**Technical Analysis Study**

**<Insert Participant’s Site Name>**

**<Insert Site Address>**

Project Number: **<Insert Project ID from Work Order>**

**<Insert facility photo below>**

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*Study sponsored by:*

**Energy Trust of Oregon - Existing Buildings Program**

*Submitted by:*

**<Insert ATAC Company name>**

*Submitted on:* **<Insert Report date>**

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**CONTACTS**

**SITE CONTACT**

The following facility personnel assisted with this report:

* Name, Title
* Building Name
* Building Street
* Building Address
* Contact Phone Number C
* Contact Email Address

**ENERGY TRUST CONTACT**

Account Manager Name

TRC

615 SW Alder Street

Suite 200

Portland, OR 97205

503.525.6140

**ATAC CONTACT INFORMATION**

The Allied Technical Assistance Contractor (ATAC) that prepared this report is:

* ATAC Engineer’s Name(s)
* Company Name
* ATAC Address
* ATAC Phone Number
* ATAC Email Address

**DISCLAIMER**

<Please include this page in your report exactly as written here>

*In no event will Energy Trust of Oregon, Inc. or ATAC be liable for (i) the failure of the customer to achieve the estimated energy savings or any other estimated benefits included herein, or (ii) for any damages to customer’s site, including but not limited to any incidental or consequential damages of any kind, in connection with this report or the installation of any identified energy efficiency measures. The intent of this energy analysis study is to estimate energy savings associated with recommended energy efficiency upgrades. This report is not intended to serve as a detailed engineering design document, any description of proposed improvements that may be diagrammatic in nature are for the purpose of documenting the basis of cost and savings estimates for potential energy efficiency measures only. Detailed design efforts may be required by participant in order to implement potential measures reviewed as part of this energy analysis. While the recommendations in this report have been reviewed for technical accuracy and are believed to be reasonably accurate, all findings listed are estimates only, as actual savings and incentives may vary based on final installed measures and costs, actual operating hours, energy rates and usage.*

**NEXT STEPS FOR THE PARTICIPANT**

**APPLY FOR ENERGY TRUST INCENTIVES**

***Make an implementation decision:*** *Please evaluate the information contained in this report and any potential measures and incentives listed in the Form 110C – Project Detail and Incentive Estimates (produced by TRC). Have your contractors bid for the measures(s) you wish to implement and send TRC a copy of the final bid. TRC will review your contractor’s proposed scope to determine compliance with Existing Building’s requirements and the energy efficiency measures as described in this report. After it is determined by TRC that the project bid specification match the studied measures, Form 120C-Incentive Application will be provided for you to review. If you apply for Energy Trust incentives for you project, your signed Form 120C – Incentive Application must be provided to TRC BEFORE you issue purchase orders or make other financial commitments to begin the project work.*

***Upon Completion of the Project:*** *TRC must be notified once the project is completed in order to arrange a post- installation verification for projects that receive incentives greater than $5,000. The program must receive all required documentation and perform any required post installation verifications before incentives can be issued.*

**APPLY FOR ENERGY TRUST SOLAR INCENTIVES**

*Make a solar implementation decision: Please evaluate the solar site evaluation (SSE), if included in this report. Your PMC will arrange a meeting to discuss the results of the evaluation. Or, if you wish to move forward, your PMC will provide you with a list of qualified Trade Ally contractors. Obtain bids on the solar measures you want to implement. When you’ve selected a solar Trade Ally contractor for the installation, the Trade Ally will provide and submit the necessary incentive application paperwork to Energy Trust on your behalf. The PMC and Energy Trust’s solar staff are available to answer all your solar questions.*

***Upon Completion of the Solar Project:*** *The solar Trade Ally will arrange for the final Energy Trust verifications, and within 30 days of a successful verification you’ll receive your solar incentive check from Energy Trust.*

