



GovEnergy
www.govenergy.gov

The Premier Energy Training Workshop
and Trade Show for Federal Agencies

A River of Energy Solutions

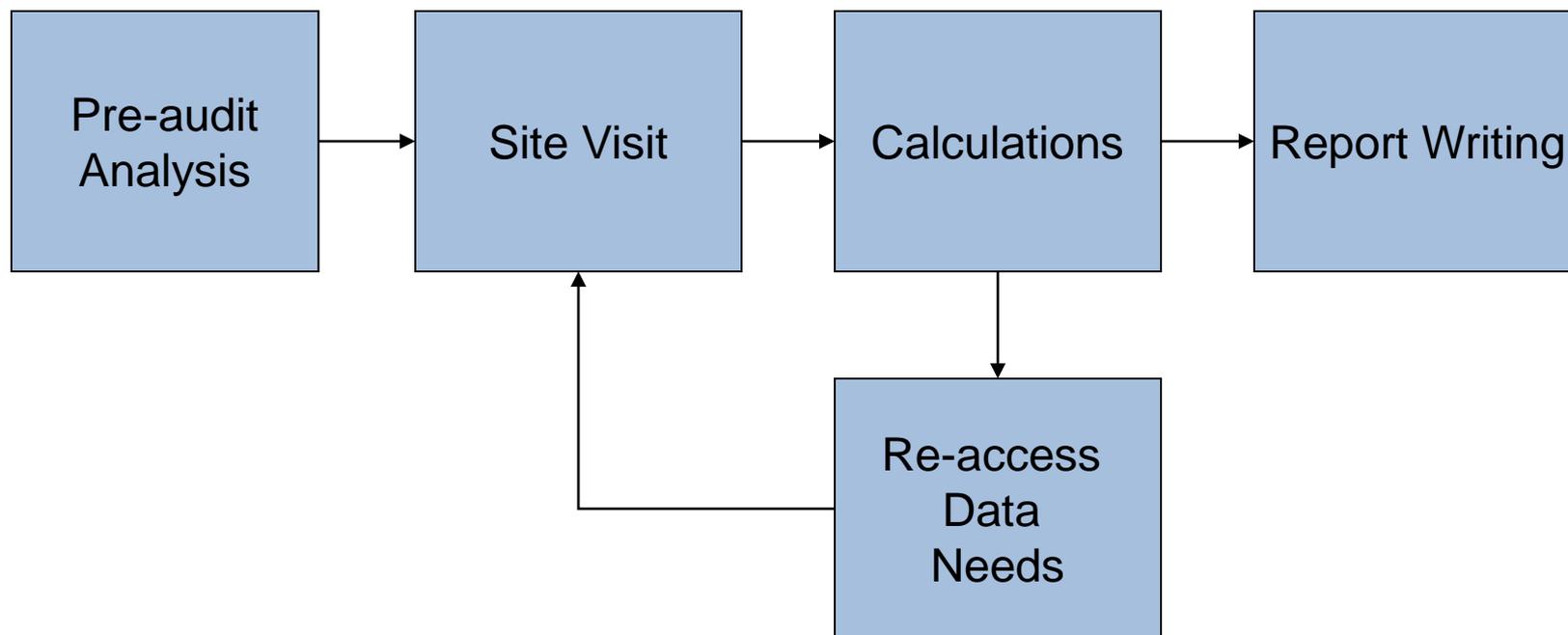
Session 3 - The Tool Box Essential Project Development Tools

Ryan Stroupe, PG&E Pacific Energy Center

Intent of Presentation

- To highlight resources that support Energy Audits and other facility evaluations.
- Emphasizing free, public-goods resources including
 - resources developed at the Pacific Energy Center
 - resources developed in California
 - resources developed by the Department of Energy
- Emphasizing resources you can utilize when planning, conducting and summarizing energy audits.

The Energy Audit Process



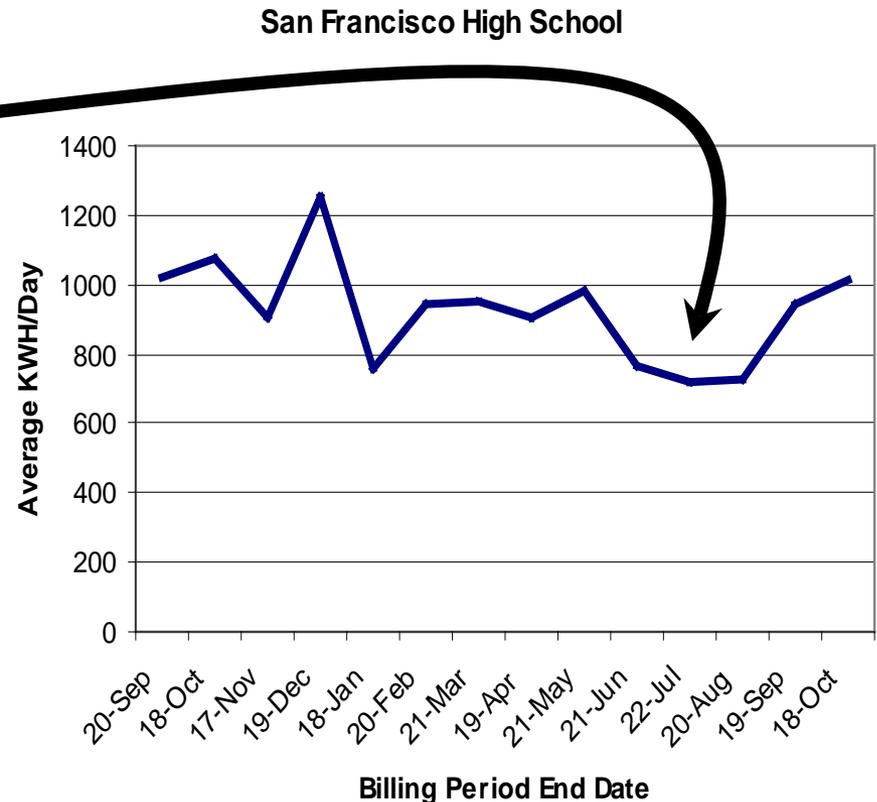
Pre-audit Analysis

Activities that should be undertaken
before visiting the facility.

Utility billing data
Benchmarking tools
Commercial building surveys

Billing Data Analysis: Factors to Consider

- Is seasonal load variation noticeable?
- Is scheduled use of facility noticeable?
- Are occupancy or production changes noticeable?
- Is there a correlation between energy usage and cost?
- Is building sub-meter data available?
- Can data be used to verify energy savings?



Accessing Utility Billing Data and Tariffs

- Utility billing data
 - Direct from customer
 - From utility*
- Tariffs
 - Utility web sites
 - Resources on understanding rates

*Most utilities will not provide data to 3rd parties; consultants must get owner agreement for utilities to provide billing data directly to 3rd party.

Pacific Gas and Electric Company WE DELIVER ENERGY.™

JANE SAMPLE
77 BEALE ST
SAN FRANCISCO CA 99999

ELECTRIC ACCOUNT DETAIL

17 Service ID#: 2468024680
18 Rate Schedule: E19S Medium General Demand-Metered TOU Service
Billing Days: 30 days

19 Social	Rotating Outage Blk	20 Meter #	Prior Meter Read	21 Current Meter Read	22 Difference	23 Meter Constant	24 Usage
R	14R	1212A1	18,405	19,205	800	120	96,000 kWh
R	14R	1212A1	11,200	11,600	400	120	48,000 Reactive

25 89.00 % Power Factor = -0.24 % Adjustment

Charges

26 01/01/07 – 01/30/07 Electric Charges	\$10,042.10
27 Power Factor Adjustment Net Charges	19.20- 10,022.90

The net charges shown above include the following component(s). Please see definitions on Page 2 of the bill.

28 Generation	\$6,037.44
Transmission	508.91
Distribution	2,040.39
Public Purpose Programs	623.04
Nuclear Decommissioning	28.80
DWR Bond Charge	450.24
Ongoing CTC	10.56
Energy Cost Recovery Amount	323.52

Taxes

Energy Commission Tax	\$21.12
Utility Users' Tax (7.500%)	751.72

Time of Use Detail

29 Season: Winter	Energy
Partial Peak	38,400 @ \$0.09355
Off-Peak	57,600 @ \$0.07568
Season: Winter	Demand
Partial-Peak	209 @ \$1.92000
Off-Peak	223 @ \$6.32000

30 **TOTAL CHARGES** \$10,795.74

Usage Comparison	Days Billed	Kwh Billed	Kwh Per Day
31 This Year	30	96,000	3,200.0
Last Year	30	87,802	2,926.7

32 Rotating outage blocks are subject to change without advance notice due to operational conditions.

Benchmarking: Energy Star Portfolio Manager

Facility Performance [Set Baseline Period](#) | [Set Energy Performance Target](#)

Select View: Performance: Environmental [Create View](#) | [Edit View](#)

12 Months Ending	Current Rating (1-100)	Current Source Energy Intensity (kBtu/Sq. Ft.)	Adjusted Percent Energy Reduction	CO2 Reduced (pounds)
May 2007	31	278.0	9.3%	131,809.14
Select Date				
Change				
REFRESH VIEW				

Space Use [Add Space](#)

Space Name	Space Type	Floor Area (Sq. Ft.)	% Floor Area	Alerts	
DPR Server Room	Computer Data Center	1,000	2		Delete Space
office space	Office	53,000	98		Delete Space
Total		54,000	100 %		

More than 50% of your building is defined as Office. Please note that your rating accounts for all of the spaces listed. If you cannot see a rating, you will be compared to the national average of Office. [Click to learn more.](#)

Due to rounding, the % Floor Area Total may not always equal 100%.

General Facility Administration

[Track](#) Energy Performance Improvements
[Delete](#) this Facility from Portfolio Manager
[Contact](#) us

Sharing Data

[Add](#) user to share this Facility
[Modify](#) list of users
[Transfer](#) Facility to another user
[View](#) entire Access List for this Facility

Applying for the ENERGY STAR

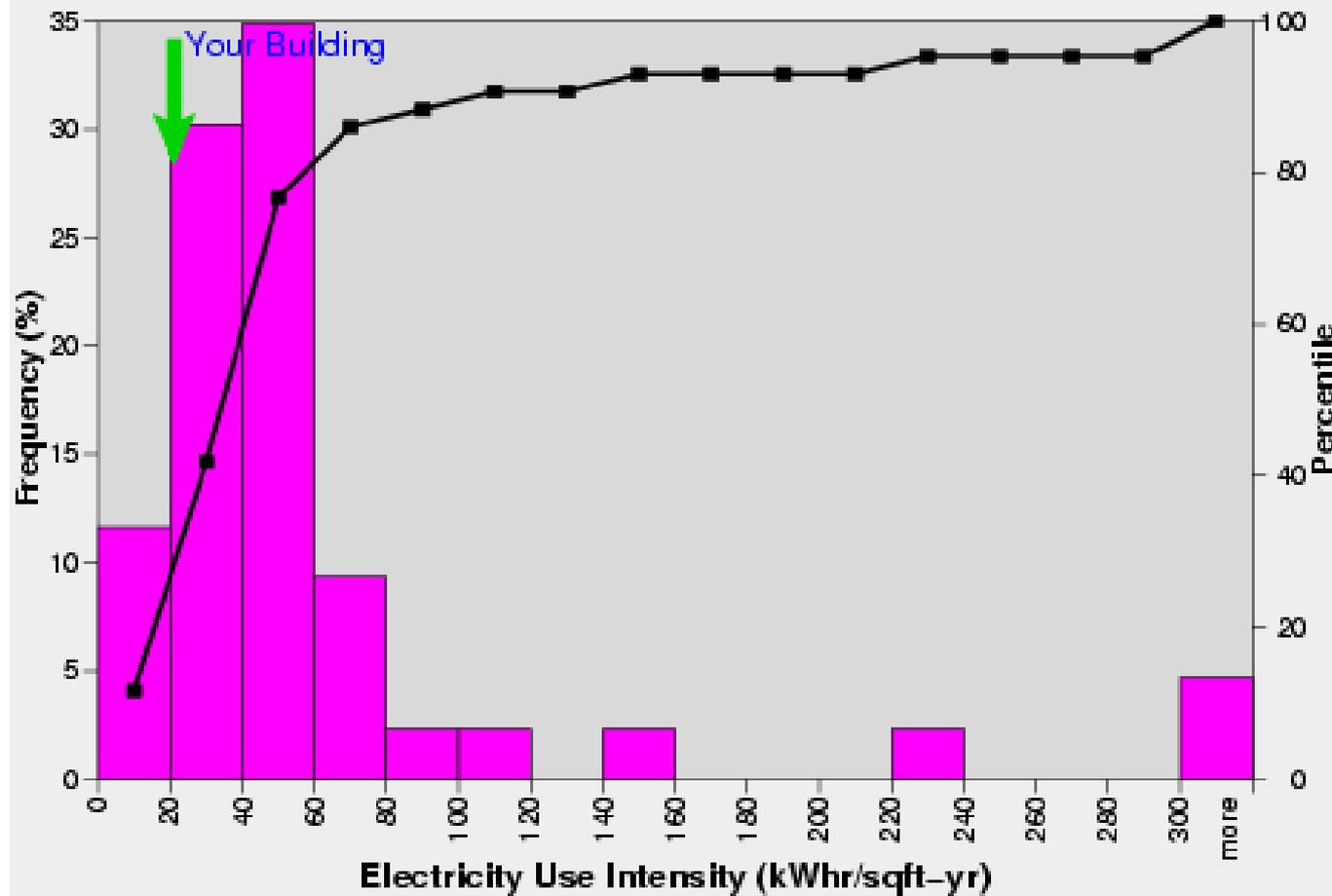
[Apply](#) for the ENERGY STAR
[View](#) status of ENERGY STAR Applications

