

# Dashboards for Buildings

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**“The question is not what you look at, but what you see.”  
Henry David Thoreau**

## Overview

Building systems can provide a lot of data through BAS points, sensors, meters, databases and measurements with a subset of that data being the foundation for energy management. However, lots of data does not necessarily mean lots of actionable information. Data is “raw” material and its real value is being transformed into useful information where some intelligence has been gleaned from analyzing or studying the raw product. The final link in this chain, and probably the most important, is the user interface (UI) or the human-machine interface (HMI), where the actionable information is presented to the person who will act upon the information. For years the user interface was the typical BAS graphics, which generally looked like something designed in the 1980s. Today the more advanced integrated building management systems use the increasingly popular browser-based dashboards to present information to users.



What follows are some tips and guidelines on creating dashboards for facility and energy management covering what information is needed, how that information should be presented to a user, and a couple of industry examples.

## What to Present

Dashboards can provide relevant and timely information to several organizational levels or groups involved with a building’s performance. These different users can be facility technicians, managers, C-level executives and even tenants, occupants or visitors through kiosks or a web page. The information provided may cover the specifics of particular building systems such as HVAC, electrical or specialty systems, but they tend to focus on energy usage, costs, KPIs, trends, alarm management, comparisons with similar buildings or building uses, etc. So the first and probably the most important steps are determining the right information for the intended viewer of the dashboard.

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Facility technicians have different information needs than C-level executives or the general public. For example, a facility engineer may be interested in subsystem alarms and alarm management. In this case the dashboard needs to display alarm priority, escalation status, alarm acknowledgment, repetitive alarms, “out-of-service” alarms and sub-system communications or component failure, etc. C-level executives, such as Directors of Facilities, Sustainability or Procurement may want information on energy usage and cost. In this case the dashboard should display the usage and costs of a building’s comprehensive and individual utilities, budgeted versus actual utility costs, budget deviations, comparisons with other similar buildings, meter output for alternative energy sources such as photovoltaic and wind energy, etc.

In developing a series of dashboards, you need to identify what decisions or insight each user or group hopes to gain by using the dashboard and what information at what time interval is needed to support their decision process.

Dashboards will be fed from data and that data will probably need to be collected from several sources: building automation systems, specialty systems, business systems, etc. For example, if it’s an energy dashboard you’re creating, energy usage may be generated in a BAS, whereas the cost of the energy may be in a database in the company’s accounts payable system. If you’re a healthcare organization you may be interested in metrics such as energy use of an MRI machine per patient and need patient counts from business systems; or, if you are a retail company it may be energy use per customer or per sale and you need customer and sale data from the business systems.

To gather all the information needed for a dashboard you may need a middleware platform to normalize and standardize data generated from several sources in possibly different database formats. This would allow a flexible and consistent platform for the dashboard but also could potentially trigger additional data management with large amounts of data. Dashboards in general are typically used for high-level performance summaries with some dashboards such as analytical dashboards needing to “drill down” to specific data, so data management can depend on the specific use of the dashboards.

## **How to present the information**

Dashboards are meant to convey essential information quickly and clearly on one screen. Most importantly they do so based on their visual design. Visual design is much more than nice

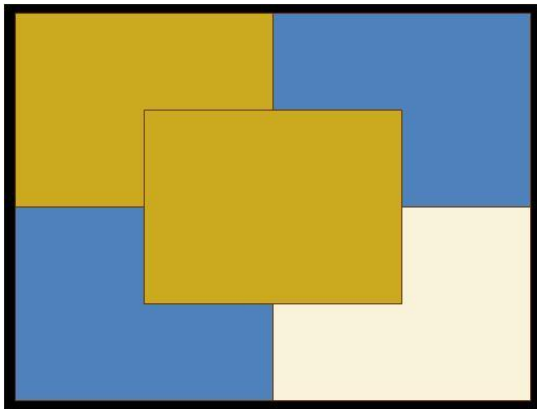
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graphs and spreadsheets. It involves how human beings perceive and act upon visual information, a science in the realm of “human factors” and “cognitive psychology”. Although this may sound like you’ll need a PhD to understand it, it actually is somewhat intuitive.

