Preliminary Assessment Template for task orders under doe’s 2017 ESPC IDIQ contracts

*Introduction: This document presents a template for the Preliminary Assessment (PA) that ESCOs are required to conduct in an ESPC project under the Energy Department (DOE) ESPC IDIQ contract (IDIQ). This template meets the requirements of the 2017 DOE ESPC IDIQ contract, Section H.3.2 B. Preliminary Assessment Development, which stipulates that “The ESCO submits a PA to the ordering agency, which provides the conceptual range of the expected ECMs, costs and savings for the project.” It also meets requirements of Section H.4, Preliminary Assessment Content Requirements, with its purpose “to set out the merits, technical feasibility, range of projected energy savings, economics, and conceptual price range of the project.”*

*In this conceptual phase, it is most resource efficient (for labor and costs) for both the ESCO and the agency to stay focused on these high-level goals in developing the PA. ECM cost savings and prices are estimated. ECM designs are preliminary and thus subcontractor quotes are not available to enable firm pricing. In addition, the PA is based on building conditions and operations observed during walk-through assessments and, at best, may incorporate some very limited measurements to support the estimation of savings if made during the walk-through (they are not required at this point). As a result, savings and pricing estimates provided have probable ranges given as percentages (e.g., see Tables 1A, 2, and the ECM templates) that are based upon the limited knowledge the ESCO obtains during the PA. Best estimates of savings and costs give the agency a projected project scope and a range of the supporting economics to determine the viability of a project. Following the PA, the ESCO will conduct an investment-grade audit to include as part of the proposal. In addition to expanding the details of the project, the investment-grade audit will refine the accuracy of the cost and saving estimates provided in the PA.*

*This PA template was developed based on typical PAs from various ESPC projects. Various names, locations, and details of the project have been altered so as not to reveal any proprietary information about the agencies or the ESCOs.*

*Instructions: This template is provided to give ESCOs an example of how to prepare a PA document that meets the DOE-stated requirement of 35 pages or less, plus an ECM summary template for each recommended ECM, while meeting all the goals and requirements of a PA. The page count limit does not include the PA cover page, table of contents, list of acronyms if provided, and TO schedules. The example template can also be used by agencies as an example of how PAs can stay within the 35-page requirement and still provide the information needed to make the decision to proceed with an ESPC project. The 35-page requirement is referenced in IDIQ Sec. H.4.2.B, and the ECM template can be found in Sec. J-13. Note that while the IDIQ reads “35 pages, plus one page per recommended ECM, using the template,” completed ECM templates are not intended to be limited to a single page; however, they should be concise. A reasonable goal is 2 pages per ECM to maintain the template content at a high level, as illustrated in the example PA (templates begin on page 30).*

*FEMP experience with hundreds of projects indicates that a PA within the page limit as described can provide the needed information to evaluate the feasibility of a project. The key is to get the right information with sufficient detail to ensure the project is viable and does not look different nor have wide economic variances from the investment-grade audit. Since the entire project team (especially on the agency side) should review the full PA, providing excessive information up front consumes both ESCO and agency resources that should be tapped later when the project moves forward. If excessive ECM study/evaluation is spent on an ECM that does not go forward, in addition to using extra ESCO and agency resources too early in the project development, the agency may bear the cost of that evaluation in a project that moves to award. FEMP requests that agencies and ESCOs take the opportunity to assess the effectiveness of this document length. If the document length proves to be insufficient for agency needs, please provide feedback to DOE/FEMP for consideration in modification of the IDIQ requirement.*

*The savings and pricing ranges given in this example template are not a guide for the ESCO. The ESCO should determine the confidence in the savings and pricing estimates that will drive the ranges it reports in its project-specific PA.*

*The ESCO and/or agency can consider building upon, modifying, reorganizing, or reformatting the content of this template, or making other changes, to best communicate with stakeholders and meet the needs of the agency project. This PA is merely an example of how to meet the IDIQ PA requirements in Section H.4 of the IDIQ.*

*Agencies should note that the PA can be used to meet the audit requirement of the EISA 2007 and for audit reporting in FEMP’s EISA 432 Compliance Tracking System (CTS) if some special considerations are addressed. The EISA requires that a recommissioning/retro-commissioning assessment be undertaken as part of the audit. This assessment needs to be incorporated into the contractor’s facility assessment. In addition, the agency does not own (have rights to) the PA until the PA is paid for or the (ESPC) project is awarded, so there is a timing consideration for using the data within a PA in the CTS (reference 2017 IDIQ Sec. H.3.12.B).*

*\*\*\*DISCLAIMER: THIS Template IS PROVIDED ONLY TO STIMULATE IDEAS. tHE STRUCTURE AND CONTENT ARE NOT INTENDED TO CONVEY ANY DETAIL OF COMPLETENESS OR PREFERENCE ON THE PART OF THE GOVERNMENT.\*\*\**

*If you need any assistance with the PA requirements, please consult the agency’s contracting officer (CO). If you are an agency that needs assistance in drafting the PA requirements or reviewing the PA(s) submitted to you by the ESCO(s), please consult your project facilitator.*

**(The PA Template begins following this instructional page. The remainder of this page is intentionally left blank.)**

**TEMPLATE**

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**Preliminary Assessment  
Submitted by ABC Corporation**

**for**

**Department of Energy**

**Rockwell Laboratories**

**Golden, Colorado**

**Department of Energy**

**Energy Savings Performance Contract**

**Contract No. DE-EE00080XX/000**

**January 7, 2019**

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Abbreviations, Acronyms, and Initialisms

AC  Alternating current

AHU Air handling unit

BAS Building automation system

BHP Brake horsepower

BTU British thermal unit

CHP Combined heat and power

CO Contracting officer

CTS Compliance Tracking System

DC Direct current

DDC Direct digital control

DHW Domestic hot water

DOE Department of Energy

ECM Energy conservation measure

EERC Energy escalation rate calculator

EISA Energy Independence and Security Act

EO Executive order

ePB eProject Builder

eQUEST DOE QUick Energy Simulation Tool

ESCO Energy services contractor

ESPC Energy savings performance contract

FEMP Federal Energy Management Program

GPF Gallons per flush

GPM Gallons per minute

HET High-efficiency toilet

HEU High-efficiency urinal

HID High-intensity discharge

HUB Historically underutilized business

HVAC Heating, ventilating, and air conditioning

IDIQ Indefinite delivery, indefinite quantity

IDS Investor deal summary

IES Illuminating Engineering Society

IGA Investment-grade audit

IP Internet protocol

Kgal Thousand gallons

kW Kilowatt

kWh Kilowatt-hour

LED Light emitting diode

M&V Measurement and verification

MMBtu Million British thermal units

NEPA National Environmental Policy Act

NG Natural gas

NIST National Institute of Standards and Technology

NOO Notice of opportunity

O&M Operation and maintenance

ODC Other direct charge

PA Preliminary assessment

PF Project facilitator

PLC Programmable logic controller

PV Photovoltaic

R&R Repair and replacement

RL Rockwell Laboratories

RTU Roof top unit

SFO Standard financing offer

SB Small business

SDVOSB Service-disabled, veteran-owned small business

SDB Small disadvantaged business

SF Square foot

SP Static pressure

TO Task order

UV Ultraviolet

VOSB Veteran-owned small business

VAV Variable air volume

VSD Variable speed drive

W Watt

WOSB Woman-owned small business

Yr Year

# Project Overview—Executive Summary

*[The Executive Summary shall include a narrative description of the project, summarizing the project management plan, the recommended and potential ECMs, the energy, water, and related cost savings ranges, and conceptual range of implementation price.]*

ABC Corporation (ABC) is pleased to submit this Preliminary Assessment (PA) in response to the requirements stated in the Department of Energy (DOE), Rockwell Laboratories’ (RL) Notice of Opportunity (NOO) letter dated September 6, 2018. ABC considered the site’s objectives as expressed in the NOO and has developed a conceptual project that includes the design, installation, and commissioning of proven and integrated energy conservation measures (ECMs). The project would invest approximately $11 million in energy conservation measures (ECMs), resulting in savings of approximately $700,000 annually. Energy savings are estimated at around 32,000 million Btu annually, including 2.7 million kWh of electrical energy. In addition, approximately 13 million gallons of water would be saved every year. The guaranteed annual savings of approximately $700,000, when considered over the project duration, will yield a total of about $23 million in savings over the contract term. The project would be paid for over a performance period of about 24 years through guaranteed cost savings.

## Overall Project Savings and Cost Estimates

This feasibility study was performed to develop preliminary technical and price information without the benefit of a detailed investment-grade audit (IGA) or pricing data. As a result, the project financials and savings for the recommended measures are provided as estimates with projected variance ranges in Table 1A. The magnitude of the ranges reflect ABC’s best estimates based on its previous experience at similar facilities, on-site walk-through observations, limited measurements made during the walk-through, and the degrees of uncertainty in savings and costs at this project conceptualization stage (e.g., the project is not developed sufficiently to obtain supplier quotes or simulation models may not have been run or thoroughly calibrated). The cost to perform the proposed performance period operation and maintenance (O&M) and measurement and verification (M&V) are provided as estimates in Table 1B.





ABC’s project management and development teams worked closely with RL stakeholders to develop the proposed project into one that best achieves the goals and needs of the facility. Through the on-site survey and periodic working meetings and discussions with RL staff, we were able to identify ECMs that achieved significant impact and that met and even far exceeded (in one case) every goal communicated to ABC. This close collaboration is critical to project success and, given the opportunity, ABC will build upon it in the IGA development phase. Going forward, ABC’s Project Manager will have overall responsibility for project development, implementation, and long-term performance, ensuring dedicated and centralized oversight of the project during all of its future phases. ABC’s Project Management Plan is more fully described in the Technical Assessment section of this document.

With RL approval to proceed, ABC proposes to complete the IGA within 75 days, leading to Task Order award in approximately 7 months. Construction is expected to be completed within 18 months after receiving the award. Under this plan, RL can have an impactful, operational project up and running in approximately 26 months.

## Recommended and Potential ECMs

Based on our surveys and resulting analyses, ABC has evaluated and developed energy and water savings opportunities and related infrastructure improvements for RL. The recommended technology measures are proven and innovative and include major upgrades to the boiler and hot water systems, heating, ventilation, and air conditioning (HVAC) controls, lighting, and water-consuming devices, as well as implementation of a sizeable renewable energy measure. ABC proposes to implement the following recommended ECMs:

* ECM 1A-Boiler Improvements: Replacement of existing boilers with high-efficiency condensing boilers. The new boilers will be gas-fired units providing cost savings due to the unit cost of natural gas versus the existing #2 fuel oil.
* ECM 3A-Controls: Replacing pneumatics with direct digital controls (DDC), implementing robust control strategies, and integrating systems and advanced meters with the existing ACME building automation system (BAS).
* ECM 5A-Lighting Improvements: Retrofitting existing 2-lamp 4 foot, 3-lamp 4 foot, and 4-lamp 4 foot fluorescent fixtures with 22.5 W, 45 W and 67.5 W light emitting diode (LED) retrofit kits.
* ECM 6A-Building Envelope Improvements: Installation of a double-pane window system and resealing of windows in select locations.
* ECM 11A-Renewable and Alternative Energy: Installation of a total of 500 kW of roof-mount and ground-mount photovoltaic (PV) systems.
* ECM 13A-Water Conservation Measures: Retrofit or replace water fixture devices (faucets, toilets, and urinals) with more efficient water-conserving fixtures throughout the facility. Additionally, ABC will harvest and treat groundwater and rainwater for non-potable uses, including irrigation and cooling tower makeup.

Other “potential” ECMs may be considered for evaluation in the IGA based on their potential to integrate into the comprehensive project or at the agency’s suggestion. Potential ECMs that require further investigation during the more comprehensive evaluation offered by the IGA include (1) the installation of a combined heat and power system with islanding capability instead of a proposed boiler replacement and (2) the upgrade of secondary chilled water pumps to variable flow.

