



PORTFOLIO CASE STUDY

PARTNER



BETTER Enables California State Agency Retrofit Program to Cut Energy Spend by an Estimated \$834,000 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**)² - 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 Level 1 audit costs of \$3.28 million³ and initiate retrofit and retro commissioning (RCx) projects that will provide the savings and benefits listed in the results table.

Motivation

The California agency sought to align with state energy and environmental goals, including reducing greenhouse gas (GHG) emissions 40% by 2030 (against 1990 levels).⁴ At the same time, the agency aimed to meet internal goals to reduce annual building portfolio energy costs through a combination of EE improvements and load shifting.

Challenge

The core challenge was to reduce energy consumption and costs across the state agency's large, geographically diverse and ageing portfolio, with a variety of equipment and systems. For instance, the heating, ventilation, and air-conditioning systems ranged from central plant configurations with cooling towers and chilled or hot water loops to basic split systems or packaged rooftop units (RTU). The building automation systems (BAS) also varied. Newer buildings combined central BAS with direct digital control technology for programmable and precise control of indoor temperature, humidity, lighting, and other functions. Older buildings utilized basic local thermostats and local RTU controls.

PORTFOLIO PROFILE

TYPE	Office
SIZE	450 buildings 41 million ft ²
VINTAGE	83% built before 2000
OCCUPANCY	100%
OPERATING HOURS	60 hrs/week
FUEL TYPES	Electricity and Natural Gas

PARTNER TESTIMONIAL

"BETTER improved our workflow efficiency, in relation to both time and cost of analysis, by giving visibility of likely energy saving opportunities prior to visiting geographically remote locations across the State of California. I believe that other large commercial buildings portfolio users such as city, state, and federal EE program administrators would enjoy similar results."

SUSTAINABILITY SUPERVISOR FOR THE CALIFORNIA STATE AGENCY

RESULTS

AUDIT SAVINGS	
Avoided Level 1 audit costs of \$3.28 million.	
Streamlined Level 2 audits in nine sites (saved six hours of time on-site).	
Initiated retrofit and RCx projects in nine public buildings.	
ESTIMATED RETROFIT AND RCX SAVINGS IN NINE BUILDINGS	
Estimated Electricity Savings	4,236,860 kWh/year
Estimated Natural Gas Savings	68,700 therms/year
Estimated Cost Savings	\$834,350/year
Estimated Payback Period	3.4 years
Estimated Emissions Reductions	2,271 MtCO ₂ e/year
<i>Equivalent to the CO₂ sequestered by planting 37,551 new trees annually⁵</i>	

Solution

The state agency partnered with Energy Resources Integration (ERI) LLC., an engineering firm headquartered in San Francisco, to implement a portfolio EE improvement strategy that involved: benchmarking energy performance of buildings, prioritizing buildings for audits, conducting audits, and implementing retrofit and RCx projects (applying utility rebates). ERI decided to use DOE's **BETTER** tool to help benchmark and prioritize buildings for audits.⁶

Actions Taken

Accessing its [open-source](#) analytical engine and user-friendly web interface, ERI used BETTER to analyze each of the California state agency's 450 buildings' monthly energy usage in response to weather conditions; benchmark each building's electric and fossil energy usage against similar buildings in the portfolio; quantify energy, cost and GHG emissions reduction potentials at the building and portfolio levels; and identify EE measures to decarbonize the state agency's buildings and portfolio. ERI benchmarked buildings in BETTER in batches of 50, grouping buildings with similar equipment or operating characteristics into the same batch for comparative analysis.

Using BETTER, ERI produced detailed reports that identified the scope for retrofit and RCx projects in 450 sites, which could save up to \$6.6 million in annual energy costs, reduce annual electricity usage by 33 million kilowatt hours (kWh) and natural gas usage by 900,000 therms. Moreover, BETTER enabled ERI to select nine buildings for investment-grade audits, and determined RCx investigations would yield high energy and cost savings, based on the following criteria:

- energy and cost savings potential greater than 25%;
- energy use intensity greater than 50,000 British thermal units /square foot (ft²); and
- electricity demand greater than 300 kilowatts (kW).

1 The California state agency requested to remain anonymous.

2 2020 R&D 100 Award, 2020 Berkeley Lab Director's Award for Tech Transfer, and 2021 EarthX E-Capital Summit Climate Tech Prize Semi-finalist.

3 Audit costs range from \$0.08 to \$0.24 per ft². 41,000,000 ft² * \$0.08 = \$3,280,000.

NightDog Energy Management. 2021. Commercial Energy Audit. May 3. nightdogenergy.com/services/commercial-energy-audit/.

4 Senate Bill 32 (SB 32) and Executive Order B-30-15 (EO B-30-15). California Air Resources Board (CARB). 2017. California's 2017 Climate Change Scoping Plan. Sacramento, CA: CARB. ww2.arb.ca.gov/our-work/programs/ab-32-climate-change-scoping-plan. California Air Resources Board. n.d. Building Decarbonization. Accessed August 20, 2021. ww2.arb.ca.gov/our-work/programs/building-decarbonization/about.

5 "U.S. Environmental Protection Agency. 2021. Greenhouse Gas Equivalencies Calculator. March. <https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator>.

6 BETTER is a free, on-line tool of the U.S. DOE BTO. With minimal data inputs, the tool benchmarks a building's electric and fossil energy usage against peers; quantifies energy, cost and GHG reduction potentials at the building and portfolio levels; and recommends EE measures to decarbonize and electrify buildings and portfolios. Visit better.lbl.gov for more.



Results

As a result of the audits and investigations, ERI scoped retrofit projects in nine buildings across its portfolio which are estimated to save approximately \$834,350 in annual energy costs and avoid emissions of 2,271 metric tons of carbon dioxide equivalent (MtCO₂e) per year. Results from the BETTER analysis and audit of one of these California state agency buildings show it is on track to reduce energy costs by more than \$100,000 annually through RCx and lighting retrofits. For more detail, see the **Building Showcase** case study.

Next Steps

The California state agency will continue to implement the scoped retrofit projects. The agency is also considering entering buildings prioritized by BETTER for retrofits into DOE's [Building Energy Asset Score](#) tool to further assess the costs and potential savings from large capital improvements recommended by BETTER (e.g., fenestration upgrades).

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

Sydney Applegate U.S. DOE
sydney.applegate@ee.doe.gov

Carolyn Szum, Lawrence Berkeley National Laboratory
ccszum@lbl.gov

Marc LaFrance, U.S. DOE
marc.lafrance@ee.doe.gov

BETTER is developed under Cooperative Research and Development Agreement (CRADA) No. FP00007338 between the Regents of the University of California Ernest Orlando Lawrence Berkeley National Laboratory, under its U.S. DOE Contract No. DE-AC02-05CH11231, and Johnson Controls, with assistance from ICF.