

# 2030 District Program and Small Commercial Toolkit

2014 Building Technologies Office Peer Review



2030  
DISTRICTS®



U.S. DEPARTMENT OF  
**ENERGY**

Energy Efficiency &  
Renewable Energy

Cindy Regnier, [CMRegnier@lbl.gov](mailto:CMRegnier@lbl.gov)  
Lawrence Berkeley National Lab

# Project Summary (New Project)

## Timeline:

Start date: October 1, 2013

Planned end date: March 30, 2016

## Key Milestones

1. Develop program resources and tools, 9/30/14
2. Complete demonstrations, 9/30/15
3. Deployment to other 2030 Districts, 3/30/16

## Budget:

Total DOE \$ to date: \$2M (for program and toolkit, no dollars are applied to retrofits – these costs are born by bldg owners)

Total future DOE \$: N/A

## Target Market/Audience:

Small commercial office and retail buildings within 2030 Districts.

## Key Partners:

LBNL	Architecture 2030
Cleveland 2030 District	Green Building Alliance / Pittsburgh 2030 District
Seattle 2030 District	Prospect Silicon Valley / City of San Jose
ASU	Emerging 2030 Districts

## Project Goal:

Create 2030 District Program guidance and a technical Toolkit that provides products to promote, develop, and successfully execute 2030 District energy efficiency savings programs specifically for small commercial office and retail, which can be deployed nationwide.

# Purpose and Objectives

**Problem Statement:** The small commercial buildings sector has distinct issues in implementing energy efficiency (EE) –

- Buildings are very resource constrained and lack access to affordable EE expertise (architects, engineers, consultants)
- Existing EE tools and services have high-cost entry points

**Target Market and Audience:** Commercial buildings under 50,000 square feet, (office and retail) representing over 90% of all U.S. commercial buildings and consumes over 40% of the sector's energy use. Small commercial property currently comprise 66% of the properties in the existing 2030 Districts. Total commercial building stock is 6.5 quads energy use.

# Approach

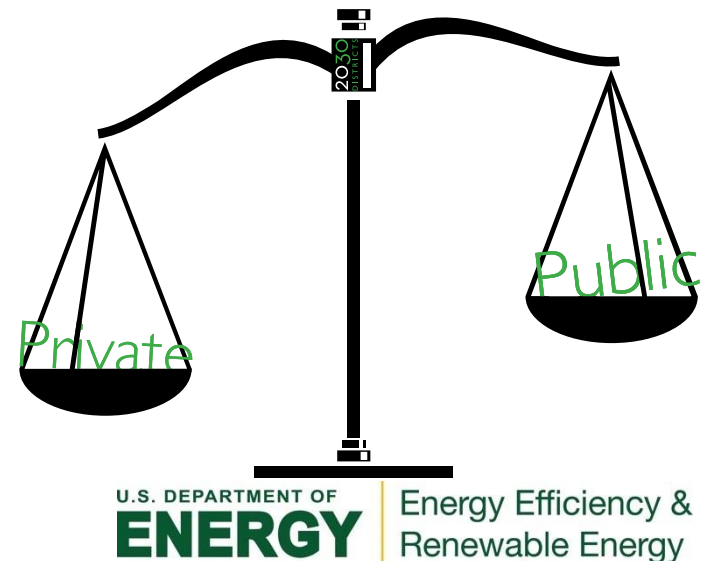
**Approach:** District scale approaches provide multiple advantages:

- motivates members
- leverages the needs at scale to deliver EE programmatic offerings such as low cost auditing and Cx, financing opportunities, and early equipment retirement programs.

The best practices these districts employ to establish self-sustaining EE programmatic local resources are captured in this project for use by other districts. A suite of no- or low- cost EE tools and services will be packaged that serve this sector, designed for use by practitioners engaged in this sector, e.g. HVAC or electrical contractors. Existing tools are leveraged, and a small set developed to fill identified needs.

## **Distinctive Characteristics:**

2030 Districts are private sector-led – increases buy-in and ownership of the effort. Independent demonstration areas are tied into a Network with shared goals, timelines and performance metrics. Increases best practice sharing and collaboration.



# Approach (cont'd)

**Key Issues:** Some key barriers to energy reductions in this sector are:

Technical	Programmatic
1) access to centralized, comprehensive, cost-evaluative information about how to achieve energy targets	5) guidance on bringing disparate stakeholders together
2) access to tools that measure buildings' progress toward targets and provide actionable feedback	6) financial models for district self-sufficiency
3) affordable access to auditing and Cx services	7) member outreach, including to historically underserved communities
4) reduced transaction costs or financial incentives that make reduction efforts attractive	

# 2030 Districts Network

SEATTLE  
**2030**  
 DISTRICT

CLEVELAND  
**2030**  
 DISTRICT

PITTSBURGH  
**2030**  
 DISTRICT

LOS ANGELES  
**2030**  
 DISTRICT

DENVER  
**2030**  
 DISTRICT



**100M Square Feet  
 Committed**

District and Member Reduction Targets	Potential District Savings
20% Individual Building Retrofits by 2015	Up to 240 Million kBtu/year District Wide
10% Aggregated District Savings by 2015	\$4 Million in Energy Cost Savings
50% Incremental District Savings by 2030	\$17.5 Million/year Economic Activity = \$29 Million Asset Value Increases

# 2030 District + Small Commercial Building Toolkit



## Key Project Highlights:

- Year 1 – Program guidance on Districts and Toolkit developed to enable and make easier identification, execution and tracking of efficiency measures and consumption
- Year 2 - 25-40 demonstration sites in 4 partner Districts, 20% reduction target per demonstration + 10% per district by 2015
- Year 3 - Deployment to 5-10 new Districts

***Identify > Execute > Track***

# Year 1 - Program and Small Commercial Toolkit Development

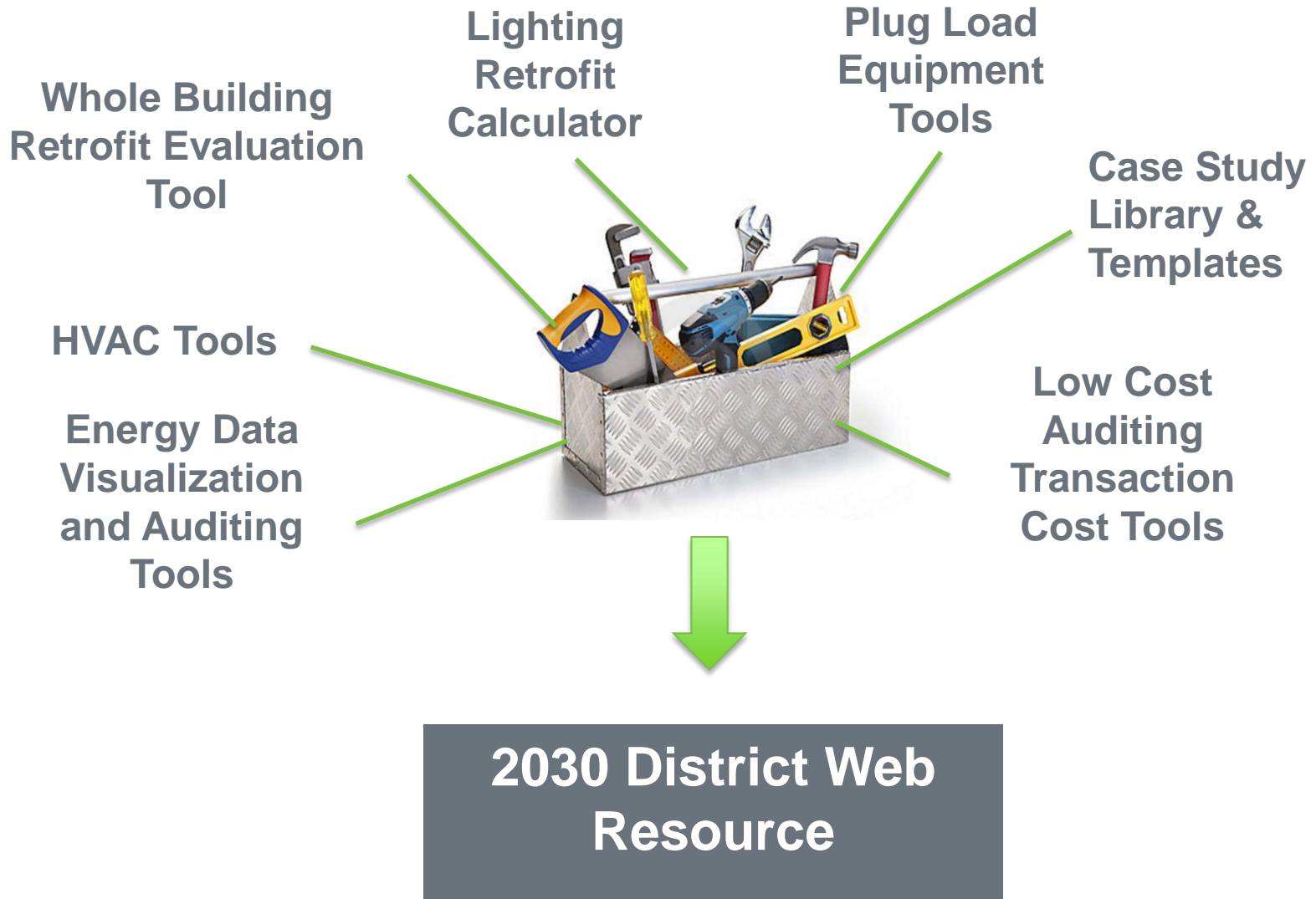
- **Program guidance** is developed by Partner Districts, using best practices from established and emerging districts. Provides multiple models for program approaches to achieve success on:
  - *Management and administration* (launch, scheduling, financial sustainability and funding models, lessons learned)
  - *Member organization* (data disclosure practices, commitment letters)
  - *Outreach and district membership* (community relations, underserved communities)
  - *Public and private sector partnerships* (utilities for Cx/auditing programs, early equipment retirement etc.; financial services allies; service providers, e.g. bulk lighting retrofits; local trade associations, public agencies and community groups)
  - *Benchmark and track energy savings* (member and district scale), metrics, methodologies and platforms