# EXECUTIVE SUMMARY

<The following information must be contained in this section in paragraph form>

1. YEAR BUILT, 2. NUMBER OF STORIES, 3. FLOOR AREA, 4. AREA OR SPACE AFFECTED BY MEASURES

ANNUAL AVERAGE GAS & ELECTRICITY USAGE, 6. CURRENT EUI, 7. TOTAL % SAVINGS FOR ELECTRICITY & GAS

Example: This report documents energy efficiency improvements for the HVAC systems at the ABC Buildings at 1234 State Street in Portland. The facility was built in 1985, is three stories above ground and one below, and contains a total floor area of 44,000 square feet. The energy efficiency measures (EEM) affect the upper three floor area of 33,000 square feet. Using data from the last three years, the average annual energy use for the building was 34,000 therms and 498,000 million kWh. This translates to an Energy Use Index of 117. The EUI for this building is [xx% more/less] than the target energy use per square foot for a building of this type per ODOE EUI target ranges. [Use published ODOE EUI ranges for comparison based on school type and location] Table 1 below lists the energy efficiency recommendations for the facility. Combined, these recommendations are expected to reduce the building’s gas usage by 15% and reduce the electricity consumption by 10%.

*\* ODOE EUI Target Ranges Table – Use for comparison above but please delete from report.*



# ENERGY EFFICIENCY MEASURE SUMMARY

* 1. **EEM 1: [Brief Title:** Brief on or two lines of description].
	2. **EEM 2: [Brief Title:** Brief on or two lines of description].
	3. **EEM 3: [Brief Title:** Brief on or two lines of description].

Table 1: EEM Summary Table (Annual)

|  |
| --- |
|  **Utility Rate Summary** |
|  | **Electricity** | **Nat. Gas** | **Other Fuel** | **Other Fuel** |
|  | $/kWh | $/therm | $/Gals | $/MBtu |
| ODOE  |  |  |  |  |
| ETO |  |  |  |  |

**Energy Efficiency Measure (EEM) Summary**

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Energy Savings Summary** | **Cost Savings Summary** |  |
|  | **Energy Savings Electricity** | **Energy Savings Natural Gas** | **Savings Other Fuel** | **Energy Savings Total** | **Savings****% of Total Baseline Energy** | **Per EEM (negative indicates savings)** | **Cost Savings Electricity** | **Cost Savings Natural Gas** | **Cost Savings Other Fuels** | **Cost Savings Total** | **Full Measure Cost(ODOE)** | **Incremental Measure Cost****(ETO)** | **Full Cost Simple Payback** | **Incremental Simple Payback** | **ROI** | **Measure Life** | **Cx Required** |
| **EEM #** | **EEM Description** | kWh/Yr | therms/ Yr | Gals/ Yr | MBtu/Yr | % | kBtu/SF/Yr | $/Yr | $/Yr | $/Yr | $/Yr | $ | $ |  | Yrs | % | Yrs | Yes/No |
| EEM-1 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| EEM-1 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | **TOTAL EEM Energy Savings** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Electric** | **Natural Gas** | **Other** | **Energy Total** | **% of Baseline** | **EUI** | **Cost Electricity** | **Cost****Natural Gas** | **Cost All Other Fuels** | **Cost Total** |
|  | kWh/Yr | therms/ Yr | Gals/ Yr | MBtu/Yr | % | kBtu/SF/Yr | $/Yr | $/Yr | $/Yr | $/Yr |
| **TOTAL Baseline Energy Usage** |  |  |  |  |  |  |  |  |  |  |
| **TOTAL Proposed Energy Usage** |  |  |  |  |  |  |  |  |  |  |

NOTES:

\* Cost savings are based on the blended rate of the customer’s actual utility provider. The blended rate for each utility is as follows:

 Electric: Pacific Power $0.0807, PGE $0.0946

 Natural Gas: Avista $1.01, Cascade $0.59, NW Natural $0.80

\*\* Non-energy cost benefits are from items such as avoided maintenance, reduced water costs, or other cost savings.