ABC investigated additional ECMs that are not recommended at this time, such as biomass-fueled boilers (see the Evaluated But Not Recommended Energy Conservation Measures section on page 25).

## Conceptual Cost Savings and Financial Summary

Conceptual price and year-one savings estimates and their projected ranges for the recommended ECMs are provided in Table 2. The differing range estimates are driven by ABC’s past experience with similar ECMs in other projects. For example, the lighting design is easier for ABC to scope and price at the conceptual stage (because lighting count approximations made during the walk-through should be close) than the more complex controls ECM, which would require better detail regarding site conditions and further investigation in the IGA. As a result, the lighting ECM has tighter ranges on the estimates provided.



Conceptual estimates and ranges for energy and water cost savings for the potential ECMs are provided in Table 3.



## Alignment with Agency and Facility Goals

This PA aligns with the goals of RL. It includes the design, installation, and guaranteed performance of integrated ECMs that work toward overall energy reduction and facility improvements at RL.

|  |  |  |
| --- | --- | --- |
|  | Goal | Recommendation |
| Federal energy goals EO 13834 | Meet statutory requirements relating to the consumption of renewable energy and electricity | Consider implementing the solar PV array, which will provide 4.4% of site electricity use (after full project implementation) |
| Achieve and maintain annual reductions in building energy use and implement energy efficiency measures that reduce costs | Consider implementing all energy measures. The project is estimated to reduce energy use by 25%. |
| Reduce potable and non-potable water consumption, and comply with storm water management requirements | Consider implementing the recommended water measures. The project is estimated to yield a 51% reduction in site water use. |
| Facility improvement goals | Modernize infrastructure with a priority on improvements that support critical operations | Consider implementing the full project to achieve extensive modernization of heating systems, controls, lighting systems, and water systems infrastructure. The proposed upgrades will impact all mission-critical buildings. |
| Deep retrofit | While the most comprehensive and impactful project is desired, there is no specific savings target. | Consider implementing the full project to achieve large, across-the-board impacts (estimated at 51% for water, 30% for natural gas and fuel oil, and 17% for electricity). |
| Energy resiliency | Maximize resilience for mission-critical facilities and operations where energy disruptions must be avoided | New distributed systems will provide smaller, less energy- and O&M-intensive, and more reliable systems to increase resiliency for critical facilities and operations. Dual-fuel boilers for mission critical buildings will further increase their resiliency. The PV array will provide on-site power generation that can be directed to mission-critical buildings and operations to provide islanding capability. |
| Deferred maintenance | Minimize O&M challenges for energy-related systems | Replacing antiquated, energy- and O&M-intensive boilers will significantly reduce operational costs and operational demands and improve reliability. |

# 

# Technical Assessment

## 1. Project Management Plan

### Project Management Overview

ESPC project success relies on effective project management as much as the technical approach. During the IGA phase, ABC will strengthen the partnership with RL developed during the PA and design a project that will best achieve agency objectives. The ABC team is led by the ABC Project Manager and a highly qualified team of dedicated professionals chosen to ensure delivery of a quality ESPC project that exceeds expectations. ABC has developed an effective approach to project management based upon our experience. We have established an experienced and qualified team consisting of ABC employees and subcontractors. The senior Project Manager, supported by the Project Designer, will be responsible for preparation of the IGA and Task Order Proposal. ABC will engage RL personnel to refine the project design to ensure that it meets agency needs. After task order award, the Project Manager will retain overall responsibility for implementation of the recommended ECMs and the Construction Manager will have primary responsibility for construction efforts. After project acceptance, the Project Manager will be responsible for ensuring performance and M&V reporting.

#### Communication Plan

After receipt of the Notice of Intent to Award, the ABC team will meet with the RL team in a kick-off meeting to initiate the IGA stage of the project. This effort will be led by ABC’s Lead Design Engineer and include all team members required to investigate the recommended and approved energy conservation measures and confirm and refine the findings included in the PA. Regular progress meetings will be conducted on-site at RL and attended by ABC team leads to ensure open communication and resolve any issues that surface. ABC will provide meeting notes to agency points of contact and the agency project facilitator for review. At a minimum, a midpoint review will be conducted with agency stakeholders and ABC development leads to ensure the project is closely aligned with and achieving agency objectives. All significant proposal issues—such as which ECMs will be included in the proposal; who will perform operations, maintenance, repair and replacement; the performance measurement plan; as well as savings and price estimates—will be reviewed with the agency before proposal submission. This gives the agency confidence that its input has been incorporated into the proposal and smooths the way toward contract negotiations and award.

#### Organization Chart

ABC’s project delivery team is led by an overall Project Manager, who reports directly to the ABC Government Services Director, and is organized as shown in the following graphic. ABC’s Project Manager remains with the project from initial development throughout the entire period of performance. They serve as the primary agency interface for the project. Other key players are kept consistent throughout the phases of the project, such as the senior Project Designer and M&V engineer. Responsibilities of ABC’s key project personnel are outlined in the “Key Personnel” table that follows.

#### Key Personnel

|  |  |
| --- | --- |
| ***Title*** | ***Job Responsibilities*** |
| *Project Manager* | The Project Manager has complete responsibility for the definition and implementation of the project scope with complete authority concerning the approval, allocation, and control of resources, and assigned subcontractors. This person will be the primary point of contact during the proposal development phase and will coordinate the technical and design efforts during this time. |
| *Sr. Project Designer* | Responsible for overseeing all design efforts related to the project and managing the engineering aspects effectively. Responsible for coordinating and directing the integration of technical activities into the project. |
| *Lead Engineer* | Oversees engineering analysis and manages the project engineering team during the development phase. Guides the identification and development of the ECM scopes. |
| *Construction Pricing & Support* | Will manage the implementation phase at RL and directly supervise site personnel and trade subcontractors through the site-specific construction tasks. |
| *O&M Pricing & Support* | During development, defines O&M project scope and establishes cost budgets. During construction, monitors the construction progress to prepare for the transition to the performance phase. During the performance phase, guides and manages the effort of the O&M and becomes the primary point of contact for RL. |
| *M&V Engineer* | Works with RL representatives to develop an M&V plan that ensures accurate determination of energy savings throughout the performance period. Develops plan for government staff witnessing of M&V activities. |
| *Construction Manager* | In development, determines ECM cost budgets, creates bid packages, and leads site walks. During construction, guides the effort of the site construction managers and oversees resources and the construction budget. Becomes the primary point of contact with agency during construction to ensure that crucial issues, such as safety, security, and mission goals, are upheld. |
| *Commissioning Lead* | Will ensure that the ECMs are properly installed and operating and that agency facilities staff are properly trained to operate the new and upgraded systems. |

#### Subcontract Management Plan

ABC will both self-perform and subcontract different parts of engineering and design efforts to achieve best value. ABC anticipates that, during installation, we will utilize subcontractors, primarily local subcontractors, to support the installation work. Subcontractors will be selected on a competitive basis to the maximum practical extent, consistent with the objectives and requirement of the indefinite delivery, indefinite quantity (IDIQ) contract. All subcontract offers will be evaluated and selection will be based on best overall value to the government.

ABC maintains a longstanding commitment to supporting small business concerns. We will make outreach efforts to ensure that SB, SDVOSB, VOSB, SDB, WOSB, and HUB Zone concerns have an equitable opportunity to compete for subcontracts. Specific subcontracting goals will be consistent with our IDIQ contract. The levels that can be achieved will be determined once the scope is agreed to by RL and included in the final proposal.

#### Risk, Responsibility and Performance Matrix

##### The best projects reflect a shared responsibility for risks, with the agency or energy services contractor (ESCO) most able to control or manage a specific risk bearing the burden or responsibility for it. Based on previous meetings with RL during the PA development process, ABC proposes the following sharing of risks and responsibilities as an optimum distribution of shared responsibility.

