2 2023	9 2023	33 2025	132 2025	305 2024	476 2024	615 2025	553 2024	401 2025	158 2023	41 2024	8 2025	2524 2025
Min	0 2025	0 2025	19 2024	32 2023	183 2025	439 2023	528 2024	517 2025	312 2024	145 2025	17 2025	0 2024	2425 2023

Figure 4: Monthly CDD and HDD Days

This results in a total HDD value of 2,516 and a CDD value of 2,524. Using these values one can estimate the amount of thermal energy lost for both the heating and cooling seasons using the following equations:

$$Current\ Heat\ Loss = \frac{Window\ U\ Factor * Glass\ Area * HDD * \frac{24\ hours}{1\ Day}}{HVAC\ Heating\ Efficiency}$$

$$Current\ Heat\ Loss_{Large\ Window} = \frac{0.83\frac{Btu}{hr * ft^2 * °F} * (7ft * 3ft) * 2{,}516\ HDD * \frac{24\ hours}{1\ Day}}{0.96}$$

$$Current\ Heat\ Loss_{Large\ Window} = 1{,}096{,}347\ Btu$$

$$Current\ Heat\ Loss_{Large\ Window} = 1{,}096{,}347\ Btu * \frac{1\ Therm}{99{,}980\ Btu}$$

$$Current\ Heat\ Loss_{Large\ Window} = 10.97\ Therms$$

$$Current\ Heat\ Gain = \frac{Window\ U\ Factor * Glass\ Area * CDD * \frac{24\ hours}{1\ Day}}{HVAC\ Cooling\ Efficiency}$$

$$Current\ Heat\ Gain_{Large\ Window} = \frac{0.83\frac{Btu}{hr * ft^2 * °F} * (7ft * 3ft) * 2{,}524\ CDD * \frac{24\ hours}{1\ Day}}{3.28}$$

$$Current\ Heat\ Gain_{Large\ Window} = 321{,}902.34\ Btu$$

$$Current\ Heat\ Gain_{Large\ Window} = 321{,}902.34\ Btu * \frac{1\ kWh}{3{,}412\ Btu}$$

$$Current\ Heat\ Gain_{Large\ Window} = 94.34\ kWh$$

Using this equation one can determine the current energy loss/gain for each window. For simplicity's sake the audit team will tabulate the data in Table 4 below.

Table 4: Current Energy Loss/Gain

Window Type	# of Windows	Window U-Factor (Btu/hr*ft^2*°F)	Window Area (ft^2)	Current Winter Heat Loss per Window (Therms)	Current Summer Heat Gain per Window (kWh)	Total Current Winter Heat Loss (Therms)	Total Current Summer Heat Gain (kWh)
Large Double Paned Windows	41	0.83	21	10.97	94.34	449.59	3,867.94
Smaller Double Paned Windows	22	0.83	15	7.83	67.39	172.32	1,482.58
Total						**621.91**	**5,350.52**

Using the same equations as before one can determine the proposed energy heat gain/loss for each window type. The only difference would be using the low-E window U-factor in place of the current window's U-Factor. From a study done in 2012 by the National Renewable Energy Laboratory, NREL, the commonly seen U-factors for double pane low-E windows ranges from 0.25 to 0.42, depending on the vendor and how efficient the consumer wants the windows. For the case of this recommendation the audit team will assume that the building staff would choose one of most efficient windows. Using this value the proposed energy loss/gain are tabulated in Table 5 below.

Table 5: Proposed energy Loss/Gain

Window Type	# of Windows	Proposed U-Factor (Btu/hr*ft^2*°F)	Proposed Winter Heat Loss per Window (Therms)	Proposed Summer Heat Gain per Window (kWh)	Total Proposed Winter Heat Loss (Therms)	Total Proposed Summer Heat Gain (kWh)
Large Double Paned Windows	41	0.27	3.57	30.69	146.37	1,258.29
Smaller Double Paned Windows	22	0.27	2.55	21.92	56.1	482.24
Total					**202.47**	**1,740.53**

From these values one can determine the *Natural Gas Savings, NGS,* and the *Electrical Consumption Savings, ECS,* using the following equations.

$$NGS = Current\ Heat\ Loss - Proposed\ Heat\ Loss$$

$$NGS = 621.91\ \frac{Therms}{yr} - 202.47\frac{Therms}{yr}$$

$$NGS = 419.44\frac{Therms}{yr}$$

$$ECS = Current\ Heat\ gain - Proposed\ Heat\ Gain$$

$$ECS = 5{,}350.52\frac{kWh}{yr} - 1{,}740.53\frac{kWh}{yr}$$

$$ECS = 3{,}609.99\frac{kWh}{yr}$$

From these values one can determine the *Natural gas Cost Savings, NGCS,* and the *Electrical Consumption Cost Savings, ECCS,* by multiplying the NGS and ECS by their respective utility rate.

$$NGCS = \frac{419.44\ Therms}{yr} * \frac{\$1.6204}{Therm}$$

$$\boldsymbol{NGCS = \frac{\$679.66}{yr}}$$

$$ECCS = \frac{3{,}609.99\ kWh}{yr} * \frac{\$0.1136}{kWh}$$

$$\boldsymbol{ECCS = \frac{\$410.09}{yr}}$$

$$Total\ Cost\ Savings\ (TCS) = NGCS + ECCS$$

$$TCS = \frac{\$679.66}{yr} + \frac{\$410.09}{yr}$$

$$\boldsymbol{TCS = \frac{\$1{,}089.76}{yr}}$$

In addition to energy savings, there are carbon dioxide emission savings as well. The Environmental Protection Agency (EPA) reports that electrical energy in the building's region is responsible for 898.1 lbs. CO_2 / MWh. The *carbon dioxide reduction, CDR,* is calculated as:

$$CDR = \left[\left(NGS * 0.029307 \frac{MWh}{Therm}\right) + \left(ECS * \frac{1\ MWh}{1{,}000kWh}\right)\right] * 898.1\ \frac{lbs\ CO_2}{MWh}$$

$$CDR = \left[\left(\frac{419.44\ Therms}{yr} * 0.029307 \frac{MWh}{Therm}\right) + \left(\frac{3{,}609.99\ kWh}{yr} * \frac{1\ MWh}{1{,}000kWh}\right)\right] * 898.1\ \frac{lbs\ CO_2}{MWh}$$

$$\boldsymbol{CDR = 14{,}282.05\ \frac{lbs\ CO_2}{yr}}$$

Implementation Cost:

The *Implementation Cost, IC,* of this recommendation stems from the cost of either replacing the window entirely or adding and a coating to the glass. For the case of this recommendation the audit team will assume the building staff will replace the windows rather than coat them. From a search of vendors and prices of low-E windows, the prices for double-pane low-E windows range from $500-$1,500 depending on the vendor and efficiency of the window. The audit team will assume that the building staff will purchase low-e windows costing $1,500/window. Using this value the implementation cost can be found by the following.

$$IC = \left(\frac{\$1{,}500}{Window} * Number\ of\ Standard\ Windows\right)$$

$$IC = \left(\frac{\$1{,}500}{Window} * 63\ Windows\right)$$

$$\boldsymbol{IC = \$94{,}500}$$

Simple Payback Period (SPP):

The *Simple Payback Period, SPP*, value can be found using the following equation:

$$SPP = \frac{IC}{TCS}$$

$$SPP = \frac{94{,}500}{\frac{\$1{,}089.76}{yr}}$$

$$\boldsymbol{SPP = 1{,}040.6\ Months}$$

*** Note:** Even though this is a long payback for the windows the calculations do not include other savings that would be gained by replacing the windows. Some of these savings would be maintenance savings, employee comfort, building stability, etc.*

Recommendation 2: Add Insulation to the Basement Roof

Est. Electrical Consumption Savings	= ***30,490.92 kWh/yr***
Est. Natural Gas Savings	= ***1037.09 therms/yr***
Est. Electrical Consumption Cost Savings	= ***$3,463.77/yr***
Est. Natural Gas Cost Savings	= ***$1,680.50/yr***
Est. Total Cost Savings	= ***$5,144.27/yr***
Est. Carbon Dioxide Reduction	= ***54,680.74 lbs. CO_2/yr***
Implementation Cost	= ***$9,075***
Internal Rate of Return Over 20 Years	= ***56.68%***
Simple Payback Period	= ***21.17 Months***

Recommended Action:

It is recommended to add roof insulation to the courthouse basement.

Background Information:

The energy savings of this recommendation mainly stem from the reduction in heat transfer between conditioned and unconditioned spaces. By adding insulation, the building would typically see a reduction in HVAC use during the winter and summer months, this is due to the HVAC system not needing to supply as much heating/cooling to maintain the desired temperature in the building. This also typically increases the wellbeing and work environment for those employees in the building.

During the audit the audit team noticed that the flooring separating the unconditioned basement and the 1st floor of the courthouse has little to no insulation beyond the built-up flooring. The basement gets incredibly cold in the winter and decently warm in the summer due to large amounts of infiltration through the building's envelope. A majority of the HVAC ducting and furnace units are located in the basement. Multiple employees have informed the audit team that hot air in the summer and cold air in the winter can be felt through the vents in the floor when the HVAC units are not running. The state of the basement roof insulation can be seen in Figure 5 below. From a discussion with the staff the building is occupied about 2,250 hrs/yr, but the area in question is rarely regularly used. The county currently pays and $1.6204/therm and $0.1136/kWh.



Figure 5: Current Basement Roof Insulation

Anticipated Savings:

As stated above the anticipated energy savings of this recommendation stem from the decreased HVAC usage during the winter and summer months. To determine the estimated energy savings of adding more insulation to the basement roof and ducting system, the current and proposed energy loss/gain during the winter and summer months must be determined. This can be done using the following equations.

$$Winter\ Heat\ Loss\ (WHL) = U\ Value\ of\ Basement\ Roof * Roof\ Area * HDD * \frac{24\ hrs}{Day}$$

$$Summer\ Heat\ Gain\ (SHG) = U\ Value\ of\ the\ Roof * Roof\ Area * CDD * \frac{24\ hrs}{Day}$$

The U-value used in the equations above is equal to 1/thermal resistance of the materials used to construct the roof. These U or R values can be found from multiple different sources and can change depending on the thickness, density, and specific heat of the material used. The audit team used averaged U values for wood floors on joists[2], R~3.45, U~0.29. By adding 4 inches of R-13 Batt insulation the thermal resistance value of the floor would increase to R~16.45, U~0.061.

Other than the U and R values of the assembly, one needs to determine the HDD and CDD of the area the building is located. This data is usually collected at the nearest airport

[2] Typical U values of building construction methods and materials
Guide to Home Insulation

and/or large city, which in this case is the Memphis area. Using the monthly local Heating Degree Day, HDD, and Cooling Degree Day, CDD, data provided by the National Weather Service for the area near the Perry County Courthouse as seen in Figure 6 below. One can get an idea of how often the HVAC system would run and how loaded it might need to be. For example, the peak summer months of June, and July had average CDD values of 473 and 615 respectively for the 2025-2026 year. This means that on average every day in June and July had an average temperature of ~15.77°F, and ~19.84°F above 65°F respectively. With these CDD values being this high means that the HVAC system would typically run at a higher load or more often during these months to provide adequate cooling. A similar situation can be seen for the HDD values for the peak winter months of December and January, the only difference is that HDD is related to the temperature below 65°F. This means that during the months of December and January one would typically see the most use of their HVAC heating.

NOWData - NOAA Online Weather Data — Enlarge results — Print

Monthly Total HDD for Memphis Area, TN (ThreadEx)

Click column heading to sort ascending, click again to sort descending.

Year	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Season
2022-2023	0	0	3	102	397	619	510	381	323	120	18	0	2473
2023-2024	0	0	0	88	313	486	838	363	260	93	0	0	2441
2024-2025	0	0	0	47	240	528	844	532	227	88	10	0	2516
2025-2026	0	0	0	82	286	613	M	M	M	M	M	M	M
Mean	0	0	1	80	309	562	731	425	270	100	9	0	2477
Max	0 2025	0 2025	3 2022	102 2022	397 2022	619 2022	844 2025	532 2025	323 2023	120 2023	18 2023	0 2025	2516 2025
Min	0 2025	0 2025	0 2025	47 2024	240 2024	486 2023	510 2023	363 2024	227 2025	88 2025	0 2024	0 2025	2441 2024

NOWData - NOAA Online Weather Data — Enlarge results — Print

Monthly Total CDD for Memphis Area, TN (ThreadEx)

Click column heading to sort ascending, click again to sort descending.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2023	2	9	20	32	260	439	543	552	388	158	22	0	2425
2024	0	7	19	102	305	476	528	553	312	147	41	0	2490
2025	0	0	33	132	183	473	615	517	401	145	17	8	2524
2026	M	M	M	M	M	M	M	M	M	M	M	M	M
Mean	1	5	24	89	249	463	562	541	367	150	27	3	2480
Max	2 2023	9 2023	33 2025	132 2025	305 2024	476 2024	615 2025	553 2024	401 2025	158 2023	41 2024	8 2025	2524 2025
Min	0 2025	0 2025	19 2024	32 2023	183 2025	439 2023	528 2024	517 2025	312 2024	145 2025	17 2025	0 2024	2425 2023

Figure 6: Monthly CDD and HDD Days

Using these collected values the *Current Winter Heat Loss, CWHL, Current Summer Heat Gain, CSHG, Proposed Winter Heat Loss (PWHL),* and the *Proposed Summer Heat Gain, PSHG,* through the roof can be determined.

$$CWHL = 0.29\ \frac{Btu}{hr * ft^2 * °\text{F}} * 7{,}500 ft^2 * 2{,}516 * \frac{24\ hrs}{Day}$$

$$CWHL = 131{,}335{,}200\ Btu * \frac{1\ therm}{100{,}000\ Btu}$$

$$CWHL = 1313.35\ therms$$

$$CSHG = 0.29\ \frac{Btu}{hr * ft^2 * °\text{F}} * 7{,}500 ft^2 * 2{,}524 * \frac{24\ hrs}{Day}$$

$$CSHG = 131{,}752{,}800\ Btu * \frac{1\ kWh}{3{,}412.14\ Btu}$$

$$CSHG = 38{,}612.95\ kWh$$

$$PWHL = 0.061\ \frac{Btu}{hr * ft^2 * °F} * 7{,}500 ft^2 * 2{,}516 * \frac{24\ hrs}{Day}$$

$$PWHL = 27{,}625{,}680 * \frac{1\ therm}{100{,}000\ Btu}$$

$$PWHL = 276.26\ therms$$

$$PSHG = 0.061\ \frac{Btu}{hr * ft^2 * °F} * 7{,}500 ft^2 * 2{,}524 * \frac{24\ hrs}{Day}$$

$$PSHG = 27{,}713{,}520\ Btu * \frac{1\ kWh}{3{,}412.14\ Btu}$$

$$PSHG = 8{,}122.03\ kWh$$

After finding the current and proposed heat losses and heat gains one can determine the *Natural Gas Savings, NGS,* and the *Electrical Consumption Savings, ECS,* the building could see by installing additional insulation.

$$NGS = CWHL - PWHL$$

$$NGS = 1313.35\ therms - 276.26\ therms$$

$$\boldsymbol{NGS = 1{,}037.09 \frac{therms}{yr}}$$

$$ECS = CSHG - PSHG$$

$$ECS = 38{,}612.95\ kWh - 8{,}122.03\ kWh$$

$$\boldsymbol{ECS = 30{,}490.92 \frac{kWh}{yr}}$$

Using these values one can then determine the *Natural Gas Cost Savings, NGCS,* and the *Electrical Consumption Cost Savings, ECCS,* by multiplying the values by the associated utility rates.

$$NGCS = NGS * \frac{\$1.6204}{therm}$$

$$NGCS = 1{,}037.09 \frac{therms}{yr} * \frac{\$1.6204}{therm}$$

$$\boldsymbol{NGCS = \frac{\$1{,}680.50}{yr}}$$

$$ECCS = ECS * \frac{\$0.1136}{kWh}$$

$$ECCS = 30{,}490.92\frac{kWh}{yr} * \frac{\$0.1136}{kWh}$$

$$\boldsymbol{ECCS = \frac{\$3,463.77}{yr}}$$

$$Total\ Cost\ Savings\ (TCS) = NGCS + ECCS$$

$$TCS = \frac{\$1{,}680.50}{yr} + \frac{\$3{,}463.77}{yr}$$

$$\boldsymbol{TCS = \frac{\$5,144.27}{yr}}$$

In addition to energy savings, there are carbon dioxide emission savings as well. The Environmental Protection Agency (EPA) reports that electrical energy in the building's region is responsible for 898.1 lbs. CO_2 / MWh. The *carbon dioxide reduction, CDR,* is calculated as:

$$CDR = \left[\left(NGS * 0.029307\frac{MWh}{Therm}\right) + \left(ECS * \frac{1\ MWh}{1{,}000kWh}\right)\right] * 898.1\ \frac{lbs\ CO_2}{MWh}$$

$$CDR = \left[\left(\frac{1{,}037.09\ Therms}{yr} * 0.029307\frac{MWh}{Therm}\right) + \left(\frac{30{,}490.92\ kWh}{yr} * \frac{1\ MWh}{1{,}000kWh}\right)\right] * 898.1\ \frac{lbs\ CO_2}{MWh}$$

$$\boldsymbol{CDR = 54{,}680.74\frac{lbs\ CO_2}{yr}}$$

Implementation Cost:

The *Implementation Cost, IC,* of this recommendation is the cost of installing the insulation. From a search of vendors the cost of R-13 Batt insulation averages around \$1.09/ft^2. The audit team will also assume that it will take one hour to install 500 ft^2 at a rate of \$60/hr. To determine the amount of insulation needed one can use the surface of the space they are insulating, 7,500ft^2.Using this surface area value the implementation cost can be found by the following equation:

$$IC = \left(Surface\ area * \frac{\$}{ft^2}\right) + \left(\frac{Surface\ Area}{500ft^2} * \frac{\$60}{hr}\right)$$

$$IC = \left(7{,}500ft^2 * \frac{\$1.09}{ft^2}\right) + \left(\frac{7{,}500ft^2}{500ft^2} * \frac{\$60}{hr}\right)$$

$$\boldsymbol{IC = \$9{,}075}$$

Internal Rate of Return (IRR) and Simple Payback Period (SPP):

The *Internal Rate of Return, IRR,* and the *Simple Payback Period, SPP*, values can be found using the following equations:

$$0 = NPV = \sum_{t=i}^{T} \frac{C_t}{(1+IRR)^t} - C_O$$

$$IRR = \sqrt[t]{\frac{C_t}{C_O}} - 1$$

Where:

NPV	= Net Positive Value
C_t	= Net Cash Inflow During Period t
C_O	= Total Initial Cost
t	= The Number of Time Periods

$$SPP = \frac{IC}{TCS}$$

For the case of this recommendation the audit team will assume a lifespan of 20 years. This would result in the following:

$$IRR = \sqrt[20]{\frac{(\$102{,}885.40)}{\$9{,}075}} - 1$$

$$\boldsymbol{IRR = 56.68\%}$$

$$SPP = \frac{\$9{,}075}{\$5{,}144.27} * \frac{12\ months}{Year}$$

$$\boldsymbol{SPP = 21.17\ months}$$

Recommendation 3: Install ERV Systems on the HVAC Systems

Est. Electrical Consumption Savings	***= 41,074.20 kWh/yr***
Est. Natural Gas Consumption Savings	***= 2,113.76 Therms/yr***
Est. Electrical Consumption Cost Savings	***= $4,666.03/yr***
Est. Natural Gas Consumption Cost Savings	***= $3,425.14/yr***
Est. Total Cost Savings	***= $8,091.17/yr***
Est. Carbon Dioxide Reduction	***= 92,524.21 lbs. CO_2/yr***
Est. Implementation Cost	***= $33,000***
Internal Rate of Return After 15 Years	***= 23.48%***
Simple Payback Period	***= 48.94 Months***

Recommended Action:

It is recommended to install energy recovery ventilation, ERV, systems on the rooftop HVAC units.

Background Information:

The energy savings of this recommendation stem from the load and runtime reduction the HVAC system(s) would experience by utilizing the ERV system(s). These systems reduce the load on the HVAC system(s) by recirculating a portion of the already conditioned air back through the HVAC system(s) instead of dumping it outside and bringing in more unconditioned air. The effectiveness of these systems tends to range between 70% and 80% depending on the model and specifications.

Currently the Lake County Courthouse has six split HVAC Systems where the natural gas furnace units are located inside the building rather than both the AC and furnace components being packaged together. Two of the furnace units are on the second floor of the courthouse, while the other four are in the basement. The AC part of the HVAC equipment are on the ground floor outside the building. From investigating the systems the audit team found that all the HVAC systems are similar if not the same size. These units are tabulated in Table 6 below. From a discussion with the County mayor the audit team will assume an operation schedule of 2,250 hrs/yr for the building. The building also pays $1.6204/Therm and $0.1136/kWh.

Table 6: HVAC Specifications

Unit	# of Units	Designed Flow (CFM)	Average Vent Flow (CFM)	Average Heating Capacity (MBtu/hr.)	Heating Efficiency (%)	Cooling Capacity (MBtu/hr.)	Rated COP/SEER
Goodman 5 Ton AC Unit	6	2,200	2,200	NA	NA	61	3.28/13
Goodman Furnace Unit	6	2,157	850	100	96	NA	NA

Anticipated Savings:

As stated above the anticipated savings of this recommendation stem from the load reduction of the HVAC system(s). To quantify this load reduction the systems are split into two separate conditions, a heating condition in the winter months and a cooling condition in the summer months. With this the weather conditions inside and outside the building must be considered for both conditions. The local weather data, TMY3 data, was collected and analyzed to determine the average outside conditions, while the inside conditions come from what the building is currently set to operate at, 75°F in the summer and 70°F in the winter. With this information, local psychometric charts were used to determine the enthalpy of both the inside and outside air. An example of the psychometric charts used is shown in Figures 7 and 8 below. All these values for both the winter and summer conditions are tabulated in Table 7 below.

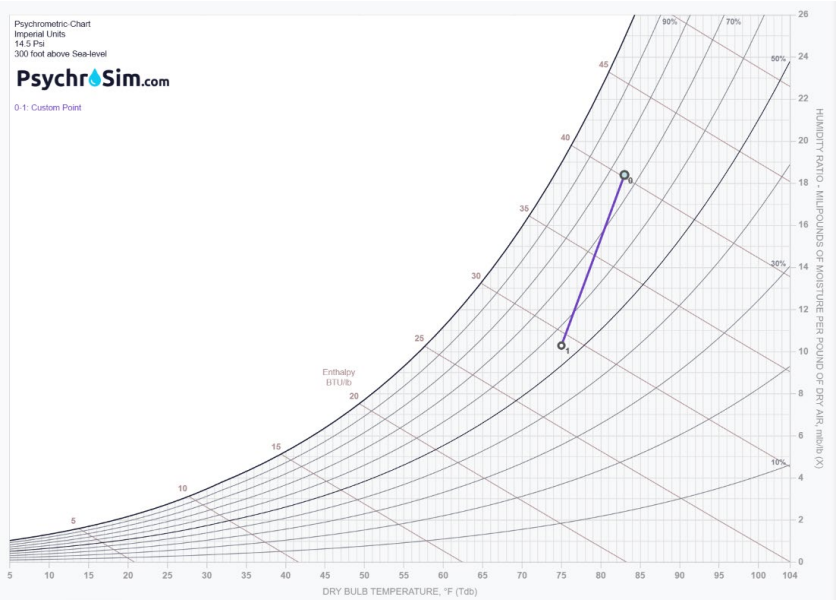


Figure 7: Cooling Process

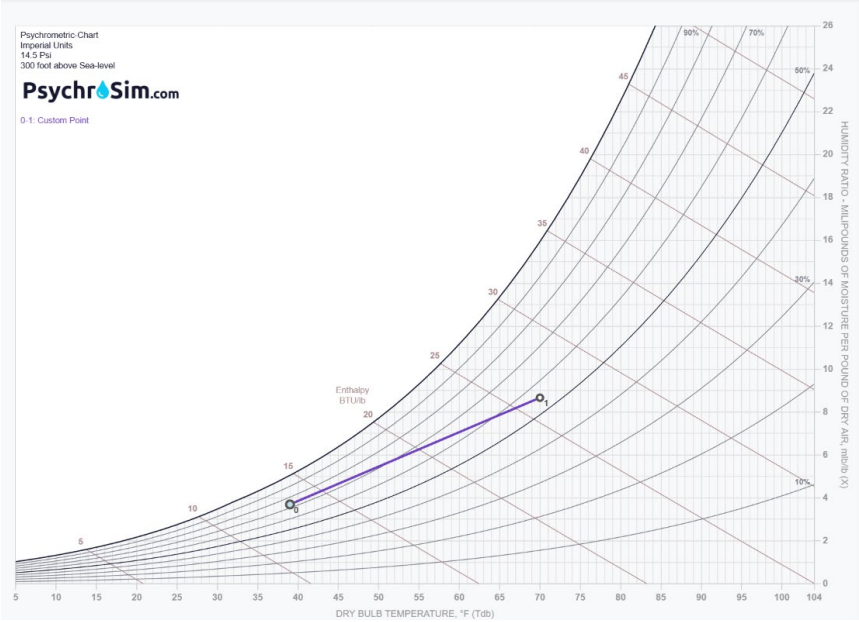


Figure 8: Heating Process

Table 7: Weather Conditions

Heating/Cooling Condition	Indoor Temperature (°F)	Indoor Enthalpy (Btu/lb.)	Average Outdoor Temperature (°F)	Outdoor Enthalpy (Btu/lb.)	Current Enthalpy Difference (Btu/lb.)	ERV Enthalpy Difference (Btu/lb.)
Heating (Winter Months)	70	26.3	39	13.4	12.90	3.87
Cooling (Summer Months)	75	29.3	83	40.1	10.86	3.24

To determine the above ERV enthalpy difference, one would need to know the ERV effectiveness, which according to many vendors and unit specifications range between 70% - 80% on average. For this recommendation the audit team will assume that the building would install ERV systems with 70% effectiveness. Using this value one can estimate the enthalpy difference that the ERV would provide.

$$Effectiveness = \frac{h_2 - h_1}{h_3 - h_1}$$

Where:

h_1 = Outside Air Enthalpy Without/Before ERV (Btu/lb.)

h_2 = Outside Enthalpy With/After ERV (Btu/lb.)

h_3 = Inside Enthalpy (Btu/lb.)

$$ERV\ Enthalpy\ Difference_{Heating} = Indoor\ Enthalpy - [ERV\ Effectiveness * (Indoor\ Enthalpy - Outdoor\ Enthalpy) + Outdoor\ Enthalpy]$$

$$ERV\ Enthalpy\ Difference_{Heating} = 26.3\frac{Btu}{lb} - \left[0.7 * \left(26.3\frac{Btu}{lb} - 13.4\frac{Btu}{lb}\right) + 13.4\frac{Btu}{lb}\right]$$

$$ERV\ Enthalpy\ Difference_{Heating} = 3.87\frac{Btu}{lb}$$

$$ERV\ Enthalpy\ Difference_{Cooling} = ABS\{Indoor\ Enthalpy - [ERV\ Effectiveness * (Indoor\ Enthalpy - Outdoor\ Enthalpy) + Outdoor\ Enthalpy]\}$$

$$ERV\ Enthalpy\ Difference_{Cooling} = ABS(29.3\frac{Btu}{lb} - \left[0.7 * \left(29.3\frac{Btu}{lb} - 40.1\frac{Btu}{lb}\right) + 40.1\frac{Btu}{lb}\right]$$

$$ERV\ Enthalpy\ Difference_{Cooling} = 3.24\frac{Btu}{lb}$$

The next step in determining the anticipated savings is to determine the current energy usage for both the heating and cooling months for each unit type. This data is tabulated in Tables 8 and 9 below.

$$Thermal\ Energy_{\ Heating}\left(\frac{Btu}{hr}\right) = \frac{4.7 * \Delta Enthalpy * Ventilation\ Flow}{Heating\ Efficiency}$$

$$Thermal\ Energy_{\ Heating}\left(\frac{Btu}{hr}\right) = \frac{4.7 * 12.90\frac{Btu}{lb} * 850\ CFM}{0.96}$$

$$Thermal\ Energy_{\ Heating}\left(\frac{Btu}{hr}\right) = 53{,}682.81\frac{Btu}{hr}$$

$$Natural\ Gass\ Usage = Thermal\ Energy_{\ Heating} * \frac{1\ Therm}{100{,}000\ Btu} * \left(Operation\ Hours * \frac{5\ Heating\ months}{12\ months}\right)$$

$$Natural\ Gass\ Usage = 53{,}682.81\frac{Btu}{hr} * \frac{1\ Therm}{100{,}000\ Btu} * \left(2{,}250\frac{hrs}{yr} * \frac{5\ Heating\ months}{12\ months}\right)$$

$$Natural\ Gas\ Usage = \frac{503.28\ Therms}{yr} per\ Furnace\ Unit$$

Table 8: Current Heating Energy Usage

Unit Type	# of Units	Thermal Energy (Btu/hr)	Natural Gas Usage Per Unit (Therms/yr)	Total Natural Gas Usage (Therms/yr)
Goodman Furnace Unit	6	53,682.81	503.28	3,019.66

$$Thermal\ Energy_{\ Cooling}\left(\frac{Btu}{hr}\right) = \frac{4.7 * \Delta Enthalpy * Ventilation\ Flow}{COP}$$

$$Thermal\ Energy_{\ Cooling}\left(\frac{Btu}{hr}\right) = \frac{4.7 * 10.86\frac{Btu}{lb} * 2{,}200\ CFM}{3.35}$$

$$Thermal\ Energy_{\ Cooling}\left(\frac{Btu}{hr}\right) = 35{,}593.90\frac{Btu}{hr}$$

$$Electrical\ Consumption = Thermal\ Energy_{\ Cooling} * \frac{0.00029307\ kWh}{1\ Btu} * \left(Operation\ Hours * \frac{5\ Cooling\ months}{12\ months}\right)$$

$$Electrical\ Consumption = 35{,}593.90\frac{Btu}{hr} * \frac{0.00029307\ kWh}{1\ Btu} * \left(2{,}250\frac{hrs}{yr} * \frac{5\ Cooling\ months}{12\ months}\right)$$

$$Electrical\ Consumption = 9{,}779.57\frac{kWh}{yr}\ per\ 5\ ton\ Goodman\ Unit$$

Table 9: Current Cooling Energy Usage

Unit Type	# of Units	Thermal Energy (Btu/hr)	Electrical Consumption Usage Per Unit (kWh/yr)	Total Electrical Consumption Usage (kWh/yr)
Goodman 5 Ton AC Unit	6	35,593.90	9,779.57	58,677.43

After calculating the current energy usage for both the heating and cooling months the same must be done for the proposed cases using the ERV systems. These calculations are the same as the current case values, but instead of using the current enthalpy difference one would use the enthalpy difference provided by the ERV system. The calculated values for the proposed cases are tabulated in Tables 10 and 11 below.

Table 10: Proposed Heating Energy Usage

Unit Type	# of Units	Thermal Energy (Btu/hr)	Natural Gas Usage Per Unit (Therms/yr)	Total Natural Gas Usage (Therms/yr)
Goodman Furnace Unit	6	16,104.84	150.98	905.90

Table 11: Current Cooling Energy Usage

Unit Type	# of Units	Thermal Energy (Btu/hr)	Electrical Consumption Usage Per Unit (kWh/yr)	Total Electrical Consumption Usage (kWh/yr)
Goodman 5 Ton AC Unit	6	10,678.17	2,933.87	17,603.23

With both the current and proposed energy usage values one can determine the estimated energy savings for both the winter and summer months. These energy savings are tabulated in Table 12 below.

$$Natural\ Gas\ Savings\ (NGS) = Current\ Natural\ Gas\ usage - Proposed\ Natural\ Gas\ Usage$$

$$Natural\ Gas\ Savings = 3{,}019.66\frac{Therms}{yr} - 905.90\frac{Therms}{yr}$$

$$Natural\ Gas\ Savings = \mathbf{2{,}113.76}\frac{\boldsymbol{Therms}}{\boldsymbol{yr}}$$

$$Natural\ Gas\ Cost\ Savings\ (NGCS) = NGS * Utility\ Rate$$

$$NGCS = 2{,}113.76 \frac{Therms}{yr} * \frac{\$1.6204}{Therm}$$

$$NGCS = \frac{\mathbf{\$3{,}425.14}}{\boldsymbol{yr}}$$

$$Electrical\ Consumption\ Savings\ (ECS) = Current\ Electrical\ Consumption - Proposed\ Electrical\ Consumption$$

$$ECS = 58{,}677.43 \frac{kWh}{yr} - 17{,}603.23 \frac{kWh}{yr}$$

$$ECS = 41{,}074.20 \frac{kWh}{yr}$$

$$Electrical\ Consumption\ Cost\ Savings\ (ECCS) = ECS * Utility\ Rate$$

$$ECCS = 41{,}074.20 \frac{kWh}{yr} * \frac{\$0.1136}{kWh}$$

$$ECCS = \frac{\mathbf{\$4{,}666.03}}{\boldsymbol{yr}}$$

Table 12: Energy Savings

Unit Type	Natural Gas Savings (Therms/yr)	Electrical Consumption Savings (kWh/yr)	Natural Gas Cost Savings	Electrical Consumption Cost Savings	Total Cost Savings
Goodman 5 Ton AC Unit	NA	41,074.20	NA	$4,666.03	$4,666.03
Goodman Furnace Unit	2,113.76	NA	$3,425.14	NA	$3,425.14
Total	**2,113.76**	**41,074.20**	**$3,425.14**	**$4,666.03**	**$8,091.17**

In addition to energy savings, there are carbon dioxide emission savings as well. The Environmental Protection Agency (EPA) reports that electrical energy in the building's region is responsible for 898.1 lbs. CO_2 / MWh. The *carbon dioxide reduction, CDR,* is calculated as:

$$CDR = \left[\left(NGS * 0.029307 \frac{MWh}{Therm}\right) + \left(ECS * \frac{1\,MWh}{1{,}000kWh}\right)\right] * 898.1\ \frac{lbs\ CO_2}{MWh}$$

$$CDR = \left[\left(\frac{2{,}113.76\,Therms}{yr} * 0.029307 \frac{MWh}{Therm}\right) + \left(41{,}074.20 \frac{kWh}{yr} * \frac{1\,MWh}{1{,}000kWh}\right)\right] * 898.1\ \frac{lbs\ CO_2}{MWh}$$

$$\boldsymbol{CDR = 82{,}524.21\ \frac{lbs\ CO_2}{yr}}$$

Implementation Cost:

The *Implementation Costs, IC,* of this recommendation stem from the cost of the ERV systems. From a search of vendors, the average cost of an ERV system ranges from $2,000 to $4,000 per rooftop unit/zone as well as a $1,500 installation cost per unit. For the sake of this recommendation the audit team will assume the building will purchase the basic ERV systems at $4,000 per system. Since the courthouse has 6 sperate HVAC units the implementation cost would result in the following:

$$IC = \frac{\$5{,}500}{ERV\ System} * \#\ of\ Needed\ ERV\ Systems$$

$$IC = \frac{\$5{,}500}{ERV\ System} * 6\ Systems$$

$$\boldsymbol{IC = 33{,}000}$$

Internal Rate of Return (IRR) and Simple Payback Period (SPP):

The *Internal Rate of Return, IRR,* and the *Simple Payback Period, SPP*, values can be found using the following equations:

$$0 = NPV = \sum_{t=i}^{T} \frac{C_t}{(1 + IRR)^t} - C_O$$

$$IRR = \sqrt[t]{\frac{C_t}{C_O}} - 1$$

Where:

NPV	= Net Positive Value
C_t	= Net Cash Inflow During Period t
C_O	= Total Initial Cost
t	= The Number of Time Periods

$$SPP = \frac{IC}{TCS}$$

For the case of this recommendation the audit team will assume a life span of 15 years. This would result in the following:

$$IRR = \sqrt[15]{\frac{(\$121{,}367.55)}{\$33{,}000}} - 1$$

$$\boldsymbol{IRR = 23.48\%}$$

$$SPP = \frac{\$33{,}000}{\frac{\$8{,}091.17}{yr}} * \frac{12\ months}{yr}$$

$$\boldsymbol{SPP = 48.94\ Months}$$

Recommendation 4: Replace Current HVAC Units with Higher Efficient Heat Pump Units

Est. Electrical Consumption Savings	= ***-18,170.08 kWh/yr***
Est. Natural Gas Savings	= ***3,019.66 Therms/yr***
Est. Electrical Consumption Cost Savings	= ***-$2,064.12/yr***
Est. Natural Gas Cost Savings	= ***$4,893.05/yr***
Est. Total Cost Savings	= ***$2,828.93/yr***
Est. Carbon Dioxide Reduction	= ***63,160.76 lbs. CO_2/yr***
Implementation Cost	= ***$36,000***
Est. Return of Investment Over 25 Years	= ***6.05%***
Simple Payback Period	= ***152.71 months***

Recommended Action:

It is recommended to replace the current HVAC units with ones utilizing heat pumps.

Background Information:

The energy savings of this recommendation mainly stem from the higher efficiency the new units have compared to the current ones. There are a few efficiency metrics that are commonly seen for HVAC systems, and these are SEER, EER, and COP, which are "Seasonal Energy Efficiency Ratio", "Energy Efficiency Ratio", and "Coefficient of Performance" respectively. Each of these metrics are a measurement of how efficient the HVAC system is in providing cooling and possibly heating to the zone(s) they are a part of. Heat pumps provide both heating and cooling through a refrigeration cycle rather than the current system that uses a furnace/burner to heat the air in the heating months and electricity to cool in the cooling months. By switching to heat pumps the building can reduce their natural gas usage, with the caveat of increasing their electrical consumption. Typically using a heat pump can provide higher efficiency than furnace/burners of gas heaters but can have some issues supplying in extreme cold temperatures.

Currently the Lake County Courthouse has six split HVAC Systems where the natural gas furnace units are located inside the building rather than both the AC and furnace components being packaged together. Two of the furnace units are on the second floor of the courthouse, while the other four are in the basement. The AC part of the HVAC equipment are on the ground floor outside the building. From investigating the systems the audit team found that all the HVAC systems are similar if not the same size. These units are tabulated in Table 13 below. From a discussion with the County mayor the audit team will assume an operation schedule of 2,250 hrs/yr for the building. The building also pays $1.6204/Therm and $0.1136/kWh.

Table 13: HVAC Specifications

Unit	# of Units	Designed Flow (CFM)	Average Vent Flow (CFM)	Average Heating Capacity (MBtu/hr.)	Heating Efficiency (%)	Cooling Capacity (MBtu/hr.)	Rated COP/SEER
Goodman 5 Ton AC Unit	6	2,200	2,200	NA	NA	61	3.28/13
Goodman Furnace Unit	6	2,157	850	100	96	NA	NA

Anticipated Savings:

As stated above the anticipated savings of this recommendation stem from the load reduction of the HVAC system(s). To quantify this load reduction the systems are split into two separate conditions, a heating condition in the winter months and a cooling condition in the summer months. With this the weather conditions inside and outside the building must be considered for both conditions. The local weather data, TMY3 data, was collected and analyzed to determine the average outside conditions, while the inside conditions come from what the building is currently set to operate at, 75°F in the summer and 70°F in the winter. With this information, local psychometric charts were used to determine the enthalpy of both the inside and outside air. An example of the psychometric charts used is shown in Figures 9 and 10 below. All these values for both the winter and summer conditions are tabulated in Table 14 below.

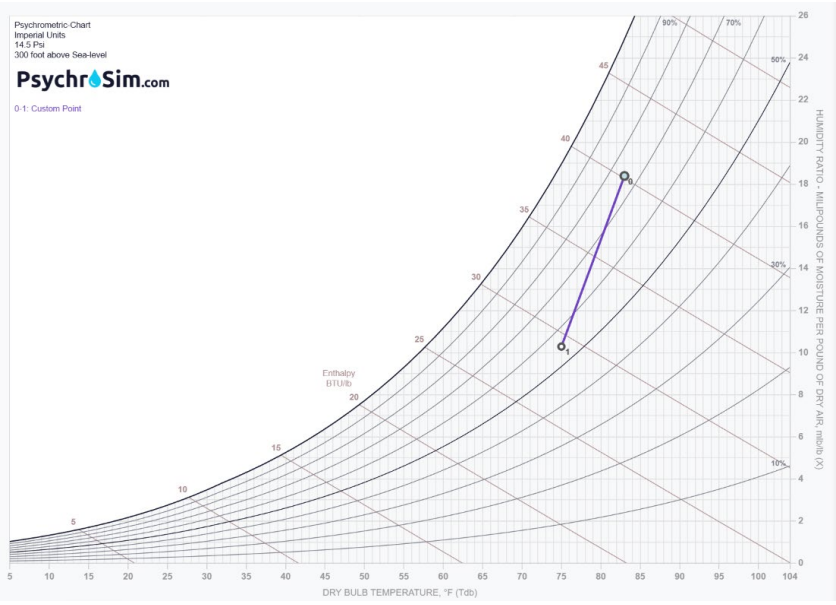


Figure 9: Cooling Process

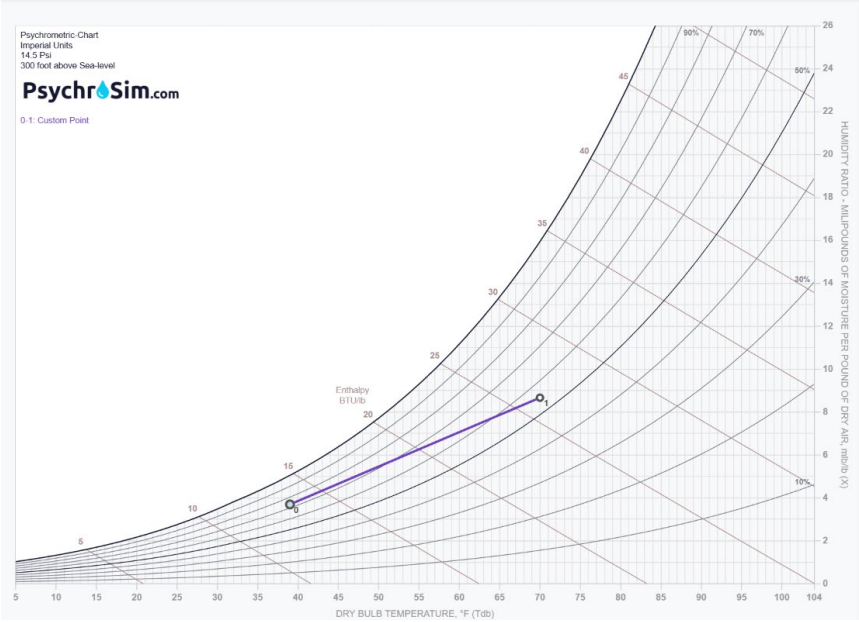


Figure 10: Heating Process

Table 14: Weather Conditions

Heating/Cooling Condition	Indoor Temperature (°F)	Indoor Enthalpy (Btu/lb.)	Average Outdoor Temperature (°F)	Outdoor Enthalpy (Btu/lb.)	Current Enthalpy Difference (Btu/lb.)	ERV Enthalpy Difference (Btu/lb.)
Heating (Winter Months)	70	26.3	39	13.4	12.90	3.87
Cooling (Summer Months)	75	29.3	83	40.1	10.86	3.24

The next step in determining the anticipated savings is to determine the current energy usage for both the heating and cooling months for each unit type. This data is tabulated in Tables 15 and 16 below.

$$Thermal\ Energy_{\ Heating}\left(\frac{Btu}{hr}\right) = \frac{4.7 * \Delta Enthalpy * Ventilation\ Flow}{Heating\ Efficiency}$$

$$Thermal\ Energy_{\ Heating}\left(\frac{Btu}{hr}\right) = \frac{4.7 * 12.90\frac{Btu}{lb} * 850\ CFM}{0.96}$$

$$Thermal\ Energy_{\ Heating}\left(\frac{Btu}{hr}\right) = 53{,}682.81\frac{Btu}{hr}$$

$$Natural\ Gass\ Usage = Thermal\ Energy_{\ Heating} * \frac{1\ Therm}{100{,}000\ Btu} * \left(Operation\ Hours * \frac{5\ Heating\ months}{12\ months}\right)$$

$$Natural\ Gass\ Usage = 53{,}682.81\frac{Btu}{hr} * \frac{1\ Therm}{100{,}000\ Btu} * \left(2{,}250\frac{hrs}{yr} * \frac{5\ Heating\ months}{12\ months}\right)$$

$$Natural\ Gas\ Usage = \frac{503.28\ Therms}{yr} per\ Furnace\ Unit$$

Table 15: Current Heating Energy Usage

Unit Type	# of Units	Thermal Energy (Btu/hr)	Natural Gas Usage Per Unit (Therms/yr)	Total Natural Gas Usage (Therms/yr)
Goodman Furnace Unit	6	53,682.81	503.28	3,019.66

$$Thermal\ Energy_{\ Cooling}\left(\frac{Btu}{hr}\right) = \frac{4.7 * \Delta Enthalpy * Ventilation\ Flow}{COP}$$

$$Thermal\ Energy_{\ Cooling}\left(\frac{Btu}{hr}\right) = \frac{4.7 * 10.86\frac{Btu}{lb} * 2{,}200\ CFM}{3.35}$$

$$Thermal\ Energy_{\ Cooling}\left(\frac{Btu}{hr}\right) = 35{,}593.90\frac{Btu}{hr}$$

$$Electrical\ Consumption = Thermal\ Energy_{\ Cooling} * \frac{0.00029307\ kWh}{1\ Btu} * \left(Operation\ Hours * \frac{5\ Cooling\ months}{12\ months}\right)$$

$$Electrical\ Consumption = 35{,}593.90\frac{Btu}{hr} * \frac{0.00029307\ kWh}{1\ Btu} * \left(2{,}250\frac{hrs}{yr} * \frac{5\ Cooling\ months}{12\ months}\right)$$

$$Electrical\ Consumption = 9{,}779.57\frac{kWh}{yr}\ per\ 5\ ton\ Goodman\ Unit$$

Table 16: Current Cooling Energy Usage

Unit Type	# of Units	Thermal Energy (Btu/hr)	Electrical Consumption Usage Per Unit (kWh/yr)	Total Electrical Consumption Usage (kWh/yr)
Goodman 5 Ton AC Unit	6	35,593.90	9,779.57	58,677.43

After calculating the current energy usage for both the heating and cooling months the same must be done for the proposed cases using the heat pump HVAC systems. These calculations are the same as the current case values, but instead of using the current COP and thermal efficiency one would use the proposed COP value as tabulated in Table 17 below.

Table 17: Current and Proposed COP

Current Tonnage	Current COP	Proposed Tonnage	Proposed COP
5	3.28	5	3.61

Using these new COP values one can use the following equations to determine the proposed heating and cooling energy consumption of the Heat pump systems.

$$Thermal\ Energy_{\ Heating}\left(\frac{Btu}{hr}\right) = \frac{4.7 * \Delta Enthalpy * Ventilation\ Flow}{COP}$$

$$Thermal\ Energy_{\ Heating}\left(\frac{Btu}{hr}\right) = \frac{4.7 * 12.90\frac{Btu}{lb} * 850\ CFM}{3.61}$$

$$Thermal\ Energy_{\ Heating}\left(\frac{Btu}{hr}\right) = 14{,}275.76\frac{Btu}{hr}$$

$$Electrical\ Consumption_{Heating} = Thermal\ Energy_{\ heating} * \frac{0.00029307\ kWh}{1\ Btu} * \left(Operation\ Hours * \frac{5\ Heating\ months}{12\ months}\right)$$

$$Electrical\ Consumption_{Heating} = 14{,}275.76\frac{Btu}{hr} * \frac{0.00029307\ kWh}{1\ Btu} * \left(2{,}250\frac{hrs}{yr} * \frac{5\ Heating\ months}{12\ months}\right)$$

$$Electrical\ Consumption_{Heating} = 3{,}922.32\frac{kWh}{yr}$$

$$Thermal\ Energy_{\ Cooling}\left(\frac{Btu}{hr}\right) = \frac{4.7 * \Delta Enthalpy * Ventilation\ Flow}{COP}$$

$$Thermal\ Energy_{\ Cooling}\left(\frac{Btu}{hr}\right) = \frac{4.7 * 10.86\frac{Btu}{lb} * 2{,}300\ CFM}{3.61}$$

$$Thermal\ Energy_{\ Cooling}\left(\frac{Btu}{hr}\right) = 32{,}340.17\frac{Btu}{hr}$$

$$Electrical\ Consumption_{Cooling} = Thermal\ Energy_{\ Cooling} * \frac{0.00029307\ kWh}{1\ Btu} * \left(Operation\ Hours * \frac{5\ Cooling\ months}{12\ months}\right)$$

$$Electrical\ Consumption_{Cooling} = 32{,}340.17\frac{Btu}{hr} * \frac{0.00029307\ kWh}{1\ Btu} * \left(2{,}250\frac{hrs}{yr} * \frac{5\ Cooling\ months}{12\ months}\right)$$

$$Electrical\ Consumption_{Cooling} = 8{,}885.59\frac{kWh}{yr}$$

The calculated values for the proposed cases are tabulated in Tables 18 and 19 below.

Table 18: Proposed Heating Energy Usage

Unit Type	# of Units	Thermal Energy (Btu/hr)	Electrical Consumption Usage Per Unit (kWh/yr)	Total Electrical Consumption Usage (kWh/yr)
Goodman Furnace Unit	6	14,275.76	3,922.32	23,533.95

Table 19: Proposed Cooling Energy Usage

Unit Type	# of Units	Thermal Energy (Btu/hr)	Electrical Consumption Usage Per Unit (kWh/yr)	Total Electrical Consumption Usage (kWh/yr)
Goodman 5 Ton AC Unit	6	32,340.17	8,885.59	53,313.57

With both the current and proposed energy usage values one can determine the estimated energy savings for both the winter and summer months. These energy savings are tabulated in Table 20 below.

$$Natural\ Gas\ Savings\ (NGS) = Current\ Natural\ Gas\ usage - Proposed\ Natural\ Gas\ Usage$$

$$NGS = 3{,}019.66\frac{Therms}{yr} - 0\frac{Therms}{yr}$$

$$NGS = \mathbf{3{,}019.66}\frac{\boldsymbol{Therms}}{\boldsymbol{yr}}$$

$$Natural\ Gas\ Cost\ Savings\ (NGCS) = NGS * Utility\ Rate$$

$$NGCS = 844.53\frac{Therms}{yr} * \frac{\$1.6204}{Therm}$$

$$NGCS = \frac{\mathbf{\$4{,}893.05}}{\boldsymbol{yr}}$$

$$Electrical\ Consumption\ Savings\ (ECS) = Current\ Electrical\ Consumption - \left(Proposed\ Electrical\ Consumption_{Cooling} + Proposed\ Electrical\ Consumption_{Heating}\right)$$

$$ECS = 58{,}677.43\frac{kWh}{yr} - \left(23{,}533.95\frac{kWh}{yr} + 53{,}313.57\frac{kWh}{yr}\right)$$

$$ECS = -\mathbf{18{,}170.08}\frac{\boldsymbol{kWh}}{\boldsymbol{yr}}$$

$$Electrical\ Consumption\ Cost\ Savings\ (ECCS) = ECS * Utility\ Rate$$

$$ECCS = -18{,}170.08\frac{kWh}{yr} * \frac{\$0.1136}{kWh}$$

$$ECCS = \frac{\mathbf{\$ - 2{,}064.12}}{\boldsymbol{yr}}$$

Table 20: Energy Savings

Unit Type	Natural Gas Savings (Therms/yr)	Electrical Consumption Savings (kWh/yr)	Natural Gas Cost Savings	Electrical Consumption Cost Savings	Total Cost Savings
Goodman 5 Ton AC Unit	NA	(18,170.08)	NA	-$2,064.12	-$2,064.12
Goodman Furnace Unit	3,019.66	NA	$4,893.05	NA	$4,893.05
Total	**3,019.66**	**(18,170.08)**	**$4,893.05**	**-$2064.12**	**$2,828.93**

In addition to energy savings, there are carbon dioxide emission savings as well. The Environmental Protection Agency (EPA) reports that electrical energy in the building's region is responsible for 898.1 lbs. CO_2 / MWh. The *carbon dioxide reduction, CDR,* is calculated as:

$$CDR = \left[\left(NGS * 0.029307 \frac{MWh}{Therm}\right) + \left(ECS * \frac{1\ MWh}{1{,}000 kWh}\right)\right] * 898.1\ \frac{lbs\ CO_2}{MWh}$$

$$CDR = \left[\left(\frac{3{,}019.66\ Therms}{yr} * 0.029307 \frac{MWh}{Therm}\right) + \left(\frac{-18{,}170.08\ kWh}{yr} * \frac{1\ MWh}{1{,}000 kWh}\right)\right] * 898.1\ \frac{lbs\ CO_2}{MWh}$$

$$\boldsymbol{CDR = 63{,}160.76\ \frac{lbs\ CO_2}{yr}}$$

Implementation Cost:

The *Implementation Costs, IC,* of this recommendation stem from the cost of the new HVAC systems. From a search of vendors, the average cost of a 5-ton heat pump HVAC unit ranges from $4,000 to $6,000 per unit. For this recommendation the audit team will assume the building will purchase high efficiency heat pump units costing $6,000 each. The implementation cost would result in the following:

$$IC = \left(\frac{\$6{,}000}{5\ ton\ HVAC\ Unit} * \#of\ 5\ ton\ Units\right)$$

$$IC = \left(\frac{\$6{,}000}{5\ ton\ HVAC\ Unit} * 6\ Units\right)$$

$$\boldsymbol{IC = \$36{,}000}$$

Internal Rate of Return (IRR) and Simple Payback Period (SPP):

The *Internal Rate of Return, IRR,* and the *Simple Payback Period, SPP*, values can be found using the following equations:

$$0 = NPV = \sum_{t=i}^{T} \frac{C_t}{(1+IRR)^t} - C_O$$

$$IRR = \sqrt[t]{\frac{C_t}{C_O}} - 1$$

Where:

NPV	= Net Positive Value
C_t	= Net Cash Inflow During Period t
C_O	= Total Initial Cost
t	= The Number of Time Periods

$$SPP = \frac{IC}{TCS}$$

For the case of this recommendation the audit team will assume a lifespan of 25 years. This would result in the following:

$$IRR = \sqrt[25]{\frac{(\$70{,}723.25)}{\$36{,}000}} - 1$$

$$\boldsymbol{IRR = 6.05\%}$$

$$SPP = \frac{\$36{,}000}{\frac{\$2{,}828.93}{yr}} * 12\frac{months}{yr} = 152.71\boldsymbol{months}$$

Recommendation 5: Install Higher Efficiency Lighting

Est. Electrical Consumption Savings	= ***1,780.48 kWh/yr***
Est. Total Cost Savings	= ***$202.27/yr***
Est. Carbon Dioxide Reduction	= ***672.5 lbs. CO_2/yr***
Est. Implementation Cost	= ***$300***
Internal Rate of Return Over 15 Years	= ***67.39%***
Simple Payback Period	= ***17.8 Months***

Recommended Action:

It is recommended to replace the old Fluorescent T8 bulbs with higher efficiency LED bulbs.

