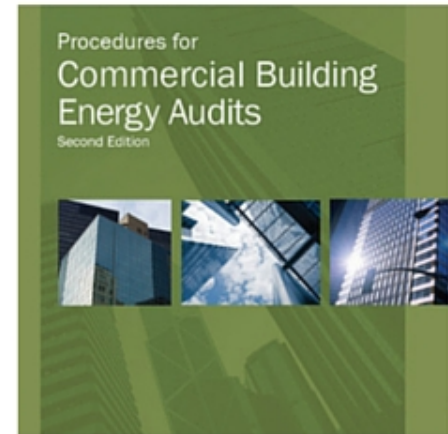


BUILDING AUDIT TRAINING AND TOOLS

BEST CENTER VISIT - JAN 2016

Presented By: Siva Gunda
Research Director, Energy Efficiency Center
January 7th 2016



OVERVIEW

- Background
- Development of preliminary Tools
- Where we are and next steps
- Market Transformation Efforts

BACKGROUND

CCC ENERGY
CORPS

WORKFORCE
DEVELOPMENT

MARKET NEEDS
DEFINITION

- Addressing Small & Medium Commercial Bldgs.
- Prop 39 – California Conservation Corps
- Addressing Legislation and mandates

SMB Audits with CCC

CCC ENERGY
CORPS

WORKFORCE
DEVELOPMENT

MARKET NEEDS
DEFINITION



Prop 39: Energy Corps

CCC ENERGY
CORPS

WORKFORCE
DEVELOPMENT

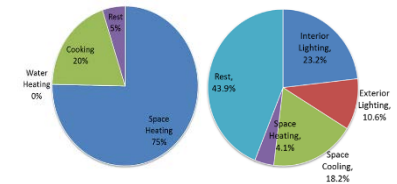
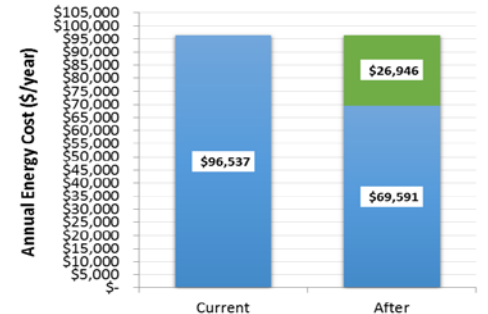
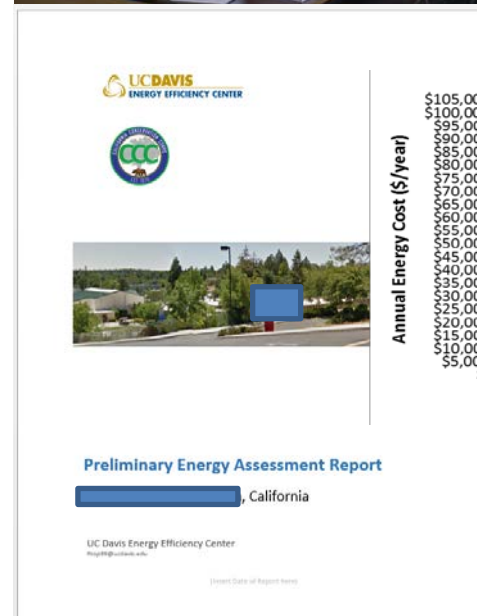
MARKET NEEDS
DEFINITION

- Interagency agreement with CCC
 - Specifically CCC's Energy Corps Program
 - Energy Efficiency ("EE") and Renewable Energy ("RE") industry projects and programs
- SCOPE OF PARTNERSHIP
 - Provide overall coordination and administration of the
 - statewide Energy Corps
 - Establish an advisory board to include a collaboration of program partners
 - Develop and evolve a viable Energy Corps Program Design

