

# Integrated Solutions Showcase: Energy Cost Reductions in HVAC

The Navy Yard | Building 101  
Philadelphia, PA  
1/17/13 | 1:00pm – 4:30pm

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## Integrated Solutions Showcase Overview

- The EEB Hub Showcases examine how new lighting, HVAC, windows, façade, building control systems, and other technologies can be integrated into whole building solutions to significantly reduce building energy use.
- The showcases also explore Advanced Energy Retrofit (AER) projects, ROI and payback of energy efficient products and technologies, and other regional market engagement issues.
- These showcases are targeted to building owners, occupants, design and construction professionals, and suppliers.

**HVAC Energy Cost Reductions Overview:** The Carrier Corporation presented new advances in heating, ventilation, and air conditioning (HVAC) technology for commercial buildings. The speakers covered different aspects of HVAC systems, from exterior equipment (rooftop units) to interior parts (chilled induction beams) to end user controls (building automation and control networks). These systems are vitally important to energy efficiency as they represent the actual devices that expend electricity to heat and cool buildings. Making them more efficient will in turn dramatically lower a building's energy usage.

HVAC advances work in concert with other design and technology solutions, such as better building envelopes, benchmarking and disclosure, and occupant empowerment, to achieve an overall impact on a building's energy consumption that is at the heart of the integrated solutions showcase.

The latest trends in **Commercial rooftop units (RTUs)**, use in over half of all commercial buildings in the U.S. were discussed. Retrofitting RTUs is very easy, as the newer, more efficient units fit in the same location as the current units. Upgrading from an RTU with a 10.8 energy efficiency rating (EER), which is the minimum according to ASHRAE 90.1-2010 energy efficiency standards, to one with a 12 EER, the minimum requirement of the Consortium for Energy Efficiency (CEE) Tier II rating system, would provide energy savings of 38% over technology that is only ten years old. In other words, recent innovations are making a big difference. The speaker also highlighted the EnergyX Energy Recover System, which pre-conditions outside air prior to entry with cool air coming out, thus increasing the effective efficiency of the HVAC system. EnergyX can double a system's heating capacity without increasing the gas bill, and the speaker estimated that commercial buildings in Philadelphia could save \$1,500-2,000 per year. Finally reviewed were new technologies developed to meet higher standards passed in the state of California, including supply fans that slow down when cooling demands are

lower, which with upgraded equipment can easily produce 30% energy savings, while 60% savings are well within the realm of possibility.

- **Question: HVAC systems work well when they are new, clean, and in good repair, but filters can clog them and slow down belts. How do these numbers stack up in less than ideal conditions?**
  - You can only compare new product efficiency. While assumptions can be made about degradation, it is always better to maintain the product. Unfortunately, rooftop units are often out of sight and out of mind for building owners, so this doesn't always happen.

The next presentation reviewed the history of ceiling-mounted **chilled or induction beams**, which send cool air down into a room and draw up hot area to in turn be chilled. Invented by Willis Carrier in the 1930s, they were part of the initial method for air conditioning buildings but at the time were dirty and noisy. They fell out of favor until the 1990s, when Scandinavian and Northern European countries adopted and updated the technology. However, the European method is not very adaptable to U.S. buildings, because the former cycles water around a building while the latter uses air in order to heat and cool. Newer induction beams in the U.S., however, have higher capacity, provide sensible and latent cooling (which chills both dry and humid heat), create occupant comfort by eliminating drafts, and produce little noise. Induction beam systems have the potential to cut energy usage by greater than 40% as compared to ASHRAE 90.1 Baseline Rooftop/VAV (variable air volume) systems. For building owners and developers looking for LEED certification, using induction beams can earn 15 of 19 possible points under LEED 2009 EA Credit 1 standards. An added bonus, induction beam systems do not circulate air from one room to another throughout an entire building, a distinct advantage in germ-prone environments like schools and hospitals.

- **Question: In a city like Philadelphia, the issue is not so much heat as it is humidity. How do chilled induction beams handle humidity?**
  - Induction beams can remove latent as well as sensible heat. Latent heat is made up of moisture, so thus humidity, while sensible heat is dry. With induction beams, you can also install dedicated outside air sources to remove some of the humidity as well.

The last presentation addressed **how to achieve sustainability with BACnet**, a data communication protocol for building automation and control networks. The presentation started with the simple thermostat control, like the well-known brand Honeywell. Although intuitive and easy to use, there is much room for improvement. Innovations could prevent thermostat "wars" between employees in an office who cannot agree on one temperature by adding zoning that sets different rooms to different temperatures. Remote access – like setting the thermostat from a smartphone – and the ability to schedule multiple units would both allow for further fine-tuning. In turn, such innovations present other challenges, like complex systems that a user can't fix, "marriage" to a single manufacturer who makes the proprietary system and is thus the only one who can service it, and a limited pool of trained HVAC specialists able to work on such a system. Thus, the presenter introduced the idea of a common protocol

designed for building automation by ASHRAE that would give users the freedom to choose from 612 vendors internationally. Such a system would also lay the groundwork for sensors that would meet the current desires of building owners: demand-controlled ventilation that provides for the precise number of occupants, carbon dioxide sensors that measure actual occupancy and release fresh air into the space when necessary, thus reducing the amount of outside air to be heated or cooled.

- **Question: Can you put sensors on the building envelope to detect some of these indicators?**
  - We can put sensors anywhere you want to put sensor. For example, you can have infrared sensors that you don't even have to trigger. With BACnet, you can get the data in a language you can understand, then normalize it.