

Significance and objectives

Significance

- Previous research links energy feedback and behavior
- Energy visualization tools advancing and being adopted rapidly
- These tools seen as highly valuable in meeting low-energy and ZEB goals

Objectives

- Evaluate information practices and needs of decision makers (expert users) in commercial buildings
- Understand potential benefits by providing energy feedback to workplace occupants
- Identify optimal methods for displaying building performance information to influence energy behaviors and improve performance

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Progress

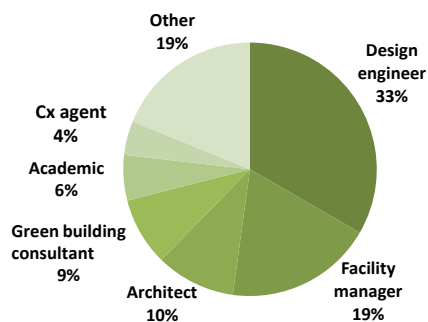
- Completed product reviews of commercial energy “dashboard” tools to understand their constraints and capabilities
- Conducted a study of expert users to understand energy information needs and preferences through surveys and interviews
- Submitted draft paper on expert user study to ACEEE Summer Study 2010
- Currently conducting a survey of energy feedback in workplaces to understand potential benefits of energy feedback (implemented in 4 buildings)
- Drafting a summary report for current phase to CEC-PIER

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Expert user survey

- Evaluate energy information needs and practices of users familiar with energy monitoring and analysis
- Asked about users’ current sources and types of energy information, usefulness, tools used, frequency of use, etc.
- Total number of respondents (N) = 70

“Which title best describes the work you do?”



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Expert user survey: information types and use

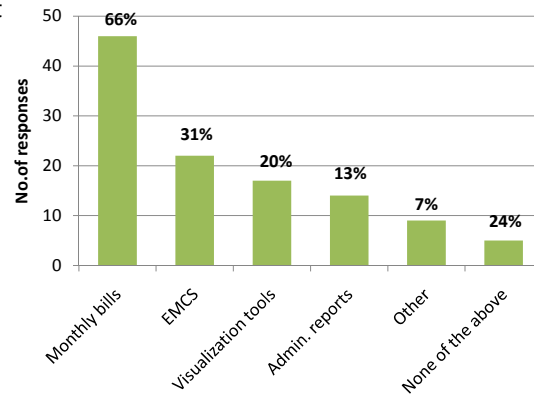
Types of available information

- Historical information most commonly available
- End-use and normative least common

Frequency of use

- Users report infrequent use of this information.
- 76% of respondents access this information only once a month or less.

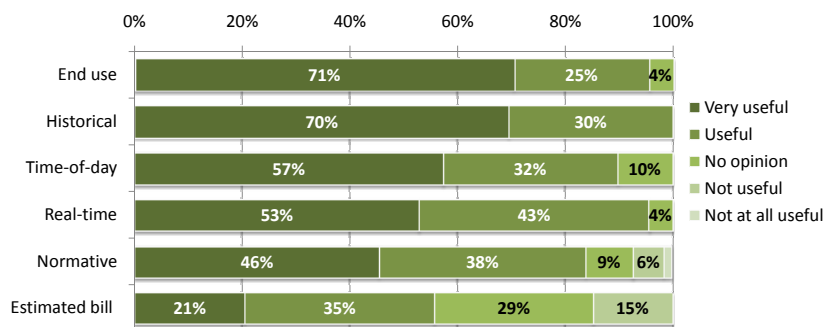
“What is your current source of energy information in your building(s)? Check all that apply.”



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Expert user survey: usefulness of information

“How useful to you is the following energy-related information for saving energy?”