# Year 1 - Program and Small Commercial Toolkit Development

- The **Technical Toolkit** identifies, executes and tracks EE retrofits by solving small commercial's unique challenges:
  - Energy efficiency measure online assessment tools
    - Existing tools (eg. PNNL RTU calculator, FEMP calculators for HVAC, EnergyStar Plug load tool)
    - Development of select tools (e.g. lighting retrofit calculator, whole building retrofit calculator (similar to Home Energy Saver))
  - Lack of data visualization and analysis (Open EIS)
  - Auditing and performance feedback (Energy Management Package)
- Central tracking tool to collate results from individual tools and prioritize strategies
- Workshops held with industry stakeholders to understand the features, needs and use cases
- Tool users focused on stakeholders most likely to engage in small commercial buildings – e.g. HVAC contractors, electrical contractors, O&M personnel, and property managers, owners or tenants

# 2030 Districts - Small Commercial Technical Toolkit



# Years 2 & 3 – Demonstrations and Deployment

- Year 2 - **Program and Technical Toolkit Demonstrations** - 25 – 40 Small Commercial Sites in demonstration partner cities – Cleveland, Seattle, Pittsburgh and San Jose
  - Application and tracking of energy savings over one year
- Year 3 (6 months) – **Verification and Deployment** - Demonstration site savings verification, case study development, outreach
  - Outreach and industry engagement, deploy 2030 District model, establishment of 5 to 10 New 2030 Districts
  - Educate potential partners about demonstrated successes and value to communities/cities
  - Dissemination of 2030 District Program and toolkit through trade associations, outreach
  - Case Studies and other materials disseminated at national conferences and partner events

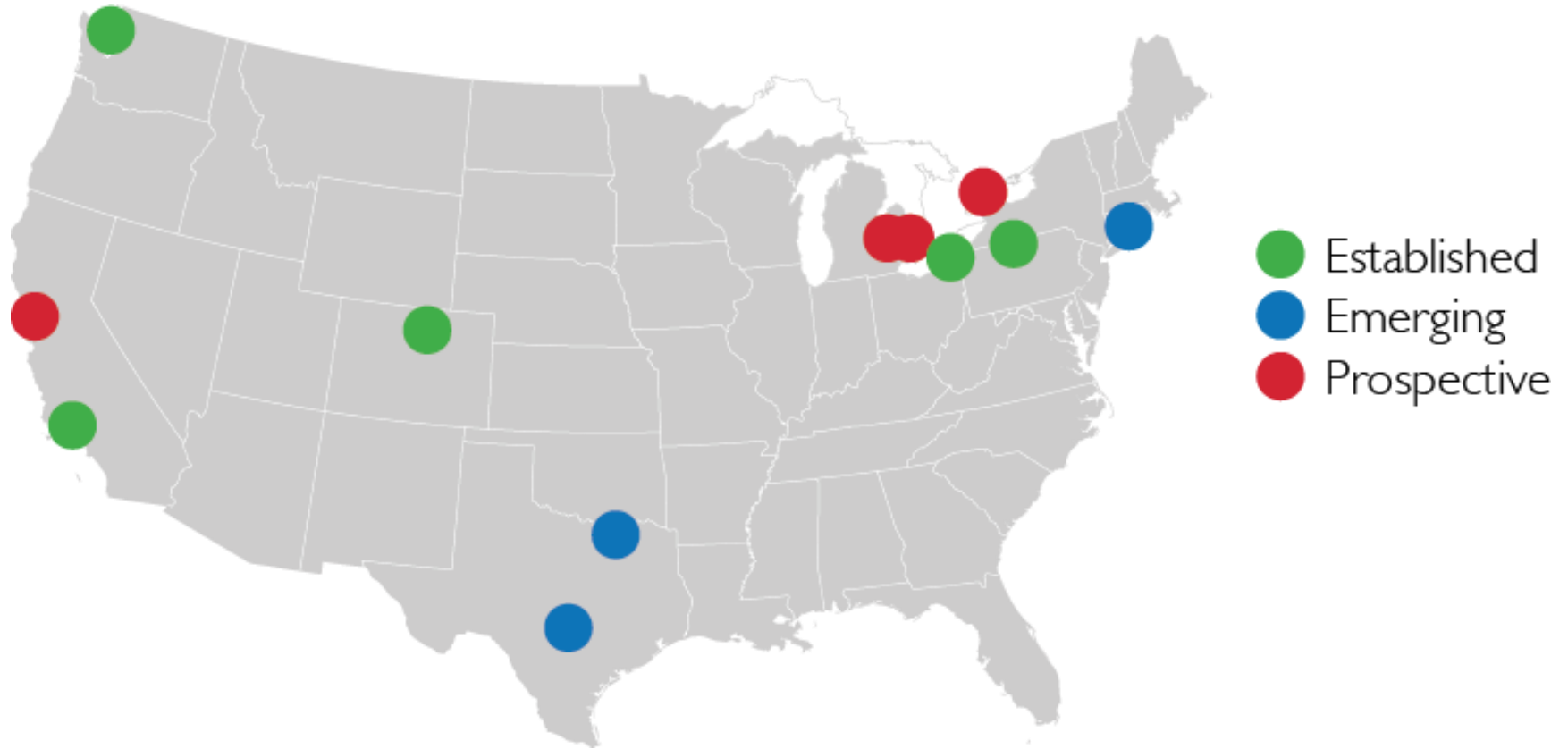


# Purpose and Objectives

## Planned Contribution to Energy Efficiency:

1. Year 1 – deliver program guidance to develop self-sufficient 2030 Districts, leveraging peer relationships to influence market uptake of EE. A suite of technical tools delivered, identifying cost effective EE strategies to achieve a minimum of 20% energy savings.
2. Year 2 - 25-40 project demonstration sites targeting a minimum of 20% reduction per site, estimated savings of 11-20 million kBtu/yr. Energy savings reported annually through EnergyStar Portfolio Manager.
3. Year 3 the demonstrations will report energy savings, using EnergyStar Portfolio Manager. Tools and program guidance will be deployed to:
  - 5-10 new 2030 District nationwide (200M sq. ft./commercial space, with 10M sq. ft. of small commercial). 2030 District and members commit to >20% building energy reduction, contributing to a target 10% energy reduction per District.
  - Energy savings up to 2.4 billion kBtu/yr, \$40 million in energy cost savings, \$175 million/year of economic activity, \$290 million of increased asset values, 1640 direct and 3370 indirect jobs.

# 2030 Toolkit – Emerging and New 2030 Districts



## Established

Seattle  
Pittsburgh  
Cleveland  
Los Angeles  
Denver

## Emerging

Dallas  
Stamford  
San Antonio

## Prospective

San Francisco  
Ann Arbor  
Detroit  
Toronto

## Affiliate

Silicon Valley

# Progress and Accomplishments (New Project)

**Discoveries:** Regardless of technically proficient tools and reasonable ROIs from analysis, any financial commitment to making improvements can deter some audiences. Financial incentive or alternative financing approach is a larger priority for this audience than in large commercial. The framing of EE assessments in the context of the business model of a small commercial owner/advocate can be useful as a first step.

## Accomplishments:

- Denver 2030 District launched December 2013, 14 million sf committed. Los Angeles 2030 District has just launched.
- Small commercial tool workshops held.
- Technical tool online drafts completed, including the web portal, case study template, and the tracking tool in development.
- Program guidance working groups drafting guidance on best practices for outreach, membership. MOUs in development for partnerships with larger national organizations (e.g. BOMA, ASHRAE, ULI, Better Buildings Challenge, EPA)



# Progress and Accomplishments (New Project)

**Project Contribution to Energy Efficiency** : Project has just started, measured results are not yet available. However, the team has completed industry workshops on small commercial tools, developed mockups of new tools and tracking tool, coordinated on web portal and completed some program guides.

