

Cleveland Clinic REDUCING OR AIR EXCHANGE RATES FOR ENERGY SAVINGS

Summary

- To meet the Cleveland Clinic’s \$12M energy demand reduction target¹, one of the reduction strategies included an analysis of the operating rooms (ORs)
- OR air exchange rates, measured in air exchanges per hour (ACH), were investigated as an energy conservation measure. It was known that OR ACH rates remained high even when surgical cases were not being performed. This included nights and weekends.
- Annual air balance reports indicated that even the surgical conditions ACH rates exceeded universally accepted guidelines by 5-15 ACH.
- Estimated annual savings of \$250,000 per year with approval and implementation of OR ACH setbacks down to the levels specified by the engineering guidelines (20 ACH).
- Reducing ACH during the nonsurgical periods reduces energy consumption by up to 484,500 kBtu per OR/year (which equates to approximately \$10,000 in utility costs). By adjusting the air changes per hour (ACH) to meet the state and federal codes of 20 ACH, this resulted in an estimated annual savings of \$250,000 per year.

The Problem

Heating, ventilation and air conditioning (HVAC) is the single most energy-intensive component in the health system’s energy profile (51%). There are 215 operating rooms (ORs) across the health system running multiple cases per day. Because of the ORs’ requirements for air changes per hour, strict temperature and humidity parameters, pressure relationships, and energy-intensive surgical lighting systems, OR HVAC systems came into sharp focus as a strategic priority for energy demand reduction.



Cleveland Clinic OR, an energy-intensive space

Strategy Selected

The first step was to illustrate the scale of the opportunity that OR setbacks presented. A third-party engineering firm assessed OR occupancy, existing conditions and costs to implement, control and maintain an OR HVAC setback strategy.

Facilities Institute Guidelines (FGI) and the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) guidelines govern the minimum total and outdoor air change rates for ORs to maintain temperature, ensure particulate removal, and overcome equipment loads. ANSI/ ASHRAE/ ASHE Standard 170-2013: Ventilation of Health Care Facilities requires a minimum of 20 ACH total and four ACH of outdoor air when the room is in use. Cleveland Clinic's design specification exceeded the guideline by 5 ACH, with no measurable benefits. ASHRAE 170 and many state codes also allow the number of air changes to be reduced when the space is unoccupied¹. OR HVAC setback, also referred to as "unoccupied setback", is an energy saving strategy that reduces the amount of air supplied to an OR when the room is not in use while still maintaining temperature and humidity ranges. HVAC systems run all night—even when the OR is unoccupied. Facilities recognized the enormous potential that unoccupied settings presented - on the order of \$2,000,000 per year². Yet, clinicians had concerns about needing to condition the space at a moment's notice and require assurances that the implementation will not negatively impact patient safety or infection rates.

Implementation Process

In collaboration with the Infection Prevention Department, Surgical Operations Executive Committee, and the Design and Planning Department, the Facilities Department adjusted all main campus ORs to 20 ACH and OR design standards were adjusted down to the 20 ACH per ASHRAE 170's guidance.

The team included representatives from facilities, design and planning team, surgical operations, infection prevention, surgical staff, and other key stakeholders. Their task was to evaluate and provide a recommendation for unoccupied settings:

- Identify peer facilities that implemented setbacks with no safety risks.
- Identify what the users of the space needed versus wanted.
- Articulate what permissions were necessary to override settings.
- Map out HVAC usage per OR suite.
- Research available technologies.
- Pilot solutions/prove out setbacks.
- Conduct cost benefits analysis when retrofitting an existing facility.
- Implement across the health system.

The end goal of this concept is to reduce the ACH when conditions permit, on a space by-space basis. This concept was pilot-tested in E Building's OR Renovation Project, an integrated set of OR design criteria and performance standards.

Benefits of Pilot Results

- Based on measured reduction in fan power and cubic feet of air per minute (CFM) of cooling, an estimated \$10,000/year/OR can be achieved.
- 20,000,000 kWh of electricity will be saved.

- The system will provide better oversight of room conditions to assure that it is always within the required guidelines for temperature, humidity, pressurization and ACH and make those parameters visible to the surgical team within the room.

Challenges and Lessons Learned

1. Costs

The OR setback strategy can be adopted with little or no additional upfront cost in new construction, while a retrofit of an existing facility requires upfront costs to be weighed against the expected energy savings. Since most OR setback solutions require periodic maintenance, the cost of maintenance should be part of the equation. Pitching for a total cost setback strategy is not an easy sell to a management team focused on cost reductions.

2. Adaptive Comfort

To respond to user differences, ORs may be kept in “ready” mode, i.e. in occupied mode, even though there is no code requirement to do so. Clinical and facility staff are working together to decide which control solution meets the surgical team’s needs while still saving energy.

3. OR Controls

It’s complicated. The facilities/buildings have different and varied HVAC system controls. Designing the right control interface was very important to the success of this project for our various user groups.

4. Surgical Staff

One strategy to ease surgical staff concerns was to automate OR setbacks with the surgical schedule. This is achieved by linking setbacks to the OR scheduling system which programmed the ORs to be set back once the schedule is completed and designed to return to occupied mode 30 minutes prior to the initiation of the daily schedule. A safety feature embedded into the surgical light ensures that setbacks aren’t activated if the surgical light is on. The monitoring system controlling OR setbacks also gives better visibility and control of prescribed temperature ranges for the surgical staff.

Enterprise implementation is slated for 2015.

Demographics

Cleveland Clinic is a nonprofit multispecialty academic medical center that integrates clinical and hospital care with research and education.

More than 3,000 full-time salaried physicians and researchers and 11,000 nurses represent 120 medical specialties and subspecialties.

The Cleveland Clinic health system includes a main campus, eight community hospitals, more than 75 Northern Ohio outpatient locations, Cleveland Clinic

Florida, the Lou Ruvo Center for Brain Health in Las Vegas, Cleveland Clinic Canada, and Cleveland Clinic Abu Dhabi (scheduled to begin seeing patients in 2015).

In 2013, there were 5.5 million outpatient visits throughout the Cleveland Clinic health system and 157,000 hospital admissions.