| **Responsibility / Description** | **Contractor-Proposed Approach** |
| --- | --- |
| **1. Financial** |  |
| **a. Interest Rates**: Neither the contractor (ESCO) nor the customer (ordering agency) has significant control over prevailing interest rates. Higher interest rates will increase project cost, financing/project term, or both. The timing of the Task Order (TO) signing may impact the available interest rate and project cost. | After completion of the IGA, the IDS and other data will be used to solicit offers from a minimum of three reputable financiers. All standard financing offers will be evaluated considering interest rates, total estimated costs and other terms and conditions to establish reasonableness and select the financier offering the most advantageous offer. The interest rate will be locked at the time of Task Order signing. This is a fixed rate over the term of the contract. The rate used in the PA is a representative rate of what could be obtained and is subject to change prior to award. |
| **b. Energy Prices:** Neither the contractor (ESCO) nor the customer (ordering agency) has significant control over actual energy prices. For calculating savings, the value of the saved energy may either be constant, change at a fixed inflation rate, or float with market conditions. If the value changes with the market, falling energy prices place the contractor (ESCO) at risk of failing to meet cost savings guarantees. If energy prices rise, there is a small risk to the customer (ordering agency) that energy saving goals might not be met while the financial goals are. If the value of saved energy is fixed (either constant or escalated), the customer (ordering agency) risks making payments in excess of actual energy cost savings. | For determining utility rates, ABC has used 12 months of data as well as billing simulation and other analysis to determine the rate of the last unit of energy used. For calculating savings, ABC has used utility rate data and other analysis to determine the incremental utility rate. ABC utilized the EERC calculator, which is a NIST tool for estimating escalation rates that are appropriate for each utility category. |
| **c. Construction Costs:** The contractor (ESCO) is responsible for determining construction costs and defining a budget. In a fixed-price design/build contract, the customer (ordering agency) assumes little responsibility for cost overruns. However, if construction estimates are significantly greater than originally assumed, the contractor (ESCO) may find that the project or measure is no longer viable and drop it before TO award. In any design/build contract, the customer (ordering agency) loses some design control. **Clarify design standards and the design approval process (including changes) and how costs will be reviewed.** | PA pricing is based on limited design detail using parametric estimates and past experience. ABC believes the costs are reasonably close to those expected for the proposal. We will seek competitive subcontractor quotes and perform an analysis to establish the reasonableness of all subcontract pricing included in the fixed price proposal. Design standards will be incorporated into the task order award. Change orders to increase or decrease price will only occur through a formal change process in concurrence with RL.  Neither ABC’s walk-through assessment nor discussions with site personnel revealed any indication of the presence of hazardous materials that will affect the ability to install the recommended ECMs. As a result, no cost or time in the schedule associated with hazardous material remediation is built into the PA. In the event such material is identified in the IGA or encountered during construction, both would potentially be affected, and ABC will work with RL to mitigate the risk and impacts as expeditiously as possible. |
| **d. Measurement and Verification (M&V) Confidence:** The customer (ordering agency) assumes the responsibility of determining the level of confidence that it desires to have in the M&V program and energy savings determinations. The desired confidence will be reflected in the resources required for the M&V program, and the contractor (ESCO) must consider the requirement prior to submittal of the proposal. **Clarify how project savings are being verified (e.g., equipment performance, operational factors, energy use) and the impact on M&V costs.** | ABC recommends an M&V approach for each ECM that optimizes the ability to successfully measure and verify contract performance. The approach is based on M&V Guidelines, version 4.0 and discussions with agency personnel, and will include a plan for government staff witnessing of M&V activities. ECM 1A has interactive relationships with ECMs 3A and 6A, so option D is recommended before acceptance, converting to option A in the post-acceptance phase. The M&V plan will be developed with RL personnel to determine responsibility for equipment maintenance, performance and operational factors, so as to develop an M&V plan that ensures an accurate and verifiable determination of energy savings throughout the performance period. |
| **e. Energy Related Cost Savings:** The customer (ordering agency) and the contractor (ESCO) may agree that the project will include savings from *recurring* and/or *one-time* costs. This may include one-time savings from avoided expenditures for projects that were appropriated but will no longer be necessary. Including one-time cost savings before the money has been appropriated may involve some risk to the customer (ordering agency). Recurring savings generally result from reduced operations and maintenance (O&M) expenses or reduced water consumption. These O&M and water savings must be based on actual spending reductions. **Clarify sources of non-energy cost savings and how they will be verified.** | As discussed with RL personnel, we have included energy related cost savings from both a one-time reduction and also recurring events. The one-time reduction is an avoided cost for appropriated replacement equipment and should be paid at project acceptance. Recurring O&M cost savings result for ECM 3A (controls) because ABC is taking over an existing maintenance contract at a reduced cost to the agency. Recurring O&M savings for ECM 5A (lighting) result from a reduction in replacement costs due to the longer life and manufacturer warranties for LED lamps.  Energy-related cost savings are escalated by 3% annually. |
| **f. Delays:** Both the contractor (ESCO) and the customer (ordering agency) can cause delays. Failure to implement a viable project in a timely manner costs the customer (ordering agency) in the form of lost savings and can add cost to the project (e.g., construction interest, re-mobilization). **Clarify schedule and how delays will be handled.** | ABC will maintain a critical path methodology project schedule and inform RL when delays are suspected and work to mitigate overall project schedule impacts. The project schedule will be reviewed during weekly job site meetings. |
| **g. Major changes in facility:** The ordering agency (or Congress) controls major changes in facility use, including closure. **Clarify responsibilities in the event of a premature facility closure, loss of funding, or other major change.** | In the event that RL (or Congress) closes a facility, then RL will be able to buy out the remaining portion of the contract (presented on Schedule TO-5 of Volume II, Price Proposal). Other changes may require a contract modification to adjust the guaranteed savings, M&V and/or payments. |
|  |  |
| **2. Operational** |  |
| **a. Operating Hours:** The customer (ordering agency) generally has control over operating hours. Increases and decreases in operating hours can show up as increases or decreases in “savings” depending on the M&V method (e.g., operating hours multiplied by improved efficiency of equipment vs. whole-building/utility bill analysis). **Clarify whether operating hours are to be measured or stipulated and what the impact will be if they change.** If the operating hours are stipulated, the baseline shall be carefully documented and agreed to by both parties. | During the IGA phase ABC and RL will discuss operating hours that will be specified in the proposal to determine savings. During the performance period, operating hours will remain unchanged for guarantee purposes. RL will maintain adequate and necessary records which will be made available to ABC during the annual M&V review. Any changes and the associated loss or gain in savings are a RL risk. |
| **b. Load:** Equipment loads can change over time. The customer (ordering agency) generally has control over hours of operation, conditioned floor area, intensity of use (e.g., changes in occupancy or level of automation). Changes in load can show up as increases or decreases in “savings” depending on the M&V method. **Clarify whether equipment loads are to be measured or stipulated and what the impact will be if they change**. If the equipment loads are stipulated, the baseline shall be carefully documented and agreed to by both parties. | For the PA, ABC used information provided by RL and information will be gathered during the IGA to determine if changes should be made for the final proposal. During the performance period, equipment loads will remain unchanged for the purpose of M&V and ABC associated guarantee. RL will maintain adequate and necessary records, which will be made available to ABC during the annual M&V review or as determined necessary. However, any changes and the associated loss or gain in savings are an RL risk. ABC will work with RL if changes during the performance period result in equipment degradation and recommend options for improvement. |
| **c. Weather:** A number of energy efficiency and water conservation measures are affected by weather, which neither the contractor (ESCO) nor the customer (ordering agency) has control over. Should the customer (ordering agency) agree to accept risk for weather fluctuations, it shall be contingent upon aggregate payments not exceeding aggregate savings. **Clearly specify how weather corrections will be performed.** | ABC will use a 30-year weather database in building models. Since weather factors typically average out over the term of an ESPC contract, weather is not a significant factor in achievement of savings. The weather conditions will be specified in the proposal. |
| **d. User participation:**  Many energy conservation measures (ECMs) require user participation to generate savings (e.g., control settings). The savings can be variable and the contractor (ESCO) may be unwilling to invest in these measures. **Clarify what degree of user participation is needed and use monitoring and training to mitigate risk.** If performance is stipulated, document and review assumptions carefully and consider M&V to confirm the capacity to save (e.g., confirm that the controls are functioning properly). | The proposal will include the recommended specifications for the equipment recommended. When user participation is required to generate savings, one of these scenarios will occur:   * ABC will provide on-site staff, or * RL has trained people on staff to participate appropriately; or * ABC will train the RL personnel to participate appropriately; or * If RL requests, ABC can perform the required participation as part of a separate service agreement. |
| **3. Performance** |  |
| **a. Equipment Performance:** The contractor (ESCO) has control over the selection of equipment and is responsible for its proper installation, commissioning, and performance. The contractor (ESCO) has responsibility to demonstrate that the new improvements meet expected performance levels, including specified equipment capacity, standards of service, and efficiency. **Clarify who is responsible for initial and long-term performance, how it will be verified, and what will be done if performance does not meet expectations.** | ABC is responsible for equipment selection, installation, commissioning and performance. Equipment performance will be verified during commissioning and as necessary, ABC will make corrections. Equipment will not be considered performing until RL representatives agree.  After acceptance, if project equipment that is operated, maintained, or repaired by RL is underperforming, it will be reported in the annual M&V report and ABC will conduct an assessment to determine the reason for the underperformance. ABC will propose options to remedy the situation. If the underperformance is related to the originally installed equipment and RL has fulfilled the operational and maintenance requirements as directed by ABC, ABC will resolve the underperformance at its expense. If the underperformance is related to a shortfall in the required operational and maintenance conducted by RL, RL will be responsible. If RL requires assistance in performing contracted tasks, ABC is available to assume the work through a contract modification or a separate contract. |
| **b. Operations:** Performance of the day-to-day operations activities is negotiable and can impact performance. However, the contractor (ESCO) bears the ultimate risk regardless of which party performs the activity. **Clarify which party will perform equipment operations, the implications of equipment control, how changes in operating procedures will be handled, and how proper operations will be assured.** | Based on initial discussions with RL, we recommended that RL perform all operations, with ABC providing operational support to ECM 3 (controls) through a part-time technician for the term of the contract. ABC will provide manuals and train RL personnel in the proper operation of newly installed equipment. Proper operation of ECMs will be verified through the performance period M&V, and any discrepancies will be reported. If improper operation results in a performance shortfall, ABC will propose options to remedy the situation. |
| **c. Preventive Maintenance:** Performance of day-to-day maintenance activities is negotiable and can impact performance. However, the contractor (ESCO) bears the ultimate risk regardless of which party performs the activity. **Clarify how long-term preventive maintenance will be ensured, especially if the party responsible for long-term performance is not responsible for maintenance (e.g., contractor provides maintenance checklist and reporting frequency).**  **Clarify who is responsible for performing long-term preventive maintenance to maintain operational performance throughout the contract term.** **Clarify what will be done if inadequate preventive maintenance impacts performance.** | ABC is responsible for project equipment maintenance. Based on initial discussions with RL, we recommend that RL perform maintenance tasks for all installed ECMs except ECM 11A (Solar PV). ABC will provide equipment maintenance requirements and train RL personnel in the proper preventative maintenance to ensure that all maintenance is performed in a timely manner and properly. Maintenance logs will be reviewed during the performance period M&V and any discrepancies will be reported in the annual M&V report. If required maintenance has not been performed, or improper maintenance is identified that results in underperformance, options will be proposed to remedy the situation. ABC is available to assume the work through a contract modification or a separate contract.  For ECM 11A, ABC is responsible for preventive maintenance in accordance with manufacturers’ recommendations over the term of the contract. |
| **d. Equipment Repair and Replacement:** Performance of day-to-day repair and replacement of contractor-installed equipment is negotiable; however, it is often tied to project performance. The contractor (ESCO) bears the ultimate risk regardless of which party performs the activity. **Clarify who is responsible for performing replacement of failed components or equipment replacement throughout the term of the contract. Specifically address potential impacts on performance due to equipment failure. Specify expected equipment life and warranties for all installed equipment. Discuss replacement responsibility when equipment life is shorter than the term of the contract.** | ABC is responsible for all equipment repairs. Unless otherwise specified in the ECM description all installed equipment will have either the full manufacturer’s warranty or a one-year warranty (whichever is longer). An extended warranty period may be negotiated. Based on initial discussions with RL, we recommend that RL perform all equipment repair and replacement after the warranty period, except for ECM 11A noted below. ABC will provide manufacturer’s suggested repair and replacement schedules and guidance and training for the proper equipment repair and replacement of project installed equipment. Most ECMs have equipment with useful lives longer than the PA term. In the event of a shorter term, ABC can include replacement costs if desired by RL, but this will extend the term or reduce the project size.  For ECM 11A, ABC recommends including inverter replacement in year 15 to ensure continued equipment performance over the contract term.  Maintenance logs will be reviewed during the performance period M&V and any discrepancies will be reported in the annual M&V report. If required repair and replacement has not been performed, or improper maintenance is identified resulting in under performance, options will be proposed to remedy the situation. ABC is available to assume additional work through a contract modification or a separate contract |

#### Expectations for Agency

During the IGA, ABC and RL will closely collaborate to ensure that the data and information needed are collected to support the development of an IGA that achieves an accurate scoping of the project matched to RL’s needs. Scoping the best project will depend upon support from RL managerial, financial, technical, contractual, and operational personnel. Access to facilities and people, escorts (if applicable), timely responses to requests for information, and meetings with both project personnel and RL leadership will be needed. Project team meetings/calls may involve discussions of goals, objectives, priorities, communication protocols, data collection/witnessing, project development reviews, equipment operations and maintenance, and measurement and verification planning.

The ECM templates (starting on page 30) detail the significant issues and needs from the agency associated with each specific recommended ECM (see “Other” section of each template). These include needs associated with interfacing new to existing equipment (such as tying into existing controls and/or distribution systems), utility interruptions, and physical changes to buildings. In addition, the agency and ABC will need to engage with the local electric utility and potentially the local public utility commission during IGA development to finalize the scope, interconnection requirements, and costs of the solar PV system.

During construction, ABC will closely coordinate upgrades affecting mission-critical equipment with RL staff to minimize downtime and the impact on its mission. The agency will be required to provide access to people and facilities and any necessary escorts. Utility interruptions will be coordinated with RL staff to minimize disruption and coordinate outages. Also, refer to the “Other” sections in the ECM templates where agency support to install specific ECMs (e.g., initiate discussions with utilities to establish the viability of the PV array) is detailed.

#### Project Development and Implementation Schedule

Project milestone dates and estimated durations for key activities are shown below at a high level. A detailed schedule will be developed with input from RL and included in ABCs proposal. Following Task Order (TO) award, the schedule will be updated and submitted to RL for approval. During design and construction, the schedule will be reviewed and updated monthly.

|  |  |  |  |
| --- | --- | --- | --- |
| Activity/Milestone | Duration | Start | Finish |
| PA Submitted to Rockwell Laboratories, DOE | 30 days | 12/8/18 | 1/7/19 |
| PA Presentation, Government Review | 45 days | 1/7/19 | 2/22/19 |
| Notice of Intent to Award and TO-Request for Proposal (RFP) Issued  (after Rockwell Laboratories obtains approvals to proceed) | 30 days | 2/22/19 | 3/21/19 |
|  |  |  |  |
| Investment Grade Audit Complete, Technical & Price Proposal Developed and Submitted | 180 days | 03/21/19 | 9/17/20 |
| Proposal Presentation, Government Review, | 60 days | 9/17/20 | 11/18/19 |
| Revised Proposal as Applicable, Rockwell Laboratories Obtains | 30 days | 11/18/19 | 12/18/19 |
| TO Award  (after Rockwell Laboratories obtains approvals to award) | 30 days | 12/18/19 | 1/17/20 |
| Project Design & Construction\*  (Including Commissioning and Post Installation M&V Report) | 18 months | 1/17/20 | 7/16/21 |
| Complete Project Acceptance\*\* | 1 month | 7/16/21 | 8/15/21 |
| Post-acceptance Performance Phase | 23 years | 8/15/21 | 8/9/44 |
| Annual Measurement & Verification Reports | 23 years | 8/15/21 | 8/9/44 |
| Invoices to Government & Government Payments | 23 years | 8/15/21 | 8/9/44 |
| TO Contract Close-Out | 60 days | 8/9/44 | 10/10/44 |

\* Government witnessing required.

