

With the Center for Sustainable Landscapes (CSL), Phipps transforms the conventions of energy efficiency in the green building movement by pursuing a goal that has never been achieved before. In generating its own energy while treating and reusing all water captured on site, the 24,350-square-foot research, education and administration facility, which opened in 2013, is designed to exceed four of the highest green construction standards: The Living Building Challenge™, for which Net Zero Energy Building Certification was achieved in February 2014, with Full Certification in pursuit; Four-Stars Sustainable Sites Initiative™ (SITES™) certification for landscapes, awarded in November 2013; LEED® Platinum, awarded in August 2013; and WELL Certification™, a new protocol measuring human wellness in the built environment. In its first operational year, the CSL achieved an EUI of 20.125 kBtu/sf/yr, with a net EUI of -0.792 kBtu/sf/yr, a 70.7% reduction vs. median EUI for a building of its type per EPA'S Target Finder (68.7 kBtu/sf/yr median EUI vs. 20.125 kBtu/sf/yr CSL EUI).

As part of the guest experience at Phipps – a public garden attraction visited by over 300,000 people annually – the CSL is uniquely positioned to maximize public exposure to energy efficient technology and strategies. A visit to the CSL affords an up-close look at PV arrays, a vertical axis wind turbine, geothermal wells, a rooftop energy recovery unit, a green roof, desiccant dehumidification, a digital building management system interface, solar-powered water distillation, phase-change materials, mechanical windows, rainwater harvesting, a lagoon, constructed wetlands, rain gardens and permeable paving — all within a single site. The CSL is the latest phase of a multi-year high-efficiency building project at Phipps, where it stands alongside the first LEED®-certified visitor center in a public garden; a 36,000 square-foot LEED Platinum EBOM production greenhouse with an open-roof system and computer-controlled temperature, light and humidity; and a 12,000-square-foot Tropical Forest Conservatory which was the most energy-efficient in the world when it opened in late 2006.

During facilitated integrated design charrettes, the CSL project team worked to design a building that connects occupants to nature and maximizes efficiency. Studies showed photovoltaics would be more effective than wind in generating energy and that geothermal energy could meet the building's imperative to operate with less than 30% of the energy of a typical office building. The CSL's was designed with a long, narrow floor plan to provide maximum southern exposure for daylighting and solar gain. The orientation maximizes ventilation via southerly spring and summer winds while minimizing exposure to westerly winter winds. Sun-tracking studies informed the design and placement of solar shades, allowing full winter sun to penetrate the building while minimizing summer solar gain. Interior light shelves provide daylighting throughout the year, extending natural light into the 40-foot maximum-width office space. The atrium is unconditioned; extensive use of concrete and phase change material provides thermal mass that, when managed via automatic shade cloths, window walls and roof top vents, creates comfortable conditions. Deciduous trees and vines covering exterior concrete walls aesthetically integrate building and landscape while improving energy performance of the building envelope. LED task lights provide additional light if necessary. Lighting power density is reduced to 0.57 W/sf without adjustment for controls. Daylight autonomy in most of the project space is approximately 80%; total projected energy savings to 90.1-2004 baseline is 77%. Having a net-zero building powered by onsite renewable energy sources eliminates use of fossil fuels and the greenhouse gasses associated with carbon-intensive energy production and distribution; adaptability during peak demand and outage periods is also enhanced.

As increasing numbers of people discover the CSL and its potential for replication, they will be encouraged to mount similar projects at their home, business and community levels. Through talks, presentations, tours and education programs, Phipps highlights the various components of the building's energy-efficiency strategy and explains how they could operate in home and community settings. With the CSL now fully operational, Phipps is conducting original research around the project in collaboration with Carnegie Mellon University and University of Pittsburgh on the subjects of sustainable building performance and the psychological health benefits of exposure to nature. To ensure the discoveries made at the CSL are available to others worldwide, *Building in Bloom*, a paperback case study of the design and construction phases – the first of its kind for a Living Building – was published in 2013, and a videography crew documented the design charrettes for educational use.

Now in its 120th year, Phipps Conservatory and Botanical Gardens has grown from a horticultural showcase into an internationally-recognized sustainable leader through the introduction of revolutionary buildings and practices to its campus. Today, efficiency and sustainable values make Phipps a model for the world. The café features local and organic foods, and utilizes produce grown in onsite display gardens; food and material waste is composted, and bottled water and soda have been eliminated from its offerings. The horticulture team promotes local, non-invasive species, utilizes drip irrigation, composts plant material, and practices integrated pest management. 100% of campus electricity is produced on-site with solar panels and wind turbines or offset by offsite renewable resources. Purchasing preference is given to sustainably produced, recycled and FSC-certified products. The gift shop promotes sustainable, fair trade goods. The Homegrown project, launched in 2013, installs home vegetable gardens in underserved neighborhoods. Botany In Action, a research fellowship for emerging plant scientists, has supported 40 PhD students. Let's Move Pittsburgh, a local collaborative to curb childhood obesity, launched in 2010. A sustainable horticulture certificate program teaches gardeners to create their own green landscapes. Studio Phipps, a consultation group, has designed sustainable landscapes and maintenance specifications for three area businesses. Through university partnerships, Phipps is conducting original research in the fields of high-performance buildings and the psychological health benefits of exposure to nature.