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Effective & Innovative Practices Award Winners

APPA's Effective & Innovative Practices Award continues to highlight the best of the most creative and practical programs and processes that enhance and transform service delivery, lower costs, increase productivity, improve customer service, generate revenue, or otherwise benefit an educational institution. The five 2011 award-winning programs featured here focus on LEED measurement and verification; energy management outreach; a roadways and walkways treatment process; cost-saving lean principles; and laboratory energy retrofits.

Up to five Effective & Innovative Practices Award submissions are eligible each year for a cash award of \$4,000, generously sponsored since the award's inception by Sodexo Campus Services. Entries are judged by APPA's Professional Affairs Committee and are based on: 1) institutional benefit; 2) innovation and creativity; 3) portability and sustainability; 4) management commitment and employee involvement; and 5) documentation, analysis, customer input, and benchmarking.

The five successful schools this year received special recognition and a check at the APPA 2011 conference in Atlanta last July.

The 2012 Effective & Innovative Practices Award is open, and the deadline for completed applications is January 31, 2012. Winning institutions will receive recognition at the APPA 2012 conference next July 17–19 in Denver, Colorado.





Georgia Institute of Technology

Georgia Institute of Technology

FACILITIES SMART M&V PROCESS

BY DONALD P. ALEXANDER, P.E., CEM, RCDD

Don Alexander is institute engineer at Georgia Tech, Atlanta, GA. He can be reached at don.alexander@facilities.gatech.edu.

Georgia Institute of Technology, as a member of the USGBC with several LEED awards, has submitted its LEED's advanced measurement and verification (M&V) plan for each new building filed under the LEED certification program. Georgia Tech Facilities Division wanted to execute the (M&V) plan to validate the projected savings of the LEED energy conservation measures.

Georgia Tech Facilities discovered a wide variation between projected LEED energy savings and actual energy savings. The School of Mechanical Engineering requested topics for their graduate students to study for their thesis. These two needs came together to develop a true evaluation of the designed energy consumption against the measured performance of the building design, therefore yielding accurate energy savings.

The second objective was to develop a methodology process that would become a standard for an accurate comparison of energy savings as compared to the LEED projected savings. A continuous SMART M&V process would then be in place to revisit the energy savings evaluation on a cycle of every two or three years. This process would also provide an ongoing research platform for the graduate students and provide Facilities with continuous updated benchmarks as to how well the building was performing.

The third objective was to obtain energy usage metrics that passed the rigors of academic review for the Masters and PhD thesis defense yielding defensible energy savings.

INSTITUTIONAL BENEFITS

The SMART M&V effort has enabled Georgia Tech Facilities to move from non-verified energy savings to a reliable methodology process to evaluate real energy savings of projects of any size, from new buildings and completely renovated buildings, to renovated building zones.

The partnership between Georgia Tech Facilities and the School of Mechanical Engineering Graduate Studies has provided a rich environment for graduate class studies and graduate thesis work. Georgia Tech, like many research campuses, has an ever changing space requirements, and its use of buildings and

spaces change approximately every three to five years. Therefore, each re-evaluation of previously studied buildings has the possibility of a completely different set of new problems for the graduate students to address.

To implement the SMART M&V process, effective and accurate metering was required to capture the effects of actual operating conditions. The energy software simulations that will be/has been created will use actual data for the occupancy, weather, and changes in equipment. The metering requirements resulted in Facilities launching a campus wide building metering program. Metering was installed for all electrical, chill water, steam and natural gas lines in every building. The meters installed are SMART meters and have the ability to communicate over the internet to a central ION database. In addition to accurate metering, records of installed systems and verification of building automation controls were required.

The availability of historical building energy usage has been of tremendous benefit to Facilities Operations and Maintenance and the Georgia Tech research community, enabling other units at Georgia Tech to pursue additional research opportunities, track energy usage and plan for additional energy conservation projects.



INNOVATIVE, CREATIVITY AND ORIGINALITY

Over the past few years Mechanical Engineering's graduate students have been conducting energy studies for the Georgia Tech Facilities department under the guidance of the institute engineer. The building energy simulation group has worked together to gain a better understanding and working knowledge of the components necessary to accomplish our goals, namely accurate measurement and verification. To capture the effects of real building performance, eQUEST energy simulations use actual data for the occupancy, weather, and changes in equipment based on the recorded meter readings of a specific building.

Georgia Tech, like many large universities, purchases electricity, gas, and produces chill water via central chill water plants. Just as the axiom goes "You cannot manage what you cannot measure,"

GT Facilities developed a project to install building level metering in all buildings for electricity, chill water, steam, and natural gas. The system database reads all of the meters every 15 minutes and stores the data in an SQL database for later use.