- Ensuring or accelerating market outcome(s) –
  - Architecture 2030 is actively fostering inquiries and early formation activities with about 2 dozen U.S. cities, priming the project for early deployment of the program guidance and tools.
  - Industry outreach continuing with conferences and working on industry collaborations with national organizations to partner at the local level (e.g. BOMA).
  - Project team has a history of success – District formation, District energy savings (Seattle 2030 District - over 120 member buildings, 34 Million member Square Feet, and deployed EE to large commercial with savings up to 27%), and tool development (LBNL).

**Awards/Recognition:** None to report yet.



# Project Integration and Collaboration

## Project Integration and Communications:

- Small commercial stakeholder workshops on tools, four cities. Included contractors, owners, consultants, utilities and program administrators who engage with the small commercial sector. Further beta testing of tools planned with user groups.
- 2030 Districts hold regularly meeting with their members and stakeholders and has working groups to develop program guidance.
- FOA Project team hold weekly meetings
- Architecture 2030 presented at the 2013 National Preservation Conference, and the 2014 SPEER Summit.

## Partners, Subcontractors, and Collaborators:

- Architecture 2030, program guidance and 2030 Districts convener
- Seattle, Cleveland and Pittsburgh 2030 Districts and Prospect Silicon Valley, small commercial outreach, demonstrations, best practices
- ASU, case studies template and library.



# Next Steps and Future Plans

1. The project has just commenced a 30 month project period. Tasks that remain include:
  - I. Complete program guidance, technical tools and web portal.
  - II. Demonstration and deployment.
  - a. Risks and mitigation
    - I. Feedback from owners is critical to ensure assessment results are framed in their context to enable decisions. We are engaging with these stakeholders.
    - II. Additional risk of the tools not achieving intended savings. Tools selected leverage existing products with successful track records, or will be tested through other projects.
  - b. No major decision points in near term. Go/No Go at end of Y1.
2. Ensuring future success – Continue to maintain a relationship with 2030 Districts and keep the technical tools updated and functional.
  - a. Building on this work – DOE and others may become more involved in 2030 Districts as a market channel for resources and tools deployment.

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# REFERENCE SLIDES

# Project Budget

**Project Budget:** 2,000k, awarded by DOE FOA-0000829

**Variations:** No variations have occurred or are expected.

**Cost to Date:** 135.8k

**Additional Funding:** N/A.

## Budget History

FY2013 (past)		FY2014 (current)		FY2015 – FY2016 (planned)	
DOE	Cost-share	DOE	Cost-share	DOE	Cost-share
N/A	N/A	2,000k	2,000k	N/A	N/A

# Project Plan and Schedule

Project plan, milestones as noted in the schedule below.

- Q1 milestone was delayed due to scheduling issues with participants

Go/No-go: Stop the demonstration phase if the following milestones not met (9/30/14):

- # of tech. tools developed >4
- Case study library developed >20 case studies
- # Case study templates >1
- # of program energy saving tracking tools developed > 1
- # of program guides & templates developed > 5

Project Schedule												
Project Start: Oct. 1, 2013	Completed Work											
Projected End: Mar. 30, 2016	Active Task (in progress work)											
	◆ Milestone/Deliverable (Originally Planned)											
	◆ Milestone/Deliverable (Actual)											
	FY2013				FY2014				FY2015			
Task	Q1 (Oct-Dec)	Q2 (Jan-Mar)	Q3 (Apr-Jun)	Q4 (Jul-Sep)	Q1 (Oct-Dec)	Q2 (Jan-Mar)	Q3 (Apr-Jun)	Q4 (Jul-Sep)	Q1 (Oct-Dec)	Q2 (Jan-Mar)	Q3 (Apr-Jun)	Q4 (Jul-Sep)
<b>Past Work</b>												
Q1 Milestone: Conduct tool workshops					◆	◆						
Q2 Milestone: Develop case study template and initiate development of toolkit products.						◆	◆					
<b>Current/Future Work</b>												
Q3 Milestone: Identify demonstration sites in partner cities.								◆				
Q4 Milestone: Develop program resources and tools.								◆				
FY15 Milestone: Conduct site demonstrations of program resources and technical tools.												◆
FY16 Milestone: Conduct site demonstration M&V.												◆
FY16 Milestone: Deployment to new Districts.												◆

2030 Districts provide a common platform for each district's unique ways of defining goals and creating a common mode of discussion



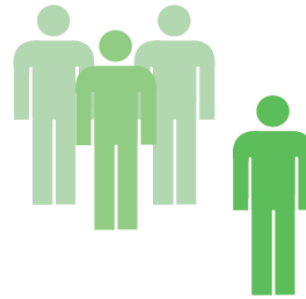


2030 Districts act as a concierge and GP – pointing partners towards tools for accurate diagnosis and treatment

## For Building Owners, Managers and Developers .....



Utilize special financing programs



Improve competitive positioning



Access exclusive incentives, discounts & programs

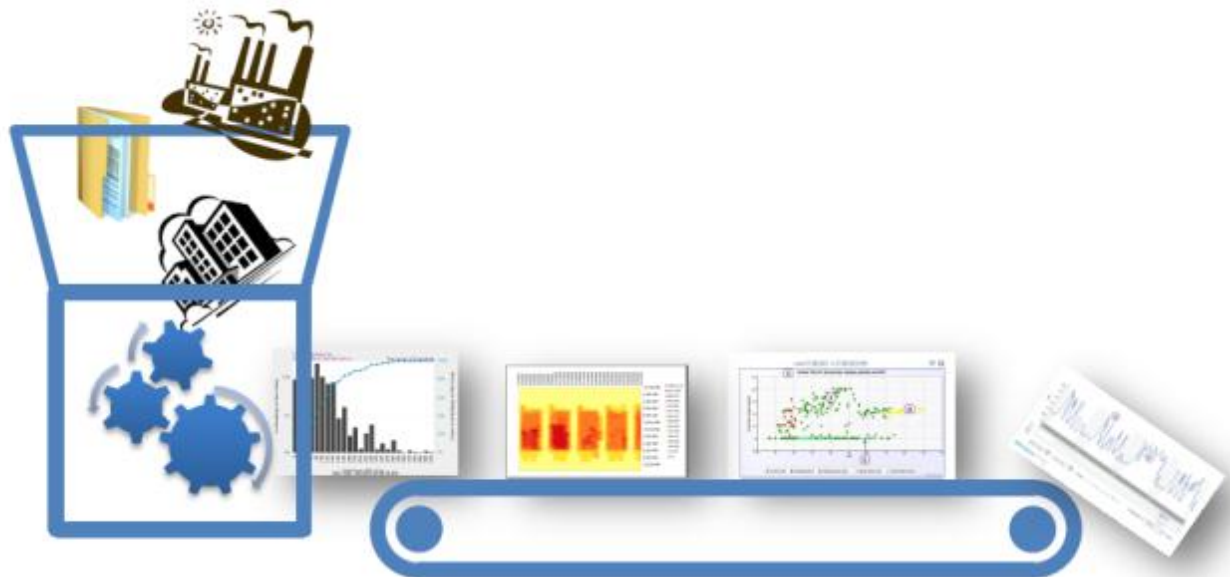


Receive comparative analysis reports

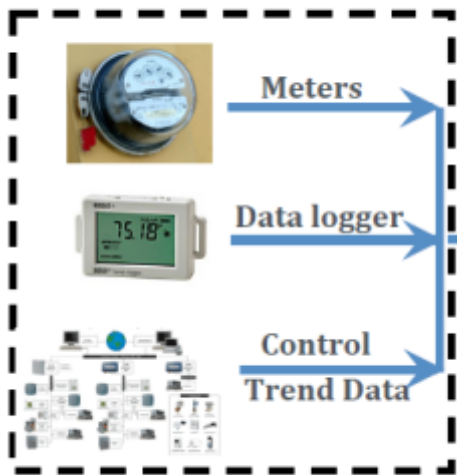
# Small Commercial Toolkit: Web Resource Landscape



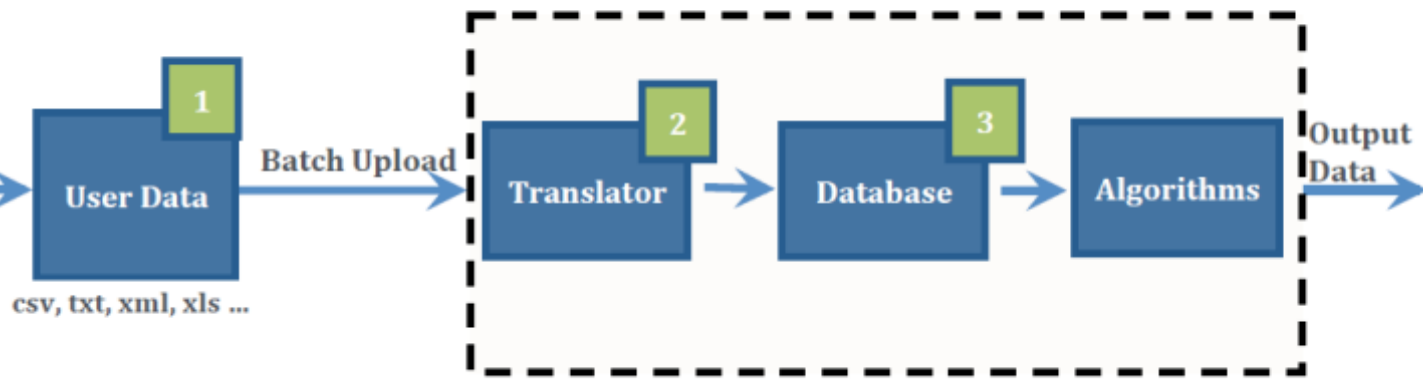




## Devices

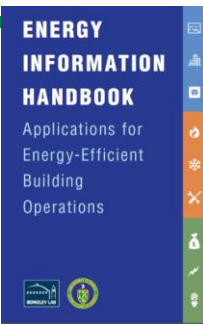


## OpenEIS



# Operations: Energy Information Handbook

## How to design performance data systems How to utilize performance data



- Reporting and Tracking Methods
- Fundamental Methods
- Advanced Methods

[www.eis.lbl.gov](http://www.eis.lbl.gov)