Background Information:

The energy savings of this recommendation typically comes from using a more efficient bulb compared to the current fluorescent bulbs. This means that the LEDs tend to use less power/energy to generate or produce more light. For example, most T8s tend to be around 32 Watts[3], while 4ft LEDs tend to be around 12-18 Watts[1]. LEDs also tend to have a higher light emittance level when compared to fluorescent T8s, which allows one to use less bulbs to achieve the same if a higher light level.

The Lake County Courthouse currently utilizes LEDs for the whole first floor but there were fluorescent lights in the court room other rooms on the 2nd floor of the building. The estimated runtime for the buildings is 2,080hrs./yrs. Currently the courthouse pays a utility rate of $0.1136/kWh.

Anticipated Savings:

As stated above, the energy savings for this recommendation mainly stem from switching from the less efficient fluorescent T8s to LEDs. The audit team also investigated reducing the total required number of bulbs due to the high emittance level of the LEDs compared to the fluorescent T8s.

[3] The wattage can change depending on the manufacturer and the bulb's intended use.

The first step to determine the anticipated savings is to determine the current cost of the lights in the building. This requires the current lighting count, bulb type, bulb wattage, and average operational time of the area(s). After this information is collected one can use the following equations to determine the current energy usage and subsequent cost of the lighting used in the building. For simplicity's sake only the calculations for the fluorescent T8s will be shown, but all the current lighting data is tabulated in Table 21 below.

$$Current\ Power\ Usage\ (CPU) = \frac{\#\ of\ Bulbs * Wattage\ per\ Bulb}{1{,}000}$$

$$CPU_{Courthouse.} = \frac{38\ Bulbs * \frac{32\ Watts}{Bulb}}{1{,}000}$$

$$CPU_{Courthouse} = 1.216\ kW$$

$$Total\ Current\ Power\ Usage\ (TCPU) = \sum CPU_i$$

From this value the *Current Electrical Consumption, CEC,* for the bulbs can be found by the following:

$$CEC = CPU * Current\ Operational\ Hours$$

$$CEC_{Courthouse} = 1.216kW * \frac{2{,}080\ hrs}{yr}$$

$$CEC_{Courthouse} = \frac{2{,}529.28kWh}{yr}$$

$$Total\ Current\ Electrical\ Consumption\ (TCEC) = \sum CEC_i$$

Using this total current electrical consumption value, one can multiply it by the utility rate to determine the *Current Cost, CC*, of the lights.[4]

$$CC = (TCEC * Electrical\ Consumption\ Utility\ Rate)$$

$$CC = \left(\frac{12{,}772.8\ kWh}{yr} * \frac{\$0.1136}{kWh}\right)$$

$$CC = \frac{\$287.326}{yr}$$

[4] Since the building is not billed for electrical demand, the energy and cost savings associated with it are ignored.

Table 21: Current Lighting Setup

Lighting Type	Total Bulb Count	Watts per Bulb	Operation Hours (hr./yr)	Total Energy Usage (kWh/yr)	Annual Energy Cost ($/yr)
Courthouse	38	32	2,080	2,529.28	287.33
Total	**38**	**-**	**-**	**2,529.28**	**287.33**

After the current lighting energy usage and cost has been determined the next step to finding the anticipated savings is to determine what the proposed lighting energy usage and cost. Due to the increased light emittance of the LED bulbs the audit team proposes that when replacing the fluorescent T8 bulbs, replace only 80% of the bulbs. This would mean for the proposed case that total bulb count would be reduced by ~8 T8 bulbs resulting in a total LED bulb count of 30 bulbs. The audit team also recommends installing occupancy sensor controls for some of the fixtures in the jury room. By installing these occupancy sensor controls in these low traffic areas, the audit team estimates a reduction in operational hours of ~25% - 50%. Table 22 below shows the proposed lighting setup using the same equations above.

$$Proposed\ Power\ Usage\ (PPU) = \frac{\#\ of\ Bulbs * Wattage\ per\ Bulb}{1{,}000}$$

$$PPU_{Courthouse} = \frac{30\ Bulbs * \frac{12\ W}{bulb}}{1{,}000} = 0.36\ kW$$

$$Total\ Proposed\ Power\ Usage\ (TPPU) = \sum PPU_i$$

$$Total\ Proposed\ Power\ Usage\ (TPPU) = 0.36kW$$

Similarly using these PPU values, the *Proposed Electrical Consumption, PEC,* can be found by the following:

$$PEC = PPU * Proposed\ Operaitional\ Hours$$

$$PEC_{Courthouse} = 0.36\ kW * \frac{2{,}080\ hrs}{yr} = \frac{748.8\ kWh}{yr}$$

$$Total\ Proposed\ Electrical\ Consumption\ (TPEC) = \sum PEC_i$$

$$TPEC = \frac{748.8kWh}{yr}$$

Using this total proposed electrical consumption value, one can multiply it by the utility rate to determine the *Proposed Cost, PC*, of the lights.

$$PC = (TPEC * Electrical\ Consumption\ Utility\ Rate) + (TPPU * Demand\ Utility\ Rate)$$

$$PC = \left(\frac{748.8\ kWh}{yr} * \frac{\$0.1136}{kWh}\right)$$

$$PC = \frac{\$85.06}{yr}$$

Table 22: Proposed Lighting Setup

Lighting Type	Total Bulb Count	Watts per Bulb	Operation Hours (hr./yr)	Total Energy Usage (kWh/yr)	Annual Energy Cost ($/yr)
Courthouse	30	12	2,080	748.8	85.06
Total	**30**	**-**	**-**	**748.8**	**85.06**

The next step is to compare both setups and determine the anticipated savings. This is as simple as subtracting the proposed lighting setup electrical consumption and cost values from the values of the current lighting setup using the following equations:

$$Total\ Electrical\ Consumption\ Savings\ (TECS) = TCEC - TPEC$$

$$TECS_{Courthouse} = \frac{2{,}529.28kWh}{yr} - \frac{748.8kWh}{yr} = 1{,}780.48\frac{kWh}{yr}$$

$$Electrical\ Consumption\ Cost\ Savings\ (ECCS) = ECS * Utility\ Rate =$$

$$ECCS_{Courthouse} = \frac{748.8\ kWh}{yr} * \frac{\$0.1136}{kWh} = \frac{\$85.06}{yr}$$

Total Cost Savings is the Difference between Total Current Cost and Total Proposed Cost.

$$\boldsymbol{TCS} = TCC - TPC = 287.33\frac{\$}{yr} - 85.06\frac{\$}{yr} = \frac{\boldsymbol{\$202.27}}{\boldsymbol{yr}}$$

In addition to energy savings, there are carbon dioxide emission savings as well. The Environmental Protection Agency (EPA) reports that electrical energy in the building's region is responsible for 898.1 lbs. CO_2 / MWh. The *carbon dioxide reduction, CDR,* is calculated as:

$$CDR = ECS * 898.1 \frac{lbs\ CO_2}{MWh} * \frac{1\ MWh}{1{,}000kWh}$$

$$CDR = 10645.5 \frac{kwh}{yr} * 898.1 \frac{lbs\ CO_2}{MWh} * \frac{1\ MWh}{1{,}000kWh}$$

$$\boldsymbol{CDR = 672.5 \frac{lbs\ CO_2}{yr}}$$

Implementation Cost:

The *Implementation Cost*, *IC,* of this recommendation stems from the cost of purchasing the required materials. In this case it would be for the replacement LED bulbs and some occupancy sensors. According to TVA Energy Right and other sources, when bought in bulk LED bulbs can range between $4 and $10 per bulb and $11 for an occupancy sensor. For the case of this recommendation the audit team will assume a cost of $10 per T8 LED bulb This results in the following equation:

$$IC = \left(\frac{\$}{LED\ Bulb} * \#\ of\ LEDs\ Bulbs\ Needed\right)$$

$$IC = \left(\frac{\$10}{LED\ Bulb} *\ 30 Bulbs\right)$$

$$IC = \$300$$

Internal Rate of Return (IRR) and Return on Investment (ROI):

The *Internal Rate of Return, IRR,* and the *Return On Investment, ROI*, values can be found using the following equations:

$$0 = NPV = \sum_{t=i}^{T} \frac{C_t}{(1+IRR)^t} - C_O$$

$$IRR = \sqrt[t]{\frac{C_t}{C_O}} - 1$$

Where:

NPV = Net Positive Value

C_t = Net Cash Inflow During Period t

C_O = Total Initial Cost

t = The Number of Time Periods

$$SPP = \frac{IC}{TCS}$$

For the case of this recommendation the audit team will assume a lifespan of 15 years. This would result in the following:

$$IRR = \sqrt[15]{\frac{(\$3{,}034.05)}{\$300}} - 1$$

$$\boldsymbol{IRR = 67.39\%}$$

$$SPP = \frac{\$300}{\frac{\$202.27}{yr}} * \frac{12\ months}{yr}$$

$$\boldsymbol{SPP = 17.8\ Months}$$

Recommendation 6: Reduce Infiltration Through the Windows

Est. Electrical Consumption Savings = ***177.42 kWh/yr***
Est. Natural Gas Savings = ***24.57 Therms/yr***
Est. Electrical Consumption Cost Savings = ***$39.81/yr***
Est. Natural Gas Cost Savings = ***$20.15/yr***
Est. Total Cost Savings = ***$59.96/yr***
Est. Carbon Dioxide Reduction = ***806.04 lbs. CO_2/yr***
Implementation Cost = ***$1,300***
Simple Payback Period = ***260.17 months***

Recommended Action:

It is recommended to reduce the amount of infiltration through the windows.

Background Information:

The energy savings of this recommendation stem from the load reduction that the HVAC system(s) would experience when the infiltration in and out of the building is reduced. Infiltration is the amount of unwanted outside air that is being brought into the building through cracks, gaps, and openings in the building's envelope. Having a high infiltration rate means that a large amount of unconditioned air is being brought into the building, which not only affects employee comfort, but causes the HVAC system to have an extra load placed on it to condition the space.

During the assessment the assessment team noticed that there are visible gaps in between a few exit doors at community center. Table 23 below tabulates the collected flow and sizing information from these gaps. The building currently operates with an estimated annual runtime of 2,250 hrs./yr. Currently the building pays $0.1136/kWh and $1.6204/therm.

Table 23: Gap Draft Information

Object	Qty	Gap size (ft)	Gap length(ft)	Gap Area (ft^2)	Measured FPM
window leak	10	0.0104	7	0.728	60

Anticipated Savings:

As stated above the anticipated energy savings of this recommendation come from the load reduction that the HVAC systems would experience. To do this one will first need to determine the amount of infiltration in CFM that the building experiences through these gaps. This can be done by multiplying the area of the gap by the FPM flow through the gap. Table 24 below tabulates the estimated flow through the found gaps,

$$Infiltration = Gap\ Flow * Gap\ Area$$

Table 24: Gap Flow Information

Object	Qty	Infiltration Per Item (CFM)	Total Infiltration (CFM)
windows leak	10	43.68	43.68
Total			43.68

After the amount of infiltration into the building is found, the amount of thermal energy lost to the infiltration needs to be determined. This can be done by using the weather data of the building's location and the HVAC system specification data to estimate the amount of thermal energy is wasted by having this large infiltration. As part of these calculations, the local areas' weather data over the year as well as the collected HVAC system data were collected. Since the infiltration happens across all the zones, the audit team will average the corresponding unit COP and thermal efficiencies for the affected systems.

Table 25: Weather Data

Heating/Cooling Condition	Indoor Temperature (°F)	Indoor Enthalpy (Btu/lb.)	Average Outdoor Temperature (°F)	Outdoor Enthalpy (Btu/lb.)	Current Enthalpy Difference (Btu/lb.)
Heating (Winter Months)	70	26.3	39	13.4	12.90
Cooling (Summer Months)	75	29.3	83	40.1	10.86

From these values the current amount of thermal energy the buildings use to combat the amount of infiltration it experiences can be found by using the following equations:

$$Current\ Thermal\ Energy_{\ Heating}\left(\frac{Btu}{hr}\right) = \frac{4.7 * \Delta Enthalpy * Infiltration\ Flow}{Average\ Heating\ Efficiency}$$

$$Current\ Thermal\ Energy_{\ Heating}\left(\frac{Btu}{hr}\right) = \frac{4.7 * 12.90\frac{Btu}{lb} * 43.68\ CFM}{0.96}$$

$$Current\ Thermal\ Energy_{\ Heating}\left(\frac{Btu}{hr}\right) = 2{,}758.665\frac{Btu}{hr}$$

$$Current\ Heating\ Usage\ (CHU) = Current\ Thermal\ Energy_{\ Heating} * \frac{1\ Therm}{100{,}000\ Btu} * \left(Operation\ Hours * \frac{5\ Heating\ months}{12\ months}\right)$$

$$CHU = 2{,}758.665\frac{Btu}{hr} * \frac{1\ Therm}{100{,}000\ Btu} * \left(2{,}250\frac{hrs}{yr} * \frac{5\ Heating\ months}{12\ months}\right)$$

$$CHU = 25.86\frac{Therms}{yr}$$

$$Current\ Thermal\ Energy_{\ Cooling}\left(\frac{Btu}{hr}\right) = \frac{4.7 * \Delta Enthalpy * Infiltration\ Flow}{Average\ COP}$$

$$Current\ Thermal\ Energy_{\ Cooling}\left(\frac{Btu}{hr}\right) = \frac{4.7 * 10.86\frac{Btu}{lb} * 43.68\ \ CFM}{3.28}$$

$$Current\ Thermal\ Energy_{\ Cooling}\left(\frac{Btu}{hr}\right) = 679.73\frac{Btu}{hr}$$

$$Current\ Cooling\ Electrical\ Consumption\ (CCEC) = Thermal\ Energy_{\ Cooling} * \frac{0.00029307\ kWh}{1\ Btu} * \left(Operation\ Hours * \frac{5\ Cooling\ months}{12\ months}\right)$$

$$CCEC = 679.73\frac{Btu}{hr} * \frac{0.00029307\ kWh}{1\ Btu} * \left(2{,}250\frac{hrs}{yr} * \frac{5\ Cooling\ months}{12\ months}\right)$$

$$CCEC = 186.76\frac{kWh}{yr}$$

Next the proposed load on the HVAC systems after the infiltration amount has been reduced needs to be determined. If one is very proactive, they might be able to reduce the infiltration entirely, but for this recommendation the assessment team will assume that the staff will be able to reduce the amount of infiltration by 95%. This results in the infiltration flow dropping to ~ 2.184 CFM.

$$Proposed\ Thermal\ Energy_{\ Heating}\left(\frac{Btu}{hr}\right) = \frac{4.7 * \Delta Enthalpy * Propsoed\ Infiltration\ Flow}{Average\ Heating\ Efficiency}$$

$$Propsed\ Thermal\ Energy_{\ Heating}\left(\frac{Btu}{hr}\right) = \frac{4.7 * 12.90\frac{Btu}{lb} * 2.184\ CFM}{0.96}$$

$$Proposed\ Thermal\ Energy_{\ Heating}\left(\frac{Btu}{hr}\right) = 137.933\frac{Btu}{hr}$$

$$Proposed\ Heating\ Usage\ (PHU) = Thermal\ Energy_{\ Heating} * \frac{1\ Therm}{100{,}000\ Btu} * \left(Operation\ Hours * \frac{5\ Heating\ months}{12\ months}\right)$$

$$PHU = 137.933\frac{Btu}{hr} * \frac{1\ Therm}{100{,}000\ Btu} * \left(2{,}250\frac{hrs}{yr} * \frac{5\ Heating\ months}{12\ months}\right)$$

$$PHU = 1.29\frac{Therms}{yr}$$

$$Proposed\ Thermal\ Energy_{\ Cooling}\left(\frac{Btu}{hr}\right) = \frac{4.7 * \Delta Enthalpy * Propsed\ Infiltration\ Flow}{Average\ COP}$$

$$Proposed\ Thermal\ Energy_{\ Cooling}\left(\frac{Btu}{hr}\right) = \frac{4.7 * 10.86\frac{Btu}{lb} * 2.184\ CFM}{3.28}$$

$$Propsed\ Thermal\ Energy_{\ Cooling}\left(\frac{Btu}{hr}\right) = 33.99\frac{Btu}{hr}$$

$$Proposed\ Cooling\ Electrical\ Consumption\ (PCEC)$$
$$= Propsed\ Thermal\ Energy_{\ Cooling} * \frac{0.00029307\ kWh}{1\ Btu}$$
$$* \left(Operation\ Hours * \frac{6\ Cooling\ months}{12\ months}\right)$$
$$PCEC = 33.99 \frac{Btu}{hr} * \frac{0.00029307\ kWh}{1\ Btu} * \left(2{,}250 \frac{hrs}{yr} * \frac{5\ Cooling\ months}{12\ months}\right)$$
$$PCEC = 9.34 \frac{kWh}{yr}$$

The final step in determining the energy savings is to subtract the proposed case from the current one. This is done by the following:

$$Natural\ Gas\ Savings\ (NGS) = CHEU - PHEU$$
$$NGS = 25.86\ \frac{therms}{yr} - 1.29 \frac{therms}{yr}$$
$$\boldsymbol{NGS = 24.57 \frac{therms}{yr}}$$
$$Electrical\ Consumption\ Savings\ (ECS) = (CCEC) - (PCEC)$$
$$ECS = (186.76 \frac{kWh}{yr}) - (9.34 \frac{kWh}{yr})$$
$$\boldsymbol{ECS = 177.42 \frac{kWh}{yr}}$$

The cost savings for this recommendation can be found by the following:

$$Natural\ Gas\ Cost\ Savings\ (NGCS) = NGS * \frac{\$1.6204}{therm}$$
$$NGS = 24.57 \frac{therms}{yr} * \frac{\$1.6204}{therm}$$
$$\boldsymbol{NGS = \frac{\$39.81}{yr}}$$

$$Electrical\ Consumption\ Cost\ Savings\ (ECCS) = ECS * Utility\ Rate$$

$$ECCS = 177.42 \frac{kWh}{yr} * \frac{\$0.1136}{kWh}$$

$$\boldsymbol{ECCS = \frac{\$20.15}{yr}}$$

$$Total\ Cost\ Savings\ (TCS) = NGCS + ECCS$$

$$\boldsymbol{TCS = \frac{\$59.96}{yr}}$$

In addition to energy savings, there are carbon dioxide emission savings as well. The Environmental Protection Agency (EPA) reports that electrical energy in the building's region is responsible for 898.1 lbs CO_2 / MWh. The *carbon dioxide reduction, CDR,* is calculated as:

$$CDR = \left[\left(NGS * 0.029307 \frac{MWh}{Therm}\right) + \left(ECS * \frac{1\ MWh}{1{,}000kWh}\right)\right] * 898.1\ \frac{lbs\ CO_2}{MWh}$$

$$CDR = \left[\left(\frac{24.57\ Therms}{yr} * 0.029307 \frac{MWh}{Therm}\right) + \left(\frac{177.42\ kWh}{yr} * \frac{1\ MWh}{1{,}000kWh}\right)\right] * 898.1\ \frac{lbs\ CO_2}{MWh}$$

$$\boldsymbol{CDR = 806.04 \frac{lbs\ CO_2}{yr}}$$

Implementation Cost:

The *Implementation Cost, IC,* of this recommendation stems from the cost of resealing the doors, windows, and other gaps. From a search of vendors, the cost of sealing materials can cost around $100 per window. The assessment team will also assume that it would take the maintenance staff around 0.5 hour to seal 1 window at a rate of $60 per hour. This results in the following implementation cost:

$$IC = \left(\frac{\$100}{Window} * \#\ of\ Windows\right) + \left[(\#\ of\ Windows) * \frac{0.5\ hours}{window} * \frac{\$60}{hour}\right]$$

$$IC = \$1{,}000 + \$300$$

$$\boldsymbol{IC = \$1{,}300}$$

Simple Payback Period (SPP):

$$SPP = \frac{IC}{ECCS} * \frac{12\ months}{yr}$$

$$SPP = \frac{\$1{,}300}{\frac{\$59.96}{yr}} * \frac{12\ months}{yr}$$

$$\boldsymbol{SPP = 260.17\ Months}$$

IV. Energy Management

This section provides an account of energy consumption at the facility. An essential component of any energy management program is a continuous accounting of energy use and its cost. This can best be done by keeping up-to-date records of energy use, demand, and other administrative costs. Graphs will sometimes show irregularities in energy use that should be studied. In addition, a comparison to the same month in consecutive years can give insight into equipment problems. It is necessary to graph individual and total energy use and costs. Any "spikes" should be investigated, and their cause explored. Through careful observation of trends, it may be possible to catch wasteful equipment and practices before they get out of hand. The energy usage for a typical year is graphed on the following pages. The conversion factors used to prepare the graphs are listed in the following table.

Energy Conversion Factors

Table 26: Electric Conversion Factors

Energy Unit	Energy Equivalent
1 kWh	3,412 BTU
1 therm	100,000 BTU
1 ft^3 of natural gas	970-1,030 BTU*
1 HP-hr.	2,545 BTU

* - varies by supplier

Energy Cost for Subject Facility

Table 27: Electricity Cost

Electric Charge	All kWh	$0.1136/kWh

Table 28: Natural Gas Cost

Gas Charge	All Therms	$1.6204/Therm

1. Electric Consumption, Demand, and Cost

Table 29: Electric Consumption Usage and Charges

Usage Month	Usage (kWh)	Total Usage (MMBtu)	Total Usage Charges
Jan-24	5,840.00	20	$716.66
Feb-24	5,080.00	17	$620.26
Mar-24	5,000.00	17	$597.50
Apr-24	6,560.00	22	$701.97
May-24	9,480.00	32	$967.65
Jun-24	12,280.00	42	$1,469.17
Jul-24	13,160.00	45	$1,589.73
Aug-24	12,360.00	42	$1,502.70
Sep-24	7,880.00	27	$927.24
Oct-24	6,440.00	22	$762.55
Nov-24	4,320.00	15	$560.70
Dec-24	5,240.00	18	$730.96
12 mo. Totals	93,640	320	$11,147

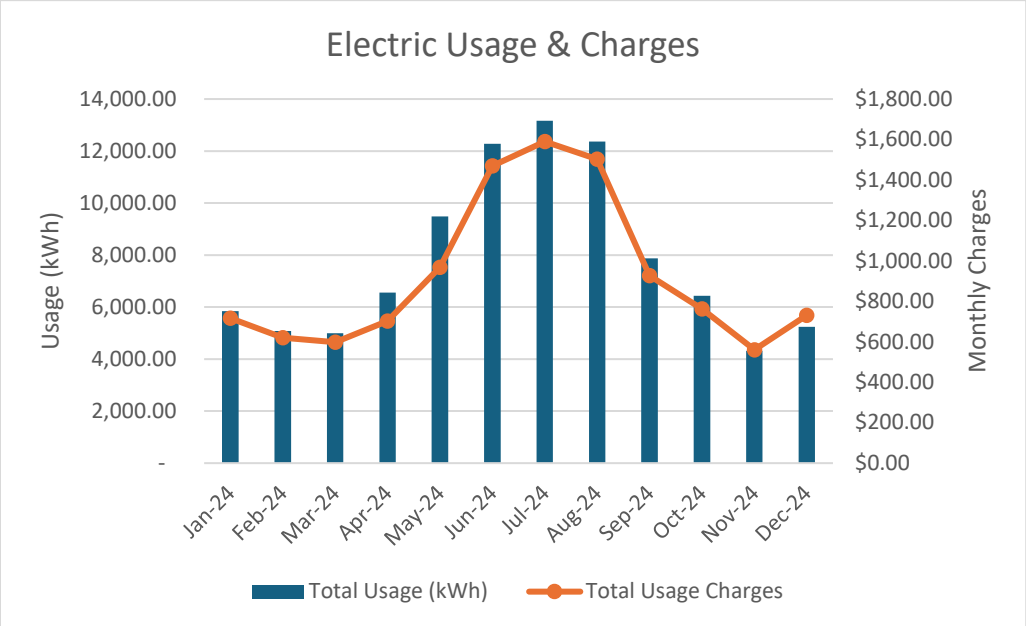


Figure 11: Electric Consumption Usage and Charges

2. Natural Gas Consumption, and Cost

Table 30: Natural Gas Consumption and Charges

Usage Month	Usage (therms)	Total Charges
Apr-24	286.00	$462
May-24	73.00	$118
Jun-24	-	$4
Jul-24	-	$4
Aug-24	-	$4
Sep-24	-	$4
Oct-24	-	$4
Nov-24	51.00	$83
Dec-24	374.00	$604
Jan-25	813.00	$1,313
Feb-25	1,294.00	$2,090
Mar-25	960.00	$1,551
Totals	**3,851**	**$6,241**

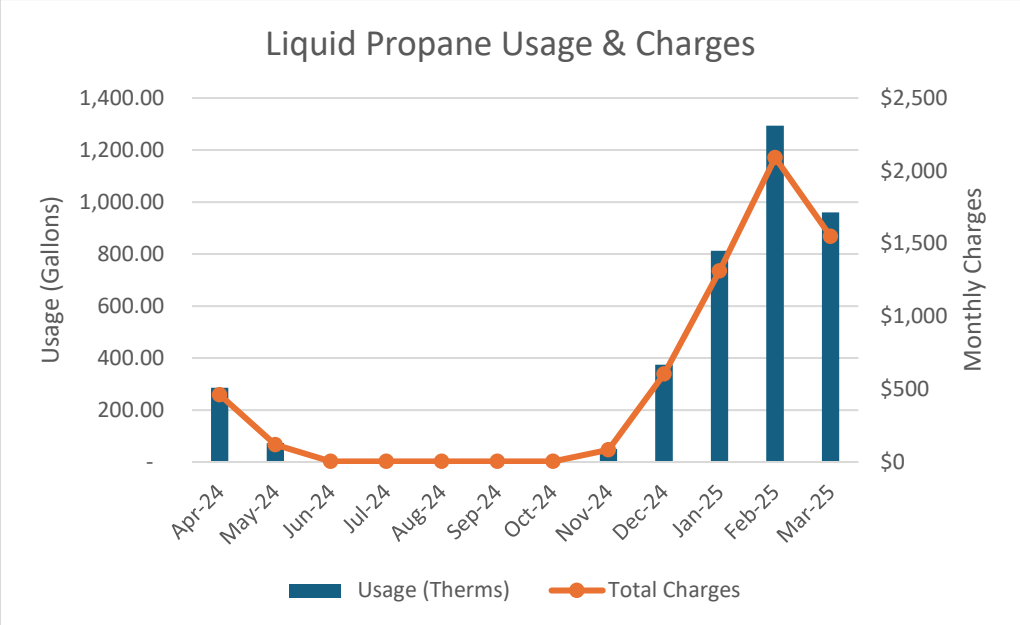


Figure 12: Natural Gas Usage & Charges

V. Additional Items

In the interest of making this report more complete, this section gives some general information about good energy management practices and presents other possible energy conservation opportunities.

Additional Recommendations:

Additional Recommendation 1: Seal the Basement

During the audit the audit team noticed that the basement area of the courthouse has many open to the environment. One example can be seen in Figure 13 below.



Figure 13: Basement Hole

Having these holes in the building envelope cause the HVAC systems to run at a higher load to supplement the amount of heat loss or gained form the ambient environment. At the moment the basement is not conditioned but these holes still cause the basement to be warmer in the summer and colder in the winter which impacts the HVAC systems as seen in Recommendation 2. These holes in the building envelope can also cause stability and health issues due to weather damage and infiltration of unwanted pests. The audit team recommends that the county address these issues as it will help with the building environment and reduce weather damage.

Additional Recommendation 2: Redesign HVAC Zones

During the audit, the county staff mentioned that multiple office spaces share thermostats and this causes some employee discomfort. It has lead to some spaces being hotter/colder than others when they share the same thermostat. The reason why this recommendation is not listed above is due to the fact there would be little to no energy savings by doing this, just an improvement in employee comfort.

Additional Recommendation 3: Address Water Leaks

The county staff explained that the offices around the exterior wall of the courthouse seem to experience water leaks during times of large rainfall, particularly through the window seams. Recommendation 1 references this and could be a potential solution to the problem. If this does not solve the issue the audit team recommends the county hire someone to investigate this issue as if untreated it can cause structural issues to the building. Depending on the severity the solution could be as simple as resealing the envelope of the building or repairing parts of the roof.

VII. Energy Financing Options

Financing energy conservation measures is often capital intensive. For a small or medium-sized business, the outlay of this capital may be the primary obstacle in implementing recommendations. However, there are a few programs available through government and the utilities provider, which assist businesses in financing energy improvements. The audit team has summarized some of these programs below; the applicability of each program to the facility may vary.

Government Tax Benefits

Energy Efficient Commercial Building Tax Deduction (§179D of federal tax code)

The Energy Act of 2005 established a new deduction for expenses incurred for energy efficient commercial building property. The deduction is equal to energy efficient commercial building property expenditures made by the taxpayer subject to a cap.

To qualify for a full deduction:

If the interior lighting, heating, cooling, ventilation, hot water systems, and building envelope have been incorporated and will reduce the total energy costs by 50% or more as compared to a reference building. Reductions in any other energy uses such as receptacles, process loads, refrigeration, cooking and elevators are **not** taken into account in determining whether the 50% reduction is achieved.

Deduction Allowed:

The Aggregate amount of improvement costs **Or** $1.80 per sq. ft of the building, whichever is less.

Partial Property Qualification:

If any of the following separate building systems can reduce total annual energy power costs by 16 2/3% as compared to a reference building

- Lighting expenditures
- Heating, Cooling, Ventilation, or Hot Water
- Energy Efficient Building Envelope

Deduction allowed:

Cost of improvements **Or**, $.60 per sq. ft of building, whichever is less.

Before a taxpayer can receive the deduction, the taxpayer must receive certification that the energy reduction has been met and retain with taxpayer's records. The certification must be completed by a qualified individual. This individual must not be related to the taxpayer and must be an engineer or contractor that is properly licensed as a professional engineer or contractor in the jurisdiction in which the building is located. The engineer must use qualified computer software to make the determination. A list of the software that is acceptable is provided on the following website:

http://www.eere.energy.gov/buildings/info/qualified_software/index.html

TVA Energy Efficiency Incentives

When qualifying industries make an investment in energy savings through TVA, they may qualify for an incentive payment that will help offset some of their investment costs. These incentives are available for projects that help reduce energy intensity in the facility. Industrial customers that are served by a participating power company or by TVA and have an electric energy efficiency project may be able to participate.

Financial assistance is available to help the plant make the transition to a more energy efficient facility. Two types of financial assistance, Standard and Custom Incentives, are available to help reduce the plant's project costs and accelerate the plant's payback. These incentives are offered through participating local power companies in partnership with TVA. Follow these simple steps to find out more:

- Contact the local power company to find out if it participates in the EnergyRight Solutions incentive program. If so, the local power company can provide more information on program details, the process for subscribing and whether the business qualifies for the efficiency incentive.
- If the plant is a Directly Served customer, contact the plant's TVA account manager.

  Go to the TVA's EnergyRight page **EnergyRight**
- Start applications for incentives at http://www.tvaenergyefficiencyincentive.com/

It is important that the plant starts to communicate with the TVA about possible projects before implementation. The plant will not have the ability to receive incentives if a pre-assessment by the TVA is not performed initially.

MEASUR Software Tools

MEASUR is a suite that includes various free to use programs and calculators. They can be used to calculate the energy usage and cost caused from systems within a building and how much energy and money would be saved from upgrading them.

More information about this software can be found here:

MEASUR

Appendix A: Energy Score Report

BUILDING ENERGY ASSET SCORE
U.S. DEPARTMENT OF ENERGY

Building Assessment Tool Report

Upgrade Opportunities

BUILDING INFORMATION

Lake County: Courthouse
229 Church Street
Tiptonville, TN 38079

Building Type:	**Courthouse**	Score Date:	**01/09/2026**
Gross Floor Area:	**19,150 ft²**	Building ID #:	**34389**
Climate Zone:	**3A**	Climate Description:	**Warm - Humid**
Year Built:	**1969**	Software Release:	1.0.0

Estimated Annual Site Energy Use Intensity and Greenhouse Gas Intensity

	Site EUI (kBtu/ft²/yr)	GHGI (kg CO_2e/ft²/yr)
Current	**60**	**6.99**
Upgraded	**32**	**3.93**

Estimated annual site energy savings: 46.67%

Energy Use Intensity by Fuel Type

Current Building: Site Energy Use (kBtu/ft²/yr)



Upgraded Building: Site Energy Use (kBtu/ft²/yr)



Fuel Type Site EUI (kBtu/ft²) [Current, Upgraded]

- Natural Gas [6.7, 0.0]
- Electricity [53.2, 31.5]
- District Hot Water [0.0, 0.0]
- District Steam [0.0, 0.0]
- Fuel Oil [0.0, 0.0]
- Propane [0.0, 0.0]
- District Chilled Water [0.0, 0.0]

Standard Occupancy and Operating Conditions

Number of Assumed Occupants	1379
Hours of Operation	49.0 hrs/wk
Cooling Set Point	75° F
Heating Set Point	70° F
Misc. Energy Loads	0.25 W/ft²

The **Building Energy Asset Score** is a national rating system developed by the U.S. Department of Energy. The **Score** reflects the energy efficiency of a building based on the building's structure, heating, cooling, ventilation, and hot water systems. The building's **Structure and Systems** are individually evaluated and ranked. The **Upgrade Opportunities** page provides recommendations for how to improve the building's energy efficiency, increase the building's Asset Score, and save money.

[3] The energy savings range reflects the expected incremental savings for the overall building associated with the specific efficiency upgrade opportunity assuming all other recommended upgrades have already been implemented. This assumption is made to avoid double counting of savings. The ranges reflect site energy savings and are based on standard operating assumptions, unless actual operating conditions are provided by the user.
[4] The costs are based on Advanced Energy Retrofit Guide and RS Means. The costs are replacement costs, not incremental costs. The costs do not include local incentives. Costs are shown as a range ($ = low cost, $$ = medium cost, $$$ = high cost).
† User-selected energy efficiency measure

U.S. DEPARTMENT OF ENERGY

Building Assessment Tool Report

Upgrade Opportunities

Building Name: **Lake County: Courthouse**

Gross Floor Area: **19,317 ft²**

Selected Upgrade Opportunities	Energy Savings [3]	Cost[4]
Building Envelope		
• Add Floor Insulation for Block in blocks Main Courthouse and Back Office space for Foundation Type 28036 - Basement.† - *Learn More*	Low	$$
• Seal Building Envelope to Reduce Air Infiltration† - *Learn More*	Low	$$
• Upgrade to High-performance Windows for Block in blocks Main Courthouse and Back Office space for Window 43410 - Metal, Double Pane.† - *Learn More*	Medium	$$-$$$
• Add Roof Insulation for Block in block Basement for Basement Roof.† - *Learn More*	Low	$-$$
Lighting Systems		
• Upgrade to LED Fixtures for Lighting Fixture in blocks Main Courthouse, Back Office space, and Basement for Fixture 2 - Fluorescent T8.† - *Learn More*	Medium	$
• Add Occupancy Sensors for Interior Lighting Control to Lighting Fixture in block for Fixture 2 - Fluorescent T8.† - *Learn More*	Low	$$
• Add Occupancy Sensors for Interior Lighting Control to Lighting Fixture in block for Fixture 2 - Fluorescent T8.† - *Learn More*	Low	$$
• Add Occupancy Sensors for Interior Lighting Control to Lighting Fixture in block for Fixture 2 - Fluorescent T8.† - *Learn More*	Low	$$
• Add Occupancy Sensors for Interior Lighting Control to Lighting Fixture in block for Fixture 1 - LED.† - *Learn More*	Low	$$
• Add Occupancy Sensors for Interior Lighting Control to Lighting Fixture in block for Fixture 1 - LED.† - *Learn More*	Low	$$
HVAC Systems and Controls		
• Add Air-Side Economizer to Air Loop in blocks Main Courthouse, Back Office space, and Basement for Air Handler for HVAC System 84113.† - *Learn More*	Medium	$$-$$$

[3] The energy savings range reflects the expected incremental savings for the overall building associated with the specific efficiency upgrade opportunity assuming all other recommended upgrades have already been implemented. This assumption is made to avoid double counting of savings. The ranges reflect site energy savings and are based on standard operating assumptions, unless actual operating conditions are provided by the user.

[4] The costs are based on Advanced Energy Retrofit Guide and RS Means. The costs are replacement costs, not incremental costs. The costs do not include local incentives. Costs are shown as a range ($ = low cost, $$ = medium cost, $$$ = high cost).

† User-selected energy efficiency measure

Building Assessment Tool Report

Upgrade Opportunities

Building Name: **Lake County: Courthouse**

Gross Floor Area: **19,317 ft²**

Selected Upgrade Opportunities	Energy Savings [3]	Cost[4]
• Add Demand Controlled Ventilation (DCV) Sensors to Air Loop in blocks Main Courthouse, Back Office space, and Basement for Air Handler for HVAC System 84113.† - *Learn More*	Medium	$$-$$$
• Add Energy Recovery Ventilation (ERV) to Air Loop in blocks Main Courthouse, Back Office space, and Basement for Air Handler for HVAC System 84113.† - *Learn More*	Medium	$$-$$$
• Implement Fan Static Pressure Reset for Air Loop in blocks Main Courthouse, Back Office space, and Basement for Air Handler for HVAC System 84113.† - *Learn More*	Medium	$$-$$$
• Implement Lower VAV Minimum Flow Setpoints for Air Loop in blocks Main Courthouse, Back Office space, and Basement for Air Handler for HVAC System 84113.† - *Learn More*	Medium	$$-$$$
• Implement Supply Air Temperature Reset on Air Loop in blocks Main Courthouse, Back Office space, and Basement for Air Handler for HVAC System 84113.† - *Learn More*	Medium	$$-$$$

Service Hot Water Systems

No opportunities identified.

[3] The energy savings range reflects the expected incremental savings for the overall building associated with the specific efficiency upgrade opportunity assuming all other recommended upgrades have already been implemented. This assumption is made to avoid double counting of savings. The ranges reflect site energy savings and are based on standard operating assumptions, unless actual operating conditions are provided by the user.
[4] The costs are based on Advanced Energy Retrofit Guide and RS Means. The costs are replacement costs, not incremental costs. The costs do not include local incentives. Costs are shown as a range ($ = low cost, $$ = medium cost, $$$ = high cost).
† User-selected energy efficiency measure

Building Assessment Tool Report

Health and Safety Impact

Building Name: **Lake County: Courthouse**

Gross Floor Area: **19,317 ft²**

Health and Safety Impact of Upgrade Opportunities

Building Envelope	Health and Safety Impact
• Add Floor Insulation for Block in blocks Main Courthouse and Back Office space for Foundation Type 28036 - Basement.†	Better insulation may improve thermal comfort. However, adding insulation can disturb existing building materials that may contain asbestos. Consult an accredited asbestos professional to determine if this is a concern.
• Seal Building Envelope to Reduce Air Infiltration†	Air sealing can improve thermal comfort by reducing cold drafts, and reduce occupant exposure to outdoor air pollutants, such as vehicle exhaust. It may also help with moisture and pest control by eliminating entry points. But with less outside air being provided by air infiltration, it is important to make sure that the building has sufficient ventilation after air sealing, such as by HVAC commissioning, otherwise indoor air quality may deteriorate.
• Upgrade to High-performance Windows for Block in blocks Main Courthouse and Back Office space for Window 43410 - Metal, Double Pane.†	Selecting windows with the appropriate heat gain and visible light transmittance can help maintain thermal comfort and improve occupant satisfaction with indoor lighting level.
• Add Roof Insulation for Block in block Basement for Basement Roof.†	Better insulation may improve thermal comfort. However, adding insulation can disturb existing building materials that may contain asbestos. Consult an accredited asbestos professional to determine if this is a concern.
Lighting Systems	
• Upgrade to LED Fixtures for Lighting Fixture in blocks Main Courthouse, Back Office space, and Basement for Fixture 2 - Fluorescent T8.†	Indoor lighting retrofit has the potential to improve lighting quality and occupant satisfaction. Retrofits that also allow occupants to have more lighting control can provide greater flexibility to adapt and respond to changing needs.
• Add Occupancy Sensors for Interior Lighting Control to Lighting Fixture in block for Fixture 2 - Fluorescent T8.†	Automated controls have the benefits that they are adjust more often than people would otherwise do manually. Lighting controls need to provide simple override for occupants to make adjustments when needed.
• Add Occupancy Sensors for Interior Lighting Control to Lighting Fixture in block for Fixture 2 - Fluorescent T8.†	Automated controls have the benefits that they are adjust more often than people would otherwise do manually. Lighting controls need to provide simple override for occupants to make adjustments when needed.

Building Assessment Tool Report

Health and Safety Impact

Building Name: **Lake County: Courthouse**

Gross Floor Area: **19,317 ft²**

Health and Safety Impact of Upgrade Opportunities

• Add Occupancy Sensors for Interior Lighting Control to Lighting Fixture in block for Fixture 2 - Fluorescent T8.†	Automated controls have the benefits that they are adjust more often than people would otherwise do manually. Lighting controls need to provide simple override for occupants to make adjustments when needed.
• Add Occupancy Sensors for Interior Lighting Control to Lighting Fixture in block for Fixture 1 - LED.†	Automated controls have the benefits that they are adjust more often than people would otherwise do manually. Lighting controls need to provide simple override for occupants to make adjustments when needed.
• Add Occupancy Sensors for Interior Lighting Control to Lighting Fixture in block for Fixture 1 - LED.†	Automated controls have the benefits that they are adjust more often than people would otherwise do manually. Lighting controls need to provide simple override for occupants to make adjustments when needed.

HVAC Systems and Controls

• Add Air-Side Economizer to Air Loop in blocks Main Courthouse, Back Office space, and Basement for Air Handler for HVAC System 84113.†	Adding an economizer will increase outside air and can improve indoor air quality. In offices and schools, studies found that more outside air can reduce building-related symptoms and improves work performance and learning. Increasing ventilation can also mean more outdoor air pollutants may be brought indoors, such as vehicle exhausts if the outside air intake is near an area with significant traffic. It is therefore even more important to use high efficiency air filters, such as MERV 13 or better, to removal particulate matter (PM).
• Add Demand Controlled Ventilation (DCV) Sensors to Air Loop in blocks Main Courthouse, Back Office space, and Basement for Air Handler for HVAC System 84113.†	For DCV with zone level CO2 sensors, the control system can reduce the risk of having insufficient outside air ventilation when the space is occupied. Adequate ventilation is important for occupant health, work performance and learning. Adequate ventilation is also important for reducing building-related symptoms and mitigating infectious disease airborne transmission risks. For proper functioning of DCV, it is important that CO2 sensors are calibrated regularly.
• Add Energy Recovery Ventilation (ERV) to Air Loop in blocks Main Courthouse, Back Office space, and Basement for Air Handler for HVAC System 84113.†	This measure is not expected to directly impact occupant health and safety. Follow commissioning, operation and maintenance, and performance monitoring best practices to enable efficient operation and outside air ventilation requirements are met.
• Implement Fan Static Pressure Reset for Air Loop in blocks Main Courthouse, Back Office space, and Basement for Air Handler for HVAC System 84113.†	Adjustment of HVAC system control can affect thermal comfort. Monitor indoor temperature, relative humidity, and supply air flow, or conduct occupancy survey, to check for potential impact.

Building Assessment Tool Report

Health and Safety Impact

Building Name: **Lake County: Courthouse**

Gross Floor Area: **19,317 ft²**

Health and Safety Impact of Upgrade Opportunities

• Implement Lower VAV Minimum Flow Setpoints for Air Loop in blocks Main Courthouse, Back Office space, and Basement for Air Handler for HVAC System 84113.†	Lowering VAV box minimum flow setpoints can improve thermal comfort by avoiding overcooling in summer and overheating during the winter. However, this may impact the outside air ventilation rate. Therefore, increase attention is needed to make sure that adequate outside air ventilation rate is provided to maintain indoor air quality.
• Implement Supply Air Temperature Reset on Air Loop in blocks Main Courthouse, Back Office space, and Basement for Air Handler for HVAC System 84113.†	Adjustment of HVAC system control can affect thermal comfort. Monitor indoor temperature, relative humidity, and supply air flow, or conduct occupancy survey, to check for potential impact.

Service Hot Water Systems

No opportunities identified.

Building Assessment Tool Report

Structures and Systems

Building Name: **Lake County: Courthouse**

Gross Floor Area: **19,317 ft²**

ABOUT THE BUILDING SYSTEMS

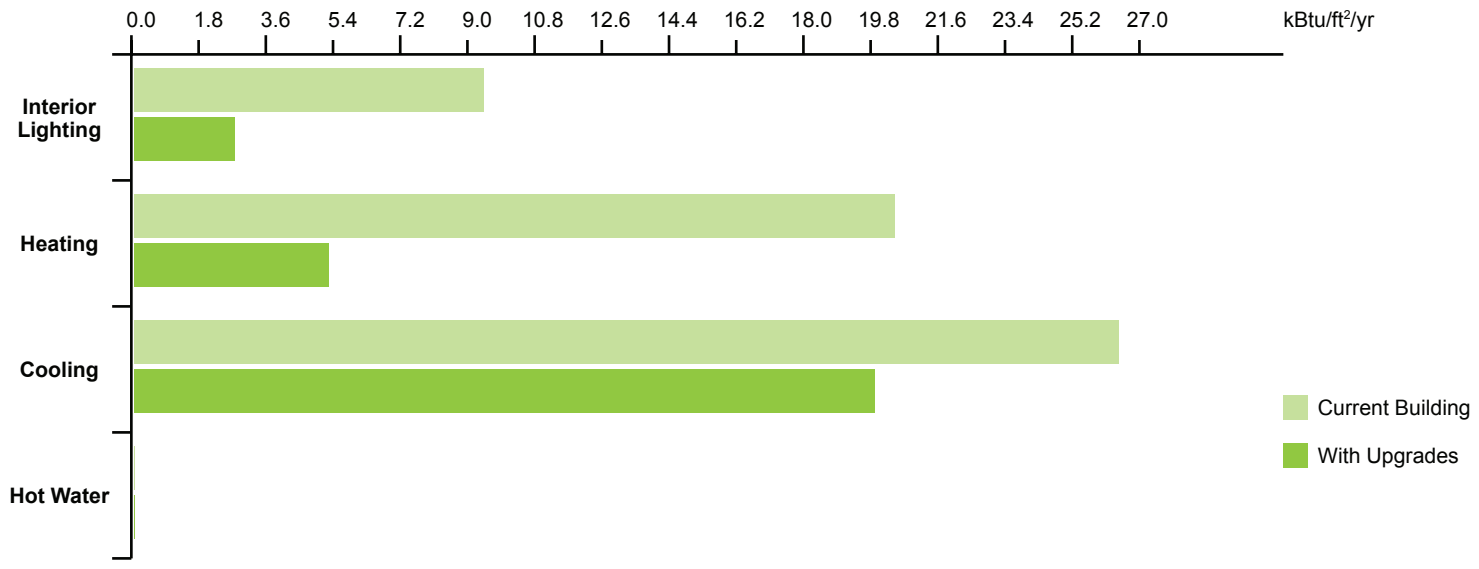
	Ranking[5]
Interior Lighting	Good
Whole Building HVAC System TSPR	Good
Air Handler for HVAC System 84113	Good

ABOUT THE BUILDING ENVELOPE

	Ranking[5]
Roof U-Value, Non-Attic (Btu/ft²·h·°F)	Good
Walls U-Value, Framed (Btu/ft²·h·°F)	Fair
Windows U-Value (Btu/ft²·h·°F)	Fair
Walls + Windows U-Value (Btu/ft²·h·°F)	Fair
Window Solar Heat Gain Coefficient	Fair

*System evaluation is not based on a verified TSPR

SITE ENERGY USE INTENSITY BY END USE



[5] Ranking Range:
Fair: Building Envelope or Building Systems are less efficient than a typical building built to the AHSRAE 90.1-2004 energy code.
Superior: Building Envelope is more efficient than a typical building built to the AHSRAE 90.1-2013 energy code. Building Systems exceed the highest efficiency levels with market viable technologies.
Good: Building Envelope or Building Systems are between Fair and Superior.
N/A: The building does not have a heating or a cooling system, or the loads are too low for the system to be effectively ranked.

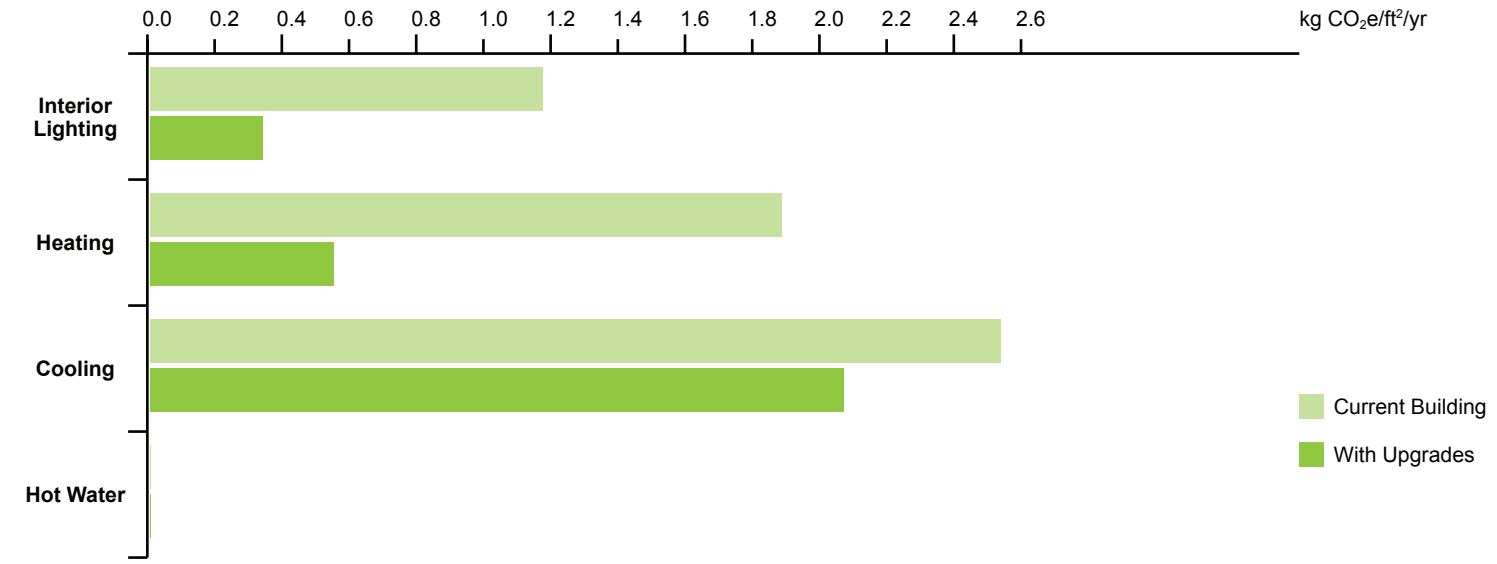
Building Assessment Tool Report

Structures and Systems

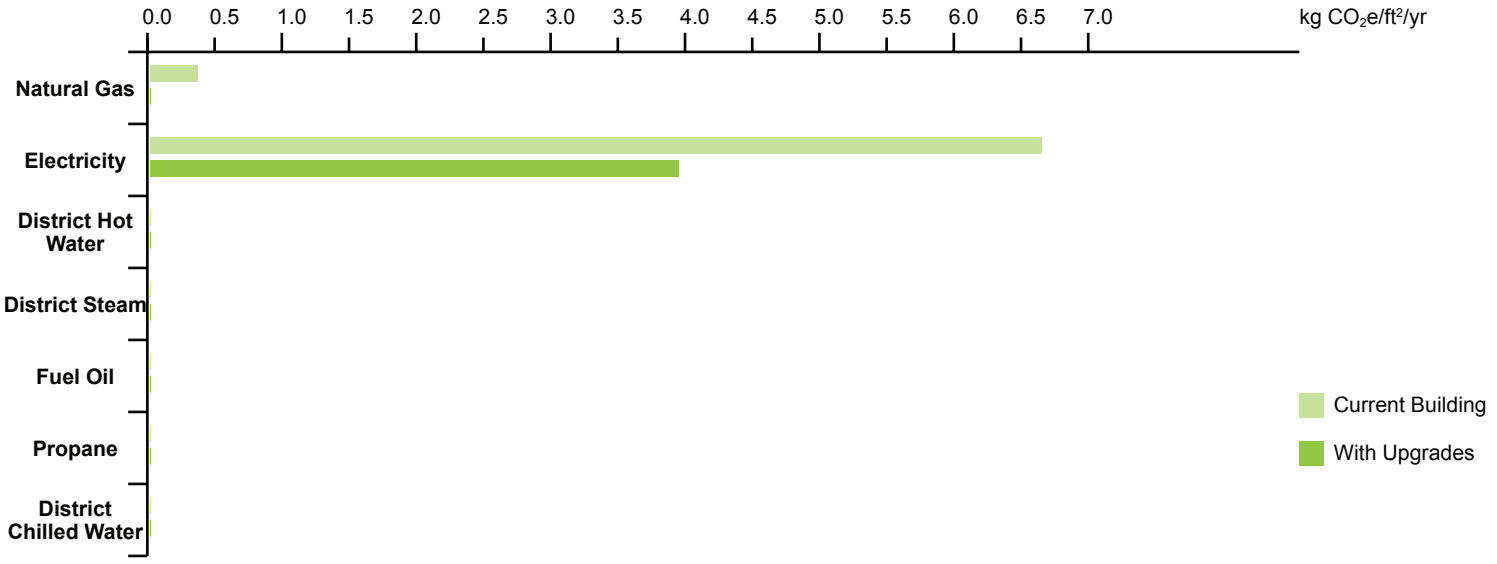
Building Name: **Lake County: Courthouse**

Gross Floor Area: **19,317 ft²**

CARBON EMISSIONS BY END USE[6]



CARBON EMISSIONS BY FUEL TYPE[6]



[6] Carbon dioxide equivalent (CO_2e) greenhouse gas annual emission rates are calculated by multiplying theannual energy use rates for each end use and fuel type by emission factors that are specific to each fuel typeand then by dividing by the total floor area for the affected blocks. The emission factors for electricity areprovided by U.S. EPA Power Profiler v9.1 and are specific to the eGRID subregions that are assigned to the ZIPcode for the building. The emissions factors for electricity do not include gross grid loss (line loss).

