Implementing Design Principles to Enhance Energy Efficiency

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...ing research facilities to operate at the highest possible level of energy efficiency requires the lementation of specific design strategies aimed at maximizing resources and increasing savings. In... reductions of between 30 and 50 percent in energy costs, creating billions of dollars in annual savings.

Approximately Reduce the Pressure Drop

...e pressure drop, which represents an original standard set at least decades ago. The environmental safety and health officer was asked why rate was set at 10 and whether the potential hazards were reviewed. After... issues of fume hoods being massive beasts of energy consumption must be sidestepped, as well. A single fume hood consumes as much energy as three average homes, while a lab with 100 hoods utilizes as much energy as a small mid-sized city. The LBNL provides an online tool at http://fumehoodcalculator.lbl.gov that enables users to compare fume hoods.

...eory that fume hoods is the best way to improve energy efficiency," says Mathew. he sure you allow for easy additions and removals to alleviate concerns from...be the Pressure Drop

...roximately 50 percent of the total heating, ventilation, and air conditioning...
Reheat

New chilled-beam technology can be used in labs to avoid systems that require simultaneous heating and cooling. A single-zone requiring cooling can create artificial heating and cooling loads throughout the building. (Photo courtesy of Zimmer Gunsul Frasca Architects.)

Commissioning

All systems should operate the way they were designed to work. Commissioning the building by inspecting all systems prior to occupancy can avoid potential problems in the future. (Photo courtesy of Zimmer Gunsul Frasca Architects.)

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Real with Plug Loads

The loads are basically the heat loads that result from any lab equipment that uses electricity and generates heat. HVAC systems are often oversized out of that a facility might not be able to meet over-estimated plug loads in the re. As a result, chillers and air handlers are often oversized and this leads to necessary expense and wasted operating cost in the long term.

Hanical equipment should be right sized to save capital and operating costs. By actual loads at comparable facilities to fully understand the real load, g improved estimates of heat gain from plug loads.

d out what the plug loads are at a comparable lab and then start your sizing from that rather than an arbitrarily high number," suggests Mathew. "You d to design for high part-load efficiency because labs aren't always going to rate at peak loads. One of the ways you can do this is by using a modular approach.

Example, two large boilers at the LBNL were replaced with 11 smaller, liquid boilers. Each boiler is sized to meet the needs of a single lab space, ramping up or down as needed. This was more efficient and demonstrated how oversizing occurs.

Davis is concerned about plug loads and is using right-sizing, in part, to ease construction budgets and the need to minimize the impact of a mechanical equipment. In order to accomplish these objectives, the center began sizing to a 15-minute average peak rather than an instantaneous peak. Electrical systems must be sized accordingly, but for systems should be sized for a lower quantity.

The use of plug loads is also being used at the Molecular Foundry Laboratory at the UCB. The air handlers and electrical generators were downsized, totaling in a million-dollar initial cost savings. Some of the money saved applied toward additional green features that qualify the facility for a LEED certification.

Say No to Reheat

Id systems that require simultaneous heating and cooling. High-load areas are lower supply air temperature, so reheat occurs in other spaces. Untenable heating and cooling is problematic in labs where variations of heat loads can be enormous. A single zone requiring cooling can create artificial heating and cooling loads throughout a building.

are systems that can be designed to avoid reheat and simultaneous heating and cooling. They involve decoupling of thermal conditioning from the pl of ventilation air," says Mathew. "For example, tempered air could be added to each lab space and then within each lab space fan coils can be zed to take care of the heating and cooling loads in that lab space, so it is sized thermal conditioning with central ventilation supply."

berford College in Philadelphia uses two heat wheels to provide plerature-neutral air to the lab spaces. The heat wheel system requires the pl and exhaust points to be located in close proximity to each other in larger shafts. Within each space, fan coils were used to provide the heating and cooling. The setup completely eliminates reheat in the labs.

The scheme for decoupling and ventilation using passive chilled beams in spaces is being considered in the design of the Li Ka Shing Center, a 0-million health science building that will be constructed at the University of formia, Berkeley beginning in 2008.

Cold beam has chilled water running through it and with a process of natural convection, the warm air rises, comes into contact with the cold beam, cools, then discharges," explains Mathew. "It is a passive approach to effectively the space. Like any good system, it has to be properly engineered and rolled. It is important to remember that 55 degree air that you supply in a duct condensation risk and these passive beams are at a much higher plerature of about 62 degrees."

The Commissioner

nsure all systems are operating the way they are designed to work and that equipment is installed in accordance with planning. There is less expense and decreased risk when the commissioning is done prior to occupancy. If it e during the design, commissioning can avoid potential problems and ever possible opportunities to improve performance.

missioning ensures that systems operate as they are intended, says Mathew. "In labs, commissioning can be used to identify excessive reheat use and control sequences that are not properly implemented, such as air age setbacks during unoccupied periods."
Also, utility companies offer a “Savings by Design” program that reimburses for the initial capital cost of an energy saving measure, up to $150,000 of the incentive. In this case, the local utility company is so enthused about the University of California, Berkeley being a model project for other energy uses, such as labs, that it has raised the standard contribution to the minimum total incentive of $500,000, if certain performance levels are met.

“Those of you looking for sources of capital for your projects, don’t forget energy efficiency because there is big incentive money available,” says Ins of Zimmer Gunsul Frasca Architects.

Fracy Carbasho
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