Statement of Qualifications

February 26, 2021

Submitted in Response to

Standing Request for Qualifications
for the
Arkansas Energy Performance Contracting Program

Issued by the Arkansas Energy Office

Submitted By:

Stan Green, President

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1. Executive Summary

1. Summarize your firm's commitment to comply with the policies, procedures and rules as outlined in the AEPC Program Rules Manual.

Clear Energy sees the Arkansas Energy Performance Contracting Program as a vehicle that can deliver value to Arkansas taxpayers through the facilitation of wise energy efficiency investments. The program structure with pro-forma documents, a prescribed process and available assistance from the Arkansas Energy Office should increase participation by state agencies, institutions of higher education and, potentially, municipal governments. We believe there is much untapped potential in the state of Arkansas for energy efficiency investments.

As an approved provider, Clear Energy would be committed to comply with the policies, procedures and rules as outlined in the AEPC Program Rules Manual. Clear Energy would further promote the program as an option to eligible participants. Examples of this commitment include recent presentations including the AEPC program as an option to municipal governments, K-12 schools, and higher education as a solution to address their otherwise limited availability of funds for energy efficiency improvements.

2. Summarize how your firm meets the minimum qualifications, stated in Part 1, Section 5.

Clear Energy meets the requirements of a qualified provider as follows:

- Clear Energy Solutions, LLC holds the following licenses in the state of Arkansas
    - Arkansas General Contractors License No. 0199620416, categories of Building and Energy Management, Retrofit Systems
    - Arkansas Certificate of Authorization to provide Engineering Services No. 2644
- Clear Energy is a member of the National Association of Energy Service Companies
- Members of the Clear Energy team have decades of combined experience in the field of energy efficiency, including both retrofit applications and new construction
    - Completion of multiple successful energy efficiency projects of varying sizes in public buildings.
    - Three principals worked in the energy efficiency area for Wal-Mart Stores, Inc., identifying and designing improvement opportunities in both the domestic and international building portfolios of one of the largest consumers of energy in the world. Experience included designing and implementing

custom measurement and verification protocols to confirm energy efficiency results for both established and emerging technologies.

- Clear Energy has been in business since 2008. The experience of its principals begins well prior to 2008.
- One of the principals is the former chief financial and corporate development officer of a publicly traded energy company, including chief financial officer of its natural gas utility operations. This principal has participated in arranging multiple financings of various forms and sizes, including the project financing for a large intrastate natural gas pipeline project, and has participated in utility rate proceedings as both an expert witness and a drafter of expert testimony in both Arkansas and Missouri.
- Clear Energy's response includes documentation evidencing Clear Energy's approval as a participant in Energi's Energy Savings Warranty program.
- Clear Energy has an established track record of utilizing and managing subcontractors in the completion of its energy efficiency projects.

3. Summarize how your firm's expertise and approach will enhance the effectiveness and reputation of the AEPC Program.

Clear Energy's approach to energy efficiency projects will enhance the overall effectiveness of the AEPC Program as follows:

- The size of our firm allows us to view smaller projects as great opportunities. Smaller projects may not be as desirable to larger performance contractors, or may receive an allocation of less experienced resources by a larger provider.
- Clear Energy is Arkansas based and our principals have a track record of community involvement. Our Arkansas presence enables our primary resources to be easily and readily available to AEPC Program participants.
- We view energy efficiency projects as investments and have a high focus on the economic returns that can be generated on the capital invested. Our customers will attest to the fact that our completed projects have generated the projected savings/returns.
- Our principals have hands-on experience with large construction programs, including both engineering design and field management of construction projects.

4. State your permission for the AEP to share your SOQ publicly (online electronically, print) and may acknowledge that your SOQ may be used by Agencies to help select which ESCO's to interview for EPC projects.

The Arkansas Energy Office will have our permission to share our Statement of Qualifications ("SOQ") through various media (online, electronically, print) and the SOQ may be used by agencies to help select ESCOs to interview for EPC projects.

2. Company Overview

a. History and Focus of Company.

Clear Energy, Inc. is a subchapter-S corporation co-founded in 2010 by Stan Green, its current President, and Paul Hill, an energy efficiency specialist who served as a consultant to Wal-Mart Stores, Inc. Mr. Green acquired 100% ownership in Clear Energy upon the retirement of Mr. Hill.

Clear Energy, Inc. owns the following subsidiaries:

- Clear Energy Solutions, LLC, which holds an Arkansas contractor license and an Arkansas certificate of authorization to provide engineering services.
- Clear Energy Services, LLC, which previously performed lighting retrofit projects, but is presently inactive.

Mr. Green served as Director of Energy for Wal-Mart Stores, Inc. from 2001 through late 2005 and formed Clear Energy Consulting, LLC in 2006. During his time with Wal-Mart, Mr. Green was responsible for all aspects of managing the energy consumption of one of the world's largest consumers of energy, including energy procurement in both regulated and deregulated markets and energy efficiency initiatives in existing buildings. Mr. Green was also co-leader of the energy team that participated in development of Wal-Mart's widely publicized sustainability initiative that continues to be a key part of that company's strategy.

Clear Energy Consulting was formed for the purpose of providing general energy industry consulting services. Through this entity, Mr. Green provided financial consulting services to the developer of a bio-ethanol process during its sale to one of the world's largest chemical companies. Mr. Green also developed and proposed to Wal-Mart Stores, Inc. a concept that became the retailer's Supplier Energy Efficiency Program ("SEEP").

Clear Energy Consulting also completed lighting retrofit designs and installations, using subcontracted installation, in the first two years of its existence. As energy efficiency projects because a larger part of its business, Clear Energy Solutions, LLC (previously named Clear Energy Contracting, LLC) was formed in 2008.

The first project developed by Clear Energy Contracting was the conversion of the 250,000 square foot former Mercy Hospital in Rogers, AR to the Center for Nonprofits at St. Mary's, now owned by The Jones Trust. This conversion project totaled approximately $10.0 million and spanned two years. Every aspect of the architectural, mechanical and electrical design and all construction activities for this major project were managed by Clear Energy Solutions for The Jones Trust. The Center for Nonprofits was funded in part by the Wal-Mart Foundation and Clear Energy's introduction to The Jones Trust came through Wal-Mart's SEEP program.

Clear Energy Solutions was a prime provider of outsourced energy efficiency services to Wal-Mart's SEEP program during the time it was in place. The services provided by Clear Energy included facility energy audits and implementation of turnkey energy efficiency solutions.

Clear Energy Solutions was also selected by Wal-Mart to provide energy audits and efficiency opportunity assessments for two major supplier textile mills in China. These services were provided as a part of a program to identify opportunities for Wal-Mart to reduce the carbon footprint of its supply chain.

A prime subcontractor to Clear Energy and considered a part of its team for purposes of this RFQ response is HP Engineering, Inc. which is headquartered in Rogers, AR. Bill Hodge and Brandon Pinkerton formed HP in 2007. Mr. Hodge was formerly an energy engineer and project manager in Wal-Mart's energy department and also the manager of mechanical design for its new store construction program. As mechanical design manager, Mr. Hodge was responsible for developing initiatives to improve the energy efficiency of Wal-Mart's new store construction program. Mr. Pinkerton started his career as an engineer with General Motors.

HP Engineering is a full-service mechanical, electrical, and plumbing design firm. HP is licensed in forty-eight (48) states and offers lighting design, commissioning, fire protection, energy modeling, daylight modeling, and energy analysis services.

HP's project experience covers a wide range of size and complexity, including education (K-12 and higher education), office, medical, retail, hospitality, large custom residential, specialty industrial, LEED, and religious buildings.

In recent years, Clear Energy has turned its focus to the completion of turnkey energy efficiency projects for public buildings, primarily K-12 public school districts, and major non-profit facilities. HP Engineering has provided technical assistance to Clear Energy for each of these projects in the area of energy audits, economic assessments, mechanical design, and engineering review during construction. Clear Energy and HP Engineering have a combined staff of more than 50 employees. The companies enjoy a strong working relationship and an established track record of completing successful energy efficiency projects.

Please see the table in Section 9 for a description of energy efficiency projects completed over the last five years, all of which were in excess of $1.0 million.

b. Industry Accreditations and Memberships

Clear Energy has the following accreditations and professional memberships:

- Arkansas Contractor License, Building and Energy Management, Energy Retrofit classifications
- Arkansas Certificate of Authorization to Provide Engineering Services
- Member, National Association of Energy Service Companies
- Member, Arkansas Advanced Energy Association
- Member, Arkansas Association of Facilities Administrators
- Member, Association of Energy Engineers

HP has the following accreditations and professional memberships:

- Engineering license in 48 states and Puerto Rico
- Member U.S. Green Building Council
- Member American Society of Heating, Refrigerating and Air-Conditioning Engineers
- Staff includes LEED Aps and Certified Building Commissioners
- Native American Owned, TERO Certified

3. Management and Staffing

a. Project Management and Staffing

a. Organizational Structure. Show a typical/generic organization chart for implementing and managing a project.

By design, the number of our team principals is relatively small, but these individuals have completed multiple energy efficiency projects with values of up to approximately $5.0 million following the lines of responsibility described below. Our approach assures that a Program Participant will receive hands-on participation and contact with individuals who have a track record of competency and delivering the expected results.

Other staff members will support the individuals below. Further, Clear Energy will engage other highly qualified consultants to provide necessary skills as called for by the specifics of a particular situation. Our approach of subcontracting specific work to industry experts assures that we utilize the most capable individuals for a specific situation, not just those individuals that happen to be on our payroll at a point in time.

Based on the process flow chart published by the Arkansas Energy Office, following are the steps and key individuals expected to be responsible for oversight of each step in a typical project. Summary resumes for the key individuals mentioned below and for key supporting staff members of HP Engineering are included in Exhibit A.

Step 1: Intro

- Describe Clear Energy's services, approach and experience to potential Program Participants
  - Stan Green, Clear Energy
  - Josh Meyer, Clear Energy
- Initial assessment of energy efficiency opportunities (Phase I audit) to demonstrate competency and existence of opportunity
  - Bill Hodge, HP Engineering
  - Steve Williams, HP Engineering
  - John McAdams, Clear Energy
- Summary presentation of Phase I findings to Program Participant
  - Stan Green, Clear Energy
  - John McAdams, Clear Energy
  - Bill Hodge, HP Engineering

Step 2: ESCO Selection

- Response to RFQ Issued by Program Participant
  - Stan Green, Clear Energy
  - Josh Meyer, Clear Energy
- Presentation/Interview by Program Participant
  - Stan Green, Clear Energy
  - John McAdams, Clear Energy
  - Bill Hodge, HP Engineering
  - Steve Williams, HP Engineering

Step 3: Audit and Project Development

- Completion of field audit and identification of efficiency opportunities, including savings estimates
  - John McAdams, Clear Energy
  - Steve Williams, HP Engineering
- Overall project economics, including identification of financing options and coordination with potential providers of financing
  - Stan Green, Clear Energy
- Identification of utility incentive programs and payment amounts
  - John McAdams, Clear Energy
  - Stan Green, Clear Energy
- Summarize and present proposed project to Program Participant
  - Stan Green, Clear Energy
  - John McAdams, Clear Energy
  - Steve Williams, HP Engineering

- Develop energy baseline and coordinate with Program Participant to select final measures for inclusion in program
    - John McAdams, Clear Energy
    - Steve Williams, HP Engineering

Step 4: Negotiate Energy Performance Contract

- Interaction with Program Participant and AEO to develop final documentation
    - Stan Green, Clear Energy
- Execution of contract
    - Stan Green, Clear Energy

Step 5: Construction and Commissioning

- Primary contact with Program Participants and AEO
    - John McAdams, Clear Energy
    - Tra Meyer, Clear Energy
- Solicitation of trade subcontractors and subcontract bid management
    - John McAdams, Clear Energy
    - Tra Meyer, Clear Energy
- Field management of construction activities, including regular status reporting
    - Tra Meyer, Clear Energy
    - John McAdams, Clear Energy
- Construction engineering inspections and quality assurance
    - Bill Hodge, HP Engineering
    - John McAdams, Clear Energy
- Punch list development and management
    - Tra Meyer, Clear Energy
- Commissioning of Energy Conservation Measures
    - Bill Hodge and Staff, HP Engineering
    - Specialized Consultant, to be identified and engaged depending on nature of a particular project

Step 6: Project Performance Monitoring

- Ongoing measurement and verification
    - John McAdams, Clear Energy
    - Bill Hodge and Staff, HP Engineering
- Preparation of annual performance reports
    - John McAdams, Clear Energy
    - Bill Hodge, HP Engineering
    - Stan Green, Clear Energy

Step 7: Share Results

- Develop case studies and related collateral material
    - Stan Green, Clear Energy

- Outside marketing/design firm engaged by Clear Energy

b. In a single table, list your personnel pool of individuals who will potentially be assigned responsibility for each task and phase of a project under the AEPC Program.

Name	Office Location	Job Title
Clear Energy		
Stan Green	Fayetteville, AR	President
John McAdams, PE	Fayetteville, AR	Project Manager/Engineer
Tra Meyer	Little Rock, AR	Project Manager/Superintendent
HP Engineering		
Bill Hodge, PE, CEM	Rogers, AR	Executive Vice President
Brandon Pinkerton, PE, LEED AP	Rogers, AR	President
Steve Williams, PE	Rogers, AR	Chief Operating Officer
Jeff Bays, PE	Tulsa, OK	Electrical Design Team Leader
Daniel Miles, PE	Rogers, AR	Senior Electrical Engineer
David E. Adams, PE	Rogers, AR	Office Manager
Mark Mizell	Rogers, AR	Mechanical Design Team Leader
Silva Waterson	Rogers, AR	Mechanical Designer

c. Approach to Subcontracting. Describe the types of services (both professional and construction services) that your company offers in-house and the services typically offered through subcontractors.

The combined team of Clear Energy and its prime subcontractor HP Engineering expects to offer the following services from its combined pool of resources:

- Energy audits, including Phase 3 Investment Grade Audits
- Project development
- Economic evaluation of cost and savings estimates
- Identification and cultivation of financing opportunities
- Identification of utility incentive payments

- All aspects of engineering design
- All aspects of construction management, including trade subcontractor bid solicitation and evaluation
- Development of energy baseline
- Measurement and verification services, including ongoing reporting

While Clear Energy expects to provide the above services through its existing resources, including HP Engineering, there may be times when additional subcontracted services could be beneficial to developing and assuring the performance of a project. This evaluation would be made on a case-by-case basis and would likely be determined by the overall complexity or uniqueness of a project. Subcontracted technical resources would be identified and engaged based on the particular requirements of a specific project. Some areas where subcontracted technical resources might be engaged are:

- Economic evaluation of cost and savings estimates
- Development of energy baseline
- Measurement and verification

All construction trades (electrical, mechanical and plumbing and other miscellaneous) will be provided through subcontract arrangements.

b. Arkansas State Construction Requirements

Clear Energy holds both a current Arkansas general contractor's license and a current Arkansas certificate of authorization to provide engineering services. Requirements of the Arkansas Energy Code are also factored into project design work.

Clear Energy has and will continue to comply with all prevailing wage laws and safety regulations. Compliance with prevailing wage laws includes appropriate

4. Company Financial Status

a. Financial Soundness and Profitability

Clear Energy has experienced sound profitability over the course of its history. The year 2017 was a refocusing year as the company changed its direction and approach with the retirement of a founding principal. The company made a substantial investment in business development spending, which has paid dividends. Clear Energy returned to profitability in 2018 while 2020 is expected to be the company's most profitable year since its formation.

Clear Energy's policy has been to maintain an adequate amount of cash on hand to fund its working capital needs and to remain debt free. Clear Energy has the ability to make cash calls on its equity owner if necessary but has done so only one time in its history. In summary, the Company is adequately capitalized to fund the needs of its ongoing operations and to provide for growth without undue financial stress.

Clear Energy currently has a Dun & Bradstreet Paydex score of 80, which indicates that payments to vendors are made within terms, and a Delinquency Predictor rating of 63 with an indicated probability of delinquency of only 4.42%.

A summary of Clear Energy's financial performance for the last three years is included as a part of Exhibit B. The summary is supported by Clear Energy's financial statements for the last three calendar years which are also attached as a part of Exhibit B. The statements for 2018 and 2019 were compiled by HoganTaylor, LLP, 688 E. Millsap Road, Suite 203, Fayetteville, AR 72703, phone 479-521-9191. The Assurance Partner assigned to Clear Energy's account is currently Sarah Langham. The 2020 statements are drafts of the Balance Sheet and Income Statement as the 2020 financial statement compilation by HoganTaylor has not yet been completed. A summary of the

b. Bonding

Clear Energy has established the following relationships:

A. Performance and Payment Bonds: Travelers Insurance, through Risk Services of Arkansas provides payment and performance bonding for Clear Energy. Please see Exhibit C for a letter from Risk Services of Arkansas that provides the required information concerning Clear Energy's performance and payment bonding capability. Clear Energy has a project bonding capacity of at least $10.0 million for a single project with the ability to request and receive approval for a larger project amount on the submission of a specific project to Travelers. The company may also have multiple projects underway at any one point.

B. Energy Savings Warranty: Clear Energy has been approved for participation in the Energy Savings Warranty program offered through Energi Insurance Services. Please see Exhibit C for documentation confirming Clear Energy's acceptance into the program provided by Risk Services of Arkansas.

5. Marketing Approach

Briefly describe your firm's proposed approach to promoting and marketing the AEPC program both in concert with AEO and in your individual marketing efforts for EPC.

Clear Energy would present the AEPC Program as an alternative to any potential Program Participant, including entities that are not required by law to fully participate in the program. We anticipate developing collateral materials to explain the program to potential participants. Clear Energy's business development staff would be fully versed in the advantages of the AEPC and prepared to answer questions.

We would view the AEO as a resource to help develop the program and would plan to include representatives of the AEO in potential customer situations whenever appropriate.

Clear Energy's marketing efforts would include development of a case study for posting on the company web site once a project is completed through the AEPC.

6. Reporting Approach

Describe your firm's approach to providing signed copies of contracts and measurement and verification reports to AEO in a timely manner. In addition, describe how you will meet the requirements for providing project performance metrics, described in detailin the Program Manual.

Clear Energy understands that all measurement and verification will take place in accordance with the measurement and verification guidelines for the AEPC Program as published by the AEO. We understand that all M&V in the AEPC must comply with the latest version of the IPMVP in place at the time of execution of an investment grade audit contract.

We further understand that the Federal Energy Management Program (FEMP) Measurement & Verification Guidelines must be adhered to by projects in the AEPC Program.

It is Clear Energy's intent to comply with these requirements and cooperatively include AEO throughout the process. In fact, we believe that AEO's representation could be a very strong asset in helping Program Participants understand the baseline energy development and the full M&V protocol, including quarterly and annual reports.

We further view the requirements of the AEPC measurement and verification guidelines as appropriate and valuable in developing the appropriate understanding of the M&V process by all parties involved.

In summary, Clear Energy understands the requirements and will provide all reports required within thirty (30) days of the reporting schedule.

Clear Energy will also make available copies of contracts as requested by the Arkansas Energy Office.

7. Technical Approach

a. Investment Grade Audit.

The principals of Clear Energy have developed numerous energy efficiency projects and performed measurement and verification of the results. However, the company has not developed guaranteed energy savings contracts. As a result, the procedures followed for measurement and verification have been less formal and more tailored to the level of understanding and expectation of the particular project participants and building users.

While ASHRAE standards have been followed in developing energy audits, recommendations and energy efficiency proposals, the reports prepared by Clear Energy have not specifically been identified as Investment Grade Audits.

As support that the principals of our team have the capabilities to produce formal Investment Grade Audits, the following report prepared by Clear Energy is attached as Exhibit D:

- Arkansas Career Training Institute, Hot Springs AR

John McAdams, Josh Meyer and Stan Green participated in the development of part or all of the above report.

Clear Energy's overall approach to energy auditing and efficiency assessment is to take a systems view of total building operation. While individual units of equipment are inventoried and analyzed, we determine the optimum role that each unit should play in overall operation of a facility.