Minimum Data Requirements

Analysis Methods	Utility		Interval Meter		Submeter			Other*
	Gas	Electric	WB Gas	WB Electric	Heating Load	Cooling Load	Lighting Load	
Simple Tracking	●	●						
Utility Cost Accounting	●	●						
Internal Rate of Return	●	●						●
Carbon Accounting	●	●						●
Longitudinal Benchmarking	●	●						●
Cross-Sectional Benchmarking	●	●						●
Loading Profiling			●	●				
Peak Load Analysis				●				
PV Monitoring								●
Loading Histograms					●	●		
Simple Baselines	●	●						●
Model Baselines			●	●				●
Lighting Efficiency							●	●
Heating and Cooling Efficiency					●	●		●
Energy Signature	●	●						●
Energy Savings	●	●						●
Cumulative Sum	●	●						●
Anomaly Detection			●	●				●

WB = whole-building.

\*Other Includes for example, weather data, square footage, or equipment costs.

Applicable Building Systems

Analysis Methods	Whole Building	Heating	Cooling	Lighting	Plug Loads
	Simple Tracking	●	●	●	●
Utility Cost Accounting	●	●	●	●	●
Internal Rate of Return	●	●	●	●	●
Carbon Accounting	●	●	●	●	●
Longitudinal Benchmarking	●	●	●	●	●
Cross-Sectional Benchmarking	●	●	●	●	●
Loading Profiling	●	●	●	●	●
Peak Load Analysis	●				
PV Monitoring*	●				
Loading Histograms		●	●		
Simple Baselines	●	●	●	●	●
Model Baselines	●	●	●	●	●
Lighting Efficiency				●	
Heating and Cooling Efficiency		●	●		
Energy Signature	●	●	●		
Energy Savings	●	●	●	●	●
Cumulative Sum	●	●	●	●	●
Anomaly Detection	●	●	●	●	●

\*Energy production from PV arrays is typically accounted for at the whole-building level.

Interpretation of Method Output

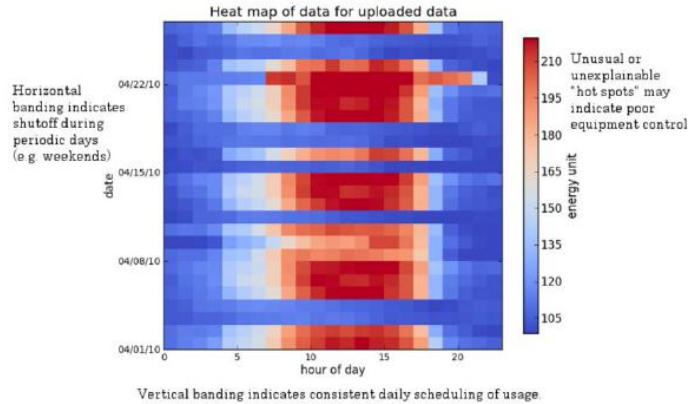
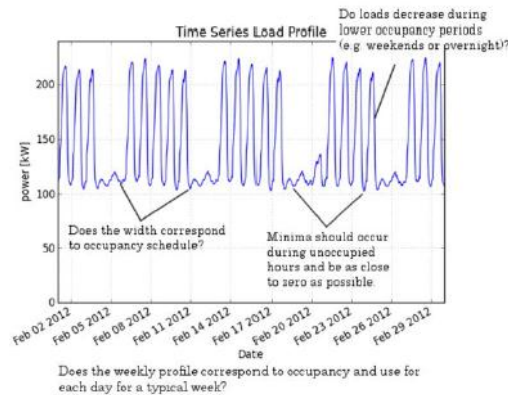
Analysis Methods	Requires Minimal Expertise	Requires Advanced Expertise
	Simple Tracking	██████████
Utility Cost Accounting	██████████	
Internal Rate of Return	██████████	
Carbon Accounting	██████████	
Longitudinal Benchmarking	██████████	
Cross-Sectional Benchmarking	██████████	
Loading Profiling		██████████
Peak Load Analysis		██████████
PV Monitoring		██████████
Loading Histograms		██████████
Simple Baselines		██████████
Model Baselines		██████████
Lighting Efficiency		██████████
Heating and Cooling Efficiency		██████████
Energy Signature		██████████
Energy Savings	██████████	
Cumulative Sum	██████████	
Anomaly Detection	██████████	



Energy Efficiency & Renewable Energy

# Operations: Open EIS

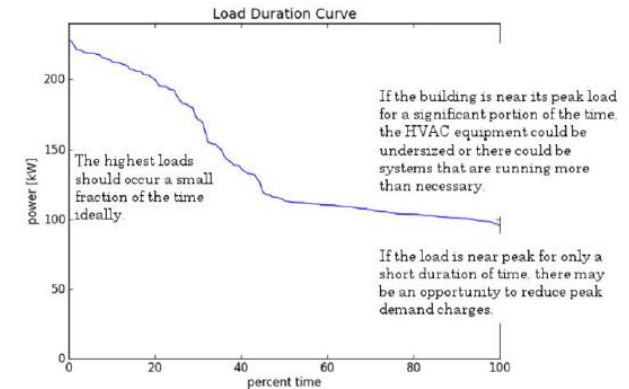
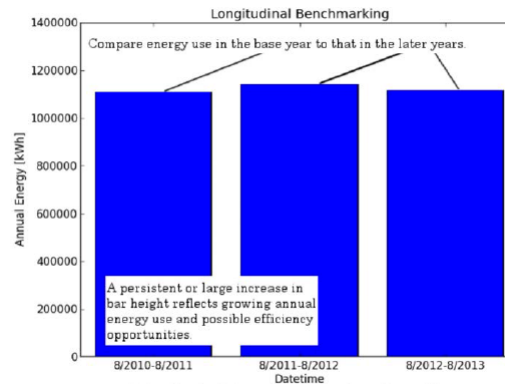
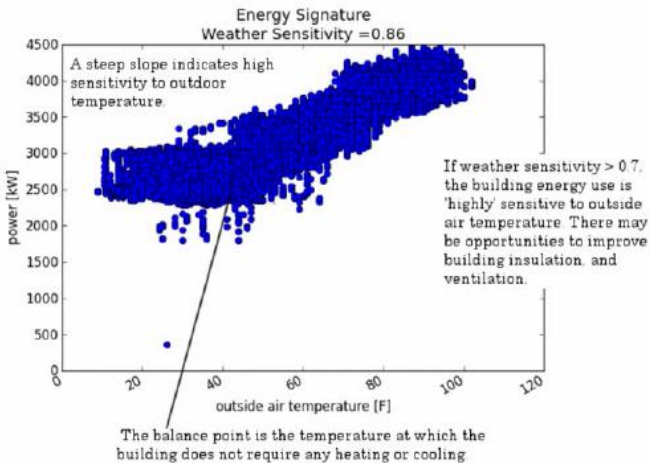
## Using Visualization to Inform Next Steps



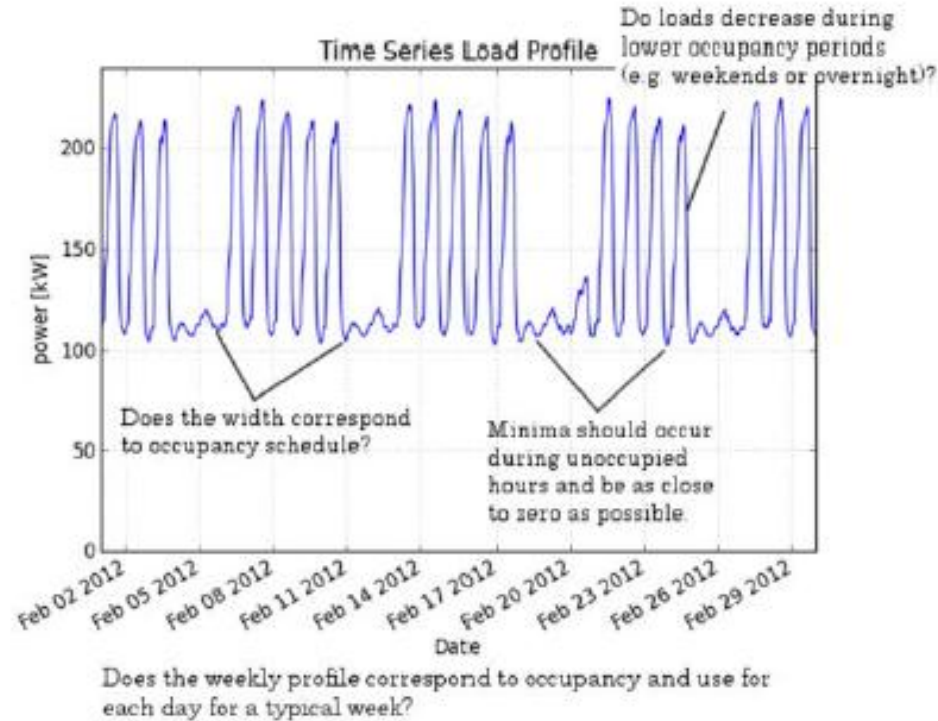
## Algorithms

### Time Series Load Profiling

- Heat Maps
- Energy Signature
- Weather Sensitivity
- Longitudinal Benchmarking
- Base-to-Peak Load Ratios
- Load Duration Curve
- Load Variability



