How Low Can You Go?

Setting Performance Targets for the Design of High-Performance, Low-Energy Buildings

“We simply must do everything in our power to slow down global warming before it's too late,” said Gov. Arnold Schwarzenegger in September 2006, when he signed Assembly Bill 32, the California Global Warming Solutions Act of 2006. This landmark legislation, also known as the California Global Warming Solutions Act of 2006, requires the California Air Resources Board (CARB) to develop regulations and market mechanisms that will reduce California's greenhouse gas emissions to 1990 levels by 2020.

In December 2008, CARB submitted its Climate Change Proposed Scoping Plan, which outlines the State's strategy to achieve the 2020 goals via a "comprehensive set of actions designed to reduce overall greenhouse gas emissions in California, improve our environment, reduce our dependence on oil, diversify our energy sources, save energy, create new jobs, and enhance public health." Measures in the Scoping Plan approved by CARB will be further developed over the next two years and put in place by 2012. Although AB 32 doesn't target specific energy-using sectors, the Scoping Plan calls for expanding and strengthening existing building and appliance standards and states that “Green building systems have the potential to reduce approximately 26 MMTCO₂E [million metric tons of CO₂ equivalent] of greenhouse gas emissions.” Clearly, buildings are a major contributor of greenhouse gas emissions.

Targets as aggressive as a 50% reduction in building energy use may sound daunting, but information, technologies, and products crucial to achieving high-performance buildings are available today. In fact, according to the U.S. Department of Energy (DOE), buildings in the United States use more energy than any other sector of the economy. DOE estimates that the nation's 114 million households and over 4.7 million commercial buildings account for about 40% of total U.S. energy use, with 22% from residential buildings and 18% from commercial buildings.

Other estimates place building energy consumption even higher. According to Architecture 2030, a nonprofit group addressing climate change solutions in the fields of architecture and planning, buildings account for as much as 48% of all U.S. energy consumption. This figure factors in not just the energy required to operate buildings, but also the embodied energy of building materials, such as the energy used to extract, transport, and process the materials used to manufacture concrete, glass, metal, and carpet.

Ratcheting Up Building Energy Performance

These days, many forward-looking designers and owners of commercial buildings across the state are taking a harder look at their buildings’ energy use and related greenhouse gas emissions—and many are setting extremely ambitious energy performance targets for their new construction projects.

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Targets as aggressive as a 50% reduction in building energy use may sound daunting, but keep in mind that information, technologies, and products crucial to achieving high-performance buildings are available today. In fact, Energy Design Resources’ Design Guides, Design Briefs, and other online resources were specifically developed to help designers and owners meet ambitious energy performance targets for new construction. To access these and many more free resources, visit www.energydesignresources.com.

**Whole-building Energy Performance Targets**

A number of organizations promote using whole-building targets as a path to dramatically improving the performance of the nation’s building stock. Here is a rundown of the principal yardsticks for new commercial buildings in California:

**Savings By Design**  
Sponsored by California’s largest utilities under the auspices of the Public Utilities Commission, Savings By Design (SBD) offers nonresidential building owners and their design team incentives and design assistance to meet ambitious energy efficiency targets.

SBD’s Whole Building Approach enables the design team to consider integrated, optimized energy efficiency solutions. For a new building to be eligible for incentives, its energy performance must be at least 10% better than required by Title 24. The better the performance compared to Title 24, the higher the incentive rate, up to a maximum of $500,000 for the owner and $50,000 for the design team. See Table 1.