Building Assessment Tool Report

Building Asset Information

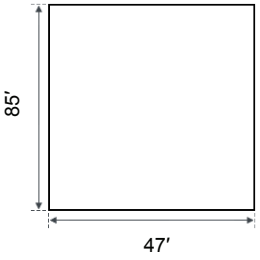
Building Name: **Lake County: Courthouse**

Gross Floor Area: **19,317 ft²**

Main Courthouse CHARACTERISTICS SUMMARY

Geometry

Above Ground:	2 floors
Below Ground:	0 floors
Floor-to-Floor Height	12.00 ft
Floor-to-Ceiling Height:	9.00 ft
Orientation:	0.0° from North
Use Type:	Courthouse



Current Building

Roof

Roof	Roof 38511 - Built-Up with Wood Deck
Roof Type	Built-up w/ wood deck
Roof R-Value	15.0 °F·ft²·h/Btu
Cool Roof	

Skylights

No Skylights

Floor

Floor	Foundation Type 28036 - Basement
Floor Type	Wood Framed
Floor U-value	0.28 Btu/°F·ft²·h

Walls and Windows

All Surfaces

Wall	Above Grade Floors - Wall 37846 - Brick/Stone on Masonry
Wall Type	Brick/Stone on masonry
Wall R-value	15.0 °F·ft²·h/Btu
Window	Window 43410 - Metal, Double Pane
Window Framing Type	Metal
Window Glass Type	Double Pane
Window Gas Fill Type	Default***
Window U-value	Estimated*

Current Building

Window SHGC	Estimated*
Window VT	Estimated*
Window Layout	Continuous
Window-to-Wall Ratio	0.35
Exterior Shading Type	No Shading

Infiltration

Energy code the building complies with	Estimated*

Lighting

Lighting Power Density	0.79 W/ft²
Fixture	Fixture 1 - LED
Lighting Type	LED
Mounting Type	Recessed
Lamp Wattage	12 W/lamp
Lamps per Fixture	4
Percent Served	90.0%
Fixture	Fixture 2 - Fluorescent T8
Lighting Type	Fluorescent T8
Mounting Type	Recessed
Lamp Wattage	32 W/lamp
Lamps per Fixture	4
Percent Served	10.0%

Heating/Cooling

Thermal Zone Layout	Estimated*
Perimeter Zone Depth	15 ft
Primary Heating/Cooling System	Air Handler for HVAC System 84113
System Type	Pkgd AC
Cooling Equipment	
Cooling Source	Central DX
# Pieces of Equipment	1

Notes:
[1] 'Total Gross Wall Area' includes both opaque and glazed wall area.
[2] Window includes all vertical fenestration, including curtainwall and storefront.
[3] Total Gross Roof Area' includes both opaque and glazed roof area.

Building Assessment Tool Report

Building Asset Information

Building Name: **Lake County: Courthouse**

Gross Floor Area: **19,317 ft²**

	Current Building
Efficiency	3.65 COP
Capacity	5.00 tons
Heating Equipment	
Heating Source	Central Furnace
Fuel Type	Natural Gas
# Pieces of Equipment	1
Thermal Efficiency	89.26%
Capacity	100.00 kBtu/hr
Distribution	
Distribution Type	Multiple Zone
Terminal	
Terminal Unit	Reheat
Reheat Source	Electric Resistance
Minimum Air Flow Fraction	0.4
Fan Systems	
Fan Control	Variable Air Volume
Supply Air Temperature (SAT) Reset	None

Service Water Heating

No Water Heater

Operations

Operation	Using Standard Operations**

Notes:
[1] 'Total Gross Wall Area' includes both opaque and glazed wall area.
[2] Window includes all vertical fenestration, including curtainwall and storefront.
[3] Total Gross Roof Area' includes both opaque and glazed roof area.

Building Assessment Tool Report

Building Asset Information

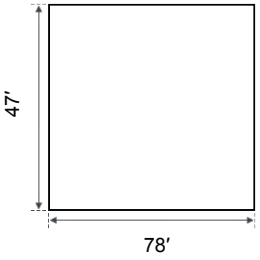
Building Name: **Lake County: Courthouse**

Gross Floor Area: **19,317 ft²**

Back Office space CHARACTERISTICS SUMMARY

Geometry

Above Ground:	1 floor
Below Ground:	0 floors
Floor-to-Floor Height	12.00 ft
Floor-to-Ceiling Height:	9.00 ft
Orientation:	0.0° from North
Use Type:	Courthouse



Current Building

Roof

Roof	Roof 38511 - Built-Up with Wood Deck
Roof Type	Built-up w/ wood deck
Roof R-Value	15.0 °F·ft²·h/Btu
Cool Roof	

Skylights

No Skylights

Floor

Floor	Foundation Type 28036 - Basement
Floor Type	Wood Framed
Floor U-value	0.28 Btu/°F·ft²·h

Walls and Windows

All Surfaces

Wall	Above Grade Floors - Wall 37846 - Brick/Stone on Masonry
Wall Type	Brick/Stone on masonry
Wall R-value	15.0 °F·ft²·h/Btu
Window	Window 43410 - Metal, Double Pane
Window Framing Type	Metal
Window Glass Type	Double Pane
Window Gas Fill Type	Default***
Window U-value	Estimated*

Current Building

Window SHGC	Estimated*
Window VT	Estimated*
Window Layout	Continuous
Window-to-Wall Ratio	0.35
Exterior Shading Type	No Shading

Infiltration

Energy code the building complies with	Estimated*

Lighting

Lighting Power Density	0.81 W/ft²
Fixture	Fixture 1 - LED
Lighting Type	LED
Mounting Type	Recessed
Lamp Wattage	12 W/lamp
Lamps per Fixture	4
Percent Served	90.0%
Fixture	Fixture 2 - Fluorescent T8
Lighting Type	Fluorescent T8
Mounting Type	Recessed
Lamp Wattage	32 W/lamp
Lamps per Fixture	4
Percent Served	10.0%

Heating/Cooling

Thermal Zone Layout	Estimated*
Perimeter Zone Depth	15 ft
Primary Heating/Cooling System	Air Handler for HVAC System 84113
System Type	Pkgd AC
Cooling Equipment	
Cooling Source	Central DX
# Pieces of Equipment	1

Notes:
[1] 'Total Gross Wall Area' includes both opaque and glazed wall area.
[2] Window includes all vertical fenestration, including curtainwall and storefront.
[3] Total Gross Roof Area' includes both opaque and glazed roof area.

Building Assessment Tool Report

Building Asset Information

Building Name: **Lake County: Courthouse**

Gross Floor Area: **19,317 ft²**

	Current Building
Efficiency	3.65 COP
Capacity	5.00 tons
Heating Equipment	
Heating Source	Central Furnace
Fuel Type	Natural Gas
# Pieces of Equipment	1
Thermal Efficiency	89.26%
Capacity	100.00 kBtu/hr
Distribution	
Distribution Type	Multiple Zone
Terminal	
Terminal Unit	Reheat
Reheat Source	Electric Resistance
Minimum Air Flow Fraction	0.4
Fan Systems	
Fan Control	Variable Air Volume
Supply Air Temperature (SAT) Reset	None

Service Water Heating

No Water Heater

Operations

Operation	Using Standard Operations**

Notes:
[1] 'Total Gross Wall Area' includes both opaque and glazed wall area.
[2] Window includes all vertical fenestration, including curtainwall and storefront.
[3] Total Gross Roof Area' includes both opaque and glazed roof area.

Building Assessment Tool Report

Building Asset Information

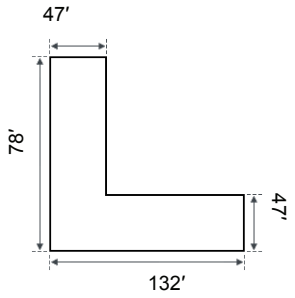
Building Name: **Lake County: Courthouse**

Gross Floor Area: **19,317 ft²**

Basement CHARACTERISTICS SUMMARY

Geometry

Above Ground:	0 floors
Below Ground:	1 floor
Floor-to-Floor Height	12.00 ft
Floor-to-Ceiling Height:	9.00 ft
Orientation:	270.0° from North
Use Type:	Courthouse



Current Building

Roof

Roof	Basement Roof
Roof Type	Built-up w/ wood deck
Roof R-Value	3.45 °F·ft²·h/Btu

Skylights

No Skylights

Floor

Floor	Foundation Type 28037 - Slab-On-Grade
Floor Type	Slab-on-Grade
Slab Insulation	Fully Insulated Slab
Floor R-value	10.0 °F·ft²·h/Btu

Walls and Windows

All Surfaces

Wall	Below Grade Floors - Wall 37846 - Brick/Stone on Masonry
Wall Type	Brick/Stone on masonry - Below Grade Walls
Intended Occupancy Type	Non-Residential

No Windows

Infiltration

Energy code the building complies with	Estimated*

Current Building

Lighting

Lighting Power Density	1.14 W/ft²
Fixture	Fixture 2 - Fluorescent T8
Lighting Type	Fluorescent T8
Mounting Type	Recessed
Lamp Wattage	32 W/lamp
Lamps per Fixture	4
Percent Served	100.0%

Heating/Cooling

Thermal Zone Layout	Estimated*
Perimeter Zone Depth	15 ft
Primary Heating/Cooling System	Air Handler for HVAC System 84113
System Type	Pkgd AC
Cooling Equipment	
Cooling Source	Central DX
# Pieces of Equipment	1
Efficiency	3.65 COP
Capacity	5.00 tons
Heating Equipment	
Heating Source	Central Furnace
Fuel Type	Natural Gas
# Pieces of Equipment	1
Thermal Efficiency	89.26%
Capacity	100.00 kBtu/hr
Distribution	
Distribution Type	Multiple Zone
Terminal	
Terminal Unit	Reheat
Reheat Source	Electric Resistance
Minimum Air Flow Fraction	0.4

Notes:
[1] 'Total Gross Wall Area' includes both opaque and glazed wall area.
[2] Window includes all vertical fenestration, including curtainwall and storefront.
[3] Total Gross Roof Area' includes both opaque and glazed roof area.

Building Asset Information

Building Name: **Lake County: Courthouse**

Gross Floor Area: **19,317 ft²**

	Current Building
Fan Systems	
Fan Control	Variable Air Volume
Supply Air Temperature (SAT) Reset	None

Service Water Heating

No Water Heater

Operations

Operation	Using Standard Operations**

Notes:
[1] 'Total Gross Wall Area' includes both opaque and glazed wall area.
[2] Window includes all vertical fenestration, including curtainwall and storefront.
[3] Total Gross Roof Area' includes both opaque and glazed roof area.

Building Assessment Tool Report

Building Asset Information

Building Name: **Lake County: Courthouse**

Gross Floor Area: **19,317 ft²**

BUILDING ENVELOPE INFORMATION

Total Gross Above Grade Wall Area [1]	8208.0 ft²
Total Window Area [2]	2873.0 ft²
Building Window to Wall Ratio	35%
Total Below Grade Wall Area	5040.0 ft²
Total Gross Roof Area [3]	7661.0 ft²
Total Skylight Area	0.0 ft²
Total Conditioned Floor Area	Not Available
Total Footprint Area	Not Available

Areas by Orientation

NORTH	
Gross Wall Area	1500.0 ft²
Window Area	525.0 ft²
SOUTH	
Gross Wall Area	1500.0 ft²
Window Area	525.0 ft²
EAST	
Gross Wall Area	2604.0 ft²
Window Area	911.4 ft²
WEST	
Gross Wall Area	2604.0 ft²
Window Area	911.4 ft²

Notes:
[1] 'Total Gross Wall Area' includes both opaque and glazed wall area.
[2] Window includes all vertical fenestration, including curtainwall and storefront.
[3] Total Gross Roof Area' includes both opaque and glazed roof area.

Building Name: **Lake County: Courthouse**

Gross Floor Area: **19,317 ft²**

SOFTWARE PROVENANCE

Asset Score/Audit Template	Version: 1.0.0 Build: build
Asset Score Open Studio Web Service	4.0.0
EnergyPlus	23.2
OpenStudio	3.7.0

Appendix B: Audit Template Report

BUILDING ENERGY AUDIT TEMPLATE
U.S. DEPARTMENT OF ENERGY

OVERVIEW

BUILDING INFORMATION

Lake County: Courthouse
229 Church Street
Tiptonville, TN 38079

Report Type	**EE-RLF Template**	Report Status:	**In Progress**
Building Type:	**Commercial**	Report Date:	**01/09/2026**
Gross Floor Area:	**19,150.0 ft²**	Year Built:	**1904**
Building ID #:	**47678**	Software Release:	1.0.0

AUDIT TEAM

Not provided

DATA SUMMARY

This report was generated from data entered into the Audit Template tool, developed by the Pacific Northwest National Laboratory (PNNL) for the U.S. Department of Energy (DOE). Audit Template is a national standardized tool for building energy audit data collection and reporting.

This report follows the ANSI/ASHRAE/ACCA Standard 211-2018, Standard for Commercial Building Energy Audits. It also includes additional data fields required by specific cities, where applicable. The icons below identify data categories.

- ASHRAE inputs
- City-specific inputs

If this report is used to comply with a local energy audit ordinance, the fields marked with * indicate the minimum data to be reported. The audit team listed above is responsible for any information entered and reported through Audit Template. DOE and PNNL do not warranty data accuracy, completeness, legality, and reliability.

CONTACT INFORMATION AND AUDIT DETAILS

Building Name: **Lake County: Courthouse**

Submission Information

Date of Submission*	Never
Submission Version*	None

Audit Details

Date of Completion for Level 1 Audit	
Date of Completion for Level 2 Audit	12/09/2025
Date of Completion for Level 3 Audit	
Year of Last Renovation	
Year of Prior Energy Audit	
Year Last Commissioned	
Additional Comments	

Audit Team and Building Staff

Auditor

- Name*
- Company Name or Organization
- Title
- Street Address
- City
- State
- Postal Code
- Phone
- Email
- Auditor's Years of Experience

Building Owner

- Name*
- Company Name or Organization
- Title
- Street Address
- City
- State
- Postal Code
- Phone

CONTACT INFORMATION AND AUDIT DETAILS

Building Name: **Lake County: Courthouse**

- Email
  Additional Comments

FACILITY DESCRIPTION

Building Name: **Lake County: Courthouse**

Building Characteristics

Gross Floor Area*	19150.0 ft^2
Spaces Excluded from Gross Floor Area	
Conditioned Floor Area, Heated Only	
Conditioned Floor Area, Cooled Only	
Conditioned Floor Area, Heated and Cooled	11700.0 ft^2
Total Conditioned Floor Area	11700.0 ft^2
Number of Floors Above-Grade, Conditioned	2
Number of Floors Below-Grade, Conditioned	0
General Building Shape	L Shape
Building Automation System?	No
Historic Building?	No
Comfort or health concerns, including indoor environmental quality (IEQ) deficiencies	No
Comfort or health concerns comments	
N/A Comments*	

Use Types

Courthouse (Original: Courthouse)

Use Type / Space Function / Building Area Type*	Courthouse
Original Intended Use	Courthouse
Gross Floor Area*	19150.0 ft^2
Percentage of Space Conditioned	61.0 %
Number of Occupants	50
Use (hours/week)	45.0 hours/week
Use (weeks/year)	50.0 weeks/year
Approximate Plug Loads	0.35 W/ft^2
Number of Dwelling Units	
Percentage of Dwelling Units Currently Occupied	
Principal HVAC Type	Other
Principal Lighting Type	LED

Roofs

FACILITY DESCRIPTION

Building Name: **Lake County: Courthouse**

Roof 38511 - Built-Up with Wood Deck

Roof Construction	Built-Up with Wood Deck
Roof R Value	16.0 °F.ft^2.h/Btu
Roof Condition	Average
Cool Roof	Yes
Green Roof	No
Blue Roof	No
Roof Area	7500.0 ft^2

Walls

Wall 37846 - Brick/Stone on Masonry

Wall Construction	Brick/Stone on Masonry
Above Grade Wall Insulation R Value	16.65 °F·ft2·h/Btu
Below Grade Wall Insulation R Value	3.5 °F·ft2·h/Btu
Total Exposed Above Grade Wall Area	9840.0 ft^2
Below Grade Wall Area	6000.0 ft^2
Above Grade Demising Wall Area	
Overall Enclosure Tightness Assessment	2 (bad = higher rate of infiltration/exfiltration)
Type of Exterior Door Construction	Insulated metal

Windows

Window 43410 - Metal, Double Pane

Framing Material	Metal
Window Glass Type	Double Pane
Fenestration Seal Condition	2 (bad = higher rate of infiltration/exfiltration)
Window Wall Ratio	0.4

Foundation Types

Foundation Type 28036 - Basement

Floor Construction Type	Basement
Ventilated Crawlspace	No
R Value	3.45 °F·ft2·h/Btu

FACILITY DESCRIPTION

Building Name: **Lake County: Courthouse**

Foundation Type 28037 - Slab-On-Grade

Floor Construction Type	Slab-On-Grade
Ventilated Crawlspace	No
R Value	10.0 °F·ft2·h/Btu

Exterior Floors

None given

Lighting

Fixture Locations

Fixture (^^^); *	**Location**	**Quantity Definition**	**Area Served (%)**	**Area Served (ft²)**
Fixture 1: LED; ^^^2	Courthouse (Original: Courthouse)	% Area Served	95.0	0.0
Fixture 2: Fluorescent T8; ^^^2	Courthouse (Original: Courthouse)	% Area Served	5.0	0.0

FACILITY DESCRIPTION

Building Name: **Lake County: Courthouse**

Controls

Fixture (^^^); *	**Manual**	**Photocell**	**Timer**	**Occupancy Sensor**	**Building Automation System**	**Advanced**	**Other**
Fixture 1: LED; ^^^2	Yes	No	No	No	No	No	No
Fixture 2: Fluorescent T8; ^^^2	Yes	No	No	No	No	No	No

*** Fixture Key**

^^^ *Ballast Type:*
1. Premium Electronic
2. Standard Electronic
3. Magnetic
4. N/A

Heating Plants

None given

Cooling Plants

None given

Condenser Plants

None given

HVAC Systems

HVAC System 84113

Heating

Heating Source	Furnace
Fuel Type	Natural Gas
Location of Equipment	Interior
Approximate Year Installed	
Condition	Good
Number of Pieces of Equipment	6
Output Capacity	100.0 MBH

FACILITY DESCRIPTION

Building Name: **Lake County: Courthouse**

Efficiency Units	AFUE
Rated Efficiency	96.0
Cooling	
Cooling Source	DX Cooling
Fuel Source	Electricity
Location of Equipment	Exterior
Approximate Year Installed	
Condition	Good
Number of Pieces of Equipment	6
Output Capacity	60.0 MBH
Efficiency Units	SEER
Rated Efficiency	13.0
Distribution Equipment	
Delivery Equipment Type	Split unit (mini-split/multi-split)
Other Delivery Equipment Type	
Central Distribution Type	Forced Air
Other Central Distribution Type	
Fan Control	Variable Volume
Energy Recovery Ventilation	None
Outdoor Air Control	No Functioning Economizer
Zone Controls	
Direct Digital Controls (DDC)	No
Pneumatic Control	No
Manual Thermostat	Yes
Programmable Thermostat	Yes
None	No
Space Function Served	Courthouse (Original: Courthouse)
Area Served by this Equipment	100.0 %

Service Hot Water Systems

Hot Water System 53930 - Direct Fired- Instantaneous, Electricity

System Type	Direct Fired- Instantaneous
Location of Equipment	Interior
Approximate Year Installed	

FACILITY DESCRIPTION

Building Name: **Lake County: Courthouse**

Fuel Source	Electricity
Efficiency Units	EF
Rated Efficiency	0.85

Controls

Space Function Served	Courthouse (Original: Courthouse)
Area Served by this Hot Water System	100.0 %

UTILITY DATA AND BENCHMARKING

Building Name: **Lake County: Courthouse**

Ownership Details

- Percent Owned
- Percent Leased

UTILITY DATA AND BENCHMARKING

Building Name: **Lake County: Courthouse**

Metered Energy Supply Source Details

None given

Energy Reporting Years

Start Date	End Date	Metering entries	Delivery entries
01/01/2023	12/31/2023	24	0

Metered Energy

Energy Type: Electricity

Start Date	End Date	Days	Use (kWh)	Cost ($)	Peak (kW)	Load Factor	kWh / day	kBtu / day
01/01/2022	01/31/2022	31	6040.0	655.27	0.0	0%	195	665
02/01/2022	02/28/2022	28	5280.0	568.55	0.0	0%	189	643
03/01/2022	03/31/2022	31	5360.0	526.45	0.0	0%	173	590
04/01/2022	04/30/2022	30	5880.0	577.37	0.0	0%	196	669
05/01/2022	05/31/2022	31	9080.0	862.03	0.0	0%	293	999
06/01/2022	06/30/2022	30	13760.0	1601.57	0.0	0%	459	1565
07/01/2022	07/31/2022	31	16440.0	2096.61	0.0	0%	530	1809
08/01/2022	08/30/2022	30	14240.0	1940.08	0.0	0%	475	1620
09/01/2022	09/30/2022	30	10120.0	1127.17	0.0	0%	337	1151
10/01/2022	10/31/2022	31	5400.0	582.65	0.0	0%	174	594
11/01/2022	11/30/2022	30	5120.0	542.6	0.0	0%	171	582
12/01/2022	12/31/2022	31	5840.0	666.18	0.0	0%	188	643
01/01/2023	01/31/2023	31	5520.0	663.33	0.0	0%	178	608
02/01/2023	02/28/2023	28	4720.0	600.91	0.0	0%	169	575
03/01/2023	03/31/2023	31	5360.0	578.45	0.0	0%	173	590
04/01/2023	04/30/2023	30	5320.0	587.99	0.0	0%	177	605
05/01/2023	05/31/2023	31	8920.0	917.1	0.0	0%	288	982
06/01/2023	06/30/2023	30	12160.0	1403.48	0.0	0%	405	1383
07/01/2023	07/31/2023	31	15440.0	1773.5	0.0	0%	498	1699
08/01/2023	08/31/2023	31	14160.0	1623.38	0.0	0%	457	1559
09/01/2023	09/30/2023	30	10160.0	1152.49	0.0	0%	339	1156
10/01/2023	10/31/2023	31	6360.0	691.92	0.0	0%	205	700
11/01/2023	11/30/2023	30	4800.0	534.67	0.0	0%	160	546
12/01/2023	12/31/2023	31	5040.0	603.17	0.0	0%	163	555
01/01/2024	01/31/2024	31	5840.0	716.66	0.0	0%	188	643
02/01/2024	02/28/2024	28	5080.0	620.26	0.0	0%	181	619
03/01/2024	03/31/2024	31	5000.0	597.5	0.0	0%	161	550
04/01/2024	04/30/2024	30	6560.0	701.97	0.0	0%	219	746
05/01/2024	05/31/2024	31	9480.0	967.65	0.0	0%	306	1043

UTILITY DATA AND BENCHMARKING

Building Name: **Lake County: Courthouse**

06/01/2024	06/30/2024	30	12280.0	1469.17	0.0	0%	409	1397
07/01/2024	07/31/2024	31	13160.0	1589.73	0.0	0%	425	1448
08/01/2024	08/30/2024	30	12360.0	1502.7	0.0	0%	412	1406
09/01/2024	09/30/2024	30	7880.0	927.24	0.0	0%	263	896
10/01/2024	10/31/2024	31	6440.0	762.55	0.0	0%	208	709
11/01/2024	11/30/2024	30	4320.0	560.7	0.0	0%	144	491
12/01/2024	12/31/2024	31	5240.0	730.96	0.0	0%	169	577
	Average Annual Total		**97960**	**11130**	**0**	**0%**		

Energy Type: Natural Gas

Start Date	End Date	Days	Use (therms)	Cost ($)	therms / day	kBtu / day
03/01/2025	03/31/2025	31	960.0	1550.62	31	3097
02/01/2025	02/28/2025	28	1294.0	2090.03	46	4621
01/01/2025	01/31/2025	31	813.0	1313.22	26	2623
12/01/2024	12/31/2024	31	374.0	604.23	12	1206
11/01/2024	11/30/2024	30	51.0	82.59	2	170
10/01/2024	10/31/2024	31	0.0	4.0	0	0
09/01/2024	09/30/2024	30	0.0	4.0	0	0
08/01/2024	08/31/2024	31	0.0	4.0	0	0
07/01/2024	07/31/2024	31	0.0	4.0	0	0
06/01/2024	06/30/2024	30	0.0	4.0	0	0
05/01/2024	05/31/2024	31	73.0	118.12	2	235
04/01/2024	04/30/2024	30	286.0	462.11	10	953
03/01/2024	03/31/2024	31	497.0	802.88	16	1603
02/01/2024	02/28/2024	28	1253.0	2023.82	45	4475
01/01/2024	01/31/2024	31	724.0	1169.48	23	2335
12/01/2023	12/31/2023	31	386.0	623.61	12	1245
11/01/2023	11/30/2023	30	69.0	111.66	2	230
10/01/2023	10/31/2023	31	0.0	4.0	0	0
09/01/2023	09/30/2023	30	0.0	4.0	0	0
08/01/2023	08/31/2023	31	0.0	4.0	0	0
07/01/2023	07/31/2023	31	0.0	4.0	0	0
06/01/2023	06/30/2023	30	9.0	14.59	0	30
05/01/2023	05/31/2023	31	107.0	173.03	3	345
04/01/2023	04/30/2023	30	442.0	714.05	15	1473
03/01/2023	03/31/2023	31	602.0	972.45	19	1942
02/01/2023	02/28/2023	28	723.0	1167.87	26	2582
01/01/2023	01/31/2023	31	913.0	1474.72	29	2945
12/01/2022	12/31/2022	31	582.0	940.15	19	1877
11/01/2022	11/30/2022	30	105.0	169.8	4	350
10/01/2022	10/31/2022	31	0.0	4.0	0	0
09/01/2022	09/30/2022	30	0.0	4.0	0	0
08/01/2022	08/31/2022	31	0.0	4.0	0	0
07/01/2022	07/31/2022	31	0.0	4.0	0	0
06/01/2022	06/30/2022	30	2.0	4.0	0	7

Building Name: **Lake County: Courthouse**

05/01/2022	05/31/2022	31	206.0	316.84	7	665
04/01/2022	04/30/2022	30	446.0	685.72	15	1487
		Average Annual Total	**3251**	**5268**		

Note: fields displayed in green indicate values calculated by the tool and not directly entered by the user.

Delivered Energy

None given

Building Annual Summary for Energy Use and Energy Cost

Baseline Year Selected:

Energy Type	Total Annual Use	Units	Conversion Multiplier	Thousands BTU	Total Annual Cost ($)	Carbon (t CO_2e)
Electricity	97960	kWh	3.412	334240	11130	41.68
Natural Gas	3251	therms	100.0	325100	5268	17.27
			Total	**659340**	**16398**	58.94

Shared System Annual Summary for Energy Use and Energy Cost

No annual summary available.

Annual Summary for On-Site Renewable Energy Production

No annual summary available.

Annual Summary for Exported Energy

No annual summary available.

Existing Building EUI/ECI

Building Name | Lake County: Courthouse

UTILITY DATA AND BENCHMARKING

Building Name: **Lake County: Courthouse**

Gross Conditioned Square Feet	19150.0
EUI_{BLD} (kBtu/ft²/yr)	34.43
EUI_{SITE} (kBtu/ft²/yr)	34.43
Site ECI (energy cost index or $/ft²/yr)	0.856
CO_2e Intensity (kg CO_2e/ft²/yr)	3.078

UTILITY DATA AND BENCHMARKING

Building Name: **Lake County: Courthouse**

Benchmarking

Benchmarking Source	
Benchmarking Source (Other)	
Year Benchmarked	
Benchmark Site Energy Use Intensity	
Benchmark Site Energy Cost Intensity	0.0 $/ft^2
Target Site Energy Intensity	0.0 kBtu/ft^2
Target Site Energy Cost	0.0 $/ft^2
Annual Energy Savings to Reach Target	0 kBtu
Annual Cost Savings to Reach Target	$ 0.0
Additional Comments	

UTILITY DATA AND BENCHMARKING

Building Name: **Lake County: Courthouse**

Building Energy Use and Carbon Emissions by End Use

Note: fields displayed in green indicate values calculated by the tool and not directly entered by the user.

Building End Use Summary

End Use	Total Energy Use (kBtu)	% of Total Energy Use (kBtu)	Total Carbon (t CO_2e)
Total	0	100%	0
Total (from annual summary)	659340		58.94
Difference	-659340		-58.94
% Difference	-100%		-100%

ENERGY SAVINGS OPPORTUNITIES

Building Name: **Lake County: Courthouse**

Building Energy Savings Opportunities - Measures

Measure Information

Measure Identifier	Measure Category	Measure Name	Measure Description	Measure Status	Implementation Year
Install Low-E Windows	Building Envelope Modifications	Replace windows	It is recommended to replace/install low-E windows in place of regular windows	Recommended	
Add Insulation to the Basement Roof	Building Envelope Modifications	Increase floor insulation	It is recommended to add roof insulation to the courthouse basement.	Recommended	
Install ERV Systems on the HVAC Systems	Heating; Ventilating and Air Conditioning	Add energy recovery	It is recommended to install energy recovery ventilation, ERV, systems on the rooftop HVAC units.	Recommended	
Replace Current HVAC Systems with Higher Efficient Heat Pump Units	Heating; Ventilating and Air Conditioning	Install air source heat pump	It is recommended to replace the current HVAC units with ones utilizing heat pumps.	Recommended	
Install Higher Efficiency Lighting	Lighting Improvements	Other	It is recommended to replace the old Fluorescent T8 bulbs with higher efficiency LED bulbs.	Recommended	
Reduce Infiltration	Building Envelope Modifications	Air seal envelope	It is recommended to reduce the amount of infiltration through the windows.	Recommended	

Measure Annual Energy and Cost Savings

Measure Identifier	Total Cost Savings ($)	Electricity Savings (kWh)	Natural Gas Savings (therms)	Total Energy Savings (kBtu)
Install Low-E Windows	1089.76	3609.99	419.44	54261.28566654921
Add Insulation to the Basement Roof	5144.27	30490.92	1037.09	207744.01723713873
Install ERV Systems on the HVAC Systems	8091.17	41074.2	2113.76	351521.1679713726
Replace Current HVAC Systems with Higher Efficient Heat Pump Units	2828.93	18170.08	3019.66	363962.311885643
Install Higher Efficiency Lighting	202.27	1780.48	0.0	6074.997654724121
Reduce Infiltration	59.96	177.42	24.57	3062.357029509544

Measure Cost

Measure Identifier	Measure Cost ($)	Potential Incentives ($)	Measure Life (years)	*Net Measure Cost ($)*
Install Low-E Windows	94500.0	0.00	25	94500.0
Add Insulation to the Basement Roof	9075.0	0.00	20	9075.0
Install ERV Systems on the HVAC Systems	33000.0	0.00	15	33000.0
Replace Current HVAC Systems with Higher Efficient Heat Pump Units	36000.0	0.00	25	36000.0
Install Higher Efficiency Lighting	300.0	0.00	15	300.0
Reduce Infiltration	1300.0	0.00	5	1300.0

For more information on the input fields, calculation methods, and units of measure found in this report, please visit the Audit Template web site: https://buildingenergyscore.energy.gov

ENERGY SAVINGS OPPORTUNITIES

Building Name: **Lake County: Courthouse**

Measure Identifier	Measure Cost ($)	Potential Incentives ($)	Measure Life (years)	*Net Measure Cost ($)*

ENERGY SAVINGS OPPORTUNITIES

Building Name: **Lake County: Courthouse**

Building Energy Savings Opportunities - Packages

Annual Energy & Cost Savings

Package Name Measure Identifier	Measure Name	Measure Description	Measure Status	Total Cost Savings ($)	Electricity Savings (kWh)	Natural Gas Savings (therms)
Potential Capital Recommendations						
Capital Projects						
Add Insulation to the Basement Roof	Increase floor insulation	It is recommended to add roof insulation to the courthouse basement.	Recommended	5144.27	30490.92	1037.09
Install Low-E Windows	Replace windows	It is recommended to replace/install low-E windows in place of regular windows	Recommended	1089.76	3609.99	419.44
Install ERV Systems on the HVAC Systems	Add energy recovery	It is recommended to install energy recovery ventilation, ERV, systems on the rooftop HVAC units.	Recommended	8091.17	41074.2	2113.76
Replace Current HVAC Systems with Higher Efficient Heat Pump Units	Install air source heat pump	It is recommended to replace the current HVAC units with ones utilizing heat pumps.	Recommended	2828.93	18170.08	3019.66
Low Cost and No Cost Recommendations						
Low-Cost Recomendations						
Reduce Infiltration	Air seal envelope	It is recommended to reduce the amount of infiltration through the windows.	Recommended	59.96	177.42	24.57
Install Higher Efficiency Lighting	Other	It is recommended to replace the old Fluorescent T8 bulbs with higher efficiency LED bulbs.	Recommended	202.27	1780.48	0.0

Payback with Incentives

Package Name Measure	Measure Cost ($)	Potential Incentives ($)	Measure Life (years)	*Net Package Cost ($)*	*Net Measure Cost ($)*	*Lifecycle Savings - Package ($)*	*Total Energy Savings - Measure (kBtu)*
Potential Capital Recommendations							
Capital Projects				172575.0		252574.11	
Add Insulation to the Basement Roof	9075.0	0.00	20		9075.0		207744.0
Install Low-E Windows	94500.0	0.00	25		94500.0		54261.3
Install ERV Systems on the HVAC Systems	33000.0	0.00	15		33000.0		351521.2
Replace Current HVAC Systems with Higher Efficient Heat Pump Units	36000.0	0.00	25		36000.0		363962.3
Low Cost and No Cost Recommendations							

ENERGY SAVINGS OPPORTUNITIES

Building Name: **Lake County: Courthouse**

Package Name Measure	**Measure Cost ($)**	**Potential Incentives ($)**	**Measure Life (years)**	***Net Package Cost ($)***	***Net Measure Cost ($)***	***Lifecycle Savings - Package ($)***	***Total Energy Savings - Measure (kBtu)***
Low-Cost Recomendations				1600.0		2782.95	
Reduce Infiltration	1300.0	0.00	5		1300.0		3062.4
Install Higher Efficiency Lighting	300.0	0.00	15		300.0		6075.0

ENERGY SAVINGS OPPORTUNITIES

Building Name: **Lake County: Courthouse**

Energy Savings Opportunities Summary

Package Name Measure	**Lifecycle Savings ($)**	**Total Cost Savings ($)**
Potential Capital Recommendations		
Capital Projects	$252574.11	$17154.13
Add Insulation to the Basement Roof		
Install Low-E Windows		
Install ERV Systems on the HVAC Systems		
Replace Current HVAC Systems with Higher Efficient Heat Pump Units		
Low Cost and No Cost Recommendations		
Low-Cost Recomendations	$2782.95	$262.23
Reduce Infiltration		
Install Higher Efficiency Lighting		

Note: fields displayed in italics indicate values calculated by the tool and not directly entered by the user.

Revolving Loan Fund (RLF)

Does this audit recommend controls and management systems to reduce or redistribute peak energy consumption?*	Yes
Recommended Controls and Management Systems*	Install ERV Systems on the HVAC Systems Replace Current HVAC Systems with Higher Efficient Heat Pump Units Install Higher Efficiency Lighting
Identify the sources of energy consumption that are contributing the most to that period of peak energy demand:*	HVAC Systems Lighting

ATTACHMENTS

Building Name: **Lake County: Courthouse**

References	Description	File Name

ATTACHMENT B

Tennessee Tech Commercial Energy Conservation Audit Report

TT-C-15 Revised - Lake County EMS Building

Commercial Energy Conservation Audit Report

Conducted by
Industrial Training and Assessment Center Team
Tennessee Technological University
for
Tennessee Department of Environment and Conservation

Energy Conservation Audit Report: TT-C-15

Assessment Date:	12/9/25
Location:	333 Kentucky St, Tiptonville, TN
Building:	Lake County EMS Building
Building Type:	Emergency Response Building
Report Date:	1/09/26
Revision Date:	2/13/26

Sponsored by The Tennessee Department of Environment and Conservation
under the contract of the
U.S. Department of Energy Office of State and Community Energy Programs

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PREFACE AND DISCLAIMER

The work described in this report was performed under the direction of the project team from Industrial Training and Assessment Center (ITAC) at Tennessee Technological University. Recommendations are based on observations and measurements made during a one-day site visit. Although time limitations prohibit the examination of every aspect of a building's operation, an effort is made to identify the major "Audit Recommendations" and to offer specific and quantitative recommendations for energy and cost savings. Under this program, Tennessee Technological University does not prepare engineering designs or perform services normally offered by an engineering firm, vendor, or a facility's representative. When the need for such assistance arises, it is suggested the participating facility contact these specialists directly. If, however, the recommendations and conclusions offered in this report require further clarification or explanation, the participating building is encouraged to contact the team members listed below.

The contents of this report are offered as guidance. Tennessee Technological University, Tennessee Department of Environment and Conservation, the U.S. Department of Energy, and all technical sources referenced in this report do not (a) make any warranty or representation, expressed or implied, with respect to the accuracy, completeness, or usefulness of the information contained in this report, or that the use of any information, apparatus, method, or process disclosed in this report may not infringe on privately owned rights; (b) assume liabilities with respect to the use of, or for damages resulting from use of, any information, apparatus, method, or process disclosed in this report. This report does not reflect official views or the policy of the above-mentioned institutions. Mention of trade names or commercial products does not constitute endorsement or recommendation of use.

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I. Executive Summary:

Briefly goes over the energy consumption of the facility and the proposed amount of savings.

Table 1: Yearly Use

Energy	Usage/Year	Total Cost/Year
Electricity	44,459 kWh	$5,516
Natural Gas	718 Therms	$1,173
Total	44,459 kWh 718 Therms	$6,679

Table 2: Utility Rates

Energy Source	Units	Rate
Electric Consumption	**All kWh**	$0.1199
Natural Gas	**All Therm**	$1.6215

Conservation measures described below would reduce energy usage by an estimated 24,173.42 kWh/yr. Along with energy demand, natural gas, and water savings, these conservation measures amount to a total estimated savings of $13,746.66. This represents around 54.37% of the total annual energy cost based on the EMS Building's operation of 8,760 hours each year.
The initial cost of implementation is estimated to be $31,810, giving an overall Simple Payback Period of 27.77 months. Analyses and technical information to support the recommendations are contained in section III of this report. The proposed energy conservation measures are summarized in Table 3.

Table 3: Summary of Audit Recommendations

Recommendation	Recommended Action	Energy Savings (-/yr)	Carbon Dioxide Reduction (lbs. CO_2/yr)	Cost Savings ($/yr)	Implementation Cost	SPP
Replace Current HVAC Unit with a Larger Higher Efficient Heat Pump Unit*	It is recommended to replace the current HVAC unit with a larger one utilizing a heat pump.	1,667.93 kWh 751.33 Therms	21,272.65	1,418.21	12,000	101.54 Months
Install ERV Systems on the HVAC Systems*	It is recommended to install energy recovery ventilation, ERV, systems on the HVAC units	16,525.62 kWh 525.93 Therms	28,684.46	2,834.21	5,500	23.29 Months
Replace Old Natural Gas Space Heaters in The Garage*	It is recommended to install new higher efficient space heaters in the garage of the EMS building	807.51 Therms	21,227.84	1,309.37	10,000	91.65 Months
Reduce the Infiltration Through Doors and Windows	It is recommended to reduce the amount of infiltration through the doors and windows.	202.07 kWh 4,605.53 Therms	121,401.87	7,492.10	3,960	6.34 Months
Install Higher efficiency Lighting*	It is recommended to replace the old Fluorescent T8 bulbs with higher	5,777.82 kWh	5,189.06	692.77	350	6.06 Months

	efficiency LED bulbs.					
Totals[1]		**24,173.42 kWh 6,690.30 Therms**	**197,775.88**	**13,746.66**	**31,810**	**27.77 Months**

All these recommendations provide some form of energy savings during the peak energy hours of the day. There are a few however that also recommend controls or management systems that allow for the building or county to have more control over the energy usage of the building. These recommendations have been highlighted above with a * and are also shown at the bottom of *Appendix B: Audit Template Report*.

[1] These totals include all recommendations, even conflicting recommendations that cannot be implemented together

II. General Building Information

2.1 Building Information

Location	Lake County, Tiptonville, TN
Use Type	Garage and Living Space
Building Size (ft^2)	4,500
Floors	1
Operation Schedule	24/7, 8,760 hrs./yr
Is the Building Historic	No
Main HVAC Type	Packaged AC and Natural Gas Unit
Main Lighting Type	Fluorescent T8 Bulbs and LEDs

2.2 Building Layout



Figure 1: Perry County Courthouse (Top)



Figure 2: Perry County Courthouse (Front)

2.4 Energy Asset Score Report:

This section goes over the highlights of the attached energy asset score that was performed using the Department of Energy's Asset Score/Audit Template online reporting tool. This energy asset score report takes into account the current systems of the building and provides possible energy efficiency recommendations along with projections on current energy usage and the possible energy usage after the suggested recommendations are implemented. There might be some discrepancies in the report compared to reality due to the limitations of the program to use more than one HVAC system per building, due to this the audit team used the most prominent HVAC system. To see the energy asset score report please see *Appendix A: Energy Asset Score Report.*

2.5 Energy Audit Template Report:

This section goes over the highlights of the attached audit template report that was performed using the Department of Energy's Asset Score/Audit Template online reporting tool. This audit template report takes the input specification data of the building's energy systems and provides an overview of them. This report also includes the relevant utility charges over the last 12 months. The report also includes the recommendations outlined in this audit report and splits them into separate different recommendation packages that the building can choose from based on the estimated life of the project, cost, and savings. These savings are then compared to the current energy usage of the facility to show a difference in energy usage after implementation. To see the audit template report please see *Appendix B: Audit Template Report*

III. Audit Recommendations

This section provides detailed descriptions of audit recommendations identified at the subject facility. The documentation of each recommendation summarizes the action to be taken, the cost savings, the implementation cost, and the estimated payback period. Calculations are included to show how energy and cost savings were determined. Each recommendation is self-contained. The cost savings for a given recommendation do not depend on the implementation of other recommendations, unless otherwise noted.

Recommendation 1: Replace Current HVAC Unit with a Larger Higher Efficient Heat Pump Unit

Est. Electrical Consumption Savings	= ***1,667.93 kWh/yr***
Est. Natural Gas Savings	= ***751.33Therms/yr***
Est. Electrical Consumption Cost Savings	= ***$199.98/yr***
Est. Natural Gas Cost Savings	= ***$1,218.23/yr***
Est. Total Cost Savings	= ***$1,418.21/yr***
Est. Carbon Dioxide Reduction	= ***21,272.65 lbs. CO_2/yr***
Implementation Cost	= ***$12,000***
Est. Return of Investment Over 25 Years	= ***10.94%***
Simple Payback Period	= ***101.54 months***

Recommended Action:

It is recommended to replace the current HVAC unit with a larger one utilizing a heat pump.

Background Information:

The energy savings of this recommendation mainly stem from the higher efficiency the new units have compared to the current ones. There are a few efficiency metrics that are commonly seen for HVAC systems, and these are SEER, EER, and COP, which are "Seasonal Energy Efficiency Ratio", "Energy Efficiency Ratio", and "Coefficient of Performance" respectively. Each of these metrics are a measurement of how efficient the HVAC system is in providing cooling and possibly heating to the zone(s) they are a part of. Heat pumps provide both heating and cooling through a refrigeration cycle rather than the current system that uses a furnace/burner to heat the air in the heating months and electricity to cool in the cooling months. By switching to heat pumps the building can reduce their natural gas usage, with the caveat of increasing their electrical consumption. Typically using a heat pump can provide higher efficiency than furnace/burners of gas heaters but can have some issues supplying in extreme cold temperatures.

Currently the Lake County EMS building has one 5-ton Rheem packaged gas/electric HVAC unit that supplies heating and cooling for the building. ***It was brought to the audit team's attention during the audit that the current unit doe not provide enough cooling in the summer which has caused the staff to run window AC units to supplement the cooling.*** This Rheem

unit and one of the window AC units is shown in Figures 3 and 4 below. This unit is tabulated in Table 4 below. From a discussion with the County mayor the audit team will assume an operation schedule of 8,760 hrs/yr for the building, this is due to the fact that this building is typically occupied by personnel at all times. The building also pays $1.6215/Therm and $0.1199/kWh.



Figure 3: 5-Ton Rheem Unit



Figure 4: Window AC Unit

Table 4: HVAC Specifications

Unit	# of Units	Designed Flow (CFM)	Average Heating Vent Flow (CFM)	Average Cooling Vent Flow (CFM)	Average Heating Capacity (MBtu/hr.)	Heating Efficiency (%)	Cooling Capacity (MBtu/hr.)	Rated COP/SEER
Rheem 5 Ton Unit	6	2,000	275	1,500	100	81	56	3.45/14

Anticipated Savings:

As stated above the anticipated savings of this recommendation stem from the load reduction of the HVAC system(s). To quantify this load reduction the systems are split into two separate conditions, a heating condition in the winter months and a cooling condition in the summer months. With this the weather conditions inside and outside the building must be considered for both conditions. The local weather data, TMY3 data, was collected and analyzed to determine the average outside conditions, while the inside conditions come from what the building is currently set to operate at, 75°F in the summer and 70°F in the winter. With this information, local psychometric charts were used to determine the enthalpy of both the inside and outside air. An example of the psychometric charts used is shown in Figures 5 and 6 below. All these values for both the winter and summer conditions are tabulated in Table 5 below.

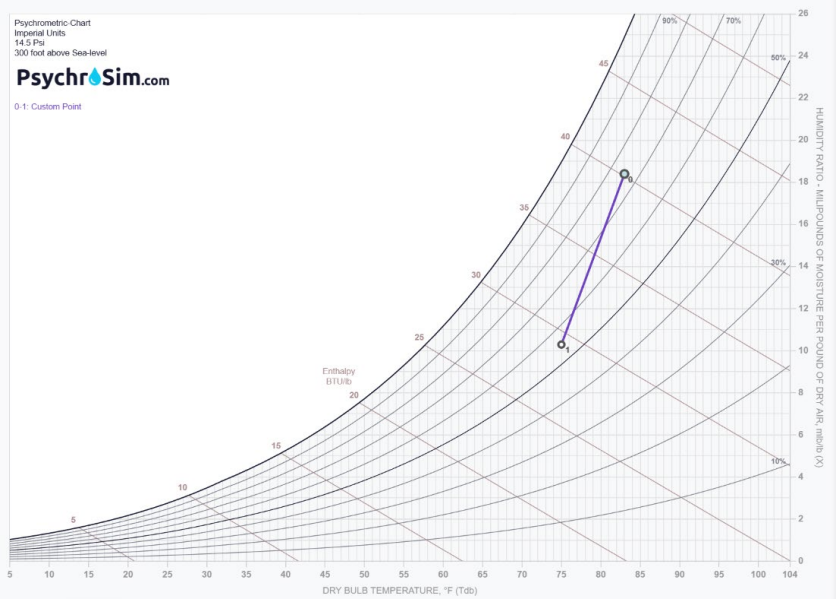


Figure 5: Cooling Process

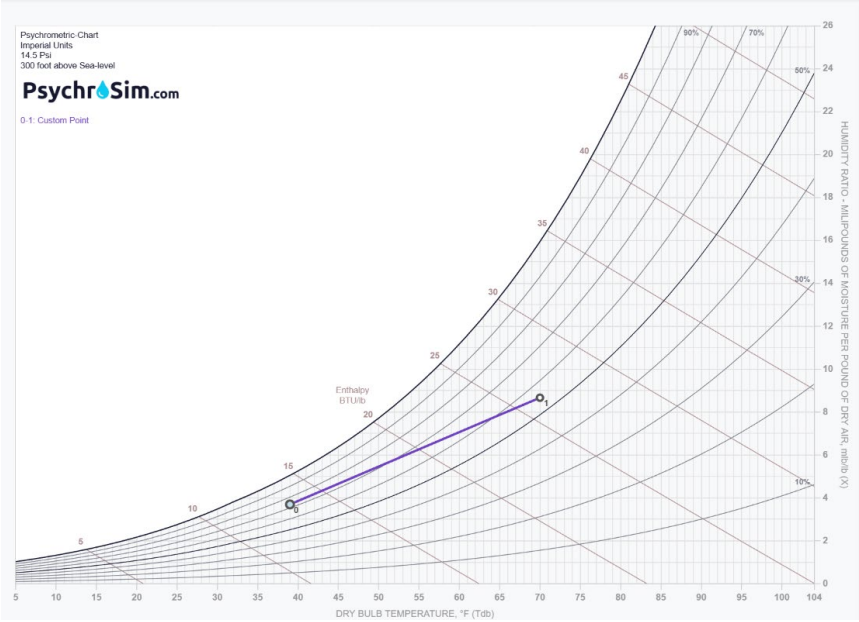


Figure 6: Heating Process

Table 5: Weather Conditions

Heating/Cooling Condition	Indoor Temperature (°F)	Indoor Enthalpy (Btu/lb.)	Average Outdoor Temperature (°F)	Outdoor Enthalpy (Btu/lb.)	Current Enthalpy Difference (Btu/lb.)	ERV Enthalpy Difference (Btu/lb.)
Heating (Winter Months)	70	26.3	39	13.4	12.90	3.87
Cooling (Summer Months)	75	29.3	83	40.1	10.86	3.24

The next step in determining the anticipated savings is to determine the current energy usage for both the heating and cooling months for each unit type. This data is tabulated in Tables 6 and 7 below.

$$Thermal\ Energy_{\ Heating}\left(\frac{Btu}{hr}\right) = \frac{4.7 * \Delta Enthalpy * Ventilation\ Flow}{Heating\ Efficiency}$$

$$Thermal\ Energy_{\ Heating}\left(\frac{Btu}{hr}\right) = \frac{4.7 * 12.90\frac{Btu}{lb} * 275\ CFM}{0.81}$$

$$Thermal\ Energy_{\ Heating}\left(\frac{Btu}{hr}\right) = 20{,}584.26\frac{Btu}{hr}$$

$$Natural\ Gass\ Usage = Thermal\ Energy_{\ Heating} * \frac{1\ Therm}{100{,}000\ Btu} * \left(Operation\ Hours * \frac{5\ Heating\ months}{12\ months}\right)$$

$$Natural\ Gass\ Usage = 20{,}584.26\frac{Btu}{hr} * \frac{1\ Therm}{100{,}000\ Btu} * \left(8{,}760\frac{hrs}{yr} * \frac{5\ Heating\ months}{12\ months}\right)$$

$$Natural\ Gas\ Usage = \frac{751.33\ Therms}{yr}$$

Table 6: Current Heating Energy Usage

Unit Type	# of Units	Thermal Energy (Btu/hr)	Natural Gas Usage Per Unit (Therms/yr)	Total Natural Gas Usage (Therms/yr)
Rheem 5 Ton Unit	1	20,584.26	751.33	751.33

$$Thermal\ Energy_{\ Cooling}\left(\frac{Btu}{hr}\right) = \frac{4.7 * \Delta Enthalpy * Ventilation\ Flow}{COP}$$

$$Thermal\ Energy_{\ Cooling}\left(\frac{Btu}{hr}\right) = \frac{4.7 * 10.86\frac{Btu}{lb} * 1{,}500\ CFM}{3.45}$$

$$Thermal\ Energy_{\ Cooling}\left(\frac{Btu}{hr}\right) = 22{,}069.57\frac{Btu}{hr}$$

$$Electrical\ Consumption = Thermal\ Energy_{\ Cooling} * \frac{0.00029307\ kWh}{1\ Btu} * \left(Operation\ Hours * \frac{5\ Cooling\ months}{12\ months}\right)$$

$$Electrical\ Consumption = 22{,}069.57\frac{Btu}{hr} * \frac{0.00029307\ kWh}{1\ Btu} * \left(8{,}760\frac{hrs}{yr} * \frac{5\ Cooling\ months}{12\ months}\right)$$

$$Electrical\ Consumption = 23{,}608.02\frac{kWh}{yr}$$

Table 7: Current Cooling Energy Usage

Unit Type	# of Units	Thermal Energy (Btu/hr)	Electrical Consumption Usage Per Unit (kWh/yr)	Total Electrical Consumption Usage (kWh/yr)
Rheem 5 Ton Unit	1	22,069.57	23,608.02	23,608.02

After calculating the current energy usage for both the heating and cooling months the same must be done for the proposed cases using the heat pump HVAC systems. Due to the staff's concerns over the supply of heating and cooling, the audit team will use the values for 7.5-ton units compared to the 5-ton Rheem unit. With this larger unit the building would expect to see a larger flow through the ventilation as well as the heating and cooling rate. These calculations are the same as the current case values, but instead of using the current COP and thermal efficiency one would use the proposed COP value as tabulated in Table 8 below.

