

Operable Windows Considerations

Overview

The design of buildings with operable windows as a measure of sustainability is a growing trend for commercial and institutional facilities, especially in Europe. In the United States, however, operable windows are rare in new non-residential buildings. The June 2015 NIH News to Use series article, *Operable Windows*, addressed the functional incompatibilities of operable windows in laboratories and animal research facilities. This article will review the various issues and considerations regarding the application of operable windows in office and other types of non-laboratory facilities, as well as rules, regulations and liabilities.

Application

Operable windows have many potential benefits, including saving energy by providing natural ventilation, thereby reducing the load on the mechanical systems. Operable windows can also reduce or eliminate Sick Building Syndrome, caused by the build-up of volatile organic compounds (VOCs) and other indoor contaminants in inadequately ventilated, tightly sealed building. Operable windows also provide psychological benefits, including a sense of personal control and a physical connection with the exterior.



Figure 1
BAS Controlled Window

Despite these positive attributes, an assessment must be done to determine whether operable windows are appropriate for a particular project. The design team must consider various parameters such as geographical location of the facility, architectural aesthetics, owner/user's priorities, first and life cycle costs, energy savings/payback, risks, and liabilities.

Considerations

- The climate conditions of the location of the building or facility should be considered when determining the benefits of natural ventilation. The number of days with appropriate environmental conditions must be assessed. To ensure that windows are only opened during appropriate conditions the windows should be motorized and operated and monitored by a sophisticated building automation system (BAS). If a BAS system is not utilized, windows may be left open at inappropriate times, burdening the HVAC system and wasting energy. The BAS can also ensure that the minimum ventilation rates, as defined by the International Energy Code and ASHRAE, are met.
- A number of Indoor Air Quality (IAQ) issues such as outdoor noise, dust, airborne pollutants and moisture must be considered. It may



Figure 2
BAS Controlled Display

also result on unexpected allergies or illnesses averting worker distraction and possibly deficiency on productivity. In a building with inoperable windows all outside air enters through the HVAC system and is monitored by the BAS, which controls the IAQ. Unless controlled by the BAS, operable windows will allow outside air to enter freely, thus losing control of IAQ. This may result in an interior which is unpleasant and unhealthy, possibly requiring pest control program tailored to the functions of the operable windows.

- Operable windows can be a security issue, presenting undesired accessibility, both from interior and exterior of the building. Considerations should be made for operable windows to be installed at higher floors.
- In new construction, the cost of operable windows is normally significantly higher than fixed windows, especially when motorized and controlled and monitored by the BAS. See Figure 1. The BAS control system is normally installed to achieve optimal HVAC system performance and IAQ. See BAS display sample in Figure 2.
- The cost of operable windows should be looked as part of an integrated system along with the HVAC equipment being installed. A clear and knowledgeable understanding of such integration as well as the required maintenance are very important for reliable functionality and should be implemented prior to the final design of the facility.



Figure 3
BAS Window Status

Conclusion

Depending on location and climactic conditions, operable windows can offer the flexibility of providing natural fresh air while saving energy. For this to be successful, however, the operable windows must be designed as an integral part of the HVAC system, controlled and monitored by the BAS. In this way the benefits of operable windows (natural ventilation, reduced HVAC load) can be realized while maintaining IAQ and HVAC system efficiency.

Life cycle cost analysis should be performed to weigh the cost of motorized windows, BAS control, monitoring and maintenance against the energy savings from reduced HVAC load. Items that are harder to quantify, like psychological benefits of a sense of personal control and a physical connection with the exterior, should be considered as well.

Further Reading

- NIH Design Requirements Manual, 2016
https://www.orf.od.nih.gov/PoliciesAndGuidelines/BiomedicalandAnimalResearchFacilitiesDesignPoliciesandGuidelines/Documents/2016DesignRequirementsManual/NIH-DRM-Rev.%200.2%20-%20090517%20-%20Secured_508.pdf
- A Breath of Fresh Air, Buildings, September, 2005
<https://www.buildings.com/article-details/articleid/2749/title/a-breath-of-fresh-air>
- Efficient Windows Collaborative (EWC).
<http://www.commercialwindows.org/ventilation.php>