\*\* Burn-in period recommended to ensure equipment readiness prior to acceptance.

## 2. ECM Descriptions

### Recommended Energy Conservation Measures

*[For each recommended ECM, the Contractor shall submit narrative information and estimated implementation price and savings ranges in the format specified in Attachment J-13. For each potential ECM, the Contractor shall provide a short narrative at a conceptual level.]*

ABC embraces a comprehensive approach toward developing ECMs. As part of this approach, our team evaluates a wide range of measures for their technical potential and their ability to meet agency needs. This starts with establishment of a baseline of the existing facilities energy and water usage. Once this baseline is developed, we methodically evaluate potential energy and water conservation measures. ABC performed site surveys at RL between October 10 and October 31, 2018. As agreed to by the agency, all buildings and ECMs were evaluated.

Based upon the site surveys and information gathered while on-site, in conjunction with data packages and drawings provided by RL, we identified ECMs specific to the various systems and site profile characteristics. Table 4 summarizes recommended ECMs by building number where they will be installed. Based on our periodic meetings and discussions with RL, our initial analysis indicates that implementation of the ECMs in the buildings shown will deliver a project that meets or exceeds agency expectations. *(Note: The ESCO and agency should consider discussing the format of Table 4 before delivery of the PA, as the agency may prefer this table in a different form. For example, the agency may prefer the table with ECMs listed in each row and the building numbers in the column headings, so the ECM Costs/Cost Savings columns represent individual ECM costs in contrast to the total ECM costs and cost savings by building as in this table).*



#### Facility Description

RL, located just outside of Denver, Colorado, comprises multiple office, laboratory, mixed-use, training, and maintenance facilities. The site also includes small distribution/warehouse and canteen buildings. The primary buildings at the site comprise over 500,000 square feet of occupied space. RL staff indicated a desire for a comprehensive project with all buildings considered in the scope of the assessment. RL provides research and development space for approximately 350 researchers and supporting staff. A map of the site is shown below and Table 4 lists the primary buildings at the campus.

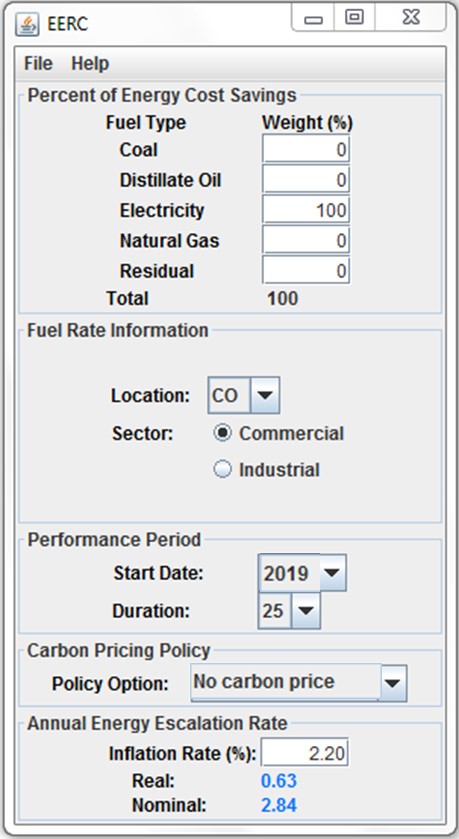


#### Energy, Water, and Utility Rate Data

RL receives all utilities from local, public utility providers. In 2017, Rockwell labs consumed 15,356,000 kWh of electricity, 74,090 MMBtu of natural gas and fuel oil, and 25,374 kgal of water. Annual utility costs totaled $2,541,000. Approximately 60% of the site’s building space (floor area) is supported by gas heating (via steam from the central plant) and 40% is supported by fuel oil (localized boilers). The following utility rates were used in developing the savings calculations presented in this PA:

|  |  |  |  |
| --- | --- | --- | --- |
| Utility | Annual Use | Utility Rate | Source |
| Water and Sewer | 25,374 kgal | $10.00/kgal | 2017 Utility Bills (weighted avg.) |
| Electrical Demand | NA | $8.18/kW | Current Utility Bill / Rate Schedule |
| Electrical Energy | 15,356,000 kWh | $0.08/kWh | 2017 Utility Bills / Rate Schedule |
| Natural Gas | 37,047 MMBtu | $6.00/MMBtu | 2017 Utility Bills |
| Oil (Other Type 1) | 37,042 MMBtu | $23.00/MMBtu | 2017 Utility Bills |

For the projection of savings over the project term, ABC escalated these rates for future year prices using FEMP’s Energy Escalation Rate Calculator (EERC). The resulting electricity escalation rate from the EERC is shown in the graphic below, and all escalation rates (energy, water, and O&M) are detailed in the TO schedules. Additional details of the analysis will be provided in the proposal.



#### Implementation Price and Savings Ranges

Implementation price estimates for individual ECMs (from Table 2) range from around $1 mil (envelope modifications) to $3 mil (controls upgrades). These estimates will be refined in the follow-on IGA development using actual bids from competing suppliers and implementation subcontractors. Annual savings estimates for individual ECMs range from a low of $32K (envelop modifications) to $225K (controls upgrades). These will also be refined in the IGA. Consistent with the requirement in the IDIQ, ECM scope overviews along with more detail on individual ECM cost and performance metrics are provided in the ECM narrative one-pagers in the IDIQ Attachment J-13 ECM Summary Descriptions section of this document that begins on page 30. Details of savings calculations, assumptions, and measured data used in the calculations and pricing backup documentation will be provided in the proposal per the IDIQ contract.

Two incentive opportunities will be investigated further during the IGA phase. The local electric utility does have a rebate program that can provide an incentive for LED lighting. In addition, there is a potential federal tax credit opportunity for the solar PV system if the legalities for obtaining this credit can be met. ABC will assist, but RL will ultimately need to execute the documents needed to capture these incentives. Neither potential incentive is included in the project financials at this conceptual stage (not included in the ECM templates nor the TO schedules) because RL’s ability to obtain is not ensured. The proposed project stands on its own financially and does not require these incentives to cash flow. The incentives will be affirmed during the IGA and, if obtainable, will reduce the costs and project term projected in this PA.

#### Technology Category 1, ECM 1A - Boiler Plant Improvements

Most buildings at RL are currently provided heat through fuel oil boilers, because natural gas is only provided to the main steam plant and Building 300. Recently a gas line has been brought into the west end of the campus with plans to serve the new research facilities. With the extension of a natural gas distribution system provided by Buymore Gas, these units can be economically converted to the less expensive natural gas fuel source.

Despite the continued increase in overall energy costs, natural gas has maintained a significant cost advantage over other energy and fuel sources for building heating, water heating, and other applications requiring a fossil fuel. Current natural gas prices in the area are less than half that of #2 fuel oil when compared on a $/Btu basis. In addition, natural gas HVAC and water heating equipment is available at consistently higher rated efficiencies than oil-fired equipment. It is also easier to maintain and poses less emissions concerns compared with fuel oil fired units.

RL currently has natural gas lines on both ends of the campus. Natural gas is distributed by Buymore Gas, which has the capability to extend these lines to the necessary buildings. ABC has worked with Buymore to confirm that natural gas can be extended to the necessary areas of the base and has developed a plan for extending natural gas distribution.

This ECM includes the replacement/conversion of existing boilers, hot water heaters, and direct-fired units with high-efficiency natural gas equipment. All associated equipment for the specific building is included in this ECM. The new boilers/burners will be gas-fired units providing cost savings due to the unit cost of natural gas versus the existing #2 fuel oil. The new domestic hot water heaters and burners will be gas-fired units providing cost savings due to the unit cost of natural gas versus the existing electric or fuel oil and the more efficient new boilers. All replacements include demolition and disposal of the existing boilers/burners and fuel supply lines within the mechanical room. Also included is turnkey installation of new equipment and natural gas supply lines. The installation includes flue modifications to serve the new units.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Boiler-Burner Replacement/Conversion to NG** | | | | | |
| Building | Convert | Replace | Type | Quantity | Brand |
| 100 |  | X | DHW | 2 | ACME Hot Water Pro |
| 110/120 |  | X | Oil | 2 | ACME 2100 |
| 200 |  | X | Steam | 2 | ACME District 2000 |
| 300/320 |  | X | Steam | 2 | ACME Boil-master 1000 |
| 300/320 |  | X | DHW | 2 | ACME Hot Water Pro |
| 330 |  | X | Oil | 1 | ACME 501 |
| 350 |  | X | Oil | 1 | ACME 2100 |
| 350 | X |  | Radiant | 6 | ACME Radiant Pro |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Direct Fired Unit Replacement/Conversion to NG** | | | | | |
| Building | Convert | Replace | Type | Quantity | Brand |
| 330 | X |  | RTU | 2 | ACME RTU Pro |
| 330 |  | X | Packaged RTU | 2 | ACME RTU P-1000 |

#### Technology Category 3, ECM 3A - Controls

Replacing pneumatics with DDC, implementing robust control strategies, and integrating systems and advanced meters with the existing ACME BAS will ensure optimum performance of mission-critical equipment, provide maintenance staff with the tools to better maintain building systems, save energy and maintenance costs, and take significant steps toward creating an all-ACME control system.

ABC will expand upon RL’s efforts to build a campus-wide ACME controls network at the lab and leverage the full potential of this BAS. The ECM will reduce energy consumption by 28%, extend the life of equipment, reduce maintenance costs, improve occupant comfort, and optimize building and mission-critical system performance. Upgrades will include programming that supports mission-critical operations, improves energy efficiency, and reduces HVAC run times. The system will react to sustain comfortable conditions for staff. In addition, we will integrate advanced metering within the BAS, allowing lab staff to monitor utility consumption in real time to identify and troubleshoot inefficiencies proactively.

ABC will work with RL maintenance staff to retro-commission the BAS and HVAC equipment by analyzing and addressing root causes of poor system performance. ABC will review these issues, the impact on equipment efficiency and longevity, how to resolve them, and how to prevent them from recurring. Training activities will also include reviewing the system manual to answer questions, flagging important topics and identifying sections that need updates or clarification. ABC’s comprehensive solution will leverage and expand upon RL’s investment in building automation to support the maintenance program.

RL’s building controls include a combination of DDC and pneumatic end devices controlled by a mix of ACME and older Master-Tech control systems. Based on discussions with lab staff during the site walk, the goal is to transition to an all-ACME system. ABC is vendor-neutral and has installed multiple types of BASs, including ACME.

