ZNE Design Fundamentals

A ZNE building produces as much energy as it consumes over the course of a year.

Integrated Design and Advanced Technologies = High Performance

National Renewable Energy Laboratory | Golden, CO
Photo: Dennis Schroeder, courtesy of NREL/DOE

Achieving a zero net energy (ZNE) goal for any new commercial construction or deep renovation project requires a commitment by the design team to a fully integrated process where the interrelationships between the building and its systems, surroundings and occupants make efficient and effective use of all resources. For example, many of the completed ZNE buildings located in coastal marine areas have been able to greatly reduce or even eliminate the need for mechanical cooling by prioritizing natural ventilation as part of their design scheme.

Integrated project delivery involves making all members of the design team aware of the project goals and outcomes including setting energy performance targets such as EUI (energy use intensity) at the onset. It also requires engaging project participants early in the design process, so each member can understand how their role contributes to the greater design of the whole project.

This team-oriented approach ensures the proper design strategies and high performance technologies that are so critical to the outcome of ZNE buildings are selected and implemented in a way that maximizes effectiveness and efficiency.

"The traditional approach, where the architect designs the building shape, orientation and envelope and then transmits the drawings to the mechanical and electrical engineers for their design, is a sequential approach that misses the rich opportunities for optimizing building performance through a collaborative approach throughout the design process."

Lynn G. Bellenger, P.E. ASHRAE Fellow
Former President, ASHRAE

The Four Major Components of Integrated Design

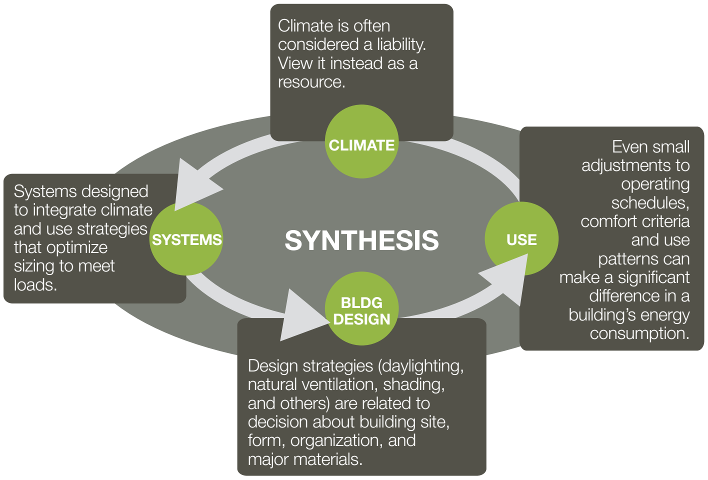

Image courtesy of BetterBricks/NEEA

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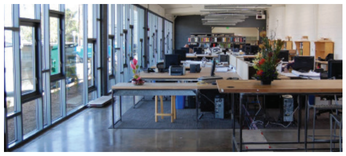

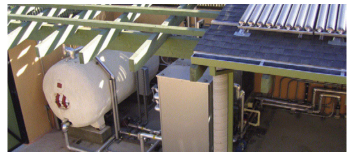

F1/ HIGH PERFORMANCE SHELL

A high performing building shell needs to consider air tightness, insulation levels, glazing attributes, roof reflectivity, mass and the orientation of the building to sunlight, wind and the elements. Ultimately the shell should help optimize the other building systems.

F2/ HIGH PERFORMANCE LIGHTING & DAYLIGHTING

When combined with daylighting and integrated controls, efficient electric lighting offers significant energy savings due to reduced electric lighting loads—up to 70%, according to some studies. A reduced lighting load can also result in a downsized mechanical cooling system.

F3/ HIGH PERFORMANCE MECHANICAL SYSTEM

Utilize local climate/site resources to offset building energy needs. Once the design team has selected a system, the components specified must be the most cost-effective and efficient available. Consider decoupling the ventilation component from heating and cooling systems.

F4/ HIGH PERFORMANCE CONTROLS

Building controls are critical to integrating multiple high performance systems and recognizing potential energy savings associated with mechanical, lighting and plug load strategies. It is important that all control systems are commissioned to ensure optimal performance.

PROJECT PROFILE

DPR Construction Office | San Diego, CA

Photo: David Hewitt

Taking advantage of San Diego's mild climate, the DPR Construction office building was designed to use cross and stack ventilation strategies to passively ventilate and cool the open office area. By installing operable windows at the north curtain wall and roof monitors at the south side, the number of hours the HVAC system is used was reduced by 79% a year.

DPR's concept of "bringing the outside in" was a key component to reducing the building's energy consumption. Removing suspended ceilings, adding roof monitors and installing Solatube skylights over the work stations gives all employees access to natural daylight and reduces their estimated lighting energy consumption by 53%, or 29,000 kilowatt-hours (kWh) annually.

To reach DPR's Zero Net Energy goal, a roof-mounted 64 kw-AC photovoltaic (PV) panel system was installed. This system generates enough renewable energy to offset the building'sestimated annual energy consumption. According to their online dashboard, DPR's total annual energy use for 2011 is about 100,000 kWh offset by 118,000 kwh generated through solar PV's.

Resources for more information:

New Buildings Institute ZNE Resources

http://newbuildings.org/zero-net-energy-resources

Produced by New Buildings Institute. For more information, visit **www.newbuildings.org**.