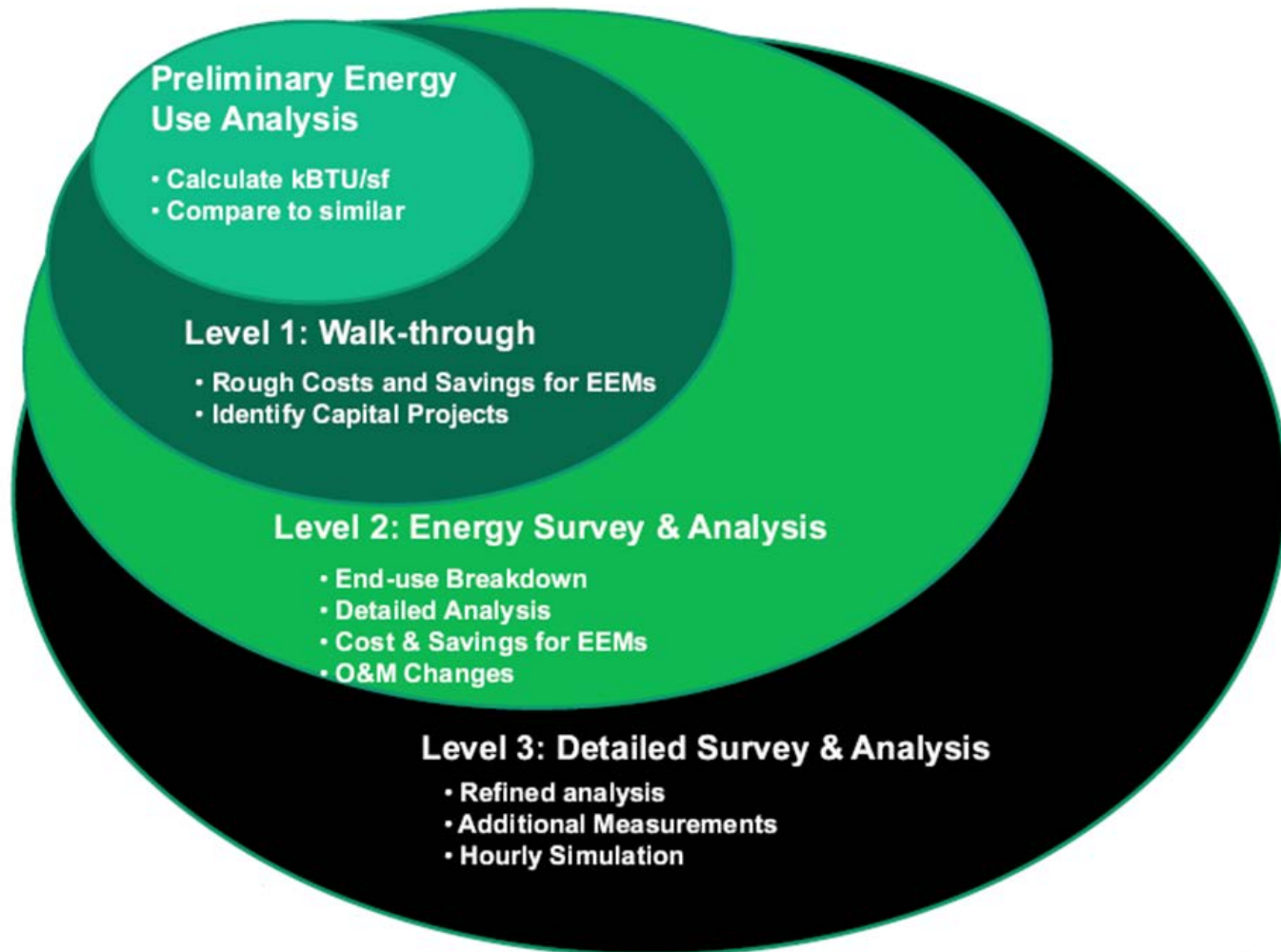


Energy Corps Outcomes

- Four Key Roles
 - Curriculum Development
 - 10 day and 5 day versions
 - Will be publically available
 - Training
 - 180 corpsmembers trained
 - **Paper based Audit forms** and procedure
 - Analysis and Reporting
 - Analysis and automation tools
 - Report
 - Pre-filled CEC calculator
 - Inventory




Training for ASHRAE 1+ Audits



Training for ASHRAE 1+ Audits

1.51 INTERIOR LIGHTING
(Room/Space Level Form)

Use this sheet to describe the electric lighting plan for each zone in your building. *Print multiple sheets as necessary.*




Zone/Room Name/Description						Area (ft ²):	
Fixture Type	Area	Task	Exit	Track	Display	Other:	No. of Fixtures:
Mounting	Recessed	Suspended	Surface Mount	Other:			No. of Lamps/Fixtures:
Lamp Type	Fluorescent Tube	Length:	Diameter: T12 T8 T5 Other:				Wattage of Lamps:
	Circle one: CFL Incandescent Halogen LED HID Other:						
Ballast	Circle one: Magnetic Electronic		No. of Ballasts/Fixtures:		BF:	Watts:	
Control Type (circle one)	Manual Switch	Bi-Level Switch	Time Clock	Daylight Sensor	Occupancy Sensor	Dimming Step Dimming None Other:	Total Watts:

Fixture Type	Area	Task	Exit	Track	Display	Other:	No. of Fixtures:
Mounting	Recessed	Suspended	Surface Mount	Other:			No. of Lamps/Fixtures:
Lamp Type	Fluorescent Tube	Length:	Diameter: T12 T8 T5 Other:				Wattage of Lamps:
	Circle one: CFL Incandescent Halogen LED HID Other:						
Ballast	Circle one: Magnetic Electronic		No. of Ballasts/Fixtures:		BF:	Watts:	
Control Type (circle one)	Manual Switch	Bi-Level Switch	Time Clock	Daylight Sensor	Occupancy Sensor	Dimming Step Dimming None Other:	Total Watts:

Fixture Type	Area	Task	Exit	Track	Display	Other:	No. of Fixtures:
Mounting	Recessed	Suspended	Surface Mount	Other:			No. of Lamps/Fixtures:
Lamp Type	Fluorescent Tube	Length:	Diameter: T12 T8 T5 Other:				Wattage of Lamps:
	Circle one: CFL Incandescent Halogen LED HID Other:						
Ballast	Circle one: Magnetic Electronic		No. of Ballasts/Fixtures:		BF:	Watts:	
Control Type (circle one)	Manual Switch	Bi-Level Switch	Time Clock	Daylight Sensor	Occupancy Sensor	Dimming Step Dimming None Other:	Total Watts:

3.0 SWIMMING POOLS
(Room/Space Level Form)



AUDIT FORM GUIDANCE

General Information

Site Name

Location of Pool

Size (gallons)

Activity Schedule

Indicate what pool is used for (recreation, teaching, training, etc) and ask Facility Manager about a typical weekly schedule

