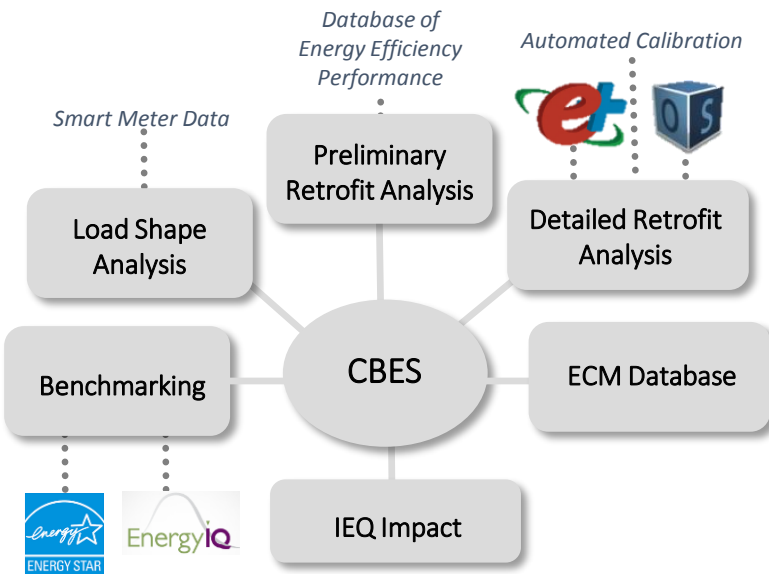


Commercial Building Energy Saver (CBES)

Lawrence Berkeley National Laboratory



CBES Toolkit



Overview

1. Three levels of retrofit analysis considering goal, data availability, and user experience
2. Public available web-based application for small and medium office and retail buildings in California
3. CBES API package enabling a third party development of comprehensive retrofit apps
4. Funded by California Energy Commission PIER Program

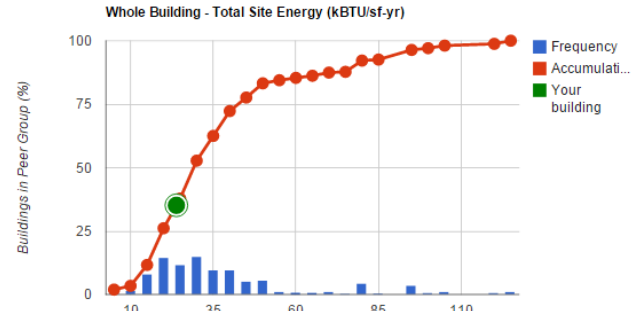
Main Features

1. Benchmarking using ENERGY STAR and EnergyIQ
2. Level 1: No- or Low-Cost Improvement using smart meter data and actual weather data
3. Level 2: Preliminary Retrofit Analysis powered by DEEP, a database of energy efficiency performance compiled from results of 10-million EnergyPlus simulations using NERSC clusters
4. Level 3: Detailed Retrofit Analysis providing user-configurable retrofit analysis using real-time EnergyPlus simulation
5. Considering indoor environmental quality impact during retrofits
6. 100 energy conservation measures (ECMs) including latest technologies and considering their interactions for HVAC, lighting, plug loads, service water heating, envelope, controls / sensors calibration
7. Cost data of ECMs for economic analysis
8. Automated model calibration ensuring more reliable retrofit analysis results

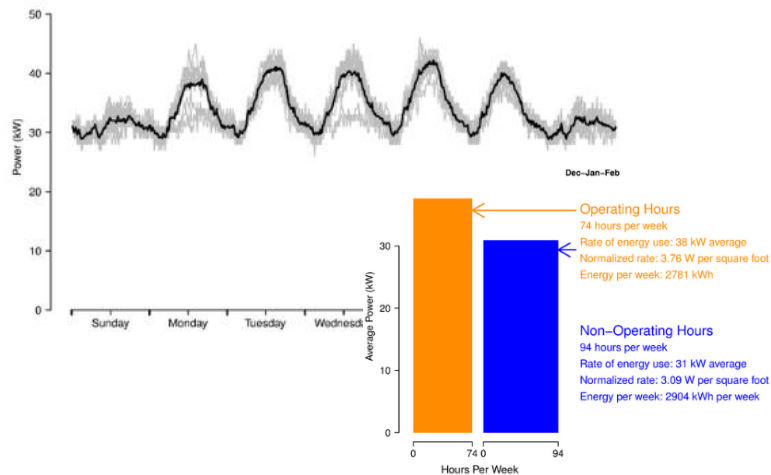
Benchmarking Results

The **EnergyStar Score** is 97.

The **EnergyIQ** result based on California Commercial End-Use Survey (CEUS) is:



Load Shape Analysis Results



Retrofit Analysis Results

Annual economic analysis

Measure ID(s)	Energy Cost Savings (\$)	Energy Savings (kWh)	Electricity Cost Savings (\$)	Electricity Savings (kWh)	Natural Gas Cost Savings (\$)	Natural Gas Savings (therm)	Investment Cost (\$)	Payback (Year)	
1	ECM 12;1	13,662	88,901	13,192	95,248	-214	-217	8,564	0.6
2	ECM 1;15	13,472	87,430	12,899	93,132	-193	-195	14,320	1.1
3	ECM 1	11,443	74,429	10,959	79,128	-159	-160	6,320	0.6
4	ECM 12;15	5,788	39,852	5,642	40,736	-30	-30	10,783	1.9
5	ECM 36	4,833	36,818	4,432	32,002	163	164	1,994	0.4
6	ECM 12	4,062	28,519	4,023	29,048	-18	-18	2,896	0.7
7	ECM 31	3,719	22,797	3,618	26,126	-112	-114	654	0.2
8	ECM 33	2,195	11,990	2,189	15,804	-129	-130	0	NA
9	ECM 14	1,847	10,052	1,851	13,367	-112	-113	5,000	2.7
10	ECM 30	942	9,027	847	6,114	98	99	0	NA

Description of measures

Measure ID	Category	Name	Cost Unit	Total cost per Unit
ECM 1	Lighting	Replace existing lighting with T8 upgrade	\$/sf	0.63
ECM 12	HVAC - Economizer	Add Economizer	\$/ton	387
ECM 14	Plug Loads	Plug Load Efficiency Upgrade (25% efficient from Baseline)	\$/sf	0.5
ECM 15	Plug Loads	Use Plug Load Controller (30% efficient from Baseline)	\$/sf	0.8
ECM 30	HVAC - Operation & Maintenance	Add Programmable Thermostat	\$/zone	1220
ECM 31	Lighting - Controls	Install daylighting sensors for interior lighting control	\$/sf_daylighting	0.81
ECM 33	HVAC - Ventilation	Replace Air Filter	\$/cfm	0.07
ECM 36	HVAC - Ventilation	Add Ceiling Fan	\$/sf	0.2

CBES web site: cbes.lbl.gov

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