# Operations: Open EIS



**Figure 1. OpenEIS reference code output for time series load profiling**

- Abnormalities or changes in load profiles = potential efficiency opportunities

## Algorithms

### Time Series Load Profiling

- Heat Maps
- Energy Signature
- Weather Sensitivity
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# Operations: Open EIS

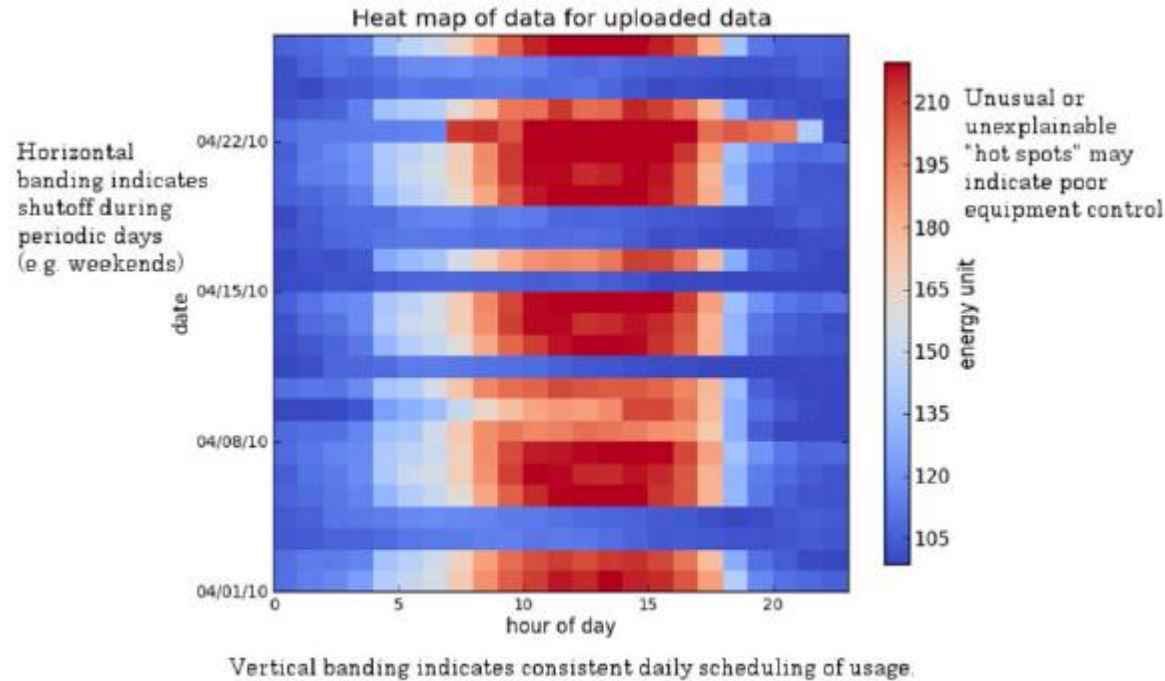


Figure 2. OpenEIS reference code output for heat maps

## Algorithms

Time Series Load Profiling

### Heat Maps

Energy Signature

Weather Sensitivity

Longitudinal Benchmarking

Base-to-Peak Load Ratios

Load Duration Curve

Load Variability

- The color code and mapping allow identification of hot spots to investigate further.

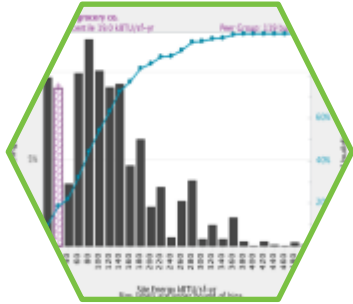
# Energy Management Package - Auditing

- Streamlined package for energy management: guidelines & worksheets
- Focused on operational savings measures
- Delivered by HVAC contractors



# Element 1: Monthly Data & Benchmarking

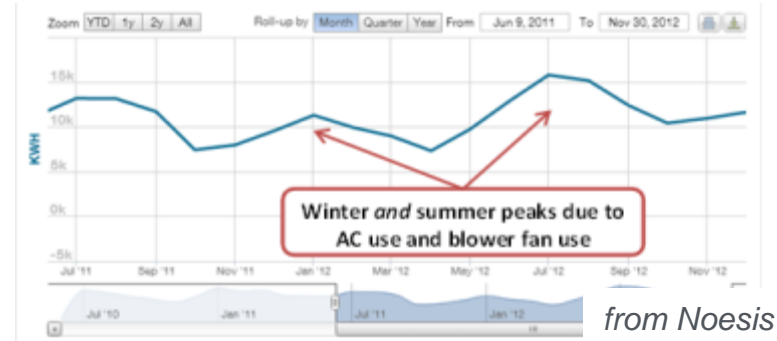
Analyze monthly data & benchmark



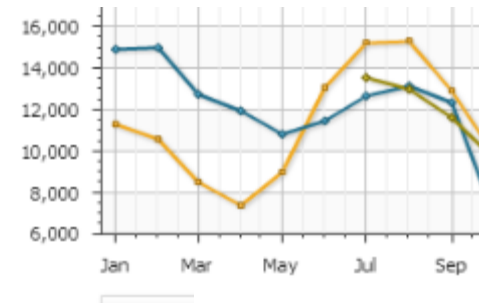
Requires:

- ❖ At least 1 year of monthly electricity and fuel use;
- ❖ Building floor area & type;
- ❖ 30-60 minutes

A) *What are the seasonal patterns?*

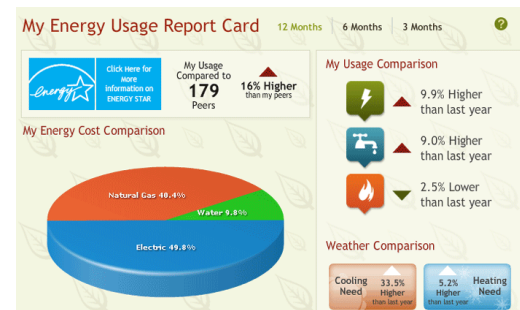


B) *How does this year compare with the previous year?*



C) *How does my building compare to others?*

- ❖ Energy use intensity (kBtu / sf – yr)
- ❖ % of buildings with higher EUI (Energy Star Score)



from GreenQuest

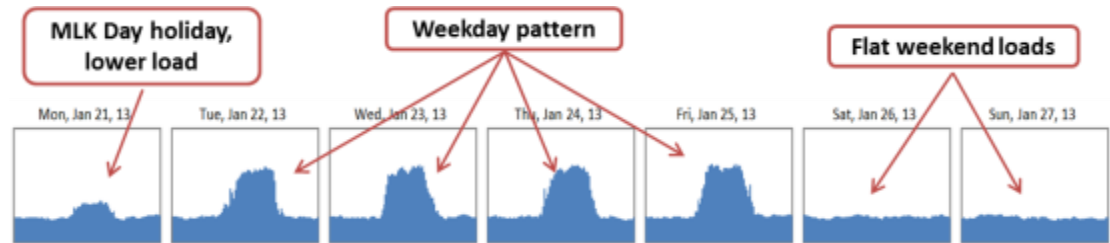
# Element 2: Interval Data

Requires:

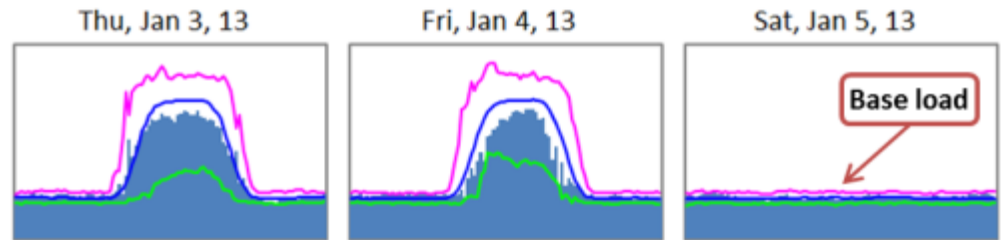
- ❖ 3-12 months of hourly (smart meter) electricity data
- ❖ 30-60 minutes