Building Profiles

A building Profile can be created when an ENERGY STAR label application is submitted

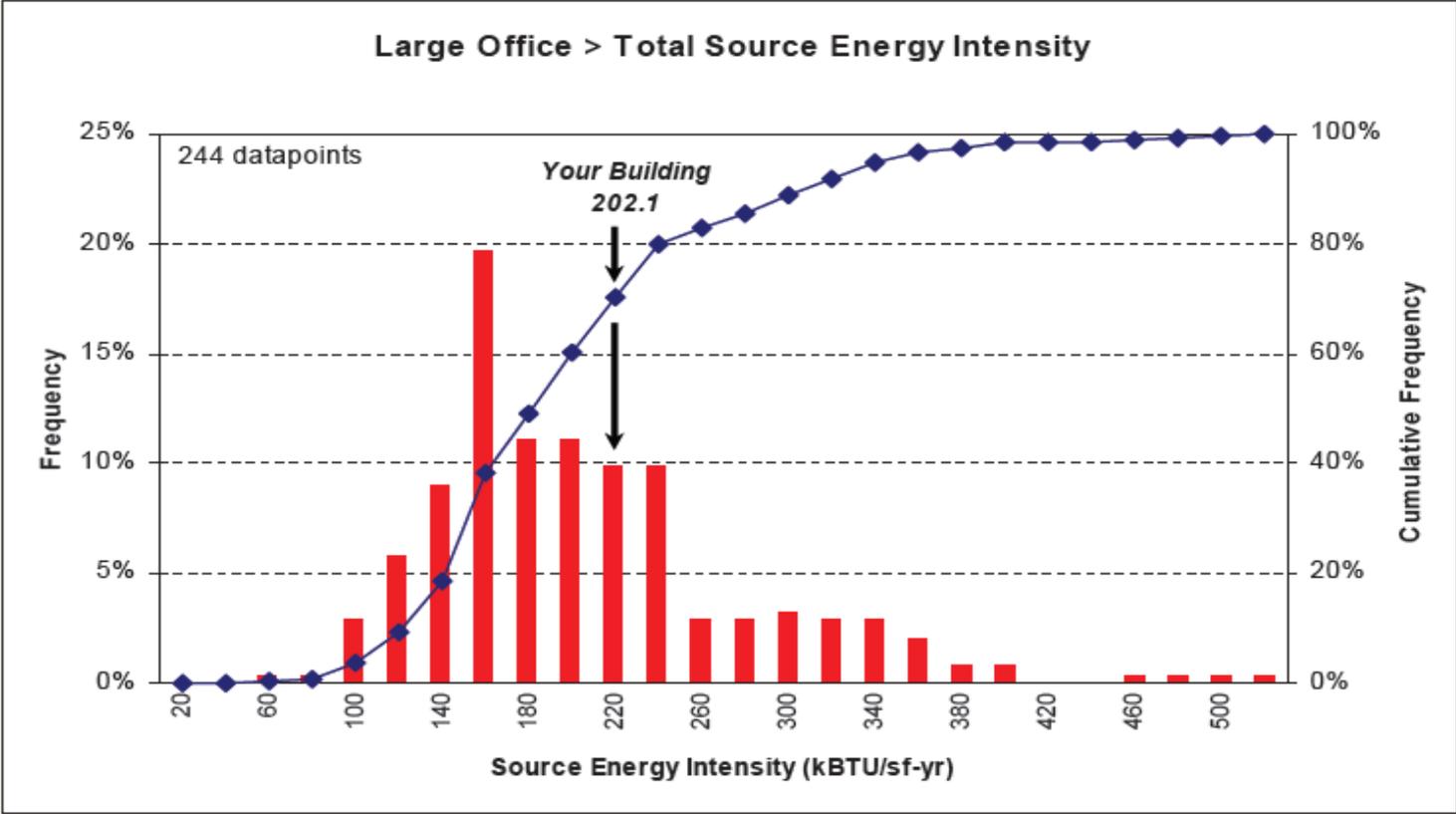
http://www.energystar.gov/index.cfm?c=evaluate_performance.bus_portfoliomanager

Other Benchmarking Tools: CalArch



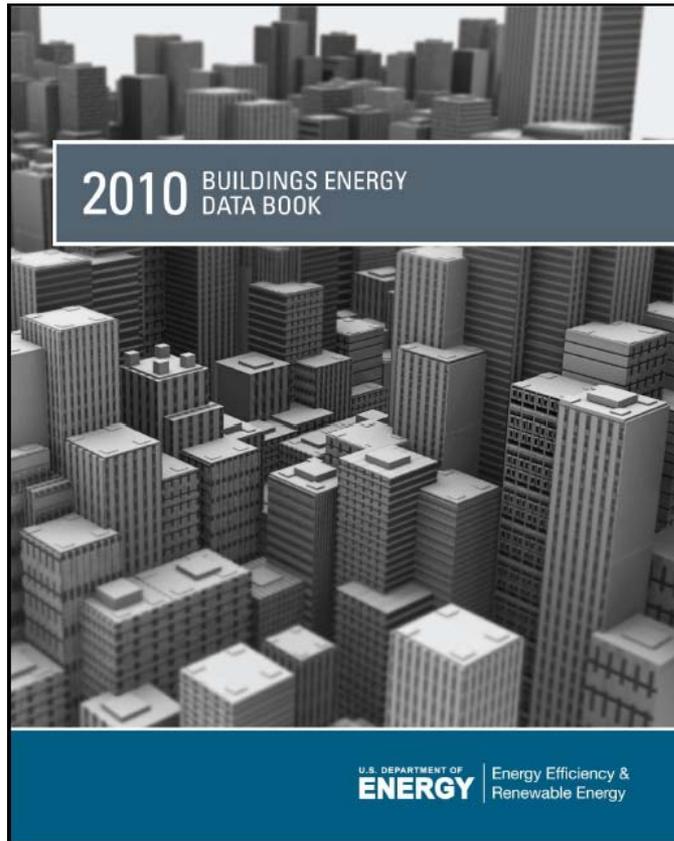
<http://poet.lbl.gov/cal-arch/>

Other Benchmarking Tools: Energy IQ

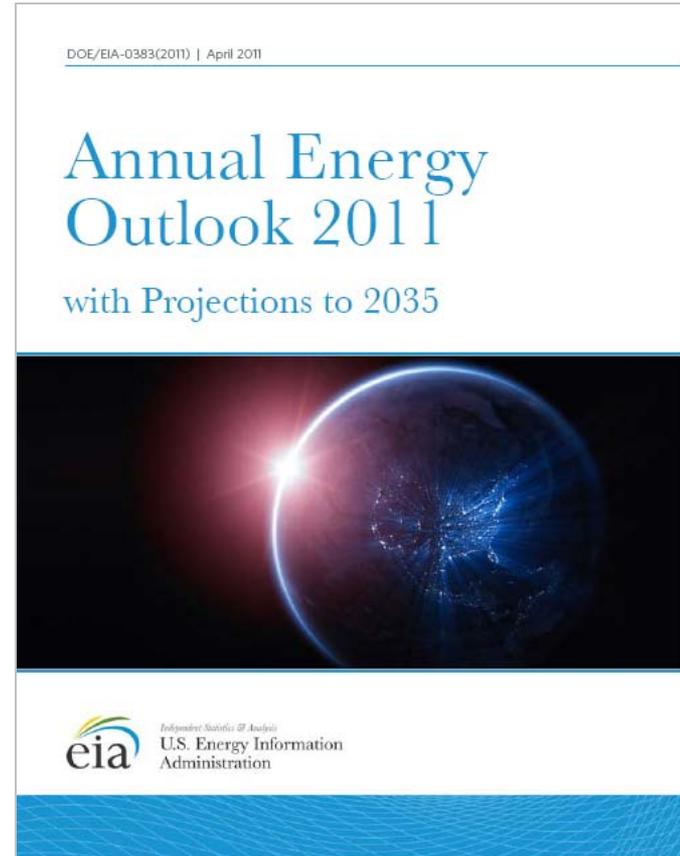


<http://energyiq.lbl.gov/>

National Building Energy Studies

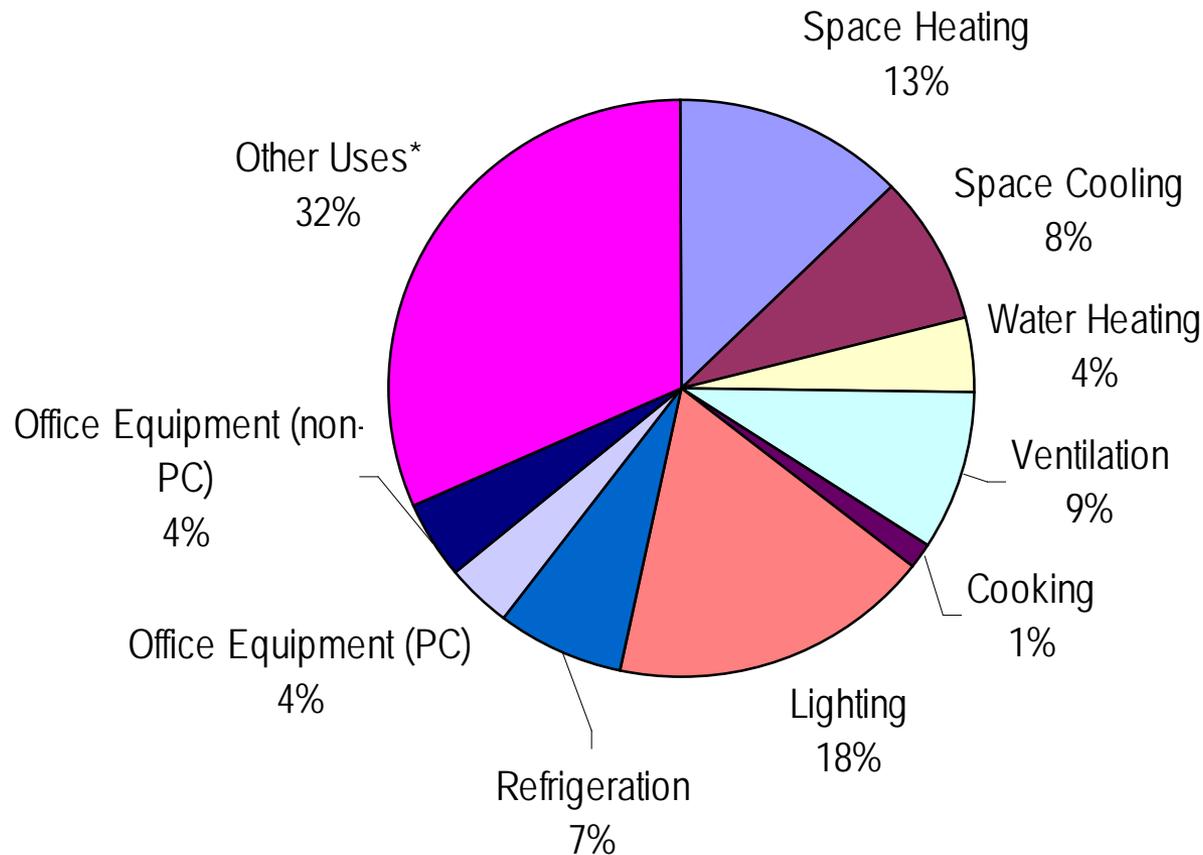


<http://buildingsdatabook.eren.doe.gov/>



<http://www.eia.gov/forecasts/aeo/>

Building Energy – Where Is It All Going?



