

Net Zero Labs: Pipe Dream or Next Big Thing?
I²SL New England Chapter Event
May 29, 2014

The New England Chapter of I²SL facilitated an evening of presentations, panel discussion, and networking on May 29th, focused on the theme of Net Zero Labs. While “Net Zero” has become the pinnacle of sustainable building design, achieving this level of combined energy reduction and onsite production has not been perceived to be achievable in laboratory facilities that typically consume four to ten times the amount of energy used by a typical office building. What deep energy efficiency measures can be successfully applied to different labs? How close are we to achieving Net Zero in lab? These were the questions posed to presenters and panelists alike in front of a gathering of approximately 70 guests at the Fort Point meeting room at the BSA in Boston.

Ralph Stuart, Chemical Hygiene Officer at Cornell University, started the evening’s presentations by providing an overview of Cornell’s Climate Action Plan, which has a long term goal of reaching a net zero



campus in spite of being a research intensive institution. Cornell’s first green power source dates back to 1904 when they brought a hydroelectric dam online for the university (and city’s) power needs. The university also makes good use of the nearby Cayuga Lake, deploying lake water cooling in 2000 and eliminating 86% of its electrical cooling demand. Most recently, the university has nearly completed the installation of a 1,600kW, 11.5 acre solar photovoltaic field which will produce an estimated 2.5 million kWh per year.

Ralph Stuart presents Cornell’s Sustainability Plan

On the energy conservation side of the equation, Cornell is in the second phase of an energy conservation initiative, committing \$43 million across 150 buildings (nearly 14 million gross square feet of space); a third phase of this program is already in development to address energy conservation beyond the year 2015. Laboratories represent a critical path to a successful energy conservation program at Cornell; labs make up approximately 33% of their overall campus footprint, but are responsible for 50% of the energy budget. Cornell’s lab energy conservation measures include:

- Fume hood sash height mechanical limit of 18 inches
- Reduced fume hood face velocities (80 fpm)
- Occupancy Sensors for lighting control
- ACH Reduction based on control banding
- A Lab Ventilation Management Plan (LVMP) to balance the energy, safety, and operational objectives of each lab facility

Following Cornell's kickoff presentation, Neil Cahalane, Principal with Ellenzweig and Kevin Moriarty, Associate with Ellenzweig, reviewed a recently completed renovation of Harvard's Nocera laboratory. The project involved a complete internal demolition and fit out of a wet chemistry lab and a laser lab, as well as the creation of a 2,000GSF mechanical space as a rooftop penthouse.

The project was targeted for LEED Gold certification, incorporating a large number of sustainable features including:

- Water Efficiency improvements, saving an estimated 40% of water usage
- Lighting improvements, reducing lighting power density to 0.94W/sf
- HVAC energy efficient equipment upgrades
- Low emitting construction materials and other Indoor Air Quality measures

The new lab incorporated systems to lower energy consumption as well as informational devices to help drive improved behaviors that would further increase energy savings. Combination and spit sash designs on the new fume hoods will help minimize the hood opening, while decreased face velocities (70-80fpm) will reduce exhaust requirements of those hoods, saving an estimated \$56,000 per year. Visual displays were installed to show real-time air flows next to minimum and maximum flow rates help occupants "keep score" of how well they are managing their sashes. These behavior changes could save an additional \$120,000 to \$160,000 annually.



Harvard's Nocera Laboratory, third floor chemistry labs before and after renovation