\*\*\* Costs shall be broken out to full cost to install the measure for ODOE/PPC and incremental measure cost for Energy Trust. Please refer to ATAC Guide for Existing Buildings for details on what is included with incremental measure cost.

\*\*\*\* Simple Payback is a measure of how quickly your investment in the measure will pay for itself and does not include any potential incentive and/or non-energy benefits.

\*\*\*\*\* Simple ROI is another measure of measure’s benefits. This is simply the inverse of the Simple Payback and can be used as a rough comparison to other investment opportunities.

\*\*\*\*\*\* Measures that would require Commissioning for Public Purpose Charge (PPC) Schools Program:

1) All boiler or chiller measures exceeding $100,000

2) All other HVAC measures and all HVAC controls measures exceeding $50,000

Commissioning is required for this measure under the guidelines for the Public Purpose Charge (PPC) Schools Program.

Please see the Oregon Department of Energy’s website for the list of Qualified Commissioning Firms and the commissioning requirements for measures that use PPC funds.

# HISTORICAL Energy Usage

Table 2: Historical Building Energy Use

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Electricity** | **Fossil - Nat Gas** | **Other Fuels** | **Total** |
| **Month/Year\*** | **Electricity Use** (kWh) | **Electricity Use** (MBtu) | **Electricity Cost** ($) | **Nat. Gas Use** (therms) | **Nat. Gas Use** (MBtu) | **Nat. Gas Cost** ($) | **Other Fuel Use** (Gals) | **All Other Fuel Use** (MBtu) | **All Other Fuel Cost** ($) | **Total Energy Use** (MBtu) | **Total Energy Cost** ($) |
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| **1st Year Totals** |  |  |  |  |  |  |  |  |  |  |  |
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| **2nd Year Totals** |  |  |  |  |  |  |  |  |  |  |  |
| **2-Year Average (Baseline Energy Usage)** |  |  |  |  |  |  |  |  |  |  |  |

*\*May add additional monthly data at auditor's discretion. Two years of consecutive monthly data is required. Heating oil data may be intermittent data and entered in the month the school district purchased the heating oil.*

Note: Baseline energy usage data and energy savings calculations shall be in the specific units (electricity – kWh, natural gas – therms, #2 oil – diesel – gallons, propane – gallons, #5 oil – gallons, biomass fuel – tons, etc.)

## ENERGY CONSUMPTION GRAPHS

<EXAMPLES BELOW>

Electric Consumption



Natural Gas Consumption



## CONSUMPTION GRAPH NARRATIVE

*Include brief narrative describing seasonal utility usage patterns and anything that stands out (e.g., note and explain any anomalies, etc.). Explain any trends. As relevant, correlate with features that may drive consumption profiles (e.g., occupancy, use patterns, weather, etc.). Explain calibration of baseline model to utility data as applicable.*

## BUILDING OCCUPANCY

Table 3. Building Occupancy

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Typical Daily Use: Buildings/Areas** | **Hours/Day** | **Days/Week** | **Weeks/Year** | **Annual Hrs** | **% of Bldg Used** |
|   |   |   |   |   |   |
|   |   |   |   |   |   |
|   |   |   |   |   |   |
| **Number of persons in building during normal occupancy**  | **Actual:** |   | **Design:** |   |
| **Is building ever partially occupied? Y/N** |
| **Partial Use: Buildings/Areas** | **AdditionalHours/Day** | **Days/Week** | **Weeks/Year** | **Annual Hrs** | **% of Bldg Used** |
|
|   |   |   |   |   |   |   |
|   |   |   |   |   |   |   |
|   |   |   |   |   |   |   |

*Table Instructions*

1. *For the Column Heading “% of Bldg Used,” calculate the in-use building square footage divided by the total square footage, shown as a percentage.*
2. *Expected Table Customization/Adaption: Add rows to accommodate the entire list of unique space types.*