2009 U.S. Commercial Sector Energy Usage; Annual Energy Outlook 2011

*Other uses includes service station equipment, automated teller machines, telecommunications equipment, medical equipment, pumps, emergency generators, combined heat and power in commercial buildings, manufacturing performed in commercial buildings, and cooking (distillate), plus residual fuel oil, liquefied petroleum gases, coal, motor gasoline, and kerosene.

California Commercial End-Use Survey (CEUS)

- The **California Commercial End-Use Survey (CEUS**, pronounced "soos" like Dr. Seuss) is a comprehensive study of commercial sector energy use, primarily designed to support the state's energy demand forecasting activities. A stratified random sample of 2,790 commercial facilities was collected from the service areas of Pacific Gas and Electric, San Diego Gas & Electric, Southern California Edison, Southern California Gas Company, and the Sacramento Municipal Utility District. The sample was stratified by utility service area, climate region, building type, and energy consumption level.
- For each utility service area, floor stocks, fuel shares, electric and natural gas consumption, energy-use indices (EUIs), energy intensities, and 16-day hourly end-use load profiles were estimated for twelve common commercial building type categories.
- <http://www.energy.ca.gov/ceus/>

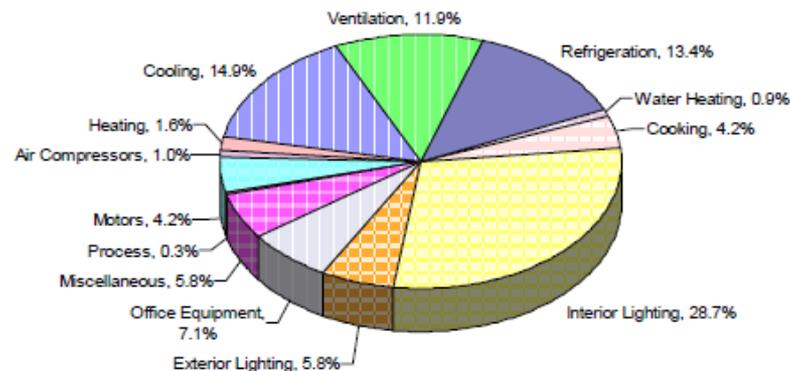


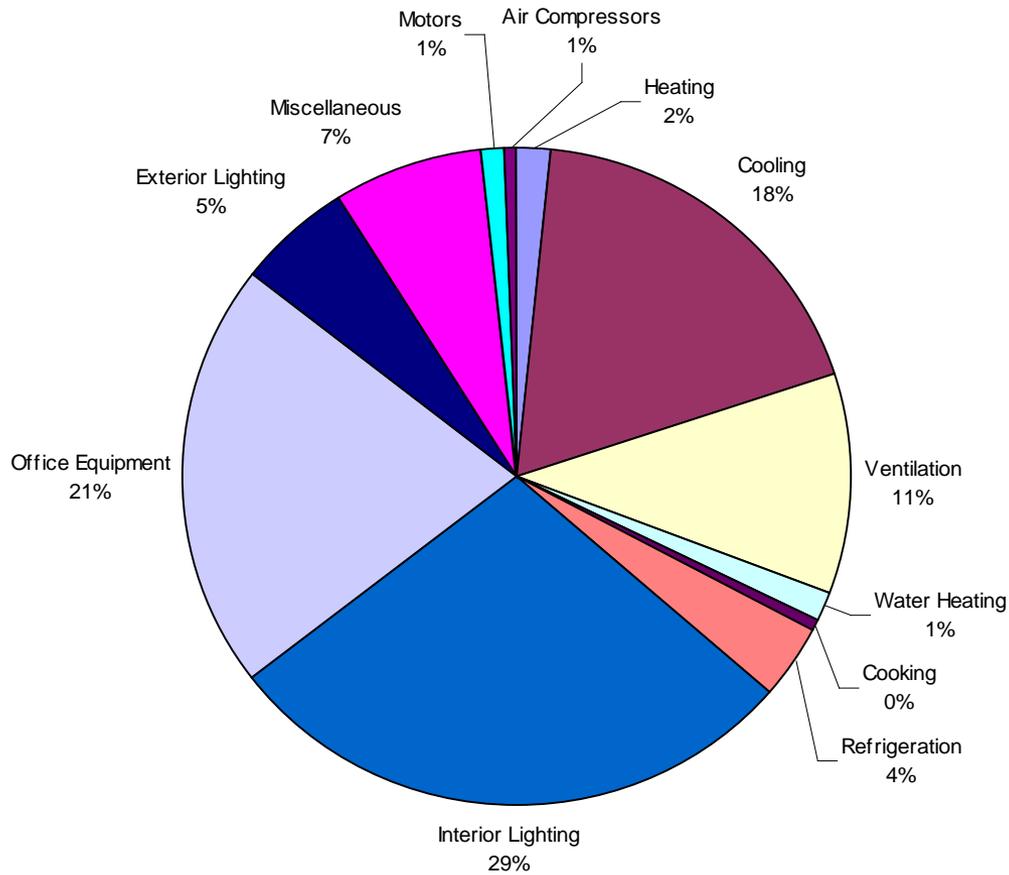
Table 8-6: All Commercial Electric EUIs, Fuel Shares, and EIs

End Use	Electric EUI (kWh/End-Use ft ²)	Electric Fuel Share	Electric EI (kWh/ft ²)
Heating	0.53	41.40	0.22
Cooling	2.97	68.60	2.04
Ventilation	2.16	75.10	1.63
Water Heating	0.27	45.70	0.12
Cooking	0.62	91.50	0.57
Refrigeration	1.94	94.40	1.83
Interior Lighting	3.92	99.60	3.92
Office Equipment	0.99	98.40	0.97
Exterior Lighting	0.89	89.60	0.80
Miscellaneous	0.87	91.30	0.80
Process	1.91	2.20	0.04
Motors	0.99	57.70	0.57
Air Compressors	0.36	36.60	0.13
All End Uses			13.63

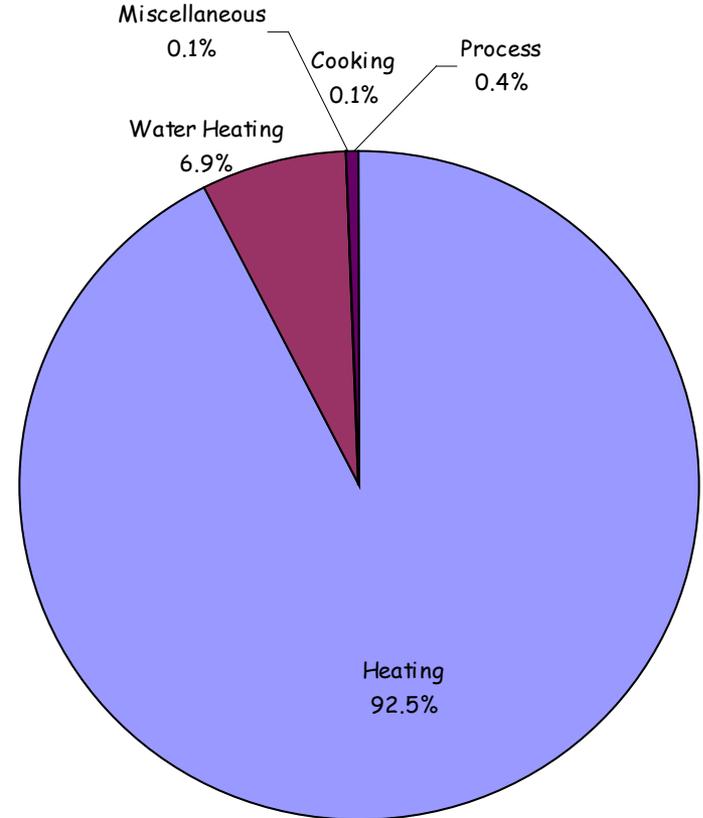
Table 8-7: All Commercial Natural Gas EUIs, Fuel Shares, and EIs

End Use	Natural Gas EUI (kBtu/End-Use ft ²)	Natural Gas Fuel Share	Natural Gas EI (kBtu/ft ²)
Heating	16.91	55.9	9.46
Cooling	25.68	1.50	0.39
Water Heating	14.47	57.10	8.27
Cooking	20.66	28.40	5.88
Miscellaneous	4.36	10.70	0.47
Process	46.92	3.30	1.53
All End Uses			26.00

CEUS Example 1: Small Office

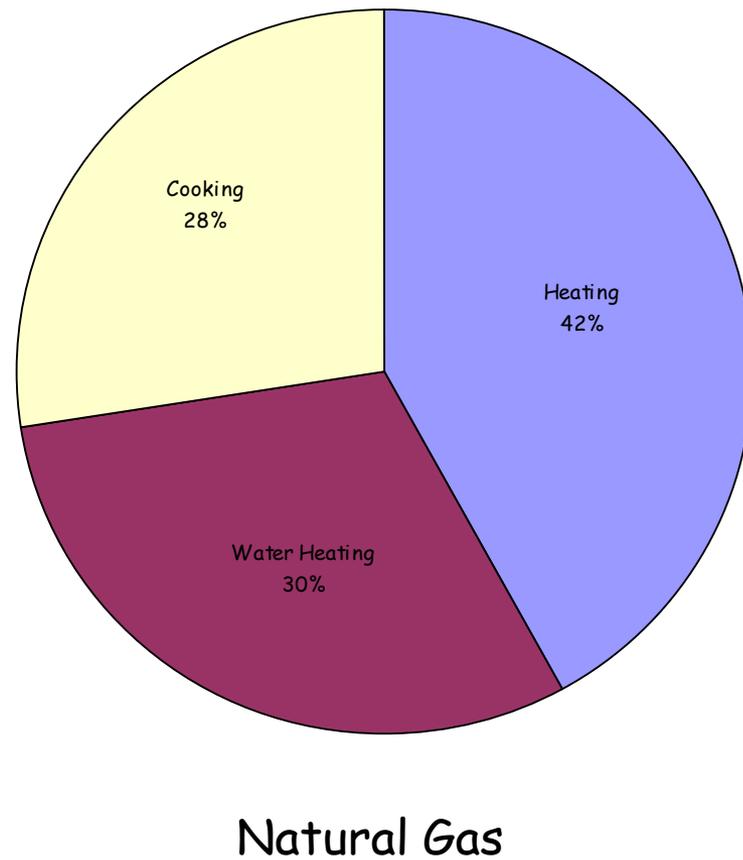
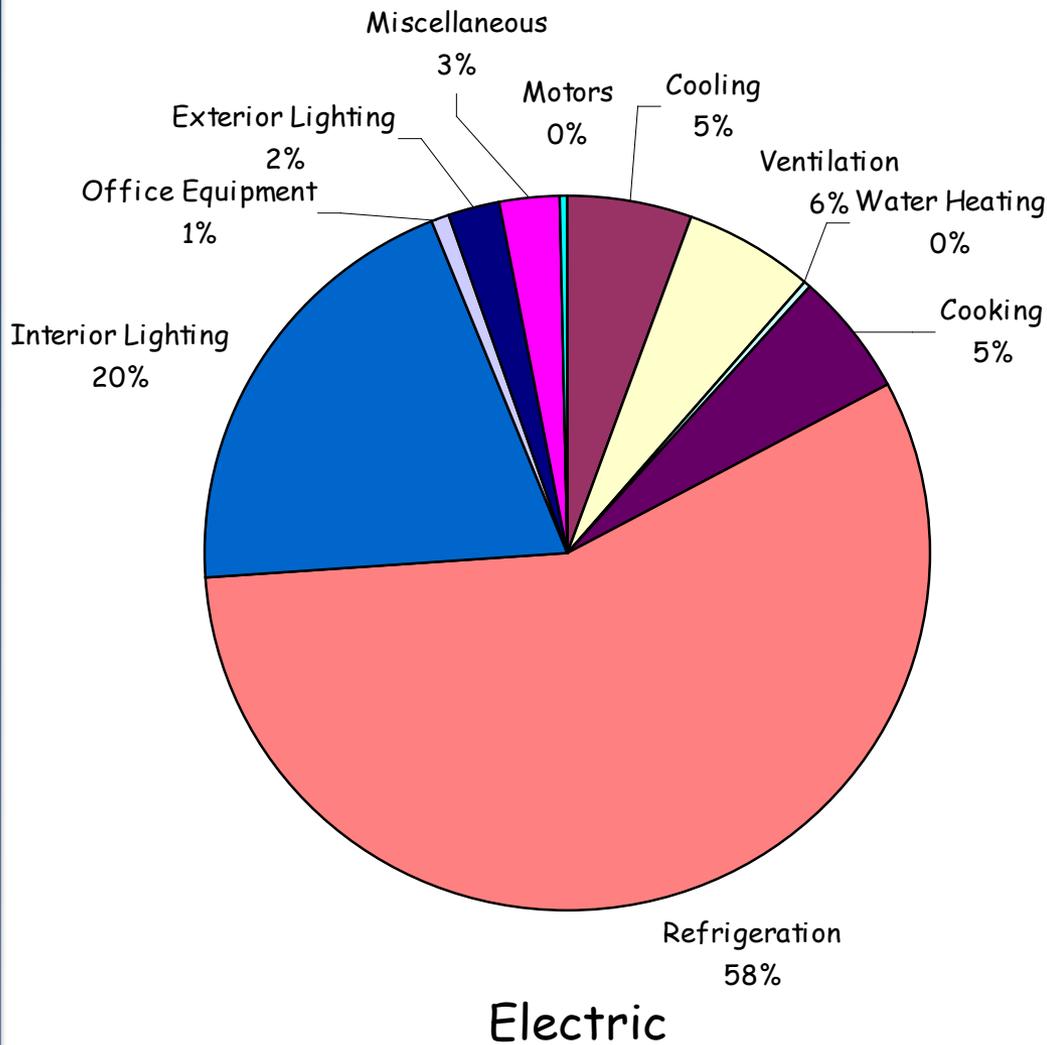