Analyze interval data

A) *Are the daily and weekly load schedules as expected?*



B) *How much energy is used at night and on weekends (Base load)?*



from BizEE

C) *Are there spikes or unusual activity ?*

D) *Can peak loads be reduced or shifted to non-peak periods in the day?*

E) *Are there changes over time?*



# Element 3: Walkthrough

## Walkthrough



1 hour walkthrough at building site

Check lighting & thermostat settings

Consult with manager about energy management practices

### E3 Walkthrough Worksheet

Building: \_\_\_\_\_ Date: \_\_\_\_\_

Facility contact name: \_\_\_\_\_


Phone: \_\_\_\_\_

Building operating hours:

Weekdays \_\_\_\_\_ to \_\_\_\_\_

Saturday: \_\_\_\_\_ to \_\_\_\_\_

Sunday: \_\_\_\_\_ to \_\_\_\_\_



**STEP 1 Overview**  
List major energy consuming equipment in this building: \_\_\_\_\_

✓	If issues were highlighted in:	Pay special attention to question number:
	E2 Step 3: High evening / weekend / base load	1, 5, 6, 7, 8, 11c, 11e, 12 (office), 13 (kitchen)
	E2 Step 2: Load schedule does not match occupancy schedule	8, 11a, 13 (kitchen)
	E2 Step 5: High peak, daytime loads	11b, 11d, 9
	E1 Step 5: High seasonal variability	10

Questions in **bold** below are the typically the most important to assess.

**STEP 2 Look for these items throughout the building**

#	Description	Yes	No	NA	Corrective Action / Comments	Solved ?
1	<b>Are occupancy sensors installed and working? Are they placed appropriately?</b> <small>Consult manager / occupant about functioning.</small>					
2	<b>Are incandescents or T12 fixtures present?</b>					
3	Are fans or portable space heaters being used?					
4	Are radiators and air vents clear and unobstructed?					

*E3 Walkthrough Worksheet -- DRAFT: Do not Circulate*

# Element 4: Communicate with Owner

Communicate with owner

- ❖ Tips on pitching efficiency measures
- ❖ Tool to generate summary (right)
- ❖ Incentive identification
- ❖ Goal setting guidelines
  - ❖ *“I think together we can improve the Energy Star Score by 5 points this year.”*


**How is your building performing?**  
 Prepared for Delightful Dentistry, 32 Main St. by GetYourBack HVAC

Your building uses 150 kWh/ft<sup>2</sup>/yr, which is more efficient than 8% of office buildings.

Your building's energy use has decreased by 2%, compared with the previous year.

Based on your percentile ranking, there are likely many low-cost opportunities to improve the energy efficiency of this facility.

By reducing your building's energy use by 5%, you could save \$310 annually, based on national average energy costs. This is equivalent to selling 31 more dental cleanings per year! This program aims to use low-cost measures to reduce energy use by 3-5%, but higher savings can be achieved by completing many recommendations or additional measures with higher upfront costs.



Knowing is half the battle. But what's the other half? The following table includes low-cost opportunities to reduce your building's energy costs. The more items you choose to implement, the more energy you are likely to save. Additionally, regular energy monitoring is recommended to maintain the energy savings that you achieve.

Recommendations	How easy is this?	Who?	Cost	Incentive?	Date Completed
Switch off computers and monitors at night	Easy	Owner	\$		
Replace T12 lamps with efficient T8 lamps	Medium	Lighting Contractor	\$5	Utility rebate \$16/fixture	
Install occupancy sensors or time clocks for lighting control	Difficult	Lighting Contractor	\$55	Utility rebate \$8/sensor	
Adjust thermostat setpoints	Medium	Owner or Contractor	\$		
Switch off copiers, printers, etc. at night	Easy	Owner	\$		
Address load spikes and erratic behavior in daily load profiles	Medium	Contractor and owner	\$5		

# Element 5: Check Results

Check results

Requires:

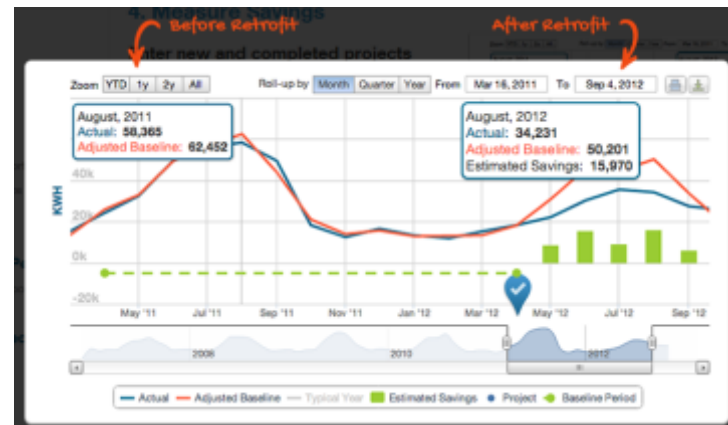
- ❖ Updated monthly and/or hourly data
- ❖ 30-60 minutes

A) *How much energy as been saved?*

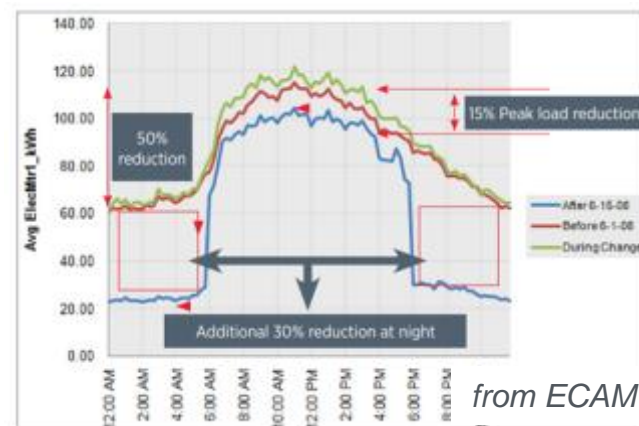
B) *Can we verify changes to scheduling?*

C) *Further steps to energy efficiency*

D) *Leveraging success in future sales opportunities*

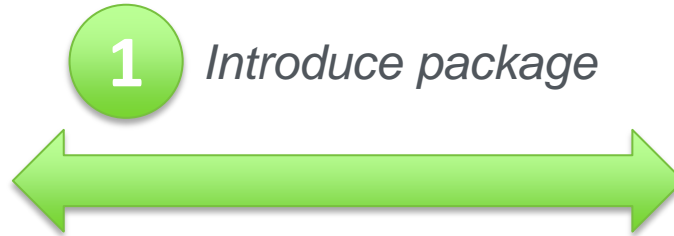


from Noesis

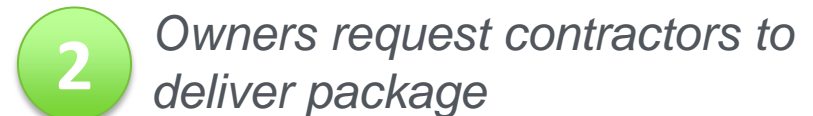
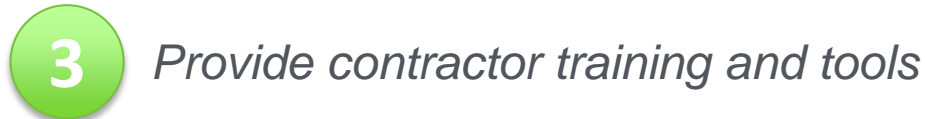


from ECAM

# EMP is one option for 2030 Districts



2030  
DISTRICT™



# Whole Building: Small Commercial Retrofit Tool

Evaluates whole building approaches to save energy. Will be modeled after the Home Energy Saver online tool.

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**HOME ENERGY SAVER™**

START DESCRIBE COMPARE UPGRADE COMMUNITY

*Save money, live better, help the earth!* *Over 6 million visits!*

**ENERGY CALCULATOR**

Enter your zip code, or  
02474

Enter previous session #  
\_\_\_\_\_

**GO**

[Look up zip code](#)  
[Import Home Energy Score Inputs](#)

**Case Studies**

"Home Energy Saver helped me save thousands of dollars per year. It is one government service that makes paying taxes worthwhile."  
— Nick Wilder  
Wheat Ridge, Colorado

[Read more stories. Add yours.](#)

**Energy NewsWire**

- [Get the latest on energy-efficiency tax credits](#)
- [Obama at Home Depot](#)
- [HES featured by Suze Orman in Oprah Magazine](#)

**How do you compare?**

What is your experience using spray foam insulation?

- Haven't used it
- Have used it: excellent results
- Have used it: acceptable results
- Have used it: unacceptable results

**SUBMIT** [What others say...](#)

More resources for: Teachers... [Energized Learning](#) • Professionals... [HESpro](#) • Help implementing our recommendations... [ENERGYSTAR.gov](#)



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# Whole Building: Home Energy Saver



## HOME ENERGY SAVER™

START

DESCRIBE

COMPARE

UPGRADE

COMMUNITY

QUICK INPUT | DETAILED INPUT

Building ID:

Location: Arlington, Massachusetts

Zip Code: 02474

Session: 4003831

### QUICK INPUT

General

Building Design

Appliances & Equipment

DETAILED INPUT

### GENERAL

Are you finished customizing this section?  Yes  No

Providing more details will make your results more accurate.