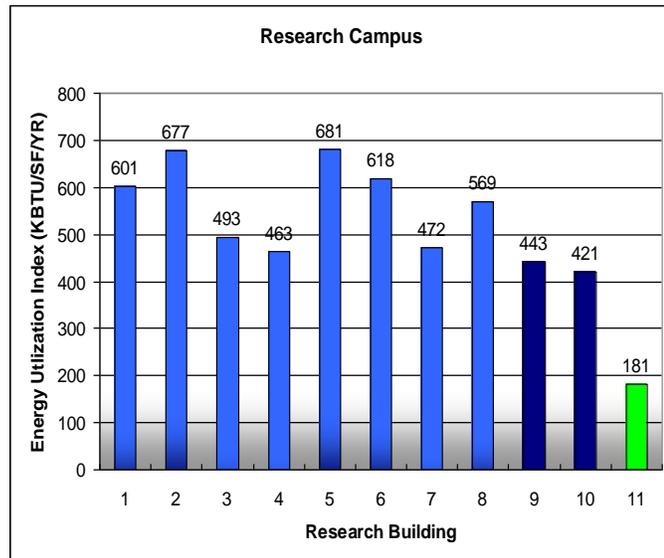
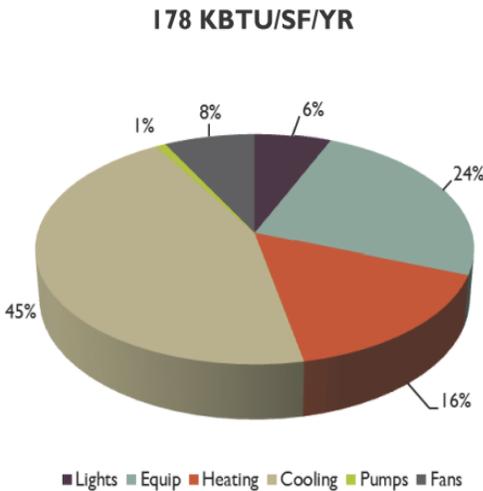
Tom Stella and Roselin Osser from WSP wrapped up the presentation portion of the agenda with an overview of the Yale Sterling Chemistry lab renovation project. The goals of this project were to renovate both the teaching lab areas and basement mechanical space and incorporate energy conservation measures that would leverage the buildings' design and usage.

WSP's strategy involved new LED lighting, use of a multi-process chilled water system, exhaust heat recovery, advanced building controls, and distinct use of separate air handlers for different types of spaces in the building. Laboratory spaces requiring 100% outside air were served by a dedicated air handler unit based on a distinct occupancy schedule; unlike research labs that could be in use at any time of the day or night, these teaching spaces will be used infrequently on a specific schedule. Office space surrounding the labs are served by a different air handler, with the conditioned air from these spaces naturally transferring into the lab spaces, reducing the reheat load in the labs. Exhaust heat

recovery played a significant role in the energy reduction of this project, both in terms of pre-heat energy and re-heat energy savings.

WSP’s strategy yielded very positive results; energy modeling of the renovation calculated 34% savings from ASHRAE 90.1 2007 baseline figures, with an estimated energy use index (EUI) of approximately 180KBTU/sf/yr. This estimated EUI is far below the benchmark for research facilities; typical laboratory EUIs can range between 400 and 700KBTU/sf/yr (see chart below).

ESTIMATED EUI (ENERGY USE INDEX)
OF BUILDING AREA INCLUDED IN MODEL



Panel Discussion

Paul Sullivan, President of R.W. Sullivan Engineering, served as the evening’s moderator for the panel discussion to further explore the progress towards net zero and the issues and obstacles hindering the achievement of this goal. The invited panelists—Fran Boucher, Energy Efficiency Manager at National Grid, Bob Flaherty, Senior VP and Senior Mechanical Engineer from WSP, Paul Lukitsch, Regional Facilities Manager at EMD Millipore, and Ralph Stuart from Cornell—all brought unique perspectives to the topic of net zero laboratories. Here are a few of the points made by the participants in response to questions from the audience and moderator:

- Very few labs are capable of achieving net zero, but it is possible; Bristol Community College is projected to be the first net zero lab facility in New England.
- New technologies, such as filtered fume hoods being deployed by Bristol CC, will play an important role in reducing the energy consumption of laboratory buildings.
- Utility incentives can also play an important role in achieving deep energy efficiency within laboratory buildings; these programs are well funded and are being modified to be more favorable to net zero projects.
- Communication is another critical component to achieving energy reduction goals. Occupants need to understand their impact on the ultimate success or failure of any energy conservation measure. Charging lab occupants for their energy use is another way to “raise awareness” in this regard.
- A range of energy efficiency strategies need to be deployed, which may stretch the return on investment timeframe, but this will help building owners realize maximum energy savings and reduce the amount of onsite renewable needed to achieve net zero.