Electric

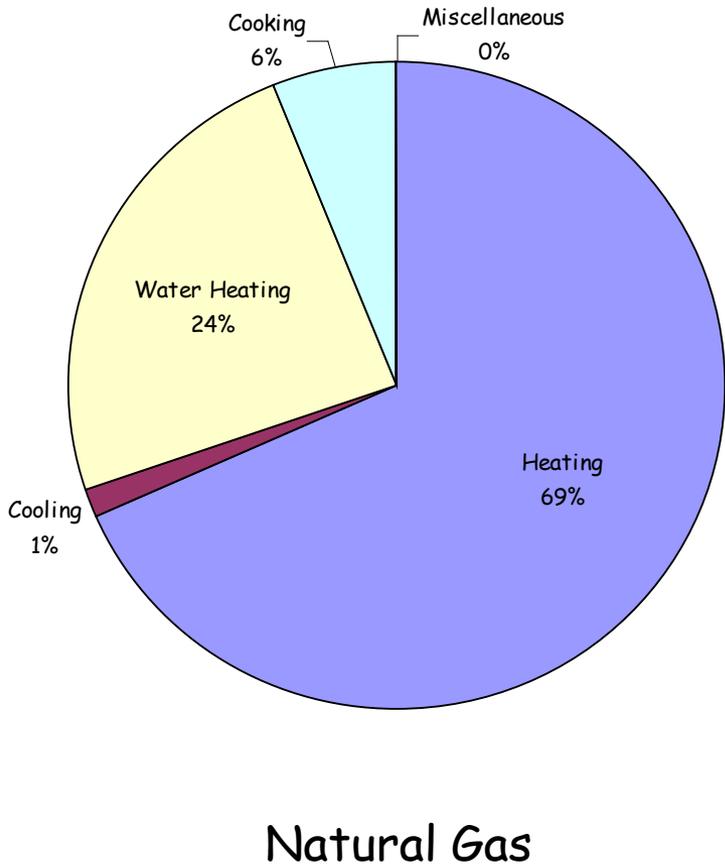
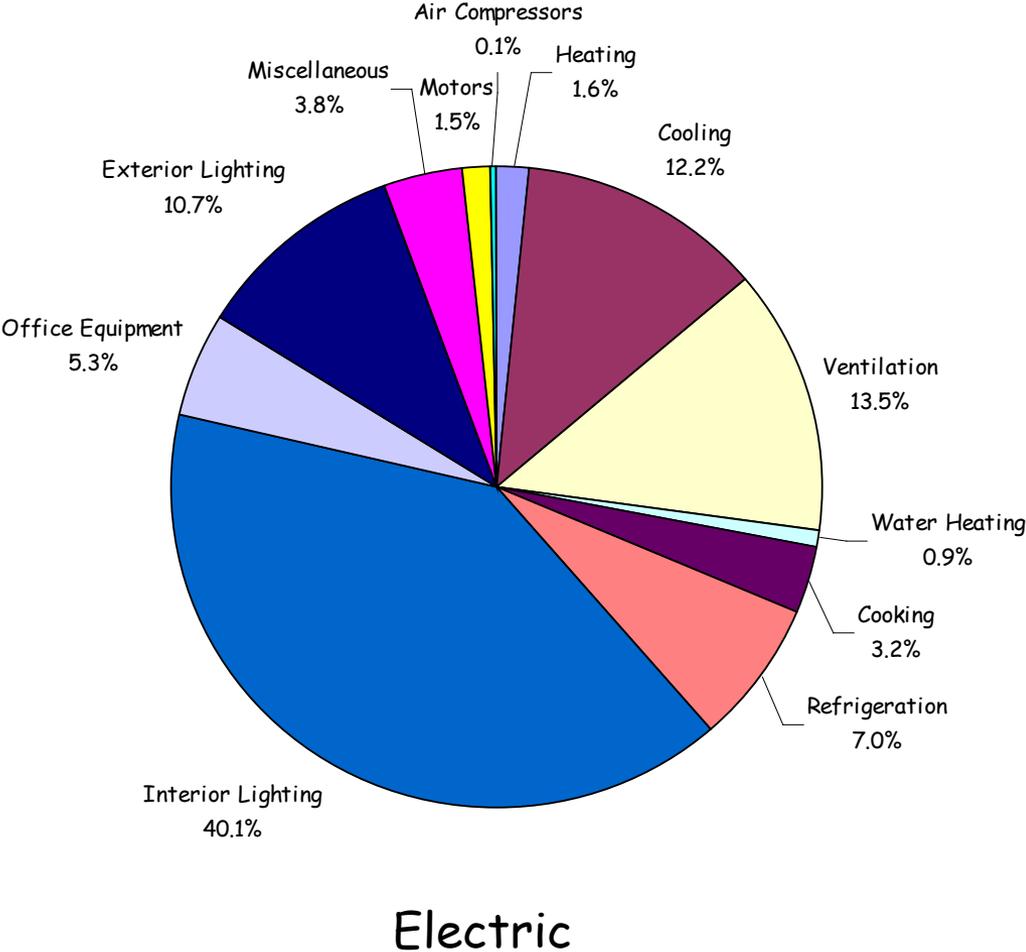


Natural Gas

CEUS Example 2: Grocery Store



CEUS Example 3: School



Site Visit

The facility investigation where equipment is cataloged, dataloggers are installed, staff interviews are conducted and initial energy-saving opportunities are identified.

Equipment Cataloging Documents

Drawings and Other Building Documents

Hand-held meters

Dataloggers

Other Tools

Equipment Cataloging Tools

Please Print or Type
1. Building Information

Name of Institution		Address	
Owner, if other than Institution		Address	
Name of Building		Building #	
Address (Street or P.O. Box)		City, State, Zip	
Date of Audit	Type of Institution Public ___ Private Non-Profit ___ Other ___		
Building Manager (administrator responsible for bldg.)		Bldg. Mgr.'s Phone	
Energy Management Coordinator (EMC) or Monitor		EMC's Phone	
Person Completing this Audit (include Cert. #)		Phone	
Building Type and Category			Building Use
School ___Element. ___Second. ___Comm. Coll. ___Coll./Univ. ___Voc. Tech. ___Other, Specify	Hospital ___General ___Psychiatric ___Other, Specify	Government ___Federal ___State ___City/County ___Special Dist. ___Indian Tribe	Public Care ___Nurs. Home ___Long-term care ___Rehab. Center ___Orphanage ___Public Health ___Res. Child Care ___Other, Specify
Date of construction, if known _____			Office ___Storage ___Library ___Services ___Police Station ___Fire Station ___Dormitory ___Prisoner Detention ___Other, Specify
Original Architects (if known)		Original Engineers (if known)	
Building Modifications or Changes in Use Anticipated in the next 15 yrs:		Remaining Useful life of the building: _____ Years	
Does the Institution Have an ongoing energy management program? ___Yes ___No			
Previous Energy Audits Completed? (if yes, give dates) ___Yes ___No Dates _____			
Previous Architectural/Engineering Studies Undertaken? (if Yes, Specify) ___Yes ___No			
Name of Electric Utility		Is this building on the National Historic Preservation Register? ___Yes ___No	

WASHINGTON STATE UNIVERSITY
EXTENSION ENERGY PROGRAM

Preliminary Data Gathering for Energy Efficiency Opportunities

Subject Building Information

Business Name			
Address			
City		State	Zip Code
Contact Name		Title	
Phone		Mobile	Fax
Email			
Building Use			
Electric Utility		Gas Utility	

Facility Information

Square Footage Affected by Project Yes No

Year Building was Built

Total Daily Hours of Operation

Sunday	<input type="text"/>	Thursday	<input type="text"/>
Monday	<input type="text"/>	Friday	<input type="text"/>
Tuesday	<input type="text"/>	Saturday	<input type="text"/>
Wednesday	<input type="text"/>		

Open Major Holidays? Yes No

Total Weekly Hours

Total Annual Hours

Copyright 2011 Pre-Audit Preliminary Envelope Lighting & Power Mechanical Food

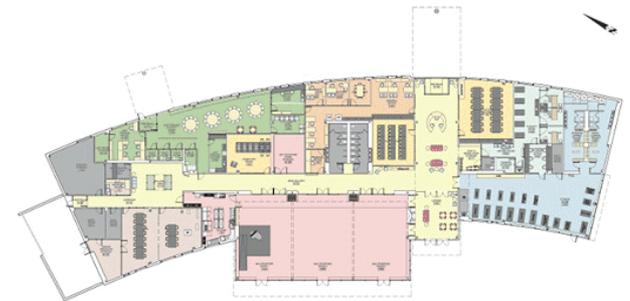
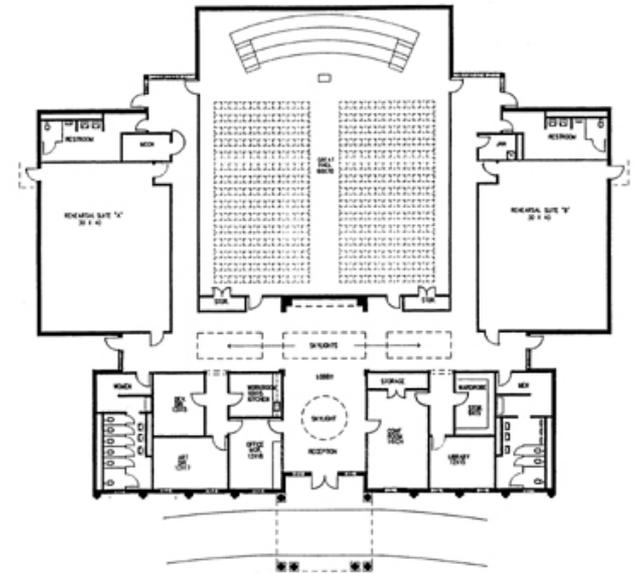
<http://www.energy.wsu.edu/PublicationsandTools.aspx>

<http://www.energy.wsu.edu/Documents/audit2.pdf>

http://www.energy.wsu.edu/Documents/Commercial_audit_checklist_tool.xlsx

Building Floor Plan

- Reduce to 8.5" x 11"
- If drawings not available
 - Photograph egress plans
 - Building outline from Google maps
- Plan should include
 - Outline of buildings
 - Name and location of each building
 - Year of construction for each building
 - Size (# of floors and square footage)
 - North arrow
 - Location of utility meters
 - Location of mechanical, electrical and other rooms with specialized equipment
 - Room layout with glazing shown



MILL RACE CENTER
William Foy Associates, Architects, Inc., Boston, MA
AECI Architects, Inc., Indianapolis, IN

June 2008
BUILDING PLAN

Auditor Hand-held Tools

- Temperature/RH/air-speed/illuminance/temp immersion probe
- Surface temperature meter
- Laser distance meter
- Compass
- Strobe tachometer
- Ballast discriminator or Flicker Checker



