

PARTNER



BETTER Helps California State Agency Building Cut Energy Spend by an Estimated \$100,000 Annually

Summary

A California state agency¹ needed to streamline an energy efficiency (EE) audit and retrofit program across 450 public buildings. The agency turned to the award-winning Building Efficiency Targeting Tool for Energy Retrofits (BETTER) - a free online tool developed out of the U.S. Department of Energy's (DOE's) Building Technologies Office (BTO). BETTER enabled the state agency to avoid audit costs of \$3.28 million and initiate retrofit and retro commissioning (RCx) projects in nine public buildings to reduce annual energy costs. This case study highlights the results of BETTER's remote audit and recommended retrofit and RCx actions on one of the nine buildings (Building 50-A1) run by the California state agency.

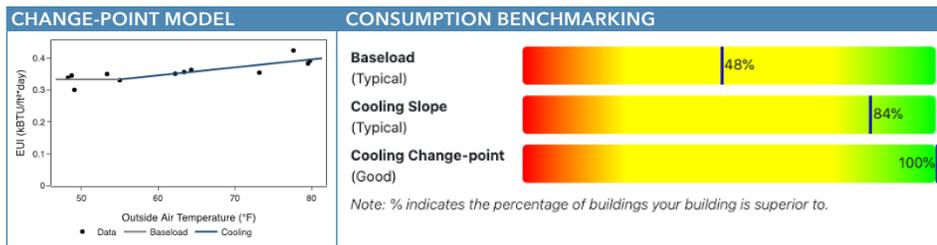
BUILDING PROFILE

TYPE	Office
SIZE	64,091 ft ²
VINTAGE	1960
OCCUPANCY	100%
OPERATING HOURS	60 hrs/week
FUEL TYPE	Electricity and Natural Gas
ENERGY STAR® RATING	2

BETTER Analysis Results

BETTER Change-Point Models and Benchmarks

Figure 1. Electricity Results



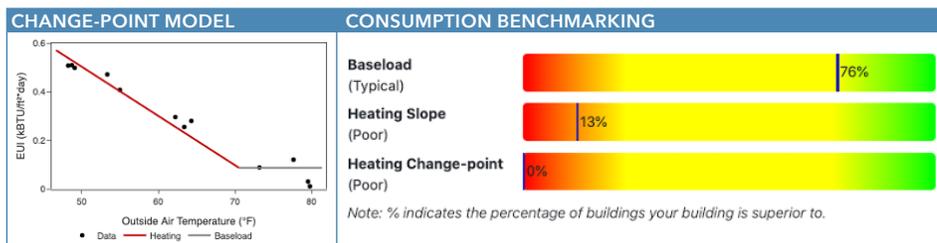
BETTER determined that Building 50-A1 had typical to good electricity performance as compared to similar buildings in the state agency portfolio.² The model and benchmark indicated the mechanical cooling system efficiently cooled the building, and the occupied and unoccupied building cooling setpoints did not require adjustments. However, the benchmark showed there could be opportunities to reduce lighting and plug loads in the building.

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"The BETTER tool has allowed us to analyze sites quickly to prioritize them for investment-grade audits. The tool provides visualizations to compare buildings against one another for both electric and fossil fuel usage. The change-point regression models help to understand the impact of weather on a building and provide a starting point for prioritizing cost-effective EE improvements."

ERIC NOLLER,
Energy Resource Integration, LLC

Figure 2. Fossil Fuel Results



BETTER determined that Building 50-A1 had poor fossil fuel performance as compared to similar buildings in the portfolio. The building's heating slope coefficient was worse than 87% of peer buildings, pointing to potential problems with the building envelope, infiltration/ventilation rates, and the overall efficiency of the mechanical heating system. Finally, analysis indicated that occupied and unoccupied heating setpoints in the building needed to be reduced.