Our basic approach to an energy audit includes the following steps:

- Inventory buildings: square footage, age, additions to original structure, building envelope characteristics
- Gather occupancy and usage information, including recent changes that could impact evaluation of historical utility information
- Inventory existing equipment, including name plate data and specification sheets as necessary
- Determine energy efficiency improvements completed or in progress
- Identify other equipment changes that could impact historical energy consumption
- Inventory energy management procedures currently in place
- Compile building documentation, including construction plans, maintenance information and prior energy audits
- Review/compile maintenance expense records for energy consuming equipment
- Review recent equipment performance testing, if performed
- Facility visit, including discussion with site personnel of perceived needs and performance issues
- Develop energy baseline through historical utility data and, if available non-utility sub-metering data
- Develop and analyze proposed energy efficiency measures
    - Capital cost and savings estimates
    - Measurement and verification plan specific to each measure

    - Identify potential financing sources
    - Project net savings available to service proposed financing/funding
- Develop commissioning plan
- Develop construction plan and identify hurdles to success
- Develop measurement and verification plan

b. Standards of Comfort and Construction Specifications.

Clear Energy follows ASHRAE and IESNA standards of comfort in designing energy efficiency projects. In any situation, we consult with building owners/occupants to explain the standards to which the project will be developed and confirm that those standards meet the needs of the owners/occupants or identify appropriate modifications. A Program Participant would be fully involved in making these determinations.

c. Baseline Calculation Methodology.

Clear Energy's approach to developing an energy baseline is customized for each particular situation but is generally keyed off the data gathered in connection with the energy audit, as described above. Further steps are:

- Energy modeling software is used as appropriate to calculate projected current energy consumption and the impact of proposed improvements
- Gather 12-36 months of historical energy data from utility bills and, if available, non-utility sub-meters
- Reconcile projected energy consumption with historical utility information to confirm that the energy model is accurate
- Convert historical energy consumption to appropriate metrics, such as consumption per square foot, and benchmark against comparable facilities to identify the potential for anomalies
- Determine the appropriate baseline year or average of multiple years
- Through the site visit and discussion with building owner/occupants, determine if any changes in operation have occurred that would raise or lower historical energy consumption, such as increased or decreased operating hours or recent changes in energy-consuming equipment
- Calculate impact of identified changes and finalize energy baseline

Participation of building owners/occupants is critical to the successful completion of the energy audit, the determination of the energy baseline, and any necessary adjustments to the energy baseline. Building owners/occupants are the best source of knowledge concerning changes in the facility or its operations. At the same time, it is Clear Energy's responsibility to assist the owners/occupants in identifying and understanding the potential impact of identified operational changes that could impact the energy baseline.

The typical process to establish the baseline performance for an ECM will be based on International Performance Measurement and Verification Protocols and may include the following:

- Energy usage may be based on instantaneous measurements with stipulated operation hours where practical. This type of ECM might include certain lighting applications or equipment with constant loads such as a constant speed pump.
- Monitoring the equipment or system over a representative period of time may be more appropriate for other equipment such as cooling equipment that cycles or has variable power input.
- Where available, building automation systems trends may be used to help establish the baseline energy usage.
- A variety of software tools may be used to simulate baseline energy where it is not practical to obtain direct measurements. In addition to the full modeling systems, other building hourly simulation software may be used, such as Excel based calculation tools and Department of Energy bin weather data.

d. Adjustments to Baseline

Adjustments to ECM baselines may be recommended for some of the following reasons:

- Usage of the building may have changed or may change after the utility data was collected.
- Weather data may need to be normalized for comparison to ECMs.
- Equipment or building systems may have changed since the utility data was collected.

If baseline adjustments are appropriate, methods of adjustment may include the following:

- Adjustment to the input of annual simulation programs including hours of operation, occupancy, system types, and other adjustments needed to match existing building systems and operation as closely as possible to the actual conditions.
- Calibration of the annual simulation model to actual energy use.
- Weather regression models for other software calculations.

8. Company Scope of Services

Provide a brief description that highlights your firm's capabilities to provide services for the listed items.
Clear Energy's ability to provide the scope of services is found in the Project References provided later in this RFQ response that included the provision of the following services.

a. Energy Systems in Buildings:

- Central plants

- Control and building automation systems
- Daylighting (new building lighting design and system installation)
- Heating systems
- Indoor air quality
- Kitchens
- Lighting systems: indoor and outdoor
- Renewables including Solar Services Agreements
- Swimming pools and recreational facilities
- Utility management
- Ventilation systems
- Water-consuming systems

b. Project Development and Implementation

- Investment grade energy auditing (ASHRAE Level 3 audit): see example Exhibit D
- Financing knowledge
- Identification and application for utility rebates
- Commissioning of projects and retro-commissioning of existing buildings
- Identification of asbestos and other hazardous materials and abatement, recycling or disposal as applicable
- Construction
- System design engineering: mechanical, electrical, etc.
- Project/construction management
- Procurement, bidding, cost estimating
- Project constructability

c. Support Services

- Measurement and verification of savings
- Equipment warranties
- Calculation and reporting of emission reductions (key part of energy audits conducted for programs of Wal-Mart Stores described in Company Overview section above)
- Insurance per contract requirements
- Training of maintenance staff and occupants
- Hazardous material handling
- Long-term maintenance services of energy systems

9. Project History

In a single table, list all public energy efficiency projects developed and implemented within the past five years:

Owner/Project Name	Facility Type	CE or Previous	City & State	Project Size ($)	Annual Energy Savings $	Annual Energy Savings MMBtu	Timeline	Assigned Staff
West Fork School District	K-12 School	CE	West Fork, AR	$ 5,779,000	$ 88,100	3,161	6-16 to 12-19	McAdams Green Hodge Waterson
Texarkana Arkansas School District	K-12 School	CE	Texarkana, AR	$ 9,299,000	$ 190,600	6,746	6-14 to 10-17	McAdams Green Hodge
Ashdown School District	K-12 School	CE	Ashdown, AR	$ 1,007,000	$ 96,204	3,565	5-18 to 9-18	McAdams Green J. Meyer
University of Arkansas for Medical Sciences	Medical School Campus	CE	Little Rock, AR	$ 5,523,000	$ 1,049,400	51,000	3-19 to 5-21	McAdams Green J. Meyer T. Meyer

10. Project References

Provide detailed information for a maximum of three public energy efficiency projects your firm completed or were completed by members of your locally represented firm, which can be used for references.

Following are representative energy savings projects developed and implemented by Clear Energy. As described earlier, most of Clear Energy's projects are conventional energy savings projects rather than performance contracting projects. Projects 1-3 were completed in a Construction Management format with Clear Energy providing pre-construction services in the form of project identification, development and design. An energy audit functionally equivalent to an Investment Grade Audit was completed in all cases to identify energy savings opportunities and these opportunities were then reviewed and accepted by the project customer. Detail design of the energy conservation measures was completed by Clear Energy. Formal measurement and verification procedures were not required by our customers as a cost control measure, although informal measurement and verification procedures were typically applied. In summary, these projects were all approached in a manner identical to an energy savings performance contract, but without the formal guarantee and attendant measurement and verification procedures. Clear Energy is presently completing the Investment Grade Audit stage of a guaranteed energy savings project for the Arkansas Career Training Institute in Hot Springs, AR under the Arkansas Energy Performance Contracting program administered by the Arkansas Energy Office.

The reference projects that are all structured similar to an energy savings contract are:

1. West Fork Public School District
359 School Avenue
West Fork, Arkansas 72774

Contact: John Karnes, Superintendent
e-mail: jkarnes@wftigers.org
phone: 479-839-2231, ext. 5001

Contract Amount: Series of four projects totaling $5,779,045, 3 buildings, 233,000 SF

Financing: Financing was provided directly by the customer through a combination of debt issuance and state participation through the Arkansas Division of Public School Academic Facilities and Transportation Partnership Program.

Contract Term: Not applicable.

Annual Savings: Utility—$88,100
MMBtu—3,161

Operational & Avoided Costs—$97,400

Scope of Work Summary:

- Project was heavily weighted toward replacing end-of-life equipment and adding HVAC to previously unconditioned space.
- Redesigned, expanded and replaced HVAC systems in High School, Middle School, Elementary School and ancillary buildings, using a combination of split systems and package units.
- Distributed/on demand fresh air for classrooms per ASHRAE standards.
- Energy recovery ventilators in locker rooms for better odor control.
- Created additional zones in administrative area for improved control.
- Expandable building automation system to provide increased control and save energy.
- Interlock HVAC with lighting occupancy sensors.
- LED lighting retrofit.

Start Date of Installation: June 2016

Completion Date of Installation: December 2019.

Project Highlights/Added Value for Customer: In addition to energy and operational savings, occupancy comfort was significantly improved, including the addition of HVAC to previously unconditioned facilities.

2. Texarkana Arkansas School District

3512 Grand Avenue
Texarkana, Arkansas 71854

Contact: Andrew Hill, Business Manager
e-mail: Andrew.Hill@tasd7.net
phone: 870-772-3371

Contract Amount: Series of four projects totaling $9,298,803, 9 buildings, 723,000 SF

Financing: Financing was provided directly by the customer through a combination of debt issuance and state participation through the Arkansas Division of Public School Academic Facilities and Transportation Partnership Program.

Contract Term: Not applicable.

Annual Savings: Utility—$190,600
MMBtu—6,746
Operational & Avoided Costs—$515,000

Scope of Work Summary:

- Project was heavily weighted toward end-of-life equipment replacement, including installation of 100% new system in middle school building.
- Redesigned, expanded and replaced HVAC systems in nine buildings.
- Lighting retrofits throughout district.
- Distributed/on demand fresh air for classrooms per ASHRAE standards.
- Created additional zones for improved control.
- Expandable building automation system to increase control and save energy.
- Designed geothermal system for a 50-year old middle school building.

Start Date of Installation: June 2014

Completion Date of Installation: October 2017. Projects were staged to comply with customer requirements.

Project Highlights/Added Value for Customer: In addition to energy and operational savings, occupancy comfort was significantly improved. ***Improvements resulted in the middle school becoming a "high performing building" that uses about one-third of the energy consumed by the average K-12 school, ranking it among the most efficient in the country.***

3. Ashdown School District
751 Rankin Street
Ashdown, Arkansas 71822

Contact: Casey Nichols, Superintendent
e-mail: cnichols@ashdownschools.org
phone: 870-898-3208

Contract Amount: $1,007,256, 4 buildings, 358,000 SF

Financing: Financing was provided directly by the customer through debt issuance.

Contract Term: Not applicable.

Annual Savings: Utility—$96,204
MMBtu—3,565
Operational—$18,200

Scope of Work Summary:

- Redesigned, expanded or replaced HVAC systems in seven buildings.
- Work included improvements to improve air quality to ASHRAE standards.
- Designed and installed wireless thermostat controls & web-based interface.
- LED lighting retrofits throughout district.

Start Date of Installation: May 2018

Completion Date of Installation: September 2018

Project Highlights/Added Value for Customer: In addition to energy and operational savings, various district buildings had air quality issues which were corrected through the project. Issues included poorly designed ventilation systems and HVAC exhaust systems along with non-functioning units that were repaired or replaced.

In addition to the above completed projects, following is a description of the project covered by the example investment grade audit report submitted:

Arkansas Career Training Institute
105 Reserve Street
Hot Springs, Arkansas 71901

Contact: Jonathan Bibb, Director
e-mail: Jonathan.Bibb@arkansas.gov
phone: 501-624-4411, ext. 6310

This project was being developed under the Arkansas Energy Performance Contracting Program. After an initial review of the investment grade audit, the Arkansas Department of Career Education made the decision to downsize the programs of ACTI and the program identified will not move forward. Nonetheless, the energy conservation measures identified are wide-ranging and complex and the proposed program is indicative of the capabilities of Clear Energy.

Contract Amount: Program identified totaled $10,240,000. Project covered in excess of 400,000 square feet of building space.

Financing: Financing was not finalized but was expected to be through the issuance of conventional debt to take advantage of the low borrowing cost of the State of Arkansas.

Contract Term: Was anticipated to be 15 years.

Annual Savings: Utility—$364,000 in Year One, escalating to $586,000 annually
Operational—$471,617 in Year One, escalating to $680,833 annually

Scope of Work Summary:

- Conversion of steam boiler system to hot water system. Decreased monitoring requirements enabled staff reductions that accounted for most of the operational cost savings.
- Install campus-wide building energy management control system.
- Upgrade chilled water system.
- Install solar array system.
- Replace DX air handling units with chilled water.
- Convert 2-pipe HVAC systems to 4-pipe.
- LED lighting retrofit, both interior and exterior.

Start Date of Installation & Completion Date of Installation: N/A

Project Highlights/Added Value for Customer: The major building in this project is a former Army/Navy hospital, was constructed in the 1930s and is on the National Register of Historic Places. The project was designed to provide a significant update of the campus mechanical systems and address numerous deferred maintenance issues while increasing occupant comfort.

11. Cost and Pricing

a. Please describe your company's approach to IGA pricing.

Clear Energy has read and reviewed the IGA pricing requirements and understands that the maximum IGA cost is as determined by the AEO and provides for adjustments related to special purpose facilities where the established cost may not be appropriate. Clear Energy sees no issues with these requirements.

b. Describe your company's approach to fuel escalation rates.

Fuel escalation rates, if deemed appropriate to utilize, should be based on projections from credible sources, determined for each separate fuel source, and tuned as closely as possible to the particular utility providing service to the facility.

c. Describe your company's process to solicit bids on equipment/labor to ensure price/cost competition and the best value for the Agency.

Clear Energy is product/vendor neutral and assures that all specifications are written so that multiple suppliers will be able to participate in the bidding process. We actively solicit participation by multiple equipment suppliers and labor providers. At the same time, we pre-qualify all providers to assure they have the capability to perform at the expected level and honor all contractual commitments required to complete the work.

d. Describe your company's approach to open book pricing and its method for maintaining cost accounting records on authorized work performed under actual costs for labor and material, or other basis requiring accounting records.

Clear Energy is completely supportive of the open book pricing concept. We maintain a job cost accounting system that tracks each invoice or other charge to each specific job. Our system has the ability to generate detailed line item cost reports that accumulate to the total charges for each individual job. We regularly reconcile the job cost detail reports to the overall construction in process account to assure that all costs are properly captured and charged. We also review the detail of costs charged to each job as a part of every billing cycle to assure that a cost has been charged to the correct job.

e. Please describe your company's approach to EPC project costs and pricing.

Clear Energy has reviewed the pricing table format in the AEPC Cost & Pricing Table tool and will follow the stated guidelines. We expect that the specific terms of each project will be individually negotiated based on these guidelines and will approach the process on a good-faith basis.

Exhibit A

Key Team Member Resumes

Clear Energy Resumes

Stan Green is the founder and President of Clear Energy. Stan has over three decades of experience in the energy industry. He was Director of Energy for Walmart Stores, Inc., one of the world's largest consumers of energy. He initiated a focus on energy efficiency in existing buildings and also served as team leader for the group that developed the energy strategy for Walmart's sustainability initiative. Stan was responsible for all aspects of Walmart's $1.6 billion annual domestic energy spend, including applying economic rate of return hurdles to energy projects, procurement strategies and contract structures in deregulated markets, and improved training of regional energy managers to optimize building energy costs. Prior to that, he was Executive Vice President of Finance and Corporate Development for Southwestern Energy Company and Arkansas Western Gas Company (now Black Hills Energy). He is past Chairman of the Board of the Arkansas Development Finance Authority, which is the bond issuing authority for projects completed by state agencies under the Arkansas Energy Performance Contracting program. He is also Chairman of the Board of the University of Arkansas Technology Development Foundation which manages the Arkansas Research and Technology Park and was a member of the Board of the Northwest Arkansas Regional Airport Authority for twenty-seven (27) years, serving as Chairman for fifteen (15) years. He earned a BS in Business Administration from the University of Arkansas and is a Certified Public Accountant.

John McAdams is an energy engineer and project manager, responsible for project development, construction management and oversight, development of any facilities-related training programs, and post-construction activities including commissioning and closeout. John is a native of El Dorado, AR, a licensed Professional Engineer and earned a BS in Electrical Engineering from the University of Arkansas. He has been with Clear Energy since 2012 and has been project manager for the West Fork School District, Texarkana Arkansas School District, and University of Arkansas for Medical Sciences projects listed in the reference section. John has also served as Project Manager for Clear Energy projects on the campuses of the University of Arkansas Fayetteville and John Brown University. John was previously an Energy Engineer and Electrical Engineering Manager—Prototype Design for Walmart Stores, Inc. and managed the electrical engineering design collective for all Walmart store formats. His team developed a store prototype that was 30% more efficient than the baseline design. John developed a monitoring and verification system to validate energy savings, developed testing procedures for new energy efficiency technology applications and managed a nationwide distribution center lighting retrofit.

Josh Meyer is a Project Executive. Josh is responsible for communications and assuring that the team stays in tune with the needs of the customer. Josh has spent much of his career helping customers with mechanical systems solutions that save money and enhance building comfort. He previously served in business development for Comfort SystemsUSA Energy Services, a subsidiary of one of the country's largest mechanical contractors. While there, he developed new businesses relationships with a wide variety of concerns ranging from health care and higher education to construction and heavy industries. He later headed up Comfort Systems USA's HVAC Service Sales office in Arkansas, developing that business from the ground up. Josh also brings real-world industrial sustainability experience in waste and pollution management. As project manager for a company contracted by an international manufacturing concern, he managed a no-landfill policy by developing a recycling system for their newly built facility. Josh has also worked in hazardous spill management by setting up spill responders, compliance with OSHA and DOT safety protocols, and overseeing components of wastewater treatment operations. Josh earned a BS degree in Environmental Soil and Water Science from the University of Arkansas.

McCurry (Tra) Meyer is a project coordinator responsible for cost estimation, bid management and supervision of construction field work. Tra spent thirty-five (35) years as a Construction Representative with the United States Army Corps of Engineers where he was responsible for quality assurance on major construction projects, safety, job site inspection and compliance, environmental compliance and problem solving, including the interpretation of the requirements of contract requirements, plans, specifications. Tra has an Associates Degree in Medical Technology from Southwestern Oklahoma University. He has additional training in electrical systems, materials testing, crane safety, welding inspection, mechanical systems and fiscal law.

HP Engineering, Inc. | Our Owners

Brandon Pinkerton, PE
BSEE, University of Arkansas
President

Licensure in 49 states & Puerto Rico

Brandon is the President of HP Engineering, Inc., and Principal in Charge of the electrical design teams. He has over 16 years of experience in electrical design and over thirteen years at the firm. His project management experience includes: education, medical, municipal, hospitality, multi-family, residential, commercial, industrial, government, entertainment, and retail sectors.

Brandon is highly experienced in renovations, energy audits and retrofit programs. He also collaborates with energy managers and commissioning agents on projects across the United States and internationally. His experience includes alternative energy source designs (solar and wind) providing pay-back analyses as well.

Bill Hodge, PE
BSME, University of Arkansas
Executive Vice President

Licensure in 49 states

As Executive Vice President, Bill manages HP Engineering's business development, while remaining dedicated to overseeing many of our clients' projects from design development through to occupancy. Bill has over two decades of experience as a Mechanical Engineer for new build and renovation projects and over thirteen years at the firm. His experience includes: education, retail, medical, municipal, hospitality, multi-family, corporate, industrial, government, and entertainment sectors.

He understands the importance of balancing design performance with ease of maintenance. As a Certified Building Commissioning Professional and Certified Energy Manager, he works alongside owners and engineers on projects across the United States and overseas.

On a personal note, Bill is a veteran of the United States Air Force.

Senior Leadership Team

Steve Williams, PE
BSME, University of Arkansas
Chief Operating Officer
Licensure in nine states

Steve is HP Engineering's Chief Operations Officer (COO). He has over 30 years of experience in mechanical design and serves as Project Manager or Principal in Charge. Steve has over four years at the firm. His project experience includes educational, healthcare, municipal, hospitality, multi-family, commercial, industrial, retail, government, and entertainment sectors.

He is also responsible for Quality Control (QC) assurance to significantly reduce errors and omissions, resulting in minimal RFI's and change order requests from contractors, saving additional construction costs for our clients. Steve is experienced in building system commissioning and energy conservation projects.