**Table 1. Incentive Rates and Entry Levels**

<table>
<thead>
<tr>
<th>Approach and System Categories</th>
<th>Entry Levels (% Beyond T24)</th>
<th>Incentive Rate Per Annualized Energy Savings</th>
<th>Peak kW Incentive Rate</th>
<th>Maximum Incentive Per Project*</th>
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<tbody>
<tr>
<td><strong>WHOLE BUILDING APPROACH</strong></td>
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<td></td>
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<tr>
<td>Owner Incentive</td>
<td>10%</td>
<td>$.10 - $.25/kWh</td>
<td>$.34 - $1.00/therm</td>
<td>$500,000</td>
</tr>
<tr>
<td>Design Team Incentive</td>
<td>15%</td>
<td>$.05 - $.083/kWh</td>
<td>$.186 - $.33/therm</td>
<td>$50,000</td>
</tr>
<tr>
<td><strong>SYSTEMS APPROACH</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Daylighting System</td>
<td></td>
<td>See NRNC brochure for specific thresholds and requirements</td>
<td>$.04/kWh</td>
<td>$500,000</td>
</tr>
<tr>
<td>Lighting System (Interior &amp; Outdoor)</td>
<td></td>
<td></td>
<td>$.05/kWh</td>
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<tr>
<td>HVAC System</td>
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<td></td>
<td>$.15/kWh</td>
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<tr>
<td>Service Hot Water System</td>
<td></td>
<td></td>
<td>$.10/therm</td>
<td></td>
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<tr>
<td>Process System**</td>
<td></td>
<td></td>
<td>$.09/kWh</td>
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* Incentives are limited to 50% of the incremental costs associated with efficiency upgrades.

** Benchmarking the Energy Performance of Existing Buildings **

Benchmarking is the comparison of the energy performance of an existing building to other typical similar buildings. The following resources can help you identify how much room for improvement there may be for your building:

- **California Commercial End-Use Survey (CEUS), a comprehensive study of commercial sector energy use, primarily designed to support the state’s energy demand forecasting activities.** The latest available survey data, from 2006, can be found at www.energy.ca.gov/ceus/.


To assist in meeting these energy performance targets, the program provides access to computer simulation tools and analysis techniques that can be used to develop the information needed for cost-effective design decisions. For more information, see: www.savingsbydesign.com.
ENERGY STAR Challenge for Architects

The U.S. Environmental Protection Agency’s ENERGY STAR logo is a familiar sight on appliances, electronics, and commercial buildings. But did you know that architecture firms can also benefit from the widespread recognition of ENERGY STAR? Firms that have designed buildings deemed to be among the nation’s best in energy efficiency can now display the “Designed to Earn the ENERGY STAR” graphic on project drawings. Receiving the graphic not only affirms your commitment to energy-efficient designs; it’s also how your firm participates in the ENERGY STAR Challenge and receives recognition from EPA.

To earn this recognition, the Architect of Record must become an ENERGY STAR partner, which is easy and no cost. The designer uses EPA’s Target Finder, an on-line tool to determine if estimated energy use for the design project achieves a rating of 75 or higher, to receive “Designed to Earn the ENERGY STAR” designation. This rating means that the building is designed to perform among the top 25% or better of U.S. buildings.

All projects submitted for the ENERGY STAR Challenge to EPA by March 6, 2009 will be displayed at the 2009 AIA National Convention in San Francisco. For more information: http://www.energystar.gov/index.cfm?c=new_bldg_design.architects_challenge

2030 Challenge

While “Designed to Earn the ENERGY STAR” is a good starting place, EPA encourages architects and their clients to strive for even higher design targets presented by the 2030 Challenge. This challenge, issued by Architecture 2030, calls on the architecture and building community to adopt targets to drastically reduce building-related greenhouse gas emissions.

For new construction and major renovations, the 2030 Challenge sets these targets:

- Design all projects to meet a fossil-fuel, GHG-emitting energy consumption performance standard of 50% of the regional average for that building type.
- Increase the fossil fuel reduction standard to:
  - 60% in 2010
  - 70% in 2015
  - 80% in 2020
  - 90% in 2025
- Carbon neutral by 2030

Architecture 2030 defines carbon-neutral as using no fossil-fuel greenhouse-gas-emitting energy to operate.

Among the many endorsers of the 2030 Challenge are the American Institute of Architects; the U.S. Conference of Mayors; the EPA, the U.S. Green Building Council; and the American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE). For more information, see www.architecture2030.org.