Table 8: Current and Proposed COP

Current Tonnage	Current COP	Proposed Tonnage	Proposed COP
5	3.45	7.5	3.91

Using these new COP values one can use the following equations to determine the proposed heating and cooling energy consumption of the Heat pump systems.

$$Thermal\ Energy_{\ Heating}\left(\frac{Btu}{hr}\right) = \frac{4.7 * \Delta Enthalpy * Ventilation\ Flow}{COP}$$

$$Thermal\ Energy_{\ Heating}\left(\frac{Btu}{hr}\right) = \frac{4.7 * 12.90\frac{Btu}{lb} * 350\ CFM}{3.91}$$

$$Thermal\ Energy_{\ Heating}\left(\frac{Btu}{hr}\right) = 5{,}427.24\frac{Btu}{hr}$$

$$Electrical\ Consumption_{Heating} = Thermal\ Energy_{\ heating} * \frac{0.00029307\ kWh}{1\ Btu} * \left(Operation\ Hours * \frac{5\ Heating\ months}{12\ months}\right)$$

$$Electrical\ Consumption_{Heating} = 5{,}2427.24\frac{Btu}{hr} * \frac{0.00029307\ kWh}{1\ Btu} * \left(8{,}760\frac{hrs}{yr} * \frac{5\ Heating\ months}{12\ months}\right)$$

$$Electrical\ Consumption_{Heating} = 5{,}805.57\frac{kWh}{yr}$$

$$Thermal\ Energy_{\ Cooling}\left(\frac{Btu}{hr}\right) = \frac{4.7 * \Delta Enthalpy * Ventilation\ Flow}{COP}$$

$$Thermal\ Energy_{\ Cooling}\left(\frac{Btu}{hr}\right) = \frac{4.7 * 10.86\frac{Btu}{lb} * 1{,}800\ CFM}{3.91}$$

$$Thermal\ Energy_{\ Cooling}\left(\frac{Btu}{hr}\right) = 23{,}367.77\frac{Btu}{hr}$$

$$Electrical\ Consumption_{Cooling} = Thermal\ Energy_{\ Cooling} * \frac{0.00029307\ kWh}{1\ Btu} * \left(Operation\ Hours * \frac{5\ Cooling\ months}{12\ months}\right)$$

$$Electrical\ Consumption_{Cooling} = 23{,}367.77\frac{Btu}{hr} * \frac{0.00029307\ kWh}{1\ Btu} * \left(8{,}760\frac{hrs}{yr} * \frac{5\ Cooling\ months}{12\ months}\right)$$

$$Electrical\ Consumption_{Cooling} = 24{,}996.73\frac{kWh}{yr}$$

The calculated values for the proposed cases are tabulated in Tables 9 and 10 below.

Table 9: Proposed Heating Energy Usage

Unit Type	# of Units	Thermal Energy (Btu/hr)	Electrical Consumption Usage Per Unit (kWh/yr)	Total Electrical Consumption Usage (kWh/yr)
7.5-Ton Unit	1	5,427.24	5,805.57	5,805.57

Table 10: Current Cooling Energy Usage

Unit Type	# of Units	Thermal Energy (Btu/hr)	Electrical Consumption Usage Per Unit (kWh/yr)	Total Electrical Consumption Usage (kWh/yr)
7.5-Ton Unit	1	23,367.77	24,996.73	24,996.73

With both the current and proposed energy usage values one can determine the estimated energy savings for both the winter and summer months.

$$Natural\ Gas\ Savings\ (NGS) = Current\ Natural\ Gas\ usage - Proposed\ Natural\ Gas\ Usage$$

$$Natural\ Gas\ Savings = 751.3\frac{Therms}{yr} - 0\frac{Therms}{yr}$$

$$Natural\ Gas\ Savings = \mathbf{751.3}\frac{\boldsymbol{Therms}}{\boldsymbol{yr}}$$

$$Natural\ Gas\ Cost\ Savings\ (NGCS) = NGS * Utility\ Rate$$

$$NGCS = 751.3\frac{Therms}{yr} * \frac{\$1.6215}{Therm}$$

$$NGCS = \frac{\mathbf{\$1,218.23}}{\boldsymbol{yr}}$$

Since the building staff are currently using additional window AC units to supplement the cooling in the summer months, the county could potentially see additional energy savings when upgrading the size of the HVAC system since the staff would not need to run the window AC units as much or at all. Currently the building has around 4-5 window AC units, but the audit team will assume that the building only uses 4 window units. To determine the estimated energy savings of not using the window units the current energy usage of the units need to be found.

$$Window\ AC\ Energy\ (WAE) = \left[Power\ Usage * \left(Operation\ Hours * \frac{5\ Heating\ Months}{12}\right)\right] * Number\ of\ Window\ AC\ Units$$

$$WAE = \left[0.607\ kW * \left(\frac{8{,}760\ hrs}{yr} * \frac{5\ Heating\ Months}{12}\right)\right] *\ 4\ Window\ AC\ Units$$

$$WAE = 8{,}862.2\ \frac{kWh}{yr}$$

Using this data, the *Electrical Consumption Savings, ECS,* and *Electrical Consumption Cost Savings, ECCS,* can be found by the following.

$$ECS = Current\ Electrical\ Consumption - \left(Proposed\ Electrical\ Consumption_{Cooling} + Proposed\ Electrical\ Consumption_{Heating}\right) + WAE$$

$$ECS = 23{,}608.02\,\frac{kWh}{yr} - \left(5{,}805.57\,\frac{kWh}{yr} + 24{,}996.73\,\frac{kWh}{yr}\right) + 8{,}862.2\ \frac{kWh}{yr}$$

$$ECS = 1{,}667.93\,\frac{kWh}{yr}$$

$$Electrical\ Consumption\ Cost\ Savings\ (ECCS) = ECS * Utility\ Rate$$

$$ECCS = 1{,}667.93\,\frac{kWh}{yr} * \frac{\$0.1199}{kWh}$$

$$ECCS = \frac{\mathbf{\$199.98}}{\boldsymbol{yr}}$$

$$Total\ Cost\ Savings\ (TCS) = ECCS + NGCS$$

$$TCS = \frac{\$199.98}{yr} + \frac{\$1{,}218.23}{yr}$$

$$\boldsymbol{TCS = \frac{\$1{,}418.21}{yr}}$$

In addition to energy savings, there are carbon dioxide emission savings as well. The Environmental Protection Agency (EPA) reports that electrical energy in the building's region is responsible for 898.1 lbs. CO_2 / MWh. The *carbon dioxide reduction, CDR,* is calculated as:

$$CDR = \left[\left(NGS * 0.029307\,\frac{MWh}{Therm}\right) + \left(ECS * \frac{1\ MWh}{1{,}000kWh}\right)\right] * 898.1\ \frac{lbs\ CO_2}{MWh}$$

$$CDR = \left[\left(\frac{751.3\ Therms}{yr} * 0.029307\,\frac{MWh}{Therm}\right) + \left(1{,}667.93\,\frac{kWh}{yr} * \frac{1\ MWh}{1{,}000kWh}\right)\right] * 898.1\ \frac{lbs\ CO_2}{MWh}$$

$$\boldsymbol{CDR = 21{,}272.65\ \frac{lbs\ CO_2}{yr}}$$

Implementation Cost:

The *Implementation Costs, IC,* of this recommendation stem from the cost of the new HVAC systems. From a search of vendors, the average cost of a 5-ton heat pump HVAC unit ranges from $7,000 to $12,000 per unit. For this recommendation the audit team will assume the building will purchase high efficiency heat pump units costing $12,000 each. The implementation cost would result in the following:

$$IC = \left(\frac{\$12{,}000}{7.5\ ton\ HVAC\ Unit} * \#of\ 7.5\ ton\ Units \right)$$

$$IC = \left(\frac{\$12{,}000}{7.5\ ton\ HVAC\ Unit} * 1\ Unit \right)$$

$$\boldsymbol{IC = \$12{,}000}$$

Internal Rate of Return (IRR) and Simple Payback Period (SPP):

The *Internal Rate of Return, IRR,* and the *Simple Payback Period, SPP*, values can be found using the following equations:

$$0 = NPV = \sum_{t=i}^{T} \frac{C_t}{(1 + IRR)^t} - C_O$$

$$IRR = \sqrt[t]{\frac{C_t}{C_O}} - 1$$

Where:

NPV	= Net Positive Value
C_t	= Net Cash Inflow During Period t
C_O	= Total Initial Cost
t	= The Number of Time Periods

$$SPP = \frac{IC}{TCS}$$

For the case of this recommendation the audit team will assume a life span of 25 years. This would result in the following:

$$IRR = \sqrt[25]{\frac{(\$35{,}455.25)}{\$12{,}000}} - 1$$

$$\boldsymbol{IRR = 10.94\%}$$

$$SPP = \frac{\$12{,}000}{\frac{\$1{,}418.21}{yr}} * \frac{12\ months}{yr}$$

$$\boldsymbol{SPP = 101.54\ Months}$$

Recommendation 2: Install ERV Systems on the HVAC Systems

Est. Electrical Consumption Savings	***= 16,525.62 kWh/yr***
Est. Natural Gas Consumption Savings	***= 525.93 Therms/yr***
Est. Electrical Consumption Cost Savings	***= $1,981.42/yr***
Est. Natural Gas Consumption Cost Savings	***= $852.79/yr***
Est. Total Cost Savings	***= $2,834.21/yr***
Est. Carbon Dioxide Reduction	***= 28,684.46 lbs. CO_2/yr***
Est. Implementation Cost	***= $5,500***
Internal Rate of Return After 15 Years	***= 51.43%***
Simple Payback Period	***= 23.29 Months***

Recommended Action:

It is recommended to install energy recovery ventilation, ERV, systems on the HVAC units.

Background Information:

The energy savings of this recommendation stem from the load and runtime reduction the HVAC system(s) would experience by utilizing the ERV system(s). These systems reduce the load on the HVAC system(s) by recirculating a portion of the already conditioned air back through the HVAC system(s) instead of dumping it outside and bringing in more unconditioned air. The effectiveness of these systems tends to range between 70% and 80% depending on the model and specifications.

Currently the Lake County EMS building has one 5-ton Rheem packaged gas/electric HVAC unit that supplies heating and cooling for the building. This unit is tabulated in Table 11 below. From a discussion with the County mayor the audit team will assume an operation schedule of 8,760 hrs/yr for the building, this is due to the fact that this building is typically occupied by personnel at all times. The building also pays $1.6215/Therm and $0.1199/kWh.

Table 11: HVAC Specifications

Unit	# of Units	Designed Flow (CFM)	Average Heating Vent Flow (CFM)	Average Cooling Vent Flow (CFM)	Average Heating Capacity (MBtu/hr.)	Heating Efficiency (%)	Cooling Capacity (MBtu/hr.)	Rated COP/SEER
Rheem 5 Ton Unit	6	2,000	275	1,500	100	81	56	3.45/14

Anticipated Savings:

As stated above the anticipated savings of this recommendation stem from the load reduction of the HVAC system(s). To quantify this load reduction the systems are split into two separate conditions, a heating condition in the winter months and a cooling condition in the summer months. With this the weather conditions inside and outside the building must be considered for both conditions. The local weather data, TMY3 data, was collected and analyzed to determine the average outside conditions, while the inside conditions come from what the building is currently set to operate at, 75°F in the summer and 70°F in the winter. With this information, local psychometric charts were used to determine the enthalpy of both the inside and outside air. An example of the psychometric charts used is shown in Figures 7 and 8 below. All these values for both the winter and summer conditions are tabulated in Table 12 below.

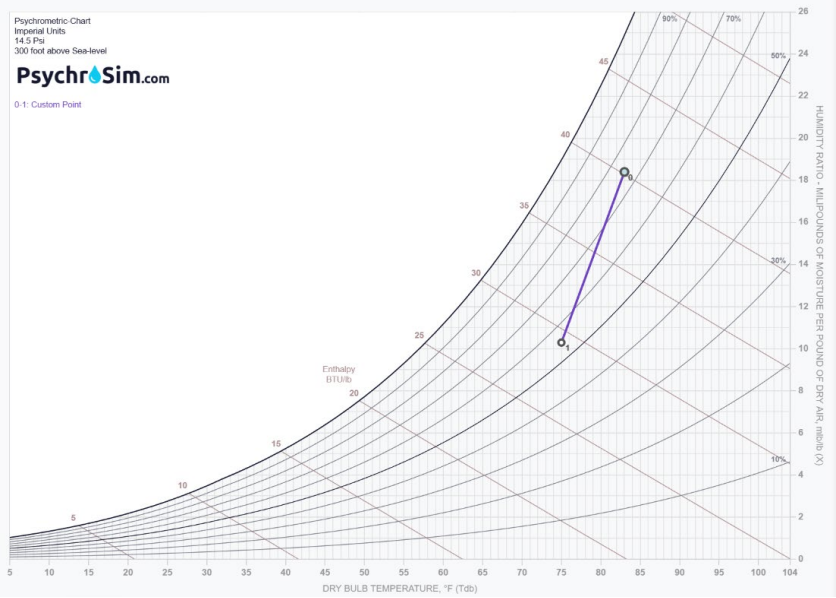


Figure 7: Cooling Process

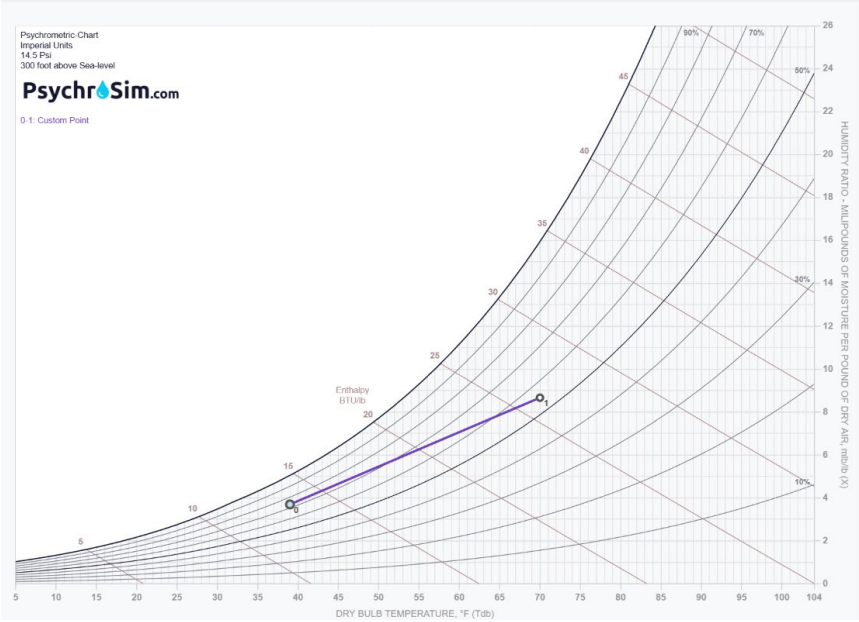


Figure 8: Heating Process

Table 12: Weather Conditions

Heating/Cooling Condition	Indoor Temperature (°F)	Indoor Enthalpy (Btu/lb.)	Average Outdoor Temperature (°F)	Outdoor Enthalpy (Btu/lb.)	Current Enthalpy Difference (Btu/lb.)	ERV Enthalpy Difference (Btu/lb.)
Heating (Winter Months)	70	26.3	39	13.4	12.90	3.87
Cooling (Summer Months)	75	29.3	83	40.1	10.86	3.24

To determine the above ERV enthalpy difference, one would need to know the ERV effectiveness, which according to many vendors and unit specifications range between 70% - 80% on average. For this recommendation the audit team will assume that the building would install ERV systems with 70% effectiveness. Using this value one can estimate the enthalpy difference that the ERV would provide.

$$Effectiveness = \frac{h_2 - h_1}{h_3 - h_1}$$

Where:

h_1 = Outside Air Enthalpy Without/Before ERV (Btu/lb.)

h_2 = Outside Enthalpy With/After ERV (Btu/lb.)

h_3 = Inside Enthalpy (Btu/lb.)

$$ERV\ Enthalpy\ Difference_{Heating} = Indoor\ Enthalpy - [ERV\ Effectiveness * (Indoor\ Enthalpy - Outdoor\ Enthalpy) + Outdoor\ Enthalpy]$$

$$ERV\ Enthalpy\ Difference_{Heating} = 26.3\frac{Btu}{lb} - \left[0.7 * \left(26.3\frac{Btu}{lb} - 13.4\frac{Btu}{lb}\right) + 13.4\frac{Btu}{lb}\right]$$

$$ERV\ Enthalpy\ Difference_{Heating} = 3.87\frac{Btu}{lb}$$

$$ERV\ Enthalpy\ Difference_{Cooling} = ABS\{Indoor\ Enthalpy - [ERV\ Effectiveness * (Indoor\ Enthalpy - Outdoor\ Enthalpy) + Outdoor\ Enthalpy]\}$$

$$ERV\ Enthalpy\ Difference_{Cooling} = ABS(29.3\frac{Btu}{lb} - \left[0.7 * \left(29.3\frac{Btu}{lb} - 40.1\frac{Btu}{lb}\right) + 40.1\frac{Btu}{lb}\right]$$

$$ERV\ Enthalpy\ Difference_{Cooling} = 3.24\frac{Btu}{lb}$$

The next step in determining the anticipated savings is to determine the current energy usage for both the heating and cooling months for each unit type. This data is tabulated in Tables 13 and 14 below.

$$Thermal\ Energy_{\ Heating}\left(\frac{Btu}{hr}\right) = \frac{4.7 * \Delta Enthalpy * Ventilation\ Flow}{Heating\ Efficiency}$$

$$Thermal\ Energy_{\ Heating}\left(\frac{Btu}{hr}\right) = \frac{4.7 * 12.90\frac{Btu}{lb} * 275\ CFM}{0.81}$$

$$Thermal\ Energy_{\ Heating}\left(\frac{Btu}{hr}\right) = 20{,}584.26\frac{Btu}{hr}$$

$$Natural\ Gass\ Usage = Thermal\ Energy_{\ Heating} * \frac{1\ Therm}{100{,}000\ Btu} * \left(Operation\ Hours * \frac{5\ Heating\ months}{12\ months}\right)$$

$$Natural\ Gass\ Usage = 20{,}584.26\frac{Btu}{hr} * \frac{1\ Therm}{100{,}000\ Btu} * \left(8{,}760\frac{hrs}{yr} * \frac{5\ Heating\ months}{12\ months}\right)$$

$$Natural\ Gas\ Usage = \frac{751.33\ Therms}{yr}$$

Table 14: Current Heating Energy Usage

Unit Type	# of Units	Thermal Energy (Btu/hr)	Natural Gas Usage Per Unit (Therms/yr)	Total Natural Gas Usage (Therms/yr)
Rheem 5 Ton Unit	1	20,584.26	751.33	751.33

$$Thermal\ Energy_{\ Cooling}\left(\frac{Btu}{hr}\right) = \frac{4.7 * \Delta Enthalpy * Ventilation\ Flow}{COP}$$

$$Thermal\ Energy_{\ Cooling}\left(\frac{Btu}{hr}\right) = \frac{4.7 * 10.86\frac{Btu}{lb} * 1{,}500\ CFM}{3.45}$$

$$Thermal\ Energy_{\ Cooling}\left(\frac{Btu}{hr}\right) = 22{,}069.57\frac{Btu}{hr}$$

$$Electrical\ Consumption = Thermal\ Energy_{\ Cooling} * \frac{0.00029307\ kWh}{1\ Btu} * \left(Operation\ Hours * \frac{5\ Cooling\ months}{12\ months}\right)$$

$$Electrical\ Consumption = 22{,}069.57\frac{Btu}{hr} * \frac{0.00029307\ kWh}{1\ Btu} * \left(8{,}760\frac{hrs}{yr} * \frac{5\ Cooling\ months}{12\ months}\right)$$

$$Electrical\ Consumption = 23{,}608.02\frac{kWh}{yr}$$

Table 15: Current Cooling Energy Usage

Unit Type	# of Units	Thermal Energy (Btu/hr)	Electrical Consumption Usage Per Unit (kWh/yr)	Total Electrical Consumption Usage (kWh/yr)
Rheem 5 Ton Unit	1	22,069.57	23,608.02	23,608.02

After calculating the current energy usage for both the heating and cooling months the same must be done for the proposed cases using the ERV systems. These calculations are the same as the current case values, but instead of using the current enthalpy difference one would use the enthalpy difference provided by the ERV system. The calculated values for the proposed cases are tabulated in Tables 16 and 17 below.

Table 16: Proposed Heating Energy Usage

Unit Type	# of Units	Thermal Energy (Btu/hr)	Natural Gas Usage Per Unit (Therms/yr)	Total Natural Gas Usage (Therms/yr)
Rheem 5 Ton Unit	1	6,175.28	225.40	225.40

Table 17: Current Cooling Energy Usage

Unit Type	# of Units	Thermal Energy (Btu/hr)	Electrical Consumption Usage Per Unit (kWh/yr)	Total Electrical Consumption Usage (kWh/yr)
Rheem 5 Ton Unit	1	6,620.87	7,082.41	7,082.41

With both the current and proposed energy usage values one can determine the estimated energy savings for both the winter and summer months. These energy savings are tabulated in Table 18 below.

$$Natural\ Gas\ Savings\ (NGS) = Current\ Natural\ Gas\ usage - Proposed\ Natural\ Gas\ Usage$$

$$Natural\ Gas\ Savings = 751.33\frac{Therms}{yr} -= 225.40\frac{Therms}{yr}$$

$$Natural\ Gas\ Savings = \mathbf{525.93}\frac{\boldsymbol{Therms}}{\boldsymbol{yr}}$$

$$Natural\ Gas\ Cost\ Savings\ (NGCS) = NGS * Utility\ Rate$$

$$NGCS = 525.93 \frac{Therms}{yr} * \frac{\$1.6215}{Therm}$$

$$NGCS = \frac{\mathbf{\$852.79}}{\boldsymbol{yr}}$$

$$Electrical\ Consumption\ Savings\ (ECS) = Current\ Electrical\ Consumption - Proposed\ Electrical\ Consumption$$

$$ECS = 23{,}608.02 \frac{kWh}{yr} - 7{,}082.41 \frac{kWh}{yr}$$

$$ECS = 16{,}525.62 \frac{kWh}{yr}$$

$$Electrical\ Consumption\ Cost\ Savings\ (ECCS) = ECS * Utility\ Rate$$

$$ECCS = 16{,}525.62 \frac{kWh}{yr} * \frac{\$0.1199}{kWh}$$

$$ECCS = \frac{\mathbf{\$1{,}981.42}}{\boldsymbol{yr}}$$

Table 18: Energy Savings

Unit Type	Natural Gas Savings (Therms/yr)	Electrical Consumption Savings (kWh/yr)	Natural Gas Cost Savings	Electrical Consumption Cost Savings	Total Cost Savings
Rheem 5 Ton Unit	525.93	16,525.62	$852.79	$1,981.42	$2,834.21
Total	**525.93**	**16,525.62**	**$852.79**	**$1,981.42**	**$2,834.21**

In addition to energy savings, there are carbon dioxide emission savings as well. The Environmental Protection Agency (EPA) reports that electrical energy in the building's region is responsible for 898.1 lbs. CO_2 / MWh. The *carbon dioxide reduction, CDR,* is calculated as:

$$CDR = \left[\left(NGS * 0.029307 \frac{MWh}{Therm}\right) + \left(ECS * \frac{1\ MWh}{1{,}000kWh}\right)\right] * 898.1\ \frac{lbs\ CO_2}{MWh}$$

$$CDR = \left[\left(\frac{525.93\ Therms}{yr} * 0.029307 \frac{MWh}{Therm}\right) + \left(16{,}525.62 \frac{kWh}{yr} * \frac{1\ MWh}{1{,}000kWh}\right)\right] * 898.1\ \frac{lbs\ CO_2}{MWh}$$

$$\boldsymbol{CDR = 28{,}684.46\ \frac{lbs\ CO_2}{yr}}$$

Implementation Cost:

The *Implementation Costs, IC,* of this recommendation stem from the cost of the ERV systems. From a search of vendors, the average cost of an ERV system ranges from $2,000 to $4,000 per rooftop unit/zone as well as a $1,500 installation cost per unit. For the sake of this recommendation the audit team will assume the building will purchase the basic ERV systems at $4,000 per system. Since the EMS building has 1 HVAC system the implementation cost would result in the following:

$$IC = \frac{\$5{,}500}{ERV\ System} * \#\ of\ Needed\ ERV\ Systems$$

$$IC = \frac{\$5{,}500}{ERV\ System} * 1\ System$$

$$\boldsymbol{IC = \$5{,}500}$$

Internal Rate of Return (IRR) and Simple Payback Period (SPP):

The *Internal Rate of Return, IRR,* and the *Simple Payback Period, SPP*, values can be found using the following equations:

$$0 = NPV = \sum_{t=i}^{T} \frac{C_t}{(1 + IRR)^t} - C_O$$

$$IRR = \sqrt[t]{\frac{C_t}{C_O}} - 1$$

Where:

NPV	= Net Positive Value
C_t	= Net Cash Inflow During Period t
C_O	= Total Initial Cost
t	= The Number of Time Periods

$$SPP = \frac{IC}{TCS}$$

For the case of this recommendation the audit team will assume a life span of 15 years. This would result in the following:

$$IRR = \sqrt[15]{\frac{(\$42{,}513.15)}{\$5{,}500}} - 1$$

$$\boldsymbol{IRR = 51.43\%}$$

$$SPP = \frac{\$5{,}500}{\frac{\$2{,}834.21}{yr}} * \frac{12\ months}{yr}$$

$$\boldsymbol{SPP = 23.29\ Months}$$

Recommendation 3: Replace Old Natural Gas Space Heaters in The Garage

Est. Natural Gas Consumption Savings	***= 807.51 Therms/yr***
Est. Natural Gas Consumption Cost Savings	***= $1,309.37/yr***
Est. Carbon Dioxide Reduction	***= 21,227.84 lbs. CO_2/yr***
Est. Implementation Cost	***= $10,000***
Internal Rate of Return After 15 Years	***= 11.65%***
Simple Payback Period	***= 91.65 Months***

Recommended Action:

It is recommended to install new higher efficient space heaters in the garage of the EMS building

Background Information:

The energy savings of this recommendation would stem from using the higher efficient space heaters compared to the current units.

The Lake County EMS building currently has two 75 MBtu space heaters that service the garage area. Currently only one machine is operational due to the age of the units, and parts either being expensive or not available to fix the heaters when they break. By upgrading to newer units, the observed heating efficiency of the systems would see an increase from 80% to ~94%. These units also supply ~80 MBtu rather than 75 MBtu, which could reduce the runtime of the heaters themselves. The EMS building currently operates 8,760 hrs./yr and pays a natural gas rate of $1.6215/therm.

Anticipated Savings:

As stated above the anticipated energy savings of this recommendation stem from the increased efficiency of the new natural gas heaters. To determine these savings one first needs to determine the current system's specifications. To quantify this efficiency increase the systems are split into two separate conditions, a heating condition in the winter months and a cooling condition in the summer months, but since the garage is only heated the audit team will ignore the cooling seasons. With this the weather conditions inside and outside the building must be considered for both conditions. The local weather data, TMY3 data, was collected and analyzed to determine the average outside conditions, while the inside conditions come from what the building is currently set to operate at, 75°F in the summer and 70°F in the winter. With this information, local psychometric charts were used to determine the enthalpy of both the inside and outside air. An example of the psychometric charts used is shown in Figure 9 below. All these values for both the winter and summer conditions are tabulated in Table 19 below.

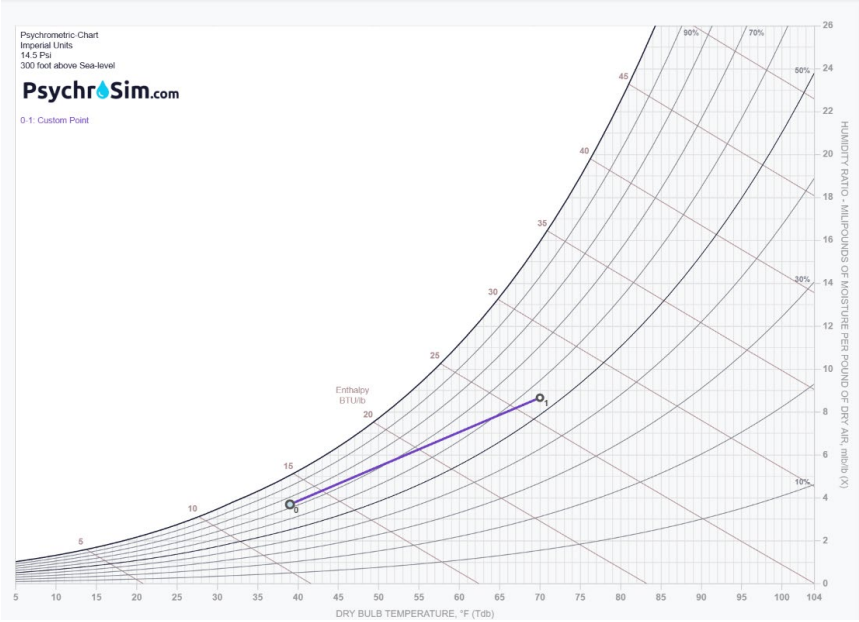


Figure 9: Heating Process

Table 19: Weather Conditions

Heating/Cooling Condition	Indoor Temperature (°F)	Indoor Enthalpy (Btu/lb.)	Average Outdoor Temperature (°F)	Outdoor Enthalpy (Btu/lb.)	Current Enthalpy Difference (Btu/lb.)
Heating (Winter Months)	70	26.3	39	13.4	12.90

The next step in determining the anticipated savings is to determine the energy usage for the heating months for the units. This data is tabulated in Table 20 below.

$$Thermal\ Energy_{\ Heating}\left(\frac{Btu}{hr}\right) = \frac{4.7 * \Delta Enthalpy * Ventilation\ Flow}{Heating\ Efficiency}$$

$$Thermal\ Energy_{\ Heating}\left(\frac{Btu}{hr}\right) = \frac{4.7 * 12.90\frac{Btu}{lb} * 980\ CFM}{0.80}$$

$$Thermal\ Energy_{\ Heating}\left(\frac{Btu}{hr}\right) = 74{,}271.75\frac{Btu}{hr}$$

$$Natural\ Gass\ Usage = Thermal\ Energy_{\ Heating} * \frac{1\ Therm}{100{,}000\ Btu} * \left(Operation\ Hours * \frac{5\ Heating\ months}{12\ months}\right)$$

$$Natural\ Gass\ Usage = 74{,}271.75\frac{Btu}{hr} * \frac{1\ Therm}{100{,}000\ Btu} * \left(8{,}760\frac{hrs}{yr} * \frac{5\ Heating\ months}{12\ months}\right)$$

$$Natural\ Gas\ Usage_{max} = \frac{2{,}710.92\ Therms}{yr}\ Per\ Heater$$

Table 20: Current Heating Energy Usage

Unit Type	# of Units	Thermal Energy (Btu/hr)	Natural Gas Usage Per Unit (Therms/yr)	Total Natural Gas Usage (Therms/yr)
Reznor F75	2	74,271.75	2,710.92	5,421.84

After calculating the max energy usage for the heating months the same must be done for the proposed cases using the new systems. These calculations are the same as the current case values, but instead of using the current efficiency one would use the efficiency provided by the new systems. The calculated values for the proposed cases are tabulated in Table 21 below.

Table 21: Proposed Heating Energy Usage

Unit Type	# of Units	Thermal Energy (Btu/hr)	Natural Gas Usage Per Unit (Therms/yr)	Total Natural Gas Usage (Therms/yr)
Reznor F75	2	63,210	2,307.17	4,615.33

With both the current and proposed energy usage values one can determine the estimated energy savings for both the winter and summer months.

$$Natural\ Gas\ Savings\ (NGS) = Current\ Max\ Natural\ Gas\ usage - Proposed\ Max\ Natural\ Gas\ Usage$$

$$Natural\ Gas\ Savings = 5{,}421.84\frac{Therms}{yr} - 4{,}615.33\frac{Therms}{yr}$$

$$Natural\ Gas\ Savings = \mathbf{806.51}\frac{\boldsymbol{Therms}}{\boldsymbol{yr}}$$

$$Natural\ Gas\ Cost\ Savings\ (NGCS) = NGS * Utility\ Rate$$

$$NGCS = 806.51 \frac{Therms}{yr} * \frac{\$1.6215}{Therm}$$

$$NGCS = \frac{\mathbf{\$1,309.37}}{\boldsymbol{yr}}$$

*** Note:** The above savings are based on the heater's max outputs and runtimes for the heating months. This is most likely not the case due to many different circumstances, and would most likely be lower. Since the units are not metered separately from the rest of the HVAC systems it is hard to get exact natural gas usage values for the space heaters over the year.*****

In addition to energy savings, there are carbon dioxide emission savings as well. The Environmental Protection Agency (EPA) reports that electrical energy in the building's region is responsible for 898.1 lbs. CO_2 / MWh. The *carbon dioxide reduction, CDR,* is calculated as:

$$CDR = \left[\left(NGS * 0.029307 \frac{MWh}{Therm}\right)\right] * 898.1\ \frac{lbs\ CO_2}{MWh}$$

$$CDR = \left[\left(\frac{806.51\ Therms}{yr} * 0.029307 \frac{MWh}{Therm}\right)\right] * 898.1\ \frac{lbs\ CO_2}{MWh}$$

$$\boldsymbol{CDR = 21,227.84\ \frac{lbs\ CO_2}{yr}}$$

Implementation Cost:

The *Implementation Costs, IC,* of this recommendation stem from the cost of the new space heater systems. From a search of vendors, the average cost of an 80 MBtu space heater system ranges from $2,000 to $4,000 per rooftop unit/zone as well as a $1,000 installation cost per unit. For the sake of this recommendation the audit team will assume the building will purchase the space heaters systems at $4,000 per system. Since the EMS building has 2 space heater system the implementation cost would result in the following:

$$IC = \frac{\$5,000}{Space\ Heater} * \#\ of\ Space\ Heater\ Systems$$

$$IC = \frac{\$5,000}{Space\ Heater} * 2\ Systems$$

$$\boldsymbol{IC = \$10,000}$$

Internal Rate of Return (IRR) and Simple Payback Period (SPP):

The *Internal Rate of Return, IRR,* and the *Simple Payback Period, SPP*, values can be found using the following equations:

$$0 = NPV = \sum_{t=i}^{T} \frac{C_t}{(1+IRR)^t} - C_O$$

$$IRR = \sqrt[t]{\frac{C_t}{C_O}} - 1$$

Where:

NPV	= Net Positive Value
C_t	= Net Cash Inflow During Period t
C_O	= Total Initial Cost
t	= The Number of Time Periods

$$SPP = \frac{IC}{TCS}$$

For the case of this recommendation the audit team will assume a life span of 20 years. This would result in the following:

$$IRR = \sqrt[20]{\frac{(\$26{,}487.40)}{\$10{,}000}} - 1$$

$$\boldsymbol{IRR = 11.65\%}$$

$$SPP = \frac{\$10{,}000}{\frac{\$1{,}309.37}{yr}} * \frac{12\ months}{yr}$$

$$\boldsymbol{SPP = 91.65\ Months}$$

Recommendation 4: Reduce Infiltration Through Doors and Windows

Est. Electrical Consumption Savings	= ***202.07 kWh/yr***
Est. Natural Gas Savings	= ***4,605.53 Therms/yr***
Est. Electrical Consumption Cost Savings	= ***$24.23/yr***
Est. Natural Gas Cost Savings	= ***$7,467.87/yr***
Est. Total Cost Savings	= ***$7,492.10/yr***
Est. Carbon Dioxide Reduction	= ***121,401.87 lbs. CO_2/yr***
Implementation Cost	= ***$3,960***
Simple Payback Period	= ***6.34 months***

Recommended Action:

It is recommended to reduce the amount of infiltration through the doors and windows.

Background Information:

The energy savings of this recommendation stem from the load reduction that the HVAC system(s) would experience when the infiltration in and out of the building is reduced. Infiltration is the amount of unwanted outside air that is being brought into the building through cracks, gaps, and openings in the building's envelope. Having a high infiltration rate means that a large amount of unconditioned air is being brought into the building, which not only affects employee comfort, but causes the HVAC system to have an extra load placed on it to condition the space.

During the assessment the assessment team noticed that there are visible gaps in between a few exit doors at community center. Table 22 below tabulates the collected flow and sizing information from these gaps. The building currently operates with an estimated annual runtime of 1,845 hrs./yr. Currently the building pays $0.1199/kWh.

Table 22: Gap Draft Information

Object	Qty	Gap size (ft)	Gap length(ft)	Gap Area (ft^2)	Measured FPM
Windows	5	0.042	16	0.336	40
Bay Doors	3	0.083	12	3	587

Anticipated Savings:

As stated above the anticipated energy savings of this recommendation come from the load reduction that the HVAC systems would experience. To do this one will first need to determine the amount of infiltration in CFM that the building experiences through these gaps. This can be done by multiplying the area of the gap by the FPM flow through the gap. Table 23 below tabulates the estimated flow through the found gaps,

$$Infiltration = Gap\ Flow * Gap\ Area$$

Table 23: Gap Flow Information

Object	Qty	Infiltration Per Item (CFM)	Total Infiltration (CFM)
Windows	5	2.688	13.44
Bay Doors	3	587	1,761
Total			**1,774.44**

After the amount of infiltration into the building is found, the amount of thermal energy lost to the infiltration needs to be determined. This can be done by using the weather data of the building's location and the HVAC system specification data to estimate the amount of thermal energy is wasted by having this large infiltration. As part of these calculations, the local areas' weather data over the year as well as the collected HVAC system data were collected. Since the infiltration happens across all the zones, the audit team will average the corresponding unit COP and thermal efficiencies for the affected systems.

Table 24: Weather Data

Heating/Cooling Condition	Indoor Temperature (°F)	Indoor Enthalpy (Btu/lb.)	Average Outdoor Temperature (°F)	Outdoor Enthalpy (Btu/lb.)	Current Enthalpy Difference (Btu/lb.)
Heating (Winter Months)	70	26.3	39	13.4	12.90
Cooling (Summer Months)	75	29.3	83	40.1	10.86

From these values the current amount of thermal energy the buildings use to combat the amount of infiltration it experiences can be found by using the following equations.[2]

$$Current\ Thermal\ Energy_{\ Heating}\left(\frac{Btu}{hr}\right) = \frac{4.7 * \Delta Enthalpy * Infiltration\ Flow}{Average\ Heating\ Efficiency}$$

$$Current\ Thermal\ Energy_{\ Heating}\left(\frac{Btu}{hr}\right) = \frac{4.7 * 12.90\frac{Btu}{lb} * 1{,}774.44\ CFM}{0.81}$$

$$Current\ Thermal\ Energy_{\ Heating}\left(\frac{Btu}{hr}\right) = 132{,}820.12\frac{Btu}{hr}$$

[2] Since the garage is just heated, it will be excluded from the cooling calculations.

$$Current\ Heating\ Usage\ (CHU) = Current\ Thermal\ Energy_{\ Heating} * \frac{1\ Therm}{100{,}000\ Btu} * \left(Operation\ Hours * \frac{5\ Heating\ months}{12\ months}\right)$$

$$CHEU = 132{,}820.12\frac{Btu}{hr} * \frac{1\ Therm}{100{,}000\ Btu} * \left(8{,}760\frac{hrs}{yr} * \frac{5\ Heating\ months}{12\ months}\right)$$

$$CHEU = 4{,}847.93\frac{Therms}{yr}$$

$$Current\ Thermal\ Energy_{\ Cooling}\left(\frac{Btu}{hr}\right) = \frac{4.7 * \Delta Enthalpy * Infiltration\ Flow}{Average\ COP}$$

Since no cooling is provided in the bay area during summer, window infiltration only is considered.

$$Current\ Thermal\ Energy_{\ Cooling}\left(\frac{Btu}{hr}\right) = \frac{4.7 * 10.86\frac{Btu}{lb} * 13.44\ CFM}{3.45}$$

$$Current\ Thermal\ Energy_{\ Cooling}\left(\frac{Btu}{hr}\right) = 198.84\frac{Btu}{hr}$$

$$Current\ Cooling\ Electrical\ Consumption\ (CCEC) = Thermal\ Energy_{\ Cooling} * \frac{0.00029307\ kWh}{1\ Btu} * \left(Operation\ Hours * \frac{5\ Cooling\ months}{12\ months}\right)$$

$$CCEC = 198.84\frac{Btu}{hr} * \frac{0.00029307\ kWh}{1\ Btu} * \left(8{,}760\frac{hrs}{yr} * \frac{5\ Cooling\ months}{12\ months}\right)$$

$$CCEC = 212.7\frac{kWh}{yr}$$

Next the proposed load on the HVAC systems after the infiltration amount has been reduced needs to be determined. If one is very proactive, they might be able to reduce the infiltration entirely, but for this recommendation the assessment team will assume that the staff will be able to reduce the amount of infiltration by 95%. This results in the infiltration flow dropping to ~ 88.722 CFM for heating and ~0.672 CFM for cooling.

$$Proposed\ Thermal\ Energy_{\ Heating}\left(\frac{Btu}{hr}\right) = \frac{4.7 * \Delta Enthalpy * Propsoed\ Infiltration\ Flow}{Average\ Heating\ Efficiency}$$

$$Propsed\ Thermal\ Energy_{\ Heating}\left(\frac{Btu}{hr}\right) = \frac{4.7 * 12.90\frac{Btu}{lb} * 88.722\ CFM}{0.81}$$

$$Proposed\ Thermal\ Energy_{\ Heating}\left(\frac{Btu}{hr}\right) = 6{,}641\frac{Btu}{hr}$$

$$Proposed\ Heating\ Electrical\ Usage\ (PHU) = Thermal\ Energy_{\ Heating} * \frac{1\ Therm}{100{,}000\ Btu} * \left(Operation\ Hours * \frac{5\ Heating\ months}{12\ months}\right)$$

$$PHU = 6{,}641\frac{Btu}{hr} * \frac{1\ Therm}{100{,}000\ Btu} * \left(8{,}760\frac{hrs}{yr} * \frac{5\ Heating\ months}{12\ months}\right)$$

$$PHU = 242.40\frac{Therms}{yr}$$

$$Proposed\ Thermal\ Energy_{\ Cooling}\left(\frac{Btu}{hr}\right) = \frac{4.7 * \Delta Enthalpy * Propsed\ Infiltration\ Flow}{Average\ COP}$$

$$Proposed\ Thermal\ Energy_{\ Cooling}\left(\frac{Btu}{hr}\right) = \frac{4.7 * 10.86\frac{Btu}{lb} * 0.672\ CFM}{3.45}$$

$$Propsed\ Thermal\ Energy_{\ Cooling}\left(\frac{Btu}{hr}\right) = 9.94\frac{Btu}{hr}$$

$$Proposed\ Cooling\ Electrical\ Consumption\ (PCEC)$$
$$= Propsed\ Thermal\ Energy_{\ Cooling} * \frac{0.00029307\ kWh}{1\ Btu}$$
$$* \left(Operation\ Hours * \frac{5\ Cooling\ months}{12\ months}\right)$$
$$PCEC = 9.94 \frac{Btu}{hr} * \frac{0.00029307\ kWh}{1\ Btu} * \left(8{,}760 \frac{hrs}{yr} * \frac{5\ Cooling\ months}{12\ months}\right)$$
$$PCEC = 10.63 \frac{kWh}{yr}$$

The final step in determining the energy savings is to subtract the proposed case from the current one. This is done by the following:

$$Natural\ Gas\ Savings\ (NGS) = CHU - PHU$$
$$NGS = 4{,}847.93\ \frac{therms}{yr} - 242.40 \frac{therms}{yr}$$
$$\boldsymbol{NGS = 4{,}605.53 \frac{therms}{yr}}$$
$$Electrical\ Consumption\ Savings\ (ECS) = (CCEC) - (PCEC)$$
$$ECS = (212.7 \frac{kWh}{yr}) - (10.63 \frac{kWh}{yr})$$
$$\boldsymbol{ECS = 202.07 \frac{kWh}{yr}}$$

The cost savings for this recommendation can be found by the following:

$$Natural\ Gas\ Cost\ Savings\ (NGCS) = NGS * \frac{\$1.6215}{therm}$$
$$NGS = 4{,}605.53 \frac{therms}{yr} * \frac{\$1.6215}{therm}$$
$$\boldsymbol{NGS = \frac{\$7{,}467.87}{yr}}$$

$$Electrical\ Consumption\ Cost\ Savings\ (ECCS) = ECS * Utility\ Rate$$

$$ECCS = 202.07 \frac{kWh}{yr} * \frac{\$0.1199}{kWh}$$

$$\boldsymbol{ECCS = \frac{\$24.23}{yr}}$$

$$Total\ Cost\ Savings\ (TCS) = NGCS + ECCS$$

$$\boldsymbol{TCS = \frac{\$7,492.10}{yr}}$$

In addition to energy savings, there are carbon dioxide emission savings as well. The Environmental Protection Agency (EPA) reports that electrical energy in the building's region is responsible for 898.1 lbs CO_2 / MWh. The *carbon dioxide reduction, CDR,* is calculated as:

$$CDR = \left[\left(NGS * 0.029307 \frac{MWh}{Therm}\right) + \left(ECS * \frac{1\ MWh}{1{,}000kWh}\right)\right] * 898.1\ \frac{lbs\ CO_2}{MWh}$$

$$CDR = \left[\left(\frac{4{,}605.53\ Therms}{yr} * 0.029307 \frac{MWh}{Therm}\right) + \left(\frac{202.07\ kWh}{yr} * \frac{1\ MWh}{1{,}000kWh}\right)\right] * 898.1\ \frac{lbs\ CO_2}{MWh}$$

$$\boldsymbol{CDR = 121{,}401.87 \frac{lbs\ CO_2}{yr}}$$

Implementation Cost:

The *Implementation Cost, IC,* of this recommendation stems from the cost of resealing the doors, windows, and other gaps. From a search of vendors, the cost of sealing materials can cost around $500 per door and $300 per window. The assessment team will also assume that it would take the maintenance staff around 2 hours to seal 1 door at a rate of $60 per hour. This results in the following implementation cost:

$$IC = \left(\frac{\$500}{Door} * \#\ of\ Doors\right) + \left(\frac{\$300}{Window} * \#\ of\ Windows\right) + \left[(\#of\ Doors\ and\ Windows) * \frac{2\ hours}{Door} * \frac{\$60}{hour}\right]$$

$$IC = \$1{,}500 + \$1{,}500 + \$960$$

$$\boldsymbol{IC = \$3{,}960}$$

Simple Payback Period (SPP):

$$SPP = \frac{IC}{ECCS} * \frac{12\ months}{yr}$$

$$SPP = \frac{\$3{,}960}{\frac{\$7{,}492.10}{yr}} * \frac{12\ months}{yr}$$

$$\boldsymbol{SPP = 6.34\ Months}$$

Recommendation 5: Install Higher Efficiency Lighting

Est. Electrical Consumption Savings	= ***5,777.82 kWh/yr***
Est. Total Cost Savings	= ***$692.77/yr***
Est. Carbon Dioxide Reduction	= ***5,189.06 lbs. CO_2/yr***
Est. Implementation Cost	= ***$350***
Internal Rate of Return Over 15 Years	= ***199.93%***
Simple Payback Period	= ***6.06 Months***

Recommended Action:

It is recommended to replace the old Fluorescent T8 bulbs with higher efficiency LED bulbs.

Background Information:

The energy savings of this recommendation typically comes from using a more efficient bulb compared to the current fluorescent bulbs. This means that the LEDs tend to use less power/energy to generate or produce more light. For example, most T8s tend to be around 32 Watts[3], while 4ft LEDs tend to be around 12-18 Watts[1]. LEDs also tend to have a higher light emittance level when compared to fluorescent T8s, which allows one to use less bulbs to achieve the same if a higher light level.

The Lake County EMS Building currently utilizes LEDs little to no LEDs in the building. The building houses EMS personnel year-round so the estimated runtime for the building is 5,848 hrs./yr. Currently the EMS Building pays $0.1199/kWh.

Anticipated Savings:

As stated above, the energy savings for this recommendation mainly stem from switching from the less efficient fluorescent T8s to LEDs. The audit team also investigated reducing the total required number of bulbs due to the high emittance level of the LEDs compared to the fluorescent T8s.

The first step to determine the anticipated savings is to determine the current cost of the lights in the building. This requires the current lighting count, bulb type, bulb wattage, and average operational time of the area(s). After this information is collected one can use the following equations to determine the current energy usage and subsequent cost of the lighting used in the building. For simplicity's sake only the calculations for the fluorescent T8s will be shown, but all the current lighting data is tabulated in Table 25 below.

[3] The wattage can change depending on the manufacturer and the bulb's intended use.

$$Current\ Power\ Usage\ (CPU) = \frac{\#\ of\ Bulbs * Wattage\ per\ Bulb}{1{,}000}$$

$$CPU_{Courthouse.} = \frac{44\ Bulbs * \frac{32\ Watts}{Bulb}}{1{,}000}$$

$$CPU_{Courthouse} = 1.41kW$$

$$Total\ Current\ Power\ Usage\ (TCPU) = \sum CPU_i$$

From this value the *Current Electrical Consumption, CEC,* for the bulbs can be found by the following:

$$CEC = CPU * Current\ Operational\ Hours$$

$$CEC = 1.41W * \frac{5{,}848\ hrs}{yr}$$

$$CEC = \frac{8{,}233.98kWh}{yr}$$

$$Total\ Current\ Electrical\ Consumption\ (TCEC) = \sum CEC_i$$

Using this total current electrical consumption value, one can multiply it by the utility rate to determine the *Current Cost, CC*, of the lights.[4]

$$CC = (TCEC * Electrical\ Consumption\ Utility\ Rate)$$

$$CC = \left(\frac{12{,}772.8\ kWh}{yr} * \frac{\$0.1199}{kWh}\right)$$

$$CC = \frac{\$987.26}{yr}$$

Table 25: Current Lighting Setup

[4] Since the building is not billed for electrical demand, the energy and cost savings associated with it are ignored.