Steve has professional licensure in nine states, including Arkansas.

David E. Adams
Senior Vice President

David creates efficient designs that are cost effective and comply with applicable codes and standards. He has strong analytical, organizational, and problem solving skills, as well as the ability to identify operational deficiencies and implement system improvements.

David joined HP Engineering in 2014 and has over 20 years of experience in AEC industry, design firms. He is a proven leader, providing motivation and training by example. He has extensive experience with project management, design, analysis, construction, and commissioning of building systems. David has been involved in educational, municipal, retail, government, and corporate projects in the continental United States, as well as internationally.

David holds degrees in Electrical Power Systems and HVAC/Refrigeration Technology from Northwest Technical Institute.

Our Team (continued)

Daniel Miles, PE
BSEE, University of Arkansas
Vice President
Licensure in AR, KS, MO, OK, TX

Dan is one of our Engineering Managers for the electrical design team in our corporate office in Rogers, Arkansas. He is active on projects from design development until occupancy. Dan's projects include designs for educational, medical, municipal, hospitality, multi-family, corporate, entertainment, and retail sectors.

Since 2000, Dan has provided engineering services for both new and renovation projects and has been with the firm for nearly twelve years. He balances design performance with project budget.

In addition to traditional electrical engineering services, his team performs existing system analysis, lighting design, data/voice cabling design, and photometric analyses and rendering.

Jeff Bays, PE, CEM
BSEET, Oklahoma State University
Vice President
Licensure in OK, TX, CO, AZ, NM, & CA

Jeff is an Electrical Engineer for HP Engineering, Inc. and responsible for MEP design projects, including new construction, expansions, acquisitions, remodel, and tenant finish-outs. He is also responsible for Quality Control (QC) assurance to significantly reduce errors and omissions, resulting in very minimal RFIs and change requests from contractors, which saves additional construction costs for the client.

His 14 years of experience includes all aspects of electrical design, including lighting and power, photometric analysis, lighting controls, power distribution, emergency power, fire alarm, telecommunications, security, and energy management. Jeff is able to combine this design experience as an Electrical Engineer with field experience as a Master Electrician to ensure document constructibility. Jeff ensures project delivery deadlines and client expectations are met or exceeded.

Mark Mizell, PE
BSME, Arkansas Tech University
Engineering Manager
Licensure in AR

Mark is a mechanical, electrical, and plumbing Engineering Manager and team leader. He has over twenty years of mechanical design experience in a wide range of healthcare, higher education, K-12, retail, government, and commercial construction projects.

His extensive knowledge of AutoCad and Revit are great tools he uses when communicating ideas with both his team and clients. Mark is a conscientious designer, effective team player, dedicated, hardworking, and is always committed to keeping projects on track.

Mark holds a BSME from Arkansas Tech University where he graduated Cum Laude. Outside the office, Mark and his wife are active in their church.

Exhibit B

Financial Statements, 2018-2020

REDACTED

Exhibit C

Bonding and Energy Savings Warranty Letter

Februray 25, 2021

Re: Clear Energy Solutions, Fayetteville, AR

Clear Energy Solutions enjoys an excellent bonding relationship with its surety The Travelers Insurance Companies.

The Travelers has provided and is prepared to provide bonds on contracts entered into by Clear Energy. The bonding capacity of Clear Energy is in excess of prior work programs and, consequently, projects of any given size up to $10,000,000 that are considered by Clear Energy will be entertained by The Travelers. If contract terms and conditions are acceptable to Clear Energy, the bonds will be favorably considered by The Travelers.

The Travelers has never received nor had reason to respond to any adverse circumstances on Clear Energy projects. Accordingly, we are pleased to offer our high recommendation of Clear Energy Solutions.

Additionally, Clear Energy has been pre-approved and is eligible for Energy Savings Warranty coverage through Energi.

Sincerely,

Steven C. Russell

Steven C. Russell, CIC
Account Executive

SCR/sb

Exhibit D

Example Energy Audit

(Full Energy Audit Included in Electronic Submission)

Arkansas Career Training Institute
Investment Grade Audit

December 2, 2019

Executive Summary

Introduction

The Arkansas Career Training Institute (ACTI) located in Hot Springs, AR engaged Clear Energy to evaluate the lighting, heating, ventilation, air conditioning, exhaust, and plumbing systems for 439,122 square feet of the existing facilities. The purpose of the evaluation was to assess current conditions, identify energy efficiency opportunities, and make recommendations to replace or upgrade existing systems and equipment by leveraging energy and operations savings to fund the improvements. The following information provides a roadmap for upgrading the infrastructure systems and achieving the desired economic return on investment. The assessment was conducted by Clear Energy with assistance from Bernhard TME (BTME). A review of building drawings, compilation of historical utility costs, a walkthrough of all buildings, and discussions with facility personnel are included in the report.

Financial Opportunity

Based on building age, average equipment age, drawings, interviews with facility personnel, and the site survey, a significant opportunity for energy and operational savings exists within the ACTI Campus. This savings is primarily attributable to lighting and heating, ventilation, and air conditioning (HVAC) and steam systems.

Because of the age of the buildings, the existing lighting systems are a mix of fluorescent T8, T12, and T5s, compact fluorescents, incandescent fixtures. Much of the existing lighting controls consist of manual wall switches. This results in high energy and maintenance costs compared to more efficient lighting technology currently available.

The mechanical systems to the buildings range in age from approximately 1 to over 30 years old. The technology of HVAC equipment is constantly changing and becoming more energy efficient as well as its ease of controllability and reliability of its components. With the use of higher energy efficient equipment, the potential for energy savings can offset the financial burdens of increased utility costs seen annually, in addition, alleviating service costs that old equipment may bring. Much of the district HVAC systems currently utilize R-22 refrigerant which has been phased out of production and is expensive to replace. The life expectancy of HVAC equipment is typically 15 to 20 years for air-cooled equipment. The campus has deferred maintenance needs that lead to increased inefficiencies. Existing HVAC equipment is controlled by stand-alone, manual thermostats for each room or zone. Newer HVAC equipment installed on multiple campuses is equipped with digital thermostats. There is not an energy management system currently in place within the district which would allow personnel to make adjustments to buildings and more efficiently control the energy systems.

Clear Energy has developed a recommended energy project scope of work based on a comprehensive evaluation of the specified facilities and equipment. The scope of work includes input and direction from facility personnel. Once implemented, the facility will be eligible to receive energy rebate incentives from its electric and natural gas utilities. The amount of the rebates is based on the estimated energy savings for the project. An estimate of the energy savings rebates has been developed for the project by Clear Energy in consultation with CleaResult, who manages the utility rebate program for the electric and natural gas utilities serving the Arkansas Career Training Institute facility. The recommended program, estimated implementation cost, potential utility incentives[1], and estimated operational savings are summarized in the table below.

[1] Utility incentive availability will vary and depend on project schedule.

Savings Summary

The Recommended Program will result in the following for the Arkansas Career Training Institute:

- An installed cost of $10,890,699
- Estimated utility rebates of $124,132
- Annual estimated first year utility savings of $349,026
- A 42% reduction in annual utility costs
- Estimated annual first year O&M savings of $500,542
- First year debt service payment of $732,026
- An annual guaranteed savings of $876,858
- A total savings over the twenty-two year period of $5,684,578

Our analysis includes a comparison between the operating cash flows that result from the Baseline Case (existing operations) and the Recommended Program. With consideration of the projected utility rebate incentives, the Recommended Program will result in a positive cash flow over the life of the finance term when compared to existing operations.

Contact Information

Clear Energy Solutions

438 Millsap Road, Suite 200
Fayetteville, AR 72703
479-695-1031

Owner
Stan Green

Project Development
Josh Meyer

Engineering
John McAdams

Bernhard TME

1 Allied Dr, Suite 2600
Little Rock, AR 72202
501-666-6776

Energy Modeling
Paige Naeyaert

#	Description	Cost ($)	Utility Savings ($/Year)	O&M Savings ($/Year)	Avoided Capital ($/Year)	Guaranteed Savings ($/Year)	Payback (Year)
ECRM-01	Upgrade capacitor bank	104,906	10,990	0	0	11,250	**9.5**
ECRM-02	Retrofit interior lighting to LED	472,500	23,635	13,388	0	31,275	**12.8**
ECRM-03	Retrofit exterior lighting to LED	159,627	3,370	5,826	0	9,195	**17.4**
ECRM-04	Convert steam heating system to heating water	1,112,397	178,421	423,764	0	549,966	**1.8**
ECRM-05	Upgrade domestic heating water	99,462	(3,229)	0	0	(3,126)	**-30.8**
ECRM-06	Retro-commissioning of air distribution equipment and controls	252,347	6,996	0	0	6,955	**36.1**
ECRM-07	Install building energy management control system	1,486,381	40,074	0	0	39,844	**37.1**
ECRM-08	Upgrade chilled water system	1,302,947	32,212	24,779	0	56,990	**22.9**
ECRM-09	Install high-efficiency water fixtures	281,787	27,246	2,709		29,955	**9.4**
ECRM-10	Update kitchen mechanical equipment	348,405	18,127	0	0	17,994	**19.2**
ECRM-11	Install solar array system	247,565	16,995	0	0	16,995	**14.5**
CRDM-01	Install exterior safety LED lighting	235,773	0	0	0	0	**NA**
CRDM-02	Replace DX air handling units with CHW	1,192,168	10,167	30,076	51,000	97,591	**13.1**
CRDM-03	Convert Building 1 and Ross Hall 2-pipe HVAC system to a 4-pipe	1,655,892	(15,977)	0	0	(15,974)	**NA**
CRDM-04	Upgrade campus electrical distribution	999,798	0	0	0	0	**NA**
Subtotal		**9,951,956**	**349,026**	**500,542**	**51,000**	**876,858**	
Financing Cost		**748,970**					
Capitalized IGA Fees and Energy Office Fee		**97,961**					
Capitalized M&V Costs		**91,812**					
Total Project		**10,890,699**					

Building Information

General Description

What is now the Arkansas Career Training Institute (ACTI) (formerly known as Hot Springs Rehabilitation Center), run by Arkansas Rehabilitation Services, was the first combined general hospital for both U.S. Army and Navy patients in the nation. The Army-Navy Hospital opened to patients in January 1887 and the present fireproof brick and steel facility was built in the early 1930s[2]. The current facility serves more than 400 students annually with the mission of providing vocational training and employment opportunities.

[2] http://www.encyclopediaofarkansas.net/encyclopedia/entry-detail.aspx?entryID=2236

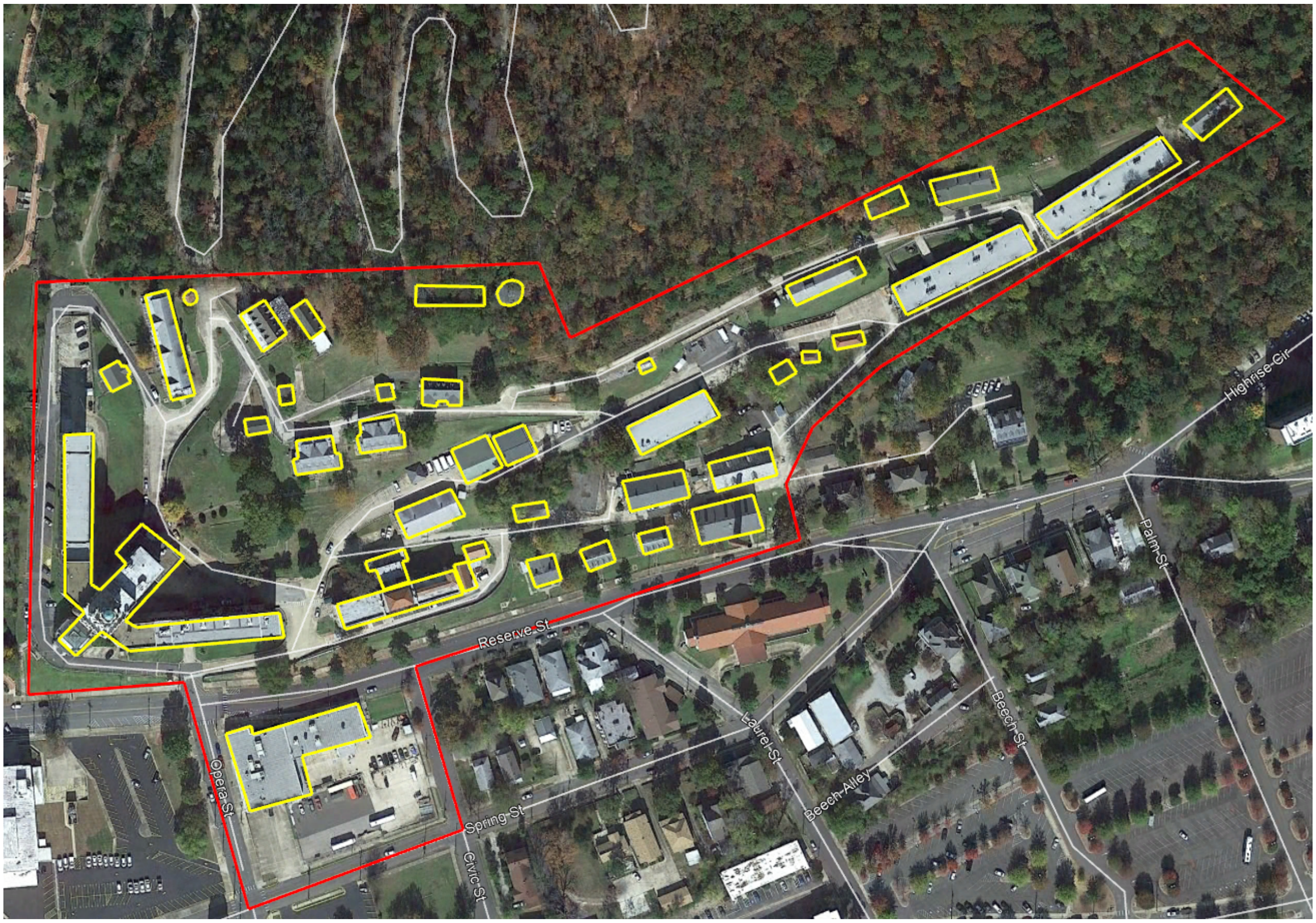


FIGURE 1 GOOGLE EARTH IMAGE OF CAMPUS

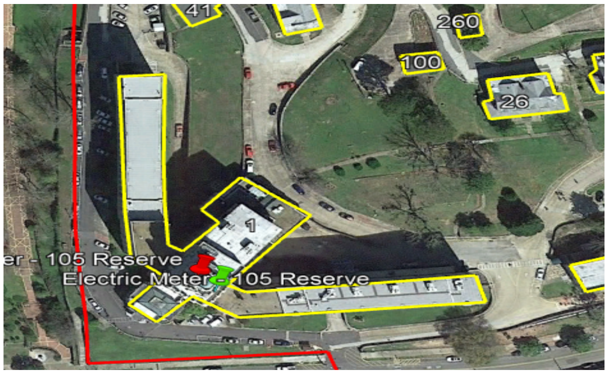
TABLE 1: EXISTING CAMPUS INFORMATION

Metric	Value
Campus Size	22 acres
Total Floor Area	439,122
Number of Buildings	35
Yearly Utility Spend (Electricity, NG, Water, Sewer)	$684,518
Yearly O&M Spend	$869,188
Total Yearly Carbon Emissions (tons CO_2)	5,860
Total Site EUI (kBtu/SF/Year)	155

Site Energy Use Intensity (EUI) provides a metric of energy performance relative to the floor area of a building. For institutions of higher education of similar size and operation, site EUI ranges between 70 kBtu/SF/Year to 120 kBtu/SF/Year with an average of approximately 95 kBtu/SF/yr. Based on current operations on campus, ACTI's site EUI is 155 kBtu/SF/Year derived from utility data obtained for 2017-2018. When compared to the average range above, ACTI's current site EUI indicates that energy performance is above average performing universities of similar size. This broad metric comparison indicates a significant energy conservation opportunity on campus exists. This opportunity is explored further as part of this IGA.

Below are overviews of the three main buildings on campus. These buildings account for 275,450 out of the 439,122 total square footage. Because the other buildings are of various sizes and conditions, their use is not consistent throughout the year and won't be affected by the energy reduction measures, only the three main buildings are listed below.

MAIN BUILDING 1



Gross Floor Area (SF): 210,134

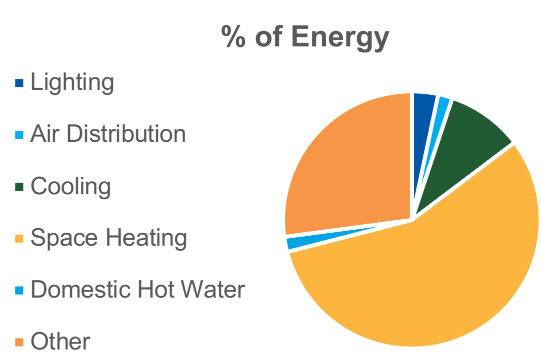
General Overview:

This building is used as the main space on the campus. It functions as classroom space, dorms, kitchen, library, conference, office, laundry, auditorium, and security.

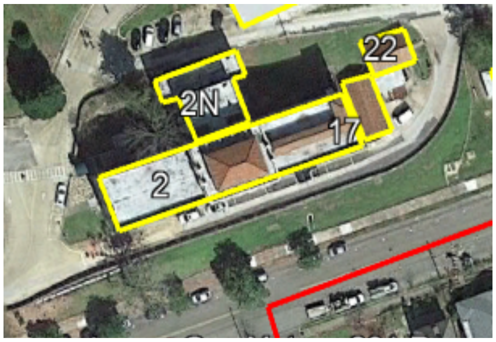
Lighting System:	A mixture of multiple types of lighting upgraded over time
Air Distribution System:	2-pipe fan coil units and single zone AHUs
Cooling System:	District chilled water to 2-pipe fan coil units and air handlers as well as roof top DX units
Space Heating System:	District steam air handling units, radiators, and 2-pipe fan coil units
Domestic Hot Water System:	Steam heat exchangers from district steam system
Building Automation Controls:	No controls
Other Systems / Loads:	Kitchen steam, dishwashers, and kettles, plug loads
Electric Utility Source:	Entergy account: 1834175
Natural Gas Utility Source:	CenterPoint account: BG-96179
Domestic Water Utility Source:	Hot Springs Municipality account: 41052000

Modeled Historical Energy Use Summary

Site EUI:	**190.9**	**kBtu/SF**
Site ECI:	**1.58**	**$/SF**
Lighting:	3.3	%
Air Distribution:	1.8	%
Cooling:	9.6	%
Space Heating:	56.3	%
Domestic Hot Water:	1.9	%
Other:	27.1	%
Total:	100.0	%



Ross Hall Building 2



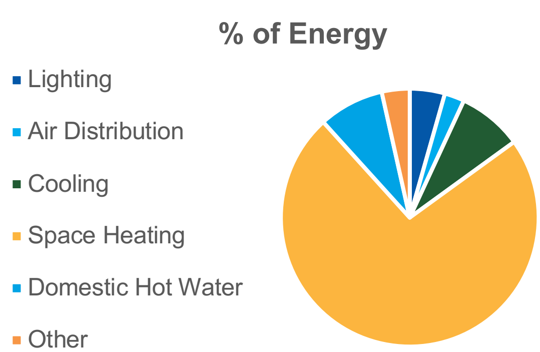
Gross Floor Area (SF): 30,794

General Overview:
Student dormitory, classrooms, and offices

Lighting System:	A mixture of multiple types of lighting upgraded over time
Air Distribution System:	2-pipe fan coil units
Cooling System:	District chilled water to 2-pipe fan coil units
Space Heating System:	District steam radiators and 2-pipe fan coil units
Domestic Hot Water System:	Steam heat exchangers from district steam system
Building Automation Controls:	No controls
Other Systems / Loads:	Plug loads
Electric Utility Source:	Entergy account: 1834175
Natural Gas Utility Source:	CenterPoint account: BG-96179
Domestic Water Utility Source:	Hot Springs Municipality account: 41052000

Modeled Historical Energy Use Summary

Site EUI:	**151.9**	**kBtu/SF**
Site ECI:	**1.3**	**$/SF**
Lighting:	4.4	%
Air Distribution:	2.5	%
Cooling:	8.1	%
Space Heating:	73.2	%
Domestic Hot Water:	8.2	%
Other:	3.5	%
Total:	100.0	%



BUILDING 6

Gross Floor Area (SF): 34,522

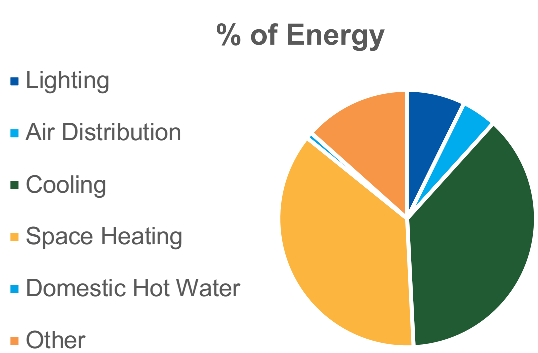
General Overview:

This building houses office spaces, culinary classes, classrooms, and conference spaces.