We will replace pneumatic control points with DDC, integrate the BAS and advanced metering systems to single ACME front-end supervisory control, and retro-commission the BAS and HVAC equipment to eliminate costly pneumatic air compressors, improve reliability, repair failed BAS components, implement optimized control strategies, and support maintenance staff in efforts to prevent disruption to the RL mission. The number of pneumatic points that will be replaced was estimated based on the equipment list provided by RL. The scope for this ECM includes the following:

* Replace 3,400 pneumatic control points with ACME DDC and connect to the existing ACME front-end.
* Integrate existing Master-Tech DDC points to the ACME front-end.
* Integrate systems and advanced meters to the ACME front-end.
* Install new communication fiber to connect buildings not already connected to the BAS.
* Retro-commission BAS and HVAC systems to repair failed sensors and actuators and remove overrides by resolving root cause issues.
* Provide programming to standardize set points and operation and implement energy saving control strategies, such as
  + Unoccupied night temperature setback in administrative and clinical areas that are not occupied 24/7
  + HVAC equipment scheduling with occupant override for after-hours operation, including programming variable-air-volume boxes served by air-handling units (AHUs) that support both Monday through Friday and 24/7 areas to significantly reduce flow during unoccupied periods, decreasing fan and reheat energy
  + Supply air /cold deck temperature reset based on load
  + More aggressive hot deck reset based on load, ensuring that no spaces are underheated
  + Economizer controls based on enthalpy instead of dry-bulb temperature
  + Static pressure reset

**Table 5. Parameters Changed to Calculate Energy Savings**

|  |  |  |
| --- | --- | --- |
| Parameters | Baseline Values | Post-Installation Values |
| HVAC Air-Side/Water-Side Equipment  Schedules | Continuous Operation | Continuous (6:00 a.m. – 6:00 p.m., Mon-Fri)  Cycle to maintain setpoints (nights and  weekends) |
| Occupied Set Points (6:00 a.m. – 6:00 p.m.,  Mon-Fri) | 72°F (heating) and 74°F (cooling) | [no change] |
| Unoccupied Set Points (nights and weekends) | 72°F (heating) and 74°F (cooling) | 64°F (heating) and 80°F (cooling) |
| Supply Air/Cold Deck Temperature | Constant 55°F | Warmest control  Max reset temp 65°F |
| Hot deck Minimum Supply Temp | 88°F | 80°F |
| Outside Air Ratio | Constant (varies by system) | Default to baseline value (6:00 a.m. – 6:00  p.m., Mon-Fri) 0.001 (nights and weekends) |
| Economizer Control | Dual temperature | Dual enthalpy |
| Variable Speed Drive (VSD) Control | None—VSD to be installed | Good static pressure reset VSD fan |

**Table 6. ECM 3A Controls Strategies to be Implemented by Building**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Building #** | **HVAC Scheduling** | **Supply Air Reset** | **Economizing** | **Chilled Water Reset** | **Hot Water Reset** |
| 100 | Y | Y | Y | Y | Y |
| 110 | Y | Y | Y | Y | Y |
| 120 | Y | N | N | N | N |
| 160 | Y | Y | Y | N | N |
| 300 | Y | Y | N | N | N |
| 330 | Y | N | N | N | N |

#### Technology Category 5, ECM 5A—Energy Efficient Lighting Upgrades

It is proposed that the existing 2-lamp 4 foot, 3-lamp 4 foot and 4-lamp fluorescent fixtures be retrofitted using 22.5 W, 45 W and 67.5 W LED retrofit kits. Screw-in incandescent lamps (floodlights and flame-tip candle lamps) can be replaced with appropriate screw-in LED lamps. In addition, dusk-to-dawn street and area lighting is also addressed. Existing technology for the exterior lighting includes high pressure sodium and metal halide, and these fixtures can also be replaced with new LED technology using new light pole heads on existing pole fixtures and with LED wall packs replacing the existing high-intensity discharge fixtures.

During the course of 5 business days (Monday, May 20th through Friday, May 24th) a PA walk-through of the areas to be addressed was conducted. The areas to be addressed were determined by the agency; a list was provided and it was occasionally modified during the daily meetings attended by RL and ABC personnel. A representative existing lighting inventory was created by auditing as many spaces as possible during the week. Due to time and access limitations, the fixture count and technology of the lighting in some areas has been estimated, based on the technologies, quantities, and square footage of the areas that were accessible.

Overall building hours-of-use in the analysis are originally from the building list spreadsheet provided before the PA site visit. Lighting hours for spaces within each building have been adjusted by space type based on observations made during the walk-through.

The fluorescent fixtures in the buildings audited are overwhelmingly 32 W T8 lamps with electronic ballasts. While this is indeed energy-efficient technology, it is not state-of-the-art technology; and it was determined that new LED technology can be installed in both interior and exterior fixtures to provide significant energy savings.

There is excellent existing lighting control, in the form of wall and ceiling-mounted lighting occupancy sensors (as well as existing on-site energy awareness and manual control). While there are still some areas where controls might be installed, the kWh reduction from the proposed lighting technology installation (and resultant cost reduction) makes the prospect of investing in new lighting controls extremely unattractive. Therefore, lighting control measures have not been addressed in any of the areas audited.

Table 7 is a summary of the proposed conditions and associated quantities.

**Table 7. Proposed Lighting Retrofits and Quantities**

|  |  |  |
| --- | --- | --- |
| Existing | Proposed | Quantity |
| 100W INC | 23W CF SI | 10 |
| 100W METAL HALIDE WALLPACK | NEW WLPK/40W LED | 30 |
| 120W INC FLOOD | 19.5W LED FLOOD | 39 |
| 150W HPS WALLPACK | NEW WLPK/75W LED | 9 |
| 150W INC | 42W CF SI | 4 |
| 150W INC FLOOD | 25W LED FLOOD | 17 |
| 250W HPS POLE | NEW Pole Head/150W LED | 26 |
| 250W MH LOWBAY | New LB/125W LED | 16 |
| 250W MH POLE | NEW Pole Head/150W LED | 32 |
| 25W INC FLAME LAMP | 3.5W LED FLAME LAMP | 16 |
| 2L20W INC EXIT | NEW LED EXIT | 24 |
| 2L4' EE/EEMAG T12 | Retro/22.5W LED Tech | 11 |
| 2L4' T8/elec | Retro/22.5W LED Tech | 2,137 |
| 3L4' T8/elec | Retro/45W LED Tech | 1,681 |
| 400W HPS POLE | NEW Pole Head/200W LED | 152 |
| 400W HPS ROOF/WALL-MTD | NEW Roof/Wall Mount/200W LED | 5 |
| 40W INC FLAME LAMP | 3.5W LED FLAME LAMP | 551 |
| 4L4' T8/elec | Retro/67.5W LED Tech | 990 |
| 60W INC | 18W CF SI | 8 |
| 65W INC FLOOD | 23W CF SI FLOOD | 10 |
| 90W INC FLOOD | 23W CF SI REFL | 25 |
| **Total** |  | **5,793** |

**Location(s) Affected**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Bldg. # | Type |  | Bldg. # | Type |  | Bldg. # | Type |
| 100 | Office |  | 170 | Comms |  | 320 | Lab/Office |
| 110 | Lab/Office |  | 180 | Canteen |  | 330 | Warehouse |
| 120 | Lab/Office |  | 200 | Steam Plant |  | 350 | Maintenance |
| 160 | Training |  | 300 | Office |  |  |  |

#### Technology Category 6, ECM 6A Upgrade Building Envelope

The building envelope is the physical barrier between the interior and exterior environments. It serves as the outer shell to help maintain the indoor environment and facilitate its climate control. An effective building envelope is one that retains the environment inside the building and is minimally susceptible to the heat transfer properties of the outside. The physical components of the envelope include the foundation, roof, walls, doors, and windows. The dimensions, thermal performance and (thermal) resistivity of materials, the fabrication process, and their connections and interactions are the main factors that determine the effectiveness of the building envelope system. As an example, during the heating season, the temperature being maintained inside the building is in contrast to much colder outside air temperatures. Buildings that are not properly insulated or use materials that have low thermal resistivity will transfer heat to the outside at a rapid rate. This heat transfer will result in additional energy being used by the building’s heating and ventilation systems to maintain indoor air temperature.

ABC proposes the addition of the ACME Window System throughout all of the outside-facing, single-pane windows in Buildings 100, 110, 120, and 160. The ACME window is an additional windowpane that will be added to the existing single-pane windows throughout the building, effectively turning a single-pane into a double-pane system. The two windows (existing and new) will be separated by a small air space that will serve to reduce the overall heat transfer coefficient, on the order of 78%, which will result in a reduction of heat losses to the outside environment and yield significant energy savings.

#### Technology Category 11, ECM 11A Solar Photovoltaic System

This ECM provides for the installation of solar PV arrays for the production of renewable energy in the form of electrical generation. The system will be sized at 500 kW (DC) and will produce on average 557,000 kWh per year.

The recommended ECM includes the following:

1. Install 500 kW (DC) in PV arrays (total of ground-based and roof-mounted).

2. Install utility-required interconnection equipment.

3. Provide monitoring of the system through the existing BAS.

The PV electrical output will be interconnected with the existing electric service. All PV-generated power will be used to displace “behind-the-meter” retail electric consumption. During the IGA, ABC will confirm that roof structures can accommodate the extra loading of the PV system and racking. We don’t anticipate any additional structural work will be required, however, because the racking system including ballast is expected to add less than 5 pounds per square foot to the roof load, which should be within the capacity of the existing roof.

#### Technology Category 13, ECM 13A Domestic Water Conservation

During the audit, ABC discovered a variety of different water conservation opportunities, including both domestic and non-domestic improvements. These improvements include

• Install Cooling Tower Water Treatment System

• Install Groundwater Harvesting System

• Install Rainwater Harvesting System

• Install Sub-meter Cooling Towers

• Upgrade Toilets to High-Efficiency Technology

• Upgrade Urinals to High-Efficiency Technology

• Upgrade Faucets to Ultra Low Flow Technology

• Upgrade Showers with Low-Flow Pressure Compensating Showerheads

Once implemented, these measures will collectively reduce water consumption at the site by 50%. Additional dollar savings will be realized from sub-metering the cooling towers, which will eliminate over 4,000 thousand gallons (kgal) in the sewer billing.

**Cooling Tower Water Treatment System**

ABC proposes to deploy an ACME water treatment system as a measure to save water at RL. This system allows for the condenser water to operate at higher cycles of concentration, thereby minimizing the amount of water that must be discharged to the sanitary sewer. This results in a savings of both water and sewerage. The ACME system consists of three main components:

1. The ACME control and monitoring system

2. Special pretreatment of the condenser water makeup

3. Sidestream filtration of the condenser water

The ACME system will be provided with an IP communication card that shall be used for integration into the BAS.

The ACME Control and Monitoring System

At the heart of the water savings measure is the ACME control and monitoring system. This system continuously monitors 15 key parameters of the condenser water treatment program. The controller contains sophisticated logic to accurately provide the needed output responses. Should any monitored parameter exceed a preset level, the system will alarm and/or send an email to the water treatment operators and managers.

Pretreatment of the Condenser Water Makeup

Additionally, a special pretreatment system will be installed. This system provides precise partial softening of the condenser water makeup to minimize the formation of calcium carbonate, a compound that would otherwise precipitate at the elevated cycles of concentration at which the new water treatment program operates. This reduction of calcium carbonate helps avoid scaling of the heat transfer surfaces.

Sidestream Filtration of the Condenser Water

The third component is the use of sidestream filtration, which draws water from the cooling tower basin, filters it, and returns it to the cooling tower water circulation system. Open recirculating cooling systems scrub airborne particulate into the condenser water. This foreign matter introduces additional bacteria and other contaminants, which impede the effectiveness of the water treatment program. During operation at higher cycles, this foreign matter becomes more concentrated and its management becomes more critical. Sidestream filtration removes this matter from the condenser water, and a much higher concentration can be achieved (saving water that would have been bled off to drain).

**Groundwater Harvesting System**

During audit walk-throughs, a constant groundwater supply source was identified in the sump pits of the main mechanical room. After analysis of this water, it was found to contain some salt residual and exhibited an overall conductivity that ranged 270 to 1400 μohms. ABC recommends enhancing the proposed cooling tower makeup water treatment system and collecting this groundwater for tower makeup. It has been determined the groundwater could provide at least a 90% offset of tower makeup water demand. The collection system will contain the following components:

• Groundwater sump station that includes sump pit cleaning, liner, transfer pump skid, flow meter, and control valves

• Storage tank and booster pump station that utilizes the existing water storage tank (sealed and lined), potable water backup, and a variable-speed pumping station to supply water to the water treatment system

• Enhancements to the water treatment skid (in addition to softeners and side stream filters) to include advanced filtration, sterilization, and programmable logic controllers to allow for complete control over makeup water quality.