Lighting Type	Total Bulb Count	Watts per Bulb	Operation Hours (hr./yr)	Total Energy Usage (kWh/yr)	Annual Energy Cost ($/yr)
EMS Building	44	32	5,848	8,233.98	987.26
Total	**44**	**-**	**-**	**8,233.98**	**987.26**

After the current lighting energy usage and cost has been determined the next step to finding the anticipated savings is to determine what the proposed lighting energy usage and cost. Due to the increased light emittance of the LED bulbs the audit team proposes that when replacing the fluorescent T8 bulbs, replace only 80% of the bulbs. This would mean for the proposed case that total bulb count would be reduced by ~9 T8 bulbs resulting in a total LED bulb count of 35 bulbs. Table 26 below shows the proposed lighting setup using the same equations above.

$$Proposed\ Power\ Usage\ (PPU) = \frac{\#\ of\ Bulbs * Wattage\ per\ Bulb}{1{,}000}$$

$$PPU_{EMS\ Building} = \frac{35 * \frac{12\ W}{bulb}}{1{,}000} = 0.42\ kW$$

$$Total\ Proposed\ Power\ Usage\ (TPPU) = \sum PPU_i$$

$$Total\ Proposed\ Power\ Usage\ (TPPU) = 0.42\ kW$$

Similarly using these PPU values, the *Proposed Electrical Consumption, PEC,* can be found by the following:

$$PEC = PPU * Proposed\ Operaitional\ Hours$$

$$PEC_{EMS\ Building} = 0.42\ kW * \frac{5{,}848hrs}{yr} = \frac{2{,}456.16\ kWh}{yr}$$

$$Total\ Proposed\ Electrical\ Consumption\ (TPEC) = \sum PEC_i$$

$$TPEC = \frac{2{,}456.16kWh}{yr}$$

Using this total proposed electrical consumption value, one can multiply it by the utility rate to determine the *Proposed Cost, PC*, of the lights.

$$PC = (TPEC * Electrical\ Consumption\ Utility\ Rate) + (TPPU * Demand\ Utility\ Rate)$$

$$PC = \left(\frac{2{,}456.16\ kWh}{yr} * \frac{\$0.1199}{kWh}\right)$$

$$PC = \frac{\$294.49}{yr}$$

Table 26: Proposed Lighting Setup

Lighting Type	Total Bulb Count	Watts per Bulb	Operation Hours (hr./yr)	Total Energy Usage (kWh/yr)	Annual Energy Cost ($/yr)
EMS Building	35	12	5,848	2,456.16	294.49
Total	**35**	**-**	**-**	**2,456.16**	**294.49**

The next step is to compare both setups and determine the anticipated savings. This is as simple as subtracting the proposed lighting setup electrical consumption and cost values from the values of the current lighting setup using the following equations:

$$Total\ Electrical\ Consumption\ Savings\ (TECS) = TCEC - TPEC$$

$$TECS_{Courthouse} = \frac{8{,}233.98kWh}{yr} - \frac{2{,}456.16\ kWh}{yr} = 5{,}777.82\frac{kWh}{yr}$$

$$Electrical\ Consumption\ Cost\ Savings\ (ECCS) = ECS * Utility\ Rate =$$

$$ECCS_{EMS\ Building.} = \frac{2{,}456.16\ kWh}{yr} * \frac{\$0.1199}{kWh} = \frac{\$294.49}{yr}$$

Total Cost Savings is the Difference between Total Current Cost and Total Proposed Cost.

$$TCS = TCC - TPC = 987.26\frac{\$}{yr} - 294.49\frac{\$}{yr} = \frac{\$692.77}{yr}$$

In addition to energy savings, there are carbon dioxide emission savings as well. The Environmental Protection Agency (EPA) reports that electrical energy in the building's region is responsible for 898.1 lbs. CO_2 / MWh. The *carbon dioxide reduction, CDR,* is calculated as:

$$CDR = ECS * 898.1\ \frac{lbs\ CO_2}{MWh} * \frac{1\ MWh}{1{,}000kWh}$$

$$CDR = 5777.82 \frac{kwh}{yr} * 898.1\ \frac{lbs\ CO_2}{MWh} * \frac{1\ MWh}{1{,}000kWh}$$

$$\boldsymbol{CDR = 5{,}189.06 \frac{lbs\ CO_2}{yr}}$$

Implementation Cost:

The *Implementation Cost*, *IC,* of this recommendation stems from the cost of purchasing the required materials. In this case it would be for the replacement LED bulbs and some occupancy sensors. According to TVA Energy Right and other sources, when bought in bulk LED bulbs can range between $4 and $10 per bulb and $11 for an occupancy sensor. For the case of this recommendation the audit team will assume a cost of $10 per T8 LED bulb This results in the following equation:

$$IC = \left(\frac{\$}{LED\ Bulb} * \#\ of\ LEDs\ Bulbs\ Needed\right)$$

$$IC = \left(\frac{\$10}{LED\ Bulb} *\ 35 Bulbs\right)$$

$$IC = \$350$$

Internal Rate of Return (IRR) and Return on Investment (ROI):

The *Internal Rate of Return, IRR,* and the *Return On Investment, ROI*, values can be found using the following equations:

$$0 = NPV = \sum_{t=i}^{T} \frac{C_t}{(1 + IRR)^t} - C_O$$

$$IRR = \sqrt[t]{\frac{C_t}{C_O}} - 1$$

Where:

NPV	= Net Positive Value
C_t	= Net Cash Inflow During Period t

C_O = Total Initial Cost

t = The Number of Time Periods

$$SPP = \frac{IC}{TCS} =$$

For the case of this recommendation the audit team will assume a lifespan of 15 years. This would result in the following:

$$IRR = \sqrt[15]{\frac{(\$10{,}391.55)}{\$350}} - 1$$

$$\boldsymbol{IRR = 197.93\%}$$

$$SPP = \frac{\$350}{\frac{\$692.77}{yr}} * \frac{12\ months}{yr}$$

$$\boldsymbol{SPP = 6.06\ Months}$$

IV. Energy Management

This section provides an account of energy consumption at the facility. An essential component of any energy management program is a continuous accounting of energy use and its cost. This can best be done by keeping up-to-date records of energy use, demand, and other administrative costs. Graphs will sometimes show irregularities in energy use that should be studied. In addition, a comparison to the same month in consecutive years can give insight into equipment problems. It

is necessary to graph individual and total energy use and costs. Any "spikes" should be investigated, and their cause explored. Through careful observation of trends, it may be possible to catch wasteful equipment and practices before they get out of hand. The energy usage for a typical year is graphed on the following pages. The conversion factors used to prepare the graphs are listed in the following table.

Energy Conversion Factors

Table 27: Electric Conversion Factors

Energy Unit	Energy Equivalent
1 kWh	3,412 BTU
1 therm	100,000 BTU
1 ft^3 of natural gas	970-1,030 BTU*
1 HP-hr.	2,545 BTU

* - varies by supplier

Energy Cost for Subject Facility

Table 28: Electricity Cost

Electric Charge	All kWh	$0.1199/kWh

Table 29: Natural Gas Cost

Gas Charge	All Therms	$1.6215/Therm

1. Electric Consumption, Demand, and Cost

Table 30: Electric Consumption Usage and Charges

Usage Month	Usage (kWh)	Total Usage (MMBtu)	Total Usage Charges
Jan-24	4,044.00	14	$501.22
Feb-24	3,375.00	12	$419.13

Mar-24	3,932.00	13	$467.86
Apr-24	4,084.00	14	$447.11
May-24	4,010.00	14	$433.87
Jun-24	4,754.00	16	$595.81
Jul-24	4,246.00	14	$544.61
Aug-24	4,019.00	14	$520.12
Sep-24	3,400.00	12	$423.90
Oct-24	3,066.00	10	$386.84
Nov-24	2,615.00	9	$351.89
Dec-24	2,914.00	10	$423.19
12 mo. Totals	**44,459**	**152**	**$5,516**

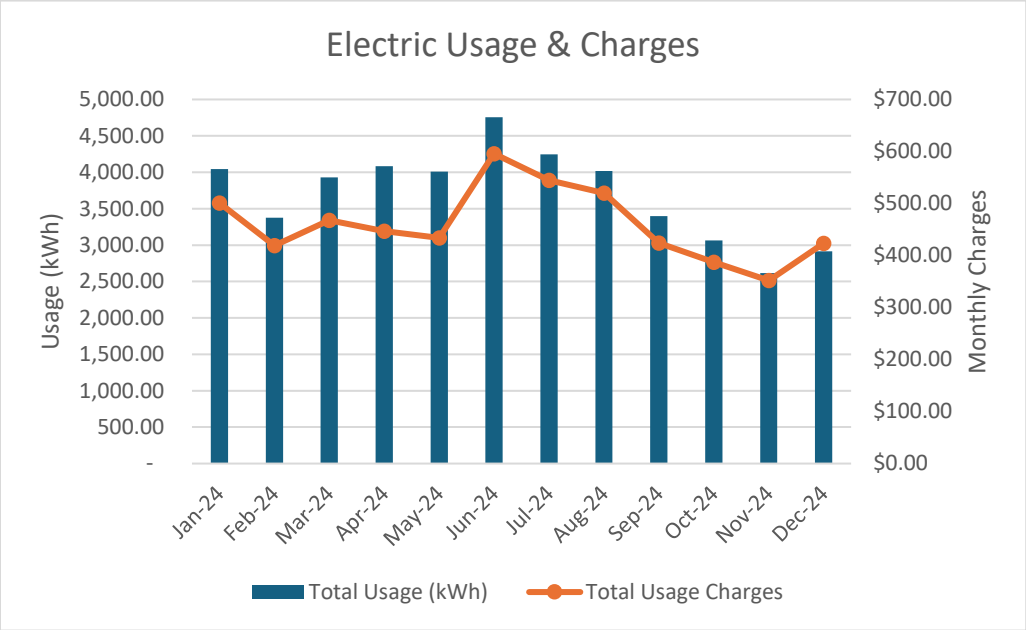


Figure 10: Electric Consumption Usage and Charges

2. Natural Gas Consumption, and Cost

Table 31: Natural Gas Consumption and Charges

Usage Month	Usage (therms)	Total Charges
Apr-24	70.00	$113
May-24	3.00	$5

Jun-24	2.00	$4
Jul-24	1.00	$4
Aug-24	1.00	$4
Sep-24	1.00	$4
Oct-24	1.00	$4
Nov-24	1.00	$4
Dec-24	32.00	$52
Jan-25	139.00	$225
Feb-25	284.00	$459
Mar-25	183.00	$296
Totals	**718**	**$1,173**

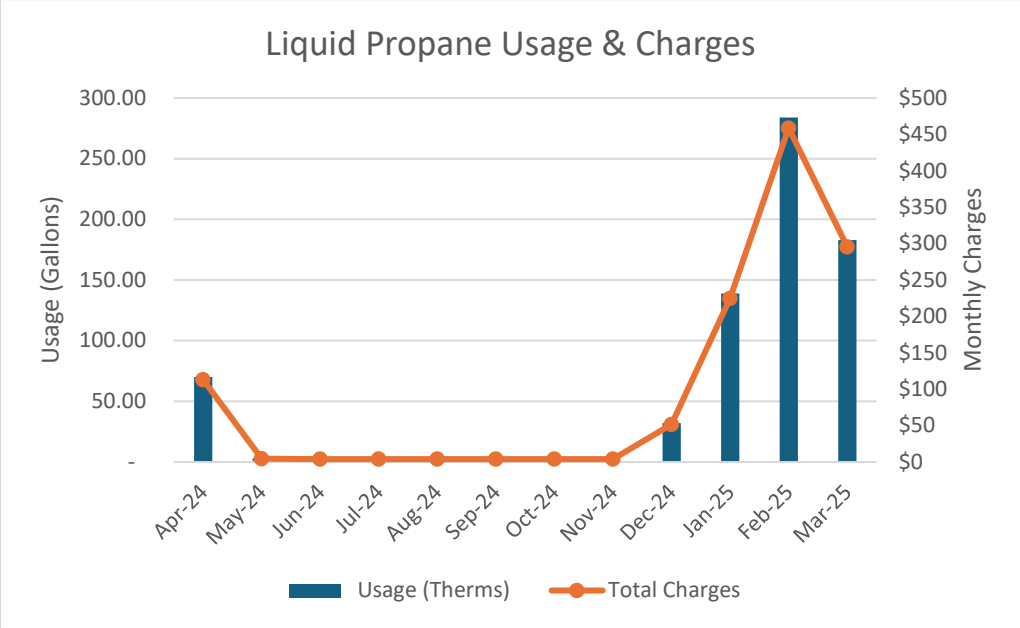


Figure 11: Natural Gas Usage & Charges

V. Additional Items

In the interest of making this report more complete, this section gives some general information about good energy management practices and presents other possible energy conservation opportunities.

Additional Recommendations:

Additional Recommendation 1: Install Low-Emissivity Windows

Est. Electrical Consumption Savings	= ***177.84 kWh/yr***
Est. Natural Gas Savings	= ***53.6 Therms/yr***
Est. Electrical Consumption Cost Savings	= ***$21.32/yr***
Est. Natural Gas Cost Savings	= ***$86.91/yr***

Est. Total Cost Savings = ***$108.23/yr***
Est. Carbon Dioxide Reduction = ***1,570.5 lbs. CO_2/yr***
Implementation Cost = ***$12,000***
Simple Payback Period = ***1,330.50 Months***

Recommended Action:

It is recommended to replace/install low-E windows in place of regular windows.

Background Information:

The energy savings of this recommendation stem from the increased thermal resistance that the low-E windows provide. These windows work by reducing the infrared and ultraviolet light that is permitted to pass through the glass, without heavily impacting the amount of light that comes through the window. This means that during the summer months the glass will reflect more solar heat rather than absorbing it into the building, keeping the building cooler. In the winter these windows would reflect more heat inside the building allowing which can help alleviate some of the thermal load that the HVAC system(s) have to cover.

Currently the Lake County EMS Building has around 8 double paned 4' by 4' windows across the sides of the building, an example of the windows are shown in Figure 12 below. In particular the audit team was notified that the windows have noticeable drafts throughout the year, especially during times of high wind**.** The building pays an average utility rate of $0.1199/kWh and $1.6215/therm.



Figure 12: Window

Anticipated Savings:

As stated above the anticipated savings of this recommendation stem from the reduction in load the HVAC system(s) would see when having the low-E windows installed. To determine the estimated savings of installing these low-E windows, the first step is the current amount heat loss/gain the building sees through these windows.

This data is usually collected at the nearest airport and/or large city, which in this case is the Memphis area. Using the monthly local Heating Degree Day, HDD, and Cooling Degree Day, CDD, data provided by the National Weather Service for the area near the Perry County Courthouse as seen in Figure 13 below. One can get an idea of how often the HVAC system would run and how loaded it might need to be. For example, the peak summer months of June, and July had average CDD values of 473 and 615 respectively for the 2025-2026 year. This means that on average every day in June and July had an average temperature of ~15.77°F, and ~19.84°F above 65°F respectively. With these CDD values being this high means that the HVAC system would typically run at a higher load or more often during these months to provide adequate cooling. A similar situation can be seen for the HDD values for the peak winter months of December and January, the only difference is that HDD is related to the temperature below 65°F. This means that during the months of December and January one would typically see the most use of their HVAC heating.

NOWData - NOAA Online Weather Data — Enlarge results — Print

Monthly Total HDD for Memphis Area, TN (ThreadEx)

Click column heading to sort ascending, click again to sort descending.

Year	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Season
2022-2023	0	0	3	102	397	619	510	381	323	120	18	0	2473
2023-2024	0	0	0	88	313	486	838	363	260	93	0	0	2441
2024-2025	0	0	0	47	240	528	844	532	227	88	10	0	2516
2025-2026	0	0	0	82	286	613	M	M	M	M	M	M	M
Mean	0	0	1	80	309	562	731	425	270	100	9	0	2477
Max	0 2025	0 2025	3 2022	102 2022	397 2022	619 2022	844 2025	532 2025	323 2023	120 2023	18 2023	0 2025	2516 2025
Min	0 2025	0 2025	0 2025	47 2024	240 2024	486 2023	510 2023	363 2024	227 2025	88 2025	0 2024	0 2025	2441 2024

NOWData - NOAA Online Weather Data — Enlarge results — Print

Monthly Total CDD for Memphis Area, TN (ThreadEx)

Click column heading to sort ascending, click again to sort descending.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2023	2	9	20	32	260	439	543	552	388	158	22	0	2425
2024	0	7	19	102	305	476	528	553	312	147	41	0	2490
2025	0	0	33	132	183	473	615	517	401	145	17	8	2524
2026	M	M	M	M	M	M	M	M	M	M	M	M	M
Mean	1	5	24	89	249	463	562	541	367	150	27	3	2480
Max	2 2023	9 2023	33 2025	132 2025	305 2024	476 2024	615 2025	553 2024	401 2025	158 2023	41 2024	8 2025	2524 2025
Min	0 2025	0 2025	19 2024	32 2023	183 2025	439 2023	528 2024	517 2025	312 2024	145 2025	17 2025	0 2024	2425 2023

Figure 13: Monthly CDD and HDD Days

This results in a total HDD value of 2,516 and a CDD value of 2,524. Using these values one can estimate the amount of thermal energy lost for both the heating and cooling seasons using the following equations:

$$Current\ Heat\ Loss = \frac{Window\ U\ Factor * Glass\ Area * HDD * \frac{24\ hours}{1\ Day}}{HVAC\ Heating\ Efficiency}$$

$$Current\ Heat\ Loss = \frac{0.83 \frac{Btu}{hr * ft^2 * °F} * (4ft * 4ft) * 2{,}516\ HDD * \frac{24\ hours}{1\ Day}}{0.81}$$

$$Current\ Heat\ Loss = 989{,}999\ Btu$$

$$Current\ Heat\ Loss = 989{,}999\ Btu * \frac{1\ Therm}{99{,}980\ Btu}$$

$$Current\ Heat\ Loss = 9.9\ Therms$$

$$Current\ Heat\ Gain = \frac{Window\ U\ Factor * Glass\ Area * CDD * \frac{24\ hours}{1\ Day}}{HVAC\ Cooling\ Efficiency}$$

$$Current\ Heat\ Gain = \frac{0.83 \frac{Btu}{hr * ft^2 * °F} * (4ft * 4ft) * 2{,}524\ CDD * \frac{24\ hours}{1\ Day}}{3.45}$$

$$Current\ Heat\ Gain = 233{,}173.7\ Btu$$

$$Current\ Heat\ Gain = 233{,}173.7\ Btu * \frac{1\ kWh}{3{,}412\ Btu}$$

$$Current\ Heat\ Gain = 68.34\ kWh$$

Using this equation one can determine the current energy loss/gain for each window. For simplicity's sake the audit team will tabulate the data in table XXX below.

Table 32: Current Energy Loss/Gain

Window Type	# of Windows	Window U-Factor (Btu/hr*ft²*°F)	Window Area (ft²)	Current Winter Heat Loss per Window (Therms)	Current Summer Heat Gain per Window (kWh)	Total Current Winter Heat Loss (Therms)	Total Current Summer Heat Gain (kWh)
Double Paned Windows	8	0.83	16	9.9	68.34	79.2	546.72

Using the same equations as before one can determine the proposed energy heat gain/loss for each window type. The only difference would be using the low-E window U-factor in place of the current window's U-Factor. From a study done in 2012 by the National Renewable Energy Laboratory, NREL, the commonly seen U-factors for double pane low-E windows ranges from 0.25 to 0.42, depending on the vendor and how efficient the consumer wants the windows. For the case of this recommendation the audit team will assume that the building staff would choose one of most efficient windows. Using this value the proposed energy loss/gain are tabulated in Table 33 below.

Table 33: Proposed Energy Loss/Gain

Window Type	# of Windows	Proposed U-Factor (Btu/hr*ft²*°F)	Proposed Winter Heat Loss per Window (Therms)	Proposed Summer Heat Gain per Window (kWh)	Total Proposed Winter Heat Loss (Therms)	Total Proposed Summer Heat Gain (kWh)

Double Paned Windows	8	0.27	3.2	22.23	25.6	177.84

From these values one can determine the *Natural Gas Savings, NGS,* and the *Electrical Consumption Savings, ECS,* using the following equations.

$$NGS = Current\ Heat\ Loss - Proposed\ Heat\ Loss$$

$$NGS = 79.2\ \frac{Therms}{yr} - 25.6\frac{Therms}{yr}$$

$$NGS = 53.6\frac{Therms}{yr}$$

$$ECS = Current\ Heat\ gain - Proposed\ Heat\ Gain$$

$$ECS = 546.72\frac{kWh}{yr} - 177.84\frac{kWh}{yr}$$

$$ECS = 3{,}68.88\frac{kWh}{yr}$$

From these values one can determine the *Natural gas Cost Savings, NGCS,* and the *Electrical Consumption Cost Savings, ECCS,* by multiplying the NGS and ECS by their respective utility rate.

$$NGCS = \frac{53.6\ Therms}{yr} * \frac{\$1.6215}{Therm}$$

$$\boldsymbol{NGCS = \frac{\$86.91}{yr}}$$

$$ECCS = \frac{177.84\ kWh}{yr} * \frac{\$0.1199}{kWh}$$

$$\boldsymbol{ECCS = \frac{\$21.32}{yr}}$$

$$Total\ Cost\ Savings\ (TCS) = NGCS + ECCS$$

$$TCS = \frac{\$86.91}{yr} + \frac{\$21.32}{yr}$$

$$\boldsymbol{TCS = \frac{\$108.23}{yr}}$$

In addition to energy savings, there are carbon dioxide emission savings as well. The Environmental Protection Agency (EPA) reports that electrical energy in the building's region is responsible for 898.1 lbs. CO_2 / MWh. The *carbon dioxide reduction, CDR,* is calculated as:

$$CDR = \left[\left(NGS * 0.029307 \frac{MWh}{Therm}\right) + \left(ECS * \frac{1\ MWh}{1{,}000kWh}\right)\right] * 898.1\ \frac{lbs\ CO_2}{MWh}$$

$$CDR = \left[\left(\frac{53.6\ Therms}{yr} * 0.029307 \frac{MWh}{Therm}\right) + \left(\frac{177.84\ kWh}{yr} * \frac{1\ MWh}{1{,}000kWh}\right)\right] * 898.1\ \frac{lbs\ CO_2}{MWh}$$

$$\boldsymbol{CDR = 1{,}570.50\ \frac{lbs\ CO_2}{yr}}$$

Implementation Cost:

The *Implementation Cost, IC,* of this recommendation stems from the cost of either replacing the window entirely or adding and a coating to the glass. For the case of this recommendation the audit team will assume the building staff will replace the windows rather than coat them. From a search of vendors and prices of low-E windows, the prices for double-pane low-E windows range from $500-$1,500 depending on the vendor and efficiency of the window. The audit team will assume that the building staff will purchase low-e windows costing $1,500/window. Using this value the implementation cost can be found by the following.

$$IC = \left(\frac{\$1{,}500}{Window} * Number\ of\ Standard\ Windows\right)$$

$$IC = \left(\frac{\$1{,}500}{Window} * 8\ Windows\right)$$

$$\boldsymbol{IC = \$12{,}000}$$

Simple Payback Period (SPP):

The *Simple Payback Period, SPP*, value can be found using the following equation:

$$SPP = \frac{IC}{TCS}$$

$$SPP = \frac{12{,}000}{\frac{\$108.23}{yr}}$$

$$\boldsymbol{SPP = 1{,}330.5\ Months}$$

VII. Energy Financing Options

Financing energy conservation measures is often capital intensive. For a small or medium-sized business, the outlay of this capital may be the primary obstacle in implementing recommendations. However, there are a few programs available through government and the utilities provider, which assist businesses in financing energy improvements. The audit team has

summarized some of these programs below; the applicability of each program to the facility may vary.

Government Tax Benefits

Energy Efficient Commercial Building Tax Deduction (§179D of federal tax code)

The Energy Act of 2005 established a new deduction for expenses incurred for energy efficient commercial building property. The deduction is equal to energy efficient commercial building property expenditures made by the taxpayer subject to a cap.

To qualify for a full deduction:

If the interior lighting, heating, cooling, ventilation, hot water systems, and building envelope have been incorporated and will reduce the total energy costs by 50% or more as compared to a reference building. Reductions in any other energy uses such as receptacles, process loads, refrigeration, cooking and elevators are **not** taken into account in determining whether the 50% reduction is achieved.

Deduction Allowed:

The Aggregate amount of improvement costs **Or** $1.80 per sq. ft of the building, whichever is less.

Partial Property Qualification:

If any of the following separate building systems can reduce total annual energy power costs by 16 2/3% as compared to a reference building

- Lighting expenditures
- Heating, Cooling, Ventilation, or Hot Water
- Energy Efficient Building Envelope

Deduction allowed:

Cost of improvements **Or**, $.60 per sq. ft of building, whichever is less.

Before a taxpayer can receive the deduction, the taxpayer must receive certification that the energy reduction has been met and retain with taxpayer's records. The certification must be completed by a qualified individual. This individual must not be related to the taxpayer and must be an engineer or contractor that is properly licensed as a professional engineer or contractor in the jurisdiction in which the building is located. The engineer must use qualified computer software to make the determination. A list of the software that is acceptable is provided on the following website:

http://www.eere.energy.gov/buildings/info/qualified_software/index.html

TVA Energy Efficiency Incentives

When qualifying industries make an investment in energy savings through TVA, they may qualify for an incentive payment that will help offset some of their investment costs. These incentives are available for projects that help reduce energy intensity in the facility. Industrial customers that are served by a participating power company or by TVA and have an electric energy efficiency project may be able to participate.

Financial assistance is available to help the plant make the transition to a more energy efficient facility. Two types of financial assistance, Standard and Custom Incentives, are available to help reduce the plant's project costs and accelerate the plant's payback. These incentives are offered through participating local power companies in partnership with TVA. Follow these simple steps to find out more:

- Contact the local power company to find out if it participates in the EnergyRight Solutions incentive program. If so, the local power company can provide more information on program details, the process for subscribing and whether the business qualifies for the efficiency incentive.
- If the plant is a Directly Served customer, contact the plant's TVA account manager.

  Go to the TVA's EnergyRight page **EnergyRight**
- Start applications for incentives at http://www.tvaenergyefficiencyincentive.com/

It is important that the plant starts to communicate with the TVA about possible projects before implementation. The plant will not have the ability to receive incentives if a pre-assessment by the TVA is not performed initially.

MEASUR Software Tools

MEASUR is a suite that includes various free to use programs and calculators. They can be used to calculate the energy usage and cost caused from systems within a building and how much energy and money would be saved from upgrading them.

More information about this software can be found here:

MEASUR

Appendix A: Energy Score Report

BUILDING ENERGY ASSET SCORE
U.S. DEPARTMENT OF ENERGY

Building Assessment Tool Report
Upgrade Opportunities

BUILDING INFORMATION

Lake County: EMS Building
333 Kentucky Street
Tiptonville, TN 38079

Building Type:	**Mixed Use**	Score Date:	**01/09/2026**
Gross Floor Area:	**4,500 ft²**	Building ID #:	**34390**
Climate Zone:	**3A**	Climate Description:	**Warm - Humid**
Year Built:	**2004**	Software Release:	1.0.0

Estimated Annual Site Energy Use Intensity and Greenhouse Gas Intensity

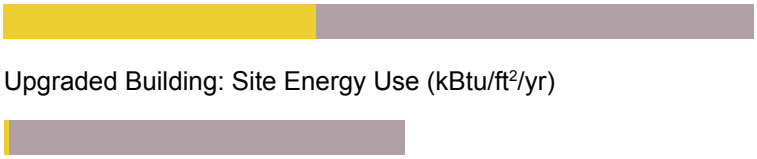
	Site EUI (kBtu/ft²/yr)	GHGI (kg CO_2e/ft²/yr)
Current	**43**	**4.06**
Upgraded	**23**	**2.83**

Estimated annual site energy savings: 46.51%

Energy Use Intensity by Fuel Type

Current Building: Site Energy Use (kBtu/ft²/yr)

Upgraded Building: Site Energy Use (kBtu/ft²/yr)



Building Use Types

Multi-family (fewer than 4 floors):	**2,025 ft²**
Parking Garage (Heated Only):	**2,100 ft²**

This report includes a Score for the entire building as well as individual Scores for each of the separate use types.

The **Building Energy Asset Score** is a national rating system developed by the U.S. Department of Energy. The **Score** reflects the energy efficiency of a building based on the building's structure, heating, cooling, ventilation, and hot water systems. The building's **Structure and Systems** are individually evaluated and ranked. The **Upgrade Opportunities** page provides recommendations for how to improve the building's energy efficiency, increase the building's Asset Score, and save money.

[3] The energy savings range reflects the expected incremental savings for the overall building associated with the specific efficiency upgrade opportunity assuming all other recommended upgrades have already been implemented. This assumption is made to avoid double counting of savings. The ranges reflect site energy savings and are based on standard operating assumptions, unless actual operating conditions are provided by the user.
[4] The costs are based on Advanced Energy Retrofit Guide and RS Means. The costs are replacement costs, not incremental costs. The costs do not include local incentives. Costs are shown as a range ($ = low cost, $$ = medium cost, $$$ = high cost).
† User-selected energy efficiency measure

Building Assessment Tool Report

Upgrade Opportunities

Building Name: **Lake County: EMS Building**

Gross Floor Area: **4,125 ft²**

Selected Upgrade Opportunities	Energy Savings [3]	Cost[4]
Building Envelope		
• Add a Cool Roof for Block in blocks Living Space and Garage (Heated Only) for Roof 38510 - Built-Up with Wood Deck.† - *Learn More*	Low	$$
• Seal Building Envelope to Reduce Air Infiltration† - *Learn More*	Low	$$
• Upgrade to High-performance Windows for Block in block Living Space for Window 43409 - Metal, Double Pane.† - *Learn More*	Medium	$$-$$$
Lighting Systems		
• Upgrade to LED Fixtures for Lighting Fixture in blocks Living Space and Garage (Heated Only) for Fixture 2 - Fluorescent T8.† - *Learn More*	Medium	$
HVAC Systems and Controls		
• Replace HVAC with High-performance Packaged Rooftop Heat Pump and a DOAS in block Living Space for Raheem Unit.† - *Learn More*	Medium	$$-$$$
Service Hot Water Systems		
• Upgrade Heat Pump Hot Water Heater in blocks Garage (Heated Only) and Living Space for Hot Water System 53929 - Direct Fired- Storage, Natural Gas.† - *Learn More*	Low	$$
• Add Low Flow Service Hot Water Fixtures for Block in block for Garage (Heated Only).† - *Learn More*	Low	$$
• Add Low Flow Service Hot Water Fixtures for Block in block for Living Space.† - *Learn More*	Low	$$

[3] The energy savings range reflects the expected incremental savings for the overall building associated with the specific efficiency upgrade opportunity assuming all other recommended upgrades have already been implemented. This assumption is made to avoid double counting of savings. The ranges reflect site energy savings and are based on standard operating assumptions, unless actual operating conditions are provided by the user.
[4] The costs are based on Advanced Energy Retrofit Guide and RS Means. The costs are replacement costs, not incremental costs. The costs do not include local incentives. Costs are shown as a range ($ = low cost, $$ = medium cost, $$$ = high cost).
† User-selected energy efficiency measure

Building Assessment Tool Report

Health and Safety Impact

Building Name: **Lake County: EMS Building**

Gross Floor Area: **4,125 ft²**

Health and Safety Impact of Upgrade Opportunities

Building Envelope	Health and Safety Impact
• Add a Cool Roof for Block in blocks Living Space and Garage (Heated Only) for Roof 38510 - Built-Up with Wood Deck.†	Cool roof can keep both the building and its surrounding area cooler on hot days. This helps to improve thermal comfort, resulting in work performance and learning benefits.
• Seal Building Envelope to Reduce Air Infiltration†	Air sealing can improve thermal comfort by reducing cold drafts, and reduce occupant exposure to outdoor air pollutants, such as vehicle exhaust. It may also help with moisture and pest control by eliminating entry points. But with less outside air being provided by air infiltration, it is important to make sure that the building has sufficient ventilation after air sealing, such as by HVAC commissioning, otherwise indoor air quality may deteriorate.
• Upgrade to High-performance Windows for Block in block Living Space for Window 43409 - Metal, Double Pane.†	Selecting windows with the appropriate heat gain and visible light transmittance can help maintain thermal comfort and improve occupant satisfaction with indoor lighting level.
Lighting Systems	
• Upgrade to LED Fixtures for Lighting Fixture in blocks Living Space and Garage (Heated Only) for Fixture 2 - Fluorescent T8.†	Indoor lighting retrofit has the potential to improve lighting quality and occupant satisfaction. Retrofits that also allow occupants to have more lighting control can provide greater flexibility to adapt and respond to changing needs.
HVAC Systems and Controls	
• Replace HVAC with High-performance Packaged Rooftop Heat Pump and a DOAS in block Living Space for Raheem Unit.†	Many existing HVAC systems are not providing proper ventilation, filtration, heating, cooling, dehumidification, and are inefficient. HVAC replacement can improve thermal comfort and potentially reduce background noise by selecting equipment that meets the sound specification and with proper installation. In addition, dedicated outdoor air ventilation systems can improve indoor air quality by meeting the minimum outside air ventilation rates and better control of indoor humidity.
Service Hot Water Systems	

Building Assessment Tool Report

Health and Safety Impact

Building Name: **Lake County: EMS Building**

Gross Floor Area: **4,125 ft²**

Health and Safety Impact of Upgrade Opportunities

• Upgrade Heat Pump Hot Water Heater in blocks Garage (Heated Only) and Living Space for Hot Water System 53929 - Direct Fired-Storage, Natural Gas.†	Heat pump water heaters (HPWHs) operate by extracting heat from the surrounding air and transferring it to the water in the tank. This process can lead to a localized cooling effect in the area where the unit is installed beneficial in warm climates for comfortable living. Additionally, since they do not rely on combustion, there are no risks associated with carbon monoxide, other harmful exhaust gases or of fire or explosion.
• Add Low Flow Service Hot Water Fixtures for Block in block for Garage (Heated Only).†	This measure is not expected to directly impact occupant health and safety. However, installing low flow faucets is an important strategy for water conservation and sustainability.
• Add Low Flow Service Hot Water Fixtures for Block in block for Living Space.†	This measure is not expected to directly impact occupant health and safety. However, installing low flow faucets is an important strategy for water conservation and sustainability.

Building Assessment Tool Report

Structures and Systems

Building Name: **Lake County: EMS Building**

Gross Floor Area: **4,125 ft²**

ABOUT THE BUILDING SYSTEMS

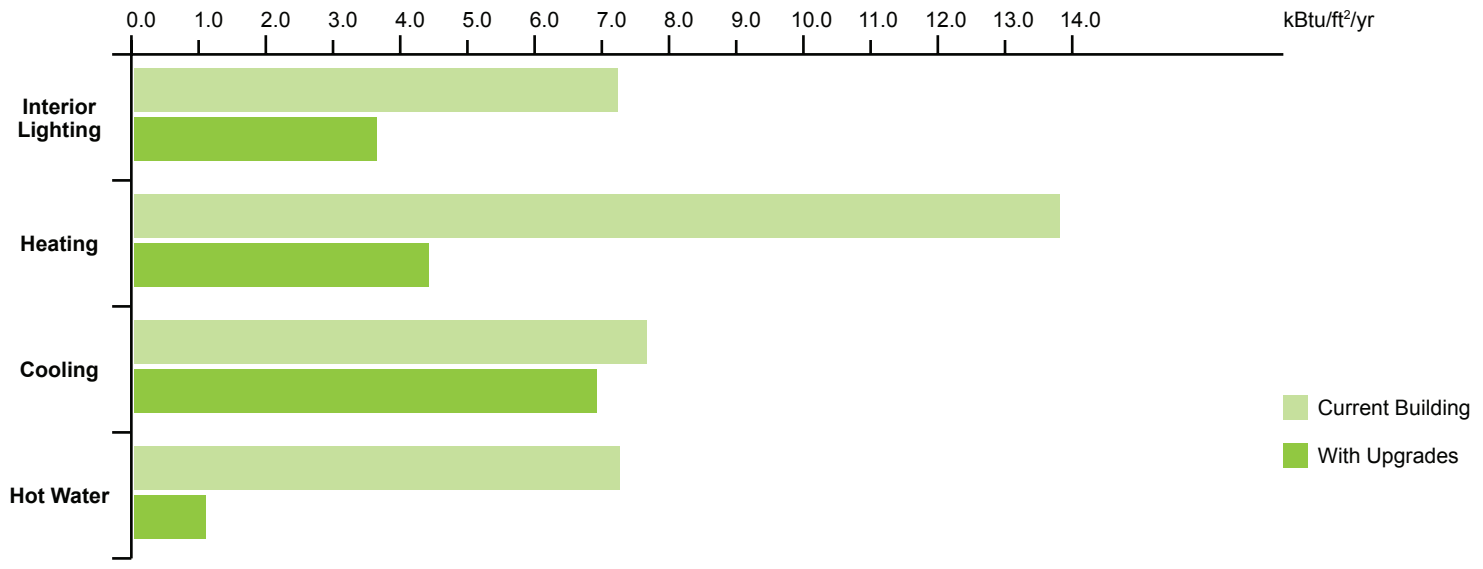
	Ranking[5]
Interior Lighting	Good
Whole Building HVAC System TSPR	Superior
Raheem Unit	N/A
Garage Space Heaters	N/A

ABOUT THE BUILDING ENVELOPE

	Ranking[5]
Roof U-Value, Non-Attic (Btu/ft²·h·°F)	Good
Walls U-Value, Framed (Btu/ft²·h·°F)	Superior
Windows U-Value (Btu/ft²·h·°F)	Fair
Walls + Windows U-Value (Btu/ft²·h·°F)	Good
Window Solar Heat Gain Coefficient	Fair

*System evaluation is not based on a verified TSPR

SITE ENERGY USE INTENSITY BY END USE



[5] Ranking Range:
Fair: Building Envelope or Building Systems are less efficient than a typical building built to the AHSRAE 90.1-2004 energy code.
Superior: Building Envelope is more efficient than a typical building built to the AHSRAE 90.1-2013 energy code. Building Systems exceed the highest efficiency levels with market viable technologies.
Good: Building Envelope or Building Systems are between Fair and Superior.
N/A: The building does not have a heating or a cooling system, or the loads are too low for the system to be effectively ranked.

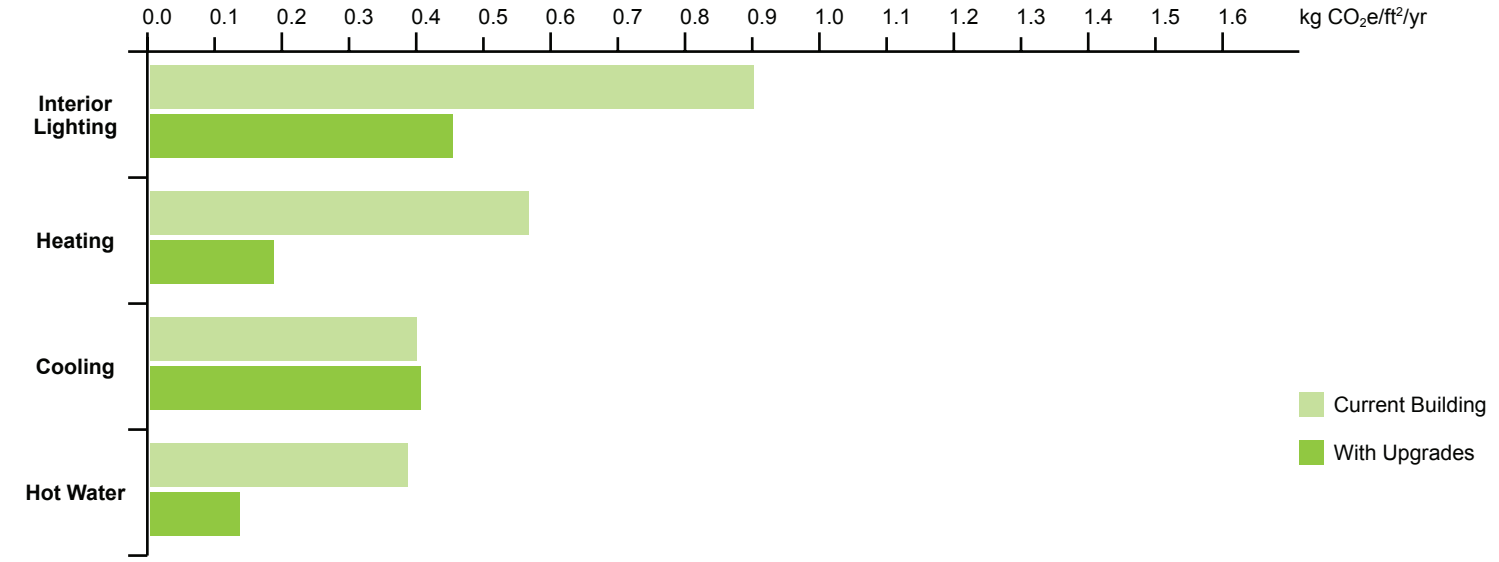
Building Assessment Tool Report

Structures and Systems

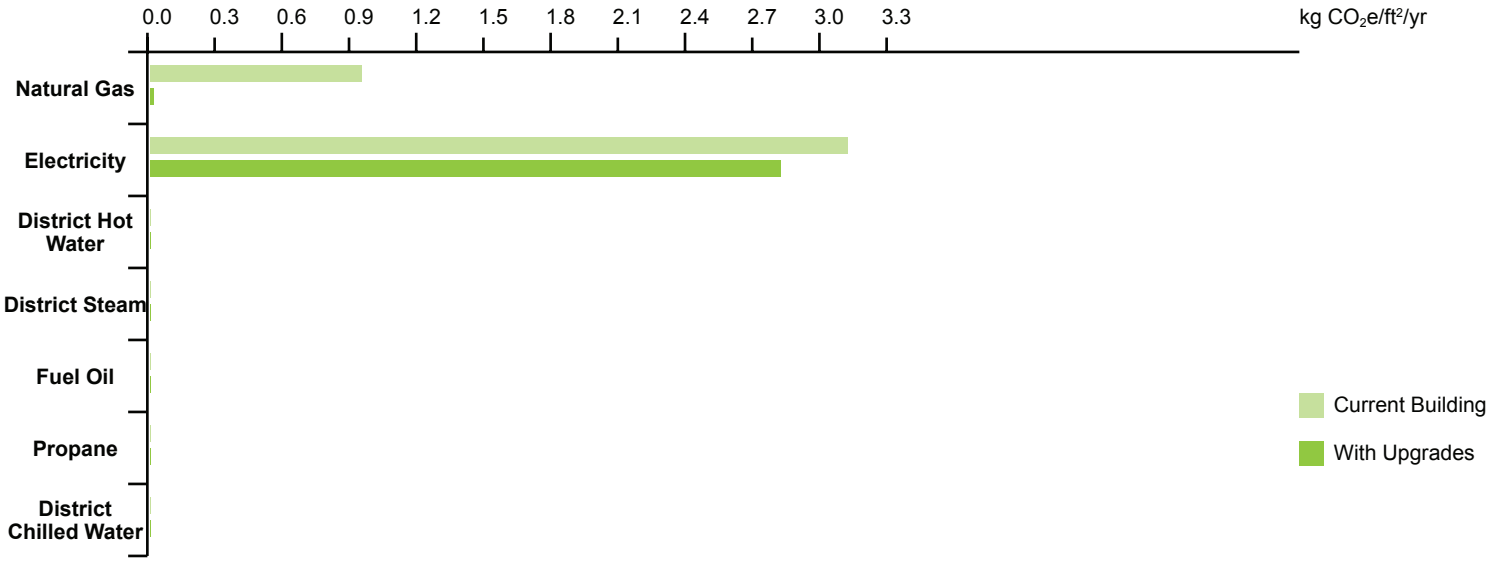
Building Name: **Lake County: EMS Building**

Gross Floor Area: **4,125 ft²**

CARBON EMISSIONS BY END USE[6]



CARBON EMISSIONS BY FUEL TYPE[6]



[6] Carbon dioxide equivalent (CO_2e) greenhouse gas annual emission rates are calculated by multiplying theannual energy use rates for each end use and fuel type by emission factors that are specific to each fuel typeand then by dividing by the total floor area for the affected blocks. The emission factors for electricity areprovided by U.S. EPA Power Profiler v9.1 and are specific to the eGRID subregions that are assigned to the ZIPcode for the building. The emissions factors for electricity do not include gross grid loss (line loss).

Building Assessment Tool Report

Building Asset Information

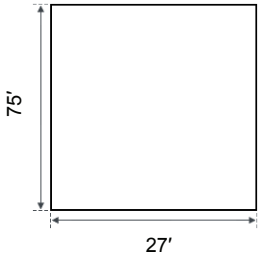
Building Name: **Lake County: EMS Building**

Gross Floor Area: **4,125 ft²**

Living Space CHARACTERISTICS SUMMARY

Geometry

Above Ground:	1 floor
Below Ground:	0 floors
Floor-to-Floor Height	12.00 ft
Floor-to-Ceiling Height:	9.00 ft
Orientation:	0.0° from North
Use Type:	Multi-family (fewer than 4 floors)



	Current Building
Roof	
Roof	Roof 38510 - Built-Up with Wood Deck
Roof Type	Built-up w/ wood deck
Roof R-Value	15.0 °F·ft²·h/Btu
Skylights	
No Skylights	
Floor	
Floor	Foundation Type 28035 - Slab-On-Grade
Floor Type	Slab-on-Grade
Slab Insulation	Fully Insulated Slab
Floor R-value	10.0 °F·ft²·h/Btu
Walls and Windows	
All Surfaces	
Wall	Above Grade Floors - Wall 37845 - Brick/Stone on Masonry
Wall Type	Brick/Stone on masonry
Wall R-value	15.0 °F·ft²·h/Btu
Window	Window 43409 - Metal, Double Pane
Window Framing Type	Metal
Window Glass Type	Double Pane
Window Gas Fill Type	Default***

	Current Building
Window U-value	Estimated*
Window SHGC	Estimated*
Window VT	Estimated*
Window Layout	Continuous
Window-to-Wall Ratio	0.1
Exterior Shading Type	No Shading
Infiltration	
Energy code the building complies with	Estimated*
Lighting	
Lighting Power Density	0.84 W/ft²
Fixture	Fixture 1 - LED
Lighting Type	LED
Mounting Type	Recessed
Lamp Wattage	10 W/lamp
Lamps per Fixture	1
Percent Served	10.0%
Fixture	Fixture 2 - Fluorescent T8
Lighting Type	Fluorescent T8
Mounting Type	Recessed
Lamp Wattage	32 W/lamp
Lamps per Fixture	1
Percent Served	90.0%
Heating/Cooling	
Thermal Zone Layout	Estimated*
Primary Heating/Cooling System	Raheem Unit
System Type	Pkgd AC
Cooling Equipment	
Cooling Source	Central DX
# Pieces of Equipment	1

Notes:
[1] 'Total Gross Wall Area' includes both opaque and glazed wall area.
[2] Window includes all vertical fenestration, including curtainwall and storefront.
[3] Total Gross Roof Area' includes both opaque and glazed roof area.

Building Assessment Tool Report

Building Asset Information

Building Name: **Lake County: EMS Building**

Gross Floor Area: **4,125 ft²**

	Current Building
Efficiency	3.83 COP
Capacity	4.70 tons
Heating Equipment	
Heating Source	Central Furnace
Fuel Type	Natural Gas
# Pieces of Equipment	1
Thermal Efficiency	81.55%
Capacity	81.00 kBtu/hr
Distribution	
Distribution Type	Single Zone
Fan Systems	
Fan Control	Variable Air Volume

Service Water Heating

Water Heater	Natural Gas
Fuel Type	Natural Gas
Water Heater Efficiency	Estimated*

Operations

Operation	Using Standard Operations**

Notes:
[1] 'Total Gross Wall Area' includes both opaque and glazed wall area.
[2] Window includes all vertical fenestration, including curtainwall and storefront.
[3] Total Gross Roof Area' includes both opaque and glazed roof area.

Building Assessment Tool Report

Building Asset Information

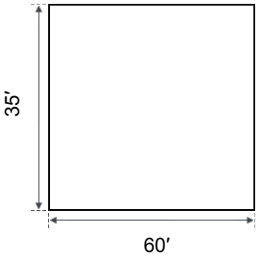
Building Name: **Lake County: EMS Building**

Gross Floor Area: **4,125 ft²**

Garage (Heated Only) CHARACTERISTICS SUMMARY

Geometry

Above Ground:	1 floor
Below Ground:	0 floors
Floor-to-Floor Height	14.00 ft
Floor-to-Ceiling Height:	14.00 ft
Orientation:	0.0° from North
Use Type:	Parking Garage (Heated Only)



Current Building

Roof

Roof	Roof 38510 - Built-Up with Wood Deck
Roof Type	Built-up w/ wood deck
Roof R-Value	15.0 °F·ft²·h/Btu

Skylights

No Skylights

Floor

Floor	Foundation Type 28035 - Slab-On-Grade
Floor Type	Slab-on-Grade
Slab Insulation	Fully Insulated Slab
Floor R-value	10.0 °F·ft²·h/Btu

Walls and Windows

All Surfaces

Wall	Above Grade Floors - Wall 37845 - Brick/Stone on Masonry
Wall Type	Brick/Stone on masonry
Wall R-value	15.0 °F·ft²·h/Btu

No Windows

Infiltration

Energy code the building complies with	Estimated*

Current Building

Lighting

Lighting Power Density	0.27 W/ft²
Fixture	Fixture 1 - LED
Lighting Type	LED
Mounting Type	Recessed
Lamp Wattage	10 W/lamp
Lamps per Fixture	1
Percent Served	10.0%
Fixture	Fixture 2 - Fluorescent T8
Lighting Type	Fluorescent T8
Mounting Type	Recessed
Lamp Wattage	32 W/lamp
Lamps per Fixture	1
Percent Served	90.0%

Heating/Cooling

Thermal Zone Layout	Estimated*
Perimeter Zone Depth	11.7 ft
Primary Heating/Cooling System	Garage Space Heaters
System Type	Warm Air Furnace
Cooling Equipment	
Cooling Source	No Cooling
Heating Equipment	
Heating Source	Central Furnace
Fuel Type	Natural Gas
# Pieces of Equipment	1
Thermal Efficiency	80.00%
Capacity	75.00 kBtu/hr
Distribution	
Distribution Type	Single Zone
Fan Systems	

Notes:
[1] 'Total Gross Wall Area' includes both opaque and glazed wall area.
[2] Window includes all vertical fenestration, including curtainwall and storefront.
[3] Total Gross Roof Area' includes both opaque and glazed roof area.

Building Assessment Tool Report

Building Asset Information

Building Name: **Lake County: EMS Building**

Gross Floor Area: **4,125 ft²**

	Current Building
Fan Control	Constant Volume
Service Water Heating	
Water Heater	Natural Gas
Fuel Type	Natural Gas
Water Heater Efficiency	Estimated*
Operations	
Operation	Using Standard Operations**

Notes:
[1] 'Total Gross Wall Area' includes both opaque and glazed wall area.
[2] Window includes all vertical fenestration, including curtainwall and storefront.
[3] Total Gross Roof Area' includes both opaque and glazed roof area.

Building Assessment Tool Report

Building Asset Information

Building Name: **Lake County: EMS Building**

Gross Floor Area: **4,125 ft²**

BUILDING ENVELOPE INFORMATION

Total Gross Above Grade Wall Area [1]	4268.0 ft²
Total Window Area [2]	203.0 ft²
Building Window to Wall Ratio	5%
Total Below Grade Wall Area	0.0 ft²
Total Gross Roof Area [3]	4125.0 ft²
Total Skylight Area	0.0 ft²
Total Conditioned Floor Area	Not Available
Total Footprint Area	Not Available

Areas by Orientation

NORTH	
Gross Wall Area	1164.0 ft²
Window Area	32.4 ft²
SOUTH	
Gross Wall Area	1164.0 ft²
Window Area	32.4 ft²
EAST	
Gross Wall Area	970.0 ft²
Window Area	90.0 ft²
WEST	
Gross Wall Area	970.0 ft²
Window Area	48.0 ft²

Notes:
[1] 'Total Gross Wall Area' includes both opaque and glazed wall area.
[2] Window includes all vertical fenestration, including curtainwall and storefront.
[3] Total Gross Roof Area' includes both opaque and glazed roof area.

Building Assessment Tool Report

Software Provenance

Building Name: **Lake County: EMS Building**

Gross Floor Area: **4,125 ft²**

SOFTWARE PROVENANCE

Asset Score/Audit Template	Version: 1.0.0 Build: build
Asset Score Open Studio Web Service	4.0.0
EnergyPlus	23.2
OpenStudio	3.7.0

Appendix B: Audit Template Report

BUILDING ENERGY AUDIT TEMPLATE
U.S. DEPARTMENT OF ENERGY

OVERVIEW

BUILDING INFORMATION

Lake County: EMS Building
333 Kentucky Street
Tiptonville, TN 38079

Report Type	**EE-RLF Template**	Report Status:	**In Progress**
Building Type:	**Multifamily**	Report Date:	**01/09/2026**
Gross Floor Area:	**4,500.0 ft²**	Year Built:	**2004**
Building ID #:	**47701**	Software Release:	1.0.0

AUDIT TEAM

Not provided

DATA SUMMARY

This report was generated from data entered into the Audit Template tool, developed by the Pacific Northwest National Laboratory (PNNL) for the U.S. Department of Energy (DOE). Audit Template is a national standardized tool for building energy audit data collection and reporting.

This report follows the ANSI/ASHRAE/ACCA Standard 211-2018, Standard for Commercial Building Energy Audits. It also includes additional data fields required by specific cities, where applicable. The icons below identify data categories.