RESULTS

Table 1. Estimated Annual Energy and Cost Savings for Selected EE Measures in Building 50-A1

ANNUAL ENERGY SAVINGS	3,576,749 kBtu
ANNUAL COST SAVINGS	\$107,484
PAYBACK PERIOD	0.61 years
ANNUAL EMISSIONS REDUCTIONS	206 tCO ₂ e

Equivalent to the CO₂ sequestered by planting 3,406 new trees annually³

1 The California state agency requested to remain anonymous.
2 The state agency utilized BETTER's "internal benchmark" capability to benchmark buildings in its portfolio against one another.
3 U.S. Environmental Protection Agency. 2021. Greenhouse Gas Equivalencies Calculator. March. <https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator>.

BETTER EE Recommendations

Based on the change-point models and benchmarks against similar buildings in the portfolio, BETTER recommended EE improvements listed in Table 2 to achieve energy, cost, and greenhouse gas (GHG) emissions reductions.

BETTER Estimated Energy, Cost, and Emissions Reductions

BETTER estimated that making the EE improvements would reduce annual energy consumption by approximately 33.7%, cutting annual energy costs by roughly \$66,687 and avoiding emission of 275.5 metric tons of carbon dioxide equivalent (MtCO₂e). BETTER analysis further showed that the majority of cost savings would result from a reduction in fossil fuel used for heating and electricity for baseload functions.

Table 2. BETTER and Level 2 Audit EE Recommendations Compared

BETTER EE RECOMMENDATIONS	LEVEL 2 AUDIT RECOMMENDATIONS
Reduce lighting load	Upgrade lighting to low-emitting diodes (LED)
Reduce lighting & plug load	Install occupancy sensors
<ul style="list-style-type: none"> Ensure adequate ventilation rates Reduce equipment schedule 	Optimize fan variable frequency drive
Reduce equipment schedule	<ul style="list-style-type: none"> Optimize chiller controls Install air-handling unit cold coil valves Install chilled-water pump variable frequency drive
Decrease heating setpoints	Implement hot water reset
<ul style="list-style-type: none"> Add wall/ceiling insulation Decrease infiltration Increase heating system efficiency 	Install Insulation
None	<ul style="list-style-type: none"> Implement chilled water setback Install high-performance windows

Table 3. BETTER and Level 2 Audit Annual Energy, Cost, and GHG Emissions Reductions Compared

	BETTER ESTIMATE	AUDIT ESTIMATE
ENERGY SAVINGS	5,093,770 kBtu/year	5,097,811 kBtu/year
ENERGY COST SAVINGS	\$66,687/year	\$149,800/year
GHG EMISSIONS REDUCTIONS	275.5 MtCO ₂ e/year	None provided

Level 2 Audit Results

Following the BETTER analysis, an investment-grade, or Level 2, audit of the building was performed by Energy Resources Integration LLC (ERI), an engineering firm based in San Francisco. The audit determined that the old masonry construction of the building provided poor insulation. This matched BETTER's recommendations to decrease infiltration, add wall/ceiling insulation, and increase heating system efficiency. The audit also showed there were problems with the building automation system (BAS) setpoints for equipment, which matched BETTER's recommendations to decrease heating setpoints and ensure adequate ventilation rates. As shown in Table 2, the EE improvements identified during the Level 2 audit mostly matched those recommended by BETTER.

Comparison of BETTER Analytics and Audit Results

The EE improvements identified in the Level 2 audit were estimated to reduce electricity and natural gas consumption by 5,097,736 kBtu annually, which is almost identical to BETTER's estimated energy savings as shown in Table 3. The auditors estimated higher cost savings by taking into account peak demand reduction from the EE measures, which BETTER does not estimate.

Project Results

Ultimately, the California state agency decided to move ahead with all EE recommendations identified by the Level 2 audit, except for the insulation and high-performance window upgrades. This was due to the long payback period for those EE improvements. As a result, the state agency expects to achieve the annual energy and costs savings listed in Table 1. The payback period for these EE measures is less than one year.

To learn more, visit better.lbl.gov or contact:

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