Lighting System:	A mixture of multiple types of lighting upgraded over time
Air Distribution System:	Variable air volume
Cooling System:	Rooftop direct expansion units
Space Heating System:	Rooftop air handler gas heating
Domestic Hot Water System:	Individual water heater
Building Automation Controls:	New Alerton direct digital controls
Other Systems / Loads:	Culinary classes and plug loads
Electric Utility Source:	Entergy account: 108563792
Natural Gas Utility Source:	CenterPoint account: 9877180-1
Domestic Water Utility Source:	Hot Springs Municipality account: 5004

Modeled Historical Energy Use Summary

Site EUI:	**89.5**	**kBtu/SF**
Site ECI:	**1.6**	**$/SF**
Lighting:	7.3	%
Air Distribution:	4.4	%
Cooling:	37.5	%
Space Heating:	36.6	%
Domestic Hot Water:	0.8	%
Other:	13.4	%
Total:	100.0	%



Building Envelope

Overall, the buildings consist of primarily masonry construction with a cementitious or masonry interior finish. A combination of overhangs and masonry walls has resulted in very few leaks being identified in the initial walk-thru. A leak in the wall was noted in the basement, but it was adjacent to a steam leak so it was impossible to differentiate the condensation from the leak. A leak in an internal roof drain was also noted in the basement and was contributing to the standing water.

The majority of windows are metal with single pane glazing which provides virtually no insulating value. Some windows have storm windows installed, but these also provide virtually no insulating value. A total building envelope survey would be advised due to the age of the facility. Multiple windows were noted as open during the site visit. Closing these windows will have a huge impact on overall performance in any building especially given the quantity of windows in the facility. Due to the historical significance of the building and the material finishes, replacing windows is a complicated endeavor that will required a professional installation team. The previously replaced windows required wood trim at the head and a new metal sill installed on the interior. Significant savings are possible with improved energy efficient windows.

ACTI also noted that the mortar joints in the cornice has eroded away. This could not be confirmed during the site visit and will not affect the energy usage, however, it is recommended that ACTI have this repaired outside of this contract.

Lighting

In general, all campus buildings are mostly equipped with standard fluorescent and incandescent lighting, with a few areas provided with LED fixtures with room level controls. A comprehensive lighting survey was completed for the entire facility. In total, there are 3,464 fixtures throughout the buildings. With exception to the existing LED fixtures, all of the remaining fixtures are recommended for retrofit or replacement to a more energy efficient LED lighting system. The table below provides a summary of the existing fixture types and quantities.

TABLE 2 INTERIOR LIGHTING FIXTURE COUNTS

Building	Total Qty	T8	CFL	LED	T12	Incandescent	T5	Halogen
Building 1 - Main	2010	703	94	132	668	395	18	0
Ross Hall	292	41	6	20	157	68	0	0
Building 6	370	327	37	0	0	6	0	0
Building 11	35	9	2	0	16	8	0	0
Building 12	57	32	0	0	23	2	0	0
Building 14	77	53	0	0	23	1	0	0
Building 16	40	8	0	0	31	1	0	0
Building 17	7	6	0	0	1	0	0	0
Building 22	15	5	0	0	1	9	0	0
Building 25	38	34	0	0	4	0	0	0
Building 26 E	19	1	4	1	0	13	0	0
Building 27 E	19	1	4	1	0	13	0	0
Building 36 E	14	1	7	3	1	2	0	0
Building 37 E	11	1	2	1	0	6	0	1

Building	Total Qty	T8	CFL	LED	T12	Incandescent	T5	Halogen
Building 40	2	0	0	0	2	0	0	0
Building 41	13	0	0	0	4	9	0	0
Building 52	24	4	0	0	20	0	0	0
Building 53	44	32	4	0	8	0	0	0
Building 54	214	209	0	0	3	2	0	0
Building 55	158	156	0	0	1	1	0	0
Building 61	5	5	0	0	0	0	0	0

TABLE 3 EXISTING EXTERIOR LIGHTING FIXTURES

Building	Quantity	Fixture Type
Main Building	5	MH-MH200-1
Main Building	1	CFL-CFQ13W-1
Walkway lighting poles green	22	MV-MV175-1
Entrance yellow slow lights	1	INCAN-I60-3
Spot lights in front of Main Building	2	MH-MH70-3
Break area outside	1	MH-MH70-1
Parking Lot behind Main Building	4	INCAN-I300-1
Parking Lot behind Main Building	2	LED-L16-1
Building 100 garage	1	MV-MV175-1
Building 100 garage	2	CFL-CF42W-1
Building 100 garage	1	INCAN-I60-3
Building 26	2	CFL-CFQ13W-1
Building 26	3	INCAN-I60-1
Building 27	1	INCAN-I90-1
Building 27	7	INCAN-I60-1
Entrance Monument spot light	1	INCAN-I60-1
Tunnel through entrance	2	LED-L25-1
Back Entrance tunnel Main Building	3	LED-L25-1
Building 6 Client Services and main entrance	10	CFL-CFQ26W-2
Building 2 Ross Hall	1	MV-MV175-1
Building 2 Ross Hall	1	MH-MH70-1
Building 2 Ross Hall	8	INCAN-I60-2
Building 2 Ross Hall	4	MH-MH175-1
Building 14 Maintenance	1	MV-MV175-1
Building 40	1	MV-MV175-1
Building 25 Welding	1	MV-MV175-1
Building 53	1	MV-MV175-1
Building 52	1	MV-MV175-1
Building 54	3	MV-MV400-1
Building 54	1	F-F48T12-4
Building 55	2	MV-MV400-1

Building	Quantity	Fixture Type
Building 55	1	F-F48T12-4
Building 55	1	MV-MV175-1
Building 58	1	MV-MV175-1
HVAC building 61	1	MV-MV175-1
Walk way and parking lot	2	MV-MV175-1
Building 12 plumbing/laundry	2	MV-MV175-1
Building 12 plumbing/laundry	1	MH-MH70-1
Building 16 Carpenter Shop	1	MH-MH70-1
Building 16 Carpenter Shop	1	MV-MV175-1
Building 16 Carpenter Shop	1	CFL-CFQ13W-1
Building 16 Carpenter Shop	1	LED-L16-1
Boiler Room	1	CFL-CFQ13W-1
Boiler Room	1	INCAN-I300-1
Boiler Room	2	INCAN-I90-1
Boiler Room	1	MV-MV175-1
Decorative pole light	4	CFL-CFS9W-1
Main Building Roof 9th floor	4	INCAN-I60-1
Main Building Roof 9th floor	25	INCAN-I150-1
Main Building Roof 9th floor	614	INCAN-11-1
Main Building Roof 9th floor	1	MV-MV175-1
Volleyball area	4	INCAN-I300-1

TABLE 4 EXISTING LIGHTING USAGES

Building	Interior Lighting Power Density (W/sqft)	Exterior Lighting Power (kW)
Building 1 - Main	0.70	15.21
Ross Hall	0.63	2.12
Building 6	0.90	0.20
Building 11	0.50	0.70
Building 12	0.92	0.51
Building 14	1.11	0.21
Building 16	0.44	0.33
Building 17	0.83	-
Building 22	2.42	-
Building 25	0.75	0.21
Building 26	0.34	0.21
Building 27	0.31	0.51
Building 36	0.41	-
Building 37	0.49	-
Building 40	1.12	0.21
Building 41	1.38	-

Building	Interior Lighting Power Density (W/sqft)	Exterior Lighting Power (kW)
Building 52	1.12	0.21
Building 53	0.91	0.21
Building 54	0.37	1.51
Building 55	0.42	1.26
Building 61	0.64	0.21
Site Lighting	-	6.03

Electrical

The electrical distribution on the campus is set up behind three utility meters. Building 6 is served by two electric meters; one to serve the main building, the other for the addition. The main campus is served off two main distribution loops, the East and West loops.

The facility is currently in the process of overhauling the electrical distribution system on campus to more reliably supply power to the buildings. Existing electric equipment is past its useful life in some areas, and faulty in others.

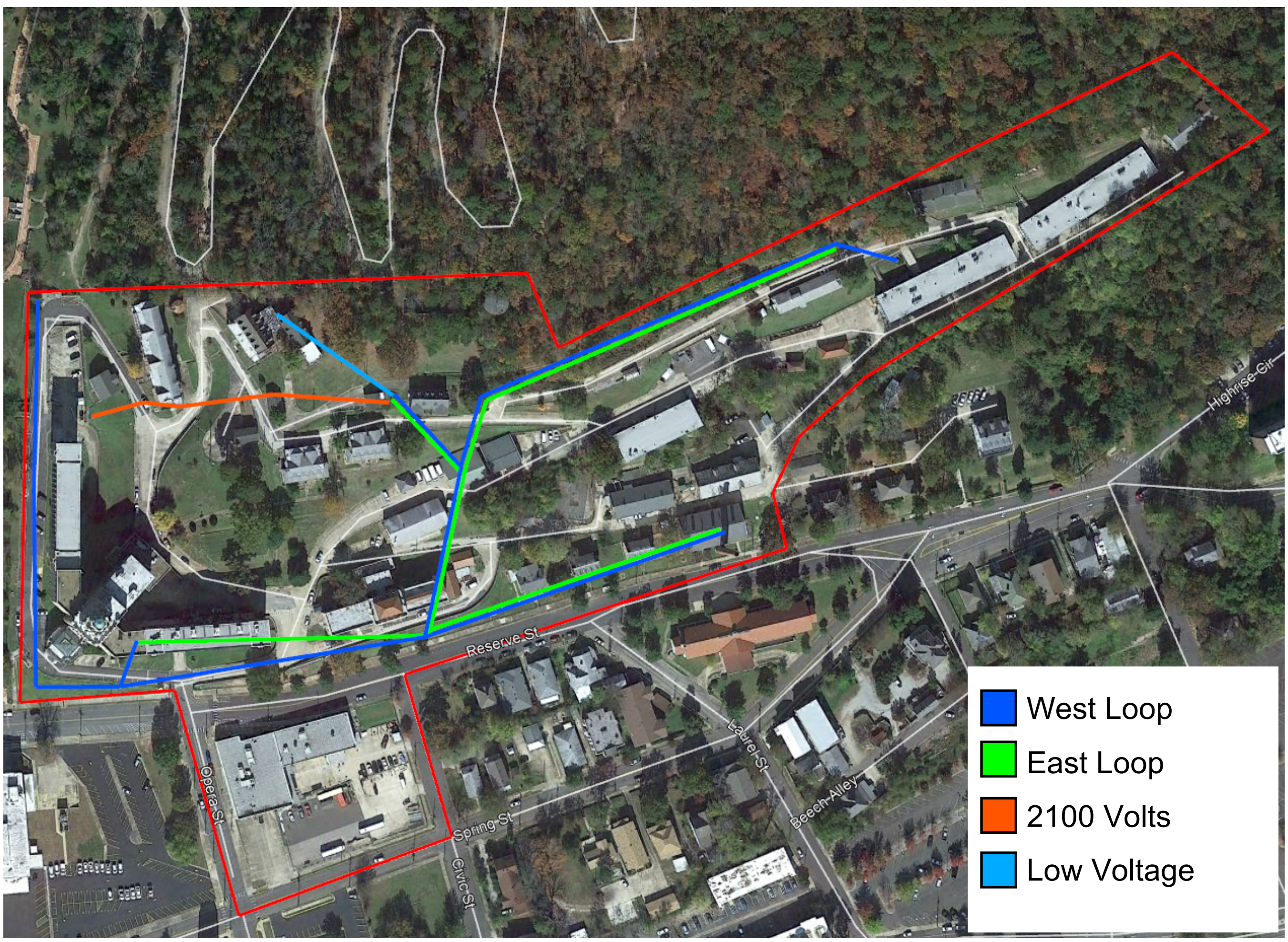


FIGURE 2 CAMPUS ELECTRICAL DISTRIBUTION

HVAC

Most campus buildings are served mostly by DX equipment for cooling and steam from the boiler plant. Several buildings are without cooling and using only gas fired heating during the winter. Buildings 1 and 2 are served primarily by 2-pipe fan coil units with chilled water from chillers in Building 1 and steam, and Building 1 has an additional combination of packaged DX units and constant volume CHW air handlers. The kitchen utilizes a standalone air-cooled chiller to a single air handler to supply adequate cooling for the space. The HVAC in Buildings 29 and 35 are not in operation since those buildings are unoccupied. ACTI hopes to renovate those two buildings in the future to add more classroom and dormitory space. For the purposes of this audit, and since no set timeframe has been allotted for their renovations, the additional usage associated with the buildings has been negated.

The split system DX units are still utilizing R-22 refrigerant which is entering the final 2 years of limited production due to ozone depletion regulations. The cost has risen dramatically to over $50 per pound and can be expected to continue increasing as production is completely phased out. This could result in significantly increased maintenance costs in future years, if the units are not replaced. In addition, replacing all HVAC systems utilized for cooling and heating with a higher efficiency system would provide extraordinary energy savings.

As well as heating the buildings, steam is also used for laundering student sheets, and several appliances in the kitchen. Because of those loads, the boilers are required to run year round.

Table 5: Current Chillers on Campus

#	Designation	Type	Manufacturer	Location	Capacity	Units
1	CH-2	Water-Cooled Centrifugal	Trane	Building 29	40	Tons
2*	CH-1	Water-Cooled Centrifugal	Carrier	Building 1	300	Tons
3*	CH-2	Water-Cooled Centrifugal	Carrier	Building 1	300	Tons
4	Kitchen	Air-cooled		Building 1	40	Tons

* Serves the District Chilled Water System

Table 6 : Current Boilers on Campus

#	Designation	Type	Manufacturer	Location	Capacity	Units
1*	B-1	Steam	Babcock Wilcox	Building 11	450	BHP
2*	B-2	Steam	Babcock Wilcox	Building 11	450	BHP
3*	B-3	Steam	Babcock Wilcox	Building 11	500	BHP
4*	B-4	Steam	Hurst	Building 11	200	BHP
5	B-5	Steam	Kewanee	Building 1	80	BHP

* Serves the District Heating Systems

Table 7: District Energy Service By Building

Building	Building Number	District CHW	District Steam	Indiv. Heating	Indiv. Cooling
Main Building	1	X	X		
Ross Hall	2	X	X		
Work Activity Center	6			X	
Heating Plant & Auto Mechanics	11		X		X
Plumbing Shop & Laundry	12		X		X

Building	Building Number	District CHW	District Steam	Indiv. Heating	Indiv. Cooling
Maintenance & Property Offices	14		X		X
Automobile Mechanics, Carpenter Shop, & Warehouse	16		X		X
Grounds Shop	17		X		X
Storage	19				
Storage	20				
Paint Shop	22		X		X
Welding	25		X		
Staff Duplex	26		X		X
Staff Duplex	27		X		X
Guest House	29		X		X
Staff Duplex	34				X
Future Classroom	35		X		X
Staff Duplex	36				X
Staff Duplex	37				X
Maintenance Storage	38				
Gas & Oil Station	40		X		X
R&T Publication Section	41				
Staff Duplex	43				
Storage	45				
Warehouse	52			X	X
Body & Fender	53				
Classrooms	54			X	X
Small Engine Repair	55			X	X
Warehouse	57				
Bowling Alley	58				
Warehouse	59				
Shelter	60				
Garage	100				
Garage	202				
Guest House Annex	29A		X		X

The table below lists the general HVAC equipment within the district buildings.

TABLE 8: BUILDING HVAC EQUIPMENT

Building Name	Building Number	Cooling System	Heating System
Main Building	1	2 pipe/DX RTU	Steam/Gas
Ross Hall	2	2 pipe FCU	Steam
Work Activity Center	6	DX	Gas
Heating Plant & Auto Mechanics	11	Window Units	Steam

Building Name	Building Number	Cooling System	Heating System
Plumbing Shop & Laundry	12	Window Units	Steam
Maintenance & Property Offices	14	Window Units	Steam
Automobile Mechanics, Carpenter Shop, & Warehouse	16	Window Units	Steam
Grounds Shop	17	DX	Steam
Storage	19	None	None
Storage	20	None	None
Paint Shop	22	Window Units	Steam
Welding	25	None	Steam
Staff Duplex	26	Window Units	Steam
Staff Duplex	27	Window Units	Steam
Guest House	29	Window Units	Steam
Staff Duplex	34	Window Units	
Future Classroom	35	Window Units	Steam
Staff Duplex	36	Window Units	Steam
Staff Duplex	37	Window Units	Steam
Maintenance Storage	38	None	None
Gas & Oil Station	40	Window Units	Steam
R&T Publication Section	41	None	None
Staff Duplex	43	None	None
Storage	45	None	None
Warehouse	52	Window Units	Gas
Body & Fender	53	None	None
Classrooms	54	DX	Gas
Small Engine Repair	55	DX	Gas
Warehouse	57	None	None
Bowling Alley	58	None	None
Warehouse	59	None	None
Shelter	60	None	None
Garage	100	None	None
Garage	202	None	None
Guest House Annex	29A	Window Units	Steam

Building Automation Control System

The main campus is currently without a Building Automation System (BAS) and relies solely on space thermostats. The existing thermostatic controls for all systems provide basic function of the systems, with limited functions and programmability. It is recommended to provide a complete BAS system, at minimum to replace these controls with wireless programmable thermostats to allow scheduling of operation, temperature limits, and remote access for troubleshooting.

Building 6 is equipped with new Alerton controls to a BAS.

Operation and Maintenance

Operation and maintenance (O&M) practices consist mostly of repairing broken equipment, and dealing with hot/cold calls as best as possible. This process leaves a lot of necessary scheduled maintenance items to become deferred and equipment to be used past its useful life. This becomes a cycle of increased maintenance calls, and inability to replace equipment, that leads to inefficiencies in the systems.

Recently, steam leaks have caused expensive repairs to become a necessity in order to maintain the ability to heat the buildings during winter. Roof leaks and other building envelope issues also become problems not only from a building health problem, but also from an energy systems efficiency standpoint. Deteriorating buildings lead to higher infiltration, and higher utility costs and decreased occupant comfort.

To combat the increased maintenance cost associated with equipment that is past its useful life and requires substantial yearly repairs, ACTI has opted to abandon in place pieces of equipment and spaces that could otherwise be used by students. Although this practice will save on energy and operations costs, the abandoned equipment will cause the spaces to become underutilized.