- ASHRAE inputs
- City-specific inputs

If this report is used to comply with a local energy audit ordinance, the fields marked with * indicate the minimum data to be reported. The audit team listed above is responsible for any information entered and reported through Audit Template. DOE and PNNL do not warranty data accuracy, completeness, legality, and reliability.

CONTACT INFORMATION AND AUDIT DETAILS

Building Name: **Lake County: EMS Building**

Submission Information

Date of Submission*	Never
Submission Version*	None

Audit Details

Date of Completion for Level 1 Audit	
Date of Completion for Level 2 Audit	12/09/2025
Date of Completion for Level 3 Audit	
Year of Last Renovation	
Year of Prior Energy Audit	
Year Last Commissioned	
Additional Comments	

Audit Team and Building Staff

Auditor

- Name*
- Company Name or Organization
- Title
- Street Address
- City
- State
- Postal Code
- Phone
- Email
- Auditor's Years of Experience

Building Owner

- Name*
- Company Name or Organization
- Title
- Street Address
- City
- State
- Postal Code
- Phone

CONTACT INFORMATION AND AUDIT DETAILS

Building Name: **Lake County: EMS Building**

- Email
  Additional Comments

FACILITY DESCRIPTION

Building Name: **Lake County: EMS Building**

Building Characteristics

Gross Floor Area*	4500.0 ft^2
Spaces Excluded from Gross Floor Area	
Conditioned Floor Area, Heated Only	2000.0 ft^2
Conditioned Floor Area, Cooled Only	
Conditioned Floor Area, Heated and Cooled	2500.0 ft^2
Total Conditioned Floor Area	4500.0 ft^2
Number of Floors Above-Grade, Conditioned	1
Number of Floors Below-Grade, Conditioned	0
General Building Shape	T Shape
Building Automation System?	No
Historic Building?	No
Comfort or health concerns, including indoor environmental quality (IEQ) deficiencies	No
Comfort or health concerns comments	
N/A Comments*	

Use Types

Multifamily Housing

Use Type / Space Function / Building Area Type*	Multifamily Housing
Original Intended Use	
Gross Floor Area*	4500.0 ft^2
Percentage of Space Conditioned	100.0 %
Number of Occupants	10
Use (hours/week)	168.0 hours/week
Use (weeks/year)	52.0 weeks/year
Approximate Plug Loads	0.4 W/ft^2
Number of Dwelling Units	4
Percentage of Dwelling Units Currently Occupied	100 %
Principal HVAC Type	Packaged Rooftop Air Conditioner
Principal Lighting Type	LED

Roofs

FACILITY DESCRIPTION

Building Name: **Lake County: EMS Building**

Roof 38510 - Built-Up with Wood Deck

Roof Construction	Built-Up with Wood Deck
Roof R Value	16.0 °F.ft^2.h/Btu
Roof Condition	Good
Cool Roof	No
Green Roof	No
Blue Roof	No
Roof Area	4500.0 ft^2

Walls

Wall 37845 - Brick/Stone on Masonry

Wall Construction	Brick/Stone on Masonry
Above Grade Wall Insulation R Value	16.65 °F·ft2·h/Btu
Below Grade Wall Insulation R Value	☑ N/A
Total Exposed Above Grade Wall Area	3840.0 ft^2
Below Grade Wall Area	0.0 ft^2
Above Grade Demising Wall Area	
Overall Enclosure Tightness Assessment	2 (bad = higher rate of infiltration/exfiltration)
Type of Exterior Door Construction	Insulated metal

Windows

Window 43409 - Metal, Double Pane

Framing Material	Metal
Window Glass Type	Double Pane
Fenestration Seal Condition	2 (bad = higher rate of infiltration/exfiltration)
Window Wall Ratio	0.1

Foundation Types

Foundation Type 28035 - Slab-On-Grade

Floor Construction Type	Slab-On-Grade
Ventilated Crawlspace	No
R Value	10.0 °F·ft2·h/Btu

FACILITY DESCRIPTION

Building Name: **Lake County: EMS Building**

Exterior Floors

None given

Lighting

Fixture Locations

Fixture (^^^); *	**Location**	**Quantity Definition**	**Area Served (%)**	**Area Served (ft²)**
Fixture 1: LED; ^^^2	Multifamily Housing	% Area Served	10.0	0.0
Fixture 2: Fluorescent T8; ^^^2	Multifamily Housing	% Area Served	90.0	0.0

FACILITY DESCRIPTION

Building Name: **Lake County: EMS Building**

Controls

Fixture (^^^); *	**Manual**	**Photocell**	**Timer**	**Occupancy Sensor**	**Building Automation System**	**Advanced**	**Other**
Fixture 1: LED; ^^^2	Yes	No	No	No	No	No	No
Fixture 2: Fluorescent T8; ^^^2	Yes	No	No	No	No	No	No

*** Fixture Key**

^^^ *Ballast Type:*
1. Premium Electronic
2. Standard Electronic
3. Magnetic
4. N/A

Heating Plants

None given

Cooling Plants

None given

Condenser Plants

None given

HVAC Systems

HVAC System 84111

Heating

☑	Heating Source	Furnace
☑	Fuel Type	Natural Gas
☑	Location of Equipment	Exterior
☑	Approximate Year Installed	☑ N/A
☑	Condition	Average
☑	Number of Pieces of Equipment	1
☑	Output Capacity	81.0 MBH

Building Name: **Lake County: EMS Building**

Efficiency Units	AFUE
Rated Efficiency	81.0
Cooling	
Cooling Source	DX Cooling
Fuel Source	Electricity
Location of Equipment	Exterior
Approximate Year Installed	
Condition	Average
Number of Pieces of Equipment	1
Output Capacity	56.0 MBH
Efficiency Units	SEER
Rated Efficiency	14.0
Distribution Equipment	
Delivery Equipment Type	Central Fan
Other Delivery Equipment Type	
Central Distribution Type	Forced Air
Other Central Distribution Type	
Fan Control	Variable Volume
Energy Recovery Ventilation	None
Outdoor Air Control	No Functioning Economizer
Zone Controls	
Direct Digital Controls (DDC)	No
Pneumatic Control	No
Manual Thermostat	Yes
Programmable Thermostat	Yes
None	No
Space Function Served	Multifamily Housing
Area Served by this Equipment	56.0 %

HVAC System 84112

Heating	
Heating Source	Furnace
Fuel Type	Natural Gas
Location of Equipment	Garage
Approximate Year Installed	
Condition	Poor
Number of Pieces of Equipment	2
Output Capacity	75.0 MBH
Efficiency Units	AFUE

FACILITY DESCRIPTION

Building Name: **Lake County: EMS Building**

Rated Efficiency	80.0
Cooling	
Cooling Source	No Cooling
Distribution Equipment	
Delivery Equipment Type	Radiators or Convectors
Other Delivery Equipment Type	
Central Distribution Type	Forced Air
Other Central Distribution Type	
Fan Control	Constant Volume
Energy Recovery Ventilation	None
Outdoor Air Control	No Functioning Economizer
Zone Controls	
Direct Digital Controls (DDC)	No
Pneumatic Control	No
Manual Thermostat	Yes
Programmable Thermostat	No
None	No
Space Function Served	Multifamily Housing
Area Served by this Equipment	44.0 %

Service Hot Water Systems

Hot Water System 53929 - Direct Fired- Storage, Natural Gas

System Type	Direct Fired- Storage
Location of Equipment	Garage
Approximate Year Installed	
Fuel Source	Natural Gas
Efficiency Units	AFUE
Rated Efficiency	85.0
Controls	
Space Function Served	Multifamily Housing
Area Served by this Hot Water System	100.0 %

UTILITY DATA AND BENCHMARKING

Building Name: **Lake County: EMS Building**

Ownership Details

- Percent Owned
- Percent Leased

UTILITY DATA AND BENCHMARKING

Building Name: **Lake County: EMS Building**

Metered Energy Supply Source Details

None given

Energy Reporting Years

Start Date	End Date	Metering entries	Delivery entries
01/01/2024	12/31/2024	24	0
01/01/2023	12/31/2023	24	0
01/01/2022	12/31/2022	21	0

Metered Energy

Energy Type: Electricity

Start Date	End Date	Days	Use (kWh)	Cost ($)	Peak (kW)	Load Factor	kWh / day	kBtu / day
01/01/2022	01/31/2022	31	3173.0	367.96	0.0	0%	102	349
02/01/2022	02/28/2022	28	2933.0	338.05	0.0	0%	105	357
03/01/2022	03/31/2022	31	2712.0	291.07	0.0	0%	87	298
04/01/2022	04/30/2022	30	2482.0	272.61	0.0	0%	83	282
05/01/2022	05/31/2022	31	2768.0	297.55	0.0	0%	89	305
06/01/2022	06/30/2022	30	3473.0	441.62	0.0	0%	116	395
07/01/2022	07/31/2022	31	4093.0	559.53	0.0	0%	132	450
08/01/2022	08/31/2022	31	3813.0	556.1	0.0	0%	123	420
09/01/2022	09/30/2022	30	3216.0	392.32	0.0	0%	107	366
10/01/2022	10/31/2022	31	2534.0	299.95	0.0	0%	82	279
11/01/2022	11/30/2022	30	2939.0	332.77	0.0	0%	98	334
12/01/2022	12/31/2022	31	3694.0	439.76	0.0	0%	119	407
01/01/2023	01/31/2023	31	2814.0	353.74	0.0	0%	91	310
02/01/2023	02/28/2023	28	3117.0	402.1	0.0	0%	111	380
03/01/2023	03/31/2023	31	3321.0	366.66	0.0	0%	107	366
04/01/2023	04/30/2023	30	2903.0	332.64	0.0	0%	97	330
05/01/2023	05/31/2023	31	3591.0	392.15	0.0	0%	116	395
06/01/2023	06/30/2023	30	4298.0	522.27	0.0	0%	143	489
07/01/2023	07/31/2023	31	3987.0	490.56	0.0	0%	129	439
08/01/2023	08/31/2023	31	3768.0	464.07	0.0	0%	122	415
09/01/2023	09/30/2023	30	3231.0	395.13	0.0	0%	108	367
10/01/2023	10/31/2023	31	2754.0	323.35	0.0	0%	89	303
11/01/2023	11/30/2023	30	2556.0	301.3	0.0	0%	85	291
12/01/2023	12/31/2023	31	3006.0	371.71	0.0	0%	97	331
01/01/2024	01/31/2024	31	4044.0	501.22	0.0	0%	130	445
02/01/2024	02/29/2024	29	3375.0	419.13	0.0	0%	116	397
03/01/2024	03/31/2024	31	3932.0	467.86	0.0	0%	127	433

UTILITY DATA AND BENCHMARKING

Building Name: **Lake County: EMS Building**

04/01/2024	04/30/2024	30	4084.0	447.11	0.0	0%	136	464
05/01/2024	05/31/2024	31	4010.0	433.87	0.0	0%	129	441
06/01/2024	06/30/2024	30	4754.0	595.81	0.0	0%	158	541
07/01/2024	07/31/2024	31	4246.0	544.61	0.0	0%	137	467
08/01/2024	08/31/2024	31	4019.0	520.12	0.0	0%	130	442
09/01/2024	09/30/2024	30	3400.0	423.9	0.0	0%	113	387
10/01/2024	10/31/2024	31	3066.0	386.84	0.0	0%	99	337
11/01/2024	11/30/2024	30	2615.0	351.89	0.0	0%	87	297
12/01/2024	12/31/2024	31	2914.0	423.19	0.0	0%	94	321
	Average Annual Total		**40545**	**4940**	**0**	**0%**		

Energy Type: Natural Gas

Start Date	End Date	Days	Use (therms)	Cost ($)	therms / day	kBtu / day
03/01/2025	03/31/2025	31	183.0	295.77	6	590
02/01/2025	02/28/2025	28	284.0	458.88	10	1014
01/01/2025	01/31/2025	31	139.0	224.71	4	448
12/01/2024	12/31/2024	31	32.0	51.83	1	103
11/01/2024	11/30/2024	30	1.0	4.0	0	3
10/01/2024	10/31/2024	31	1.0	4.0	0	3
09/01/2024	09/30/2024	30	1.0	4.0	0	3
08/01/2024	08/31/2024	31	1.0	4.0	0	3
07/01/2024	07/31/2024	31	1.0	4.0	0	3
06/01/2024	06/30/2024	30	2.0	4.0	0	7
05/01/2024	05/31/2024	31	3.0	4.86	0	10
04/01/2024	04/30/2024	30	70.0	113.27	2	233
03/01/2024	03/31/2024	31	198.0	319.99	6	639
02/01/2024	02/29/2024	29	394.0	636.53	14	1359
01/01/2024	01/31/2024	31	289.0	466.96	9	932
12/01/2023	12/31/2023	31	49.0	79.35	2	158
11/01/2023	11/30/2023	30	10.0	16.21	0	33
10/01/2023	10/31/2023	31	3.0	4.86	0	10
09/01/2023	09/30/2023	30	2.0	4.0	0	7
08/01/2023	08/31/2023	31	1.0	4.0	0	3
07/01/2023	07/31/2023	31	2.0	4.0	0	6
06/01/2023	06/30/2023	30	3.0	4.86	0	10
05/01/2023	05/31/2023	31	16.0	25.92	1	52
04/01/2023	04/30/2023	30	70.0	113.27	2	233
03/01/2023	03/31/2023	31	206.0	332.91	7	665
02/01/2023	02/28/2023	28	162.0	261.85	6	579
01/01/2023	01/31/2023	31	303.0	489.57	10	977
12/01/2022	12/31/2022	31	188.0	303.84	6	606
11/01/2022	11/30/2022	30	24.0	38.88	1	80
10/01/2022	10/31/2022	31	0.0	4.0	0	0
09/01/2022	09/30/2022	30	0.0	4.0	0	0
08/01/2022	08/31/2022	31	0.0	4.0	0	0

Building Name: **Lake County: EMS Building**

07/01/2022	07/31/2022	31	0.0	4.0	0	0
06/01/2022	06/30/2022	30	0.0	4.0	0	0
05/01/2022	05/31/2022	31	53.0	81.68	2	171
04/01/2022	04/30/2022	30	145.0	223.09	5	483
		Average Annual Total	**910**	**1479**		

Note: fields displayed in green indicate values calculated by the tool and not directly entered by the user.

Delivered Energy

None given

Building Annual Summary for Energy Use and Energy Cost

Baseline Year Selected:

Energy Type	Total Annual Use	Units	Conversion Multiplier	Thousands BTU	Total Annual Cost ($)	Carbon (t CO_2e)
Electricity	40545	kWh	3.412	138340	4940	17.25
Natural Gas	910	therms	100.0	91000	1479	4.83
			Total	**229340**	**6419**	22.08

Shared System Annual Summary for Energy Use and Energy Cost

No annual summary available.

Annual Summary for On-Site Renewable Energy Production

No annual summary available.

Annual Summary for Exported Energy

No annual summary available.

Existing Building EUI/ECI

UTILITY DATA AND BENCHMARKING

Building Name: **Lake County: EMS Building**

Building Name	Lake County: EMS Building
Gross Conditioned Square Feet	4500.0
EUI_{BLD} (kBtu/ft²/yr)	50.964
EUI_{SITE} (kBtu/ft²/yr)	50.964
Site ECI (energy cost index or $/ft²/yr)	1.427
CO_2e Intensity (kg CO_2e/ft²/yr)	4.907

UTILITY DATA AND BENCHMARKING

Building Name: **Lake County: EMS Building**

Benchmarking

Benchmarking Source	
Benchmarking Source (Other)	
Year Benchmarked	
Benchmark Site Energy Use Intensity	
Benchmark Site Energy Cost Intensity	0.0 $/ft^2
Target Site Energy Intensity	0.0 kBtu/ft^2
Target Site Energy Cost	0.0 $/ft^2
Annual Energy Savings to Reach Target	0 kBtu
Annual Cost Savings to Reach Target	$ 0.0
Additional Comments	

Building Name: **Lake County: EMS Building**

Building Energy Use and Carbon Emissions by End Use

Note: fields displayed in green indicate values calculated by the tool and not directly entered by the user.

Building End Use Summary

End Use	Total Energy Use (kBtu)	% of Total Energy Use (kBtu)	Total Carbon (t CO_2e)
Total	0	100%	0
Total (from annual summary)	229340		22.08
Difference	-229340		-22.08
% Difference	-100%		-100%

ENERGY SAVINGS OPPORTUNITIES

Building Name: **Lake County: EMS Building**

Building Energy Savings Opportunities - Measures

Measure Information

Measure Identifier	Measure Category	Measure Name	Measure Description	Measure Status	Implementation Year
Replace Current HVAC Unit with a Larger Higher Efficient Heat Pump Unit	Heating; Ventilating and Air Conditioning	Replace package units	It is recommended to replace the current HVAC unit with a larger one utilizing a heat pump.	Recommended	
Install ERV Systems on the HVAC Systems	Heating; Ventilating and Air Conditioning	Add energy recovery	It is recommended to install energy recovery ventilation, ERV, systems on the HVAC units	Recommended	
Replace Old Natural Gas Space Heaters in The Garage	Heating; Ventilating and Air Conditioning	Other heating	It is recommended to install new higher efficient space heaters in the garage of the EMS building	Recommended	
Reduce the Infiltration Through Doors and Windows	Building Envelope Modifications	Air seal envelope	It is recommended to reduce the amount of infiltration through the doors and windows	Recommended	
Install Higher efficiency Lighting	Lighting Improvements	Other	It is recommended to replace the old Fluorescent T8 bulbs with higher efficiency LED bulbs.5,777.82 kWh	Recommended	
Install Low-Emissivity Windows	Building Envelope Modifications	Replace windows	It is recommended to replace/install low-E windows in place of regular windows	Further Study Recommended	

Measure Annual Energy and Cost Savings

Measure Identifier	Total Cost Savings ($)	Electricity Savings (kWh)	Natural Gas Savings (therms)	Total Energy Savings (kBtu)
Replace Current HVAC Unit with a Larger Higher Efficient Heat Pump Unit	1418.21	1667.93	751.33	80823.97706137896
Install ERV Systems on the HVAC Systems	2834.21	16525.62	525.93	108978.4144628763
Replace Old Natural Gas Space Heaters in The Garage	1309.37	0.0	807.51	80751.0
Reduce the Infiltration Through Doors and Windows	7492.1	202.07	4605.53	461242.46282805206
Install Higher efficiency Lighting	692.77	5777.82	0.0	19713.92149837017
Install Low-Emissivity Windows	108.23	177.84	53.6	5966.79006948471

Measure Cost

Measure Identifier	Measure Cost ($)	Potential Incentives ($)	Measure Life (years)	*Net Measure Cost ($)*
Replace Current HVAC Unit with a Larger Higher Efficient Heat Pump Unit	12000.0	0.00	25	12000.0
Install ERV Systems on the HVAC Systems	5500.0	0.00	15	5500.0
Replace Old Natural Gas Space Heaters in The Garage	10000.0	0.00	20	10000.0
Reduce the Infiltration Through Doors and Windows	3960.0	0.00	5	3960.0
Install Higher efficiency Lighting	350.0	0.00	15	350.0
Install Low-Emissivity Windows	12000.0	0.00	25	12000.0

For more information on the input fields, calculation methods, and units of measure found in this report, please visit the Audit Template web site: https://buildingenergyscore.energy.gov

ENERGY SAVINGS OPPORTUNITIES

Building Name: **Lake County: EMS Building**

Measure Identifier	Measure Cost ($)	Potential Incentives ($)	Measure Life (years)	*Net Measure Cost ($)*

ENERGY SAVINGS OPPORTUNITIES

Building Name: **Lake County: EMS Building**

Building Energy Savings Opportunities - Packages

Annual Energy & Cost Savings

Package Name Measure Identifier	Measure Name	Measure Description	Measure Status	Total Cost Savings ($)	Electricity Savings (kWh)	Natural Gas Savings (therms)
Potential Capital Recommendations						
Capital Projects						
Replace Current HVAC Unit with a Larger Higher Efficient Heat Pump Unit	Replace package units	It is recommended to replace the current HVAC unit with a larger one utilizing a heat pump.	Recommended	1418.21	1667.93	751.33
Replace Old Natural Gas Space Heaters in The Garage	Other heating	It is recommended to install new higher efficient space heaters in the garage of the EMS building	Recommended	1309.37	0.0	807.51
Install ERV Systems on the HVAC Systems	Add energy recovery	It is recommended to install energy recovery ventilation, ERV, systems on the HVAC units	Recommended	2834.21	16525.62	525.93
Discussion Items						
Install Low-Emissivity Windows	Replace windows	It is recommended to replace/install low-E windows in place of regular windows	Further Study Recommended	108.23	177.84	53.6
Low Cost and No Cost Recommendations						
Low-Cost Recomendations						
Install Higher efficiency Lighting	Other	It is recommended to replace the old Fluorescent T8 bulbs with higher efficiency LED bulbs.5,777.82 kWh	Recommended	692.77	5777.82	0.0
Reduce the Infiltration Through Doors and Windows	Air seal envelope	It is recommended to reduce the amount of infiltration through the doors and windows	Recommended	7492.1	202.07	4605.53

Payback with Incentives

Package Name Measure	Measure Cost ($)	Potential Incentives ($)	Measure Life (years)	*Net Package Cost ($)*	*Net Measure Cost ($)*	*Lifecycle Savings - Package ($)*	*Total Energy Savings - Measure (kBtu)*
Potential Capital Recommendations							
Capital Projects				27500.0		81633.04	
Replace Current HVAC Unit with a Larger Higher Efficient Heat Pump Unit	12000.0	0.00	25		12000.0		80824.0
Replace Old Natural Gas Space Heaters in The Garage	10000.0	0.00	20		10000.0		80751.0
Install ERV Systems on the HVAC Systems	5500.0	0.00	15		5500.0		108978.4

ENERGY SAVINGS OPPORTUNITIES

Building Name: **Lake County: EMS Building**

Package Name Measure	**Measure Cost ($)**	**Potential Incentives ($)**	**Measure Life (years)**	***Net Package Cost ($)***	***Net Measure Cost ($)***	***Lifecycle Savings - Package ($)***	***Total Energy Savings - Measure (kBtu)***
Discussion Items				12000.0		1994.07	
Install Low-Emissivity Windows	12000.0	0.00	25		12000.0		5966.8
Low Cost and No Cost Recommendations							
Low-Cost Recomendations				4310.0		43384.46	
Install Higher efficiency Lighting	350.0	0.00	15		350.0		19713.9
Reduce the Infiltration Through Doors and Windows	3960.0	0.00	5		3960.0		461242.5

ENERGY SAVINGS OPPORTUNITIES

Building Name: **Lake County: EMS Building**

Energy Savings Opportunities Summary

Package Name Measure	**Lifecycle Savings ($)**	**Total Cost Savings ($)**
Potential Capital Recommendations		
Capital Projects Replace Current HVAC Unit with a Larger Higher Efficient Heat Pump Unit Replace Old Natural Gas Space Heaters in The Garage Install ERV Systems on the HVAC Systems	$81633.04	$5561.79
Discussion Items Install Low-Emissivity Windows	$1994.07	$108.23
Low Cost and No Cost Recommendations		
Low-Cost Recomendations Install Higher efficiency Lighting Reduce the Infiltration Through Doors and Windows	$43384.46	$8184.87

Note: fields displayed in italics indicate values calculated by the tool and not directly entered by the user.

Revolving Loan Fund (RLF)

- Does this audit recommend controls and management systems to reduce or redistribute peak energy consumption?* — Yes
- Recommended Controls and Management Systems* — Replace Current HVAC Unit with a Larger Higher Efficient Heat Pump Unit
Install ERV Systems on the HVAC Systems
Replace Old Natural Gas Space Heaters in The Garage
Install Higher efficiency Lighting

ENERGY SAVINGS OPPORTUNITIES

Building Name: **Lake County: EMS Building**

The recommended improvements in this audit are based on: 1) resolving health and safety issues; 2) satisfying customer needs and desires; 3) overall cost-benefit to the customer; and 4) programmatic goals. (These are the 4 criteria of the Home Performance Assessment, which is a required component of an RLF audit for multifamily buildings.)*	Yes

ATTACHMENTS

Building Name: **Lake County: EMS Building**

References	Description	File Name

ATTACHMENT C

TDEC OEP Build America, Buy America (BABA) Contract Language

Required for Contracts and Subcontracts

BABA Contract Language (Required for All Contracts and Subcontracts)

All contracts, subcontracts, and purchase orders funded as a whole or in part with federal financial assistance for infrastructure projects shall include the following provision as a required contract clause (insert in full in contracts and subcontracts):

Buy America Domestic Procurement Preference

As required by Section 70914 of the Infrastructure Investment and Jobs Act (IIJA), P.L. 117-58, and implementing regulations at 2 CFR part 184 and 2 CFR 200.322, none of the funds under a federal award that are part of a Federal financial assistance program for infrastructure may be obligated for a project unless all of the iron, steel, manufactured products, and construction materials used in the project are produced in the United States, unless subject to a waiver approved by the Federal awarding agency.[1] This requirement must be included in all subawards, contracts, and purchase orders for work or products under this program.

Contractors acknowledges and agrees that none of the funds provided under this award may be used for a project for infrastructure unless all iron and steel used in the project are produced in the United States, meaning all manufacturing processes, from the initial melting stage through the application of coatings, occurred in the United States; all manufactured products used in the project are produced in the United States, meaning the product was manufactured in the United States and the cost of components mined, produced, or manufactured in the United States is greater than 55 percent of the total cost of all components (unless a higher standard applies); and all construction materials are manufactured in the United States, meaning all manufacturing processes for the construction material occurred in the United States.

This requirement applies only to articles, materials, and supplies that are consumed in, incorporated into, or affixed to an infrastructure project. It does not apply to tools, equipment, and supplies brought to the construction site and removed at or before completion of the project, nor to equipment and furnishings that are not permanently affixed to the infrastructure.

Contractors shall include this provision in all lower-tier subcontracts and purchase orders.

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[1] 2 CFR part 184 and 2 CFR 200.322

When applicable, waivers may be requested through the awarding entity and must be approved by the Federal awarding agency. Allowable waiver types include nonavailability, unreasonable cost, and public interest, and must be approved prior to the use of non-compliant materials.

Contractor and subcontractors must certify compliance with these requirements and provide supporting documentation upon request.

ATTACHMENT D

Davis-Bacon and Related Acts (DBRA) Contract Provisions

29 CFR § 5.5 - Contract Provisions and Related Matters

Wages. The term ''wages'' means the basic hourly rate of pay; any contribution irrevocably made by a contractor or subcontractor to a trustee or to a third person pursuant to a bona fide fringe benefit fund, plan, or program; and the rate of costs to the contractor or subcontractor which may be reasonably anticipated in providing bona fide fringe benefits to laborers and mechanics pursuant to an enforceable commitment to carry out a financially responsible plan or program, which was communicated in writing to the laborers and mechanics affected. The fringe benefits enumerated in the Davis-Bacon Act include medical or hospital care, pensions on retirement or death, compensation for injuries or illness resulting from occupational activity, or insurance to provide any of the foregoing; unemployment benefits; life insurance, disability insurance, sickness insurance, or accident insurance; vacation or holiday pay; defraying costs of apprenticeship or other similar programs; or other bona fide fringe benefits. Fringe benefits do not include benefits required by other Federal, State, or local law.

Wage determination. The term ''wage determination'' includes the original decision and any subsequent decisions revising, modifying, superseding, correcting, or otherwise changing the provisions of the original decision. The application of the wage determination must be in accordance with the provisions of §1.6 of this subtitle.

[88 FR 57731, Aug. 23, 2023]

§§ 5.3–5.4 [Reserved]

§ 5.5 Contract provisions and related matters.

(a) *Required contract clauses.* The Agency head will cause or require the contracting officer to require the contracting officer to insert in full, or (for contracts covered by the Federal Acquisition Regulation (48 CFR chapter 1)) by reference, in any contract in excess of $2,000 which is entered into for the actual construction, alteration and/or repair, including painting and decorating, of a public building or public work, or building or work financed in whole or in part from Federal funds or in accordance with guarantees of a Federal agency or financed from funds obtained by pledge of any contract of a Federal agency to make a loan, grant or annual contribution (except where a different meaning is expressly indicated), and which is subject to the labor standards provisions of any of the laws referenced by §5.1, the following clauses (or any modifications thereof to meet the particular needs of the agency, *Provided,* That such modifications are first approved by the Department of Labor):

(1) *Minimum wages*—(i) *Wage rates and fringe benefits.* All laborers and mechanics employed or working upon the site of the work (or otherwise working in construction or development of the project under a development statute), will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by regulations issued by the Secretary of Labor under the Copeland Act (29 CFR part 3)), the full amount of basic hourly wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the contractor and such laborers and mechanics. As provided in paragraphs (d) and (e) of this section, the appropriate wage determinations are effective by operation of law even if they have not been attached to the contract. Contributions made or costs reasonably anticipated for bona fide fringe benefits under the Davis-Bacon Act (40 U.S.C. 3141(2)(B)) on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of paragraph (a)(1)(v) of this section; also, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs which cover the particular weekly period, are deemed to be constructively made or incurred during such weekly period. Such laborers and mechanics must be paid the appropriate wage rate

and fringe benefits on the wage determination for the classification(s) of work actually performed, without regard to skill, except as provided in paragraph (a)(4) of this section. Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein: *Provided*, That the employer's payroll records accurately set forth the time spent in each classification in which work is performed. The wage determination (including any additional classifications and wage rates conformed under paragraph (a)(1)(iii) of this section) and the Davis-Bacon poster (WH–1321) must be posted at all times by the contractor and its subcontractors at the site of the work in a prominent and accessible place where it can be easily seen by the workers.

(ii) *Frequently recurring classifications.* (A) In addition to wage and fringe benefit rates that have been determined to be prevailing under the procedures set forth in 29 CFR part 1, a wage determination may contain, pursuant to §1.3(f), wage and fringe benefit rates for classifications of laborers and mechanics for which conformance requests are regularly submitted pursuant to paragraph (a)(1)(iii) of this section, provided that:

(*1*) The work performed by the classification is not performed by a classification in the wage determination for which a prevailing wage rate has been determined;

(*2*) The classification is used in the area by the construction industry; and

(*3*) The wage rate for the classification bears a reasonable relationship to the prevailing wage rates contained in the wage determination.

(B) The Administrator will establish wage rates for such classifications in accordance with paragraph (a)(1)(iii)(A)(*3*) of this section. Work performed in such a classification must be paid at no less than the wage and fringe benefit rate listed on the wage determination for such classification.

(iii) *Conformance.* (A) The contracting officer must require that any class of laborers or mechanics, including helpers, which is not listed in the wage determination and which is to be employed under the contract be classified in conformance with the wage determination. Conformance of an additional classification and wage rate and fringe benefits is appropriate only when the following criteria have been met:

(*1*) The work to be performed by the classification requested is not performed by a classification in the wage determination; and

(*2*) The classification is used in the area by the construction industry; and

(*3*) The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination.

(B) The conformance process may not be used to split, subdivide, or otherwise avoid application of classifications listed in the wage determination.

(C) If the contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and the contracting officer agree on the classification and wage rate (including the amount designated for fringe benefits where appropriate), a report of the action taken will be sent by the contracting officer by email to *DBAconformance@dol.gov*. The Administrator, or an authorized representative, will approve, modify, or disapprove every additional classification action within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30–day period that additional time is necessary.

(D) In the event the contractor, the laborers or mechanics to be employed in the classification or their representatives, and the contracting officer do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), the contracting officer will, by email to *DBAconformance@dol.gov*, refer the questions, including the views of all interested parties and the recommendation of the contracting officer, to the Administrator for determination. The Administrator, or an authorized representative, will issue a determination within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30–

day period that additional time is necessary.

(E) The contracting officer must promptly notify the contractor of the action taken by the Wage and Hour Division under paragraphs (a)(1)(iii)(C) and (D) of this section. The contractor must furnish a written copy of such determination to each affected worker or it must be posted as a part of the wage determination. The wage rate (including fringe benefits where appropriate) determined pursuant to paragraph (a)(1)(iii)(C) or (D) of this section must be paid to all workers performing work in the classification under this contract from the first day on which work is performed in the classification.

(iv) *Fringe benefits not expressed as an hourly rate.* Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the contractor may either pay the benefit as stated in the wage determination or may pay another bona fide fringe benefit or an hourly cash equivalent thereof.

(v) *Unfunded plans.* If the contractor does not make payments to a trustee or other third person, the contractor may consider as part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program, *Provided,* That the Secretary of Labor has found, upon the written request of the contractor, in accordance with the criteria set forth in § 5.28, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the contractor to set aside in a separate account assets for the meeting of obligations under the plan or program.

(vi) *Interest.* In the event of a failure to pay all or part of the wages required by the contract, the contractor will be required to pay interest on any underpayment of wages.

(2) *Withholding*—(i) *Withholding requirements.* The [write in name of Federal agency or the recipient of Federal assistance] may, upon its own action, or must, upon written request of an authorized representative of the Department of Labor, withhold or cause to be withheld from the contractor so much of the accrued payments or advances as may be considered necessary to satisfy the liabilities of the prime contractor or any subcontractor for the full amount of wages and monetary relief, including interest, required by the clauses set forth in paragraph (a) of this section for violations of this contract, or to satisfy any such liabilities required by any other Federal contract, or federally assisted contract subject to Davis-Bacon labor standards, that is held by the same prime contractor (as defined in § 5.2). The necessary funds may be withheld from the contractor under this contract, any other Federal contract with the same prime contractor, or any other federally assisted contract that is subject to Davis-Bacon labor standards requirements and is held by the same prime contractor, regardless of whether the other contract was awarded or assisted by the same agency, and such funds may be used to satisfy the contractor liability for which the funds were withheld. In the event of a contractor's failure to pay any laborer or mechanic, including any apprentice or helper working on the site of the work (or otherwise working in construction or development of the project under a development statute) all or part of the wages required by the contract, or upon the contractor's failure to submit the required records as discussed in paragraph (a)(3)(iv) of this section, the [Agency] may on its own initiative and after written notice to the contractor, sponsor, applicant, owner, or other entity, as the case may be, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.

(ii) *Priority to withheld funds.* The Department has priority to funds withheld or to be withheld in accordance with paragraph (a)(2)(i) or (b)(3)(i) of this section, or both, over claims to those funds by:

(A) A contractor's surety(ies), including without limitation performance bond sureties and payment bond sureties;

(B) A contracting agency for its reprocurement costs;

(C) A trustee(s) (either a court-appointed trustee or a U.S. trustee, or both) in bankruptcy of a contractor, or a contractor's bankruptcy estate;

(D) A contractor's assignee(s);

(E) A contractor's successor(s); or

(F) A claim asserted under the Prompt Payment Act, 31 U.S.C. 3901–3907.

(3) *Records and certified payrolls*—(i) *Basic record requirements*—(A) *Length of record retention*. All regular payrolls and other basic records must be maintained by the contractor and any subcontractor during the course of the work and preserved for all laborers and mechanics working at the site of the work (or otherwise working in construction or development of the project under a development statute) for a period of at least 3 years after all the work on the prime contract is completed.

(B) *Information required*. Such records must contain the name; Social Security number; last known address, telephone number, and email address of each such worker; each worker's correct classification(s) of work actually performed; hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in 40 U.S.C. 3141(2)(B) of the Davis-Bacon Act); daily and weekly number of hours actually worked in total and on each covered contract; deductions made; and actual wages paid.

(C) *Additional records relating to fringe benefits*. Whenever the Secretary of Labor has found under paragraph (a)(1)(v) of this section that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in 40 U.S.C. 3141(2)(B) of the Davis-Bacon Act, the contractor must maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected, and records which show the costs anticipated or the actual cost incurred in providing such benefits.

(D) *Additional records relating to apprenticeship*. Contractors with apprentices working under approved programs must maintain written evidence of the registration of apprenticeship programs, the registration of the apprentices, and the ratios and wage rates prescribed in the applicable programs.

(ii) *Certified payroll requirements*—(A) *Frequency and method of submission*. The contractor or subcontractor must submit weekly, for each week in which any DBA- or Related Acts-covered work is performed, certified payrolls to the [write in name of appropriate Federal agency] if the agency is a party to the contract, but if the agency is not such a party, the contractor will submit the certified payrolls to the applicant, sponsor, owner, or other entity, as the case may be, that maintains such records, for transmission to the [write in name of agency]. The prime contractor is responsible for the submission of all certified payrolls by all subcontractors. A contracting agency or prime contractor may permit or require contractors to submit certified payrolls through an electronic system, as long as the electronic system requires a legally valid electronic signature; the system allows the contractor, the contracting agency, and the Department of Labor to access the certified payrolls upon request for at least 3 years after the work on the prime contract has been completed; and the contracting agency or prime contractor permits other methods of submission in situations where the contractor is unable or limited in its ability to use or access the electronic system.

(B) *Information required*. The certified payrolls submitted must set out accurately and completely all of the information required to be maintained under paragraph (a)(3)(i)(B) of this section, except that full Social Security numbers and last known addresses, telephone numbers, and email addresses must not be included on weekly transmittals. Instead, the certified payrolls need only include an individually identifying number for each worker (*e.g.*, the last four digits of the worker's Social Security number). The

required weekly certified payroll information may be submitted using Optional Form WH–347 or in any other format desired. Optional Form WH–347 is available for this purpose from the Wage and Hour Division website at *https://www.dol.gov/sites/dolgov/files/WHD/legacy/files/wh347/.pdf* or its successor website. It is not a violation of this section for a prime contractor to require a subcontractor to provide full Social Security numbers and last known addresses, telephone numbers, and email addresses to the prime contractor for its own records, without weekly submission by the subcontractor to the sponsoring government agency (or the applicant, sponsor, owner, or other entity, as the case may be, that maintains such records).

(C) *Statement of Compliance.* Each certified payroll submitted must be accompanied by a ''Statement of Compliance,'' signed by the contractor or subcontractor, or the contractor's or subcontractor's agent who pays or supervises the payment of the persons working on the contract, and must certify the following:

(*1*) That the certified payroll for the payroll period contains the information required to be provided under paragraph (a)(3)(ii) of this section, the appropriate information and basic records are being maintained under paragraph (a)(3)(i) of this section, and such information and records are correct and complete;

(*2*) That each laborer or mechanic (including each helper and apprentice) working on the contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in 29 CFR part 3; and

(*3*) That each laborer or mechanic has been paid not less than the applicable wage rates and fringe benefits or cash equivalents for the classification(s) of work actually performed, as specified in the applicable wage determination incorporated into the contract.

(D) *Use of Optional Form WH–347.* The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH–347 will satisfy the requirement for submission of the ''Statement of Compliance'' required by paragraph (a)(3)(ii)(C) of this section.

(E) *Signature.* The signature by the contractor, subcontractor, or the contractor's or subcontractor's agent must be an original handwritten signature or a legally valid electronic signature.

(F) *Falsification.* The falsification of any of the above certifications may subject the contractor or subcontractor to civil or criminal prosecution under 18 U.S.C. 1001 and 31 U.S.C. 3729.

(G) *Length of certified payroll retention.* The contractor or subcontractor must preserve all certified payrolls during the course of the work and for a period of 3 years after all the work on the prime contract is completed.

(iii) *Contracts, subcontracts, and related documents.* The contractor or subcontractor must maintain this contract or subcontract and related documents including, without limitation, bids, proposals, amendments, modifications, and extensions. The contractor or subcontractor must preserve these contracts, subcontracts, and related documents during the course of the work and for a period of 3 years after all the work on the prime contract is completed.

(iv) *Required disclosures and access*—(A) *Required record disclosures and access to workers.* The contractor or subcontractor must make the records required under paragraphs (a)(3)(i) through (iii) of this section, and any other documents that the [write the name of the agency] or the Department of Labor deems necessary to determine compliance with the labor standards provisions of any of the applicable statutes referenced by § 5.1, available for inspection, copying, or transcription by authorized representatives of the [write the name of the agency] or the Department of Labor, and must permit such representatives to interview workers during working hours on the job.

(B) *Sanctions for non-compliance with records and worker access requirements.* If the contractor or subcontractor fails to submit the required records or to make them available, or refuses to permit worker interviews during working

hours on the job, the Federal agency may, after written notice to the contractor, sponsor, applicant, owner, or other entity, as the case may be, that maintains such records or that employs such workers, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds. Furthermore, failure to submit the required records upon request or to make such records available, or to permit worker interviews during working hours on the job, may be grounds for debarment action pursuant to §5.12. In addition, any contractor or other person that fails to submit the required records or make those records available to WHD within the time WHD requests that the records be produced will be precluded from introducing as evidence in an administrative proceeding under 29 CFR part 6 any of the required records that were not provided or made available to WHD. WHD will take into consideration a reasonable request from the contractor or person for an extension of the time for submission of records. WHD will determine the reasonableness of the request and may consider, among other things, the location of the records and the volume of production.

(C) *Required information disclosures.* Contractors and subcontractors must maintain the full Social Security number and last known address, telephone number, and email address of each covered worker, and must provide them upon request to the [write in name of appropriate Federal agency] if the agency is a party to the contract, or to the Wage and Hour Division of the Department of Labor. If the Federal agency is not such a party to the contract, the contractor, subcontractor, or both, must, upon request, provide the full Social Security number and last known address, telephone number, and email address of each covered worker to the applicant, sponsor, owner, or other entity, as the case may be, that maintains such records, for transmission to the [write in name of agency], the contractor, or the Wage and Hour Division of the Department of Labor for purposes of an investigation or other compliance action.

(4) *Apprentices and equal employment opportunity*—(i) *Apprentices*—(A) *Rate of pay.* Apprentices will be permitted to work at less than the predetermined rate for the work they perform when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor, Employment and Training Administration, Office of Apprenticeship (OA), or with a State Apprenticeship Agency recognized by the OA. A person who is not individually registered in the program, but who has been certified by the OA or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice, will be permitted to work at less than the predetermined rate for the work they perform in the first 90 days of probationary employment as an apprentice in such a program. In the event the OA or a State Apprenticeship Agency recognized by the OA withdraws approval of an apprenticeship program, the contractor will no longer be permitted to use apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(B) *Fringe benefits.* Apprentices must be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator determines that a different practice prevails for the applicable apprentice classification, fringe benefits must be paid in accordance with that determination.

(C) *Apprenticeship ratio.* The allowable ratio of apprentices to journeyworkers on the job site in any craft classification must not be greater than the ratio permitted to the contractor as to the entire work force under the registered program or the ratio applicable to the locality of the project pursuant to paragraph (a)(4)(i)(D) of this section. Any worker listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated in paragraph (a)(4)(i)(A) of this section,

must be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any apprentice performing work on the job site in excess of the ratio permitted under this section must be paid not less than the applicable wage rate on the wage determination for the work actually performed.

(D) *Reciprocity of ratios and wage rates.* Where a contractor is performing construction on a project in a locality other than the locality in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyworker's hourly rate) applicable within the locality in which the construction is being performed must be observed. If there is no applicable ratio or wage rate for the locality of the project, the ratio and wage rate specified in the contractor's registered program must be observed.

(ii) *Equal employment opportunity.* The use of apprentices and journeyworkers under this part must be in conformity with the equal employment opportunity requirements of Executive Order 11246, as amended, and 29 CFR part 30.

(5) *Compliance with Copeland Act requirements.* The contractor shall comply with the requirements of 29 CFR part 3, which are incorporated by reference in this contract.

(6) *Subcontracts.* The contractor or subcontractor must insert in any subcontracts the clauses contained in paragraphs (a)(1) through (11) of this section, along with the applicable wage determination(s) and such other clauses or contract modifications as the [write in the name of the Federal agency] may by appropriate instructions require, and a clause requiring the subcontractors to include these clauses and wage determination(s) in any lower tier subcontracts. The prime contractor is responsible for the compliance by any subcontractor or lower tier subcontractor with all the contract clauses in this section. In the event of any violations of these clauses, the prime contractor and any subcontractor(s) responsible will be liable for any unpaid wages and monetary relief, including interest from the date of the underpayment or loss, due to any workers of lower-tier subcontractors, and may be subject to debarment, as appropriate.

(7) *Contract termination: debarment.* A breach of the contract clauses in 29 CFR 5.5 may be grounds for termination of the contract, and for debarment as a contractor and a subcontractor as provided in 29 CFR 5.12.

(8) *Compliance with Davis-Bacon and Related Act requirements.* All rulings and interpretations of the Davis-Bacon and Related Acts contained in 29 CFR parts 1, 3, and 5 are herein incorporated by reference in this contract.

(9) *Disputes concerning labor standards.* Disputes arising out of the labor standards provisions of this contract shall not be subject to the general disputes clause of this contract. Such disputes shall be resolved in accordance with the procedures of the Department of Labor set forth in 29 CFR parts 5, 6, and 7. Disputes within the meaning of this clause include disputes between the contractor (or any of its subcontractors) and the contracting agency, the U.S. Department of Labor, or the employees or their representatives.

(10) *Certification of eligibility.* (i) By entering into this contract, the contractor certifies that neither it nor any person or firm who has an interest in the contractor's firm is a person or firm ineligible to be awarded Government contracts by virtue of 40 U.S.C. 3144(b) or § 5.12(a).

(ii) No part of this contract shall be subcontracted to any person or firm ineligible for award of a Government contract by virtue of 40 U.S.C. 3144(b) or § 5.12(a).

(iii) The penalty for making false statements is prescribed in the U.S. Code, Title 18 Crimes and Criminal Procedure, 18 U.S.C. 1001.

(11) *Anti-retaliation.* It is unlawful for any person to discharge, demote, intimidate, threaten, restrain, coerce, blacklist, harass, or in any other manner discriminate against, or to cause any person to discharge, demote, intimidate, threaten, restrain, coerce, blacklist, harass, or in any other manner discriminate against, any worker or job applicant for:

(i) Notifying any contractor of any conduct which the worker reasonably believes constitutes a violation of the

DBA, Related Acts, this part, or 29 CFR part 1 or 3;

(ii) Filing any complaint, initiating or causing to be initiated any proceeding, or otherwise asserting or seeking to assert on behalf of themselves or others any right or protection under the DBA, Related Acts, this part, or 29 CFR part 1 or 3;

(iii) Cooperating in any investigation or other compliance action, or testifying in any proceeding under the DBA, Related Acts, this part, or 29 CFR part 1 or 3; or

(iv) Informing any other person about their rights under the DBA, Related Acts, this part, or 29 CFR part 1 or 3.

(b) *Contract Work Hours and Safety Standards Act (CWHSSA).* The Agency Head must cause or require the contracting officer to insert the following clauses set forth in paragraphs (b)(1) through (5) of this section in full, or (for contracts covered by the Federal Acquisition Regulation) by reference, in any contract in an amount in excess of $100,000 and subject to the overtime provisions of the Contract Work Hours and Safety Standards Act. These clauses must be inserted in addition to the clauses required by paragraph (a) of this section or 29 CFR 4.6. As used in this paragraph (b), the terms ''laborers and mechanics'' include watchpersons and guards.

(1) *Overtime requirements.* No contractor or subcontractor contracting for any part of the conract work which may require or involve the employment of laborers or mechanics shall require or permit any such laborer or mechanic in any workweek in which he or she is employed on such work to work in excess of forty hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of forty hours in such workweek.

(2) *Violation; liability for unpaid wages; liquidated damages.* In the event of any violation of the clause set forth in paragraph (b)(1) of this section the contractor and any subcontractor responsible therefor shall be liable for the unpaid wages and interest from the date of the underpayment. In addition, such contractor and subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory), for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic, including watchpersons and guards, employed in violation of the clause set forth in paragraph (b)(1) of this section, in the sum of $33 for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of forty hours without payment of the overtime wages required by the clause set forth in paragraph (b)(1).

(3) *Withholding for unpaid wages and liquidated damages*—(i) *Withholding process.* The [write in the name of the Federal agency or the recipient of Federal assistance] may, upon its own action, or must, upon written request of an authorized representative of the Department of Labor, withhold or cause to be withheld from the contractor so much of the accrued payments or advances as may be considered necessary to satisfy the liabilities of the prime contractor or any subcontractor for any unpaid wages; monetary relief, including interest; and liquidated damages required by the clauses set forth in this paragraph (b) on this contract, any other Federal contract with the same prime contractor, or any other federally assisted contract subject to the Contract Work Hours and Safety Standards Act that is held by the same prime contractor (as defined in §5.2). The necessary funds may be withheld from the contractor under this contract, any other Federal contract with the same prime contractor, or any other federally assisted contract that is subject to the Contract Work Hours and Safety Standards Act and is held by the same prime contractor, regardless of whether the other contract was awarded or assisted by the same agency, and such funds may be used to satisfy the contractor liability for which the funds were withheld.

(ii) *Priority to withheld funds.* The Department has priority to funds withheld or to be withheld in accordance with paragraph (a)(2)(i) or (b)(3)(i) of

this section, or both, over claims to those funds by:

(A) A contractor's surety(ies), including without limitation performance bond sureties and payment bond sureties;

(B) A contracting agency for its reprocurement costs;

(C) A trustee(s) (either a court-appointed trustee or a U.S. trustee, or both) in bankruptcy of a contractor, or a contractor's bankruptcy estate;

(D) A contractor's assignee(s);

(E) A contractor's successor(s); or

(F) A claim asserted under the Prompt Payment Act, 31 U.S.C. 3901–3907.

(4) *Subcontracts.* The contractor or subcontractor must insert in any subcontracts the clauses set forth in paragraphs (b)(1) through (5) of this section and a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor is responsible for compliance by any subcontractor or lower tier subcontractor with the clauses set forth in paragraphs (b)(1) through (5). In the event of any violations of these clauses, the prime contractor and any subcontractor(s) responsible will be liable for any unpaid wages and monetary relief, including interest from the date of the underpayment or loss, due to any workers of lower-tier subcontractors, and associated liquidated damages and may be subject to debarment, as appropriate.

(5) *Anti-retaliation.* It is unlawful for any person to discharge, demote, intimidate, threaten, restrain, coerce, blacklist, harass, or in any other manner discriminate against, or to cause any person to discharge, demote, intimidate, threaten, restrain, coerce, blacklist, harass, or in any other manner discriminate against, any worker or job applicant for:

(i) Notifying any contractor of any conduct which the worker reasonably believes constitutes a violation of the Contract Work Hours and Safety Standards Act (CWHSSA) or its implementing regulations in this part;

(ii) Filing any complaint, initiating or causing to be initiated any proceeding, or otherwise asserting or seeking to assert on behalf of themselves or others any right or protection under CWHSSA or this part;

(iii) Cooperating in any investigation or other compliance action, or testifying in any proceeding under CWHSSA or this part; or

(iv) Informing any other person about their rights under CWHSSA or this part.

(c) *CWHSSA required records clause.* In addition to the clauses contained in paragraph (b) of this section, in any contract subject only to the Contract Work Hours and Safety Standards Act and not to any of the other laws referenced by § 5.1, the Agency Head must cause or require the contracting officer to insert a clause requiring that the contractor or subcontractor must maintain regular payrolls and other basic records during the course of the work and must preserve them for a period of 3 years after all the work on the prime contract is completed for all laborers and mechanics, including guards and watchpersons, working on the contract. Such records must contain the name; last known address, telephone number, and email address; and social security number of each such worker; each worker's correct classification(s) of work actually performed; hourly rates of wages paid; daily and weekly number of hours actually worked; deductions made; and actual wages paid. Further, the Agency Head must cause or require the contracting officer to insert in any such contract a clause providing that the records to be maintained under this paragraph must be made available by the contractor or subcontractor for inspection, copying, or transcription by authorized representatives of the (write the name of agency) and the Department of Labor, and the contractor or subcontractor will permit such representatives to interview workers during working hours on the job.

(d) *Incorporation of contract clauses and wage determinations by reference.* Although agencies are required to insert the contract clauses set forth in this section, along with appropriate wage determinations, in full into covered contracts, and contractors and subcontractors are required to insert them

in any lower-tier subcontracts, the incorporation by reference of the required contract clauses and appropriate wage determinations will be given the same force and effect as if they were inserted in full text.

(e) *Incorporation by operation of law.* The contract clauses set forth in this section (or their equivalent under the Federal Acquisition Regulation), along with the correct wage determinations, will be considered to be a part of every prime contract required by the applicable statutes referenced by §5.1 to include such clauses, and will be effective by operation of law, whether or not they are included or incorporated by reference into such contract, unless the Administrator grants a variance, tolerance, or exemption from the application of this paragraph. Where the clauses and applicable wage determinations are effective by operation of law under this paragraph, the prime contractor must be compensated for any resulting increase in wages in accordance with applicable law.

(The information collection, recordkeeping, and reporting requirements contained in the following paragraphs of this section were approved by the Office of Management and Budget:

Paragraph	OMB Control No.
(a)(1)(ii)(B)	1235–0023
(a)(1)(ii)(C)	1235–0023
(a)(1)(iv)	1235–0023
(a)(3)(i)	1235–0023
(a)(3)(ii)(A)	1235–0023
	1235–0008
(c)	1235–0023

[48 FR 19540, Apr. 29, 1983, as amended at 51 FR 12265, Apr. 9, 1986; 55 FR 50150, Dec. 4, 1990; 57 FR 28776, June 26, 1992; 58 FR 58955, Nov. 5, 1993; 61 FR 40716, Aug. 5, 1996; 65 FR 69693, Nov. 20, 2000; 73 FR 77511, Dec. 19, 2008; 81 FR 43450, July 1, 2016; 82 FR 2225, 2226, Jan. 9, 2017; 83 FR 12, Jan 2, 2018; 84 FR 218, Jan. 23, 2019; 87 FR 2334, Jan. 14, 2022; 88 FR 2215, Jan. 13, 2023; 88 FR 57734, Aug. 23, 2023; 89 FR 1815, Jan. 11, 2024; 90 FR 1859, Jan. 10, 2025]

§5.6 Enforcement.