• Piping tie-ins to existing makeup water supply locations and new level sensor controls to better manage cooling tower water consumption and minimize overflow waste.

**Rainwater Harvesting System**

During audit walk-throughs, storm drain headers were identified in the main mechanical room space. Since the water passing through these headers originates from drainage from the green roof, organic and nutrient contamination does not make this a viable source of makeup water for the cooling tower. It could, however, be effectively used for irrigation.

ABC recommends installing a rainwater diversion and capture system that would supply exterior hose bibs to four quadrants of the facility and tie in to the basement-level restrooms near the cafeteria for water supply to toilets and urinals. The system would include the following components:

• Three-way control valves to tap into existing storm drain headers

• 2,650 gallons of storage through use of small footprint storage tanks

• Pump skid with ultraviolet sterilization, chlorination, and filtration

• Meters on all discharge lines to each end use system

**Sub-Metering Cooling Tower**

Currently, RL receives potable water from the local water utility, Buymore Water. Sewer billing is determined by correlating water use with sewer discharge, assuming that all water will eventually end up in the sewer system. This is not the case for the cooling tower systems, where substantial volumes of water may be lost to evaporation and drift and never go to a drain. RL has two service lines that provide cooling tower makeup water that are already outfitted with water meters. These meters are not read by Buymore Water because of its current inability to read the meters remotely. In conjunction with Buymore Water, ABC will install a remote communication device that can be read remotely by Buymore Water. This will enable the facility to better track water usage and identify irregular spikes in consumption, as well as quantify water that does not enter the sewer to reduce sewage expense.

**Domestic Sanitary Fixtures**

Toilets

ABC identified 252 toilets with diaphragm type valves with a rated flow of 1.6 gallons per flush (gpf). ABC proposes to replace the existing toilet fixtures with appropriate configuration HET 1.28 gpf vitreous toilet china and manual piston valves (4-bolt wall-hung rear discharge and floor-mount floor discharge configurations). Each fixture replacement shall include new commercial-grade seats to meet the local plumbing code or match the existing seat configuration. Each fixture replacement shall include all miscellaneous materials required for proper installation including caulk, wax rings, gaskets, mounting bolts, etc.

Urinals

ABC identified 29 high-flow or large water spot urinals. ABC proposes to replace these urinals with new HEU pint flush (0.125 gpf) vitreous urinal china and manual piston valves. Additionally, 49 existing small water spot urinals were identified and are proposed for retrofit with new HEU (0.5 gpf) manual piston valves. Each fixture replacement shall include all miscellaneous materials required for proper installation, including caulk, mounting bolts, etc. Many of the existing diaphragm-type valves exhibited flush rates in excess of their design; this is common with diaphragm valves, as interior components deteriorate with age, leading to increased flush volumes.

Faucets/Aerators

During audit walk-throughs, a variety of different faucets were identified. The majority of the fixtures have been upgraded with 0.5 gpm low-flow controls, but some fixtures have had flow controls removed or original faucet aerators remain. ABC recommends the retrofit or replacement of faucets so that lavatories flow at 0.5 gpm and kitchenette faucets flow at 1.0 gpm. Some faucets will require full replacement in order to achieve these specifications.

Showerheads

A total of 25 showerheads were identified during audit walk-throughs. Although the showers are used relatively infrequently, replacement with 1.5 gpm pressure-compensating showerheads will yield water and energy savings.

|  |  |
| --- | --- |
| **Measure** | **Quantity** |
| Toilet Upgrade | 252 |
| Urinal Upgrade | 78 |
| Faucet upgrade | 45 |
| ShowerHead Replacement | 25 |

### Potential Energy Conservation Measures

#### Technology Category 2, Potential ECM 1: Chiller Plant Improvements

This ECM will convert existing, constant-speed secondary chilled water pumps to variable-speed pumps in Building 100. The ECM is expected to replace two existing chilled water secondary pumping systems with new pumps, install premium-efficiency motors and variable-frequency drives, and replace existing chilled water three-way valves with two-way valves. During the IGA, ABC will make short-term measurements to collect sufficient data to fully evaluate the economics of this ECM.

#### Technology Category 10, Potential ECM 2: Distributed Generation

This ECM will evaluate the potential of installing a cogeneration system in place of a planned boiler replacement that is currently one of the recommended ECMs in this PA. ABC will also investigate the potential for islanding capability to serve the critical loads during outages that RL helps to identify. During the IGA, ABC will make short-term measurements to identify the appropriate heating load that should be used for sizing the cogeneration system, enabling a more reliable estimate of the potential cost and savings from this ECM. We will also investigate the utility interconnection and determine any additional requirements of the utility and potential rate changes.

### Evaluated But Not Recommended Energy Conservation Measures

#### Technology Category 10, ECM 10A: Biomass Boiler

ABC performed a review of the potential to utilize existing RL recycling waste streams as fuel for a biomass boiler and determined that this is not a financially viable ECM. Biomass boilers are most financially viable at larger capacities and when they can be operated at constant loads throughout the year. The analysis nominally assumed that RL recycled paper would be the most readily usable fuel source and that it would be available at the FY 2017 tonnage reported. Utilization of wood pallets and/or switchgrass would require additional processing equipment, which would only serve to worsen project economics, and was not included directly in the analysis. At the west complex, the annual heating base load for the central boiler plant, given the volume of recycled fuel available, was estimated to support the installation of a 40 BHP biomass boiler that would operate for 9 months per year. The analysis performed resulted in the following estimates:

System Capacity: 40 BHP

Installation: $420,000

Annual Energy Savings: $68,000

Annual O&M: $50,000

Simple Payback: 23 years

The preceding analysis does not include costs for a new structure to house the boiler and fuel storage, equipment for processing of recycled fuel, and permanent on-site personnel that would likely be needed to perform O&M. Additionally, likely outcomes of the ESPC project—such as decentralizing boiler plants, reducing steam distribution losses, and reducing end-use consumption—would result in a smaller base load for a biomass boiler to serve, worsening project economics. Based on the preliminary analysis and the additional items to be analyzed, ABC does not recommend pursuing this ECM.

## 3. ECM Performance Measurement

Table 8, M&V Approach, summarizes the Federal Energy Management Program guideline option used for each measure. It also summarizes the key activities for Baseline, Post Installation, and Performance Period conditions, as well as the savings determination method.

In addition to the summarized Post Installation activities, ABC will fully commission installed systems to ensure that they meet their performance specifications.

Savings for Performance Periods will be determined using the agreed-upon calculation methodologies described in the M&V plan for each measure. In addition to Performance Period activities summarized, ABC will inspect installed systems at least annually to verify that they remain in good condition and maintain their energy-savings potential.

#### M&V Approach—Summary

**Table 8. M&V Approach**

|  |  |  |  |
| --- | --- | --- | --- |
| ECM # | ECM Description | M&V Option Used | Summary of M&V Approach |
| 1A | Boiler Plant Improvements | D | Rationale: FEMP M&V Guideline v4.0 recommends option A; however, ECMs 3A and 6A have interactive effects with this ECM. Therefore, utilizing option D for all three interactive measures is the best approach.  Data gathered: Building heating loads, boiler size and efficiency, building location and orientation, long-term solar irradiation, ambient temperature, and wind speed.  Baseline: Measure combustion efficiency of existing boilers. Use plant-level and building-level meters to confirm baseline heating load of buildings that will be decentralized from the steam system. Establish system capacities based on spot or short-term measurements of fluid flow, motor power (kW), and run time. Develop eQUEST or spreadsheet model to analyze variation in input energy with load using data gathered in ECM-3A and 6A below, and calibrate model to documented input energy.  Post-Installation: Commissioning to verify proper installation and operation of new equipment and controls for boiler optimization. Measure combustion efficiency of new boilers. Use plant-level meters to confirm post-installation heating load.  Post-Acceptance:  Conduct annual boiler inspections and quarterly trend reviews of submeter and equipment performance data to confirm persistence of energy savings throughout the contract term. Annual measurement of boiler combustion efficiency will be conducted. Boiler operation and maintenance logs provided by RL will be evaluated including water quality and treatment if required. |
| 3A | Controls | D | Rationale: In alignment with FEMP M&V Guidelines 4.0  Data Gathered: Building envelope construction; wall, floor and roof areas; number, type, and sizes of windows; occupants; equipment and lighting loads in each zone; zone temperature set points and occupied hours; number and types of AHUs, fan motor size and efficiency; supply, return, and outside air design airflow; cooling coil capacity; existing control sequences, including supply air and zone temperature set points and equipment operating schedules; capacity and efficiency of chillers.  Baseline: Baseline data collection includes measurement of the following variables for use in the building models: AHU supply and return fan motor power, cooling tower fan motor power, and pump motor power  Post Installation: Post‐installation M&V activities will focus on ensuring that the new control sequence conforms to the design specifications. Successful completion of commissioning of the new control sequence in accordance with the commissioning plan shall constitute verification of the ability of the new control strategies to perform as per the design intent. The key parameters that will be examined on the affected systems are outside air dry‐bulb temperature, chilled water supply water temperature set point, and hot water supply water temperature set point.  Post-Acceptance: Annual inspection of control sequence programming and set points, as related to the installed chilled water and hot water supply temperature set point reset, will confirm that the ECM is still installed and has the potential of generating the proposed energy savings. Trending reports will be evaluated to ensure energy conservation strategies are still in place and being utilized. Adjustments to operation to bring the system back into compliance will be made as needed. |
| 5A | Lighting Improvements | A | Rationale: In alignment with FEMP M&V Guidelines 4.0  Data Gathered: Detailed lighting audit, including fixture quantity, type, type and number of lamps and ballasts, locations, use of space (administrative, industrial, etc.), estimated occupancy and operating hours, and light levels.  Baseline: Measure baseline fixture wattages for a representative sample of fixtures from a number of pre-installation lamp and ballast combination groups. Determine operating hours through facility interviews and investigations supplemented with short-term monitoring of operating hours in a sample of spaces.  Post Installation: Measure post-installation fixture wattages for a representative sample of fixtures from a number of post-installation groups. Operating hours remain the same as baseline or based upon proposed lighting control schedule.  Post-Acceptance: Throughout the contract term, annual inspection of a sample of installed fixtures and confirmation of control operation. Annual inspection of lamp and ballast inventory to ensure proper replacements are procured and installed. |
| 6A | Upgrade Building Envelope | D | Rationale: In alignment with FEMP M&V Guidelines 4.0  Data Gathered: Building envelope construction, wall, floor and roof areas, number, type and size of windows, cooling system efficiency.  Baseline: Survey of baseline window quantities and sizes, and building envelope square footage, u-values and condition of existing insulation to develop eQUEST or spreadsheet model to analyze variation in thermal losses with load. Reconciliation to submetered data, leveraging the meters installed by RL and integrated as part of ECM-1A and 3A, to estimate infiltration rate and thermal properties of existing building envelope.  Post Installation: Commission new windows and perform physical inspection to confirm that they comply with the approved design. Inspect window shading to verify proper installation. Update savings model to reflect as-built thermal insulation values, quantity and square footage of the modifications, and review submetered data to verify savings.  Post-Acceptance: Throughout contract term, annual visual inspections of the new windows, and window shading installations to confirm that they retain their performance characteristics. |
| 11A | Renewable – Solar PV | B | Rationale: In alignment with FEMP M&V Guidelines 4.0  Data Gathered: Power generated, array location, long-term solar irradiation, ambient temperature, and wind speed.  Baseline: The baseline is zero kWh produced by solar PV, as no PV system currently exists.  Post Installation: ABC will verify that the system is capable of producing the rated instantaneous peak kW (AC) output for given ambient conditions, based on a monitoring system that records ambient air temperature, solar irradiation, and kWh output. Values of energy savings calculation variables are agreed upon through the contract term.  Post-Acceptance: ABC will continuously meter the PV system output (kW and kWh AC), solar irradiation (watts/sq-ft) ambient temperature (°F). ABC will analyze measured cumulative kWh (AC) output with measured cumulative kWh solar irradiation over the PV surface area. This measured PV system performance ratio will be compared with the projected PV system performance ratio for that season from the PVSYST model, accounting for the projected 0.5% annual degradation in projected system output each year. |
| 13A | Water Improvements | A | Rationale: In alignment with FEMP M&V Guidelines 4.0  Data Gathered: Detailed plumbing audit, including fixture quantity, type of china and flush valve or faucet, locations, and number of occupants.  Baseline: Measure fixture water flow on a sample of units based on fixture type. Fixture usage based upon industry standard use profiles.  Post Installation: Measure fixture water flow on a sample of units based on fixture type. Fixture usage based upon industry standard use profiles. Inspect a sample of new fixtures.  Post-Acceptance: Throughout the contract term, annual inspection of a sample of each fixture type. |