Campus Building Sizes

TABLE 9: BUILDING LIST

Building Name	Building Number	Gross Floor Area (SF)	Function
Main Building	1	210,134	Dorms for Students, Class Rooms, Cafeteria, auditorium, Offices for staff, security
Ross Hall	2	30,794	Student Classrooms and Offices
Work Activity Center	6	34,522	Offices and Culinary Arts, also Salon training
Heating Plant & Auto Mechanics	11	7,832	1st Floor Heating Plant, Second Floor Auto Mechanics
Plumbing Shop & Laundry	12	8,036	1st Floor Auto Mechanics, Second Floor Laundry
Maintenance & Property Offices	14	7,560	Maintenance & Property Offices
Automobile Mechanics, Carpenter Shop, & Warehouse	16	12,300	1st Auto, 2nd Carpenter Shop, 3rd Auto Mech. Classroom
Grounds Shop	17	880	
Storage	19	672	Storage
Storage	20	288	Storage
Paint Shop	22	600	
Welding	25	5,537	
Staff Duplex	26	6,813	
Staff Duplex	27	6,813	
Guest House	29	9,398	Remodel into livable space
Staff Duplex	34	3,704	Remodel into livable space

Building Name	Building Number	Gross Floor Area (SF)	Function
Future Classroom	35	12,765	Future Classrooms
Staff Duplex	36	3,472	Remodel into livable space
Staff Duplex	37	3,472	Remodel into livable space
Maintenance Storage	38	2,240	
Gas & Oil Station	40	308	
R&T Publication Section	41	1,152	Storage
Staff Duplex	43	4,770	Storage
Storage	45	320	Storage
Warehouse	52	3,010	
Body & Fender	53	6,240	
Classrooms	54	21,520	Office Machine Repair/Supervisor Voc. Training/Sales Clerk/ Upholstery/Adult Basic Ed./Drafting/Comprehensive Sewing
Small Engine Repair	55	14,304	
Warehouse	57	4,640	Storage
Bowling Alley	58	3,700	Storage
Warehouse	59	1,352	Storage
Shelter	60	880	Storage
Garage	100	1,628	Storage
Garage	202	1,100	Storage
Guest House Annex	29A	6,366	Storage
Total		**439,122**	

Occupancy

- Operational Schedules
  - Building 6, 53, 54
    - 8:00-5:00 (empty after 5:00)
    - Class 8:00-3:30 (open campus after that)
    - Out of School
      - Last week of May – 2nd week of June
      - Last week of July – August 1st (students back a few days early)

- Dec. 12th – Jan. 5th

- Main Building Floors
  - Basement: Empty after hours
  - 1st: 8:00-5:00
  - 2nd: Empty
  - 3rd: Cafeteria closes at 6
  - 4th: 4:30
  - 5th: Dorm and computer lab
  - 6th: Dorm
  - 7th: 4:30
  - 8th: 4:30
  - 9th: Unoccupied

Historical Energy Use

Purchased Utilities Overview

ACTI receives electricity, natural gas, water and sewer services from three different utilities services providers.

Electricity is provided by Entergy Arkansas, Inc. through four (4) meters. Natural gas is provided by CenterPoint Energy through three (3) meters used for HVAC heating, kitchen equipment, water heaters, and steam. Water and Sewer services are provided by the City of Hot Springs through three (3) meters for domestic water use, cooking, and steam, and cooling.

A site meter survey was completed for the campus to help identify the number, types, and locations of all utility meters on campus. A copy of the meter reports is included in Appendix A for review and reference.

Electricity, natural gas, water/sewer use and costs for the facility is based on the utility information provided. A summary of the utility use and costs is provided in the tables below. More detailed summaries are included in the appendix.

The following table is a summary of existing utility accounts for ACTI. Note this information does not include utility accounts associated with telecommunication or other non-energy related utilities beyond the scope of this audit.

TABLE 10 UTILITY ACCOUNT SUMMARY

Utility Type	Utility	Account Number	Address	Description or Address	Annual Consumption	Units
Electric	Entergy Arkansas, Inc	1834175	Hot Springs Rehab Bus	Main E	3,592,000	kWh/yr
Electric	Entergy Arkansas, Inc	108563792	200 Reserve St	Building 6	567,160	kWh/yr

Utility Type	Utility	Account Number	Address	Description or Address	Annual Consumption	Units
Electric	Entergy Arkansas, Inc	118526631	105 Reserve St	Fire Pump	6,777	kWh/yr
Electric	Entergy Arkansas, Inc	1834506	210 Reserve St	Building 6 Addition	4,400	kWh/yr
Natural Gas	CenterPoint Energy	BG-96179	105 Reserve St	Main NG	52,590	MBtu/yr
Natural Gas	CenterPoint Energy	987718	200 Reserve St	200 Reserve	1,167	MBtu/yr
Natural Gas	CenterPoint Energy	73194	201 Reserve St	Building 6 Addition	0	MBtu/yr
Water/Sewer	City of Hot Springs	41052000	105 Reserve St	Main W	12,743	kGal/yr
Water/Sewer	City of Hot Springs	5004	200 Reserve St	200 Reserve	400	kGal/yr
Water/Sewer	City of Hot Springs	41051000	200 Reserve St	Fire Pump	128	kGal/yr

Most buildings on campus, with the exception of building 6, are behind a single campus meter for electric, natural gas, and water/sewer. This arrangement is often referred to as a master meter where a single meter serves multiple building loads or multiple meters are combined into a single account and treated as a single meter prior to the application of rates.

Building 6 is serviced by two electric meters, two natural gas meters, and one water meter. One set of electric and natural gas meters serves an addition on one end of the building. These meters were added during the construction of the addition as an alternative to pulling power from the opposite end of the building. The natural gas meter to the addition currently has no load associated with it, because the natural gas was necessary when the addition was being used as the cooking training center. That course has since been moved to a building on the main campus, and the meter is still active as if in service.

There are a set of meters on the campus that serve water and electricity to a fire pump. A fire pump is required by the fire department for this campus for fear that if a fire were to break out on top of the hill that the buildings sit on, there wouldn’t be enough pressure to properly push the water to the fire. Because of this requirement and the location of the pump, ACTI has a separate electric and water service to that pump. Those accounts were not included in these calculations since the usage should be consistent year to year, and only fluctuate in the case of a fire.

Throughout this IGA report, utility units have been converted to common metrics for comparative and mathematical purposes. The following table illustrates the factors utilized for these unit conversions.

TABLE 11: UTILITY UNIT CONVERSION FACTORS

Utility	Company	Utility Bill Units	IGA Units	Conversion Factor
Natural Gas	CenterPoint Energy	CCF (100 cubic feet)	MBtu (1,000,000 Btu)	0.102
Natural Gas	Constellation	DTH (Decatherm)	MBtu (1,000,000 Btu)	1
Electricity	Entergy Arkansas	kWh, kW	kWh, kW	1
Water	City of Hot Springs	100/gals	kGals (1000 Gallons)	0.10
Sewer	City of Hot Springs	100/gals	kGals (1000 Gallons)	0.10

Following the on-site inspection and data collection activities, an in-depth analysis is necessary to properly understand current operations on campus and to establish an appropriate baseline of energy consumption and costs. This in-depth analysis involves a comprehensive evaluation and understanding of historical utility consumption, existing building operations, and associated utility infrastructure serving the building and its energy related systems. This analysis requires the development of an energy model that simulates building operations. Utilizing information obtained from the inspection and data collection activities, an energy model is developed and calibrated to closely match historical utility consumption and costs. Once calibrated, the energy model provides a baseline to evaluate identified energy conservation and operational measures. This section provides information used to establish the baseline energy model for ACTI.

Building Model Methodology

Following extensive on-site surveys and data collection activities, an in-depth analysis is necessary to properly understand current operations on campus and to establish an appropriate baseline of energy consumption and costs. This in-depth analysis involves a comprehensive evaluation and understanding of historical utility consumption, existing building operations, and associated utility infrastructure serving each building and its energy related systems. This analysis requires the development of an energy model that simulates historical operations across the entire campus. Utilizing information obtained from the survey and data collection activities, an energy model is developed and calibrated to closely match historical utility consumption and costs. Once calibrated, the energy model provides a viable tool to evaluate identified cost reduction measures. This section provides information used to establish the baseline energy model and its subsequent use to evaluate cost reduction measures for ACTI.

Energy models for commercial buildings is an effective tool to simulate energy performance and quantify energy improvements, especially when complex systems are present. There are a number of approaches that can be taken to develop an energy model with the most common approaches including exception-based spreadsheet calculations, whole-building spreadsheet simulation, or third-party software simulation. For this IGA, Bernhard elected to utilize its proprietary whole-building simulation spreadsheet model. This approach provides a number of benefits to the IGA process including: expediency, transparency, and flexibility. Due to the timetable expressed by ACTI to complete the IGA and the complexity of the systems on the ACTI campus, a spreadsheet energy model approach was clearly the ideal solution for this IGA.

Overview of the Model:

- Spreadsheet-based
- Employs whole-building simulation of key energy and utility consuming systems by building.
    - Lighting
    - Air Distribution
    - Cooling

- Space Heating
- Domestic Hot Water
- Humidification
- Miscellaneous

- Utilizes annual-based calculations supported by survey and utility data.
- Utilizes engineering-based peak load calculations calibrated to weather and utility data.
- Load calibration occurs at the meter level and the plant level.
- Costs are validated based on utility invoicing by account.
- Utility consumptions are converted to costs utilizing modeled consumptions and a rate engine.
- Includes 3 key models using the same calculation engine: Historical, Baseline, and Proposed.

Historical Utility Consumptions and Costs

The following table is a summary of historical utility consumption and cost by utility type. This information is based on utility data obtained for the time period from November 2017 to October 2018 and includes all identified utility accounts as detailed in the previous section of this report.

TABLE 12: EXISTING UTILITY CONSUMPTION AND COST SUMMARY

Utility	Consumption	Units	Cost	Unit Cost	Units
Electricity	4,170,337	kWh/Year	$297,690	0.07	$/kWh
Natural Gas	53,757	MMBtu/Year	$254,629	4.74	$/MMBtu
Water/Sewer	13,270	kGals/Year	$132,198	9.96	$/kGals
Total			**$684,518**	**$/Year**	

Historical Utility Consumptions and Costs

TABLE 13: ACTUAL VERSUS MODELED UTILITY CONSUMPTION

Utility	Actual Consumption	Modeled Consumption	Units	Variance	
Electricity	4,170,337	4,209,981	kWh/Year	39,644	1%
Natural Gas	53,757	54,500	MMBtu/Year	743	1%
Water / Sewer	13,270	12,910	MGals/Year	-360	-3%

TABLE 14: ACTUAL VERSUS MODELED UTILITY COST

Utility	Actual Cost	Modeled Cost	Units	Variance	
Electricity	$297,690	$302,316	$/Year	4,626	2%
Natural Gas	$254,629	$257,844	$/Year	3,215	1%
Water / Sewer	$132,198	$132,727	$/Year	529	0%
Total	**$684,518**	**$692,887**	**$/Year**	**8,370**	**1%**

As seen from the tables above, the historical baseline energy model closely matches historical utility consumptions and costs. While some error is expected in this process due to the lack of very detailed hourly operational data at each building, the model provides sufficient accuracy to simulate historical operations and utility consumption profiles on campus. As discussed in the following sections of this report, this historical baseline model will be subsequently modified to simulate and evaluate energy conservation measures proposed on campus.

Historical Energy Plant Load Summary

Due to the lack of a building management system on campus, plant loads have been assumed based off direction from facility staff and modeled outputs. Below are the model outputs for the chilled water and steam systems.

TABLE 15: HISTORICAL PLANT PRODUCTION

Item	Unit	Value
Peak Chilled Water	Tons	206
Annual Chilled water	Ton-Hrs/Yr	549.910
Peak Steam Production	HP	177
Annual Steam Production	MMBtu/Yr	11,696

Baseline Energy Use

Baseline Utility Consumption and Costs

Once the energy model has been established and calibrated based on historical utility consumption and operations, additional adjustments to the baseline are often required to properly consider known changes that are underway or eminent. The most common adjustments to the baseline are often the result of future growth (new buildings), utility rate changes, or code deficiencies. These baseline adjustments are required to accurately compare prospective energy conservation or operational measures that are being considered. Without such adjustments to the baseline, the viability of potential energy or operational cost reduction measures may be misrepresented. Using the calibrated historical baseline model, the following adjustments were made to reflect a baseline period assuming these issues were addressed. The table 15 below provides a summary of the adjusted utility consumption and costs.

During the course of the IGA development of ACTI, the facility staff voiced concerns over the lack of security lighting on campus. In order to nullify the increase in electric usage for those lights, an additional lighting load of 30 kW was added to the energy model.

So as to eliminate sweating on chilled water pipes throughout the building, ACTI raised the chilled water supply temperatures from the chillers to 60 degrees Fahrenheit. While this method reduced the sweating and decreased energy usage, other problems developed in the buildings. Because of the high temperature of the water, there is not enough thermal energy to effectively dehumidify the air inside the building. The chilled water was lowered in the existing period, and an adjustment was made in the baseline model to capture the increased energy that wasn't properly captured in the utility bills due to the season of the year.

Currently there exists two direct expansion roof top air handling units that serve the auditorium. Those air handling units are currently not operational since the cost to repair them outweighs the usefulness of conditioning the space. During the scope of this project, ACTI wishes to replace them in order to more effectively utilize the space. An adjustment to the model has been made to assume additional total electric usage that would have been used if those air handlers were currently in operation.

TABLE 16: BASELINE UTILITY CONSUMPTION AND COST SUMMARY

Utility	Consumption	Units	Cost	Unit Cost	Units
Electricity	5,164,861	kWh/Year	$422,779	$.0819	$/kWh
Natural Gas	54,988	MMBtu/Year	$260,121	$4.73	$/MMBtu
Water/Sewer	14,520	kGals/Year	$150,956	$10.40	$/kGals
Total			**$833,856**	**$/Year**	

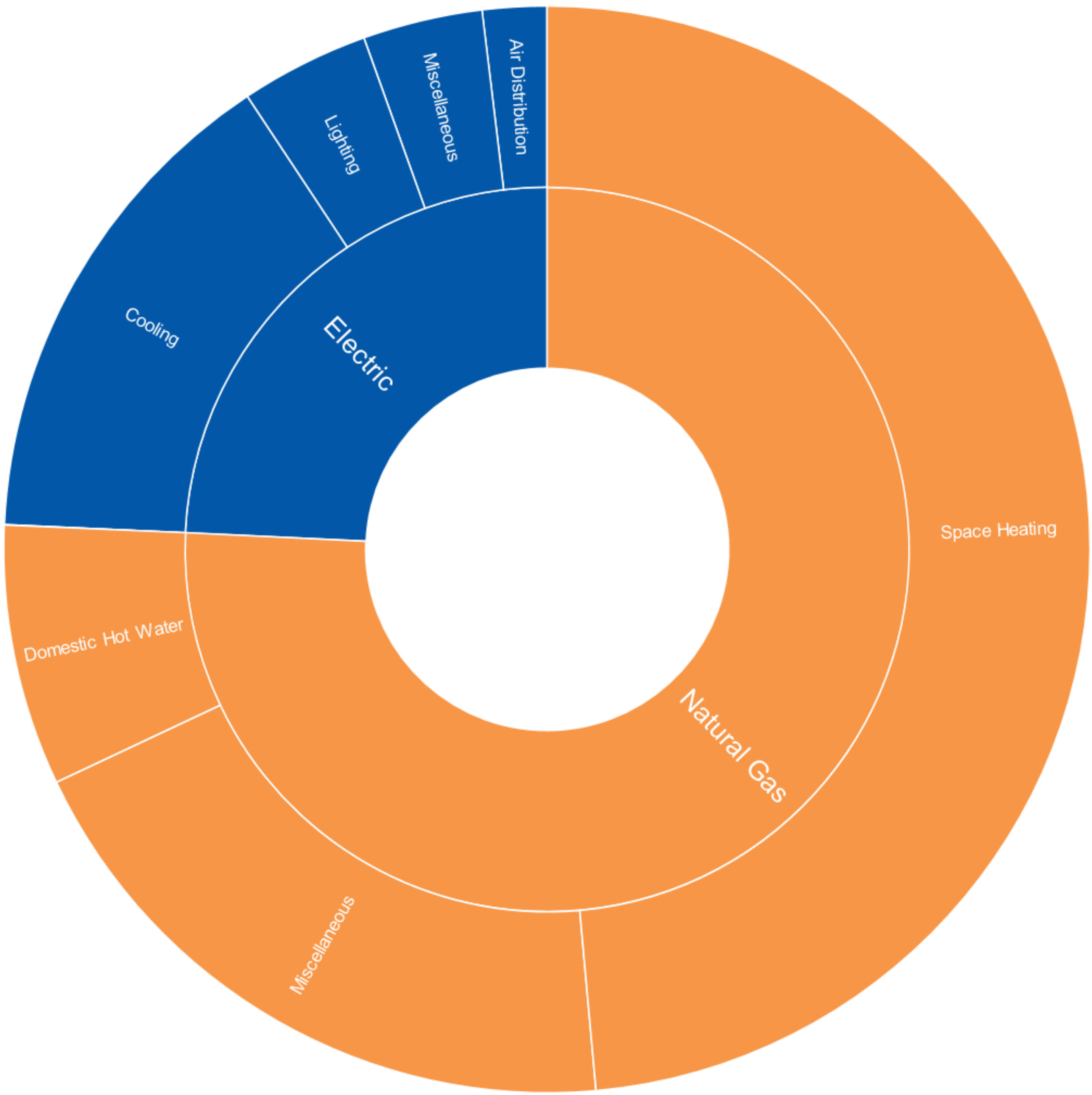


FIGURE 3 CAMPUS BASELINE UTILITY CONSUMPTION COMPARISON (PERCENTAGE OF TOTAL KBTU)

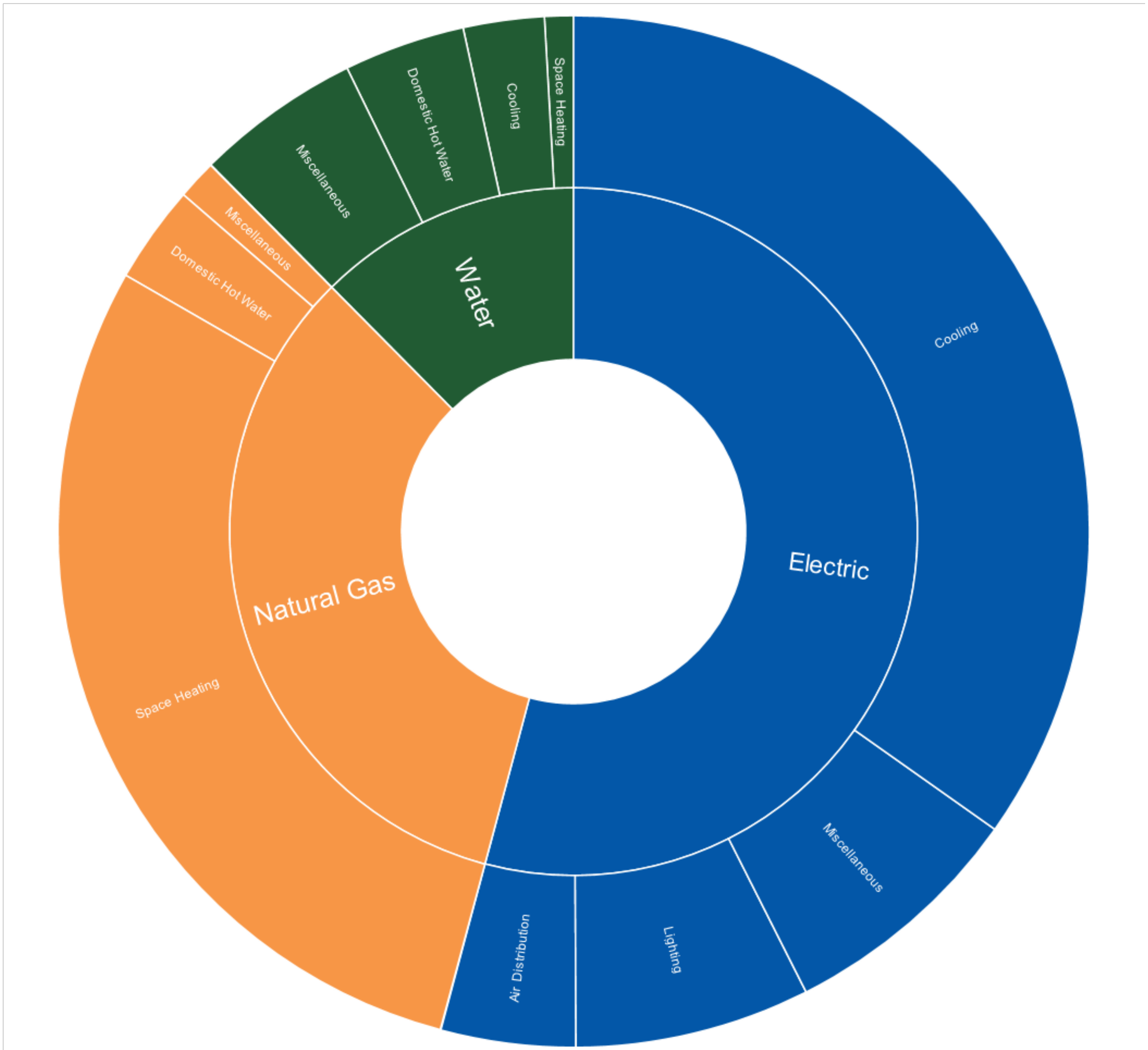


FIGURE 4 CAMPUS BASELINE UTILITY COSTS (PERCENTAGE OF TOTAL COSTS)

Current operation of the steam system is causing a large percentage of the overall consumption of the campus to fall to natural gas usage. In an Arkansas higher education setting, 76% of ACTI. A large portion of this gas usage is due to the use of steam kitchen equipment and steam laundry use. This high sum of steam use is not normal for a higher education facility, and the increased boiler size needed to accommodate all the steam uses leads to great inefficiencies in the system.