(a) *Agency responsibilities.* (1)(i) The Federal agency has the initial responsibility to ascertain whether the clauses required by §5.5 and the appropriate wage determination(s) have been incorporated into the contracts subject to the labor standards provisions of the laws referenced by §5.1. Additionally, a Federal agency that provides Federal financial assistance that is subject to the labor standards provisions of the Act must promulgate the necessary regulations or procedures to require the recipient or sub-recipient of the Federal assistance to insert in its contracts the provisions of §5.5. No payment, advance, grant, loan, or guarantee of funds will be approved by the Federal agency unless it ensures that the clauses required by §5.5 and the appropriate wage determination(s) are incorporated into such contracts. Furthermore, no payment, advance, grant, loan, or guarantee of funds will be approved by the Federal agency after the beginning of construction unless there is on file with the Federal agency a certification by the contractor that the contractor and its subcontractors have complied with the provisions of §5.5 or unless there is on file with the Federal agency a certification by the contractor that there is a substantial dispute with respect to the required provisions.

(ii) If a contract subject to the labor standards provisions of the applicable statutes referenced by §5.1 is entered into without the incorporation of the clauses required by §5.5, the agency must, upon the request of the Administrator or upon its own initiative, either terminate and resolicit the contract with the required contract clauses, or incorporate the required clauses into the contract (or ensure they are so incorporated) through supplemental agreement, change order, or any and all authority that may be needed. Where an agency has not entered directly into such a contract but instead has provided Federal financial assistance, the agency must ensure that the recipient or sub-recipient of the Federal assistance similarly incorporates the clauses required into its contracts. The method of incorporation of the correct wage determination, and adjustment in contract price, where appropriate, should be in accordance with applicable law. Additionally, the following requirements apply:

(A) Unless the Administrator directs otherwise, the incorporation of the clauses required by §5.5 must be retroactive to the date of contract award or

ATTACHMENT E

Davis-Bacon Wage Determination

General Decision TN20260166 - Building - Lake and Lauderdale Counties, Tennessee - Modification No. 2 - May 18, 2026

"General Decision Number: TN20260166 05/18/2026

State: Tennessee

Construction Types: Building

Counties: Tennessee Counties of
Lake and Lauderdale

Modification Number	Publication Date
1	01/23/2026
2	05/18/2026

ELEC1925-001 01/01/2026

	Rates	Fringes
ELECTRICIAN	$ 27.25	15.72

ENGI0917-002 05/01/2024

	Rates	Fringes
POWER EQUIPMENT OPERATOR: CRANE	$ 36.25	13.40

ENGI0917-006 05/01/2024

	Rates	Fringes
POWER EQUIPMENT OPERATOR: BULLDOZER	$ 33.23	13.40
POWER EQUIPMENT OPERATOR (BACKHOE/TRACKHOE/EXCAVATOR)	$ 33.23	13.40

SHEE0005-001 05/01/2025

	Rates	Fringes
SHEET METAL WORKER	$ 37.70	17.40

SUTN2017-019 04/16/2021

	Rates	Fringes
PLUMBER	$ 21.81	0.00
PAINTER (BRUSH AND ROLLER)	$ 14.07	0.00
LABORER: MASON TENDER - CEMENT/CONCRETE	$ 15.00	0.00
LABORER: COMMON OR GENERAL	$ 11.54	0.00
IRONWORKER, STRUCTURAL	$ 19.47	0.00
GLAZIER	$ 18.83	1.11
CEMENT MASON/CONCRETE FINISHER	$ 19.00	0.00
CARPENTER	$ 17.59	1.81

WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

Note: Executive Order (EO) 13706, Establishing Paid Sick Leave for Federal Contractors applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any

solicitation was issued) on or after January 1, 2017. If this contract is covered by the EO, the contractor must provide employees with 1 hour of paid sick leave for every 30 hours they work, up to 56 hours of paid sick leave each year. Employees must be permitted to use paid sick leave for their own illness, injury or other health-related needs, including preventive care; to assist a family member (or person who is like family to the employee) who is ill, injured, or has other health-related needs, including preventive care; or for reasons resulting from, or to assist a family member (or person who is like family to the employee) who is a victim of, domestic violence, sexual assault, or stalking. Additional information on contractor requirements and worker protections under the EO is available at https://www.dol.gov/agencies/whd/government-contracts.

Note: Executive Order 13658 generally applies to contracts subject to the Davis-Bacon Act that were awarded on or between January 1, 2015 and January 29, 2022, and that have not been renewed or extended on or after January 30, 2022. Executive Order 13658 does not apply to contracts subject only to the Davis-Bacon Related Acts regardless of when they were awarded. If a contract is subject to Executive Order 13658, the contractor must pay all covered workers at least $13.65 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract from May 11, 2026, through December 31, 2026. The applicable Executive Order minimum wage rate will be adjusted annually. Additional information on contractor requirements and worker protections under Executive Order 13658 is available at www.dol.gov/whd/govcontracts.

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (iii)).

The body of each wage determination lists the classifications and wage rates that have been found to be prevailing for the type(s) of construction and geographic area covered by the wage determination. The classifications are listed in alphabetical order under rate identifiers indicating whether the particular rate is a union rate (current union negotiated rate), a survey rate, a weighted union average rate, a state adopted rate, or a supplemental classification rate.

Union Rate Identifiers

A four-letter identifier beginning with characters other than "SU", "UAVG", "SA", or "SC" denotes that a union rate was prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2024. PLUM is an identifier of the union whose collectively bargained rate prevailed in the survey for this classification, which in this example would be Plumbers. 0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. The date, 07/01/2024 in the example, is the effective date of the most current negotiated rate.

Union prevailing wage rates are updated to reflect all changes over time that are reported to WHD in the rates in the collective bargaining agreement (CBA) governing the classification.

Union Average Rate Identifiers

The UAVG identifier indicates that no single rate prevailed for those classifications, but that 100% of the data reported for the classifications reflected union rates. EXAMPLE: UAVG-OH-0010 01/01/2024. UAVG indicates that the rate is a weighted union average rate. OH indicates the State of Ohio. The next number, 0010 in the example, is an internal number used in producing the wage determination. The date, 01/01/2024 in the example, indicates the date the wage determination was updated to reflect the most current union average rate.

A UAVG rate will be updated once a year, usually in January, to reflect a weighted average of the current rates in the collective bargaining agreements on which the rate is based.

Survey Rate Identifiers

The "SU" identifier indicates that either a single non-union rate prevailed (as defined in 29 CFR 1.2) for this classification in the survey or that the rate was derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As a weighted average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: SUFL2022-007 6/27/2024. SU indicates the rate is a single non-union prevailing rate or a weighted average of survey data for that classification. FL indicates the State of Florida. 2022 is the year of the survey on which these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. The date, 6/27/2024 in the example, indicates the survey completion date for the classifications and rates under that identifier.

"SU" wage rates typically remain in effect until a new survey is conducted. However, the Wage and Hour Division (WHD) has the discretion to update such rates under 29 CFR 1.6(c)(1).

State Adopted Rate Identifiers

The "SA" identifier indicates that the classifications and prevailing wage rates set by a state (or local) government were adopted under 29 C.F.R 1.3(g)-(h). Example: SAME2023-007 01/03/2024. SA reflects that the rates are state adopted. ME refers to the State of Maine. 2023 is the year during which the state completed the survey on which the listed classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. The date, 01/03/2024 in the example, reflects the date on which the classifications and rates under the "SA" identifier took effect under state law in the state from which the rates were adopted.

WAGE DETERMINATION APPEALS PROCESS

1) Has there been an initial decision in the matter? This can be:

- a) a survey underlying a wage determination
- b) an existing published wage determination
- c) an initial WHD letter setting forth a position on a wage determination matter
- d) an initial conformance (additional classification and rate) determination

On survey related matters, initial contact, including requests for summaries of surveys, should be directed to the WHD Branch of Wage Surveys. Requests can be submitted via email to davisbaconinfo@dol.gov or by mail to:

Branch of Wage Surveys
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

Regarding any other wage determination matter such as conformance decisions, requests for initial decisions should be directed to the WHD Branch of Construction Wage Determinations. Requests can be submitted via email to BCWD-Office@dol.gov or by mail to:

Branch of Construction Wage Determinations
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

2) If an initial decision has been issued, then any interested party (those affected by the action) that disagrees with the decision can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Requests for review and reconsideration can be submitted via email to dba.reconsideration@dol.gov or by mail to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210.

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END OF GENERAL DECISION

"

ATTACHMENT F

TDEC OEP EECBG Grant Program Manual

November 2025

STATE OF TENNESSEE
ENERGY EFFICIENCY AND CONSERVATION BLOCK GRANT (EECBG) PROGRAM
INFRASTRUCTURE INVESTMENT AND JOBS ACT SECTION 40552
GRANT PROGRAM MANUAL

November 2025

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GRANT PROGRAM OVERVIEW

The U.S. Department of Energy's (U.S. DOE) Energy Efficiency and Conservation Block Grant (EECBG) Program, funded by the Infrastructure Investment and Jobs Act (IIJA), is designed to assist states, local governments, and Tribes in implementing strategies to reduce energy use and improve energy efficiency.

STATE OF TENNESSEE EECBG PROGRAM

The State of Tennessee EECBG Program will provide funding to assist local governments in creating and implementing strategies to improve energy efficiency and community resiliency in a manner that maximizes benefits to the local community.

TDEC's Office of Energy Programs (TDEC OEP) has allocated a total of $4,607,296 as subawards[1] to units of local government in Tennessee that were not eligible for direct formula grants from U.S. DOE. This total represents $2,094,241 of the State's IIJA EECBG formula funding allocation, plus $2,513,055 from the State's IIJA Revolving Loan Fund (RLF) Capitalization Grant Program formula allocation that can be used for grants and/or technical assistance to supplement the EECBG funding.

To be eligible for grants and technical assistance funding, the Grantee must:

- Conduct a majority of its business in Tennessee.
- Own or operate one or more commercial buildings (including public buildings) or commercial space within a building that serves multiple functions, such as a building for commercial or residential operations.
- Have fewer than 500 employees.

TDEC OEP has awarded grants to FY2025 distressed counties in Tennessee, as determined by the Appalachian Regional Commission.[2] More information and a list of distressed counties in Tennessee can be accessed here. The formula utilized by TDEC OEP to determine allocations for each of the distressed counties takes into account a variety of data points, including energy burden[3], number of high-need buildings (i.e., Title 1 schools and affordable housing properties) on a per capita basis, and the TDEC Ability to Pay Index.

For the distressed counties that have been awarded grants, Tennessee's EECBG Program will provide technical assistance, including energy audits, and fund energy efficiency upgrades for county-owned, commercial buildings with multi-use purposes that support community resilience or that are deemed critical facilities. Examples of eligible buildings include K-12 schools, hospitals, emergency management facilities, and/or community centers, all of which may also function as

[1] Grants awarded under Tennessee's EECBG Program are subawards (also called subgrants), and a Grantee is a subrecipient.

[2] Each year, the Appalachian Regional Commission (ARC) prepares an index of county economic status for every county in the United States. Economic status designations are identified through a composite measure of each county's three-year average unemployment rate, per capita market income, and poverty rate. Based on these indicators, each county is then categorized as distressed, at-risk, transitional, competitive, or attainment.

[3] Nationally, low-income households spend a larger portion of their income on home energy costs (e.g., electricity, natural gas, and other home heating fuels) than other households spend. This measure is often referred to as a household's "energy burden." https://www.energy.gov/sites/prod/files/2019/01/f58/WIP-Energy-Burden_final.pdf

emergency shelters or staging areas during emergency response and recovery efforts.

Eligible Projects/Costs:

TDEC OEP has prioritized the implementation of eligible measures in county-owned commercial buildings located within the distressed counties. The grants will fund projects that improve the resilience of the communities in these counties by focusing on county-owned buildings that serve or will serve multi-use purposes, such as:

- K-12 schools,
- Government-owned hospitals,
- Emergency management facilities, and/or
- Community centers.

These facilities may also serve as emergency shelters or staging areas during response and recovery efforts.

Technical Assistance for Grantees

TDEC OEP will support the Grantee in applying for 40-60 hours of no-cost technical assistance through the U.S. DOE Energy to Communities (E2C) Expert Match Program. This assistance will help determine optimal facilities to target for energy audits and subsequent retrofits and upgrades.

After the Grantee has received technical assistance from E2C, the Grantee will provide to TDEC OEP a proposed list of facilities to undergo an energy audit. Only after TDEC OEP approval will the energy audits be conducted at no cost to the Grantee.

Energy Audits & Retrofits

To be reimbursable under this Grant, any retrofit or upgrade must be recommended by the energy audit. Grantees will retrofit existing facilities with cost-effective energy-efficient measures or the implementation of energy conservation devices to improve energy efficiency and reduce energy costs.

Required Elements of Qualifying Energy Efficiency Audits and Upgrades

Commercial Energy Audits	• Determine the overall consumption of energy of the facility. • Identify and recommend lifecycle cost-effective opportunities to reduce the energy consumption of the facility. • Identify the period and level of peak energy demand for each building within the facility of the eligible recipient and the sources of energy consumption that are contributing the most to that period of peak energy demand. • Recommend controls and management systems to reduce or redistribute peak energy consumption. • Estimate the total energy and cost savings potential for the facility of the eligible recipient if all recommended upgrades and retrofits are implemented, using software approved by U.S. DOE.

Commercial Upgrades and Retrofits	• Recommended in the qualifying commercial energy audit completed for the building or facility of the eligible recipient.
	• Are lifecycle cost-effective.
	• Improve, with respect to the building or facility of the eligible recipient, at least one of the following:
	  ○ The physical comfort of the building or facility occupants.
	  ○ The energy efficiency of the building or facility.
	  ○ The quality of the air in the building or facility.
	• Lead to at least one of the following outcomes:
	  ○ Reduce the energy intensity of the building or facility of the eligible recipient.
	  ○ Improve the control and management of energy usage of the building or facility to reduce demand during peak times.

After the energy audit is performed, recommended upgrades and retrofits must be approved by TDEC OEP in writing prior to commencement of related procurement and the performance of the retrofits and upgrades.

Grantees should work closely with TDEC OEP and the Tennessee Valley Authority (TVA) to leverage TVA's commercial energy efficiency rebates to further reduce the cost of energy-efficient retrofits. Additionally, Grantees are encouraged to evaluate federal tax incentives that may be applicable to their projects[4].

Key Requirements for Eligible Activities/Measures

Eligible activities and/or measures under Tennessee's EECBG Program must:

- Have been recommended in the energy audit completed for the facility;
- Be lifecycle cost-effective;
- Improve, with respect to the facility, at least one of the following:
  - The physical comfort of the building or facility occupants,
  - The energy efficiency of the building or facility,
  - The quality of the air in the building or facility;
- Lead to at least one of the following outcomes:
  - Reduce the energy intensity of the facility,
  - Improve the control and management of energy usage of the building or facility to reduce demand during peak times; and
- Be approved by TDEC OEP in writing prior to the commencement of related procurement and the performance of the retrofits and upgrades.

Cost Match: There is no Grantee cost match requirement under Tennessee's EECBG Program.

Grant Project/Reimbursement Timeline:

[4] Clean energy tax incentives may be eligible for elective pay. The IRS has provided information about the modification of some of these incentives. The National League of Cities provides a step-by-step guide for filing under elective pay.

- **Timeline for Project Completion**: Grantees will have 24 months from the effective date of the Grant Contract to complete the project. No-cost extensions will be evaluated on a case-by-case basis.
- **Record Keeping and Compliance**: The Grantee is responsible for maintaining records adequate to demonstrate that costs claimed have been incurred, are reasonable, allowable, and allocable, and comply with the Federal cost principles outlined in 2 CFR Part 200 for five years from the date of final payment. The Grantee is required to provide the records to TDEC OEP, and the records are subject to audit.
- **Reimbursement Process**: Payment of project expenses will take place on a reimbursement basis. The Grantee must invoice TDEC OEP no more often than monthly, with all necessary supporting documentation as outlined in Section C.5 of the Grant Contract. Grantees should include only reimbursement requests for actual expenditures that are reasonable, allowable, and allocable. TDEC OEP will not reimburse expenses that are incurred prior to the start date of the Grant Contract.

Additional Considerations:

- Grantees must attend any mandatory compliance workshops and/or webinars scheduled by TDEC OEP. These workshops and/or webinars will provide guidance on a variety of program requirements and compliance processes, including competitive procurement requirements, compliance with federal requirements (e.g., Title VI training, Build America Buy America, Davis-Bacon, National Historic Preservation Act), invoice submission, reporting, onsite monitoring, and reimbursement. Access to mandatory workshops and/or webinars will be provided at the necessary time.
- Site visits are an ongoing part of the program to ensure compliance and project success.
- Any information submitted in response to TDEC for the EECBG Program will be considered public record and will be subject to disclosure to the public. The public may request such information by submitting a records request to TDEC OEP. Specific request instructions are provided on the TDEC Public Records Webpage, including the name, title, and contact information for the TDEC OEP staff tasked with responding to such records requests.
- The Grantee must certify compliance with requirements of Title VI of the Civil Rights Act of 1964, 42 U.S.C. 2000d-1, pursuant to the guidelines established by the Tennessee Department of Human Resources' Title VI Compliance Office, by completing all of the following items:
    - Provide the name and contact information of the Grantee's Title VI Coordinator to TDEC OEP.
    - Ensure the Grantee's Policies and Procedures manual contains a Title VI section with information on: (a) Filing a complaint; (b) Investigations; (c) Report of findings; (d) Hearings and appeals; (e) Description of Title VI Training Program; (f) Limited English Proficiency (LEP) procedure; and (g) Retaliation.
    - Train all staff (regular, contract, volunteer) on Title VI upon employment and annually thereafter. Training documentation shall be made available upon request of TDEC OEP and include: 1) dates and duration of each training; 2) list of staff completing training on each date.
    - Annually complete and submit a Title VI self-survey as supplied by TDEC OEP.
    - Implement a process and provide documentation to ensure service recipients are informed of Title VI and how to file a discrimination complaint.

REQUIREMENTS FOR APPROVED PROJECTS:

Build America, Buy America (BABA) Requirement

None of the funds provided under the TDEC OEP EECBG Program may be used for a project for infrastructure unless:

- All iron and steel used in the project is produced in the United States—this means all manufacturing processes, from the initial melting stage through the application of coatings, occurred in the United States;
- All manufactured products used in the project are produced in the United States—this means the manufactured product was manufactured in the United States; and the cost of the components of the manufactured product that are mined, produced, or manufactured in the United States is greater than 55 percent of the total cost of all components of the manufactured product, unless another standard for determining the minimum amount of domestic content of the manufactured product has been established under applicable law or regulation. See 2 CFR 184.5 for determining the cost of components for manufactured products; and
- All construction materials are manufactured in the United States—this means that all manufacturing processes for the construction material occurred in the United States. See 2 CFR 184.6 for construction material standards, including additional standards for some specified construction materials in order for those materials to be considered "produced in the United States."

2 CFR Part 184 contains definitions and additional information about the BABA requirement.

U.S. DOE's Build America, Buy America website also provides information regarding the BABA requirement.

Grantee Requirements

The Grantee must ensure that the BABA Requirement flows down to all subawards, contracts, subcontracts, and purchase orders for work performed under the infrastructure project.

Prior to undertaking procurement activities for articles, materials, and supplies subject to the BABA Requirement, the Grantee must demonstrate to TDEC OEP that the solicitation contains information regarding the BABA requirement.

Grantees must also submit to TDEC OEP certifications or equivalent documentation for proof of compliance that those articles, materials, and supplies that are used in the infrastructure project, not covered by a waiver or exemption, are produced in the United States.

The certification or proof of compliance must be provided by the suppliers or manufacturers of the iron, steel, manufactured products, and construction materials, and flow up from all subrecipients, contractors, and vendors to be provided to TDEC OEP.

TDEC OEP must keep these certifications with the award/project files and be able to produce them upon request from U.S. DOE, auditors, or U.S. Office of Inspector General.

Although DOE does not require a specific format for the certification, the following elements must be present:

- A listing of all products covered by the certification, including their category (e.g., iron, steel, manufactured product, or construction material);
- A recitation of the relevant "produced in the United States" standard for any categories (iron, steel, manufactured product, or construction material) provided in the above list, to ensure the manufacturer properly understands the standards to be met;
- A clear statement that the products listed meet the relevant "produced in the United States" standard(s);
- A signature from an authorized representative of the manufacturer certifying the contents of the compliance statement; and
- Any other information the recipient deems necessary for the certification to demonstrate compliance with the BABA requirements.

A sample letter will be provided by TDEC OEP.

Public Infrastructure

An infrastructure project is any activity related to the construction, alteration, maintenance, or repair of infrastructure, regardless of whether infrastructure is the primary purpose of the project. Infrastructure includes buildings and real property. See also 2 CFR § 184.4(c) and (d).

The Buy America Requirement does not apply to non-public (private) infrastructure. For purposes of the Grant Contract, infrastructure should be considered "public" if it is: (1) publicly owned (owned, operated, funded and managed, in whole or in part, by any unit or authority of a Federal, State, or Local government-including U.S. Territories and Indian Tribes); or (2) privately owned but utilized primarily for a public purpose. Infrastructure should be considered to be "utilized primarily for a public purpose", and therefore "public", if it is privately owned but operated on behalf of the public or is a place of public accommodation.

All projects funded by the EECBG Program are public infrastructure.

Application to Articles, Materials, and Supplies

The BABA Requirement only applies to those articles, materials, and supplies that are consumed in, incorporated into, or permanently affixed to the infrastructure in the project. It does not apply to:

- Tools, equipment, and supplies, such as temporary scaffolding, brought into the construction site and removed at or before the completion of the infrastructure project.
- Equipment and furnishings, such as movable chairs, desks, and portable computer equipment, that are used at or within the finished infrastructure project but are not an integral part of the structure or permanently affixed to the infrastructure project.

The BABA Requirement only applies to an article, material, or supply classified into one of the following categories based on its status at the time it is brought to the work site for incorporation into an infrastructure project:

- Iron or steel products;
- Manufactured products; or
- Construction materials.*

An article, material, or supply incorporated into an infrastructure project should not be considered to fall into multiple categories but rather must meet the BABA Requirement for only the single category in which it is classified. All iron and steel, manufactured products, and construction materials used in the infrastructure project must be produced in the United States.

*Section 70917 (c) materials are excluded from construction materials and may be used without meeting the relevant "produced in the United States" standard. Section 70917(c) Materials are cement and cementitious materials; aggregates such as stone, sand, or gravel; or aggregate binding agents or additives as provided in section 70917(c) of BABA. Asphalt concrete pavement mixes are typically composed of asphalt cement (a binding agent) and aggregates such as stone, sand, and gravel. Accordingly, asphalt is also excluded from the definition of construction materials.

Section 70917(c) materials, on their own, are not manufactured products. Further, Section 70917(c) materials should not be considered manufactured products when they are used at or combined proximate to the work site—such as is the case with wet concrete or hot mix asphalt brought to the work site for incorporation.

Certain Section 70917(c) materials (such as stone, sand, and gravel) may be used to produce a manufactured product, such as precast concrete. Precast concrete is made of components, is processed into a specific shape or form, and is in such state when brought to the work site. Furthermore, wet concrete should not be considered a manufactured product if not dried or set prior to reaching the work site.

Further clarification is provided in 2 CFR 184 on the circumstances under which a determination is made that Section 70917(c) materials should be treated as components of a manufactured product. That determination is based on consideration of: (i) the definition of the "manufactured products" at 2 CFR 184.3; (ii) the definition of "section 70917(c) materials" at 2 CFR 184.3; (iii) instructions at 2 CFR 184.4(e) on how and when to categorize articles, materials, and supplies; and (iv) instructions at 2 CFR 184.4(f) on how to apply the BABA Requirement by category.

Waivers

When necessary, TDEC OEP may apply for, and U.S. DOE may grant, a waiver from the BABA Requirement. Requests to waive the application of the BABA must be in writing to U.S. DOE. Waiver requests are subject to review by U.S. DOE and the Office of Management and Budget, as well as a public comment period of no less than 15 calendar days.

Grantees should contact TDEC OEP as soon as a Grantee is aware that a waiver may be necessary.

Waivers must be based on one of the following justifications:

- Public Interest- Applying the Buy America Requirement would be inconsistent with the public interest;
- Non-Availability- The types of iron, steel, manufactured products, or construction materials are not produced in the United States in sufficient and reasonably available quantities or of a satisfactory quality; or
- Unreasonable Cost- The inclusion of iron, steel, manufactured products, or construction materials produced in the United States will increase the cost of the overall project by more than 25 percent.

Davis-Bacon Act Requirements

TDEC OEP EECBG Program grant contracts are funded under Division D of IIJA. All laborers and mechanics employed by the Grantee, contractors, or subcontractors in the performance of construction, alteration, or repair work funded in whole or in part under the Grant Contract, must be paid wages at rates not less than those prevailing on similar projects in the locality, as determined by the Secretary of Labor in accordance with subchapter IV of Chapter 31 of Title 40, United States Code commonly referred to as the "Davis-Bacon Act" (DBA).

Grantees must provide written assurance acknowledging the DBA requirements and confirming that the laborers and mechanics performing construction, alteration, or repair work on projects funded in whole or in part by the Grant Contract are paid or will be paid wages at rates not less than those prevailing on projects of a character similar in the locality as determined by subchapter IV of Chapter 31 of Title 40, United States Code (Davis-Bacon Act). The U.S. Department of Labor has provided FAQs for IIJA construction projects.

Summary of Roles and Responsibilities

To ensure clear delineation of responsibilities related to Davis-Bacon Act compliance and use of LCPtracker, the following summarizes primary duties:

Grantor Requirements

TDEC OEP will:

- Provide system setup, user account management, access to LCPtracker for grantees and subcontractors, and training and technical support.
- Submit proposed wage determinations (WDs) for set-up information in LCPtracker for grantees and subcontractors as soon as possible and no later than one month prior to start of construction.
- Monitor all weekly payroll submissions.
- Ensure compliance with weekly payroll submissions and work with grantees and subcontractors to correct submissions as needed.
- Submit Semi-Annual DBA Enforcement Report.

Grantee Requirements

Grantees must comply with all DBA requirements, including, but not limited to:

- Ensuring that wage determination(s) and Davis-Bacon clauses are requirements are flowed down to and incorporated into any applicable subcontracts or subrecipient awards;
- Being responsible for compliance by any subcontractor or subrecipient with the Davis-Bacon labor standards;
- Receiving and reviewing certified weekly payrolls submitted by all subcontractors and subrecipients for accuracy and to identify potential compliance issues (example of the DBA Weekly Certified Payroll Form);
- Maintaining original certified payrolls for five years after the completion of the project and

make those payrolls available to U.S. DOE or the U.S. Department of Labor upon request, as required by 29 CFR 5.6(a)(2)[5];
- Conducting payroll and job-site reviews for construction work, including interviews with employees, with such frequency as may be necessary to assure compliance by its subcontractors and subrecipients and as requested or directed by the U.S. DOE;
- Cooperating with any authorized representative of the Department of Labor in their inspection of records, interviews with employees, and other actions undertaken as part of a Department of Labor investigation;
- Posting in a prominent and accessible place the wage determination(s) and Department of Labor Publication: WH-1321, Notice to Employees Working on Federal or Federally Assisted Construction Projects.
- Notifying TDEC OEP of all labor standards issues, including all complaints regarding incorrect payment of prevailing wages and/or fringe benefits, received from the recipient, subrecipient, contractor, or subcontractor employees; significant labor standards violations, as defined in 29 CFR 5.7; disputes concerning labor standards pursuant to 29 CFR parts 4, 6, and 8 and as defined in FAR 52.222-14; disputed labor standards determinations; Department of Labor investigations; or legal or judicial proceedings related to the labor standards under this Grant Contract, a subcontract, or subrecipient award;
- Participating in DBA compliance training and maintaining competency in DBA compliance. U.S. DOE is providing grantees access to LCPtracker, a software application that helps with DBA compliance. TDEC OEP will notify the Grantee of any U.S. DOE sponsored Davis-Bacon Act compliance trainings. The Department of Labor offers free Prevailing Wage Seminars several times a year that meet this requirement, at https://www.dol.gov/agencies/whd/government-contracts/construction/seminars/events.
- The use of LCPtracker software is mandatory. TDEC OEP will provide support to grantees on the use of LCPtracker. Grantees may either enter certified payroll data manually or upload it electronically (e.g., CSV or PDF format) in LCPtracker. Uploaded files must still be reviewed and approved by the prime contractor and TDEC OEP.

Contractor/subcontractor Requirements

- Contractors and subcontractors must comply with all DBA requirements, including, but not limited to: Accurate and timely submission of certified payrolls; weekly sign-offs; and full cooperation during reviews, interviews, and audits.

- Training Requirements and Audit Readiness
  Grantees are responsible for ensuring that all users complete the applicable U.S. DOE LCPtracker training prior to payroll entry in LCPtracker and must retain attendance documentation for audit purposes. TDEC OEP will distribute registration links to all grantees and subrecipients as sessions become available.

U.S. DOE Implementation of National Environmental Policy Act (NEPA) and Other Acts

U.S. DOE has issued new regulations and procedures relative to its implementation of NEPA. This

[5] Although federal law requires these records to be maintained for three years, the Grant Contract requires all records to be maintained for five years.

manual will be amended to reflect changes to this section as TDEC OEP receives updated information from U.S. DOE.

No work may commence on project activities prior to TDEC OEP approval.

U.S. DOE must comply with NEPA prior to authorizing the use of Federal funds. U.S. DOE must also consider the effects on historic properties, pursuant to Section 106 of the National Historic Preservation Act (NHPA). Additionally, U.S. DOE must consider the impacts to floodplains and wetlands, pursuant to 10 CFR Part 1022 – Compliance with Floodplain and Wetland Environmental Review Requirements. To streamline these required reviews, U.S. DOE carries out each of these reviews under the umbrella of its NEPA review. The NEPA and Historic Preservation Training Website for the Office of State and Community Energy Programs provides more information about this review and links to the documents referenced below.

If activities don't fall within the current U.S. DOE NEPA determinations issued for the EECBG Program, TDEC OEP must submit an Environmental Questionnaire (EQ-1) in the Project Management Center for DOE to complete a review. Grantees must provide the requested information to TDEC OEP for review.

GENERAL CONDITIONS:

- As a subrecipient of federal funds, the Grantee must comply with 2 CFR §§ 200.317-200.327 when procuring property (e.g., goods, materials, supplies, equipment) or services using EECBG or RLF funds. The Grantee must maintain and use documented procurement procedures consistent with State and local law, including applicable provisions of Tenn. Code Ann. Title 4, Chapter 56; Title 12, Chapter 3; and Title 12, Chapter 4. All procurements must be conducted in a competitive manner unless provided otherwise in 2 CFR § 200.320. In each instance where it is determined that use of a competitive procurement method is not practical, supporting documentation must include a written justification for the decision and for the use of a non-competitive procurement. The Grantee must obtain prior approval from TDEC OEP before procuring any equipment or services under the Grant Contract.

- TDEC OEP will make payment to the Grantee based on review of reimbursement requests (referred to as "invoices" in the Grant Contract) detailing eligible costs with accompanying invoices, actual costs at time of purchase, and documentation of facility infrastructure upgrades or retrofit installation and operability. TDEC OEP will not fund costs in excess of the Grant Contract amount, and reimbursements must adhere to the Grant Budget as provided in the Grant Contract.

- Grantees will only be reimbursed for costs incurred by the Grantee during the Grant Contract period of performance.

- TDEC OEP will exercise monitoring activities including, but not limited to, conducting site visits; reviewing performance and financial reports; provide technical assistance and/or temporary intervention in unusual circumstances to address deficiencies that develop during the project; assuring compliance with Grant Contract terms and conditions; and reviewing technical performance after project completion to ensure that the project objectives have been accomplished.

- The Grantee must submit quarterly Performance Reports, using the attached Quarterly Performance Reporting Template, that include qualitative and quantitative information on the project progress. Quarterly Performance Reports shall be due to TDEC OEP no later than January 15, April 15, July 15, and October 15 of each year of the Grant Contract term.
    - Performance Reports shall include:
        - Tasks and Milestones;
        - Budget Outlays; and
        - Metrics.
    - Additional required reporting shall include:
        - Financial Reports;
        - Reporting tied to the National Environmental Policy Act (NEPA) and the National Historic Preservation Act (NHPA), if applicable;
        - Davis-Bacon Reports:
            - Weekly Payroll Reports due within seven (7) days of each pay period during construction.
            - Semi-Annual Report covering the periods of October 1 through March 31 and April 1 through September 30.
        - Any other reports required by the U.S. Department of Energy.
        - The Grantee must use the quarterly Performance Report template provided by TDEC OEP (which can be found at the end of this document).
        - The Grantee must provide all information required to complete the reports, and TDEC OEP will provide technical assistance to ensure that the information is accurate.
    - Failure to submit required reports may result in the required refund of any and all payments made to the Grantee by TDEC OEP.

- If the Grantee does not comply with the requirements of the Grant Contract, TDEC OEP may delay payment processing, withhold payments, or require the Grantee to refund payments already made. Continued noncompliance may result in termination of the Grant Contract for cause.

PROGRAM CONTACT:

All communications (regular mail, express mail, electronic mail, or fax) concerning this application and award process must be addressed to:

The Office of Energy Programs – Energy Efficiency and Conservation Block Grant
Tennessee Department of Environment and Conservation
C/O Angela McGee, Deputy Director of Operations
Davy Crockett Tower 9th Floor
500 James Robertson Parkway
Nashville, TN 37243
TDEC.OEP@tn.gov
Phone: 615-852-0131

APPENDIX A - ASSURANCE OF COMPLIANCE

Davis-Bacon and Related Acts
The Grantee hereby assures that all laborers and mechanics on projects funded directly by or assisted in whole or in part by and through the Grant Contract will be paid wages at rates not less than those prevailing on projects of a character similar in the locality as determined by subchapter IV of Chapter 31 of title 40, United States Code (Davis-Bacon Act) (Attachment 1).

Build America, Buy America
The Grantee acknowledges that the Build America, Buy America Act (BABA) requires that TDEC OEP will not provide federal financial assistance for "infrastructure projects" unless all of the iron, steel, manufactured products, and construction materials used in the project are produced in the United States" (Section 70914 of Public Law No. 117-58 Section 70901-52).

Title VI
The Grantee certifies compliance with requirements of Title VI of the Civil Rights Act of 1964, 42 U.S.C. 2000d-1, pursuant to the guidelines established by the Tennessee Department of Human Resources' Title VI Compliance Office and outlined in this document.

State Historic Preservation Office
The Grantee has agreed to adhere to all the Stipulations outlined in the State of Tennessee's historic preservation Programmatic Agreement with U.S. DOE (Attachment 2).

Contract Work Hours and Safety Standard Act
The Grantee has agreed to comply with the Contract Hours and Safety Standard Act at 40 U.S.C. section 3701 et seq. (Attachment 1).

The person whose signature appears below is authorized to sign this assurance and commit the Applicant to the above provisions.

Name of Authorized Official	Signature of Authorized Official
Street Address	Title of Authorized Official (please type or print)
City, State, Zip	Date

APPENDIX B - QUARTERLY PERFORMANCE REPORTING TEMPLATE

The data collected through this Quarterly Performance Reporting Template will be used to monitor the progress and effectiveness of the funded projects. This includes tracking key metrics such as energy savings, project milestones, and budget expenditures. The information will help TDEC OEP assess the overall impact of the projects, ensure compliance with Grant Contract requirements, and determine whether the projects are achieving the intended outcomes in improving energy efficiency and community resilience.

Quarterly reports are due to TDEC OEP within 15 calendar days after the end of the quarterly reporting period (January 15, April 15, July 15, October 15).

Quarter/Year: _____

County Name: _____

Site Location Address(es): _____

Project Type: _____

Name of person completing the report: _____

Title of person completing the report: _____

QUARTERLY METRICS:	THIS QUARTER	CUMULATIVE
FUNDS SPENT: (Include all expenditures incurred this quarter)		

Process Metrics			
	Previously Reported	This Period	To Date
Metric Area: 1. Buildings Retrofitted			
Number of buildings retrofitted (count)	0	0	0
Square footage of buildings retrofitted (square feet)	0	0	0
Estimated project savings ($) annually (dollars)	$0.00	$0.00	$0.00
Estimated project savings (kWh of electricity) annually (kilowatt-hours)	0	0	0
Estimated project savings (therms of natural gas) annually (therm)	0	0	0
Estimated project savings (gallons of fuel oil) annually (gallons)	0	0	0
Estimated project savings (therms of propane) annually (therm)	0	0	0
Estimated project savings (gallons of water) annually (gallons)	0	0	0
Estimated project savings (gallons of kerosene) annually (gallons)	0	0	0
Estimated project savings (tons of wood) annually (tons)	0	0	0

Infrastructure Investment Rationale (Project Description and Status):

Remarks (problems, issues, variance from plan)

Accomplishments, publicity, good news

Additional information not captured elsewhere in the report should be included here

Individuals that have worked on the project this quarter (include name, organization, job title, role in the project, start/end date (month/year), state of residence, collaboration with an individual or entity located in a foreign country in connection with this project.

Process Metrics

I certify that to the best of my knowledge and belief the data and information presented above are correct.

Type/print name of authorized official	Signature of authorized official
Title of official	Date

All records relating to submission and approval of contract deliverables are collected, maintained and stored in the Department of Environment and Conservation Office of Energy Programs.

ADDITIONAL INFORMATION:

OEP Use Only:

Reviewed and verified by: _____ Date: _____

TDEC Office of Energy Programs

APPENDIX C – MONTHLY INVOICE REQUEST FOR PAYMENT TEMPLATE

TDEC Office of Energy Program - Energy Efficiency and Conservation Block Grant Program

MONTHLY INVOICE REQUEST FOR PAYMENT

Grant Contract Number:	**Grant Number: 85105**

Invoice Number:		
Invoice Period:	Beginning:	End:

Invoice Date:
Amount of this Request: $

Grantee/County Name:	
Grantee Edison Vendor ID:	
Project Location(s):	
Grantee Remittance Address:	

Grantee Contact for Invoice Questions

Name:
Email:
Phone number:

Budget Line-Item	Grant Budget	Amount of Grant Fund Previously Invoiced	Grant Balance	Amount Requested for Current Invoice	Cumulative Amount Invoiced	Ending Grant Balance

				Period		
Professional Fee, Grant & Award						
Supplies, Telephone, Postage & Shipping, Occupancy, Equipment Rental & Maintenance, Printing & Publications						
Capital Purchase						
Total						

Type/print name of authorized official

Signature of authorized official

Title of official

Date

All records relating to submission and approval of contract deliverables are collected, maintained and stored in the Department of Environment and Conservation Office of Energy Programs.

OEP Use Only:

Reviewed and verified by: _____ Date: _____

TDEC Office of Energy Programs

Energy Efficiency and Conservation Block Grant Program

MONTHLY INVOICE REQUEST FOR PAYMENT – INVOICE DETAIL

	Budget Line-Item **Payee/Vendor Name**	**Contractor Invoice Number**	**Contractor Invoice Date**	**Total Amount Invoiced**
	Professional Fee, Grant & Award			
A1				$
A2				$
	Total Professional Fee, Grant & Award			$
	Supplies, Telephone, Postage & Shipping, Occupancy, Equipment Rental & Maintenance, Printing & Publications			$
B1				$
B2				$
	Total Supplies, Telephone, Postage & Shipping, Occupancy, Equipment Rental & Maintenance, Printing & Publications			$
	Capital Purchase			$
C1				$
C2				$
	Total Capital Purchase			$
	TOTAL			$

Attachment 1 – Davis-Bacon and Related Acts
Subpart A—Davis-Bacon and Related Acts Provisions and Procedures

29 CFR Part 5 Subpart A **(current as of 9/29/2025)**

§ 5.5 Contract provisions and related matters.

(a) ***Required contract clauses.*** The Agency head will cause or require the contracting officer to require the contracting officer to insert in full, or (for contracts covered by the Federal Acquisition Regulation (48 CFR chapter 1)) by reference, in any contract in excess of $2,000 which is entered into for the actual construction, alteration and/or repair, including painting and decorating, of a public building or public work, or building or work financed in whole or in part from Federal funds or in accordance with guarantees of a Federal agency or financed from funds obtained by pledge of any contract of a Federal agency to make a loan, grant or annual contribution (except where a different meaning is expressly indicated), and which is subject to the labor standards provisions of any of the laws referenced by § 5.1, the following clauses (or any modifications thereof to meet the particular needs of the agency, *Provided,* That such modifications are first approved by the Department of Labor):

(1) ***Minimum wages*** —

(i) ***Wage rates and fringe benefits.*** All laborers and mechanics employed or working upon the site of the work (or otherwise working in construction or development of the project under a development statute), will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by regulations issued by the Secretary of Labor under the Copeland Act (29 CFR part 3)), the full amount of basic hourly wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the contractor and such laborers and mechanics. As provided in paragraphs (d) and (e) of this section, the appropriate wage determinations are effective by operation of law even if they have not been attached to the contract. Contributions made or costs reasonably anticipated for bona fide fringe benefits under the Davis-Bacon Act (40 U.S.C. 3141(2)(B)) on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of paragraph (a)(1)(v) of this section; also, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs which cover the particular weekly period, are deemed to be constructively made or incurred during such weekly period. Such laborers and mechanics must be paid the appropriate wage rate and fringe benefits on the wage determination for the classification(s) of work actually performed, without regard to skill, except as provided in paragraph (a)(4) of this section. Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein: *Provided,* That the employer's payroll records accurately set forth the time spent in each classification in which work is performed. The wage determination (including any additional classifications and wage rates conformed under paragraph

(a)(1)(iii) of this section) and the Davis-Bacon poster (WH-1321) must be posted at all times by the contractor and its subcontractors at the site of the work in a prominent and accessible place where it can be easily seen by the workers.

(ii) ***Frequently recurring classifications.***

(A) In addition to wage and fringe benefit rates that have been determined to be prevailing under the procedures set forth in 29 CFR part 1, a wage determination may contain, pursuant to § 1.3(f), wage and fringe benefit rates for classifications of laborers and mechanics for which conformance requests are regularly submitted pursuant to paragraph (a)(1)(iii) of this section, provided that:

(*1*) The work performed by the classification is not performed by a classification in the wage determination for which a prevailing wage rate has been determined;

(*2*) The classification is used in the area by the construction industry; and

(*3*) The wage rate for the classification bears a reasonable relationship to the prevailing wage rates contained in the wage determination.

(B) The Administrator will establish wage rates for such classifications in accordance with paragraph (a)(1)(iii)(A)(*3*) of this section. Work performed in such a classification must be paid at no less than the wage and fringe benefit rate listed on the wage determination for such classification.

(iii) ***Conformance.***

(A) The contracting officer must require that any class of laborers or mechanics, including helpers, which is not listed in the wage determination and which is to be employed under the contract be classified in conformance with the wage determination. Conformance of an additional classification and wage rate and fringe benefits is appropriate only when the following criteria have been met:

(*1*) The work to be performed by the classification requested is not performed by a classification in the wage determination; and

(*2*) The classification is used in the area by the construction industry; and

(*3*) The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination.

(B) The conformance process may not be used to split, subdivide, or otherwise avoid application of classifications listed in the wage determination.

(C) If the contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and the contracting officer agree on the classification and wage rate (including the amount designated for fringe benefits where appropriate), a report of the action taken will be sent by the contracting officer by email to *DBAconformance@dol.gov*. The Administrator, or an authorized representative, will approve, modify, or disapprove every additional classification action within 30

days of receipt and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.

(D) In the event the contractor, the laborers or mechanics to be employed in the classification or their representatives, and the contracting officer do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), the contracting officer will, by email to *DBAconformance@dol.gov*, refer the questions, including the views of all interested parties and the recommendation of the contracting officer, to the Administrator for determination. The Administrator, or an authorized representative, will issue a determination within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.

(E) The contracting officer must promptly notify the contractor of the action taken by the Wage and Hour Division under paragraphs (a)(1)(iii)(C) and (D) of this section. The contractor must furnish a written copy of such determination to each affected worker or it must be posted as a part of the wage determination. The wage rate (including fringe benefits where appropriate) determined pursuant to paragraph (a)(1)(iii)(C) or (D) of this section must be paid to all workers performing work in the classification under this contract from the first day on which work is performed in the classification.

(iv) ***Fringe benefits not expressed as an hourly rate.*** Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the contractor may either pay the benefit as stated in the wage determination or may pay another bona fide fringe benefit or an hourly cash equivalent thereof.

(v) ***Unfunded plans.*** If the contractor does not make payments to a trustee or other third person, the contractor may consider as part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program, *Provided,* That the Secretary of Labor has found, upon the written request of the contractor, in accordance with the criteria set forth in § 5.28, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the contractor to set aside in a separate account assets for the meeting of obligations under the plan or program.

(vi) ***Interest.*** In the event of a failure to pay all or part of the wages required by the contract, the contractor will be required to pay interest on any underpayment of wages.

(2) ***Withholding*** —

(i) ***Withholding requirements.*** The [write in name of Federal agency or the recipient of Federal assistance] may, upon its own action, or must, upon written request of an authorized representative of the Department of Labor, withhold or cause to be withheld from the contractor so much of the accrued payments or advances as may be considered necessary to satisfy the liabilities of the prime contractor or any subcontractor for the full amount of wages and monetary relief, including interest, required by the clauses set forth in paragraph (a) of this section for violations of this contract, or to satisfy any such liabilities required by any other Federal contract, or federally assisted contract subject

to Davis-Bacon labor standards, that is held by the same prime contractor (as defined in § 5.2). The necessary funds may be withheld from the contractor under this contract, any other Federal contract with the same prime contractor, or any other federally assisted contract that is subject to Davis-Bacon labor standards requirements and is held by the same prime contractor, regardless of whether the other contract was awarded or assisted by the same agency, and such funds may be used to satisfy the contractor liability for which the funds were withheld. In the event of a contractor's failure to pay any laborer or mechanic, including any apprentice or helper working on the site of the work (or otherwise working in construction or development of the project under a development statute) all or part of the wages required by the contract, or upon the contractor's failure to submit the required records as discussed in paragraph (a)(3)(iv) of this section, the [Agency] may on its own initiative and after written notice to the contractor, sponsor, applicant, owner, or other entity, as the case may be, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.

(ii) ***Priority to withheld funds.*** The Department has priority to funds withheld or to be withheld in accordance with paragraph (a)(2)(i) or (b)(3)(i) of this section, or both, over claims to those funds by:

(A) A contractor's surety(ies), including without limitation performance bond sureties and payment bond sureties;

(B) A contracting agency for its reprocurement costs;

(C) A trustee(s) (either a court-appointed trustee or a U.S. trustee, or both) in bankruptcy of a contractor, or a contractor's bankruptcy estate;

(D) A contractor's assignee(s);

(E) A contractor's successor(s); or

(F) A claim asserted under the Prompt Payment Act, 31 U.S.C. 3901-3907.

(3) ***Records and certified payrolls*** —

(i) ***Basic record requirements*** —

(A) ***Length of record retention.*** All regular payrolls and other basic records must be maintained by the contractor and any subcontractor during the course of the work and preserved for all laborers and mechanics working at the site of the work (or otherwise working in construction or development of the project under a development statute) for a period of at least 3 years after all the work on the prime contract is completed.

(B) ***Information required.*** Such records must contain the name; Social Security number; last known address, telephone number, and email address of each such worker; each worker's correct classification(s) of work actually performed; hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in 40 U.S.C. 3141(2)(B) of the Davis-Bacon Act); daily and weekly number of hours

actually worked in total and on each covered contract; deductions made; and actual wages paid.

(C) ***Additional records relating to fringe benefits.*** Whenever the Secretary of Labor has found under paragraph (a)(1)(v) of this section that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in 40 U.S.C. 3141(2)(B) of the Davis-Bacon Act, the contractor must maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected, and records which show the costs anticipated or the actual cost incurred in providing such benefits.

(D) ***Additional records relating to apprenticeship.*** Contractors with apprentices working under approved programs must maintain written evidence of the registration of apprenticeship programs, the registration of the apprentices, and the ratios and wage rates prescribed in the applicable programs.

(ii) ***Certified payroll requirements*** —

(A) ***Frequency and method of submission.*** The contractor or subcontractor must submit weekly, for each week in which any DBA- or Related Acts-covered work is performed, certified payrolls to the [write in name of appropriate Federal agency] if the agency is a party to the contract, but if the agency is not such a party, the contractor will submit the certified payrolls to the applicant, sponsor, owner, or other entity, as the case may be, that maintains such records, for transmission to the [write in name of agency]. The prime contractor is responsible for the submission of all certified payrolls by all subcontractors. A contracting agency or prime contractor may permit or require contractors to submit certified payrolls through an electronic system, as long as the electronic system requires a legally valid electronic signature; the system allows the contractor, the contracting agency, and the Department of Labor to access the certified payrolls upon request for at least 3 years after the work on the prime contract has been completed; and the contracting agency or prime contractor permits other methods of submission in situations where the contractor is unable or limited in its ability to use or access the electronic system.

(B) ***Information required.*** The certified payrolls submitted must set out accurately and completely all of the information required to be maintained under paragraph (a)(3)(i)(B) of this section, except that full Social Security numbers and last known addresses, telephone numbers, and email addresses must not be included on weekly transmittals. Instead, the certified payrolls need only include an individually identifying number for each worker (*e.g.,* the last four digits of the worker's Social Security number). The required weekly certified payroll information may be submitted using Optional Form WH-347 or in any other format desired. Optional Form WH-347 is available for this purpose from the Wage and Hour Division website at *https://www.dol.gov/sites/dolgov/files/WHD/legacy/files/wh347/.pdf* or its successor website. It is not a violation of this section for a prime contractor to require a subcontractor to provide full Social Security numbers and last known addresses, telephone numbers, and email addresses to the prime contractor for its own records, without weekly submission by the

subcontractor to the sponsoring government agency (or the applicant, sponsor, owner, or other entity, as the case may be, that maintains such records).

(C) ***Statement of Compliance.*** Each certified payroll submitted must be accompanied by a "Statement of Compliance," signed by the contractor or subcontractor, or the contractor's or subcontractor's agent who pays or supervises the payment of the persons working on the contract, and must certify the following:

(*1*) That the certified payroll for the payroll period contains the information required to be provided under paragraph (a)(3)(ii) of this section, the appropriate information and basic records are being maintained under paragraph (a)(3)(i) of this section, and such information and records are correct and complete;

(*2*) That each laborer or mechanic (including each helper and apprentice) working on the contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in 29 CFR part 3; and

(*3*) That each laborer or mechanic has been paid not less than the applicable wage rates and fringe benefits or cash equivalents for the classification(s) of work actually performed, as specified in the applicable wage determination incorporated into the contract.

(D) ***Use of Optional Form WH-347.*** The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH-347 will satisfy the requirement for submission of the "Statement of Compliance" required by paragraph (a)(3)(ii)(C) of this section.

(E) ***Signature.*** The signature by the contractor, subcontractor, or the contractor's or subcontractor's agent must be an original handwritten signature or a legally valid electronic signature.

(F) ***Falsification.*** The falsification of any of the above certifications may subject the contractor or subcontractor to civil or criminal prosecution under 18 U.S.C. 1001 and 31 U.S.C. 3729.

(G) ***Length of certified payroll retention.*** The contractor or subcontractor must preserve all certified payrolls during the course of the work and for a period of 3 years after all the work on the prime contract is completed.

(iii) ***Contracts, subcontracts, and related documents.*** The contractor or subcontractor must maintain this contract or subcontract and related documents including, without limitation, bids, proposals, amendments, modifications, and extensions. The contractor or subcontractor must preserve these contracts, subcontracts, and related documents during the course of the work and for a period of 3 years after all the work on the prime contract is completed.

(iv) ***Required disclosures and access*** —

(A) ***Required record disclosures and access to workers.*** The contractor or subcontractor must make the records required under paragraphs (a)(3)(i) through (iii) of this section, and any other documents

that the [write the name of the agency] or the Department of Labor deems necessary to determine compliance with the labor standards provisions of any of the applicable statutes referenced by § 5.1, available for inspection, copying, or transcription by authorized representatives of the [write the name of the agency] or the Department of Labor, and must permit such representatives to interview workers during working hours on the job.

(B) ***Sanctions for non-compliance with records and worker access requirements.*** If the contractor or subcontractor fails to submit the required records or to make them available, or refuses to permit worker interviews during working hours on the job, the Federal agency may, after written notice to the contractor, sponsor, applicant, owner, or other entity, as the case may be, that maintains such records or that employs such workers, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds. Furthermore, failure to submit the required records upon request or to make such records available, or to permit worker interviews during working hours on the job, may be grounds for debarment action pursuant to § 5.12. In addition, any contractor or other person that fails to submit the required records or make those records available to WHD within the time WHD requests that the records be produced will be precluded from introducing as evidence in an administrative proceeding under 29 CFR part 6 any of the required records that were not provided or made available to WHD. WHD will take into consideration a reasonable request from the contractor or person for an extension of the time for submission of records. WHD will determine the reasonableness of the request and may consider, among other things, the location of the records and the volume of production.