It all starts with something known as “pre-attentive variables”; these are the attributes of the dashboard that humans subconsciously pay attention to before they consciously know they are paying attention; thus pre-attentive attributes. This innate perceptual and cognitive capacity to pay attention unconsciously evolved in human centuries ago. So if you’re designing a dashboard to quickly display information, you take into account the pre-attentive variables to essentially get the user’s attention before they know they’re paying attention. Here are a couple of the major pre-attentive variables:

## The position of the information on the dashboard

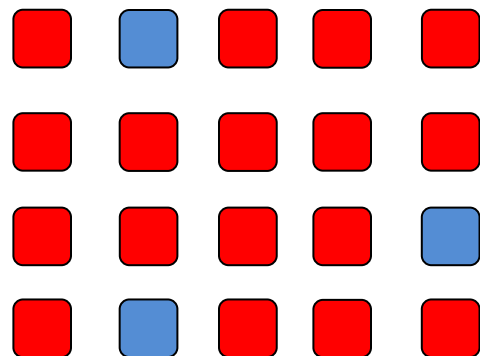


Information can be emphasized or de-emphasized by its position on a display. The visual dominance is the center of the screen (gold). Depending on the culture and how the culture reads (left to right, or right to left) the other area of dominance will either be the top left or top right of the screen. The other corners are neutral (blue), or in the case of the bottom right, actually de-emphasized. So the most important data, such as key performance indicators,

has to go in the center or the top left of the dashboard – this is especially true if other data on the dashboard can only be understood after an understanding of the most important information.

## Color

Color is another pre-attentive variable that can aid in the clarity and quickness of understanding information. Here’s an example of how easy it is to pick out data based on the blue color. In fact, if there were many more data points, the time to scan and quickly pick out the blue data points would be about the same.



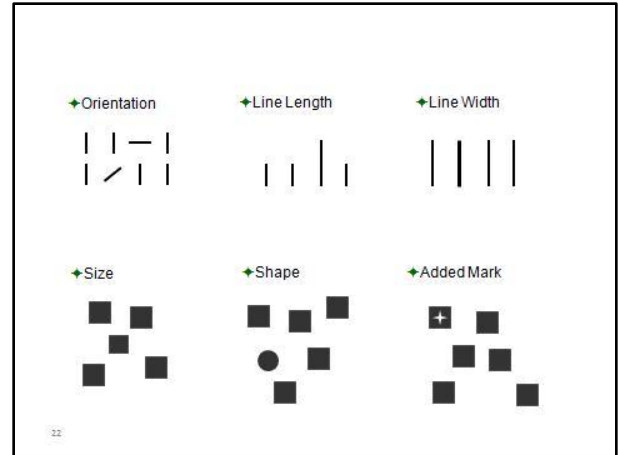
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Our perception of color is relative and dependent on the color or context that surrounds the colored object, so selecting the color of the object and a contrasting and consistent color for the background is important. There are variations of the use of color as a pre-attentive means, such as color hues, brightness and color saturation.

## Shapes and Sizes

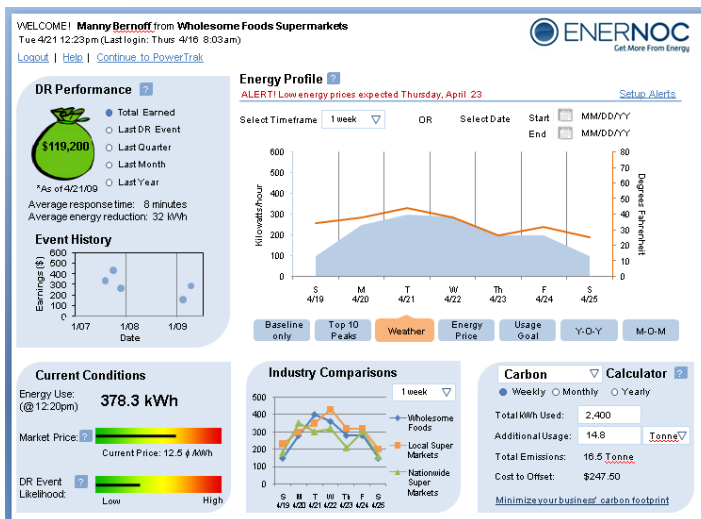
Shapes are also a pre-attentive variable that like color can assist the user in quickly differentiating data sets. The size of a shape may be used to convey quantities or magnitude. Enclosing a set of data in a border or using icons to provide meaning or draw attention are also positive uses of forms and shapes.



The reason pre-attentive attributes are important is simple. Dashboards should quickly and almost instantly allow the viewer to grasp the information important to the user. Pre-attentive features are just a head-start on that process, providing information to the viewer before the viewer consciously knows he or she is paying attention.

## Industry Examples

Here are a few industry examples of well –executed building and energy dashboards:



This is a Demand Response dashboard Enemoc created in 2009. It's one screen with the most important information in the most-emphasized screen position. Viewers can also interact with the dashboard to calculate and change timelines.