#### Verification Activities: Government Witnessing

Witnessing of M&V activities is a government responsibility; however, ABC recommends that RL consider a witnessing approached as outlined in the table below. Recommendations are based on FEMP’s "Guide to Government Witnessing and Review of Post-Installation and Annual M&V Activities," February 2007. The FEMP guideline outlines a graded approach consisting of the following levels:

Level 1—Minimum Witnessing Requirements: Review inspection/data collection forms, confirm consistency with expected operation of ECM and M&V Plan, sign data collection forms

Level 2—Recommended Practices: Level 1 + spot check of ESCO M&V activities

Level 3—Best Practices: Levels 1 and 2 + Accompany ESCO and witness all M&V activities

|  |  |  |  |
| --- | --- | --- | --- |
| **Government Witnessing Recommendations\*** | | | |
| **ECM** | **Baseline** | **Post-Installation** | **Post-Acceptance** |
| 1A | Level 3 | Level 3 | Level 3—inspections  Level 1—review of quarterly submetered trend data |
| 3A | Level 3 | Level 3 | Level 3 |
| 5A | Level 3 | Level 2 | Level 2 |
| 6A | Level 3 | Level 3 | Level 1 |
| 11A | Level 3 | Level 3 | Level 1 |
| 13A | Level 3 | Level 2 | Level 1 |

\*Details of proposed measurements to be witnessed will be provided in the IGA

### IDIQ Attachment J-13 ECM Summary Descriptions

Completed ECM templates overviewing ECM scopes, and cost and performance metrics by ECM are as follows:

|  |  |  |
| --- | --- | --- |
| **ECM 1A** | **ECM Title: Boiler Plant Improvements** | **DOE Technical Category: 1** |
| **Location(s) affected:** Rockwell Laboratories, Buildings 100, 110, 120, 200, 300, 320, 330, 350 | | |
| **ECM Description:** This ECM includes the replacement/conversion of existing boilers, hot water heaters, and direct-fired units with high-efficiency natural gas equipment. The new boilers/burners will be gas-fired units providing cost savings due to the unit cost of natural gas versus the existing fuel oil. The new domestic hot water heaters and burners will be gas-fired units providing cost savings due to the unit cost of natural gas versus the existing electric or fuel oil. | | |
| **O&M and R&R (repair and replacement):** O&M: RL will retain full operational control of the facility and installed ECMs. O&M of equipment and the savings associated with proper O&M of the installed equipment will remain the responsibility of the agency.  R&R: Based on the existing O&M contractor’s method to resource O&M, we recommend that they include repair of items not covered by the manufacturers’ warranty in regard to the ECM equipment installed under this contract. During the construction or warranty period, ABC will provide both emergency and non-emergency repairs and shall contact the Building Manager to arrange access to the appropriate building. | | |

**First-Year Savings—Ranges**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Total energy savings (MMBtu/yr) | Electric energy savings (kWh/yr) | Electric demand savings (kW/yr)\* | Fuel savings\*\*\*  (MMBtu/yr)\*\* | Water savings (gallons/yr) | Other energy savings (MMBtu/yr)\*\* | Total energy and water cost savings, Year 1 ($/yr) | Other energy-related O&M cost savings, Year 1 ($/yr) | a.  Total cost savings, Year 1 ($/yr) |
| 800 ± 10% | 0 | 0 | (8300) ± 10% | 0 | 9100 ± 10% | $159,500 ± 10% |  | $159,500 ± 10% |

**First Year Costs/Incentives—Ranges**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **b.** ECM Implementation Cost ($) | Year 1 O&M Costs ($) | Year 1 R&R  ($) | Year 1 M&V Costs ($) | **c.**  Total Cost, Year 1  ($/yr) | **d.** Incentives,  Year 1  ($) | **(b-d)/(a-c)** Simple Payback  (yr) |
|
| $1,875,000 ± 10% | $0 | $0 | $8000 ± 10% | $8000 ± 10% | $0 | 11.8 |

|  |
| --- |
| **M&V Method**: This ECM will utilize Option D, utilizing building simulation models that are required for other ECMs within the proposed project. M&V guidelines 4.0 recommends Option A for “Distributed Boilers.” |
| **Other:** ECM Interface with Agency Equipment: New boilers and domestic water heaters will be tied into the existing hot water or steam supply piping of the buildings. The replacement in Building 120 includes replacement of the steam boiler with a smaller steam boiler sized to meet the load for the building.  Physical Changes: Physical changes will include the replacement of the existing boilers, water heaters, and fuel distribution systems. The only changes external to the boiler or mechanical rooms are the new natural gas meter and gas piping from the meter to the mechanical room  Utility Interruptions: There will be temporary utility interruptions for the installation of this ECM. Heating service will be unavailable for the facility during the conversion. Electrical power may also be temporarily interrupted in some parts of the building depending on each building’s power layout. |
| **Notes:**  MMBtu=106 Btu.  \*Annual electric demand savings (kW/yr) is the sum of the monthly demand savings.  \*\*If energy is reported in units other than MMBtu, provide a conversion factor to MMBtu (e.g., 0.003413 MMBtu/kWh).  \*\*\*list fuel type(s) saved for project |

|  |  |  |
| --- | --- | --- |
| **ECM 3A** | **ECM Title: Controls** | **DOE Technical Category: 3** |
| **Location(s) affected:** Rockwell Laboratories, Buildings 100, 110, 120, 160, 300, 330 | | |
| **ECM Description:** ABC will expand upon RL’s efforts to build a site-wide ACME controls network at RL and leverage the full potential of this BAS. The ECM will reduce energy consumption by 28%, extend the life of equipment, reduce maintenance costs, improve occupant comfort, and optimize building and mission-critical system performance. Upgrades will include programming that supports mission-critical operations, improves energy efficiency, and reduces HVAC run times. The system will react to sustain comfortable conditions for lab staff. In addition, we will integrate advanced metering with the BAS, allowing lab staff to monitor utility consumption in real time, helping to identify and troubleshoot inefficiencies proactively. | | |
| **O&M and R&R:** It is proposed that ABC would be responsible for the performance (i.e., control sequences, set points, and strategies) of the BAS, as well as O&M of the BAS over the term of the contract. RL is responsible for operations and factors outside of ABC’s control, including changes that affect cooling loads (e.g., number of occupants, equipment, use of the buildings), power quality, renovations or modifications to the buildings or HVAC systems, and existing deficiencies in the buildings or HVAC systems. | | |

**First-Year Savings—Ranges**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Total energy savings (MMBtu/yr) | Electric energy savings (kWh/yr) | Electric demand savings (kW/yr)\* | Fuel savings\*\*\*  (MMBtu/yr)\*\* | Water savings (gallons/yr) | Other energy savings (MMBtu/yr)\*\* | Total energy and water cost savings, Year 1 ($/yr) | Other energy-related O&M cost savings, Year 1 ($/yr) | a.  Total cost savings, Year 1 ($/yr) |
| 23,412 ± 10% | 1,000,000± 10% |  | 20,000 ± 10% | 0 | 0 | $200,000 ± 10% | $25,000 ± 10% | $225,000 ± 10% |

**First Year Costs/Incentives—Ranges**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **b.** ECM Implementation Cost ($) | Year 1 O&M Costs ($) | Year 1 R&R  ($) | Year 1 M&V Costs ($) | **c.**  Total Cost, Year 1  ($/yr) | **d.** Incentives,  Year 1  ($) | **(b-d)/(a-c)** Simple Payback  (yr) |
|
| $3150,000 ± 10% | $30,000 ± 10% |  | $8,000 ± 10% | $38,000 ± 10% |  | 14.0 |

|  |
| --- |
| **M&V Method**: Recommended D to verify performance and then A during the performance period. M&V guidelines 4.0 suggested option is the same. |
| **Other:** ECM Interface with Agency Equipment:  ABC will install new DDC points on major existing RL HVAC systems. The new DDC points will include temperature, humidity, and pressure sensors; hydronic valves and actuators; damper actuators; motor starters; current transducers; variable-frequency drive controls; and status points. We will install new communication wiring and building-level controllers in mechanical rooms. ABC will connect the new control infrastructure to the ACME front-end located at the central plant. We will install any new communication wiring necessary to integrate systems and advanced metering with the ACME BAS.  Physical Changes:  No major physical changes to equipment or facilities, such as relocation or removal of equipment, are required to implement this ECM. Pneumatic control points identified for replacement will be replaced with DDC equivalents, and no further modification to equipment will be required.  Utility Interruptions:  Physical work will consist of replacement of controls components on existing HVAC systems. Any utility interruptions will be brief and coordinated with RL to take place after hours whenever possible to prevent disruptions. |
| **Notes:** MMBtu=106 Btu.  \*Annual electric demand savings (kW/yr) is the sum of the monthly demand savings.  \*\*If energy is reported in units other than MMBtu, provide a conversion factor to MMBtu (e.g., 0.003413 MMBtu/kWh).  \*\*\*list fuel type(s) saved for project |

|  |  |  |
| --- | --- | --- |
| **ECM 5A** | **ECM Title: Lighting Upgrades** | **DOE Technical Category: 5** |
| **Location(s) affected:** Rockwell Laboratories, Buildings 100, 110, 120, 160, 170, 180, 200, 300, 320, 330, 350 | | |
| **ECM Description:** It is proposed that the existing 2-lamp 4 foot, 3-lamp 4 foot and 4-lamp fluorescent fixtures be retrofitted using 22.5 W, 45 W and 67.5 W LED retrofit kits. Screw-in incandescent lamps (floodlights and flame-tip candle lamps) can be replaced with appropriate screw-in LED lamps. In addition, dusk-to dawn street and area lighting are addressed. Existing technology for the exterior lighting includes high-pressure sodium and metal halide, and these fixtures can also be replaced with new LED technology using new light pole heads on existing pole fixtures and with LED wallpacks replacing the existing high-intensity-discharge fixtures. | | |
| **O&M and R&R:** It is proposed that RL staff will assume O&M responsibilities for this ECM and will operate and maintain the ECMs in accordance with the ABC-provided work procedures that will be described in the IGA. It is proposed that RL will assume responsibility for the repair and replacement of all ECM components throughout the term of the task order. RL will perform operations, scheduled and unscheduled maintenance, equipment repairs, and component replacements. | | |

**First-Year Savings—Ranges**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Total energy savings (MMBtu/yr) | Electric energy savings (kWh/yr) | Electric demand savings (kW/yr)\* | Fuel savings\*\*\*  (MMBtu/yr)\*\* | Water savings (gallons/yr) | Other energy savings (MMBtu/yr)\*\* | Total energy and water cost savings, Year 1 ($/yr) | Other energy-related O&M cost savings, Year 1 ($/yr) | a.  Total cost savings, Year 1 ($/yr) |
| 3,675 ± 10% | 1,077,000 ± 10% | 3,000 ± 10% | 0 | 0 | 0 | $86,160 ± 10% | $40,000 ± 10% | $126,160 ± 10% |