(C) ***Required information disclosures.*** Contractors and subcontractors must maintain the full Social Security number and last known address, telephone number, and email address of each covered worker, and must provide them upon request to the [write in name of appropriate Federal agency] if the agency is a party to the contract, or to the Wage and Hour Division of the Department of Labor. If the Federal agency is not such a party to the contract, the contractor, subcontractor, or both, must, upon request, provide the full Social Security number and last known address, telephone number, and email address of each covered worker to the applicant, sponsor, owner, or other entity, as the case may be, that maintains such records, for transmission to the [write in name of agency], the contractor, or the Wage and Hour Division of the Department of Labor for purposes of an investigation or other compliance action.

(4) ***Apprentices and equal employment opportunity*** —

(i) ***Apprentices*** —

(A) ***Rate of pay.*** Apprentices will be permitted to work at less than the predetermined rate for the work they perform when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor, Employment and Training Administration, Office of Apprenticeship (OA), or with a State Apprenticeship Agency recognized by the OA. A person who is not individually registered in the program, but who has been certified by the OA or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as

an apprentice, will be permitted to work at less than the predetermined rate for the work they perform in the first 90 days of probationary employment as an apprentice in such a program. In the event the OA or a State Apprenticeship Agency recognized by the OA withdraws approval of an apprenticeship program, the contractor will no longer be permitted to use apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(B) ***Fringe benefits.*** Apprentices must be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator determines that a different practice prevails for the applicable apprentice classification, fringe benefits must be paid in accordance with that determination.

(C) ***Apprenticeship ratio.*** The allowable ratio of apprentices to journeyworkers on the job site in any craft classification must not be greater than the ratio permitted to the contractor as to the entire work force under the registered program or the ratio applicable to the locality of the project pursuant to paragraph (a)(4)(i)(D) of this section. Any worker listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated in paragraph (a)(4)(i)(A) of this section, must be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any apprentice performing work on the job site in excess of the ratio permitted under this section must be paid not less than the applicable wage rate on the wage determination for the work actually performed.

(D) ***Reciprocity of ratios and wage rates.*** Where a contractor is performing construction on a project in a locality other than the locality in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyworker's hourly rate) applicable within the locality in which the construction is being performed must be observed. If there is no applicable ratio or wage rate for the locality of the project, the ratio and wage rate specified in the contractor's registered program must be observed.

(ii) ***Equal employment opportunity.*** The use of apprentices and journeyworkers under this part must be in conformity with the equal employment opportunity requirements of Executive Order 11246, as amended, and 29 CFR part 30.

(5) ***Compliance with Copeland Act requirements.*** The contractor shall comply with the requirements of 29 CFR part 3, which are incorporated by reference in this contract.

(6) ***Subcontracts.*** The contractor or subcontractor must insert in any subcontracts the clauses contained in paragraphs (a)(1) through (11) of this section, along with the applicable wage determination(s) and such other clauses or contract modifications as the [write in the name of the Federal agency] may by appropriate instructions require, and a clause requiring the subcontractors to include these clauses and wage determination(s) in any lower tier subcontracts. The prime contractor is responsible for the compliance by any subcontractor or lower tier subcontractor with all the contract clauses in this section. In the event of any violations of these clauses, the prime contractor and any subcontractor(s) responsible will be liable for any unpaid wages and monetary relief,

including interest from the date of the underpayment or loss, due to any workers of lower-tier subcontractors, and may be subject to debarment, as appropriate.

(7) ***Contract termination: debarment.*** A breach of the contract clauses in 29 CFR 5.5 may be grounds for termination of the contract, and for debarment as a contractor and a subcontractor as provided in 29 CFR 5.12.

(8) ***Compliance with Davis-Bacon and Related Act requirements.*** All rulings and interpretations of the Davis-Bacon and Related Acts contained in 29 CFR parts 1, 3, and 5 are herein incorporated by reference in this contract.

(9) ***Disputes concerning labor standards.*** Disputes arising out of the labor standards provisions of this contract shall not be subject to the general disputes clause of this contract. Such disputes shall be resolved in accordance with the procedures of the Department of Labor set forth in 29 CFR parts 5, 6, and 7. Disputes within the meaning of this clause include disputes between the contractor (or any of its subcontractors) and the contracting agency, the U.S. Department of Labor, or the employees or their representatives.

(10) ***Certification of eligibility.***

(i) By entering into this contract, the contractor certifies that neither it nor any person or firm who has an interest in the contractor's firm is a person or firm ineligible to be awarded Government contracts by virtue of 40 U.S.C. 3144(b) or § 5.12(a).

(ii) No part of this contract shall be subcontracted to any person or firm ineligible for award of a Government contract by virtue of 40 U.S.C. 3144(b) or § 5.12(a).

(iii) The penalty for making false statements is prescribed in the U.S. Code, Title 18 Crimes and Criminal Procedure, 18 U.S.C. 1001.

(11) ***Anti-retaliation.*** It is unlawful for any person to discharge, demote, intimidate, threaten, restrain, coerce, blacklist, harass, or in any other manner discriminate against, or to cause any person to discharge, demote, intimidate, threaten, restrain, coerce, blacklist, harass, or in any other manner discriminate against, any worker or job applicant for:

(i) Notifying any contractor of any conduct which the worker reasonably believes constitutes a violation of the DBA, Related Acts, this part, or 29 CFR part 1 or 3;

(ii) Filing any complaint, initiating or causing to be initiated any proceeding, or otherwise asserting or seeking to assert on behalf of themselves or others any right or protection under the DBA, Related Acts, this part, or 29 CFR part 1 or 3;

(iii) Cooperating in any investigation or other compliance action, or testifying in any proceeding under the DBA, Related Acts, this part, or 29 CFR part 1 or 3; or

(iv) Informing any other person about their rights under the DBA, Related Acts, this part, or 29 CFR part 1 or 3.

Attachment 2 – Contract Work Hours and Safety Standards Act

(b) ***Contract Work Hours and Safety Standards Act (CWHSSA).*** The Agency Head must cause or require the contracting officer to insert the following clauses set forth in paragraphs (b)(1) through (5) of this section in full, or (for contracts covered by the Federal Acquisition Regulation) by reference, in any contract in an amount in excess of $100,000 and subject to the overtime provisions of the Contract Work Hours and Safety Standards Act. These clauses must be inserted in addition to the clauses required by paragraph (a) of this section or 29 CFR 4.6. As used in this paragraph (b), the terms "laborers and mechanics" include watchpersons and guards.

(1) ***Overtime requirements.*** No contractor or subcontractor contracting for any part of the conract work which may require or involve the employment of laborers or mechanics shall require or permit any such laborer or mechanic in any workweek in which he or she is employed on such work to work in excess of forty hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of forty hours in such workweek.

(2) ***Violation; liability for unpaid wages; liquidated damages.*** In the event of any violation of the clause set forth in paragraph (b)(1) of this section the contractor and any subcontractor responsible therefor shall be liable for the unpaid wages and interest from the date of the underpayment. In addition, such contractor and subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory), for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic, including watchpersons and guards, employed in violation of the clause set forth in paragraph (b)(1) of this section, in the sum of $33 for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of forty hours without payment of the overtime wages required by the clause set forth in paragraph (b)(1).

(3) ***Withholding for unpaid wages and liquidated damages*** —

(i) ***Withholding process.*** The [write in the name of the Federal agency or the recipient of Federal assistance] may, upon its own action, or must, upon written request of an authorized representative of the Department of Labor, withhold or cause to be withheld from the contractor so much of the accrued payments or advances as may be considered necessary to satisfy the liabilities of the prime contractor or any subcontractor for any unpaid wages; monetary relief, including interest; and liquidated damages required by the clauses set forth in this paragraph (b) on this contract, any other Federal contract with the same prime contractor, or any other federally assisted contract subject to the Contract Work Hours and Safety Standards Act that is held by the same prime contractor (as defined in § 5.2). The necessary funds may be withheld from the contractor under this contract, any other Federal contract with the same prime contractor, or any other federally assisted contract that is subject to the Contract Work Hours and Safety Standards Act and is held by the same prime contractor, regardless of whether the other contract was awarded or assisted by the same agency, and such funds may be used to satisfy the contractor liability for which the funds were withheld.

(ii) ***Priority to withheld funds.*** The Department has priority to funds withheld or to be withheld in accordance with paragraph (a)(2)(i) or (b)(3)(i) of this section, or both, over claims to those funds by:

(A) A contractor's surety(ies), including without limitation performance bond sureties and payment bond sureties;

(B) A contracting agency for its reprocurement costs;

(C) A trustee(s) (either a court-appointed trustee or a U.S. trustee, or both) in bankruptcy of a contractor, or a contractor's bankruptcy estate;

(D) A contractor's assignee(s);

(E) A contractor's successor(s); or

(F) A claim asserted under the Prompt Payment Act, 31 U.S.C. 3901-3907.

(4) ***Subcontracts.*** The contractor or subcontractor must insert in any subcontracts the clauses set forth in paragraphs (b)(1) through (5) of this section and a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor is responsible for compliance by any subcontractor or lower tier subcontractor with the clauses set forth in paragraphs (b)(1) through (5). In the event of any violations of these clauses, the prime contractor and any subcontractor(s) responsible will be liable for any unpaid wages and monetary relief, including interest from the date of the underpayment or loss, due to any workers of lower-tier subcontractors, and associated liquidated damages and may be subject to debarment, as appropriate.

(5) ***Anti-retaliation.*** It is unlawful for any person to discharge, demote, intimidate, threaten, restrain, coerce, blacklist, harass, or in any other manner discriminate against, or to cause any person to discharge, demote, intimidate, threaten, restrain, coerce, blacklist, harass, or in any other manner discriminate against, any worker or job applicant for:

(i) Notifying any contractor of any conduct which the worker reasonably believes constitutes a violation of the Contract Work Hours and Safety Standards Act (CWHSSA) or its implementing regulations in this part;

(ii) Filing any complaint, initiating or causing to be initiated any proceeding, or otherwise asserting or seeking to assert on behalf of themselves or others any right or protection under CWHSSA or this part;

(iii) Cooperating in any investigation or other compliance action, or testifying in any proceeding under CWHSSA or this part; or

(iv) Informing any other person about their rights under CWHSSA or this part.

(c) ***CWHSSA required records clause.*** In addition to the clauses contained in paragraph (b) of this section, in any contract subject only to the Contract Work Hours and Safety Standards Act and not to

any of the other laws referenced by § 5.1, the Agency Head must cause or require the contracting officer to insert a clause requiring that the contractor or subcontractor must maintain regular payrolls and other basic records during the course of the work and must preserve them for a period of 3 years after all the work on the prime contract is completed for all laborers and mechanics, including guards and watchpersons, working on the contract. Such records must contain the name; last known address, telephone number, and email address; and social security number of each such worker; each worker's correct classification(s) of work actually performed; hourly rates of wages paid; daily and weekly number of hours actually worked; deductions made; and actual wages paid. Further, the Agency Head must cause or require the contracting officer to insert in any such contract a clause providing that the records to be maintained under this paragraph must be made available by the contractor or subcontractor for inspection, copying, or transcription by authorized representatives of the (write the name of agency) and the Department of Labor, and the contractor or subcontractor will permit such representatives to interview workers during working hours on the job.

(d) ***Incorporation of contract clauses and wage determinations by reference.*** Although agencies are required to insert the contract clauses set forth in this section, along with appropriate wage determinations, in full into covered contracts, and contractors and subcontractors are required to insert them in any lower-tier subcontracts, the incorporation by reference of the required contract clauses and appropriate wage determinations will be given the same force and effect as if they were inserted in full text.

(e) ***Incorporation by operation of law.*** The contract clauses set forth in this section (or their equivalent under the Federal Acquisition Regulation), along with the correct wage determinations, will be considered to be a part of every prime contract required by the applicable statutes referenced by § 5.1 to include such clauses, and will be effective by operation of law, whether or not they are included or incorporated by reference into such contract, unless the Administrator grants a variance, tolerance, or exemption from the application of this paragraph. Where the clauses and applicable wage determinations are effective by operation of law under this paragraph, the prime contractor must be compensated for any resulting increase in wages in accordance with applicable law.

Attachment 3 – State Historic Preservation Agreement

RECEIVED
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TN. HISTORICAL COMMISSION

PROGRAMMATIC AGREEMENT
AMONG
THE UNITED STATES DEPARTMENT OF ENERGY, THE TENNESSEE STATE HISTORIC PRESERVATION OFFICE, THE TENNESSEE DEPARTMENT OF HUMAN SERVICES, AND THE TENNESSEE DEPARTMENT OF ECONOMIC AND COMMUNITY DEVELOPMENT REGARDING THE ENERGY EFFICIENCY AND CONSERVATION BLOCK GRANT PROGRAM, THE STATE ENERGY PLAN AND THE WEATHERIZATION ASSISTANCE PROGRAM UNDERTAKINGS
PURSUANT TO 36 CFR PART 800
October 28, 2010

WHEREAS, the United States Department of Energy (DOE) administers the following financial assistance programs: ***the Energy Efficiency and Conservation Block Grant Program*** under the Energy Independence and Securities Act of 2007 (EECBG); ***the State Energy Plan*** under the Energy Policy and Conservation Act of 1975 and the State Energy Efficiency Programs Improvement Act of 1990 (SEP); and ***the Weatherization Assistance Program*** (WAP) for Low-Income Persons under Title IV of the Energy Conservation and Production Act, the Energy Policy Act of 2005, the Energy Independence and Security Act of 2007, and the American Recovery and Reinvestment Act of 2009 (ARRA); collectively referred to as the "Programs"; and,

WHEREAS, the unprecedented levels of funding available to the Programs, due in large measure to ARRA, has created a large volume of projects requiring expedited historic preservation reviews to ensure the timely obligation of funds, that create new jobs, and improve local and state economies; and,

WHEREAS, the Tennessee State Historic Preservation Office (SHPO) is experiencing unprecedented numbers of requests for historic preservation review of undertakings funded by all Federal Agencies, including undertakings funded by the Programs; and,

WHEREAS, the Tennessee Department of Human Services and Tennessee Department of Economic and Community Development (Recipients) are receiving financial assistance from DOE to carry out the Programs; and,

WHEREAS, the Tennessee Department of Human Services and Tennessee Department of Economic and Community Development are passing a portion of this financial assistance along to various sub-recipients (Sub-Recipients); and,

WHEREAS, the projects funded by the Programs are undertakings subject to review under Section 106 of the National Historic Preservation Act, 16 U.S.C 470f (NHPA) and its implementing regulations at 36 CFR part 800 and include rehabilitation, energy efficiency retrofits, renewables, and weatherization (undertakings); and,

WHEREAS, DOE has determined that these undertakings may adversely affect properties that

are listed in or eligible for listing in the National Register of Historic Places (National Register) and subject to the requirements of the National Historic Preservation Act (NHPA); and,

WHEREAS, in accordance with 36 CFR 800.14(b)(4), the Advisory Council on Historic Preservation (the ACHP) has designated this Agreement as a Prototype Programmatic Agreement (PA), which does not require the participation or signature of the ACHP;

WHEREAS, DOE, the ACHP, and the National Conference of State Historic Preservation Officers (NCSHPO) have determined that the requirements of Section 106 can be more effectively and efficiently fulfilled if a programmatic approach is used to stipulate roles and responsibilities, exempt undertakings from Section 106 review, establish tribal protocols, facilitate identification and evaluation of historic properties, establish treatment and mitigation measures, and streamline the resolution of adverse effects; and,

WHEREAS, by memorandum dated August 28, 2009 (attached as Appendix C), DOE delegated certain tasks necessary for compliance with Section 106 of the NHPA to Recipients and Sub-Recipients of funding from the Programs; and,

WHEREAS, according to the August 28, 2009 memorandum, the Recipients are authorized, to initiate Section 106 compliance in accordance with 36 CFR 800.2 (c)(4); and,

WHEREAS, the undertakings covered under this PA are not located on Tribal lands and are primarily smaller scale activities and routine projects, rather than complex undertakings with a greater potential to adversely affect historic properties, which would require completion of the Section 106 review process as codified at 36 CFR 800.3 through 800.7; and,

WHEREAS, DOE and the ACHP were guided by the principles set forth in the ACHP's Affordable Housing Policy statement, adopted on November 9, 2006, in negotiating the Prototype Programmatic Agreement upon which this PA is based.

NOW, THEREFORE, the U.S. Department of Energy, the Tennessee Department of Human Services, the Tennessee Department of Economic and Community Development and the Tennessee State Historic Preservation Office agree that the Programs shall be administered in accordance with the following stipulations to satisfy the U.S. Department of Energy's Section 106 responsibilities for all individual undertakings of the Programs in Tennessee:

STIPULATIONS

DOE, the Recipients, and the SHPO shall ensure that the following stipulations are carried out:

I. Roles and Responsibilities

A. DOE shall be responsible for providing oversight of the PA, executing PAs with SHPOs, participating in the resolution of disputes between the SHPO and the

Recipients, and providing technical assistance and guidance as needed. DOE shall be responsible for government-to-government consultation with Indian tribes. If any activity has the potential to effect any cultural resources with tribal religious and cultural significance, the recipient must notify DOE immediately in order for DOE to initiate tribal consultation before the project proceeds further.

B. The Recipients shall be responsible for consulting with consulting parties and conducting Section 106 reviews in a timely manner, preparing documentation for the SHPO and DOE, and maintaining records on all Program undertakings. The Recipients shall submit all undertakings that involve properties fifty (50) years old and older that are not listed as exemptions on either Appendices A or B to the SHPO for review in accordance with this PA.

C. Recipients shall ensure that the provisions of this PA apply to their Sub-Recipients by inclusion of requirements for adherence to Section 106 procedures and the stipulations contained in this PA in their contracts or amendments to such contracts with Sub-Recipients. The Tennessee SHPO, through the Department of Human Services and the Department of Economic and Community Development, shall provide training to their WAP, SEP, and EECBG sub-recipients regarding Section 106 requirements.

D. In carrying out their Section 106 requirements, the Recipients will utilize qualified professionals certified by the SHPO.

E. The SHPO shall be responsible for promptly reviewing and commenting upon project documentation and participating in consultation as set forth in this PA.

F. The ACHP shall be responsible for providing technical guidance, participating in dispute resolutions if it so requests, and monitoring the effectiveness of this PA.

II. Tribal Review

A. Execution of this PA presumes that DOE will continue to carry out its government-to government responsibilities with federally recognized Indian tribes consistent with applicable Federal laws and regulations. The Recipients shall not substitute for DOE in matters related to findings of potential effects on historic properties of cultural and religious significance to Indian tribes.

B. DOE acknowledges that Indian tribes possess special expertise in assessing the National Register eligibility of properties with tribal religious and cultural significance to them. DOE shall , consult with them, as appropriate, in identifying historic properties listed in or eligible for listing in the Area of Potential Effect (APE) of program areas.

C. If either of the Recipients notifies DOE that an undertaking under this PA may result in an adverse effect on historic properties with tribal religious and cultural significance, DOE shall notify Indian tribes of individual undertakings that may result in an adverse effect on cultural resources with tribal religious and cultural significance and invite them to participate in consultations. Indian tribes and the Recipients may develop a bi-party agreement that outlines their review procedures

for undertakings covered in this PA. Such agreements will be submitted to DOE and the SHPO for review and approval, and a copy sent to the ACHP for its records.

III. Exemptions from Section 106 review

A. The Recipients shall not submit to the SHPO undertakings listed in Appendices A or B of this PA as they do not have the potential to cause effects on historic properties even when historic properties may be present. The Recipients and the SHPO may agree to modify Appendix A and/or Appendix B, with advance notification of such modifications to the ACHP and DOE. Recipients will maintain file records with verification that they determined the undertakings to be exemptions under this PA for a period of three (3) years from project completion and make these file records available for review if requested by DOE, the SHPO or the ACHP.

B. Recipients of any of the Programs may utilize either Appendix A or Appendix B in identifying exempt undertakings.

IV. Review Procedures for Non-exempt Undertakings

A. The Recipients shall review the undertaking in accordance with Stipulations V through IX below, or shall review the undertakings consistent with other SHPO approved historic preservation protocols that may be attached to this PA by amendment.

V. Identification and Evaluation

A. The Recipients shall establish the Area of Potential Effect (APE) for all program undertakings as defined in the DOE grant agreement for the State. B. The Recipients and SHPO shall complete the identification and evaluation of historic properties not excluded from further review by this PA utilizing existing information: including the National Register of Historic Places, review by SHPO of its historic property site files, state surveys, and county and local surveys. In addition, the Recipients and the SHPO may use or develop protocols that are consistent with 36 CFR 800.4 for the review of consensus determinations of eligibility in the form of cultural resources survey reports. Subject to this PA, the Tennessee Department of Human Services will use Appendix D and the Tennessee Department of Economic and Community Development will use Appendix E as the protocols developed for the process of the identification and evaluation of all properties located within Programs APEs, consistent with 36 CFR 800.4, for determination of their eligibility for listing on the National Register of Historic Places.

C. Recipients shall commission the preparation of Archaeological Survey Reports only in cases where there are anticipated significant new ground disturbing Program undertakings. In those cases, Recipients shall inform DOE and DOE will consult with Indian tribes that may attach religious or cultural significance to historic properties within the undertaking's area of potential effects. To determine the scope of such Surveys and to avoid potential delays, the SHPO will review and comment upon the Recipient's scopes of work for both above ground surveys and archaeological surveys that satisfy the requirements of this PA before Recipients commission them.

D. Recipients shall forward undertakings requiring more than minimal ground disturbance to the SHPO and DOE for review and comment, which will inform the Recipients' proposed Scopes of Work. DOE will share the results of any such Surveys with affected Tribes.

E. The Recipients shall refer disputes regarding determinations of eligibility to DOE for review and referral to the Keeper of the National Register in accordance with 36 CFR 800.4(c)(2).

VI. Treatment of Historic Properties

A. When the Recipients and the SHPO have concurred that the subject of a Program undertaking is eligible for listing in the National Register of Historic Places, or the Keeper of the National Register has made a Formal Determination to that effect, and the Recipients and the SHPO have formally concurred that the particular undertaking has been designed and planned in accordance with the Secretary of the Interior's *Standards for the Treatment of Historic Properties* (36 CFR Part 68, July 12, 1995 *Federal Register*) (Standards), the SHPO will so state in a formal letter to the Recipient within three (3) business days of receipt, and that Program undertaking will not be subject to further Section106 review.

B. The Recipients and SHPO will make their best efforts to expedite reviews through a formal SHPO finding of "No Adverse Effect with conditions" within three (3) business days of receipt of adequate documentation when the Recipient and the SHPO have concurred that plans and specifications or scopes of work can be modified to ensure adherence to the Standards. If the undertaking cannot meet the Standards or would otherwise result in an adverse effect to historic properties, the Recipients will proceed in accordance with Stipulation VII.

VII. Resolution of Adverse Effects

A. The Recipients shall consult with the SHPO, to resolve adverse effects. The Recipients will notify DOE to consult with Indian tribes as appropriate. The Recipients will notify DOE of the pending consultation with the SHPO, and DOE will participate through its designated representative.

B. The Recipients may use standard stipulations included in Attachment A of this

PA, or as negotiated as part of this PA between the SHPO and the Recipients, or if the project warrants, mitigations carried in an alternate PA due to the complexity of the undertaking.

C. All Signatories to this PA shall make every effort to ensure that this consultation shall conclude within 45-days or less to avoid the loss of funding. In the event the consultation extends beyond this period, DOE shall formally invite the ACHP to participate in consultation. The ACHP will consult with DOE regarding the issues and the opportunity to negotiate a Memorandum of Agreement (MOA) specific to the undertaking under consultation. Within seven (7) days after notification, the ACHP will enter consultation and provide its recommendation for either concluding the Section 106 review through an MOA or Chairman's comment from the ACHP to the Secretary of DOE within 21 days.

D. In the case of an ACHP Chairman comment, DOE may proceed once DOE provides its response to the ACHP.

VIII. Emergency Situation Undertakings

A. When a Recipient has designated a particular undertaking as an emergency undertaking and it is associated with an historic property, the Recipient shall submit appropriate documentation to the SHPO by email and afford the SHPO one (1) business day to respond by e-mail. For the purposes of this PA, emergencies exist when there is a need to eliminate an imminent threat to the health and safety of the residents of the historic property as stated formally by the local or County building inspectors, fire department officials, or other local or County building officials.

1) The Recipient shall forward documentation listed in Appendix D and E to the SHPO for review immediately upon notification that an emergency exists. This documentation should include a) the nature of the emergency; b) the address of the historic property involved; c) photographs showing the current condition of the building; and d) the time-frame allowed by local officials to respond to, or correct, the emergency situation.

2) The Recipient shall consider mitigation measures recommended by the SHPO and implement them. If the Recipient finds that the SHPO recommendations are infeasible, the Recipient shall consult with the SHPO to resolve the issue and take SHPO recommendations into account when determining its appropriate action.

IX. Public and Consulting Party Involvement

A. The Recipients shall maintain a list of Program undertakings and shall make this documentation available to the public. The Recipient shall notify the SHPO if it is notified of other consulting party or public interest in any undertakings covered under the terms of the PA.

B. The Recipients, independently or at the recommendation of the SHPO, may

invite interested persons to participate as consulting parties in the consultation process for adverse effects in accordance with Stipulations VI, VII, and VIII.

X. Administrative Coordination

A. The Recipients, in consultation with the SHPO, may determine that a Program undertaking has already been reviewed under a previous Section 106 effect determination or an agreement document that is still in effect. In such cases no further Section 106 review under this PA is required.
B. Upon receipt of adequate documentation, The SHPO shall provide comments to the Recipients within three (3) business days, unless otherwise agreed upon by the SHPO and the Recipient, for reviews required under the terms of this PA with the exception of emergency undertakings. In the event that the SHPO fails to comment within the established period, the Recipient may assume the SHPO has concurred, and proceed.
C. The Recipient shall advise Sub-Recipients, in writing, that they may have their grant funding for a specific project disallowed for violation of the provisions in Section 110(k) of the Act which states that a Sub-Recipient who, with intent to avoid the requirements of Section 106 of the National Historic Preservation Act, has, previous to the grant award, intentionally significantly adversely affected a historic property to which the grant would relate, or having legal power to prevent it, has allowed such significant adverse effect to occur.
D. The SHPO and the Recipients shall make every effort to expedite Section 106 reviews. To this end, the SHPO will respond to Recipient requests to review and comment upon Architectural and Archaeological Survey Reports accompanied with adequate documentation in fewer than the three (3) day when such response times are consistent with the terms of the DOE grant agreements and the Recipient has utilized the services of qualified professionals to prepare the Reports; and in one (1) business day by e-mail in emergency circumstances where the Recipient has submitted appropriate documentation.
E. For projects that will require either an Environmental Assessment or an Environmental Impact Statement under the National Environmental Policy Act (NEPA), nothing contained in this PA shall prevent or limit the Recipient and DOE from utilizing the procedures set forth in 36 CFR 800.8 to coordinate and conduct the historic preservation review in conjunction with the NEPA review.

XI. Discoveries

If Recipients, Sub-Recipients, or their contractors and consultants discover historic properties within a Program undertaking's Area of Potential Effects (APE) after the undertaking has been initiated, the Recipient will ensure the implementation of the following procedures:

A. The Recipient or affected Sub-Recipient shall immediately cease all operations for the portion of the undertaking with the potential to affect an historic property;
B. The Sub-Grantee shall advise the Recipient that it has discovered the National Register eligibility of the historic property and the potential of the undertaking to impact its qualifying characteristics. In addition, the Sub-Recipient shall provide the Recipient an explanation of the nature of the adverse effect. Upon receipt of this notification the Recipient shall notify the DOE and consult with the SHPO either to resolve the affected property's National Register eligibility or to prepare either avoidance, minimization treatment plan, or a mitigation plan.
C. The Recipient shall notify DOE who will then notify Indian tribes of any discoveries and any Program undertakings that have the potential to adversely affect sites or buildings of religious or cultural significance to them. After reviewing such discoveries, the Indian tribes can request further consultation on the project by notifying
DOE, ACHP, and the SHPO in writing.
D. In consultation with the SHPO, the Recipient or Sub-Recipient shall develop and implement an avoidance, treatment or mitigation plan and advise the Recipient, the SHPO, and DOE, if appropriate, of the satisfactory completion of the approved work. Once the approved work is complete, the Sub-Recipient may resume the activities that were halted to address the discovery situation.

XII. Dispute Resolution

A. Should the SHPO, either by letter or electronic mail, object within the time frames outlined in this PA to any Program undertakings, the Recipient shall consult further with the SHPO to attempt to resolve the SHPO's objection. If the SHPO does not withdraw its objection, then the Recipient shall refer the matter to DOE. The Recipient shall forward all documentation relevant to DOE, who will notify and consult with the ACHP to resolve the objection.
B. The ACHP will provide its recommendations, if any, within twenty-one (21) days following receipt of relevant documentation. DOE will take into account the ACHP's recommendations or formal comments in reaching a final decision regarding the dispute.

XIII. Reporting and Monitoring

A. DOE, the ACHP, and the SHPO may monitor any undertakings carried out pursuant to this PA. The ACHP may review undertakings, if requested by DOE. DOE shall be entitled to address and make determinations on overall policy or administrative issues related to the implementation of these Programs.

B. The Recipients shall adhere to DOE's established protocols for ARRA reporting program undertakings.

C. Beginning on October 15, 2010, DOE will submit annual reports to the ACHP and the NCSHPO summarizing the Programs' undertakings, to include data on the total number of undertakings, the number of exempt undertakings, and the number of reviews conducted under this PA.

XIV. Amendments

DOE, the SHPO, or the Recipient may request that this PA be amended, whereupon DOE, the Recipients, the SHPO, and the ACHP, if it has requested, will consult to consider such an amendment. Any such amendment shall be drafted and executed among DOE, the Recipient, and the SHPO in the same manner as this PA, and pertain only to this State's PA.

XV. Duration of Agreement

This PA will be valid for three (3) years from the date of execution, as verified with DOE filing the PA with the ACHP.

XVI. Termination of Agreement

DOE, the SHPO, or the Recipient may terminate the PA, provided that the party proposing termination notifies the other signatories and the ACHP in writing explaining the reasons for termination and affording the other signatories at least thirty (30) days to consult and seek alternatives to termination. If, after thirty days, consultation has not resolved the reasons for termination, this PA shall be terminated. If this PA is terminated, DOE will complete the requirements of 36 CFR 800.3 through 800.7 relative to the Programs.

XVII.

The execution of this PA among the U. S. Department of Energy, the Tennessee State Historic Preservation Officer, the Tennessee Department of Human Services, and the Tennessee Department of Economic and Community Development, and the implementation of its terms evidences that the U. S. Department of Energy has taken into account the effects of these undertakings on historic properties.

SIGNATORIES

United States Department of Energy
Office of Energy Efficiency and Renewable Energy
Office of Weatherization and Intergovernmental Programs

11/5/10
Name, Date

Tennessee State Historic Preservation Officer

E. Patrick McIlhaney 11/15/10
Name, Date

Tennessee Department of Economic and Community Development

Matthew Kisber 11/1/10
Name, Date

Tennessee Department of Human Services

Virginia Lodge 10-28-10
Name, Date

APPENDIX A—WAP UNDERTAKINGS EXEMPT FROM SECTION 106 REVIEW

All undertakings will be done in accordance with applicable local building codes or the International Building Code, where applicable. In accordance with 36 CFR 800.3(a)(1), the following undertakings have been determined to have no potential to cause effects on historic properties:

A. Exterior Work

1) Air sealing of the building shell, including caulking, weather-stripping, and other air infiltration control measures on windows and doors, and installing thresholds in a manner that does not harm or obscure historic windows or trim. These measures in residential homes should be conducted in accordance with the Southeast Weatherization Field Guide or successor standard building guides for the Southeast.
2) Thermal insulation, such as non-toxic fiberglass and foil wrapped, in walls, floors, ceilings, attics, and foundations in a manner that does not harm or damage historic fabric.
3) Blown in wall insulation where no holes are drilled through exterior siding, or where holes have no permanent visible alteration to the structure.
4) Removable film on windows (if the film is transparent), in a manner that does not harm or obscure historic windows or trim.
5) Roofing in a manner that closely resembles the historic materials and form, or with materials that restore the original feature based on historic evidence, and in a manner that does not alter the roofline, or where not on a primary roof elevation or visible from the public right-of-way.
6) Full View Storm windows or doors, and wood screen doors in a manner that does not harm or obscure historic windows or trim
7) In-kind replacement or repair of primary windows, doors and door frames that duplicate as closely as possible in appearance and materials the existing substrate and framing.
8) Repair of minor roof and wall leaks prior to insulating attics or walls, provided repairs duplicate as closely as possible in appearance and materials existing surface composite.
9) Energy audits
10) Painting over previously painted exterior surfaces, provided destructive surface preparation treatments are not used (such as water-blasting, sandblasting and chemical removal)
11) Repair or replacement of existing exterior siding provided that new siding duplicates as closely as possible in appearance and materials the existing siding in dimension, profile and texture
12) Installing foundation vents, if painted or finished to match the existing foundation material.

13) Installing sun tubes or skylights not on a primary roof elevation or visible from the public right-of-way.

B. Interior Work

Special Note: Undertakings to interior spaces where the work will not be visible from the public right of way; no structural alterations are made; no demolition of walls, ceilings or floors occurs; no drop ceilings are added; or no walls are leveled with furring or moved, and incidental repairs to any walls, ceiling or floors that are associated with energy efficiency work, heating and cooling system work, energy efficiency work affecting the electric base load of the property, or health and safety measures, shall be automatically excluded from **SHPO** review. This work includes:

1. Energy efficiency work within the building shell:

a. Thermal insulation in walls, floors, ceilings, attics, crawl spaces, ducts and foundations
b. Blown in wall insulation where no decorative plaster is damaged.
c. Plumbing work, including installation of water heaters, and water conservation measures such as low flow faucets, shower heads, etc.
d. Electrical work, including improving lamp efficiency
e. Sealing air leaks using weather stripping, door sweeps, and caulk and sealing major air leaks associated with bypasses, ducts, air conditioning units, etc.
f. Repair or replace water heaters
g. Adding adjustable speed drives such as fans on air handling units, cooling tower fans, and pumps
h. Install insulation on water heater tanks and water heating pipes
i. Install solar water heating systems, provided the structure is not visible from the public right of way
j. Install waste heat recovery devices, including desuperheater water heaters, condensing heat exchangers, heat pump and water heating heat recovery systems, and other energy recovery equipment
k. Repair or replace electric motors and motor controls like variable speed drives
l. Incorporate other lighting technologies such as dimmable ballasts, day lighting controls, and occupant controlled dimming

2. Work on heating and cooling systems:

a. Clean, tune, repair or replace heating systems, including furnaces, boilers, heat pumps, vented space heaters, and wood stoves
b. Clean, tune repair or replace cooling systems, including central air conditioners, window air conditioners, heat pumps, and evaporative coolers
c. Install insulation on ducts and heating pipes
d. Conduct other efficiency improvements on heating and cooling systems, including replacing standing pilot lights with electronic ignition devices and installing vent

dampers
e. Modify duct and pipe systems so heating and cooling systems operate efficiently and effectively, including adding return ducts, replace diffusers and registers, replace air filters, install thermostatic radiator controls on steam and hot water heating systems
f. Install programmable thermostats, outdoor reset controls, UL listed energy management systems or building automation systems and other HVAC control systems

3. Energy efficiency work affecting the electric base load of the property:

a. Convert incandescent lighting to fluorescent
b. Add reflectors, LED exit signs, efficient HID fixtures, and occupancy (motion) sensors
c. Replace refrigerators and other appliances

4. Health and safety measures:

a. Installing fire, smoke or carbon monoxide detectors / alarms
b. Repair or replace vent systems on fossil-fuel-fired heating systems and water heaters to ensure that combustion gases draft safely to outside
c. Install mechanical ventilation, in a manner not visible from the public right of way, to ensure adequate indoor air quality if house is air-sealed to building tightness limit

APPENDIX B – SEP AND EECBG UNDERTAKINGS EXEMPT FROM SECTION 106 REVIEW

A. Category 1 - No Consultation Required

In addition to the undertakings provided in ***Exhibit A (WAP Undertakings exempt from Section 106 Review)***, DOE and the SHPO have concluded that the following undertakings do not have the potential to cause effects on historic properties per 36 CFR § 800.3(a)(1):

1. General efficiency measures not affecting the exterior of the building:

a. Energy audits and feasibility studies
b. Weatherization of mobile homes and trailers
c. Caulking and weather-stripping around doors and windows in a manner that does not harm or obscure historic windows or trim.
d. Water conservation measures – like low flow faucets, toilets, shower heads, urinals – and distribution device controls
e. Repairing or replacing in kind existing driveways, parking areas, and walkways with materials of similar appearance
f. Excavating to gain access to existing underground utilities to repair or replace them, provided that the work is performed consistent with previous conditions
g. Ventilating crawl spaces
h. Replacement of existing HVAC equipment including pumps, motors, boilers, chillers, cooling towers, air handling units, package units, condensers, compressors, heat exchangers that do not require a change to existing ducting, plumbing, electrical, controls or a new location, or if ducting, plumbing, electrical and controls are on the rear of the structure or not visible from any public right of way.
i. Adding or replacing existing building controls systems including HVAC control systems and the replacement of building-wide pneumatic controls with digital controls, thermostats, dampers, and other individual sensors like smoke detectors and carbon monoxide detectors (wired or non-wired)
j. New installation of non-hard wired devices including photo-controls, occupancy sensors, carbon dioxide, thermostats, humidity, light meters and other building control sensors, provided the work conforms with applicable state and local permitting requirements
k. Adding variable speed drive motors
l. Insulation of water heater tanks and pipes
m. Furnace or hot water tank replacement that does not require a visible new supply or venting

2. Insulation measures not affecting the exterior of the building:

a. Thermal insulation installation in walls, floors and ceilings (excluding spray foam insulation)
b. Duct sealing, insulation, repair or replacement in unoccupied areas
c. Attic insulation with proper ventilation; if under an effective R8 - add additional R-19 up to R-38 (fiberglass bat only)
d. Band joist insulation - R-11 to R19 as applicable
e. Water heater tank and pipe insulation

3. Electric base load measures not affecting the exterior of the building:

a. Appliance replacement (upgrade to EnergyStar appliances)
b. Compact fluorescent light bulbs
c. Energy efficient light fixtures, including ballasts (Replacement)
d. LED light fixtures and exit signs (Replacement)
e. Upgrade exterior lighting (replacement with metal halide bulbs, LEDs, or others) along with ballasts, sensors and energy storage devices not visible from any public right of way

4. Electric Street Lamp and Traffic Signal Replacement:

a. Replacement of traffic signals and street lamp bulbs with LED or other energy-efficient bulbs and interior components.

B. Category 2 - No Consultation Required if grant recipients follow the Secretary of the Interior's Standards for Rehabilitation contained in ATTACHMENT B of this PA

1. Efficiency and repair measures:

a. Painting over previously painted exterior surfaces, provided destructive surface preparation treatments are not used (such as water-blasting, sandblasting and chemical removal)
b. Installation or replacement of downspout extensions, provided that the color of the extensions is historically appropriate for the period and style of the property
c. Repairing or upgrading electrical or plumbing systems and installing mechanical equipment, in a manner that does not permanently change the appearance of the interior or exterior of the building
d. Installation of new HVAC equipment (such as pumps, motors, boilers, chillers, cooling towers, air handling units, package units, condensers, compressors, or heat exchangers) in a manner that does not permanently change the appearance of the building.
e. Integrated shingle-style or thin film solar systems on the rear roof of the structure,

behind the parapet or not visible from the public right of way.
f. Solar systems (including photovoltaic and solar thermal) not visible from the public right of way and if ground-mounted can be installed without ground disturbance and if roof-mounted will not require new building reinforcement.
g. Wind system additions to existing wind power facilities that will not require ground disturbance and if building mounted will not require building reinforcement.
h. Lead-based paint abatement in accordance with the Standards and Preservation Brief #37
i. Building cleaning in accordance with the Standards and Preservation Briefs #1, #6, and #10
j. Repairing masonry, including re-pointing and rebuilding chimneys in accordance with the Standards and Preservation Brief # 2
k. New lighting controls including photo-sensors and shading elements if not visible from the public right of way
l. New metering devices in a manner that does not permanently change the appearance of the interior or exterior of the building, or if the addition is on the exterior of the structure and is not visible from the public right of way
m. New water efficient fixtures and fittings in a manner that does not permanently change the appearance of the interior or exterior of the building

2. Installation or repair of roofing, siding, and ventilation:

a. White Roofs, Cool Roofs, Green Roofs, Sod or Grass Roofs not visible from the public right-of-way
b. Rainwater catches and/or gray water systems not viewable from the public right of way
c. Repair or replacement of existing exterior siding provided that new siding closely resembles the existing siding in dimension, profile and texture
d. Flat or shallow pitch roof replacement (shallow pitch is defined as a pitch with a rise-to-run ratio equal to or less than 3" to 12") with no part of the surface of the roof visible from the ground
e. Roof repair or replacement with materials that duplicate as closely as possible in appearance and materials the historic materials and form, or with replacement materials that are close to the original in color, texture, composition and form to restore the original feature based on historic evidence, and in a manner that does not alter the roofline
f. Installing vents (such as continuous ridge vents covered with ridge shingles or boards, roof vents, bath and kitchen vents, soffit and frieze board vents or combustion appliance flues) if not located on a primary roof elevation or not visible from the public right-of-way
g. Installing foundation vents, if painted or finished to match the existing foundation material.

3. Windows and doors:

a. Installing full storm windows, storm doors or wood screen doors in a manner that does not harm or obscure historic windows, doors or trim.
b. Installing insulated exterior replacement doors where the door openings are not altered and are not visible from the public right-of-way
c. Window or glazing treatments that do not change the appearance of the interior or exterior of the building, or if the addition is on the exterior of the structure

APPENDIX C – AUGUST 28, 2009 DELEGATION MEMORANDUM

(next page)

Appendix D

Historic Properties Identification and Review Procedures Weatherization Assistance Program- Referral Process for Non-Exempt Properties to SHPO for Review

A. The Recipient shall prepare, or have prepared, the documentation in Section B for submittal to SHPO for review and comment upon the eligibility of a building or structure fifty (50) years or older for inclusion in the National Register of Historic Places; provided the dwelling or the work to be performed on the exterior or interior of the dwelling has not already been determined to be exempt from Section 106 review as established in Appendices A or B of this Agreement.

B. The Recipient, or the Sub-Recipient shall provide via E-Mail to the SHPO the following item for buildings not exempt from review: a letter requesting Section 106 review of the National Register eligibility of the building or structure that should include:

(a) The street address, city, and county of the building or structure;

(b) Digital 4x6 inch photographs of the exterior and interior of the building or structure; and

(c) The building or structure's date of construction.

C. The SHPO will review the information submitted, and, within three (3) business days, provide a written response (via E-Mail) to the requesting party regarding the building's National Register eligibility, with a copy to the Weatherization Program Director. In the case of an emergency request, the SHPO will provide a response within one (1) business day, per section VIII of this PA.

D. If the SHPO and Recipient determine that the building is not eligible for inclusion in the National Register of Historic Places, no further action regarding coordination with SHPO is required for the Section 106 review of that undertaking and weatherization assistance program services will proceed.

E. 1. If the SHPO determines that the property is eligible for inclusion on the National Register of Historic Places, and the Recipient agrees with this determination, the Recipient shall provide to the SHPO a project narrative/work write-up in sufficient detail regarding the work to be performed on the property that is subject to SHPO review, including materials to be used, to enable a reader unfamiliar with the undertaking or its location to gain a full understanding of the undertaking and all of its elements and their potential to affect directly and indirectly the subject historic property. 2. The SHPO shall review and comment upon this project narrative/work write up within three (3) business days from the date of receipt with a

finding either that the project will not adversely affect the historic property or that the project will adversely affect the historic property. If the former, the weatherization work will begin. If the latter, the Recipient and the SHPO will then consult to resolve the adverse effect in accord with stipulations contained in this PA.

3. If the Recipient disagrees with the SHPO respecting the National Register eligibility of the building, the Recipient will submit the documentation required by stipulations contained in this PA to DOE for a Formal Determination of Eligibility by the Keeper of the National Register. If the Keeper determines the building not to be National Register eligible, there will be no further review under Section 106 or the provisions of this PA. If the Keeper determines the building to be National Register eligible, the Recipient will proceed in accordance with sub-sections 1 and 2 of this section.
4. All instructions, notices, consents, demands, or other communications required or contemplated by Appendix D shall be in writing, and shall be made by certified, first class mail, return receipt requested and postage prepaid, by overnight courier service with an asset tracking system, or by EMAIL or facsimile transmission with Recipient confirmation.

Appendix E

Historic Properties Identification and Review Procedures for the Energy Efficiency and Conservation Block Grant (EECBG) Program and the State Energy (SEP) Program- Referral Process for Non-Exempt Properties to SHPO for Review

A. The Recipient shall prepare, or have prepared, the documentation in Section B for submittal to SHPO for review and comment upon the eligibility of a building or structure fifty (50) years or older for inclusion in the National Register of Historic Places; provided the work to be performed on the exterior or interior of the building has not already been determined to be exempt from Section 106 review as established in Appendices A or B of this PA.

B. The Recipient, or sub-recipients, shall provide the SHPO the following item in writing for buildings not exempt from review: a letter requesting Section 106 review of the National Register eligibility of the property that should include:

(a) The street address, city, and county of the building or structure;

(b) Digital 4x6 inch photographs of the exterior and interior of the building or structure; and

(c) The building or structure's date of construction.

C. The SHPO will review the information submitted, and within three (3) business days provide a written response to the requesting party regarding the property's eligibility, with a copy to the Director of the Office of Energy Policy in the Department of Economic and Community Development for Section 106 review. In the case of an emergency request, SHPO will provide a response within one (1) business day, per section VIII of this agreement.

D. If the SHPO and Recipient determine that the property is not eligible for inclusion in the National Register of Historic Places, no further action regarding coordination with SHPO is required for the Section 106 review of that undertaking and Energy Efficiency and Conservation Block Grant (EECBG) program or State Energy Program (SEP) measures and services will proceed.

E. 1. If the SHPO determines that the property is eligible for inclusion on the National Register of Historic Places, and the Recipient agrees with this determination, the Recipient shall provide to the SHPO a project narrative/work write-up in sufficient detail regarding the work to be performed on the property that is subject to SHPO review, including materials to be used, to enable a reader unfamiliar with the undertaking or its location to gain a full understanding of the undertaking and all of

its elements and their potential to affect directly and indirectly the subject historic property.

2. The SHPO shall review and comment upon this project narrative/work write up within three (3) business days from the date of receipt with a finding either that the project will not adversely affect the historic property or that the project will adversely affect the historic property. If the former, the Energy Efficiency and Conservation Block Grant (EECBG) program or State Energy Program (SEP) services work will begin. If the latter, the Recipient and the SHPO will then consult to resolve the adverse effect in accord with stipulations contained in this PA.
3. If the Recipient disagrees with the SHPO respecting the National Register eligibility of the building, the Recipient will submit the documentation required by stipulations contained in this PA to DOE for a Formal Determination of Eligibility by the Keeper of the National Register. If the Keeper determines the building not to be National Register eligible, there will be no further review under Section 106 or the provisions of this PA. If the Keeper determines the building to be National Register eligible, the Recipient will proceed in accordance with sub-sections 1 and 2 of this section.
4. All instructions, notices, consents, demands, or other communications required or contemplated by Appendix D shall be in writing, and shall be made by certified, first class mail, return receipt requested and postage prepaid, by overnight courier service with an asset tracking system, or by EMAIL or facsimile transmission with Recipient confirmation.

ATTACHMENT A:
STANDARD MITIGATION MEASURES FOR ADVERSE EFFECTS

The Recipient and the SHPO may develop and execute an Agreement that includes one or more of the following Standard Mitigation Measures, as may be modified to a particular activity, with the concurrence of both parties, for undertakings found to have an adverse effect on listed or eligible historic properties. The ACHP will not be a party to these Agreements.

1. Recordation

The Recipient shall ensure that the historic property is recorded before its alteration in accordance with methods or standards established in consultation with the SHPO. The SHPO shall identify appropriate archive locations for the deposit of recordation materials and the Recipient shall be responsible for submitting required documentation to identified archive locations. The Recipient and the SHPO may mutually agree to waive the recordation requirement in situations where the integrity of the building has been compromised or other representative samples of a similar historic resources has been previously recorded.

2. Architectural Salvage

The Recipient, in consultation with the SHPO, shall identify significant architectural features for salvage, and appropriate parties to receive the salvaged features. The Recipient shall ensure that any architectural features identified for salvage are salvaged prior to initiation of undertakings and properly stored and curated. When feasible, and determined appropriate in consultation with SHPO, salvaged architectural features shall be reused in other preservation projects.

3. Rehabilitation

If the SHPO has found that a proposed rehabilitation of an historic property does not meet the *Standard* or SHPO approved design guidelines, the Recipient shall ensure that the rehabilitation of this historic property is carried out in accordance with treatments agreed upon by the Recipient and the SHPO and that these agreed to treatments are incorporated in the project's final plans and specifications. The SHPO will approve the project's final plans and specifications before the Recipient initiates the undertaking.

4. New Construction

If the SHPO has found that a proposed new addition to an historic property or new construction that adversely affects an historic property does not meet the *Standard* or SHPO approved design guidelines, the Recipient shall ensure that the new construction is carried out in accordance with treatments agreed upon by the Recipient and the SHPO and

that these agreed to treatments are incorporated in the project's final plans and specifications. The SHPO will approve the project's final plans and specifications before the Recipient initiates the undertaking.

5. Archaeology

In cases where the undertaking will cause unavoidable adverse effects to National Register eligible archaeological properties, the Recipient shall notify the DOE who will consult with affected tribes, and, in the event that the archaeological property contains no human remains, grave goods, or funerary objects, the Recipient shall consult with the SHPO to determine whether archaeological data recovery or some other treatment measure is appropriate and in the public interest. If all consulting parties agree that archaeological data recovery is the appropriate treatment measure, the Recipient shall consult further with the SHPO to develop and implement a data recovery plan for those portions of the historic property that will be adversely affected. The data recovery plan shall:

- be based on firm background data, sound planning, and accepted archaeological methods;
- be consistent with applicable State laws and regulations;
- be accomplished in a thorough, efficient manner, using the most cost effective techniques practicable;
- provide for appropriate curation of archeological materials and records, and
- provide for reporting and interpretation of what has been learned in a format understandable and accessible to the public;
- be consistent with the National Park Service's *Archeology and Historic Preservation: Secretary of the Interior's Standards and Guidelines* (at: http://www.nps.gov/history/local-law/arch_stnds_7.htm), and shall take into account the ACHP's publications, *Recommended Approach for Consultation on Recovery of Significant Information from Archeological Sites* (1999), ACHP Section 106 *Archaeology Guidance* (at: http://www.achp.gov/archguide/), and any archaeological guidance issued by the SHPO.

ATTACHMENT B:
SECRETARY OF THE INTERIOR'S STANDARDS FOR REHABILITATION

Standards for Rehabilitation

REHABILITATION is defined as the act or process of making possible a compatible use for a property through repair, alterations, and additions while preserving those portions or features which convey its historical, cultural, or architectural values.



1. A property will be used as it was historically or be given a new use that requires minimal change to its distinctive materials, features, spaces, and spatial relationships.
2. The historic character of a property will be retained and preserved. The removal of distinctive materials or alteration of features, spaces, and spatial relationships that characterize a property will be avoided.
3. Each property will be recognized as a physical record of its time, place, and use. Changes that create a false sense of historical development, such as adding conjectural features or elements from other historic properties, will not be undertaken.
4. Changes to a property that have acquired historic significance in their own right will be retained and preserved.
5. Distinctive materials, features, finishes, and construction techniques or examples of craftsmanship that characterize a property will be preserved.
6. Deteriorated historic features will be repaired rather than replaced. Where the severity of deterioration requires replacement of a distinctive feature, the new feature will match the old in design, color, texture, and, where possible, materials. Replacement of missing features will be substantiated by documentary and physical evidence.
7. Chemical or physical treatments, if appropriate, will be undertaken using the gentlest means possible. Treatments that cause damage to historic materials will not be used.
8. Archeological resources will be protected and preserved in place. If such resources must be disturbed, mitigation measures will be undertaken.
9. New additions, exterior alterations, or related new construction will not destroy historic materials, features, and spatial relationships that characterize the property. The new work will be differentiated from the old and will be compatible with the historic materials, features, size, scale and proportion, and massing to protect the integrity of the property and its environment.
10. New additions and adjacent or related new construction will be undertaken in such a manner that, if removed in the future, the essential form and integrity of the historic property and its environment would be unimpaired.

Rehabilitation as a Treatment

When repair and replacement of deteriorated features are necessary; when alterations or additions to the property are planned for a new or continued use; and when its depiction at a particular period of time is not appropriate, Rehabilitation may be considered as a treatment.