Net Zero Buildings

Almost 40 percent of all the energy used in the United States is consumed through the construction, maintenance, and use of buildings. Various industries, private home owners, educational and public institutions are increasingly focused on improving efficiency and reducing energy use across all stages of a building's life. Green building, such as using local and renewable materials or passive solar design, date back millennia – the Anasazi in the Southwest built entire villages so that all the homes received solar heat in the winter. The contemporary green building movement arose out of the need and desire for more energy efficient and environmentally friendly building practices. The oil price increases of the 1970s spurred significant research and activity to improve energy efficiency and find renewable energy sources. This, combined with the environmental movement of the 1960s and 1970s, led to the earliest experiments with contemporary green building. The green building field began to come together more formally in the 1990s. A few early milestones in the U.S. include:

- the ENERGY STAR program (1992),
- the first local green building program introduced in Austin, TX (1992),
- U.S. Green Building Council (USGBC) founded (1993)
- Leadership in Energy and Environmental Design (LEED) pilot program (1998)

The J. Craig Venter Research Institute at UC San Diego of California is considered one of the most sustainable laboratories in the world. It is designed for LEED Platinum certification and to achieve net zero energy, but is expected to produce more energy than it uses. (Nick Merrick © Hedrich Blessing Photographers)

The concept of a Net Zero Building, one which uses no more energy over the course of a year than it produces from onsite renewable sources, is evolving from research to reality. Currently, there are only a small number of highly efficient buildings that meet the criteria to be called Net Zero, but as a result of advances in construction technologies, renewable energy systems, and academic research, creating Net Zero buildings is becoming more and more feasible.
While the exact definitions vary, most agree that Net Zero Buildings combine:

1. Exemplary building design to minimize energy requirements
2. Renewable energy systems that meet these reduced energy needs.

Most Net Zero Buildings are still connected to the electric grid, allowing for the electricity produced from traditional energy sources (natural gas, electric, etc.) to be used when renewable energy generation cannot meet the building's energy load. Conversely, when on-site energy generation exceeds the building energy requirements, the surplus energy can be exported back to the utility grid, where allowed by law. The excess energy production offsets later periods of excess demand, resulting in a **net** energy consumption of zero.

Getting to Net Zero — Progress & Ideas

In the United States, California leads in the number of low and zero energy projects with 58, followed by Oregon (18), Colorado (17), Washington (16), Virginia (12), Massachusetts (11), Florida (10), **Pennsylvania (10),** Illinois (8), North Carolina (8), and New York (8). If Net Zero buildings are to become commonplace or standard, they will need to be supported by updated building codes and other regulatory improvements. An examination of the entire permitting process can help prevent unintended consequences of regulatory fixes that could make another aspect of sustainable design impractical or unworkable. Local governments need the appropriate information and resources to help evaluate their full suite of design and development regulations to ***identify and remove permitting barriers that inhibit sustainable site design and green buildings in their communities.***

While broadly requiring Net Zero buildings may not be feasible, a process that progressively updates codes incrementally over time is an important policy and a clear signal to the marketplace that change is coming. Ideally this updating process would be aligned with voluntary and incentive programs to ease market transformation. Elements could include:

- Establish a long-term goal for energy efficiency and require or incentivize progressive steps over time
  - Oregon and California have passed legislation requiring all new buildings be net zero by 2030
  - Washington State legislation requires a 70% reduction in energy use relative to the base building code of 2009 by the year 2027
- Create incentives for net zero at the local level (e.g. density bonuses, fast track permitting, technical assistance, awards, etc.)

The Sustainability Chapter of the **Centre Region's Comprehensive Plan** (2013) includes several objectives and policies that support moving towards greater energy efficiency and utilization of renewable or alternative energy including:

OBJECTIVE 4.1 - Alternative energy sources that take advantage of renewable or alternative technologies should be considered for the Centre Region.

POLICY 4.1.5 - In conjunction with accepted emergency management practices, municipalities should encourage residents to explore alternative energy sources that can provide self-reliance for homes in cases of natural disasters or other emergencies when extended electrical outages are expected and access to emergency services are limited.

OBJECTIVE 4.2 - The Centre Region municipalities should work to reduce barriers to alternative energy uses to help decrease dependence on finite natural resources.