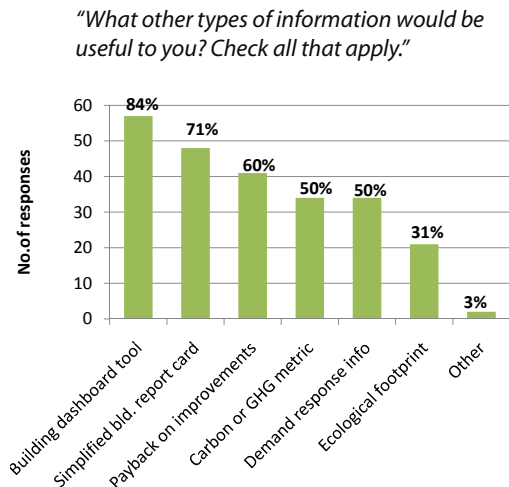


- 71% of users consider end-use information to be the most useful, although only 21% have access to it
- Estimated bill is least useful, yet it is the most common feature in commercial ‘dashboards’

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Expert user survey: other useful information

- Significant interest in building dashboard tools and report cards
- General preference for simplified displays that are easily understandable and easily read in a short time



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Expert user survey: occupant feedback

- 54% receive feedback from occupants on occupants’ satisfaction and general building problems
- Most common sources of occupant feedback are discussions with occupants/representatives, email, phone and anecdotal information
- Over 90% of respondents indicate would like a more systematic way of communicating with building occupants
- Incorporating occupant feedback capabilities into energy monitoring and visualization tools would be beneficial

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Expert user interviews

Method

- Conducted seven semi-structured interviews
- Observed participants' use of current tools
- Captured screen shots of tools



Subjects

- Design team members for a commercial building
- Architect in a firm known for designing green and LEED projects
- Program manager with a university campus
- Facility manager of a single building on a university campus
- Energy consultants with an engineering firm who work with building, campus, and community scale data
- Principal with an engineering firm

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Expert user interviews: tools used

- Most people rely on BMS such as Metasys, Automated Logic, Barrington Online, Obvius systems for energy monitoring
- Some also use web-based energy 'dashboards' for quick visualizations of energy profiles and trends
- People use BMS for monitoring specific equipment loads
- Energy "dashboards" are useful for spotting anomalies in whole building energy use and identifying high base loads



Screen capture of Metasys in use from interview



Campus energy dashboard at UC Davis

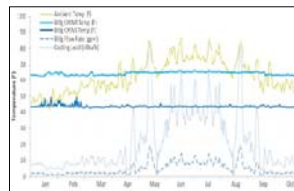
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Expert user interviews: limitations of current tools

- The number of systems and the lack of integration between them is a challenge for data analysis
- No effective visualization of end-use energy data and BMS the only source of end-use data
- Limited or no support for data analysis within tool
- Many users export energy data to tools such as Universal Translator and Excel for data analysis



Data analysis with BMS data exported to Excel



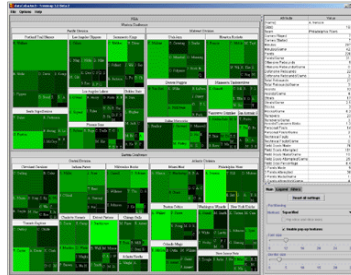
Proposed designs for energy visualization mockups from UC Davis

Expert user study: identified needs

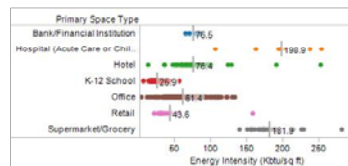
- High-level overview with drill-down capabilities
- Visualization of different types of end-use energy information including lighting, plug loads, HVAC components by zones, occupancy and function
- Integration of energy visualization features with data analysis
- Compatibility with existing BMS and EMS
- Support for energy benchmarking
- Support for occupant interaction capability

Next steps

- Continue the survey of energy feedback in workplaces
- Submit final summary report to CEC-PIER
- Present the ACEEE paper in August
- Develop experimental method for second phase (design methodology, usability testing protocols, etc.)
- Design mockups for visualizing energy use in a single building and benchmarking



<http://www.cs.umd.edu/hcil/treemap/>



Benchmarking visualization using Tableau

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Questions?

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