*Any other significant customization needs to be authorized by ODOE in advance.*

## BUILDING OCCUPANCY NARRATIVE

*Provide a brief narrative describing typical daily, weekly, and annual occupancy patterns. Be sure to note unusual patterns, after-school, weekend or summer occupancy, especially if they affect total or seasonal energy usage. This information is also useful when comparing to HVAC schedules and understanding opportunities or limitations for certain EEM savings.*

# FACILITY OVERVIEW

## GENERAL

*Building layout (show sections and years if remodeled), general construction, types of spaces/general layout,*

*square footage. Note any differences between total, conditioned, unoccupied square footages. Include summary description of envelope (roof, walls, windows, and doors) that describes general construction, type, and condition. Include any assumptions made for use in developing baseline model/calculations.*

*Insert simple line floor plans that include all buildings on campus. For each building, show building sections and notes eras of construction if remodeled. Simple floor plans should include current room and building names, including classrooms and accessory buildings (e.g. portables)*

***If any EEM in this TAS impacts these areas****, please also include additional detail where relevant:*

*Envelope: Describe construction, layers, R-values/U-values, condition, presence of asbestos or other materials as relevant. Energy Auditor may include table with various component R-values or total assembly U-values.*

*Roof/Ceiling: Construction, attic or built-up, insulation type and placement, R-value, and area for each unique section of the facility.*

*Walls: Construction, insulation type, R-value, and area for each unique section of the facility. Note any weather sealing issues.*

*Windows: Glazing type, frame type, operability, weather-stripping, and condition. Include U or R-values, approximate Solar Heat Gain Coefficient (SHGC), and window tint description. Note if specific windows are left open for purposes of ventilation or comfort issues.*

*Doors: Types, number, and size of each unique type. Describe weather-stripping, condition, and self-closing mechanisms. Note any doors that tend to be left open.*

## OTHER

* Representative photos of major building elevations and exterior.
* Photos of building elements, systems, or conditions that are related to the proposed EEMs.
* Photographs should include descriptive captions and be large enough to clearly see in 8.5X11 inch page.

## WATERSIDE HVAC SYSTEM

<Address the following bulleted points in this section in paragraph form>

* Chilled Water Loop System (age of existing equipment)
	+ Chiller(s) – Type, efficiency, COP
	+ Pumps
		- Condenser Pumps – type, power, schedule
		- Evaporator Pumps – type, power, schedule
	+ Cooling Tower
		- Fan
	+ Details of operation
* Hot Water Loop System (age of existing equipment)
	+ Boiler(s) - type, efficiency, capacity
	+ Pumps – type, power, schedule
	+ Details of operation
* Domestic Hot Water Loop System (age of existing equipment)
	+ Boiler(s) – type, efficiency, turndown ratio, maximum capacity
	+ Heat Exchanger (if the boiler is shared between hot water loop and domestic hot water loop) – type, efficiency, etc.
	+ Details of operation

## AIR SIDE HVAC SYSTEM

<Address the following bulleted points in this section in paragraph form>

* Type – (Single zone system, terminal reheat system, multi-zone system, dual duct system, variable air volume, induction system, etc.)
* Fans/RTUs – type, power, schedule
	+ Age
	+ Size (CFM, tonnage, etc.)
	+ Efficiency
	+ VFD, IGV, constant, etc.
	+ Cooling type
	+ Heating type

## CONTROLS

<Address the following bulleted points in this section in paragraph form>

* Include room set points (winter/summer), supply air temps (winter/summer), economizer settings, supply air temp reset based on load, supply air static pressure reset based on load, demand controlled ventilation, start/stop of HVAC equipment, schedules, and age of existing controls system.

## HVAC ZONE MAP

* Insert HVAC zone map and provide brief narrative as needed

## INTERNAL LOADS

<Address the following bulleted points in this section in paragraph form>

* Lighting
* Equipment
* Other (Pool, Laundry, Data Center, etc.)

