The Medical Education Building at UC Irvine is the instructional hub for more than 1000 medical students, residents, and fellows of the university’s School of Medicine. The building houses a broad range of functions including state-of-the-art teaching and simulation spaces for surgery, emergency medicine, obstetrics, and student testing; advanced telemedicine facilities; and administrative offices.

The project team anticipates a LEED Gold certification for the building. One of the team’s fundamental design decisions for the project was to site and orient the building so as to maximize natural daylighting on the north and south sides (reducing reliance on artificial lighting) and to minimize solar heat gain on the east and west facades. On the west and south sides, sunscreens and blinds control glare and solar gain while bringing in diffused light.

One of the most distinctive and efficient aspects of the building’s design is the way natural ventilation was incorporated into the project. Through an integrated design process, the team decided to divide the building into two main sections: a larger block for instructional and technical uses, and a narrower block — comprising about one-third of the total building area — for offices and meeting rooms. The two sections of the building are connected by an exterior pedestrian breezeway that is covered to provide some protection from the elements. This type of unconditioned circulation space is a highly viable option in Irvine, due to the area’s mild climate.

The Instructional block is mechanically heated and cooled, while the narrow office block is able to rely on natural ventilation for much of the year.

Along with operable windows on the southern side, which take advantage of the prevailing breezes from the southwest, the natural ventilation strategy also employs “solar chimneys” topped with airfoils. The chimneys rely on the natural buoyancy of warm air and the Venturi effect. As warm exhaust air exits the top of the solar chimneys, outdoor air is drawn in through windows to provide ventilation and cooling.

The mixed-mode building zone operates in passive cooling mode throughout most of the year. However, since Irvine usually has several uncomfortably warm days each year — when natural ventilation alone would fall short of occupants’ expectations — a supplementary cooling system was provided. This system uses fan terminal units (FTUs) located in the main, conditioned block of the structure to deliver moderately cool air to the naturally ventilated rooms, when activated by central control. The supply air is a mixture of recirculated air from the air-conditioned areas and primary air from the central air handler. The
intent is to use as much recirculated air as possible, as that reduces the energy needed to cool the incoming air supply. 

Research has shown that occupants in naturally ventilated spaces are more accepting of warmer temperatures, and that allowing the temperatures to be even a few degrees warmer can result in significant energy savings. UCI can establish a reasonable balance between comfort and energy efficiency with this approach and can fine-tune the thermostat set-points based on feedback from occupants. UCI plans to conduct an occupant thermal comfort survey once occupants have adapted to using the passive controls. The supplementary system also provides heating when needed during winter months. Variable volume and temperature (VVT) dampers with subzone thermostats are used to control the volume supplied to each group of rooms.

**Designing the building with a naturally ventilated section and an outdoor circulation space resulted in significantly reduced energy requirements, which allowed for a smaller mechanical system. The resulting savings enabled the team to add an additional floor to the building, providing 23 percent more space within the original program budget.**

It is worth noting that this high-performance building was built within a standard budget. UC Irvine’s Quality Assurance Architect, Jim Brittell, says, “The budget was not augmented to enhance the project’s sustainability. All of the sustainability features were included without sacrificing program requirements or providing additional funding.” This achievement is partly attributed to the project’s design-build approach and the team’s highly collaborative, integrated design process.

The project also received Savings By Design incentives from Southern California Edison. The university received a one-time payment of $56,000, equal to one year’s energy savings, and the design team received $18,000 to help offset the cost of the energy analysis.

Additional energy efficiency features in the building include a highly efficient machine-room-less elevator, low-e glazing on the windows, and carbon dioxide sensors (located in high-occupancy rooms and inside the ductwork of the office zones).

The Medical Education Building has many additional green attributes beyond energy efficiency, including features related to site sustainability and alternative transportation, water efficiency, indoor air quality, and resource use.

For example, the project was designed to achieve exemplary water savings of more than 45 percent compared to a similar conventional building. In addition to having water-efficient toilets and plumbing fixtures, the project followed the sustainable landscaping practices used across the UC Irvine campus. Campus policies call for a number of water-saving measures, including the use of native and drought-tolerant plantings. The building’s irrigation system is also connected to the campus’ reclaimed water system, so that potable water isn’t used to water the landscape.

UC Irvine also has a comprehensive Sustainable Transportation Program, which includes a campus car-share program (with a fleet of low-emission vehicles) and a bike-share program.
Green materials featured in the building include: low-emitting (low-VOC) paints, carpet systems, and adhesives and sealants; recycled-content materials such as steel, carpet, and ceiling tile; and thousands of reused concrete pavers, collected from the existing site. In addition, more than 85 percent of the project’s construction waste was recycled.

LESSONS LEARNED

The team worked closely with faculty and other users from the beginning of the design process. However, after the building was occupied, the team was surprised to find that many occupants were not operating the building properly in the passive mode, i.e., they weren’t opening or closing windows or drawing the blinds when they should, to take advantage of, or to manage natural ventilation and daylighting. Architect Tom Nelson of Mithun explains that the design team had assumed that “a building that operates much like most people’s houses would be easier to use.” However, they’ve come to the conclusion that “because many people’s houses are air-conditioned and most of the other buildings that people use are entirely mechanically controlled with automated systems, people tend to ‘forget’ how to interact with passive systems.” The team’s original intent was to have the building management system generate email messages to notify occupants when they should open or close windows. However, that system is not currently feasible due to conflicts between the campus email system and the BMS system.

For now, the issue has been addressed by presenting a 30-minute slideshow to occupants, to teach them about the building’s passive systems and how to use its passive controls effectively. The presentation uses the metaphor of a sailboat: Unlike a power boat, a sailboat isn’t run with fossil fuels; its course depends on the elements; and the crew’s participation is required for it to sail properly.