Provide name of site

Observe location in relation to building

Ask Facility Manager

Outdoor Conditions

Avg Temp for Coldest Month of US

% Shaded Area in Pool Area

Estimate avg. percentage based on observations and ask Facility Manager

Indoor Conditions

Room Temperature Setpoint

Method of Air Delivery

Ask Facility Manager

Filter Pump Data

Hours on per Day

VFD

Ask Facility Manager

Solar Pool Heaters

Collector Type

Ask Facility Manager

Heating Conditions

Heating Method

Cover Type

Cover Schedule

Desired Water Temp

Ask Facility Manager

Ask Facility Manager

Ask Facility Manager

Ask Facility Manager

Gas Pool Heaters

Capacity

Fuel Type

Ask Facility Manager

Ask Facility Manager

Heat Pump Pool Heaters

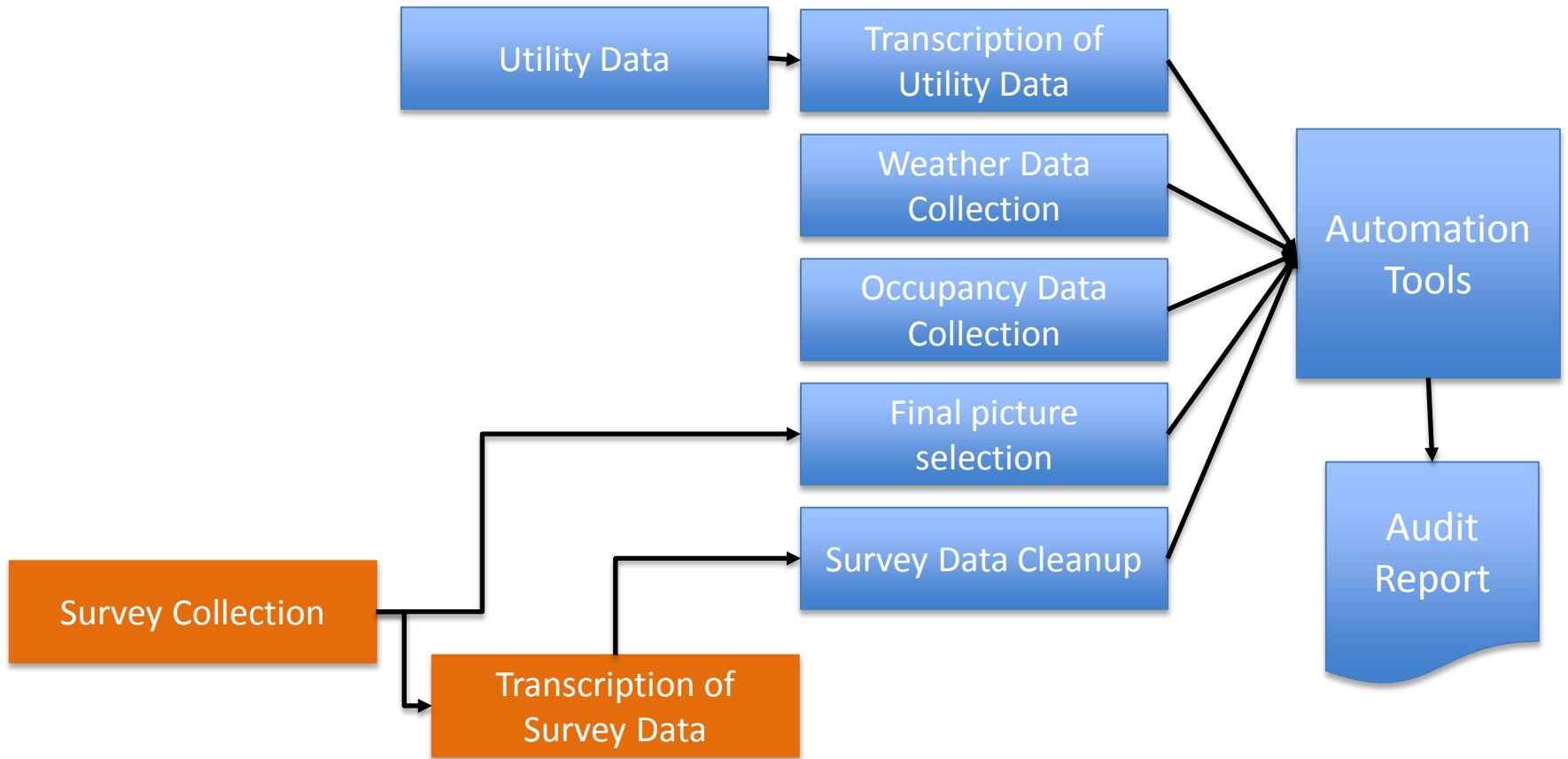
Capacity

Air/Water Source

Ask Facility Manager

ask-bulksubmit

Process



Migration to ZOHO


Zoho Creator

Home | Setup | ?

Create Application


Welcome to Zoho Creator! You have three ways to start your journey with Creator.
Click on any one of them.

Application Gallery




Start your trial with our most popular ready to use applications.

Import A File



Import your data from Excel, Access, FileMaker and Google Docs into Creator.

From Scratch



Create your first application from scratch using our drag & drop builder.

Not finding time to build your app? Hire a Creator Certified [Expert](#)

ZOHO Audit Tool



Valley Oak Cottage

Creator

	Survey Database Forms	Project Data Tables	Reference Material	LEA Project Information	Revision History	
CCC Project I Add School Site Na Onsite Contac Contact Numb Contact Email School Site Ad School Site Ad School Site Ci School Site Zi Total Number Student Prese FRPM Amount Number of Electrical Meters Site and Building Map File Upload During School Day or After Hours Can Access Keys be Issued to Crew Supervisor?	CCC Project Information Worksheet Report A - Site Level Information A - Site Level Exterior Lighting A - Building Information B - Building Exterior Lighting B - HVAC Inventory B - Building Roof and Exhaust Fans B - Building Misc Inventory C - Room Information C - Interior Lighting C - Windows - Envelope Fenestration C - Doors - Envelope Fenestration C - Plugloads C - Skylights - Envelope Fenestration C - Domestic Hot Water Form D - Runtime Scheduler E - Specialty Kitchen Equipment E - Specialty Swimming Pools Z - Energy Crew Submission Form			Valley Oak Cottage Roxanne Loe 00 Rgloe@ucdavis.edu 00 Davis 95616 1 No 0 0 image1449856827055.jpg School Day Yes		
	1 - 1 of 1 << < > >>					
	Edit Print Delete					

ZOHO Audit Tool



Valley Oak Cottage

Search

	Survey Database Forms	Project Data Tables	Reference Material	LEA Project In
CCC Project I	<ul style="list-style-type: none"> CCC Project Information Worksheet Report A - Site Level Information A - Site Level Exterior Lighting A - Building Information B - Building Exterior Lighting B - HVAC Inventory B - Building Roof and Exhaust Fans B - Building Misc Inventory C - Room Information C - Interior Lighting C - Windows - Envelope Fenestration C - Doors - Envelope Fenestration C - Plugloads C - Skylights - Envelope Fenestration C - Domestic Hot Water Form D - Runtime Scheduler E - Specialty Kitchen Equipment E - Specialty Swimming Pools Z - Energy Crew Submission Form 			
Add				
School Site Na				
Onsite Contac				
Contact Numb				
Contact Email				
School Site Ad				
School Site Ad				
School Site Ci				
School Site Zi				
Total Number				
Student Prese				
FRPM Amount				

Once logged into, user can go the “Survey database forms” tab and click on any of the options to start adding information.

- Zoho allows users to edit that information incase of any mistakes.

- Users can also add building, lighting and plug load pictures.

- Zoho allows multiple users to work on one single site.

ZOHO Audit Tool

Survey Database Forms	Project Data Tables	Reference Material	LEA Pr
<p>CCC Project Information Worksheet</p> <p>Add</p> <p>School Site Name</p> <p>Onsite Contact Name</p> <p>Contact Number:</p> <p>Contact Email:</p> <p>School Site Address 1:</p> <p>School Site Address 2:</p> <p>School Site City:</p> <p>School Site Zip:</p> <p>Total Number of Buildings to Survey (Th</p> <p>Student Presentation?</p> <p>FRPM Amount</p> <p>Number of Electrical Meters</p> <p>Site and Building Map File Upload</p> <p>During School Day or After Hours</p> <p>Can Access Keys be Issued to Crew Super</p> <p>Special Considerations</p>	<p><input type="checkbox"/> Project Information Worksheet Report</p> <p><input type="checkbox"/> A - Site Level Data</p> <p><input type="checkbox"/> A - Site Level Exterior Lighting Report</p> <p><input type="checkbox"/> A - Building Information Report</p> <p><input type="checkbox"/> B - Building Exterior Lighting Report</p> <p><input type="checkbox"/> B - HVAC Inventory Report</p> <p><input type="checkbox"/> B - Building Roof and Exhaust Report</p> <p><input type="checkbox"/> B - Building Misc Inventory Report</p> <p><input type="checkbox"/> C - Room Information Report</p> <p><input type="checkbox"/> C - Windows - Envelope Fenestration Report</p> <p><input type="checkbox"/> C - Doors - Envelope Fenestration Report</p> <p><input type="checkbox"/> C - Skylights - Envelope Fenestration</p> <p><input type="checkbox"/> C - Interior Lighting Report</p> <p><input type="checkbox"/> C - Plugloads form Report</p> <p><input type="checkbox"/> C - Domestic Hot Water Form Report</p> <p><input type="checkbox"/> D - Runtime Scheduler Report</p> <p><input type="checkbox"/> E - Specialty Kitchen Equipment Report</p> <p><input type="checkbox"/> E - Specialty Swimming Pools Report</p> <p><input type="checkbox"/> Z - Center Submission Form Report</p> <p><input type="checkbox"/> Electric Information Report</p> <p><input type="checkbox"/> Electric Month Collector Report</p> <p><input type="checkbox"/> Gas Information Report</p> <p><input type="checkbox"/> Gas Collector Report</p> <p><input type="checkbox"/> Solar Information Report</p> <p><input type="checkbox"/> Solar Collector Report</p> <p><input type="checkbox"/> LEA Information Submission Report</p>		