POLICY 4.2.1 - Where appropriate, land development ordinances should be reviewed and updated accordingly to allow for alternative energy options to be incorporated into land uses. This should include but not be limited to wind, solar, geothermal, or other advanced technologies.

The Bullitt Center in Seattle produces 244,000 kilowatt-hours (kWh) per year of energy and uses only 143,000 kWh—generating enough surplus energy to power eight homes. This six-story building uses 18 percent as much energy as a typical building this size. What is most remarkable about this is that the building achieves net-positive energy in an environment with limited year-round sunshine.

Sources: Urban Land Institute, Living Building Challenge, Phipps Conservatory, New Building Institute, WildCenter.org, National Institute of Building Sciences

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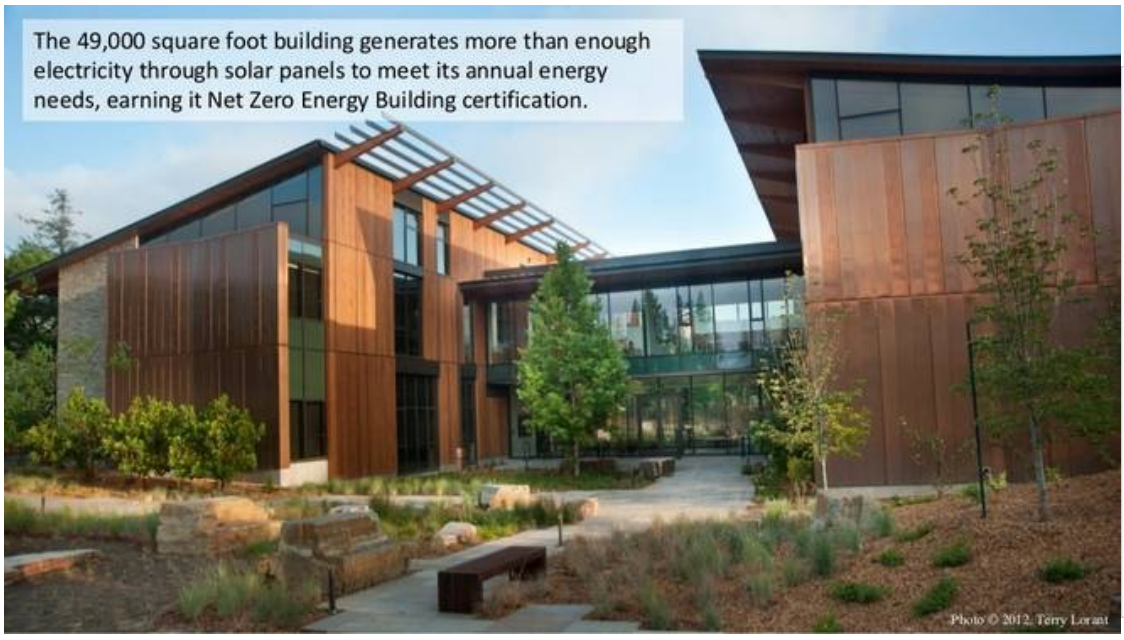
Examples of Net Zero Buildings

Phipps Conservatory and Botanical Gardens in Pittsburgh has become a world leader in sustainable innovation for its Center for Sustainable Landscapes (CSL), a facility that houses groundbreaking sustainability research and science education programs, and serves as a key part of the public garden's immersive visitor experience. In producing all of its own renewable energy, and treating and reusing all water captured on site, the CSL demonstrates the benefits of building in harmony with nature.

The CSL is the **first project** to attain the highest sustainable building certifications:

- **Living Building Challenge**, the world's most rigorous green building standard
- **LEED® Platinum** — tied for the highest points awarded
- First **Four Stars Sustainable SITES Initiative™** for a landscape project
- First **WELL Building Platinum** project



The David and Lucile Packard Foundation,
Los Altos, CA

A cooling tower provides chilled water to a 50,000 gallon storage tank that is passively cooled during nighttime hours. The water is circulated throughout the building to chilled beam exchangers. These chilled beams cool the localized air, allowing it to sink into the space and displace warm air.