## OTHER BUILDING ENERGY EQUIPMENT

<Address the following bulleted points in this section in paragraph form>

* Name of energy user and operational details

# DETAILED DESCRIPTION OF PROPOSED MEASURES

## EEM 1 – [TITLE] BASELINE CONDITION

<Write a paragraph about the existing condition pertaining to this measure only. Rolling baselines are not

encouraged, but are most appropriate in some situations. If you used a rolling baseline, state what the baseline is for this measure and explain why it was chosen. It is recommended to use qualitative information as well as quantitative information about the existing condition so that the reviewing engineer appreciates the purpose of the change.>

### MODIFIED BASELINE

*<If EEM requires an incremental approach for Energy Trust incentives write a paragraph about the modified condition pertaining to this measure only.>*

### PROPOSED CONDITION

<Write a paragraph about the proposed condition pertaining to this measure only. Consider including a scope of work for the customer to use when requesting bids>

### NON-ENERGY SAVINGS DESCRIPTION

<Address this section only if there are non-energy benefits related to this measure. Must include customer documentation in appendix.>

Table 4. Summary Of EEM1 Vs. Existing Condition

|  |  |  |  |
| --- | --- | --- | --- |
|  | **kWh Savings** | **Therm Savings** | **Gal Savings** |
| Estimated Energy Savings |  |  |  |
| Age of Equipment Being Replaced |  |
| Is Existing Equipment Currently Working or Not Working? |  |
| Cost |  |
| Notes |  |

Table 5. Summary of EEM1 VS. Modified Baseline

<Remove if existing condition used for both ODOE and Energy Trust>

|  |  |  |  |
| --- | --- | --- | --- |
|  | **kWh Savings** | **Therm Savings** | **Gal Savings** |
| Estimated Energy Savings |  |  |  |
| Cost |  |
| Notes[Specify baseline and proposed costs] |  |

Table 6. EEM 1 Conditions

|  |  |  |  |
| --- | --- | --- | --- |
| **Baseline Condition** | **\*Modified Baseline Condition** | **Proposed Condition** | **\*Calculation Location** |
|  |  |  |  |
|  |  |  |  |

*\*Remove Modified column if existing condition is applicable for DOE and Energy Trust of Oregon.*

*\*If using a custom spreadsheet, identify where the inputs were changed from baseline to proposed case.*

### ENERGY CALCULATION METHODOLOGY DETAILS

Please include description of energy savings calculation method used (bin analysis, model, etc.), assumptions, identification of key values and/or modeling inputs used for each measure.

Please describe what baselines were used for each measure and how that baseline was calibrated. Also, identify the key inputs and provide a comparison between those inputs for the baseline vs the proposed conditions. For example: setpoint changes, reduced run time, and/or reduced outside air.

***Note:*** This report does not require interactive savings between measures to be calculated. However, some ATACs calculate the interaction and either way would be accepted. The Public Purpose Charge (PPC) Schools Program prefers interactive savings to be calculated but again it is not required. Please note if interactive savings were calculated.

## EEM #1 COST ESTIMATES

Table 7. EEM 1 Detailed Cost Estimate

| **EEM #** | **EEM Description** |
| --- | --- |
|  | **Materials** | **Labor / Gen'l** | **Total** | **Data Source/Notes** |
| **Item Description** | **Qty** | **Unit** | **$/unit** | **$** | **Hours** | **$/Hour** | **$** | **$** |  |
|  |  |  |  |  |  |  |  |  |  |
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|  |  |  |  |  |  |  |  |  |  |
| **Subtotal Mtl & Labor Costs** |  |  |  |  |  |  |  |  |  |
| Contractor OH&P |  |  |  |  |  |  |  |  |  |
| Contingency |  |  |  |  |  |  |  |  |  |
| Design & Engineering |  |  |  |  |  |  |  |  |  |
| Demo/disposal (if any) |  |  |  |  |  |  |  |  |  |
| **TOTAL (\*excludes commissioning)** |  |  |  |  |  |  |  |  |  |
| **Commissioning (if any)\*** |  |  |  |  |  |  |  |  |  |

## EEM #1 ODOE MEASURE LIFE

For EEMs with single Measure Life refer to Appendix A SB 1149 Measure Life Table

For multi-component Measure Life, refer to the calculation method below.