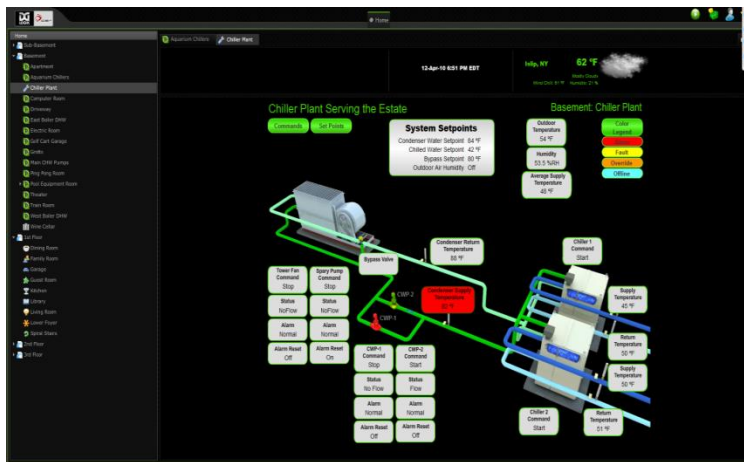
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Lucid Design is best known for their work in higher education and this dashboard addresses electrical use in a dormitory. Note the positioning, the colors, the user options and the clarity.



This is a dashboard, developed by Controlco, is meant for a building engineer to analyze a system, in this case a chiller plant. It quickly conveys the system setpoints, alarm status and provides options on the left for further information.

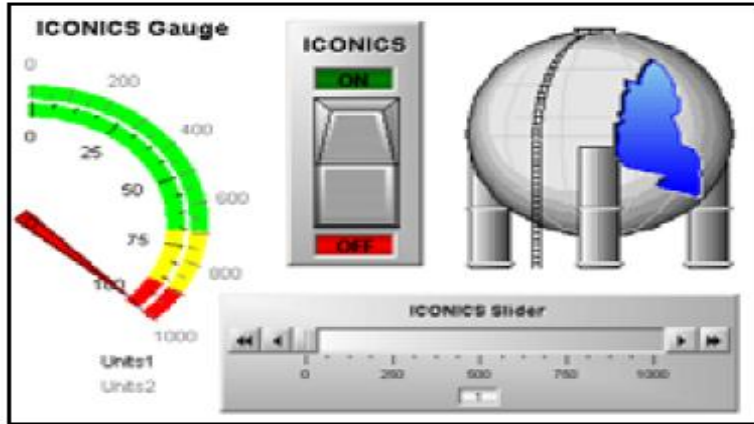


Part of the IBS Intelligent Building Interface System (IBIS®), this module provides you with real-time data and LEED Point information based on Power (Gas and Water optional) Metering sources as well as pre-selected key performance indicators for your Enterprise, Site, Buildings, Systems and Equipment. 3D is optional.



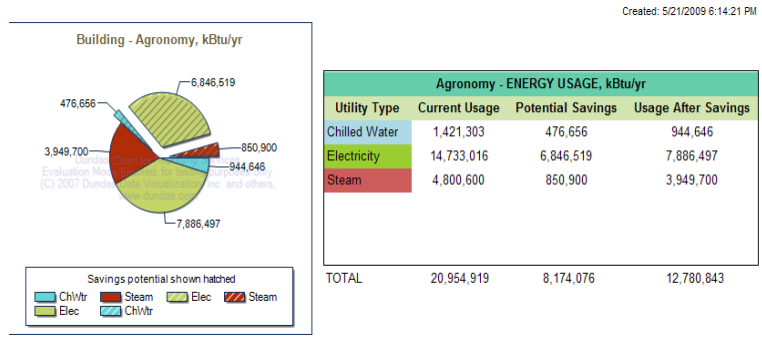
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The dashboard developed by Iconics is customizable via color, background, shapes (gauges, sliders, graphs, charts) and even width, length, captions, and tooltips.

Sensus MI utilizes its EnergyWitness to benchmark each building's performance against an established benchmark. Users can compare more operating parameters such as weather independent base load or set energy consumption goals and benchmark other buildings in the portfolio against it.



Of course, there are many more dashboards to consider and Smart Buildings makes an effort to source any and all entrants to this market. Dashboards are the end result of a lot of work that has to take place to identify, gather and standardize data and to clearly understand the roles and the needs of people involved with facilities and energy. If they succeed in providing actionable information in a timely fashion, dashboards have a positive effect on managing a building's performance and operation.

For more information, write us at [info@smart-buildings.com](mailto:info@smart-buildings.com)