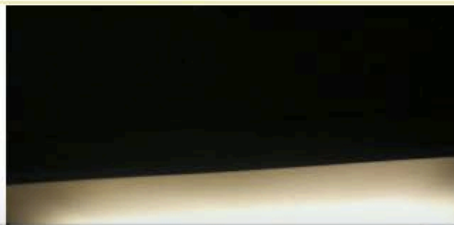
- ‘Project Data Tables’ tab allows user to check all the collected data.
- User can click on any option to check if the data has been added correctly or if there is any missing data.

ZOHO Audit Tool

Zoho Creator - C - Interior Lighting Report

<https://creatorexport.zoho.com/energyefficiencycenter/copy-of-...>

C - Interior Lighting Report

Fixture Type	Number of Fixtures	Fixture Mount Type	Number of Lamps Per Fixture	Lamp Type	Lamp Wattage (Watts)	Lamp Base Type (See Reference)	Lamp Mount or Control	PL Lamp Tube Length	PL Lamp Tube Diameter	Ballast Type	Number of Ballasts Per Fixture	Fixture Control	Fixture Photo	Diffusers Only?	Fixture Type Details
1	1	Surface Mount	4	PL Tube	10		Single	4	1 Inch (25.4)	Electronic	2	MR, Manual Switch		No	
2	2	Surface Mount	2	PL Tube	10		Single	4	1 Inch (25.4)	Electronic	2	MR, Manual Switch		No	

ZOHO Audit Tool



Valley Oak Cottage

[Edit this application](#) | [Options](#) | [Help](#) | [Go To](#) | [Sign out](#)

Survey Database Forms

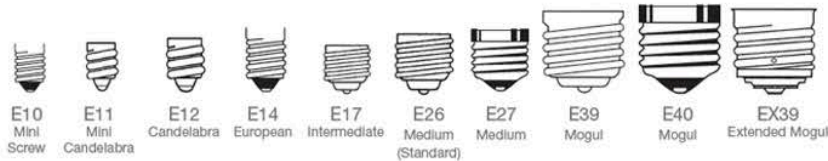
Project Data Tables

Reference Material

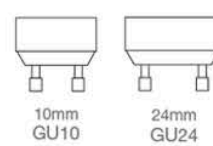
LEA Project Information

Revision History

SCREW BASES



TWIST & LOCK BASES



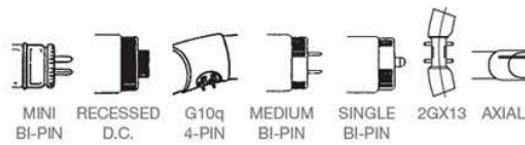
SPECIALTY BASES



BI PIN BASES



FLUORESCENT PIN BASES



ZOHO Audit Tool



HVAC information lookup database:

www.ahridirectory.org/ahridirectory/pages/ac/defaultSearch.aspx

HVAC Tonnage Tip

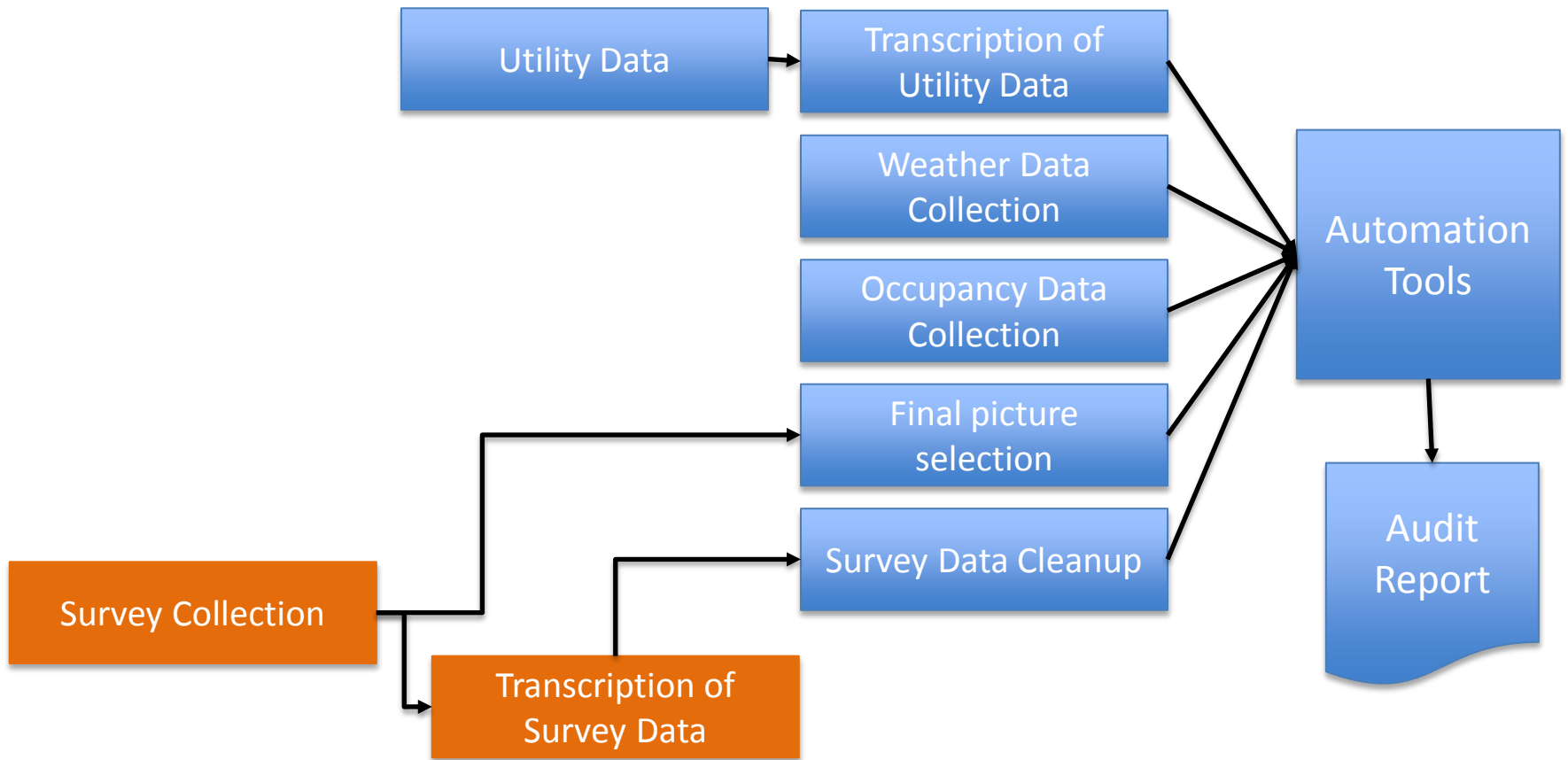
Up near the top of the label, you see the model number (M/N) and serial number (S/N). The model number is where you can find the number you're looking for. Not all manufacturers do this, but most will give you a 2 or 3 digit section that tells you how many thousands of BTU/hour the air conditioner can move out of the space.