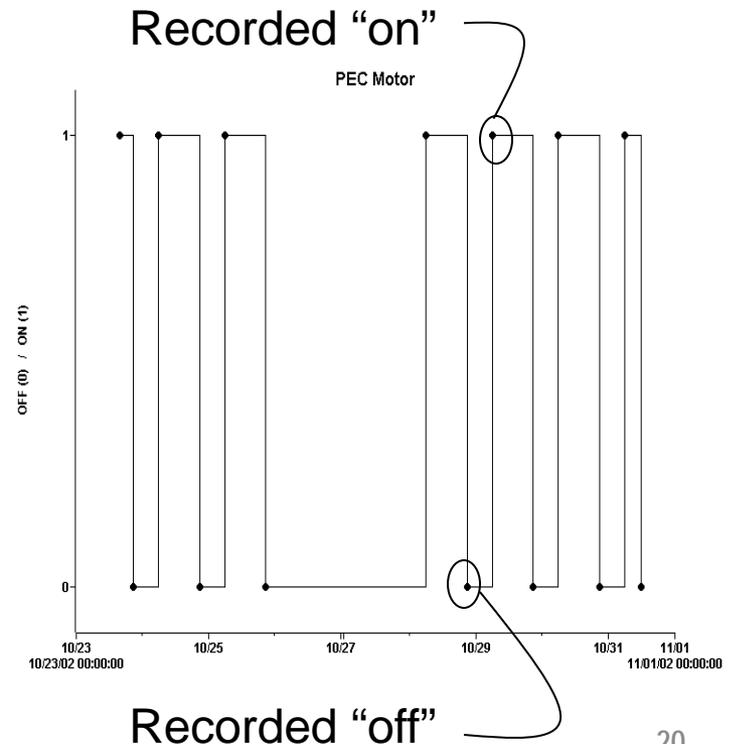
or



Dataloggers for Runtime Monitoring

$$\text{kWh} = \text{kW} \times \text{Runtime}$$

- Measures the hours of operation for energy calculations
- Can be used to determine equipment scheduling issues
- Appropriate applications
 - Non-dimmable lighting
 - Constant HVAC loads
 - Open/closed state of doors & windows
 - Digital control signals



Pacific Energy Center's Tool Lending Library

- Tools loaned for **FREE**
- Intended for energy efficiency, demand reduction and self-generation projects
- Supported by California public purpose funding
- Can be used for building diagnostics, sensor calibration or commissioning
- Over 5000 tools in library
- Support information and online Tool Request Form at: www.pge.com/pec/tll

Tool Lending Library

To request to borrow a tool, please fill out a [Tool Request Form](#).



Tool Lending Library Contents

Select a tool category below to see a list of tools available.

Select a Tool Category



[Whole Building Performance / Measurement Classes](#)

Come to our classes to learn to use tools, to learn about software and auditing techniques. Most of our programs are free of charge and qualify for continuing education credits.



[App Notes & Measurement Protocols](#)

The Tool Lending Library Application Notes describe measurement techniques and step-by-step instructions for specific tools. The notes serve as a primer for first-time users and as a reference for experienced users needing help with specific operations.



Tool Lending Library Contacts

Chris Condon, Tool Lending Library Coordinator
c1c7@pge.com (415.973.9945)

Judy Wong, Tool Lending Library Technical Consultant
jswb@pge.com (415.973.7364)

Other Items in Energy Auditor's Toolkit

- Five senses (though taste has limited utility during an audit)
- Gridded notepad, colored pens & clipboard
- Digital camera
- Business cards
- Calculator
- Rags
- Hat, sun glasses, jacket, ear protection
- Flicker checker (Sylvania: 800.544.4828)
- Simple tool kit
 - Flashlight
 - Measuring tape
 - Screw drivers
 - Complete socket set with 5/16th nut driver
 - Insulation tape
 - Angled mirror
 - Crescent wrench
 - Knife
 - Allen wrenches
 - Pliers



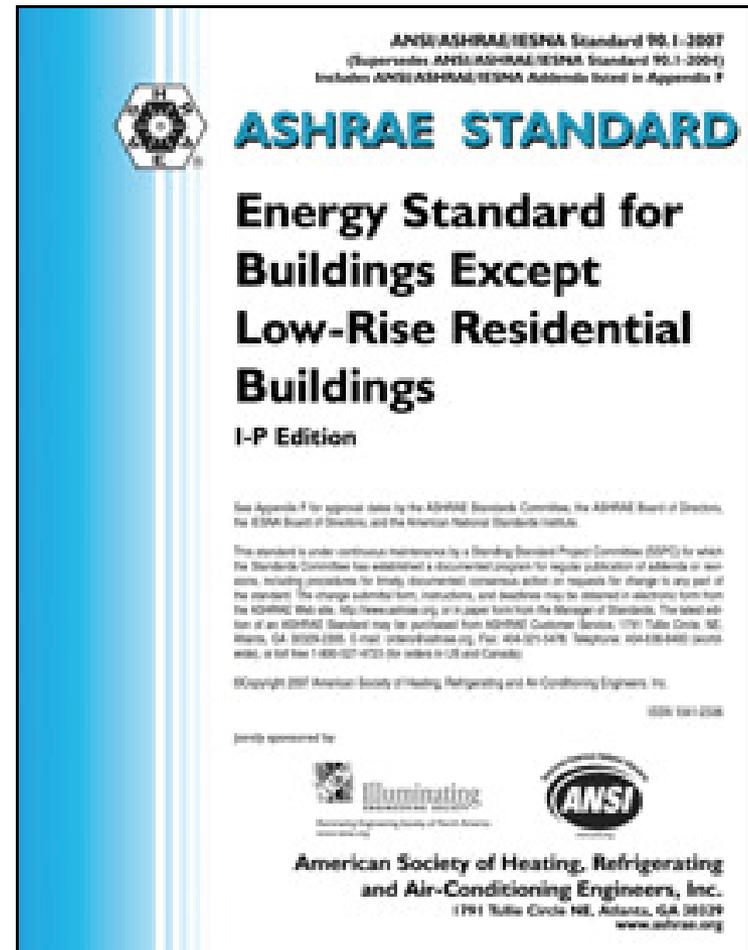
Calculations

Compiling and processing data from equipment nameplates, dataloggers, building codes, utility rates, implementation costs and rebate programs.

Building Energy Codes
Equipment Wattage Information
Equipment Efficiency Tables
Full-load Hour Data
Data Management and Analysis Tools
Energy-Savings Calculators
Climate Data
Sources for Implementation Costs
Utility Incentive Details

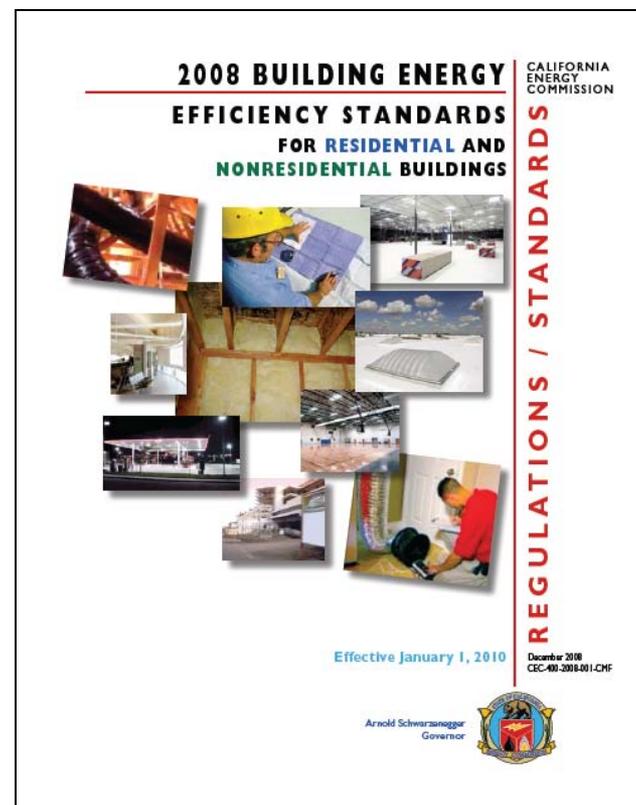
ASHRAE 90.1-2007

- Adopted energy standard for many states
- Sections
 - Building envelope
 - Heating, ventilation & AC
 - Service water heating
 - Power
 - Lighting
 - Other equipment



California's Title 24, Section 6: Building Energy Efficiency Standards

- To provide California with an adequate, reasonably-priced, and environmentally-sound supply of energy.
- Building standard for residential and non-residential facilities.
- Baseline for utility incentive programs
- Identifies "the minimum performance allowable"



expected update in 2013

Lighting Wattage Tables

Central Standard Lighting Wattage Table

FIXTURE CODE	LAMP CODE	DESCRIPTION	BALLAST	LAMP/ FIXT	WATT/ LAMP	WATT/ FIXT	Compliant	Actual	WATT/ FIXT	SOURCE	DATE ADDED	NOTES
Compact Fluorescent Fixtures												
CFD10/1	CFD10W	Compact Fluorescent, 2D, (1) 10W lamp	Mag-STD	1	10	16		16				
CFD16/1	CFD16W	Compact Fluorescent, 2D, (1) 16W lamp	Mag-STD	1	16	26		26				
CFD21/1	CFD21W	Compact Fluorescent, 2D, (1) 21W lamp	Mag-STD	1	21	26		26				
CFD28/1	CFD28W	Compact Fluorescent, 2D, (1) 28W lamp	Mag-STD	1	28	35		35				
CFD38/1	CFD38W	Compact Fluorescent, 2D, (1) 38W lamp	Mag-STD	1	38	46		46				
CFM13/1.1	CFM13W	Compact Fluorescent, Multi, 4-pin, (1) 13W lamp	Electronic	1	13	16		16	Mfg. Data	4/7/99	MagnaTek, Motorola	
CFM13/2.1	CFM13W	Compact Fluorescent, Multi, 4-pin, (2) 13W lamps	Electronic	2	13	30		30	Mfg. Data	4/7/99	MagnaTek, Motorola	
CFM18/1.1	CFM18W	Compact Fluorescent, Multi, 4-pin, (1) 18W lamp	Electronic	1	18	20		20	Mfg. Data	4/7/99	MagnaTek, Motorola, Profit, Lumatech	
CFM18/2.1	CFM18W	Compact Fluorescent, Multi, 4-pin, (2) 18W lamps	Electronic	2	18	40		40	Mfg. Data	4/7/99	MagnaTek, Motorola	
CFM26/1.1	CFM26W	Compact Fluorescent, Multi, 4-pin, (1) 26W lamp	Electronic	1	26	29		29	Mfg. Data	4/7/99	MagnaTek, Advance, Motorola, Profit, Lumatech	
CFM26/2.1	CFM26W	Compact Fluorescent, Multi, 4-pin, (2) 26W lamps	Electronic	2	26	51		51	Mfg. Data	4/7/99	MagnaTek, Motorola	
CFM32/1.1	CFM32W	Compact Fluorescent, Multi, 4-pin, (1) 42W lamps	Electronic	1	32	35		35	Mfg. Data	4/7/99	MagnaTek, Advance, Motorola, Profit, Lumatech	
CFM42/1.1	CFM42W	Compact Fluorescent, Multi, 4-pin, (1) 42W lamps	Electronic	1	42	48		48	Mfg. Data	4/7/99	MagnaTek, Advance, Motorola	
CFM42/2.1	CFM42W	Compact Fluorescent, Multi, 4-pin, (2) 42W lamps, (4) 2-lamp ballasts	Electronic	8	42	314		314	Mfg. Data	3/30/99	Based on Sportlite, Inc. fixtures: wattage is +/- 10%	
CFQ13/1	CFQ13W	Compact Fluorescent, quad, (1) 13W lamp	Mag-STD	1	13	15		15				
CFQ13/1.1	CFQ13W	Compact Fluorescent, quad, (1) 13W lamp, BF=1.05	Mag-STD	1	13	15		15				
CFQ13/2	CFQ13W	Compact Fluorescent, quad, (2) 13W lamp	Mag-STD	2	13	31		31				
CFQ13/2.1	CFQ13W	Compact Fluorescent, quad, (2) 13W lamp, BF=1.0	Electronic	2	13	28		28				
CFQ13/3	CFQ13W	Compact Fluorescent, quad, (3) 13W lamp	Mag-STD	3	13	48		48				
CFQ15/1	CFQ15W	Compact Fluorescent, quad, (1) 15W lamp	Mag-STD	1	15	20		20				
CFQ17/1	CFQ17W	Compact Fluorescent, quad, (1) 17W lamp	Mag-STD	1	17	24		24				
CFQ17/2	CFQ17W	Compact Fluorescent, quad, (2) 17W lamp	Mag-STD	2	17	48		48				
CFQ18/1	CFQ18W	Compact Fluorescent, quad, (1) 18W lamp	Mag-STD	1	18	26		26				
CFQ18/1.1	CFQ18W	Compact Fluorescent, quad, (1) 18W lamp, BF=1.0	Electronic	1	18	20		20				
CFQ18/2	CFQ18W	Compact Fluorescent, quad, (2) 18W lamp	Mag-STD	2	18	45		45				
CFQ18/2.1	CFQ18W	Compact Fluorescent, quad, (2) 18W lamp, BF=1.0	Electronic	2	18	38		38				
CFQ18/4	CFQ18W	Compact Fluorescent, quad, (4) 18W lamp	Mag-STD	4	18	90		90				
CFQ20/1	CFQ20W	Compact Fluorescent, quad, (1) 20W lamp	Mag-STD	1	20	23		23				
CFQ20/2	CFQ20W	Compact Fluorescent, quad, (2) 20W lamp	Mag-STD	2	20	46		46				
CFQ22/1	CFQ22W	Compact Fluorescent, Quad, (1) 22W lamp	Mag-STD	1	22	24		24				
CFQ22/2	CFQ22W	Compact Fluorescent, Quad, (2) 22W lamp	Mag-STD	2	22	48		48				
CFQ22/3	CFQ22W	Compact Fluorescent, Quad, (3) 22W lamp	Mag-STD	3	22	72		72				
CFQ25/1	CFQ25W	Compact Fluorescent, Quad, (1) 25W lamp	Mag-STD	1	25	33		33				
CFQ25/2	CFQ25W	Compact Fluorescent, Quad, (2) 25W lamp	Mag-STD	2	25	66		66				
CFQ26/1	CFQ26W	Compact Fluorescent, quad, (1) 26W lamp	Mag-STD	1	26	33		33				
CFQ26/1.1	CFQ26W	Compact Fluorescent, quad, (1) 26W lamp, BF=0.95	Electronic	1	26	27		27				
CFQ26/2	CFQ26W	Compact Fluorescent, quad, (2) 26W lamp	Mag-STD	2	26	66		66				
CFQ26/2.1	CFQ26W	Compact Fluorescent, quad, (2) 26W lamp, BF=0.95	Electronic	2	26	50		50				
CFQ26/3	CFQ26W	Compact Fluorescent, quad, (3) 26W lamp	Mag-STD	3	26	99		99				
CFQ26/6.1	CFQ26W	Compact Fluorescent, quad, (6) 26W lamp, BF=0.95	Electronic	6	26	150		150				
CFQ28/1	CFQ28W	Compact Fluorescent, quad, (1) 28W lamp	Mag-STD	1	28	33		33	Mfg. Data	11/25/98		
CFQ9/1	CFQ9W	Compact Fluorescent, Quad, (1) 9W lamp	Mag-STD	1	9	14		14				
CFQ9/2	CFQ9W	Compact Fluorescent, Quad, (2) 9W lamp	Mag-STD	2	9	23		23				
CF11/1	CF11W	Compact Fluorescent, twin, (1) 11W lamp	Mag-STD	1	11	17		17				
CF11/2	CF11W	Compact Fluorescent, twin, (2) 11W lamp	Mag-STD	2	11	31		31				