First, list the components, their costs and Measure Life, as shown in Columns A, B and C. Second, multiply the Measure Life by the cost for each component, as shown in Column D. Finally, divide the Total of Column D by the Total of Column B to get the weighted Measure Life.

Table 8. ODOE Multi-Component Measure Life Calculator

| **Multi-Component Measure Life Calculator** |
| --- |
| Energy Efficiency Measure Component | Component Cost1 | Measure Life2 | Cost \* Life |
| A | B | C | D |
| Component 1 (Describe) |   |   |   |
| Component 2 |   |   |   |
| Component 3 |   |   |   |
| Component 4 |   |   |   |
| Component 5 |   |   |   |
| Component 6 |   |   |   |
| **Total** |  |   |   |
| **ODOE Weighted Measure Life:**  |  |  |  |
|  |  |  |  |
| 1. Costs per component category should include the equipment, appropriate labor, overhead and proportional contingency costs |  |
| 2. From the APPENDIX A SB 1149 Measure Life table |  |  |

## EEM #1 ETO MEASURE LIFE

**For EEMs with single Measure Life refer to Appendix A SB 1149 Measure Life Table**

For multi-component Measure Life, refer to the calculation method below.

First, list the components, their utility cost savings and Measure Life, as shown in Columns A, B and C. Second, multiply the Measure Life by the cost for each component, as shown in Column D. Finally, divide the Total of Column D by the Total of Column B to get the weighted Measure Life.

Table 9. ETO Multi-Component Measure Life Calculator

|  |
| --- |
| **Multi-Component Measure Life Calculator** |
| Energy Efficiency Measure Component | Component Utility Cost Savings | Measure Life2 | Utility Cost Savings \* Life |
| A | B | C | D |
| Component 1 (Describe) |   |   |   |
| Component 2 |   |   |   |
| Component 3 |   |   |   |
| Component 4 |   |   |   |
| Component 5 |   |   |   |
| Component 6 |   |   |   |
| **Total** |  |   |   |
| **ETO Weighted Measure Life:**  |  |  |  |
|  |  |  |  |
| 1. Utility cost savings should be based on electricity and natural gas only. |  |
| 2. From the APPENDIX A SB 1149 Measure Life table |  |  |

# APPENDIX A



# APPENDIX B – EEM 1

<Please provide all the supporting documents for EEM 1. The documents may include cut sheets, specification sheets, performance curves, schematic diagrams, eQuest results, spreadsheet calculation sheets, cost estimate sheets, customer provided backup of non-energy benefits, etc. It is advised to have an appendix for each EEM.>

<Note: Regardless of project complexity, clear documentation of assumptions used for baseline and anticipated project operations must be included within the study. Where practical, ATACs may use spreadsheet calculations or energy analysis software such as eQuest, HAP, Trace, EZ Sim, RetScreen, etc. All back-up calculation files must be included with each TAS submission. If an ATAC uses spreadsheet calculation or eQuest model for the study, submission of the soft copies of the Excel files or .pd2 & .inp files is mandatory. PDF files or locked Excel spreadsheets are not acceptable. Other specialized software tools may be used depending on the facility and the complexity of the recommendations. If the files are large and submitted to the PMC by email, the files should be in zip format or utilize a document share site like Dropbox.

For eQuest files: provide files for baseline, and files for each EEM in separate folders. Preferably not in a parametric run.

For Trace and HAP: provide input and output of baseline and EEM in both original analysis and pdf.>

# APPENDIX C – EEM 2