Just past the first string of 5 characters is the part that tells you the nominal size: 048. That means the air conditioner—or heat pump in cooling mode in this case—has a nominal capacity of 48,000 BTU/hour.

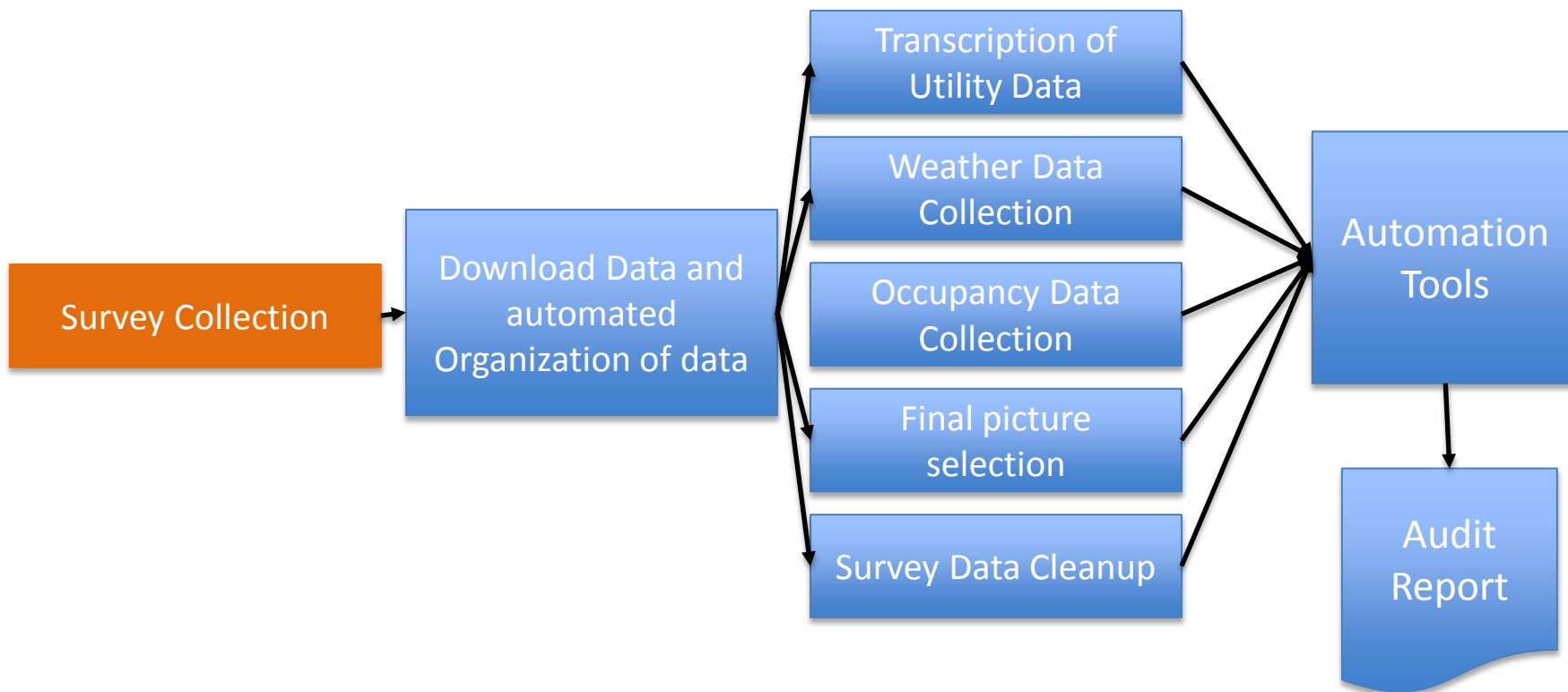
The numbers you'll see on residential air conditioners and heat pumps are:

M/N	Tons
018	1.5
024	2
030	2.5
036	3
042	3.5
048	4
060	5

Process



Process with Zoho



BEPAS (Building Energy Performance Audit System)

Objective

Enhance the efficiency of the energy audit process, and provide an one-stop service solution that is accessible 24/7 from anywhere on any device.

Key characteristics of BEPAS

- A single system for data entry and output
- Centrally managed data in a secure environment
- Ensuring data integrity by establishing structured data hierarchy
- Accessible on any device (PC, Tablet, Smartphone, Any web browser)
- No EEC intervention during the audit - Faster and more efficient audit process