NEXT

CALCULATE

SAVE & EXIT

Name or other identifier for this home/session

User's email address

Purpose of this assessment

- Hypothetical analysis
- Inspection of actual house
- Energy audit of actual house
- Designing a new home
- Other

Address   
(omit address to exclude/remove home from [carbon map](#).)

City

State

City with most similar climate to modeled house

Year house was built

People living in the house, by age  0 to 5 years  6 to 13 years

14 to 64 years  65 years and older

### Energy Prices

Electricity	<input type="text" value="0.148"/>	\$/kilowatt-hour
Piped Natural Gas	<input type="text" value="1.45"/>	\$/therm or \$/100 cubic feet
Liquid Propane Gas (LPG)	<input type="text" value="3.01"/>	\$/gallon
Fuel Oil	<input type="text" value="2.49"/>	\$/gallon

Are you finished customizing this section?  Yes  No


NEXT

CALCULATE

SAVE & EXIT

Energy Efficiency &  
**ENERGY** | Renewable Energy

# Whole Building: Home Energy Saver



## HOME ENERGY SAVER™

START
DESCRIBE
COMPARE
UPGRADE
COMMUNITY

QUICK INPUT | DETAILED INPUT

Building ID: home  
 Location: Arlington, Massachusetts  
 Zip Code: 02474  
 Session: 4003831

**BUILDING DESIGN** Are you finished customizing this section?  Yes  No

Providing more details will make your results more accurate.

**QUICK INPUT**

General

Building Design

Appliances & Equipment

---

[DETAILED INPUT](#)

Stories above ground level

Heated or cooled floor area (all stories combined)  square feet

Type of foundation

Foundation or floor insulation  Yes  No/Don't Know

Ceiling Insulation level

Roof insulation level

Attic or ceiling type

Wall insulation

Airtightness

Does the house have weather-stripping and/or caulking to prevent air leakage?  Yes  No

Describe windows on each side of house

	Window Type	Estimated window area (square feet)
Front:	<input type="text" value="Double-pane, solar-control low-E, argon gas"/>	<input type="text" value="72.00"/>
Back:	<input type="text" value="Double-pane, solar-control low-E, argon gas"/>	<input type="text" value="72.00"/>
Left:	<input type="text" value="Double-pane, solar-control low-E, argon gas"/>	<input type="text" value="36.00"/>
Right:	<input type="text" value="Double-pane, solar-control low-E, argon gas"/>	<input type="text" value="36.00"/>

Are you finished customizing this section?  Yes  No



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# Whole Building: Home Energy Saver



## HOME ENERGY SAVER™

START

DESCRIBE

COMPARE

UPGRADE

COMMUNITY

[QUICK INPUT](#) | [DETAILED INPUT](#)

Building ID: home  
Location: Arlington, Massachusetts  
Zip Code: 02474  
Session: 4003831

### APPLIANCES & EQUIPMENT

Are you finished customizing this section? [?](#)  Yes  No

Providing more details will make your results more accurate.

[PREVIOUS](#) [CALCULATE](#) [SAVE & EXIT](#)

#### QUICK INPUT

- General
- Building Design
- Appliances & Equipment

[DETAILED INPUT](#)

Clothes washer

Yes  No

Number of refrigerators

1 Refrigerator

Water heater

Year purchased:

2004

Tank size:

40 gallons

Fuel:

Natural Gas

Heating equipment

Type: [?](#)

Central Gas furnace

Year purchased:

2004

Cooling equipment

Type: [?](#)

No Cooling Equipment

Year purchased:

Do not know / Default

Thermal distribution

Duct Location: [?](#)

Unconditioned basement or unvented crawlspace

Ducts Insulated:

Yes  No/Don't Know

Boiler pipe insulation:

Yes  No/Don't Know

Are you finished customizing this section? [?](#)  Yes  No

[PREVIOUS](#) [CALCULATE](#) [SAVE & EXIT](#)



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# Whole Building: Home Energy Saver

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## HOME ENERGY SAVER™

START

DESCRIBE

COMPARE

UPGRADE

COMMUNITY

[SUMMARY](#) | [DETAILS](#) | [CARBON MAP](#)

Building ID: home  
 Location: Arlington, Massachusetts  
 Zip Code: 02474  
 Session: 4003831

Print: [This page](#) | [Report](#)

### YEARLY ENERGY COSTS

Providing more details will make your results more accurate.



#### Potential Yearly Savings

Money: **\$1,560**  
 Electricity: **2,584 kWh**  
 Natural Gas: **812 Therms**  
 Emissions: **11,374 lb. CO<sub>2</sub>**

This reduction in greenhouse-gas emissions is like taking 1 car(s) off the road.



[Will I make a difference?](#)

[Existing Home Configuration](#)

	Total	Heating	Cooling	Hot Water	Large Appliances	Small Appliances	Lighting
Existing Home	\$3,416	\$2,430	\$0	\$189	\$392	\$191	\$214
With Upgrades	\$1,856	\$1,172	\$0	\$114	\$304	\$191	\$75
<b>Savings</b>	<b>\$1,560</b>	<b>\$1,258</b>	<b>\$0</b>	<b>\$75</b>	<b>\$88</b>	<b>\$0</b>	<b>\$139</b>

*Important Note:* These are initial estimates only, and results may vary. If the owner has not already done so, we strongly recommend that they retain a professional energy auditor to develop a detailed work scope and budget for improving the home. We also recommend the Home Performance with ENERGY STAR program when considering home improvements.

[Comparing Results to Home's Utility Bill](#)



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California Environmental Protection Agency  
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U.S. DEPARTMENT OF  
**ENERGY** | Energy Efficiency & Renewable Energy

# Lighting Retrofit Calculator (Inputs) - Mockup



## SMALL COMMERCIAL TOOLKIT



---



basics | schedule | lighting types | economics | controls: tuning + occupancy | controls: daylight harvesting + personal

?

### Lighting Retrofit Tool

Analyzes the potential energy savings (demand and annual) associated with lighting types and controls for open office and private office layouts

[Intro](#)

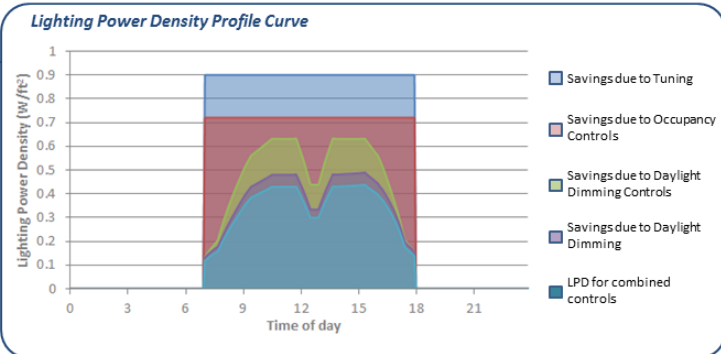



[Rebates Database](#)

Open Office
Private Office
Aggregator

#### Results

##### Lighting Power Density Profile Curve



**62 %**  
**Energy Savings**  
from Open Office Controls

**51 %**  
**Peak Demand Savings**  
from Open Office Controls

**18.4 years**  
**Simple Payback Period**  
for Open Office Controls

[Export Results](#)

#### Inputs

Open office-1
save

##### General inputs

Basic	Control Strategies	Location & Rates
Floor Area <input style="width: 50px;" type="text"/> Sq ft Workstations: Number <input style="width: 50px;" type="text"/> Workstations: Area <input style="width: 50px; background-color: #add8e6;" type="text"/>	<input checked="" type="checkbox"/> Tuning <input checked="" type="checkbox"/> Occupancy <input checked="" type="checkbox"/> Daylight Dimming <input checked="" type="checkbox"/> Personal Control	State <input style="width: 50px;" type="text" value="MA"/> Avg. Commercial Electricity Billing Rate \$ <input style="width: 50px; background-color: #add8e6;" type="text" value="0.1537"/> /kWh Electricity Use Cost \$ <input style="width: 50px; background-color: #add8e6;" type="text" value="0.15"/> /kWh Electricity Demand Cost \$ <input style="width: 50px; background-color: #add8e6;" type="text" value="12.00"/> /kWh/mo.

Note: The cells with the blue background are calculated based on input selections and/or input values.