DESCRIPTION	Actual WATT/ FIXT
Compact Fluorescent Fixtures	
Compact Fluorescent, 2D, (1) 10W lamp	16
Compact Fluorescent, 2D, (1) 16W lamp	26
Compact Fluorescent, 2D, (1) 21W lamp	26
Compact Fluorescent, 2D, (1) 28W lamp	35
Compact Fluorescent, 2D, (1) 38W lamp	46
Compact Fluorescent, Multi, 4-pin, (1) 13W lamp	16
Compact Fluorescent, Multi, 4-pin, (2) 13W lamps	30
Compact Fluorescent, Multi, 4-pin, (1) 18W lamp	20
Compact Fluorescent, Multi, 4-pin, (2) 18W lamps	40
Compact Fluorescent, Multi, 4-pin, (1) 26W lamp	29
Compact Fluorescent, Multi, 4-pin, (2) 26W lamps	51
Compact Fluorescent, Multi, 4-pin, (1) 42W lamps	35
Compact Fluorescent, Multi, 4-pin, (1) 42W lamps	48
Compact Fluorescent, Multi, 4-pin, (8) 42W lamps, (4) 2-lamp ballasts	314
Compact Fluorescent, quad, (1) 10W lamp	15
Compact Fluorescent, quad, (1) 13W lamp	17
Compact Fluorescent, quad, (1) 13W lamp, BF=1.05	15
Compact Fluorescent, quad, (2) 13W lamp	31
Compact Fluorescent, quad, (2) 13W lamp, BF=1.0	28
Compact Fluorescent, quad, (3) 13W lamp	48
Compact Fluorescent, quad, (1) 15W lamp	20
Compact Fluorescent, quad, (1) 17W lamp	24
Compact Fluorescent, quad, (2) 17W lamp	48
Compact Fluorescent, quad, (1) 18W lamp	26
Compact Fluorescent, quad, (1) 18W lamp, BF=1.0	20
Compact Fluorescent, quad, (2) 18W lamp	45
Compact Fluorescent, quad, (2) 18W lamp, BF=1.0	38
Compact Fluorescent, quad, (4) 18W lamp	90
Compact Fluorescent, quad, (1) 20W lamp	23
Compact Fluorescent, quad, (2) 20W lamp	46
Compact Fluorescent, Quad, (1) 22W lamp	24
Compact Fluorescent, Quad, (2) 22W lamp	48
Compact Fluorescent, Quad, (3) 22W lamp	72
Compact Fluorescent, Quad, (1) 25W lamp	33
Compact Fluorescent, Quad, (2) 25W lamp	66
Compact Fluorescent, quad, (1) 26W lamp	33
Compact Fluorescent, quad, (1) 26W lamp, BF=0.95	27
Compact Fluorescent, quad, (2) 26W lamp	66
Compact Fluorescent, quad, (2) 26W lamp, BF=0.95	50
Compact Fluorescent, quad, (3) 26W lamp	99
Compact Fluorescent, quad, (6) 26W lamp, BF=0.95	150
Compact Fluorescent, quad, (1) 28W lamp	33
Compact Fluorescent, Quad, (1) 9W lamp	14
Compact Fluorescent, Quad, (2) 9W lamp	23
Compact Fluorescent, twin, (1) 11W lamp	17
Compact Fluorescent, twin, (2) 11W lamp	31

- http://www.nationalgridus.com/non_html/shared_energyeff_super_t8.pdf
- http://www.oncor.com/pdf/programs/objectives/smci_lighting_tab.pdf
- http://www.massave.com/~media/Files/Professional/Applications-and-Rebate-Forms/2011_Retrofit_MA_Lighting_Device_Codes_03-02-2011.ashx

CEE Premium-Efficiency Initiative

EFFICIENCY SPECIFICATIONS

(Terms of Usage Follow)

CEE Specification aligned with NEMA PREMIUM[®] on June 13, 2001

Note: Concurrent with the Dec. 19, 2010 effective date of the 2007 Energy Independence and Security Act (EISA) minimum efficiency standards, the CEE Premium Efficiency Specification for 1-200 hp motors will be downgraded to a Tier 0 for a period of six months. In June 2011, the Tier 0 specification will be retired.

Additional Information about the EISA motor standards is available at: http://www.motorsmatter.org/resources/gen_legislation.html

Covered Equipment: 1-200 horsepower (hp) NEMA Design A and B, three phase, low voltage, integral horsepower, general purpose motors ODP and TEFC, 1200, 1800, and 3600 RPM (as covered by EPAcT).

Open Drip-Proof (ODP)							Totally Enclosed Fan-Cooled (TEFC)						
HP	1200 RPMs		1800 RPMs		3600 RPMs		HP	1200 RPMs		1800 RPMs		3600 RPMs	
	EPAcT Efficiency Standard*	CEE Specification (NEMA Premium)**	EPAcT Efficiency Standard*	CEE Specification (NEMA Premium)**	EPAcT Efficiency Standard*	CEE Specification (NEMA Premium)**		EPAcT Efficiency Standard*	CEE Specification (NEMA Premium)**	EPAcT Efficiency Standard*	CEE Specification (NEMA Premium)**	EPAcT Efficiency Standard*	CEE Specification (NEMA Premium)**
1	80.0	82.5	82.5	85.5	N/A	77.0	1	80.0	82.5	82.5	85.5	75.5	77.0
1.5	84.0	86.5	84.0	86.5	82.5	84.0	1.5	85.5	87.5	84.0	86.5	82.5	84.0
2	85.5	87.5	84.0	86.5	84.0	85.5	2	86.5	88.5	84.0	86.5	84.0	85.5
3	86.5	88.5	86.5	89.5	84.0	85.5	3	87.5	89.5	87.5	89.5	85.5	86.5
5	87.5	89.5	87.5	89.5	85.5	86.5	5	87.5	89.5	87.5	89.5	87.5	88.5
7.5	88.5	90.2	88.5	91.0	87.5	88.5	7.5	89.5	91.0	89.5	91.7	89.5	89.5
10	90.2	91.7	89.5	91.7	88.5	89.5	10	89.5	91.0	89.5	91.7	89.5	90.2
15	90.2	91.7	91.0	93.0	89.5	90.2	15	90.2	91.7	91.0	92.4	90.2	91.0
20	91.0	92.4	91.0	93.0	90.2	91.0	20	90.2	91.7	91.0	93.0	90.2	91.0
25	91.7	93.0	91.7	93.8	91.0	91.7	25	91.7	93.0	92.4	93.8	91.0	91.7
30	92.4	93.8	92.4	94.1	91.0	91.7	30	91.7	93.0	92.4	93.8	91.0	91.7
40	93.0	94.1	93.0	94.1	91.7	92.4	40	93.0	94.1	93.0	94.1	91.7	92.4
50	93.0	94.1	93.0	94.5	92.4	93.0	50	93.0	94.1	93.0	94.5	92.4	93.0
60	93.8	94.5	93.8	95.0	93.0	93.8	60	93.8	94.5	93.8	95.0	93.0	93.8
75	93.8	94.5	94.1	95.0	93.0	93.8	75	93.8	94.5	94.1	95.4	93.0	93.8
100	94.1	95.0	94.1	95.4	93.0	93.8	100	94.1	95.0	94.5	95.4	93.8	94.1
125	94.1	95.0	94.5	95.4	93.8	94.1	125	94.1	95.0	94.5	95.4	94.5	95.0
150	94.5	95.4	95.0	95.8	93.8	94.1	150	95.0	95.8	95.0	95.8	94.5	95.0
200	94.5	95.4	95.0	95.8	94.5	95.0	200	95.0	95.8	95.0	96.2	95.0	95.4

CEE Contact: Kelleem Emanuele, phone: 617-337-9273 email: kemanuele@cee1.org

CEE Initiative Web page: www.cee1.org/ind/motrs/mtr-ms-main.php3

* This standard, equivalent to NEMA Standards Publication MG 1-2006, Table 12-11, became effective October 1997 through EPAcT. New motors manufactured and imported for the U.S. market must meet or exceed these full load nominal efficiencies.