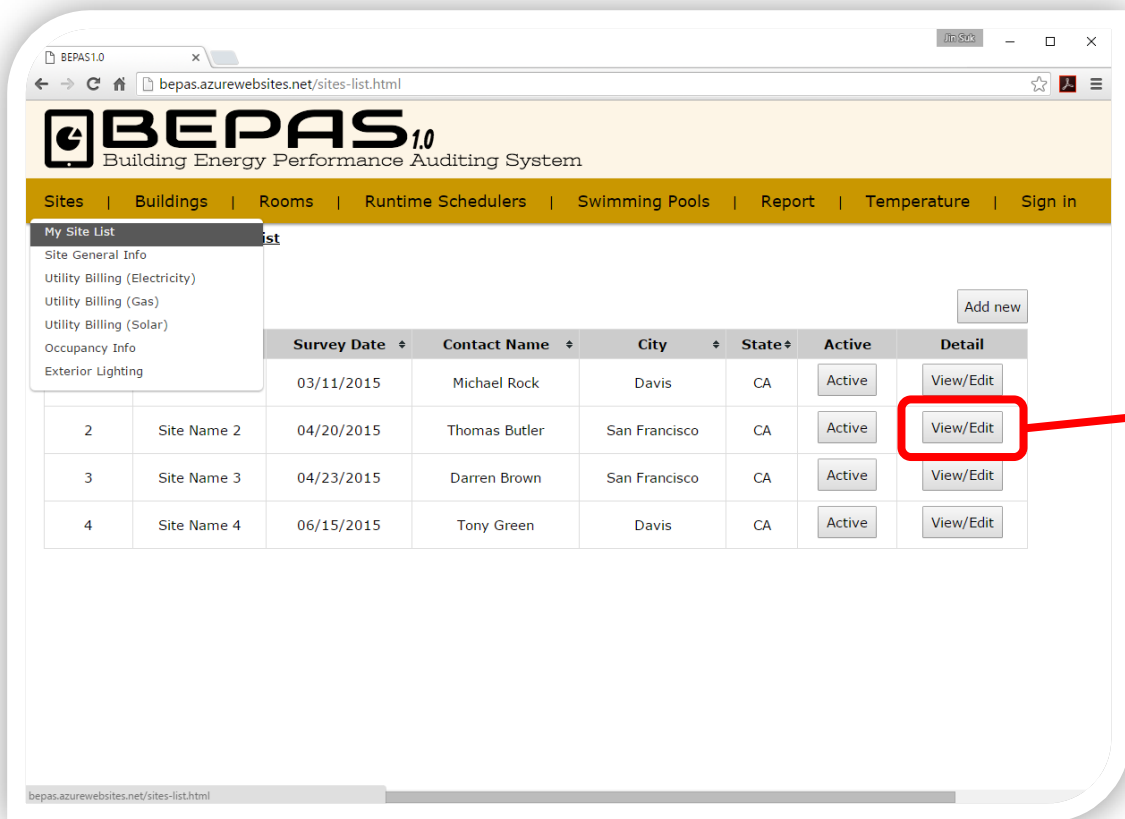
User group and role matrix

There are two main user groups (Auditors and Building owners), and UCD EEC plays the system administrator role.

	Auditors	Building Owners	UCD EEC
Data Entry	<ul style="list-style-type: none"> Input audit results Set up data sharing 	<ul style="list-style-type: none"> Input utility billing info. Input site occupancy info. 	
Data Consumption	<ul style="list-style-type: none"> View audit reports 	<ul style="list-style-type: none"> View audit reports 	
System Maintenance			<ul style="list-style-type: none"> Security management Master data management Server management

BEPAS prototype screenshots

My Site List Page: Shows the list of audited sites that the user has access to.



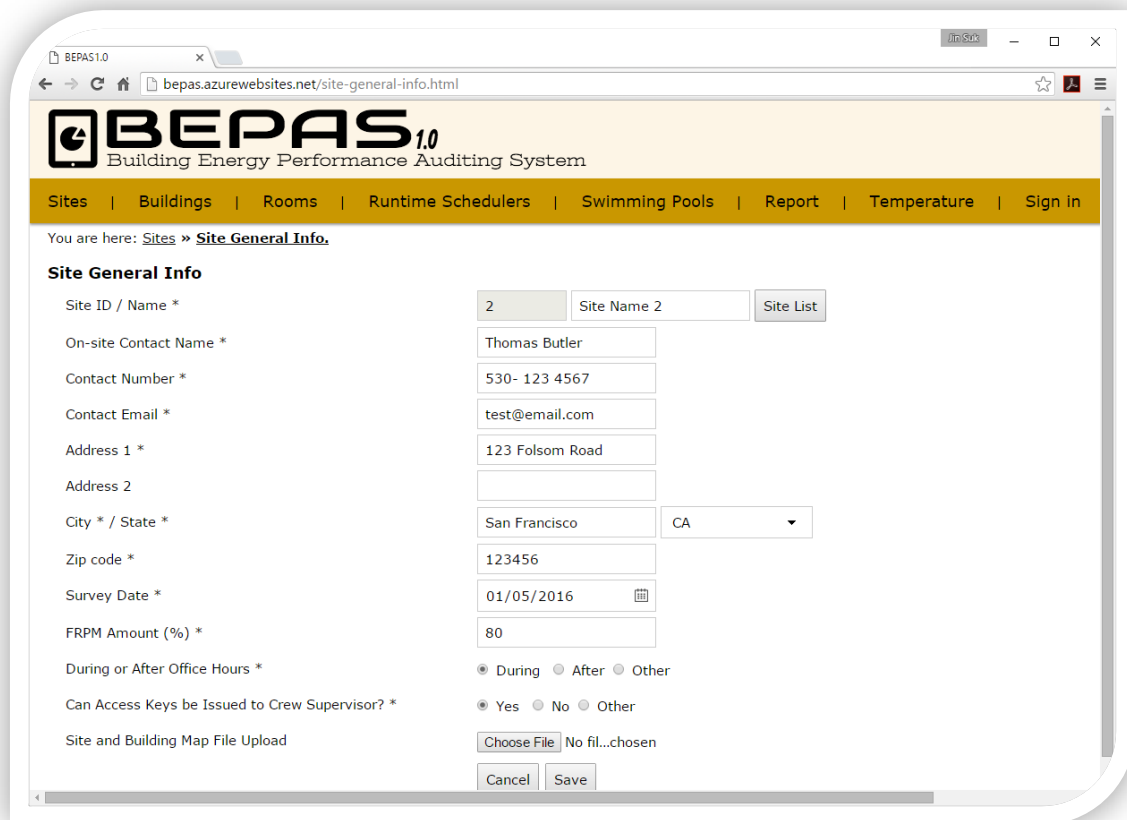
The screenshot shows the BEPAS 1.0 web application interface. The browser address bar displays 'bepas.azurewebsites.net/sites-list.html'. The page header includes the BEPAS 1.0 logo and the text 'Building Energy Performance Auditing System'. A navigation menu contains links for Sites, Buildings, Rooms, Runtime Schedulers, Swimming Pools, Report, Temperature, and Sign in. A dropdown menu for 'My Site List' is open, showing options for Site General Info, Utility Billing (Electricity), Utility Billing (Gas), Utility Billing (Solar), Occupancy Info, and Exterior Lighting. The main content area features a table with columns for Survey Date, Contact Name, City, State, Active, and Detail. An 'Add new' button is located above the table. The 'View/Edit' button for the second site is highlighted with a red box, and a red arrow points from it to the text 'Next screenshot'.

		Survey Date	Contact Name	City	State	Active	Detail
		03/11/2015	Michael Rock	Davis	CA	Active	View/Edit
2	Site Name 2	04/20/2015	Thomas Butler	San Francisco	CA	Active	View/Edit
3	Site Name 3	04/23/2015	Darren Brown	San Francisco	CA	Active	View/Edit
4	Site Name 4	06/15/2015	Tony Green	Davis	CA	Active	View/Edit

Next screenshot

BEPAS prototype screenshots

Site General Info. Page: Shows and allows the user to edit the site information.