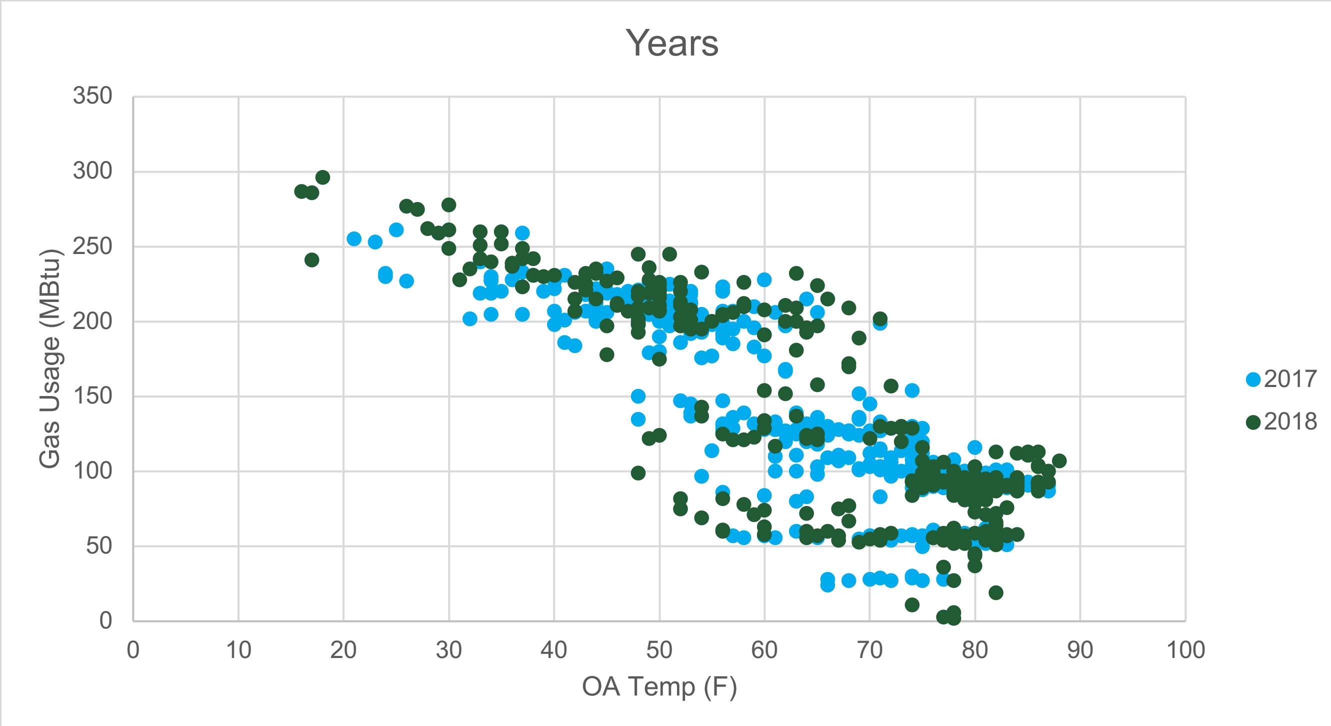


Figure 5 Daily Gas Consumption Vs Outside Air Temp

Baseline Energy Plant Load Summary

Table 17: Baseline Plant Production

Item	Unit	Value
Peak Chilled Water	Tons	444
Annual Chilled water	Ton-Hrs/Yr	1,189,787
Peak Steam Production	HP	178
Annual Steam Production	MMBtu/Yr	11,868

Baseline Operations and Maintenance Costs

No adjustments to operations and maintenance budget has been assessed.

The following table is a summary of the operations and maintenance cost baseline.

TABLE 18: O&M COST BASELINE

Item	BAU O&M Cost
Chiller Maintenance	$61,946
Water Treatment	$5,159
Electrical Maintenance	$116,528
Boiler/Steam Personnel	$336,321
Steam Repairs	$201,791
Lighting Repairs	$28,946
HVAC Maintenance/Repairs	$87,822
Other	$25,310
Generator Fuel	$5,365
Total	**$869,188**

Baseline Life Cycle Cost Summary

The consumption and costs described in this section of the report are referred to as the Business As Usual (BAU) case. The BAU reflects projected costs based on current operations as they exist today. The BAU is the comparative baseline to the ESPC proposed solution and includes costs associated with the adjusted utility baseline, operations and maintenance costs baseline, avoided capital costs, and capital renewal and deferred maintenance costs. The following table provides a summary of projected BAU costs each year over the next 22 years considering appropriate cost escalations for each category.

TABLE 19: BASELINE COST SUMMARY

Year	Electricity Costs ($)	Natural Gas Costs ($)	Water/Sewer Costs ($)	Operating Expenses ($)	Total ($)
0	422,779	260,121	150,956	869,188	1,703,043
1	433,349	266,624	155,484	886,572	1,742,028
2	444,183	273,289	160,149	904,303	1,781,924
3	455,287	280,121	164,953	926,661	1,827,023
4	466,669	287,124	169,902	945,109	1,868,805
5	478,336	294,303	174,999	963,926	1,911,563
6	490,295	301,660	180,249	983,119	1,955,322
7	502,552	309,202	185,656	1,002,696	2,000,106

Year	Electricity Costs ($)	Natural Gas Costs ($)	Water/Sewer Costs ($)	Operating Expenses ($)	Total ($)
8	515,116	316,932	191,226	1,022,664	2,045,938
9	527,994	324,855	196,963	1,043,032	2,092,843
10	541,193	332,976	202,872	1,063,807	2,140,849
11	554,723	341,301	208,958	1,084,998	2,189,980
12	568,591	349,833	215,227	1,106,612	2,240,264
13	582,806	358,579	221,683	1,128,659	2,291,728
14	597,376	367,544	228,334	1,151,147	2,344,401
15	612,311	376,732	235,184	1,174,084	2,398,311
16	627,619	386,150	242,239	1,197,481	2,453,489
17	643,309	395,804	249,507	1,221,345	2,509,965
18	659,392	405,699	256,992	1,245,686	2,567,769
19	675,876	415,842	264,702	1,270,515	2,626,934
20	692,773	426,238	272,643	1,295,839	2,687,493
21	710,093	436,894	280,822	1,321,671	2,749,479
22	727,845	447,816	289,246	1,348,019	2,812,926
Totals	$12,930,468	$7,955,639	$4,898,944	$25,157,132	$50,942,183

Energy Conservation Measures

The Clear Energy team visited the specified buildings on the Arkansas Career Training Institute campus, inspected the building systems in place, obtained copies of the building design documents where available, and examined the available utility billing histories. Using industry standard engineering calculations, we evaluated the existing building systems and found opportunities for energy and operational savings. The Energy Cost Reduction Measures (ECRM) and associated Capital Renewal and Deferred Maintenance (CRDM) items included in the Recommended Program include:

- LED Lighting Retrofits
  - Interior lighting in all occupied buildings
  - Exterior lighting on site lighting
  - Additional safety lighting around campus

- Steam Retrofits
  - Convert steam heating system to heating water
  - Upgrade domestic heating water

- Chilled Water Retrofits
  - Upgrade chilled water system
  - Upgrade DX air handlers
  - Upgrade kitchen mechanical equipment
  - Convert Building 1 and Ross Hall 2-pipe fan coils to a 4-pipe system

- Electrical Retrofits
  - Upgrade capacitor bank
  - Upgrade campus electrical distribution

- Other Upgrades
  - Install building energy management control system
  - Retro-commission of air distribution equipment and controls
  - Install solar array system
  - Install high-efficiency water fixtures

The following ECRMs and CRDMs were evaluated and not recommended for installation.

- Upgrade steam kitchen equipment
- Installing electrical generation plant to use Entergy's OIS rate
- Installing exterior decorative LED lighting
- Replacing air handling units in buildings 54 and 55
- Replacing chilled water air handling units
- Replace Building 1 single pane windows
- Installing building envelope improvements
- Roof repairs
- Install heating system with Hot Springs National Park

A summary of the scope of work is provided within this section for reference.

Lighting Retrofits

The scope of work includes recycling 100% of the existing lamps and ballasts that are removed. Exterior and interior lighting will be upgraded to current technology at appropriate lighting levels throughout the facility. LED lights are significantly more efficient than the existing fixtures at the site. In addition to consuming less energy, waste heat from the lights is also reduced. This relieves the cooling system and contributes to further energy savings, which has been included in the savings calculations.

Exterior lights will be controlled from EMCS based on schedule, photocell input, and security requirements.

When installed, the EEM will help avoid the historical maintenance costs associated with the current lighting systems. The existing compact fluorescent, T8, and Metal Halide lamps have rated lives of 18,000-20,000 hours. By contrast, the lighting systems proposed have the following characteristics:

- Rated average life:
    - TLED and LED lamps: 50,000 hours, 5-year warranty.
    - LED wall packs and parking lot fixtures: 100,000 hours, 5-year warranty.
- Equipment warranties are provided by the respective manufacturer
- Annual savings estimates include only the cost of routine lamp replacements. Additional savings for ballast replacements would be realized but are not considered.

Due to the extended life of the equipment, Clear Energy estimates an annual maintenance savings associated with not having to purchase replacement lamps, ballasts, lift equipment, etc. to be $18,000.

ECRM-2 Retrofit interior lighting to LED

Retrofit Strip Fixtures:

1. Retrofit existing strip fixtures of various lengths and lamp quantities with appropriate kit which includes universal brackets for lamp holders, new lamp holders, LED lamps, and belly pan(s).
2. The existing lamp(s), ballast(s), and belly pan will be removed and recycled.
3. The incoming power will be connected to the lamp holders per the manufacturer's instruction.
4. The bracket and lamp holders will be attached to the channel of the existing strip, the new belly pan(s) will be installed between the lamp holders, and the new LED lamp(s) will be inserted into the new lamp holders.
5. The installation area will be cleaned and returned to the general condition as prior to the retrofit.

Retrofit Troffer Fixtures with Kit:

1. Retrofit existing troffer fixtures of various lengths, widths and lamp quantities that will be delamped with appropriate kit which includes socket bars for lamp holders, new lamp holders, LED lamps, and wiring cover.
2. The existing lamp(s), ballast(s), and wiring cover will be removed and recycled.
3. The incoming power will be connected to the lamp holders per the manufacturer's instruction.
4. The socket bar with the lamp holders will be centered along each end of the troffer and attached to the troffer, the wiring cover will be installed on the socket bars between the lamp holders, and the new LED lamps will be inserted into the new lamp holders.
5. The lens of the troffer will be cleaned or replaced if it has obvious damage.
6. The installation area will be cleaned and returned to the general condition as prior to the retrofit.

Retrofit Direct / Indirect Fixtures:

1. Retrofit existing direct/indirect fixtures of various lengths, widths and lamp quantities with new LED lamps.
2. The existing lamp(s) and ballast(s) will be removed and recycled, and the lamp holders will be replaced with new lamp holders (if applicable).
3. The incoming power will be connected to the lamp holders per the manufacturer's instruction.
4. The wiring cover will be reinstalled in the fixture, and the new LED lamps will be inserted into the new lamp holders.
5. The lens of the fixture (if applicable) will be cleaned or replaced if it has obvious damage.
6. The installation area will be cleaned and returned to the general condition as prior to the retrofit.

Retrofit Troffer Fixtures:

1. Retrofit existing troffer fixtures of various lengths, widths and lamp quantities with new LED lamps.
2. The existing lamp(s) and ballast(s) will be removed and recycled and the lamp holders will be replaced with new lamp holders.
3. The incoming power will be connected to the lamp holders per the manufacturer's instruction.
4. The wiring cover will be reinstalled in the fixture, and the new LED lamps will be inserted into the new lamp holders.
5. The lens of the troffer will be cleaned or replaced if it has obvious damage.
6. The installation area will be cleaned and returned to the general condition as prior to the retrofit.

Retrofit Vanity Fixtures:

1. Retrofit existing vanity fixtures of various sizes and lamp quantities with new led lamp(s).
2. The existing lamp(s) and ballast(s) will be removed and recycled.
3. The incoming power will be connected to the lamp holders per the manufacturer's instruction.
4. The new LED lamp(s) will be inserted into the lamp holder(s).
5. The lens of the fixture will be cleaned (if applicable).
6. The installation area will be cleaned and returned to the general condition as prior to the retrofit.

Retrofit Vaportight Fixtures:

1. Retrofit existing vaportight fixtures of various lengths, widths and lamp quantities with new LED lamps.
2. The existing lamp(s) and ballast(s) will be removed and recycled, and the lamp holders will be replaced with new lamp holders.
3. The incoming power will be connected to the lamp holders per the manufacturer's instruction.
4. The wiring cover will be reinstalled in the fixture, and the new LED lamps will be inserted into the new lamp holders.
5. The lens of the fixture will be cleaned and reinstalled.
6. The installation area will be cleaned and returned to the general condition as prior to the retrofit.

Retrofit Wrap Fixtures:

1. Retrofit existing wrap fixtures of various lengths, widths and lamp quantities with new LED lamps.
2. The existing lamp(s) and ballast(s) will be removed and recycled and the lamp holders will be replaced with new lamp holders.
3. The incoming power will be connected to the lamp holders per the manufacturer's instruction.
4. The wiring cover will be reinstalled in the fixture, and the new LED lamps will be inserted into the new lamp holders.
5. The lens of the fixture will be cleaned and reinstalled.

6. The installation area will be cleaned and returned to the general condition as prior to the retrofit.

Re-lamp Decorative Fixtures:

1. Re-lamp existing decorative fixture with new LED lamp(s).
2. The existing lamp(s) will be removed and recycled, and new LED lamp(s) will be inserted into the lamp holder.
3. The lens of the fixture will be cleaned (if applicable).
4. The installation area will be cleaned and returned to the general condition as prior to the re-lamping.

Re-lamp Flood Fixtures:

1. Re-lamp existing flood fixture with new LED lamp(s).
2. The existing lamp(s) will be removed and recycled, and new LED lamp(s) will be inserted into the lamp holder.
3. The lens of the fixture will be cleaned (if applicable).
4. The installation area will be cleaned and returned to the general condition as prior to the re-lamping.

Re-lamp Jelly Jar Fixtures:

1. Re-lamp existing jelly jar fixture with new LED lamp(s).
2. The existing lamp(s) will be removed and recycled, and new LED lamp(s) will be inserted into the lamp holder.
3. The lens of the fixture will be cleaned (if applicable).
4. The installation area will be cleaned and returned to the general condition as prior to the re-lamping.

Re-lamp Keyless Fixtures:

1. Re-lamp existing keyless fixture with new LED lamp(s).
2. The existing lamp(s) will be removed and recycled, and new LED lamp(s) will be inserted into the lamp holder.
3. The lens of the fixture will be cleaned (if applicable).
4. The installation area will be cleaned and returned to the general condition as prior to the re-lamping.

Re-lamp Pendant Fixtures:

1. Re-lamp existing pendant fixture with new LED lamp(s).
2. The existing lamp(s) will be removed and recycled and new LED lamp(s) will be inserted into the lamp holder.
3. The lens of the fixture will be cleaned (if applicable).
4. The installation area will be cleaned and returned to the general condition as prior to the re-lamping.

Re-lamp Round Fixtures:

1. Re-lamp existing round fixture with new LED lamp(s).
2. The existing lamp(s) will be removed and recycled, and new LED lamp(s) will be inserted into the lamp holder.
3. The lens of the fixture will be cleaned (if applicable).
4. The installation area will be cleaned and returned to the general condition as prior to the re-lamping.

Re-lamp Square Fixtures:

1. Re-lamp existing square fixture with new LED lamp(s).
2. The existing lamp(s) will be removed and recycled, and new LED lamp(s) will be inserted into the lamp holder.
3. The lens of the fixture will be cleaned (if applicable).
4. The installation area will be cleaned and returned to the general condition as prior to the re-lamping.

Re-lamp Vanity Fixtures:

1. Re-lamp existing vanity fixture with new LED lamp(s).
2. The existing lamp(s) will be removed and recycled, and new LED lamp(s) will be inserted into the lamp holder.
3. The lens of the fixture will be cleaned (if applicable).
4. The installation area will be cleaned and returned to the general condition as prior to the re-lamping.

Replace Bed Light Fixtures:

1. Replace existing bed light fixture with new LED bed light.
2. The existing lamp(s), ballast(s) and bed light fixture will be removed and recycled.
3. The new bed light will be wired into the existing junction box and the bed light will be installed on to the wall.
4. The installation area will be cleaned and returned to the general condition as prior to the installation.

Replace Can Light Fixtures:

1. Replace existing can light fixture with new LED can light.
2. The existing lamp(s), ballast(s) and can light housing will be removed and recycled.
3. The new can light will be wired into the existing junction box and the can light will be installed into the ceiling.
4. Additional extender rings will be installed if necessary, to ensure the existing hole is fully covered.
5. The installation area will be cleaned and returned to the general condition as prior to the installation.

Replace Troffer Fixtures:

1. Replace existing troffer fixture with new LED troffer fixture or LED Panel.
2. The existing lamp(s), ballast(s) and fixture will be removed and recycled.
3. The new fixture will be installed in the T-grid and connected to electrical connection of the fixture being replaced.
4. The installation area will be cleaned and returned to the general condition as prior to the installation.

Replace Vaportight Fixtures:

1. Replace existing vaportight light fixture with new LED vaportight fixture.
2. The existing lamp(s), ballast(s) and fixture will be removed and recycled.
3. The new fixture will be connected to the existing electrical connections.
4. The fixture will be securely installed in the location the existing fixture was removed.
5. The installation area will be cleaned and returned to the general condition as prior to the installation.

ECRM-3 Retrofit exterior lighting to LED

1. Retrofit existing post top light fixtures with an internal LED retrofit kit.
2. Other existing area lighting fixtures will have the entire fixture head replaced with a solid state LED area shoebox fixture.
3. Existing metal poles for area lighting will be reused. Exterior locations without adequate lighting will utilize wall mounted LED lighting fixtures.
4. Existing historic fixtures will be preserved and retrofitted to the best of our ability to keep the historic integrity of the facility.
5. Existing historic fixtures that are no longer working and unable to be repaired will be removed and replaced with new lighting fixtures to improve lighting levels. Existing historic fixtures that are in working order, but are not in ideal locations, will be relocated to more suitable locations on campus.
6. New lighting fixtures will be controlled with integral fixture mounted photocells for dusk to dawn operation.