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Types: Open Office & Private Office




Energy Efficiency & Renewable Energy

# Lighting Retrofit Calculator (Inputs) - Mockup





## SMALL COMMERCIAL TOOLKIT





---

basics | schedule | lighting types | economics | controls: tuning + occupancy | **controls: daylight harvesting + personal**

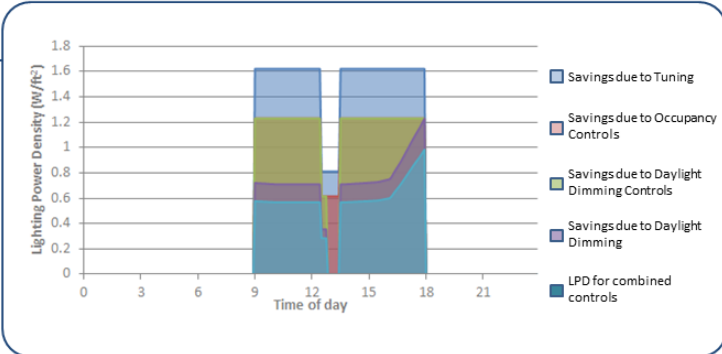


 **Lighting Retrofit Tool**
Analyzes the potential energy savings (demand and annual) associated with lighting types and controls for open office and private office layouts.
Intro



  
Rebates Database

Open Office
Private Office
Aggregator

### Results



**62 %**  
**Energy Savings**  
from Open Office Controls


**51 %**  
**Peak Demand Savings**  
from Open Office Controls

**18.4 years**  
**Simple Payback Period**  
for Open Office Controls

**Export Results**

### Inputs

#### Controls


**Daylight Harvesting**

Lights: % allowed to dim  %

High Daylight Category: % of floor area

Medium Daylight Category: % of floor area


Low Daylight Category: % of floor area

NO Daylight or w/o daylight controls:  %


#### Personal Control

Controllable Installed Light Power:  %  
% NOT via personal controls

Controllable Lighting: average % reduction (daily) due to the addition of personal controls  %



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# Rooftop Unit Comparison Calculator (Inputs)

## Rooftop Unit Comparison Calculator

RTU Comparison Calculator (BETA)	Home	Submit	Restore	
<p>Welcome to the Rooftop Unit Comparison Calculator (RTUCC).</p> <p>This calculator simulates the energy usage of both a high efficiency and a standard efficiency air conditioner. It then compares their energy and economic performance.</p> <p>The RTUCC displays best in Mozilla Firefox. Good second choices for a web browser are Microsoft Internet Explorer and Google Chrome.</p> <p>To run the RTUCC, characterize the two systems and their environment using the controls on this page. Then click the 'submit' button. Use your browser 'back' button to return from the results page to this control page or click on the "Return to Controls Page" link.</p> <p>Use the 'restore' button to change all values back to the defaults shown in the far right column (<a href="#">more on defaults</a>).</p> <p>Move your cursor over a question mark near a controls name to display a help tip. Click on the question mark for more detailed information (<a href="#">more on help</a>).</p> <p>Visit the <a href="#">engineering methods</a> pages for additional background information on the RTUCC. Click the version link (below) to view the revision history.</p> <p><a href="#">Version 4.2 (BETA)</a></p>	<input type="checkbox"/> Advanced Controls	<input type="checkbox"/>	<input type="checkbox"/> Hidden	
	<input type="checkbox"/> Show bin calculations	<input type="checkbox"/>	<input type="checkbox"/> Hide bin calcs	
	Building Type	Office-Medium	Office-Medium	
	State / City	MO Kansas City	MO	Kansas City
	Schedule	M-Fri, 7 a.m. to 7 p.m.	M-Fri, 7 a.m. to 7 p.m.	
	Indoor Temperature	75 °F Setback Cond. Off °F	75 °F	Condenser Off
	Total Capacity	084 kBtuh in 2 stages	84 kBtuh	in 2 Stages
	Oversizing Factor	0 %	0%	
	Candidate Unit	12 EER @ 4.5 k\$ 0 \$/yr	12 EER	\$4,500 \$0
	Enable Economizer	<input checked="" type="checkbox"/>	Economizer enabled	
	Standard Unit	9 EER @ 4 k\$ 0 \$/yr	9 EER	\$4,000 \$0
	Enable Economizer	<input checked="" type="checkbox"/>	Economizer enabled	
	Electric Utility Rate	0.08 \$/kWhrs	0.08 \$/kWhrs	
	Discount Rate	7 %	7.0 %	
	Equipment Life	15 years	15 years	
Number of Units	1 units	1 unit		
Chart discounted costs	<input checked="" type="checkbox"/>	<input type="checkbox"/> Chart present value		
	Home	Submit	Restore	

For more detailed analysis...

Source: [http://www1.eere.energy.gov/femp/technologies/eep\\_eccalculators.html](http://www1.eere.energy.gov/femp/technologies/eep_eccalculators.html)

# Rooftop Unit Comparison Calculator (Results)

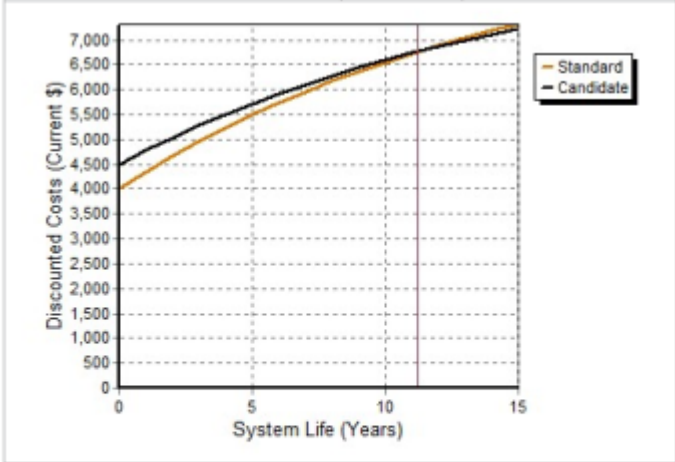
## Rooftop Unit Comparison Calculator

[Return to Controls Page](#)

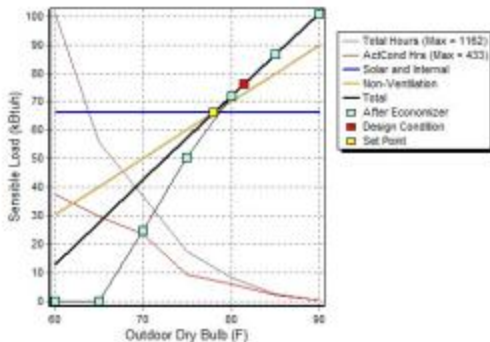
[Return to RTUCC Home](#)

### RESULTS

SEATTLE, WA	Candidate	Standard	Savings
Annual Energy Consumption (kWhrs)	3,726	4,548	<b>822</b>
Annual Operating Cost (\$)	298	364	<b>66</b>
15 Year Life Cycle Cost (\$)	7,215	7,314	<b>99</b>
Annualized Cost (\$)	792	803	<b>11</b>
Net Present Value (\$)	99		
<b>Payback (yrs)</b>	<b>11.2</b>		
Rate of Return (%)	10.01		
Savings to Investment Ratio (SIR)	1.20		

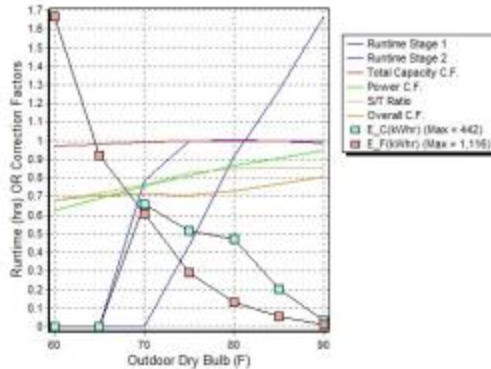


BIN CALCS: Loads and Hours — Candidate



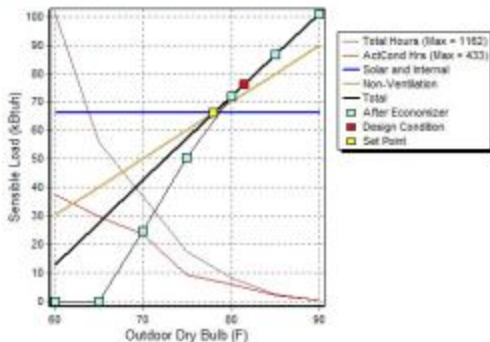
Note: The Hours' trace is normalized (see MAX value in legend)

BIN CALCS: Equipment Performance — Candidate Unit



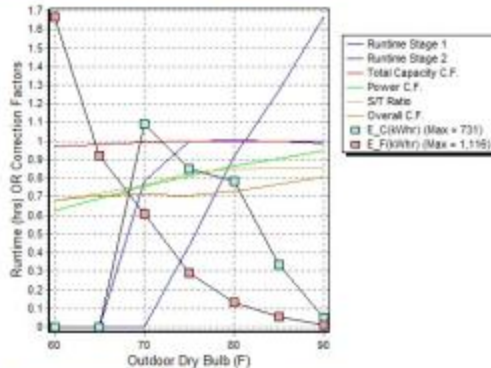
Note: The 'kWhrs' traces are normalized (see MAX values in legend)

BIN CALCS: Loads and Hours — Standard Unit



Note: The Hours' trace is normalized (see MAX value in legend)

BIN CALCS: Equipment Performance — Standard Unit



Note: The 'kWhrs' traces are normalized (see MAX values in legend)