** Equivalent to NEMA Standards Publication MG 1-2006, Table 12-12.

*** NEMA Premium is a trademark owned by the National Electrical Manufacturer's Association (NEMA).

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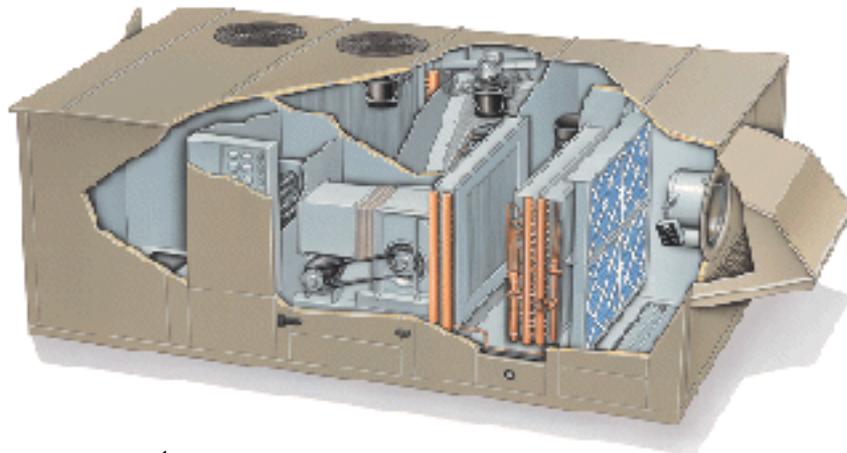
Page 1 of 2

Motor Master+ International Software



CEE Guidelines for Rooftop / Split Units

- For larger units, use Consortium for Energy Efficiency (CEE) guidelines
- Specify **Tier 1 or 2** Efficiency



www.trane.com

CEE Commercial Unitary AC and HP Specification UNITARY AIR-CONDITIONING SPECIFICATION Effective January 16, 2009

CEE periodically revises its specifications. See www.cee1.org for the most recent version.
For Terms and Conditions of these specifications, see www.cee1.org/terms.php

Equipment Type	Size Category	Sub-Category	CEE Tier 1	CEE Tier 2
Air Conditioners, Air Cooled (Cooling Mode)	<65,000 Btu/h	Split System	14.0 SEER 12.0 EER	15.0 SEER 12.5 EER
		Single Package	14.0 SEER 11.6 EER	15.0 SEER 12.0 EER
	≥65,000 Btu/h and <135,000 Btu/h	Split System and Single Package	11.5 EER 11.9 IPLV ²	12.0 EER 12.4 IPLV ²
	≥135,000 Btu/h and <240,000 Btu/h	Split System and Single Package	11.5 EER 11.9 IPLV ²	12.0 EER 12.4 IPLV ²
	≥240,000 Btu/h and <760,000 Btu/h	Split System and Single Package	10.5 EER 10.9 IPLV ²	10.8 EER 12.0 IPLV ²
≥760,000 Btu/h	Split System and Single Package	9.7 EER 11.0 IPLV ²	10.2 EER 11.0 IPLV ²	
Air Conditioners, Water and Evaporatively Cooled	<65,000 Btu/h	Split System and Single Package	14.0 EER	No specification*
	≥65,000 Btu/h and <135,000 Btu/h	Split System and Single Package	14.0 EER	No specification*
	≥135,000 Btu/h	Split System and Single Package	14.0 EER	No specification*

SEER - Seasonal Energy Efficiency Ratio
EER - Energy Efficiency Ratio
IPLV - Integrated Part Load Value

*At this time, CEE is not establishing higher tier levels for this equipment size due to limited availability.

NOTES:

1. For electrical resistance heating section types, increase required minimum EER by 0.2.
2. Integrated Partial Load Value is no longer an industry accepted parameter as of January 1, 2010. New part load performance criteria will be evaluated for incorporation into the specification by the end of the first quarter of 2010.

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Energy Star Appliance List



BUY PRODUCTS THAT MAKE A DIFFERENCE

U.S. Environmental Protection Agency • U.S. Department of Energy

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Building Products

- » Seal and Insulate
- » Roof Products
- » Windows, Doors and Skylights

Commercial Appliances

- » Commercial Clothes Washers
- » Vending Machines
- » Water Coolers

Commercial Food Service Equipment

- » Commercial Kitchen Package
- » Commercial Dishwashers
- » Commercial Fryers
- » Commercial Griddles
- » Commercial Hot Food Holding Cabinets
- » Commercial Ice Machines
- » Commercial Ovens
- » Commercial Refrigerators & Freezers
- » Commercial Steam Cookers

Computers & Electronics

- » Audio/Video
- » Battery Chargers ?
- » Computers
- » Displays ?
- » Enterprise Servers
- » Imaging Equipment ?
- » Televisions

Heating & Cooling

- » Air Conditioning, Central
- » Boilers
- » Fans, Ventilating
- » Heat pumps, Geothermal
- » Light Commercial Heating & Cooling

Lighting

- » Commercial LED Lighting
- » Light bulbs
- » Light Fixtures

Plumbing

- » Water Heater, Gas Condensing
- » Water Heater, Heat Pump
- » Water Heater, High Efficiency Gas Storage
- » Water Heater, Solar
- » Water Heater, Whole Home Gas Tankless



Full-load Hour Data for Cycling Equipment

- ASHRAE
- Energy Star

http://www.energystar.gov/ia/business/bulk_purchasing/bpsavings_calc/Calc_CAC.xls

Equivalent Full Load Cooling and Heating Hours

Values on low end of range assume units off during unoccupied hours in cooling season and 10°F set-back in heating. Values on high end assume no set-back control. Unoccupied ventilation air and internal loads minimized for both high and low range values.

	Nine Month Schools		Office – 8 to 5 Five Days / Week		Retail – 8 to 10 Seven Days / Week	
Annual Hours	1300 - 1500		2200 - 2400		2800 - 3600	
	Cooling	Heating	Cooling	Heating	Cooling	Heating
Atlanta	590-830	200-290	950-1360	480-690	1300-1860	380-600
Baltimore	410-610	320-460	690-1080	720-890	880-1480	570-770
Bismarck	150-250	460-500	250-540	950-990	340-780	810-900
Boston	300-510	450-520	450-970	960-1000	610-1380	760-870
Charleston, WV	430-570	310-440	620-1140	770-840	820-1600	620-730
Charlotte	510-730	200-320	940-1340	530-780	1280-1830	420-670
Chicago	280-410	390-470	420-780	820-920	550-1090	670-810
Dallas	620-890	120-200	1100-1580	340-520	1460-2090	280-440
Detroit	230-360	400-480	390-820	970-1020	530-1170	790-900
Fairbanks, AK	25-50	560-630	60-200	1050-1170	110-320	930-1090
Great Falls, MT	130-220	360-430	210-490	820-890	290-710	680-800
Hilo, HI	970-1390	0	1800-2580	15-25	2260-3370	10-15
Houston	670-1000	90-130	1240-1770	250-350	1600-2290	190-300
Indianapolis	380-560	400-480	560-1000	840-920	730-1410	690-820
Los Angeles	610-910	80-160	1140-1670	370-580	1650-2350	250-440
Louisville	470-670	290-430	770-1250	710-830	1000-1720	570-720
Madison	210-310	390-470	320-640	840-900	420-900	700-800
Memphis	580-830	170-240	950-1350	420-600	1250-1780	330-510
Miami	950-1300	10	1500-2150	35-45	1920-2740	25-40
Minneapolis	200-300	420-500	320-610	860-950	430-870	720-860
Montgomery	630-910	120-180	1060-1510	330-470	1390-1990	250-400
Nashville	520-740	250-320	830-1280	590-680	1030-1710	470-590
New Orleans	690-990	70-110	1200-1720	230-320	1570-2240	160-260
New York	360-550	350-440	540-1040	790-870	720-1480	630-760

Commercial Kitchen/Food Service Resource

- Life-cycle cost calculators
- Appliance performance reports
- Rebate information
- Design guides
- Field studies
- Trainings

Food Service Technology Center
Promoting Energy Efficiency in Food Service

1.800.398.3782
[Contact Us](#) | [Site Map](#)

Search...

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Equipment Rebates
Get money back for purchasing energy efficient equipment.

Educational Seminars
Free seminars to increase your energy efficiency I.Q.

What's New
Clima 2007 Well Being Indoors
Download presentations from the energy efficient solutions for restaurants workshop.
10 Ways to Save Natural Gas
These tips will save you money without compromising the comfort, performance or productivity of your kitchen.
FCSI White Paper
Commercial Kitchen Ventilation "Best Practice" Design & Specification Guidelines.
[» more](#)

Popular links for...
**Designers
End Users
Manufacturers**

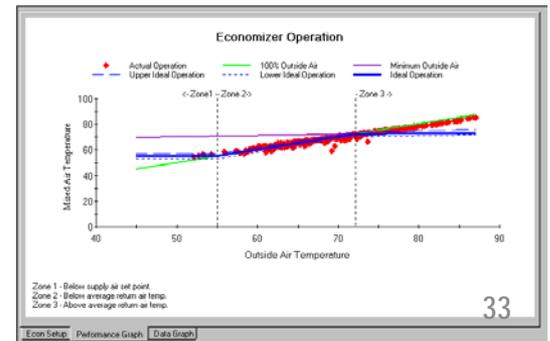
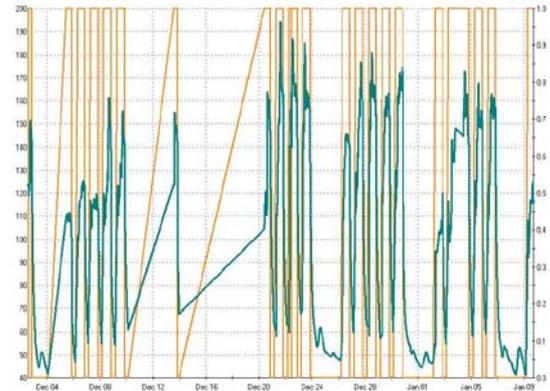
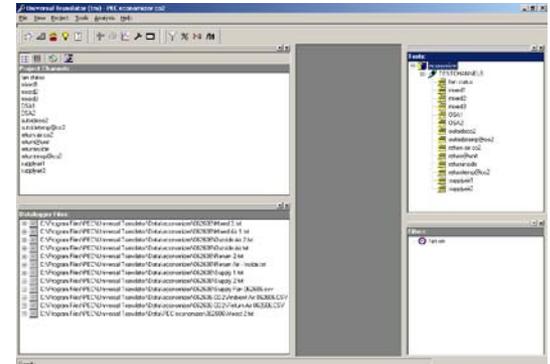
Appliance Reports

FISHER NICKEL
The Food Service Technology Center program is funded by California utility customers and administered by Pacific Gas and Electric Company under the auspices of the California Public Utility Commission.
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Pacific Gas and Electric Company

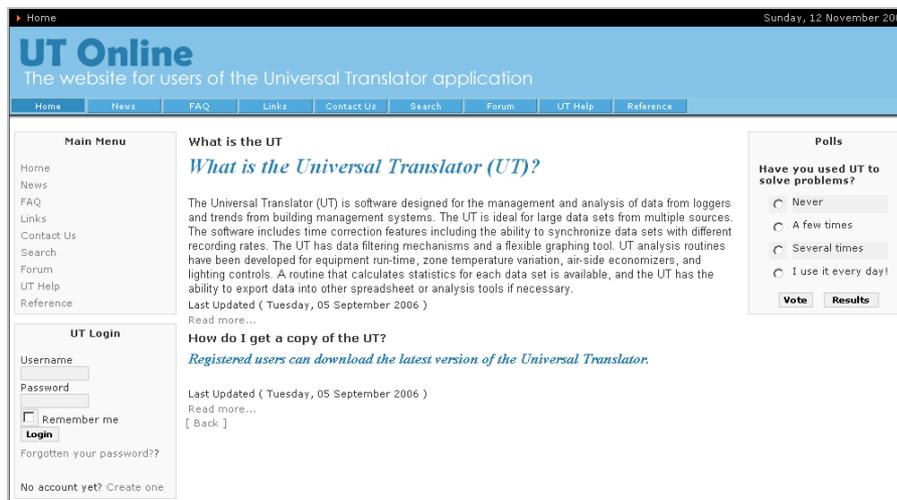
Universal Translator™ (UT) Software

- Manages data from multiple sources
 - Dataloggers
 - Trend data from energy management systems
 - Utility billing data
 - Climate data
- Visualization capabilities
- Processed data can be exported to other programs
- Includes building diagnostic tools
- Three-year PIER-funded effort began in 2011



Get UT at www.utoonline.org

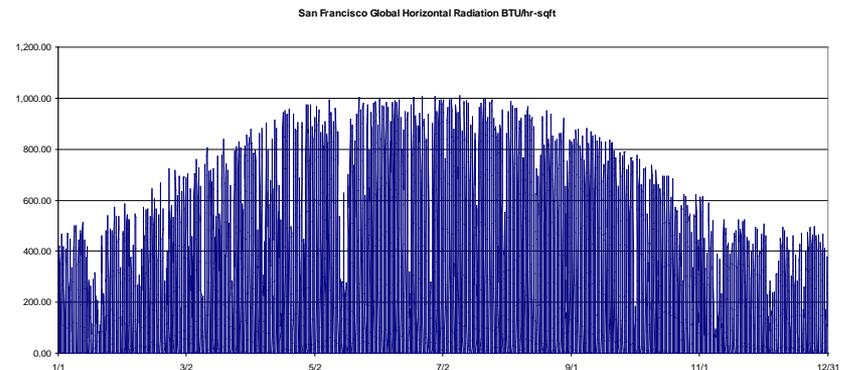
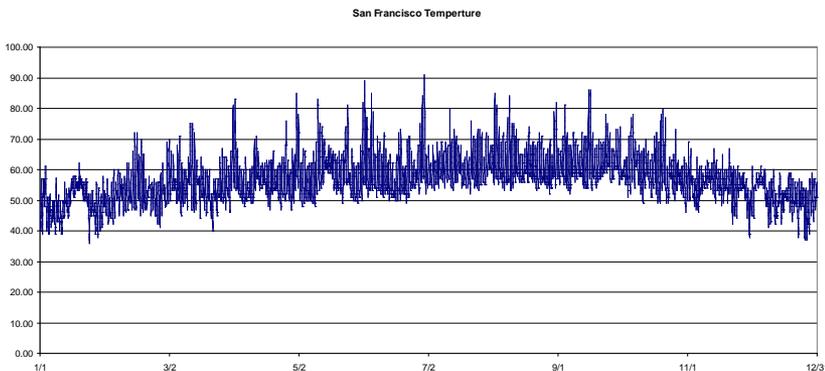
- Help
 - Searchable text version
 - Training videos
- Frequently Asked Questions
- Reference information
- Users' forum
- News
- Useful web links