COUNT	TYPE	LAMP	NOTES
2	B1	2GTL4R-48L-EZ1-LP840	24" X 48" RECESSED LIGHT LED RETROFIT ASSEMBLY
1	ER	N/A	EXISTING FIXTURE TO BE REMOVED
3	EX	N/A	EXISTING FIXTURE TO REMAIN
10	F1	9WLED/800L/840	EXTISTING FIXTURE TO REMAIN, LAMP TO BE REPLACED
3	F2	9WLED/800L/840	EXTISTING FIXTURE TO REMAIN, LAMP TO BE REPLACED
2	F3	HL-OC-36W-E39	LED FLOOD LIGHT LAMP
1	G1	8WLED/525L/840	EXTISTING FIXTURE TO REMAIN, LAMP TO BE REPLACED
10	G3	15.5PLH/840/BYP15.5WLED/1800L/840	EXTISTING FIXTURE TO REMAIN, LAMP TO BE REPLACED
24	H1	36WLED/5040L/850	GREEN POST TOP FIXTURE, FIXTURE TO REMAIN AND REPLACE LAMP
1	J3	8PAR20DIM/940FL408WLED/570L/940	EXTISTING FIXTURE TO REMAIN, LAMP TO BE REPLACED
2	J6	17PAR38DIM/930FL40/GU2417WLED/1430L/930	EXTISTING FIXTURE TO REMAIN, LAMP TO BE REPLACED
17	S	160WLED/21,833L/740-(SOLAR POWERED)	SINGLE HEAD POLE MOUNTED LED SITE FIXTURE,TYPE 5 DISTRIBUTION, MOUNTED AT 25'-0"
4	S1	114WLED/14,486L/740	DUAL HEAD POLE MOUNTED LED SITE FIXTURE, TYPE 5 DISTRIBUTION, MOUNTED AT 25'-0"
2	S2	114WLED/11486L/740	QUAD HEAD POLE MOUNTED LED SITE FIXTURE, TYPE 5 DISTRIBUTION, MOUNTED AT 25'-0"
1	S3	320WLED/43,600L/740	DUAL HEAD POLE MOUNTED LED SITE FIXTURE, TYPE 4 DISTRIBUTION, MOUNTED AT 25'-0"
5	S4	400WMH-(SOLAR POWERED)	SINGLE HEAD POLE MOUNTED LED SITE FIXTURE, TYPE 2 DISTRIBUTION, MOUNTED AT 25'-0"
52	W	56WLED/7,586L/740LED	WALL MOUNTED AREA LIGHT, TYPE 4 DISTRIBUTION, MOUNTED AT 20'-0"
157	W2	30WLED/2912L/740	LED WALL MOUNTED EXTERIOR WALL PACK, MOUNTED AT 15'-0"
3	W3	30W LED/2912L/740	LED WALL MOUNTED EXTERIOR WALL PACK, MOUNTED AT 15'-0"

Steam Retrofits

The existing campus is primarily heated by a steam system supplied by 100 year old boilers in Building 11. Steam is an inefficient heating system prone to leaks and increased staff to maintain and monitor. This projects primary goal is to remove the existing steam system, and replace it with high efficiency condensing heating water boilers and domestic heating sourced from the underground hot springs that the area is known for.

There are interdependencies between ECRM-4 and ECRM-5 so that ECRM-4 can't be implemented without also completing ECRM-5 but ECRM-5 can be completed stand alone. Currently the steam system serves both the space heating load, domestic water, laundry, and kitchen loads. In order to remove the distributed steam system from campus and convert the majority of the load to heating water, several alterations to the campus need to be made. The scope of this project proposes to remove the large steam boilers from Building 11 and install heating water boilers in Building 1 to serve the heating loads of buildings 1 and 2 in heating water air handling units. Air handling units that currently utilize steam preheat coils, will have a dedicated low pressure point of use boiler so as not to replace new HVAC equipment. The existing laundry and kitchen steam loads will be fulfilled by new, smaller low pressure point of use steam boilers at each location. Domestic heating water, which can currently be seen as using "waste" heat from the steam system, will need to have new water heaters installed which theoretically will cause more energy use for that ECRM alone. The negative impact of that scope has been taken into effect of the project, but it is outweighed by the savings obtained from removing the steam system as a whole. To combat the increased need for gas usage to heat domestic water, it has been suggested to connect to the hot water springs under the campus grounds that supply the national park. During this audit, that measure was analyzed and deemed cost prohibitive based on the cost associated with utilizing to the spring that the Natural Park service charges on a per gallon basis.

The project scope includes the following replacements, upgrades, and alterations of the existing steam system.

ECRM-4 Convert steam heating system to heating water

7. Install new heating water plant in Building 1 in Basement West.
    a. Install two (2) new 3,000 MBH high efficiency condensing heating water boilers in Building 1 to supply heating water to buildings 1 and 2.
        i. In the event of a single heating water converter failure, the remaining boiler would have sufficient capacity to accommodate the peak heating water requirement (N+1 Redundancy).
        ii. Heating water boilers will be manufactured by Lochinvar or equal.
        iii. BAS Communication Protocols shall support BACnet, LON and Modbus protocols
        iv. The heating water piping at each boiler will include isolation valves, strainer, and pressure and temperature test ports.
    b. Install three (3) new heating water pumps sized for 600 GPM, 90' head, 40 HP – HWP-1, HWP-2, and HWP-3 in Building 1 in Basement West.
        i. Heating water pumps will be of the vertical in-line or end suction type. Each pump will be furnished with a high efficiency motor, drip rim base, and spare set of mechanical seals.
        ii. Heating water pumps will be manufactured by Bell & Gossett, Aurora, PACO, TACO, or Armstrong.

iii. Install a variable frequency drive for each new heating water pump with pump bypass.

c. Install one (1) heating water expansion tanks, HW-ET-1, location to be determined in design.

i. Heating water expansion tanks will be connected to the heating water system make-up water piping. The make-up water piping will include a reduced pressure zone backflow preventer, pressure regulating valve with "quick fill" bypass, and relief valve.

ii. The expansion tanks will be of the bladder, full acceptance type.

iii. Expansion tanks will be as manufactured by Wheatley, Amtrol, or Armstrong.

d. Install one (1) heating water air separator, HW-AS-1, location to be determined in design.

i. Air separator will be of the vortex tangential type.

ii. Air separator will have an 8" inlet and outlet.

iii. Air separator will be as manufactured by Armstrong, Amtrol, or Spirotherm.

8. Remove steam fired boilers from Building 11.
9. Abandon in place and cap all existing steam piping from Building 11 to campus buildings.
10. Scope of work for new heating water gas piping to be determined in design.
11. Scope of work for boiler stacks to be determined in design.
12. Install low pressure point of use steam boilers.
    a. Install one (1) 200 MBH steam boilers into Building 1 for dishwasher and steam kettle use.
    b. Install one (1) 200 MBH steam boilers into Building 11 for laundry use.
    c. Install one (1) steam boilers into Building 1 for steam air handling units, size to be determined during design.
13. Existing electrical panel in Basement to be utilized.

ECRM-5 Upgrade domestic heating water

1. Remove (3) existing heat exchangers from buildings 1 and 2.
2. Install new domestic water heaters.
    a. Install two (2) new 200 MBH water heaters in Building 1 in Basement West.
    b. Install one (1) new 200 MBH water heater in Building 2 in Basement Center.

Chilled Water Retrofits

Although two buildings on campus already utilize chilled water, the equipment is 25 years old and is at the end of its useful life. To maximize the performance of the combined chilled water system upgrades, new, efficient chillers need to be installed in place of the old equipment.

ECRM - 8 Upgrade Chilled Water System

1. Remove existing two (2) 300-Ton chillers from Building 1.
2. Install two (2) new 350-Ton magnetic bearing variable speed chillers in Building 1 to replace existing chillers.

3. Remove five (5) existing chilled water pumps, CHP-1, CHP-2, CHP-3, CHP-4, and CHP-5.
4. Install two (2) new-chilled water pumps sized for 480 GPM, 90' head, 40 HP – CHP-1 and CHP-2.
    a. Install new variable frequency drives (VFD's) for new chilled water pumps.
5. Revise piping for five (5) existing chilled water pumps to provide one pump per chiller with crossover piping for manual backup operation.
6. Remove five (5) 3-way chilled water control valves and replace with 2-way control valves.
7. Remove two (2) existing cooling towers and associated equipment.
8. Install one (1) new 700 Ton 2-Cell Cooling Tower CT-1.
9. Remove two (2) existing condenser water pumps serving existing chillers CH-1, CH-2.
10. Install two (2) new condenser water pumps sized for 480 GPM, 20' head, 25 HP for CH-1 & 2 in Building 1 – TWP-1 & 2.
11. Revise tower water pump piping to include crossover piping for manual backup.

ECRM - 10 Update kitchen mechanical equipment

1. Remove one (1) existing 40 Ton air-cooled chiller from outside Kitchen, CH-01.
2. Incorporate kitchen air handling units into Building 1 chilled water system.
    a. Run piping from kitchen AHU to new chillers located in building 1.
3. Upgrade kitchen exhaust system
    a. Remove two (2) existing kitchen exhaust fans
    b. Install one (1) 12,000 cfm exhaust fan in kitchen
    c. Install one (1) 9,600 cfm exhaust fan in kitchen
    d. Exhaust fans are to the supplied with variable frequency drives.
    e. Exhaust fans are to be integrated into the building management system for status and monitoring.

CRDM-2 Replace DX air handling units

1. Replace six (6) existing air handling units as defined in following table (Figure 6).
2. Install new air handling unit with variable frequency drive.
3. Replace fourteen (14) existing DX air handling units with chilled water air handling units in Building 1 as defined in following table (Figure 7).
4. Relocate AHUs to following locations inside Building 1.
5. New tonnages to be verified during design.
6. Install chilled water piping from chillers in Building 1 Basement to applicable air handling units.
7. Install new air handling unit with variable frequency drive.
8. Install graphics for air handling units.

CRDM-3 Convert 2-pipe Fan Coil Units to 4-pipe configuration

1. Remove sixty-three (63) existing 2-pipe fan coil units from Building 1.
2. Install sixty-three (63) new 4-pipe fan coil units in Building 1.
3. Install approximately 4800 linear feet of 3 inch copper material piping for home runs.
    a. Install 80 feet of ¾ inch copper piping per fan coil unit.
    b. Install four (4) isolation valves at each fan coil unit.
    c. The FCUs will be capable of integrating into the building management system with points to be used in retro commissioning of the system.
    d. Writable points
        i. Occupancy Setpoint – based off either an occupancy sensor or time of day scheduling
        ii. Occupied Cooling Temperature Setpoint
        iii. Occupied Heating Temperature Setpoint
        iv. Unoccupied Cooling Temperature Setpoint
        v. Unoccupied Heating Temperature Setpoint
        vi. Max Temperature Setpoint
        vii. Min Temperature Setpoint
        viii. View Only points
        ix. Occupancy Status
        x. Heating water valve position
        xi. Cooling water valve position
        xii. Fan Status – On/Off
        xiii. Room Temperature
    e. Utilize existing electrical.
4. Remove sixty-one (61) existing 2-pipe fan coil units from Building 2.
5. Install sixty-one (61) new 4-pipe fan coil units in Building 2.
6. Install approximately 3200 linear feet of 3 inch copper material piping for home runs.
7. Install 80 feet of ¾ inch copper piping per fan coil unit.
8. Install four (4) isolation valves at each fan coil unit.
9. The FCUs will be capable of integrating into the building management system with points to be used in retro-commissioning of the system.
    a. Writable points
        i. Occupancy Setpoint – based off either an occupancy sensor or time of day scheduling
        ii. Occupied Cooling Temperature Setpoint
        iii. Occupied Heating Temperature Setpoint
        iv. Unoccupied Cooling Temperature Setpoint

v. Unoccupied Heating Temperature Setpoint
vi. Max Temperature Setpoint
vii. Min Temperature Setpoint
viii. View Only points
ix. Occupancy Status
x. Heating water valve position
xi. Cooling water valve position
xii. Fan Status – On/Off
xiii. Room Temperature

b. Utilize existing electrical.

10. Repair any damage caused by removal of existing equipment or addition of new equipment.
11. Demo and cap any existing steam radiator in Buildings 1 and 2.
    a. Additional FCUs to be placed in common areas where steam radiators are removed.
    b. Design to determine adequate size and location of additional FCUs to meet current building codes.

Electrical Retrofits

The following measure should be implemented to the electrical system to improve the overall usefulness of the other energy reduction measures.

The current capacitor bank on campus is a 100 kVAR non-switching bank that brings the average monthly measured power factor to 92%. Being that the facility is penalized by their current utility rate for power factors less than 90%, that left 5 of the historical months where savings weren't realized from the existing electrical capacitor arrangement.

The nature of a capacitor bank can be such that the bank is either one large capacitor (non-switching) or several small capacitors (switching) to make up the total capacitance of the system. Because what is already in place is a non-switching bank, it can only be sized to handle the minimum peak electrical loads without causing damage to the distribution system and equipment. Although the current bank is undersized for the existing load, the decrease in metered load from the other energy reduction measures in this proposal could lead to problems in the system. A switching style bank needs to be installed to most efficiency maximize the effect and savings from the utility rate structure.

An overhaul of the campus electrical distribution is to be completed to increase stability and safety of the campus power. The intent of the retrofit is to install a second electrical service feeder from the existing utility company service transformer. This is to be ran to the new electrical gear before moving existing feeders from the existing gear to the new electrical distribution system.

ECRM-1 Upgrade capacitor bank

1. Remove existing 100 kVAR non-switching capacitor bank from outside Building 1 South.

2. Install switching capacitor of 200 kVAR in increments of 25 kVAR in Building 1.
   a. Bank to accommodate post retrofit average kW of 400 to achieve a minimum power factor of 98% as to best utilize existing rate structure from the electric utility with room for capacity growth.

CRDM-4 Upgrade campus electrical distribution

1. The building is to be occupied for the full duration of the Electrical Gear replacement project, contractor is to coordinate all power outages with the owner.
2. Any power shut-downs are to be performed after 12:00 midnight and be back-up and running before 6:00 a.m. the next morning.
3. Provide and install new Nema 3R, main disconnect switch, on the exterior.
4. Provide and install new pull box and cut into the existing empty spare conduit from the service transformer, provide and install new service conductors, see riser.
5. Remove all existing 2' x 4' fluorescent lighting, wire and branch circuit conduit feed them in the proposed new electrical room and the south office area, existing circuit is to remain and be reused.
6. Provide new LED, chain hung strip fixtures in the new electrical room and circuit to the existing lighting circuit.
7. Provide and install new electrical gear in new electrical room, see riser.
8. Extend the existing panel feeders to the new electrical distribution gear, power outrages are to be after hours and coordinated with the owner.
9. A temporary connection method for the (2) existing Loop feeders will be required, until the metal clad gear can be removed add permanent loop feeder splice box is installed.
10. After all existing panel feeders have been moved to the new distribution system, demo and remove the existing main metal clad gear and distribution switch board.
11. Remove floor mounted (pole transformers), buss duct, conduits (see plans) for the metal clad and distribution switch board.
12. Caution-floor mounted (pole transformers) may contain PCB's and require additional haz-mat methods.
13. The (2) existing panel feeder consolidation junction boxes are to remain and panel feeders will not be separated until the future addition of equipment to support it.
14. Demolish 2' x 4' lay-in ceiling grids, tiles and hanger wires in proposed new electrical room.
15. Remove and replace existing wood door and frame at the entrance to the new Electrical room, replace with new 1 hour fire rated, outward swinging, metal 36" wide door and frame. Provide panic hardware.
16. Add new 1 hour fire rated wall, from floor to ceiling at front wall of new electrical room, fire caulk around all existing piping, ductwork, conduits, etc. that presently penetrate this wall.
17. Remove and replace the existing 34" wide corridor entry door and frame (in the adjacent office space) and replace with a 36" wide door and frame to allow installation and removal of electrical gear.
18. Remove existing office wall and door to the south office, with in the new electrical room space.
19. Remove 2' x 4' lay-in ceiling grids, tiles and hanger wires in the south office space.
20. Remove the existing ceiling grilles and flex ductwork feeding these grilles, the trunk duct above the ceiling to remain open to serve the new electrical room.

21. Remove the ceiling mounted sprinkler heads and reconfigure the existing sprinkler piping to connect to up-turned sprinkler heads in the new electrical room space.

Other Upgrades

ECRM-6 Retro-commissioning of air distribution equipment and controls

1. Buildings to be retro-commissioned:
   a. Building 1
   b. Building 2
   c. Building 6
2. Survey and Assessment
   a. Site Plan: Develop site plan indicating all buildings and all utility meters including water, natural gas, electricity, etc.
3. Repairs
   a. Repairs: Work with building staff to make repairs to air distribution equipment where needed.
   b. Equipment Service: Work with building staff to coordinate service for equipment.
   c. An allowance of $60,000 for identified repairs.
4. Implement Measurement and Verification Plan
   a. Utility Consumption: Totalize the interval utility data on a daily basis establishing the daily consumption of natural gas, electricity, and water.
5. Implement time of day scheduling for (29) air handlers in Building 1.

ECRM-7 Install building energy management control system (BAS)

1. Upgrade or replace the existing Building Automation System (BAS) with a single enterprise wide platform BAS with graphical interface, data archival, data analytics and automatic fault detection utilizing a current technology server, workstations, controllers, and network.
   a. The Building Automation System (BAS) shall consist of a peer-to-peer network of Building Controller(s), one (1) Direct Digital Control (DDC) panel and one (1) operator workstation. The operator workstation shall be a personal computer (PC) including a color monitor, mouse and keyboard. The PC shall provide users an interface with the system though dynamic color graphics of building areas and systems.
   b. The Building Automation System (BAS) server shall provide data storage for all BAS operating systems, Web server operation, graphical interface, data archival, data analytics and automatic fault detection.
   c. Direct Digital Control (DDC) technology shall be used to provide the functions necessary for control of systems defined for control on this project.
   d. The control system shall accommodate simultaneous multiple user operation with access to the control system data limited by operator password. An operator shall be able to log onto any

workstation of the control system and have access to all designated data. Security shall include strong authentication requirements with user actions recorded in audit log.

e. The control system shall be designed such that each system will operate under stand-alone control and as such, in the event of a network communication failure, or the loss of other controllers, the control system shall continue to operate independently.

f. Communication between the Building Controller and all workstations shall be over existing high-speed Ethernet network. All nodes on this network shall be peers. A network communications card shall be provided for remote access to the system.

g. All components required to accomplish the sequences of operation and/or as required for a properly operating system shall be provided by the BAS contractor unless otherwise noted.

h. Install Direct Digital Control (DDC) where indicated.

   i. (150) fan coil units, (2) chillers, (2) cooling towers, (10) pumps, (5) boilers, (50) air handling units, and (8) exhaust fans in the building.

i. Implement energy efficient sequences of operation for DDC equipment.

j. Provide graphics for each piece of equipment including air terminal units, fan coil units, air handling units, exhaust fans, chillers, cooling towers, boilers, pumps, and variable frequency drives in the building.

k. Provide graphic sequences for each piece of equipment with dynamic data values for system interrogation and setpoint adjustment.

l. Implement remote user access via internet to the BAS for remote support.

m. Implement Measurement and Verification Plan.

n. Implement Weekly Schedules.

o. Establish Trends.

p. Tune Control Loops.

   i. General: Control valves, dampers, pump speeds, and fan speeds are typically controlled by automatic temperature control systems using proportional-integral (PI) control loops. In theory, a PI control loop provides stable control with no offset from setpoint. The PI control loop output has both a proportional component based on deviation from setpoint and an integral component based on the period in which the deviation occurred. Under steady state conditions, i.e., stable loads and setpoints, the integral component eliminates any deviation from setpoint. Proper setup of a PI control loop, however, requires adjustment of the proportional and integral gains, which shall initially be “tuned” by the control system installer.

   ii. Tuning Process: Tuning typically requires review of a close interval trend showing the output, setpoint, and controlled variable, e.g. supply air temperature, supply air static pressure, chilled water differential pressure, etc., followed by an adjustment of the proportional and integral gains. The proportional gain is the ratio of the change in control loop output to the difference between the controlled variable and the setpoint, commonly referred to as the “error term”. Increasing the proportional gain will increase the control system’s initial response to a deviation from setpoint. The integral gain is the ratio of the change in control loop to the cumulative, integral, error term over time. Increasing the integral gain will increase the speed of the control system's response to a sustained deviation from setpoint.

iii. Iterative Process: In most cases, the tuning process must be repeated several times to obtain stable control. In the real world, though, proportional and integral values are rarely tuned. The result is that many valve, damper, fan speed, and pump speed control systems are either "hunting", continuously undershooting and overshooting the setpoint on a cyclical basis, or not controlling precisely to the setpoint, commonly referred to as "offset." From a distance, these systems seem to be working because they often do not trigger occupant complaints. On closer inspection, however, they are wasting energy and reducing the life of control components.

