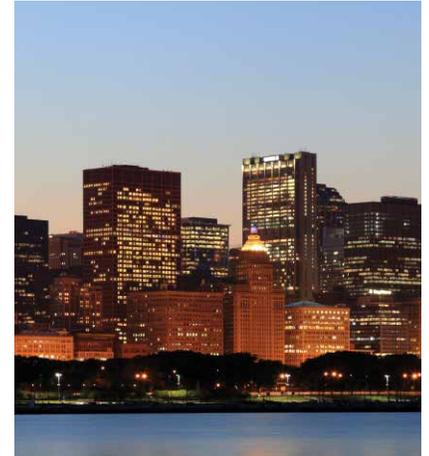


LABORATORIES AND CLEAN ROOMS: AN ENERGY SAVING OPPORTUNITY

TECHNOLOGY FOR ENERGY EFFICIENCY IN CRITICAL ENVIRONMENTS

Many technology-based strategies exist for transforming lab and clean room environments. These include air system technology upgrades, calibration, and improvements to existing systems to save energy.

- **Air Exchange Optimization:** One of the most common design strategies to protect laboratory and clean room occupants is the continuous replacement of the air inside of the critical environment with outside air. This air must be conditioned, possibly filtered, and finally exhausted outside. In many cases, the rate at which air is exchanged in these spaces exceeds that which is necessary. These high levels of ventilation often do not necessarily result in improved occupant safety in critical environments.² Generally laboratories are designed to exchange air at a rate of 4-12 times per hour, but some labs see rates as high as 20 times per hour. Determining if the space may use recirculated air or may recapture heat through equipment like a heat wheel may reduce operating costs associated with space conditioning. The recommended air change rate is dependent on the type of work that is being completed in the critical environment and the number of changes may be determined with the help of an industrial hygiene (IH) expert.
- **Matching HVAC Capacity to Meet Changing Needs:** If the laboratory or clean room air systems do not evolve alongside changes in the use of the critical environment, unnecessary or legacy HVAC equipment may be left behind or used inefficiently. In the same way that an expansion of a critical environment may necessitate the installation of new HVAC equipment, laboratories and clean rooms may change or update scientific equipment, and miss the opportunity to right-size or adjust HVAC settings. Capping outdated, unused or unnecessary air benches point-of-use (snorkels), glove boxes and fume hoods and rebalancing the air system immediately reduces the demands on building equipment saving money and energy.
- **Variable Air Volume Systems:** Significant savings may be achieved by upgrading air systems to more responsive variable air volume (VAV) instead of constant volume (CV) equipment. Improved dynamics in the air system offer energy saving opportunities by allowing the equipment to adjust to changes in occupancy, time, equipment usage, and even account for fume hood door use all while maintaining required room pressures for safe operation.
- **Fume Hoods:** Installing efficient laboratory fume hoods and controls present opportunities for both new and existing critical environments. The purpose of fume hoods is the fast and effective removal of dangerous fumes. In order to balance the expedient removal of air, the building air systems must supply new air. When fume hoods are used improperly or inefficiently, operating costs are increased by the building systems working harder to supply and exhaust air in greater volumes. Fume hoods may be



Laboratories and clean rooms, a common type of critical environments, are owned or operated by schools and universities, corporate and governmental research labs, and pharmaceutical manufacturers. Many of these spaces use double the energy of a similarly sized office space.¹ Improvements in technology and advances in energy management strategies have created an opportunity to save energy and reduce costs all while maintaining occupant safety and comfort.

¹ DOE, 2008 U.S. Department of Energy – Energy Information Administration. (2008) "Commercial Building Energy Consumption Survey." Table E2A. Major Fuel Consumption (Btu) Intensities by End Use for All Buildings, 2003.

² ASHRAE Journal, Laboratory Performance, Metrics for Energy Efficiency, p42, April 2008.

replaced or upgraded to include a number of features to improve energy efficiency including automatic door closure systems, motion sensors that signal a user is nearby and adjusting airflow, sash sensors that alert the building automation system to the fume hood door position in order to more closely match supply and exhaust air volumes, and/or containment-enhancing features that allow lower face velocities.

MANAGEMENT OPPORTUNITIES FOR ENERGY EFFICIENCY

Laboratory and clean room environments are designed with occupant safety in mind. Managers and critical environment operators have several strategies at their disposal to maximize energy savings while protecting lab and clean room workers.

- **Understand the Research and Manufacturing Objectives**

A one-size-fits-all strategy can waste energy. Managers can work with lab and clean room operators to understand the needs of facilities. Selecting an airflow that meets current operational demand versus a pre-occupancy design flow can offer increased energy efficiency. Continuous communication between energy managers, industrial hygiene experts (IH), and laboratory or clean room operators provides the opportunity to create dynamic energy saving strategies that directly impact the operating costs of critical environments. Monitoring plug loads, using smart power strips, and selecting high efficiency laboratory and clean room equipment should be included in any energy efficiency strategy.

- **Ongoing Commissioning**

Managers balance the benefits of energy savings against opportunity costs from temporary laboratory or clean room closures to rebalance airflows and improve energy efficiency. Critical environments are best served by strategically scheduling times when the laboratory or clean room is not in use in order to calibrate and rebalance critical environment equipment. Combining workflows, new equipment may be installed or calibrated while air system rebalancing is completed. In pharmaceutical clean rooms, these temporary closures are a great opportunity to reconfigure the workspace for new products and better match operating demands to system operation. Critical environment air systems which incorporate automatic calibration features can adjust airflow and operate more efficiently while improved fault detection for building equipment provides the opportunity to avoid unscheduled downtime and unexpected costs.

THE BEST ENERGY EFFICIENCY STRATEGY COMBINES MANAGEMENT AND TECHNOLOGY

When management creates and commits to energy efficiency goals in critical environments and those goals are supported by technology and automation, safe and efficient operation is the result. Knowledge of the purpose and use of these spaces may be translated into design and operation goals that create cost saving opportunities while protecting laboratory and clean room workers.

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