LEED Green Building Rating Systems

Over the past decade, the U.S. Green Building Council's (USGBC) Leadership in Energy and Environmental Design (LEED®) Green Building Rating Systems have become the most widely accepted national benchmark for high-performance green buildings. While LEED has always offered points for energy efficiency in its Optimize Energy Performance category, the USGBC continues to raise the target for LEED-certified buildings to achieve better energy performance and reduce greenhouse gas emissions.

In June 2007, the Council’s membership overwhelmingly passed a vote requiring all LEED certified projects to achieve at least two Optimize Energy Performance points within LEED. This will require that all LEED-Certified new construction surpass the ASHRAE 90.1 energy standard by at least 14%. More info can be found at: www.usgbc.org.

The proposed LEED 2009 will be based upon the more stringent ASHRAE 2007 energy standard, and thus will further drive down energy usage in LEED-Certified buildings. In particular, ASHRAE 2007 includes requirements for improved window characteristics.

Comparing Yardsticks

Not all programs use the same method to quantify energy savings, so one program’s target of 50% savings, for example, may not equal 50% savings using another program’s metric. Table 2 summarizes the baseline standards and metrics that some programs use for energy performance targets.

Table 2. Baselines and Metrics Used by Programs with Energy Performance Targets

<table>
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<tr>
<th>Target System</th>
<th>Baseline Used for Savings Calculation</th>
<th>Metric for Reporting Savings</th>
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<tbody>
<tr>
<td>Savings By Design</td>
<td>Title 24 compliant building</td>
<td>Time dependent valuation (TDV) energy</td>
</tr>
<tr>
<td>Energy Star</td>
<td>Average building of similar type</td>
<td>Source energy</td>
</tr>
<tr>
<td>2030 Challenge</td>
<td>Average building of similar type</td>
<td>Site energy</td>
</tr>
<tr>
<td>LEED-NC 2.2</td>
<td>ASHRAE Standard 90.1 or Title 24 compliant building</td>
<td>Energy cost</td>
</tr>
</tbody>
</table>
Training Highlights

California utilities offer outstanding educational opportunities that focus on the design, construction and operation of energy-efficient buildings. Listed here are a few of the many upcoming classes and events; for complete schedules, visit each utility’s website.

Introduction to Lighting
A beginning-level lighting class looks at ways to reduce energy usage and costs through the proper selection of incandescent, fluorescent, and high-intensity discharge (HID) lighting systems. Offered February 5, 2009 in Tulare. See https://usage.scmu.org/yourAccount/ETCstudent/classlist.asp.

LEED NC v2.2 Exam Preparation Workshop
The USGBC Northern California Chapter, in partnership with GreenStep, is offering a full-day LEED NC v2.2 Exam Preparation Workshop. Offered in Sacramento on February 11, 2009. See https://usage.scmu.org/yourAccount/ETCstudent/classlist.asp.

2008 Nonresidential Title 24 Standards

Comparing Energy Requirements of Green Building Rating Systems

Keys to Higher Performance: Early Goal-Setting and Integrated Design
Adopting an energy performance target is just a starting place. However, targets don’t dictate the most practical or effective design strategies, but rather provide the design team with a goal or set of goals to design toward. The higher the target, the more important it is that it be established and communicated at the very outset of the planning and design process.

If architects are to meet ambitious energy performance goals, they need to know those goals very early in the design process when they are making fundamental decisions about the building’s orientation, massing, layout, materials, and other features. Engineers and energy consultants need to know performance targets at the early design stage so that they can create a simulation model of the building to determine if the design is capable of meeting its energy performance goals.

In addition to early goal-setting, to achieve a high-performance building all the major players involved in design and construction must work closely together from the beginning of the planning phase all the way through the commissioning phase.

This process, known as integrated building design, requires more design time and resources than the traditional approach to design. But it has greater potential to produce buildings that are more efficient, more comfortable, and more marketable than buildings that follow the conventional design and construction path. Some buildings designed following an integrated design approach consume less than half the energy of conventionally designed buildings. For more information, download the Energy Design Resources Design Brief, Integrated Building Design: http://www.energydesignresources.com/Design/IntegratedEnergyDesign/tabid/89/articleType/ArticleView/articleId/110/Design-Briefs-Integrated-Building-Design.aspx.