The screenshot shows the homepage of the UT Online website. The header features the logo "UT Online" and the tagline "The website for users of the Universal Translator application". A navigation menu includes links for Home, News, FAQ, Links, Contact Us, Search, Forum, UT Help, and Reference. The main content area is divided into three columns. The left column contains a "Main Menu" with links to Home, News, FAQ, Links, Contact Us, Search, Forum, UT Help, and Reference, as well as a "UT Login" section with fields for Username and Password, a "Remember me" checkbox, and a "Login" button. The middle column is titled "What is the UT" and contains a sub-heading "What is the Universal Translator (UT)?" followed by a paragraph describing the software's capabilities and a "Read more..." link. The right column is titled "Polls" and contains a poll question "Have you used UT to solve problems?" with radio button options: "Never", "A few times", "Several times", and "I use it every day!". There are "Vote" and "Results" buttons at the bottom of the poll.

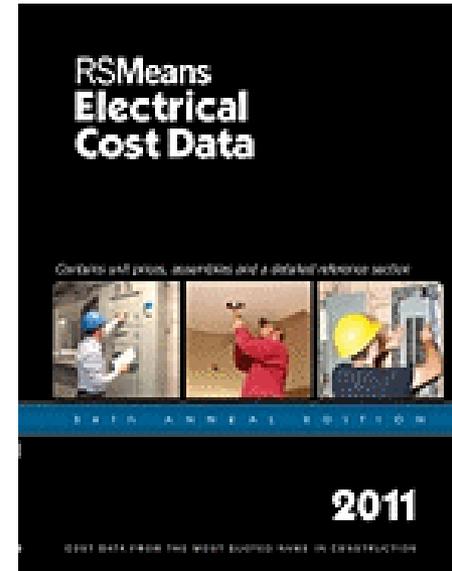
Typical Year Climate Data

- Energy Plus
 - Hourly data (8760 records)
 - Includes temp, RH, wind speed, wind direction, solar...
 - http://apps1.eere.energy.gov/buildings/energyplus/cfm/weather_data.cfm



Implementation Cost Data

- Sources
 - Quote from contractor
 - RS Means Guide
- Adjustment factors
 - Location
 - Materials
 - Labor
 - Utility rates
 - New construction or existing building



26 53 Exit Signs										
26 53 13 - Exit Lighting										
26 53 13.10 Exit Lighting Fixtures										
0010	EXIT LIGHTING FIXTURES									
0080	Exit light ceiling or wall mount, incandescent, single face	1	Elec	8	1	Eq	42.50	45.50	88	115
0100	Double face	6.70	1,194		49	54.50		103.50	135	
0120	Explosion proof	3.80	2,105		465	96		561	660	
0150	Fluorescent, single face	8	1		65	45.50		110.50	140	
0160	Double face	6.70	1,194		73	54.50		127.50	161	
0200	L.E.D. standard, single face	8	1		65	45.50		110.50	140	
0220	Double face	6.70	1,194		73	54.50		127.50	161	
0240	L.E.D. w/battery unit, single face	4.40	1,818		125	83		208	261	
0260	Double face	4	2		127	91		218	276	

Report Writing

Summarizing all findings into a single document.

Energy Audit Report Template
Report Reference Materials

Energy Audit Report Template

Energy Analysis Report

[Facility Name]
[Facility Address]
[Facility City, Zip Code]



[Facility Photograph]

Prepared by:
[Auditor]
[Auditor Contact Information]

[Report Date]

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Appendices.....	[#]

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Valuable Report Footnotes and Resources

- Typical life of equipment
[See ASHRAE Applications: Owning and Operating Costs](#)
- Insignificance of mercury content in fluorescents
http://www.energystar.gov/ia/partners/promotions/change_light/downloads/Fact_Sheet_Mercury.pdf
- List of Operations and Maintenance opportunities
<http://www.energy.wsu.edu/Documents/OMchecklists.pdf>
- Expected increases in utility costs
<http://www.eia.gov/emeu/steo/pub/contents.html>
- Demand response research
<http://drcc.lbl.gov/>
- Writing User-Friendly Energy Audit Reports
<http://www.ise.ufl.edu/capehart/papers/user-rep.doc>

Thank-You

Ryan Stroupe

Building Performance Program Coordinator

Pacific Energy Center

851 Howard Street

San Francisco, CA 94103

415.973.7257

r2s2@pge.com

Appendix

Web pages, publications and
other resources

General Energy Audit Resources List

- Procedures for Commercial Building Energy Audits
<http://www.ashrae.org>
- Database for Energy Efficient Resources (DEER)
<http://www.energy.ca.gov/deer/>
- The Consortium for Energy Efficiency (CEE)
<http://www.cee1.org/>
- Washington State University Publications and Tools:
<http://www.energy.wsu.edu/PublicationsandTools.aspx>
- Guide to preparing feasibility studies for energy efficiency projects
http://www.energy.ca.gov/reports/2000-03-20_400-00-002.PDF
- How to Hire an Energy Auditor to Identify Energy Efficiency Projects
http://www.energy.ca.gov/reports/efficiency_handbooks/400-00-001C.PDF
- Putting Energy into Profits: Energy Star Guide for Small Business
http://www.energystar.gov/ia/business/small_business/sb_guidebook/smallbizguide.pdf
- Pacific Energy Center's Tool Lending Library
www.pge.com/pec/tll

Billing Data References and Resources

- PG&E Tariff Book

<http://www.pge.com/tariffs/>

<http://www.pge.com/notes/rates/tariffs/electric.shtml>

<http://www.pge.com/notes/rates/tariffs/GRF.SHTML>

- PG&E Third Party Authorization

<http://www.pge.com/includes/docs/pdfs/mybusiness/energysavingsrebates/demandresponse/howtoapply/E79-1095%20-Third%20Party%20Authorization.pdf>

- EPA Portfolio Manager

http://www.energystar.gov/index.cfm?c=evaluate_performance.bus_portfoliomanager

- Cal-Arch/Energy IQ

<http://poet.lbl.gov/cal-arch/>

<http://energyiq.lbl.gov/>

- Commercial Building Survey data

<http://www.energy.ca.gov/ceus/>

Lighting References and Resources

- Advanced Lighting Guidelines: 2003 Edition
 - <http://www.algonline.org/>
- Lighting Fundamentals Handbook
 - Free through EPRI <http://my.epri.com/>
- Table of Standard Fixture Wattages
 - http://www.nationalgridus.com/non_html/shared_energyeff_super_t8.pdf
 - http://www.oncor.com/pdf/programs/objectives/smci_lighting_tab.pdf
 - http://www.masssave.com/~media/Files/Professional/Applications-and-Rebate-Forms/2011_Retrofit_MA_Lighting_Device_Codes_03-02-2011.ashx
- Occupancy Sensor Design and Application Guide
<http://www.wattstopper.com/getdoc/419/OSappsNewDesignFinal.pdf>
- PG&E Lighting Incentives
http://www.pge.com/includes/docs/pdfs/mybusiness/energysavingsrebates/incentivesbyindustry/lighting_catalog_final.pdf

HVAC References and Resources

- Energy Design Resources
www.energydesignresources.com
- ASHRAE Advanced Energy Design Guidelines
 - www.ashrae.org
 - Small Office, Small Retail, Small Warehouses and Self-Storage Buildings, and Schools K-12 are Free
- Energy Cost Calculator for Commercial Unitary Air Conditioners
http://www1.eere.energy.gov/femp/technologies/eep_eccalculators.html
- Ventilation Strategy Assessment Tool (VSAT):
<http://www.energy.ca.gov/research/buildings/tools.html>
- Washington State University - calculators & other resources
<http://www.energyexperts.org/CalculatorsTools.aspx>

Refrigeration References and Resources

- Compressor performance

www.emersonclimate.com

- Summary of measures and tools

www.focusonenergy.com/Business/Commercial-Business/Grocery

- Good discussions on diagnostics

www.refrigeration-engineer.com

- PG&E Incentives

http://www.pge.com/includes/docs/pdfs/mybusiness/energysavingsrebates/incentivesbyindustry/refrigeration_catalog_final.pdf

Motor References and Resources

- MotorMaster+ 4.0 Provides:
 - Tools for analyzing motor performance
 - A searchable database of available motors
 - http://www1.eere.energy.gov/industry/bestpractices/software_motormaster_intl.html
- Consortium For Energy Efficiency
 - Fact sheets and Case studies
 - <http://www.cee1.org>
 - http://www.cee1.org/ind/motrs/CEE_MotorsListApril2010a.xls
- U.S. Department of Energy's Motor Challenge Program
http://www1.eere.energy.gov/industry/bestpractices/motor_challenge_national_strategy.html
- Siemens Basics of AC Motors online course
<http://www.sea.siemens.com/step>

Natural Gas References and Resources

- Gas Appliance Manufacturers Association
<http://www.gamanet.org/>
- Database of energy efficient gas appliances
<http://www.energy.ca.gov/appliances/database/>
- National Board of Boiler and Pressure Vessel Inspectors
www.nationalboard.org
- Steam trap course
www.spiraxsarco.com/learn
- Bacharach combustion training
<http://www.bacharach-inc.com/training.htm>

Envelope References and Resources

- Insulation fact sheet

http://www.ornl.gov/sci/roofs+walls/insulation/ins_08.html

- Efficient window collaborative

<http://www.efficientwindows.org/>

- Spectrally Selective Glazing guide

http://www.energysavers.gov/your_home/windows_doors_skylights/index.cfm/mytopic=13450

- Daylighting guidelines

– <http://windows.lbl.gov/pub/designguide/default.html>

– <http://www.energydesignresources.com/technology/daylighting-design.aspx>

- SkyCalc (skylight calculator)

<http://www.energydesignresources.com/Resources/SoftwareTools/SkyCalc.aspx>

Appliance References and Resources

- Energy Star

<http://www.energystar.gov/>

- ACEEE Consumer Guides (including appliance recycling)

<http://www.aceee.org/consumerguide/>

- User Guide to Power Management for PCs and Monitors

<http://eetd.lbl.gov/EA/Reports/39466/39466.pdf>

- Leaking Electricity Research

<http://enduse.lbl.gov/info/ACEEE-Leaking.pdf>

- PG&E Incentives

http://www.pge.com/includes/docs/pdfs/mybusiness/energysavingsrebates/incentivesbyindustry/appliances_generalimprovements_catalog_final.pdf

Renewable References and Resources

- Photovoltaics:
<http://www.gosolarcalifornia.org>
- Solar Water Heating:
<http://www.solar-rating.org>
- Wind:
<http://www.awea.org>



Water Efficiency References and Resources

- California Urban Water Conservation Council
<http://www.cuwcc.org/>
- EPA's Water Sense
<http://www.epa.gov/WaterSense/>
- Pacific Institute
<http://www.pacinst.org/>
- East Bay Municipal Utility District
<http://www.ebmud.com/>
- StopWaste (Alameda County)
<http://www.stopwaste.org/home/index.asp>
- CA Dept of Water Resources/Water Use Efficiency
<http://www.water.ca.gov/wateruseefficiency/>
- American Water Works Association (AWWA)
<http://www.awwa.org/>
- US Bureau of Reclamation (USBR)
<http://www.usbr.gov/>
- CA Landscape Contractors Association (CLCA)
<http://www.clca.org/>
- Metropolitan Water District
<http://www.mwdh2o.com/>



- California Irrigation Management Information System (CIMIS)
<http://www.cimis.water.ca.gov/cimis/info.jsp>