The screenshot shows a web browser window displaying the BEPAS 1.0 interface. The browser address bar shows the URL `bepas.azurewebsites.net/site-general-info.html`. The page header includes the BEPAS 1.0 logo and the text "Building Energy Performance Auditing System". A navigation menu contains links for Sites, Buildings, Rooms, Runtime Schedulers, Swimming Pools, Report, Temperature, and Sign In. The breadcrumb trail indicates the current location: "You are here: Sites » Site General Info." The main content area is titled "Site General Info" and contains a form with the following fields and values:

Site ID / Name *	2	Site Name 2	Site List
On-site Contact Name *	Thomas Butler		
Contact Number *	530- 123 4567		
Contact Email *	test@email.com		
Address 1 *	123 Folsom Road		
Address 2			
City * / State *	San Francisco	CA	
Zip code *	123456		
Survey Date *	01/05/2016		
FRPM Amount (%) *	80		
During or After Office Hours *	<input checked="" type="radio"/> During <input type="radio"/> After <input type="radio"/> Other		
Can Access Keys be Issued to Crew Supervisor? *	<input checked="" type="radio"/> Yes <input type="radio"/> No <input type="radio"/> Other		
Site and Building Map File Upload	Choose File No file...chosen		
Cancel Save			

BEPAS prototype screenshots

Room Interior Lighting Page: Shows and allows the user to edit the interior lighting information of a room.

The screenshot shows the BEPAS 1.0 web application interface. The browser address bar displays `bepas.azurewebsites.net/interior-lighting.html`. The page header features the BEPAS 1.0 logo and the text "Building Energy Performance Auditing System". A navigation menu includes links for Sites, Buildings, Rooms, Runtime Schedulers, Swimming Pools, Report, Temperature, and Sign in. The breadcrumb trail indicates the current location: "You are here: Parent » Child".

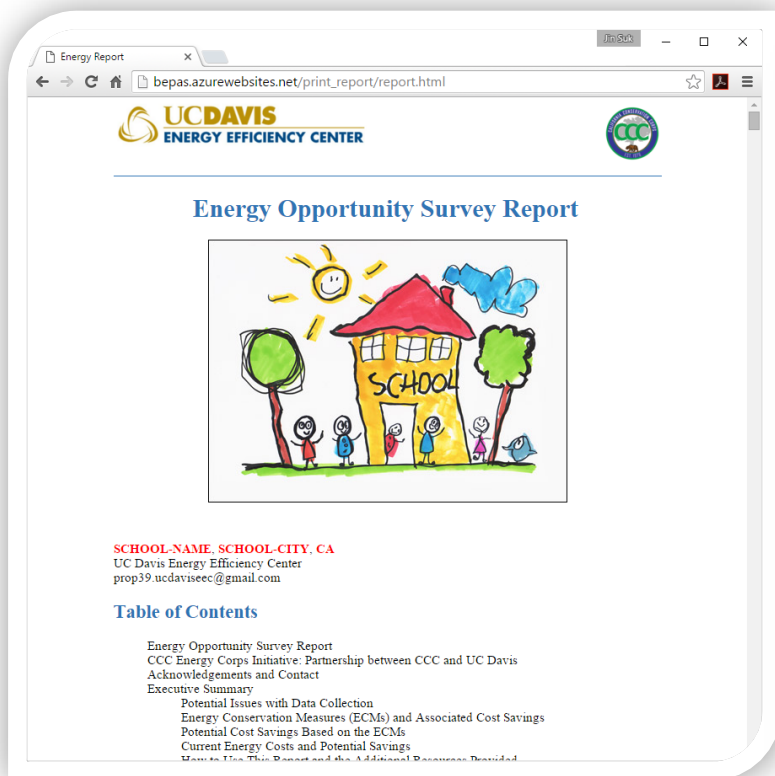
The main content area is titled "Interior Lighting" and contains a form for entering room lighting information. A dropdown menu is open, showing options: General Info, Interior Lighting (selected), Thermostats, Windows - Envelope Fenestration, Doors - Envelope Fenestration, Plugloads, Skylights - Envelope Fenestration, Domestic Hot Water Form, Specialty Kitchen Equipment, and Misc. Inventory. The form fields include:

- Site ID / Name * (12345 UC Davis) with a Site List button
- Building ID / Name * (12345 Kemper Hall) with a Building List button
- Room/Space ID & Name * (12345 Room 1) with a Room List button
- Fixture Type * (Please select)
- Number of Fixtures * (input field)
- Fixture Mounting Type * (Please select)
- Number of Lamps per Fixture * (input field)
- Lamp Type? * (Please select)
- Lamp Wattage (Watts per lamp) * (input field)
- Lamp Base Type (See Reference) (input field)
- Fluorescent detail section**
- FL Lamp Tube Length (Feet) * (Please select)
- Straight/Curved? * (Radio buttons: Straight selected, Curved)
- FL Lamp Tube Diameter * (Please select)

The footer of the page shows the URL `bepas.azurewebsites.net/interior-lighting.html`.

BEPAS prototype screenshots

Audit Report Page: Audit reports are viewable on the web in real-time.




Energy Report

bepas.azurewebsites.net/print_report/report.html

UC DAVIS
ENERGY EFFICIENCY CENTER

CCC

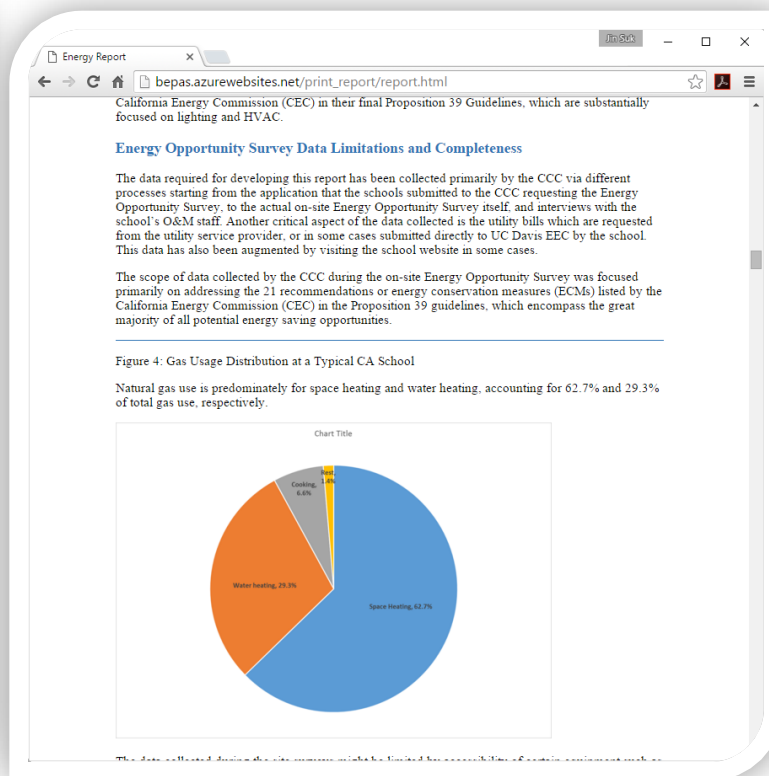
Energy Opportunity Survey Report



SCHOOL-NAME, SCHOOL-CITY, CA
UC Davis Energy Efficiency Center
prop39.ucdavis@ucdavis.edu