**First Year Costs/Incentives—Ranges**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **b.** ECM Implementation Cost ($) | Year 1 O&M Costs ($) | Year 1 R&R  ($) | Year 1 M&V Costs ($) | **c.**  Total Cost, Year 1  ($/yr) | **d.** Incentives,  Year 1  ($) | **(b-d)/(a-c)** Simple Payback  (yr) |
|
| $2,100,000 ± 10% |  |  | $7,000 ± 10% | $ 7,000 ± 10% |  | 16.6 |

|  |
| --- |
| **M&V Method**: Recommended A. M&V guidelines 4.0 suggested option is the same. |
| **Other:** Provide high-level summary of significant issues that will affect this ECM. Consider the following categories at a high level (to be provided in detail in the IGA) a. ECM interface with existing ordering agency equipment. b. Physical changes. c. Utility interruptions. d. Ordering agency support required. e. Potential environment impacts and expected coordination with the site National Environmental Policy Act (NEPA) Compliance Officer  ECM Interface with Agency Equipment:  This ECM interfaces with RL lighting and related power.  Physical Changes:  Post-retrofit lighting levels will meet or exceed existing light levels, except for some over-lit spaces. Where the number of lamps in an area is reduced, the post-retrofit lighting level (in conjunction with existing task lighting, where applicable) will meet Illuminating Engineering Society guidelines. |
| **Notes:**  MMBtu=106 Btu.  \*Annual electric demand savings (kW/yr) is the sum of the monthly demand savings.  \*\*If energy is reported in units other than MMBtu, provide a conversion factor to MMBtu (e.g., 0.003413 MMBtu/kWh).  \*\*\*list fuel type(s) saved for project |

|  |  |  |
| --- | --- | --- |
| **ECM 6A** | **ECM Title: Upgrade Building Envelope** | **DOE Technical Category: 6** |
| **Location(s) affected:** Rockwell Laboratories, Building 100, 110, 120, 160 | | |
| **ECM Description:** ABC proposes the addition of the Glaze-lite Window System throughout all of the outside-facing, single-pane windows in these buildings. The Glaze-lite window is an additional windowpane that will be added to the existing single-pane windows throughout the buildings, effectively turning a single-pane into a double-pane system. The two windows (existing and new) will be separated by a small air space that will serve to reduce the overall heat transfer coefficient, on the order of 75%, which will result in a reduction of heat losses to the outside environment and yield significant energy savings. | | |
| **O&M and R&R:** It is proposed that RL staff will maintain the ECM in accordance with the ABC-provided work procedures that will be described in the IGA. It is proposed that RL will assume responsibility for the repair and replacement of all ECM components throughout the term of the task order. | | |

**First-Year Savings—Ranges**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Total energy savings (MMBtu/yr) | Electric energy savings (kWh/yr) | Electric demand savings (kW/yr)\* | Fuel savings\*\*\*  (MMBtu/yr)\*\* | Water savings (gallons/yr) | Other energy savings (MMBtu/yr)\*\* | Total energy and water cost savings, Year 1 ($/yr) | Other energy-related O&M cost savings, Year 1 ($/yr) | a.  Total cost savings, Year 1 ($/yr) |
| 1,860 ± 10% | 25,000 ± 10% | 50 ± 10% | 710 ± 10% | 0 | 1,065 ± 10% | $32,555 ± 10% | 0 | $32,555 ± 10% |

**First Year Costs/Incentives—Ranges**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **b.** ECM Implementation Cost ($) | Year 1 O&M Costs ($) | Year 1 R&R  ($) | Year 1 M&V Costs ($) | **c.**  Total Cost, Year 1  ($/yr) | **d.** Incentives,  Year 1  ($) | **(b-d)/(a-c)** Simple Payback  (yr) |
|
| $1,125,000 ± 10% |  |  | $2,000 ± 10% | $2,000 ± 10% |  | 34.5 |

|  |
| --- |
| **M&V Method**: Recommended D to verify performance and then A during the performance period. M&V guidelines 4.0 suggested option is the same. |
| **Other:** Physical Changes: The Glaze-lite systems will be installed on the inside of the existing single-pane windows, integrating with the existing window frames. No physical changes to the buildings will be required. |
| **Notes:**  MMBtu=106 Btu.  \*Annual electric demand savings (kW/yr) is the sum of the monthly demand savings.  \*\*If energy is reported in units other than MMBtu, provide a conversion factor to MMBtu (e.g., 0.003413 MMBtu/kWh).  \*\*\*list fuel type(s) saved for project |

|  |  |  |
| --- | --- | --- |
| **ECM 11A** | **ECM Title: Solar Photovoltaic System** | **DOE Technical Category: 11** |
| **Location(s) affected:** Rockwell Laboratories, Building 330, open land behind building 330 | | |
| **ECM Description:** This ECM provides for the installation of solar PV arrays at RL for the production of renewable energy in the form of electrical generation. The system will be sized at 500 Kw (DC) and will produce on average 557,000 kWh per year | | |
| **O&M and R&R:** ABC proposes to maintain the solar array. ABC will be responsible for repair/replacement while under manufacturer’s warranty only. After the warranty period, repair and replacement of all equipment will be RL responsibility. | | |

**First-Year Savings—Ranges**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Total energy savings (MMBtu/yr) | Electric energy savings (kWh/yr) | Electric demand savings (kW/yr)\* | Fuel savings\*\*\*  (MMBtu/yr)\*\* | Water savings (gallons/yr) | Other energy savings (MMBtu/yr)\*\* | Total energy and water cost savings, Year 1 ($/yr) | Other energy-related O&M cost savings, Year 1 ($/yr) | a.  Total cost savings, Year 1 ($/yr) |
| 2,320 ± 10% | 557,000 ± 10% | 0 | 0 | 0 | 0 | $44,560 ± 10% |  | $44,560 ± 10% |

**First Year Costs/Incentives—Ranges**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **b.** ECM Implementation Cost ($) | Year 1 O&M Costs ($) | Year 1 R&R  ($) | Year 1 M&V Costs ($) | **c.**  Total Cost, Year 1  ($/yr) | **d.** Incentives,  Year 1  ($) | **(b-d)/(a-c)** Simple Payback  (yr) |
|
| $1,500,000 ± 10% | $5,000 ± 10% |  | $2,000 ± 10% | $7,000 ± 10% |  | 33.7 |

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| --- |
| **M&V Method**: Recommended B. M&V guidelines 4.0 suggested option is the same. |
| **Other:** Physical Changes: The PV array will be placed on the roofs of the existing warehouse and in the open land area behind the warehouse. The panels on the warehouse building will utilize a ballast system that does not penetrate the roof membrane.  Interface with Government Equipment: The PV system will connect to the buildings existing electrical distribution system. The required interconnection equipment will be provided and installed to interface with the existing electrical equipment. The system will be connected to and monitored by the existing BAS.  Utility Interruptions: The installation of the interconnection equipment and installation of the PV system will require a short interruption of electrical service, which will be coordinated with RL staff. |
| **Notes:**  MMBtu=106 Btu.  \*Annual electric demand savings (kW/yr) is the sum of the monthly demand savings.  \*\*If energy is reported in units other than MMBtu, provide a conversion factor to MMBtu (e.g., 0.003413 MMBtu/kWh).  \*\*\*list fuel type(s) saved for project |

|  |  |  |
| --- | --- | --- |
| **ECM 13A** | **ECM Title: Water Improvements** | **DOE Technical Category: 13** |
| **Location(s) affected:** Rockwell Laboratories, Buildings 100, 110, 120, 160, 170, 180, 200, 300, 320, 330, 350 | | |
| **ECM Description:** This ECM will upgrade existing domestic plumbing fixtures and install a cooling tower water treatment system, a groundwater harvesting system, a rainwater harvesting system, and sub-metering of cooling tower water usage. Once implemented, these measures will collectively reduce water consumption at the RL by 50%. An additional dollar savings of 21% will be realized from sub-metering the cooling towers, which will eliminate over 4,000 thousand gallons (kgal) in sewer billing. | | |
| **O&M and R&R:** It is proposed that RL staff will maintain the ECM in accordance with the ABC-provided work procedures that will be described in the IGA. It is proposed that RL will assume responsibility for the repair and replacement of all ECM components throughout the term of the task order. | | |

**First-Year Savings—Ranges**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Total energy savings (MMBtu/yr) | Electric energy savings (kWh/yr) | Electric demand savings (kW/yr)\* | Fuel savings\*\*\*  (MMBtu/yr)\*\* | Water savings (gallons/yr) | Other energy savings (MMBtu/yr)\*\* | Total energy and water cost savings, Year 1 ($/yr) | Other energy-related O&M cost savings, Year 1 ($/yr) | a.  Total cost savings, Year 1 ($/yr) |
| 0 | 0 | 0 | 0 | 26,000 ± 10% | 0 | $130,000 ± 10% | 0 | $130,000 ± 10% |

**First Year Costs/Incentives—Ranges**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **b.** ECM Implementation Cost ($) | Year 1 O&M Costs ($) | Year 1 R&R  ($) | Year 1 M&V Costs ($) | **c.**  Total Cost, Year 1  ($/yr) | **d.** Incentives,  Year 1  ($) | **(b-d)/(a-c)** Simple Payback  (yr) |
|
| $1,500,000 ± 10% |  |  | $5,000 ± 10% | $5,000 ± 10% |  | 11.5 |

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| --- |
| **M&V Method**: Recommended A. M&V guidelines 4.0 suggested option is the same. |
| **Other:** ECM Interface with Agency Equipment: This ECM interfaces with RL plumbing system, including fixtures. Existing building plumbing piping will remain. New fixtures with domestic sanitary fixtures will replace existing fixtures.  Utility Interruptions: The water flow to the existing fixtures will briefly be shut off to complete the work. There may be interruptions to water flow in areas other than the fixtures being retrofitted, depending on configuration of the plumbing piping and shutoff valves. ABC will work closely with RL to minimize disruption and coordinate these outages. Installation of the water treatment system will require only a brief condenser water outage to connect the system to the cooling towers. |
| **Notes:**  MMBtu=106 Btu.  \*Annual electric demand savings (kW/yr) is the sum of the monthly demand savings.  \*\*If energy is reported in units other than MMBtu, provide a conversion factor to MMBtu (e.g., 0.003413 MMBtu/kWh).  \*\*\*list fuel type(s) saved for project |

# Task Order Schedules

## Pricing Approach

Preliminary TO Schedules 1–4, including the summary and escalation schedule, were developed in eProject Builder (ePB) and provide a summary of the assessed pricing information. As required by DOE’s master contract, a hard copy is included with this PA. The preliminary TO Schedules provided herein represent the packaging of ECMs as described in the executive summary. However, during the IGA phase, we will work with RL to determine the optimal combination of ECMs to make up the final TO project.

Price estimates were developed using methods most appropriate for each ECM and the scope recommended. Project development cost estimates shown on schedule TO-2a are the estimated price to conduct an energy audit and submit a complete technical and price proposal to RL. The price estimate was developed based on the scope recommended in the PA and our past experience with similar ESPCs. Project implementation pricing shown on Schedules TO-2a and TO-2b shows the estimated price of the scope of recommended ECMs included in the PA. We used parametric estimates based on projects of similar size and scope that incorporate our company experience and expertise. Debt service costs reflect current interest rates for the performance period shown. Post-acceptance performance period pricing estimates the price of contract administration and performance methodologies shown in the RRPM (risk and responsibility performance matrix) to ensure sustained performance over the contract term. All price estimates include allowable state and local taxes (e.g. sales, gross receipts, commercial activities). Price estimates are based on our experience with similar projects.

During the IGA and proposal preparation phase, ABC will work with RL to determine the optimal combination of ECMs making up the final TO project. Proposal pricing will be based on this final, agreed-to scope and incorporate detailed pricing information. This will include material quotes, competitive subcontract analysis, competitive financing information required by the DOE master contract, labor and other direct charge pricing data and all other information needed to transparently support our proposed price.

**TO Schedules**

TO Schedules are intentionally not attached to this draft at this time.

Provide TO Schedules per section H.4.2, B, 2., iv. of the DOE IDIQ Contract