ECRM - 9 Install high-efficiency water fixtures

1. Replace existing high flow fixtures with efficient low flow fixtures.
   a. Counts of fixtures to be changed below:

	Fixtures															
Building	**Total**	**A1**	**F1**	**T1**	**U1**	**A2**	**F2**	**S1**	**P1**	**P2**	**U2**	**ICE1**	**KSP**	**U5**	**A3**	**T2**
BLG 14 MAINTENANCE	10	2	0	2	1	0	0	0	0	1	0	0	0	0	0	0
BLG 11 HEATING PLANT	9	0	0	2	2	0	4	1	0	0	0	0	0	0	0	0
BLG 12 LAUNDRY PLUMBING	20	4	0	4	2	1	0	0	0	0	0	1	0	0	0	0
BLG 16 GRNDS AND CARPENTRY	9	1	0	1	1	1	1	2	0	0	0	0	0	0	0	0
BLG 54 CLASSROOMS	45	24	0	15	0	1	0	0	1	0	0	1	0	3	0	0
BLG 55 CLASSROOMS	26	14	0	10	0	0	0	0	0	0	0	0	0	2	0	0
BLG 52 HVAC	4	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0
BLG 53 AUTOMOTIVE	4	0	0	1	0	0	0	1	0	0	0	0	0	1	0	0
BLG 37 STAFF DUPLEX	16	0	0	6	0	0	0	4	0	0	0	0	0	0	0	0
BLG 36 STAFF DUPLEX	16	0	0	6	0	0	0	4	0	0	0	0	0	0	0	0
BLG 34 STAFF DUPLEX	10	0	0	2	0	0	0	2	0	0	0	0	0	0	2	0
BLG 25 WELDING	6	3	0	0	1	0	0	0	0	0	0	0	0	0	0	0
BLG 26 STAFF DUPLEX	18	0	0	0	0	0	4	4	0	0	0	0	0	0	4	2
BLG 27 STAFF DUPLEX	24	0	0	6	0	0	0	6	0	0	0	0	0	0	10	0
BLG 2	142	0	0	40	0	0	4	36	0	0	0	0	0	0	50	0
BLG 1	492	0	4	89	3	0	8	51	4	5	16	2	2	1	180	0
BLG 6	56	2	0	0	0	2	0	3	0	1	0	0	0	0	0	0
TOTALS	**907**	**51**	**4**	**184**	**10**	**5**	**22**	**114**	**5**	**7**	**16**	**4**	**2**	**7**	**246**	**2**

2. For Restroom Faucets - Type A1 - Disassemble, clean, reinstall aerator.

3. For Restroom Faucets - Type A2 - Disassemble, clean, reinstall aerator.

4. For Restroom Faucets - Type A3 - Disassemble, clean, reinstall aerator.

5. For Showers - Type S1 - Disassemble, clean, reinstall showerhead

6. For Water Closets - Type T1 - Replace diaphragms, vacuum breakers, etc in flush valve, rebuild flush valve, unclog toilet

7. For Water Closets - Type T2 - Replace diaphragms, vacuum breakers, etc in flush valve, rebuild flush valve, unclog toilet
8. For Faucets - Type F1 - Replace Cartridge/seals
9. For Faucets - Type F2 - Replace Cartridge/seals
10. For Urinals - Type U1 - Replace diaphragms, vacuum breakers, etc in flush valve, rebuild flush valve
11. For Urinals - Type U2 - Replace diaphragms, vacuum breakers, etc in flush valve, rebuild flush valve
12. For Urinals - Type U5 - Replace diaphragms, vacuum breakers, etc in flush valve, rebuild flush valve
13. For Urinals - Type U2 - Replace diaphragms, vacuum breakers, etc in flush valve, rebuild flush valve
14. For Sinks - Type P1 - Replace Cartridge/seals
15. For Sinks - Type P2 - Replace Cartridge/seals

ECRM - 11 Install solar array

1. Install 150 kilowatt (kW) photovoltaic solar system on the roof of Building 6 to offset load associated with Building 6.
2. Connect solar panels to Entergy electric meter associated with Building 6.

Building 6 ECRMs

Because building 6 is across the road from the main facility, and it has newly updated heating and air conditioning equipment, not all ECRMs apply to that building. Below are the projects that pertain specifically to Building 6.

ECRM-2 Retrofit interior lighting to LED

There are 370 interior light fixtures are to be updated to LED.

ECRM-3 Retrofit exterior lighting to LED

There are ten exterior CFL lighting fixtures to be updated to LED.

ECRM-6 Retro-commissioning of air distribution equipment and controls

Although Building 6 has newer building controls, in order to sustain savings over the life of the controls, they periodically need to be retro-commissioned back to design specifications.

ECRM-11 Install solar array

The electrical rate at Building 6 makes it advantageous to install a solar array on the property around that building. The array is being sized to accommodate the demand and usage currently being used by Building 6.

#	Description	Cost ($)	Utility & OM Savings ($/Year)	Payback (Year)
ECRM-02	Retrofit interior lighting to LED	41,171	5,600	**7.4**
ECRM-03	Retrofit exterior lighting to LED	1,100	207	**5.3**
ECRM-06	Retro-commissioning of air distribution equipment and controls	10,356	1,111	**9.3**
ECRM-11	Install solar array system	247,565	16,995	**14.5**
Subtotal				

Economic Analysis

This section provides the methodology and results of the energy savings calculations completed for the specified facilities. An estimate of energy and operational cost savings has been completed for the energy efficiency measures. Due to the interdependency of the measures, evaluating the cost and savings of each measure individually does not yield accurate results. It is recommended the measures be evaluated in bundles to properly illustrate the combined savings and economic return. For this reason, the recommended energy conservation measures were bundled into a combined group to prevent overestimating energy and operational cost savings.

To determine the annual energy costs of the systems, BTME developed an energy model using a spreadsheet to quantify lighting and HVAC energy use. This energy model was developed for the facility using the inputs listed within this report. The following steps / methodology was used to develop an estimate operational cost savings for each EEM.

1. The facility was surveyed to obtain information regarding building size, construction type, occupancy types, hours of operation, staff occupancy, internal heat loads, types of HVAC equipment, types of lighting equipment, energy management controls, utility information, and other relevant building and operational data. Equipment efficiencies were determined using typical industry data and all lighting energy use (based on tables provided above) is based on the rated input watts for each fixture type. Typical heating and cooling set points were used. Schedules were created for classrooms, cafeterias / auditoriums, administrative offices, and gymnasiums to estimate equivalent full load hours for HVAC equipment.

2. The lighting information is entered into a spreadsheet to calculate annual lighting energy use by multiplying input watts by hours of operation for different occupancies. The annual energy use is adjusted based on observed lamp burn out percentages and fixture operation. This calculation approach is used for both existing and proposed lighting fixtures to estimate annual lighting energy use and energy savings. The existing annual lighting energy use is compared to historical energy use for the facility to ensure it represents a reasonable percentage of total building energy use. The assumptions and calculations are modified as needed to calibrate the calculations, if needed.

3. The HVAC information is entered into a spreadsheet to calculate annual HVAC energy use by multiplying rated efficiency (kW/ton) by equivalent full-load hours of operation for different occupancies. The annual energy use is adjusted based on observed equipment condition and efficiency. The estimated annual equivalent full-load hours are based the historical weather for Hot Springs, AR. This calculation approach is used for both existing and proposed HVAC equipment to estimate annual energy use and energy savings. The existing annual energy use is compared to historical energy use for the facility to ensure it represents a reasonable percentage of total building energy use. The assumptions and calculations are modified as needed to calibrate the calculations, if needed.

The tables below provide the estimate of energy savings for each EEM.

ECRM Savings

The solution as contained in this Investment Grade Audit is referred to as the Energy Services Performance Contract (ESPC). Under the ESPC, each ECM described in the previous section was modeled using the calibrated baseline energy model by changing the associated variables applicable to each ECM. This provided a simulation of the projected energy performance for each measure when compared to the energy model for the BAU scenario. Each ECM was modeled independently as well as collectively to capture the interdependencies between each ECM. The table below provides the resulting savings of each ECM inclusive of their interaction with other ECMs. In addition, a table summarizing the resulting utility consumption and costs for the ESPC alternative once all ECMs have been implemented is provided below.

TABLE 20: ECM SAVINGS SUMMARY

#	Description	Electricity Savings ($/Year)	Natural Gas Savings ($/Year)	Water/Sewer Savings ($/Year)	Total Savings ($/Year)
ECRM-01	Upgrade capacitor bank	10,990	0	0	10,990
ECRM-02	Retrofit interior lighting to LED	27,630	(3,878)	(117)	23,635
ECRM-03	Retrofit exterior lighting to LED	3,370	0	0	3,370
ECRM-04	Convert steam heating system to heating water	(552)	172,029	6,943	178,421
ECRM-05	Upgrade domestic heating water	0	(3,424)	195	(3,229)
ECRM-06	Retro-commissioning of air distribution equipment and controls	5,556	1,265	175	6,996
ECRM-07	Install building energy management control system	29,743	7,425	2,906	40,074
ECRM-08	Upgrade chilled water system	32,212	0	0	32,212
ECRM-09	Install high-efficiency water fixtures	0	0	27,246	27,246
ECRM-10	Update kitchen mechanical equipment	18,127	0	0	18,127
ECRM-11	Install solar array system	16,995	0	0	16,995
CRDM-01	Install exterior safety LED lighting	0	0	0	0
CRDM-02	Replace DX air handling units with CHW	22,310	(626)	(11,517)	10,167
CRDM-03	Convert Building 1 and Ross Hall 2-pipe HVAC system to a 4-pipe	(11,561)	2,530	(6,946)	(15,977)
CRDM-04	Upgrade campus electrical distribution	0	0	0	0
Total Cost Savings		**154,821**	**175,321**	**18,884**	**349,026**

TABLE 21: ESPC UTILITY CONSUMPTION AND COST SUMMARY

Utility	Consumption	Units	Cost	Unit Cost	Units
Electricity	3,160,988	kWh/Year	$250,100	$0.08	$/kWh
Natural Gas	17,641	MMBtu/Year	$82,189	$4.66	$/MMBtu
Water/Sewer	15,781	kGals/Year	$159,052	$10.08	$/kGals
Total			**$491,341**	**$/Year**	

CRDM Savings

The Operational Cost Reduction Measures identified and described in this report will have a significant impact on ACTI's annual operating expenses. The following table demonstrates the projected annual OCRM savings throughout the term of the proposed Cooperative Endeavor Agreement.

TABLE 22: OCRM SAVINGS SUMMARY

Year	BAU O&M ($/Year)	ESPC O&M ($/Year)	OCRM Savings ($/Year)
0	869,188	869,188	0
1	886,572	886,572	0
2	904,303	904,303	0
3	925,817	455,044	467,345
4	944,265	464,145	476,692
5	963,082	473,428	486,225
6	982,275	482,897	495,950
7	1,001,852	492,555	505,869
8	1,021,820	502,406	515,986
9	1,042,188	512,454	526,306
10	1,062,963	522,703	536,832
11	1,084,154	533,157	547,569
12	1,105,768	543,820	558,520
13	1,127,815	554,696	569,691
14	1,150,303	565,790	581,084
15	1,173,240	577,106	592,706
16	1,196,637	588,648	604,560
17	1,220,501	600,421	616,651
18	1,244,842	612,430	628,984
19	1,269,670	624,678	641,564
20	1,294,995	637,172	654,395
21	1,320,827	649,915	667,483
22	1,347,175	662,914	680,833

Project Costs

The following table provides a breakdown of the capital costs to implement the ECM and OCRMs described in this report.

TABLE 23: ESPC PROJECT SUMMARY

#	Description	Cost ($)	Year 0 Savings ($/Year)
ECRM-01	Upgrade capacitor bank	104,906	10,990
ECRM-02	Retrofit interior lighting to LED	472,500	23,635
ECRM-03	Retrofit exterior lighting to LED	159,627	3,370
ECRM-04	Convert steam heating system to heating water	1,112,397	178,421
ECRM-05	Upgrade domestic heating water	99,462	(3,229)
ECRM-06	Retro-commissioning of air distribution equipment and controls	252,347	6,996
ECRM-07	Install building energy management control system	1,486,381	40,074
ECRM-08	Upgrade chilled water system	1,302,947	32,212
ECRM-09	Install high-efficiency water fixtures	281,787	27,246
ECRM-10	Update kitchen mechanical equipment	348,405	18,127
ECRM-11	Install solar array system	247,565	16,995
CRDM-01	Install exterior safety LED lighting	235,773	0
CRDM-02	Replace DX air handling units with CHW	1,192,168	10,167
CRDM-03	Convert Building 1 and Ross Hall 2-pipe HVAC system to a 4-pipe	1,655,892	(15,977)
CRDM-04	Upgrade campus electrical distribution	999,798	0
Overall Total			**349,026**

Proposed Life Cycle Costs

TABLE 24: ESPC LIFE CYCLE COSTS

Year	Electricity Costs ($)	Natural Gas Costs ($)	Water/Sewer Costs ($)	Operating Expenses ($)	Project Costs ($)	Total ($)
0	422,779	260,121	150,956	869,188	0	1,703,043
1	411,639	222,793	150,763	886,572	0	1,671,767
2	366,772	185,628	150,707	904,303	0	1,607,410
3	288,562	91,319	144,318	455,044	732,026	1,711,270
4	295,776	93,602	148,647	464,145	732,026	1,734,198
5	303,171	95,942	153,107	473,428	732,026	1,757,674
6	310,750	98,341	157,700	482,897	732,026	1,781,714
7	318,519	100,800	162,431	492,555	732,026	1,806,330
8	326,482	103,320	167,304	502,406	732,026	1,831,537
9	334,644	105,902	172,323	512,454	732,026	1,857,349
10	343,010	108,550	177,493	522,703	732,026	1,883,782
11	351,585	111,264	182,818	533,157	732,026	1,910,850
12	360,375	114,045	188,302	543,820	732,026	1,938,569
13	369,384	116,897	193,951	554,696	732,026	1,966,955
14	378,619	119,819	199,770	565,790	732,026	1,996,024
15	388,084	122,814	205,763	577,106	732,026	2,025,794
16	397,786	125,885	211,936	588,648	732,026	2,056,281
17	407,731	129,032	218,294	600,421	732,026	2,087,504
18	417,924	132,258	224,843	612,430	732,026	2,119,481
19	428,373	135,564	231,588	624,678	732,026	2,152,229
20	439,082	138,953	238,536	637,172	732,026	2,185,769
21	450,059	142,427	245,692	649,915	732,026	2,220,119
22	461,310	145,988	253,062	662,914	732,026	2,255,300

Life Cycle Cost Comparison

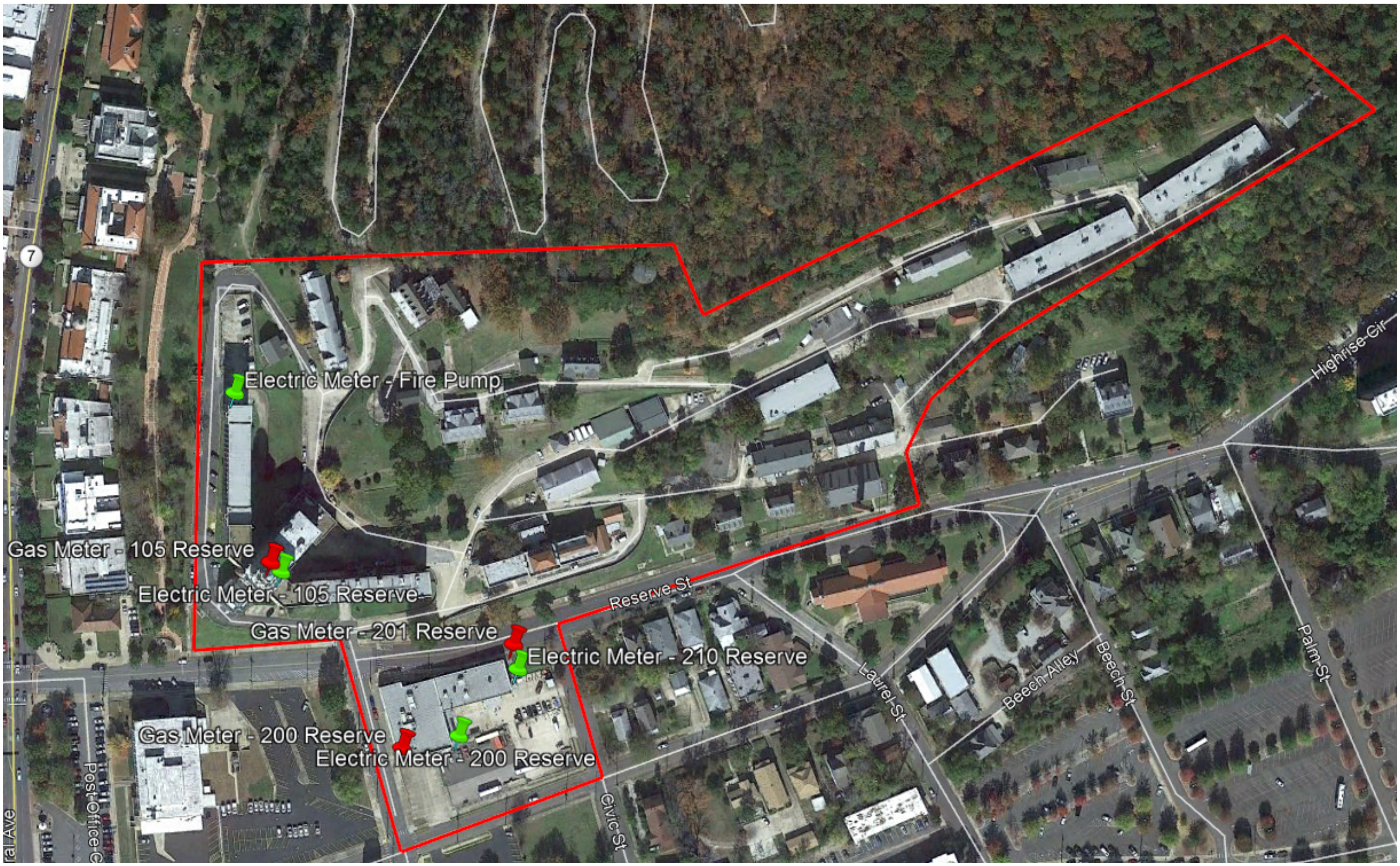
Table 25: Life Cycle Cost Comparison

Year	BAU ($)	ESPC ($)	Net Savings ($)
0	1,703,043	1,703,043	0
1	1,742,028	1,671,767	70,262
2	1,781,924	1,607,410	174,513
3	1,826,179	1,711,270	114,909
4	1,867,961	1,734,198	133,763
5	1,910,719	1,757,674	153,045
6	1,954,478	1,781,714	139,642
7	1,999,261	1,806,330	159,146
8	2,045,093	1,831,537	179,096
9	2,091,999	1,857,349	199,500
10	2,140,005	1,883,782	220,370
11	2,189,136	1,910,850	241,716
12	2,239,420	1,938,569	263,550
13	2,290,884	1,966,955	255,048
14	2,343,557	1,996,024	277,891
15	2,397,467	2,025,794	301,255
16	2,452,645	2,056,281	325,154
17	2,509,121	2,087,504	349,599
18	2,566,925	2,119,481	374,514
19	2,626,090	2,152,229	399,298
20	2,686,649	2,185,769	424,646
21	2,748,635	2,220,119	450,572
22	2,812,082	2,255,300	477,090
Totals	**50,925,301**	**44,260,949**	**5,684,578**

Appendices

A. Utility Meter Survey Reports
B. Building Plans
C. Mechanical Survey Report
D. Utility Bills

APPENDIX A


Electric Meter - Fire Pump
Gas Meter - 105 Reserve
Electric Meter - 105 Reserve
Gas Meter - 201 Reserve
Electric Meter - 210 Reserve
Gas Meter - 200 Reserve
Electric Meter - 200 Reserve
Reserve St
Civic St
Laurel St
Beech Alley
Beech St
Palm St
Highrise Cir
Post Office C
ral Ave
7