Table of Contents

- Energy Opportunity Survey Report
- CCC Energy Corps Initiative: Partnership between CCC and UC Davis
- Acknowledgements and Contact
- Executive Summary
 - Potential Issues with Data Collection
 - Energy Conservation Measures (ECMs) and Associated Cost Savings
 - Potential Cost Savings Based on the ECMs
 - Current Energy Costs and Potential Savings
 - How to Use This Report and the Additional Resources Provided



Energy Report

bepas.azurewebsites.net/print_report/report.html

California Energy Commission (CEC) in their final Proposition 39 Guidelines, which are substantially focused on lighting and HVAC.

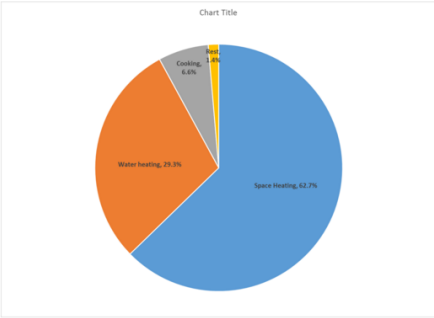
Energy Opportunity Survey Data Limitations and Completeness

The data required for developing this report has been collected primarily by the CCC via different processes starting from the application that the schools submitted to the CCC requesting the Energy Opportunity Survey, to the actual on-site Energy Opportunity Survey itself, and interviews with the school's O&M staff. Another critical aspect of the data collected is the utility bills which are requested from the utility service provider, or in some cases submitted directly to UC Davis EEC by the school. This data has also been augmented by visiting the school website in some cases.

The scope of data collected by the CCC during the on-site Energy Opportunity Survey was focused primarily on addressing the 21 recommendations or energy conservation measures (ECMs) listed by the California Energy Commission (CEC) in the Proposition 39 guidelines, which encompass the great majority of all potential energy saving opportunities.

Figure 4: Gas Usage Distribution at a Typical CA School

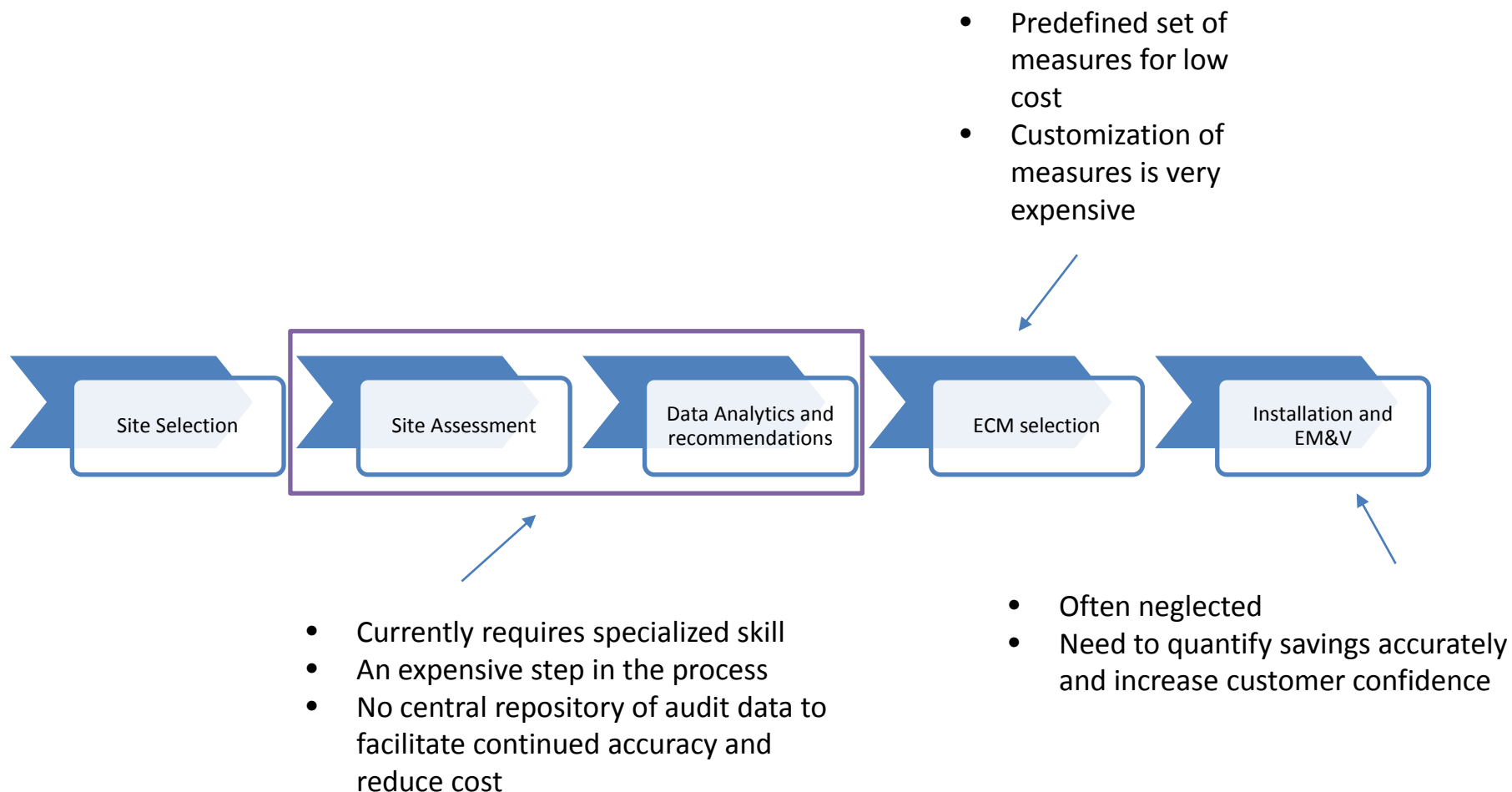
Natural gas use is predominately for space heating and water heating, accounting for 62.7% and 29.3% of total gas use, respectively.



Category	Percentage
Space Heating	62.7%
Water Heating	29.3%
Cooling	6.4%

The data collected during the site assessment might be limited by the responsibility of certain equipment and...

Need for Market Transformation



Thank you

Contact: sgunda@ucdavis.edu