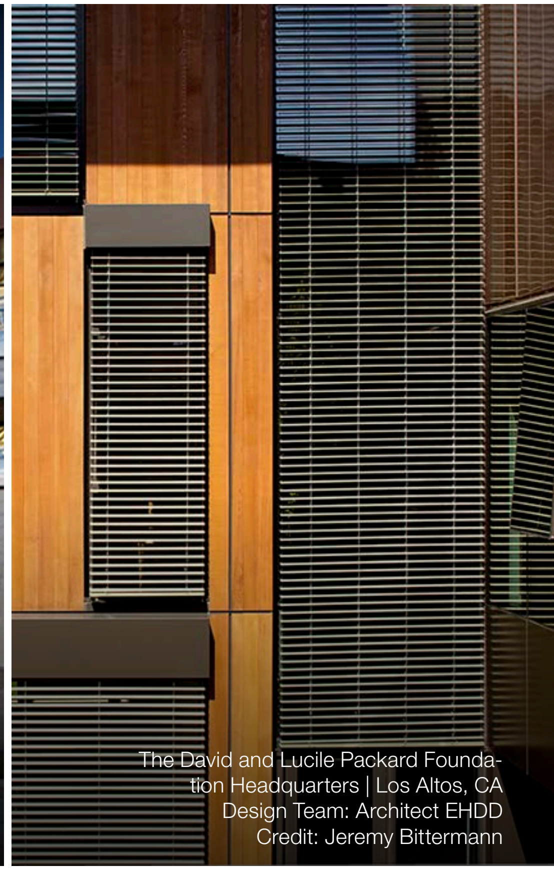
GETTING TO zero

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

Optimize Energy Outcomes with Advanced Technologies and Integrated Design



The David and Lucile Packard Foundation Headquarters | Los Altos, CA
Design Team: Architect EHDD
Credit: Jeremy Bittermann

Integrated building system design encourages interactive efficiencies of readily available, high-performance technologies to achieve the significant energy load reductions critical to zero energy (ZE) outcomes. For example, a tight, well-insulated building envelope can reduce heating and cooling capacity, decreasing the size of the mechanical system, upfront construction costs, and long-term operating costs.

Designing integrated systems requires a design team with an aligned ZE goal and one that communicates early and often during design; this process is known as the integrated design process. This team-oriented, integrated design process will ensure the most appropriate design strategies are considered and encourages exploring interactive efficiencies of readily available, high-performance technologies to achieve the significant energy load reductions critical to ZE outcomes.

THE FOUR MAJOR COMPONENTS OF INTEGRATED DESIGN

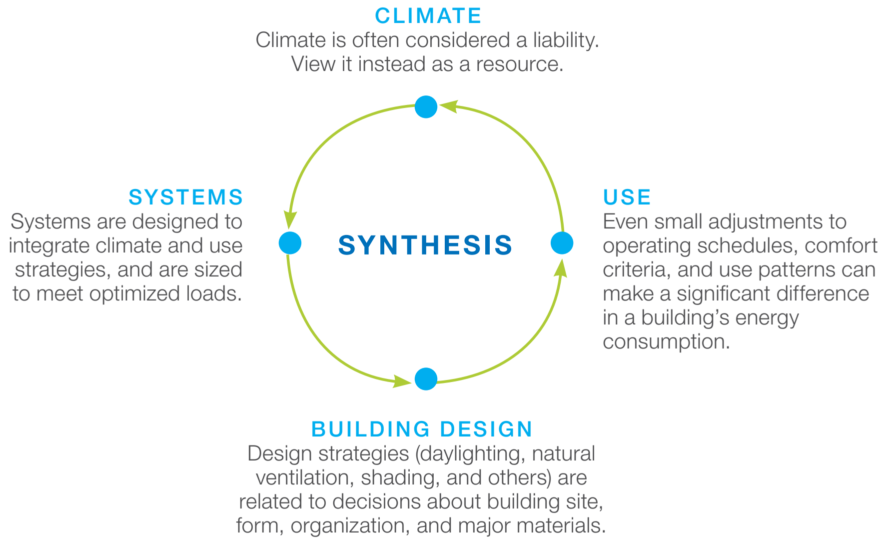


Image courtesy of BetterBricks/NEEA

“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

ZE DESIGN FUNDAMENTALS

1

ENVELOPE

A high performing building envelope 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 envelope should help optimize the other building systems.

2

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.

3

MECHANICAL SYSTEM

Decouple the ventilation and heating and cooling components to save up to 50% of mechanical system energy needs. Utilize temporary (night flush) or permanent passive ventilation to further reduce or eliminate mechanical space conditioning needs.

4

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. The role of the controls integrator is creating a platform to ensure all system controls communicate as designed and can optimize building performance.

PROJECT PROFILE

DPR CONSTRUCTION OFFICE

SAN DIEGO, CA

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, DPR Construction reduced the number of hours the HVAC system is used by 79 percent 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 DPR's estimated lighting energy consumption by 53%, or 29,000 kilowatt-hours (kWh) annually.

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

RESOURCES

To access NBI's collection of ZE resources, including case studies, research, and tools and guides for getting your project to ZE, visit **gettingtozeroforum.org**.

nbi new buildings institute

New Buildings Institute (NBI) is a nonprofit organization driving better energy performance in commercial buildings. We work collaboratively with industry market players—governments, utilities, energy efficiency advocates and building professionals—to promote advanced design practices, innovative technologies, public policies and programs that improve energy efficiency. We also develop and offer guidance and tools to support the design and construction of energy efficient buildings.