Accurate weather was also required to evaluate the thermal effects of weather on energy usage. A weather station was installed in the central portion of campus and the meter reading database engine was used to record the weather by the hour.

The influences of occupancy have dramatic effects on energy usage. Electronic people counters are being installed on all new projects with the data being recorded by the meter reading database to further gain real data of building usage.

Because the data is Web-based, Facilities can quickly determine if an implemented energy conservation measure is yielding the planned results. The metering database has provided the opportunity for accurate utility billing of Auxiliary, Athletic, and non-state funded research facilities. The meter database has opened up additional research opportunities.

PORTABILITY AND SUSTAINABILITY

The process and methodology is completely portable and adaptable to other colleges and universities. This process provides the means to evaluate the LEEDs energy submittal and to provide accurate documentation of energy savings. Proposed designs of LEED buildings use theoretical assumptions of occupancy, plug loads and weather. This yields an approximation or best guess of what the energy savings of the final design is, as compared to meeting the minimum energy code. Comparing actual meter readings to these theoretical assumptions will yield faults, energy savings or over usage. For a true comparison of energy savings, the eQUEST simulation model has to be adjusted to the actual conditions for occupancy, weather, and plug loads during the same time period as the meter readings.

MANAGEMENT COMMITMENT AND EMPLOYEE INVOLVEMENT

Georgia Tech has demonstrated its commitment to the SMART M&V process by adding this requirement of the additional metering in the campus design standards (GT-Yellow Book) for all projects.

Georgia Tech Facilities Division has committed funding for energy metering which support the SMART M&V process as well as other Facilities operational requirements. The Office of the Senior Vice

President provides funding to the Georgia Tech School of Mechanical Engineering Graduates Studies Programs to support graduate students research opportunities. Graduate students perform the fundamental analytical analysis required for the energy simulation comparisons and the academic requirements for their thesis.

The School of Mechanical Engineering continually involves new candidates and other disciplines for studies of GT buildings through a wide variety of research projects. GT facilities engineers support Mechanical Engineering graduate students by providing guidance and wisdom on the implementation of new research projects related to building operation.

DOCUMENTATION, ANALYSIS, CUSTOMER INPUT, AND BENCHMARKING

The following two documents are presented as background, define objectives, and provide results of the process. The first document is a presentation to the Senior Vice President of Georgia Tech, documenting the achievements and to lay out the future of the program. The second document is a detailed report of a major renovation to a 1928 building that once housed the School of Civil Engineering for approximately 40 years. The building is on the National Historic Register. Recently, Georgia Tech renovated the entire building, renovating all of the

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electrical, HVAC, and communications systems. The remodeling provided new, advanced, classroom resources and offices. The renovations rejuvenated and kept the classic charter of the building and won a LEED Gold Certificate.

The Gold Certificate ratifies Georgia Tech's Design Standards as striving to achieve excellence. The performance of the SMART M&V process, confirms that savings can be achieved above and beyond the potential savings of the buildings LEED submitted savings.

1- "Research Conducted with Georgia Tech Facilities Department and Analysis of Old Civil Engineering Building"

<http://www.facilities.gatech.edu/dc/smart-m-v/smart-m-v-research-conducted-with-gt-facilities#2DPA.pdf>

2- "SMART M&V Research Conducted with GT Facilities Update"

<http://www.facilities.gatech.edu/dc/smart-m-v/research-and-activities-conducted-with-georgia-tech-facili.pdf>



Medaille College

THE MEDAILLE 100 – AN "EFFECTIVE AND INNOVATIVE" OUTREACH PROGRAM

BY NATHAN MARTON

Nate Marton is director of operations and facilities at Medaille College, Buffalo, NY. He can be reached at nrm26@medaille.edu. This is his first article for Facilities Manager.

As an extension to Medaille College's energy management strategic plan that has achieved 15 percent savings in less than two years, the campus developed *The Medaille 100*, an innovative program that engaged students, staff and faculty into the effort through a hands-on approach to monitoring and changing their energy use activities and habits.

Medaille's program successfully integrated energy management with student engagement and education to create a highly-interactive six-week energy competition leveraging social media and other engaging activities to produce results far beyond simple consumption reduction. Modeled on a Formula 1 race, *The Medaille 100* tracked real-time performance, communicated energy-saving tips, encouraged competition, and engaged students. Software programming tied real-time energy use to the acceleration and deceleration of the two race cars. The cars accelerated and decelerated based on the level of instantaneous savings compared to previous year's energy performance for the same time period. Each car could reach

a maximum speed of 270 MPH if a 15 percent savings was achieved. Similar to an actual race, when the caution flag is waived, the race car would be slowed to a constant 70 MPH when no energy savings was being achieved.

The main screen automatically updated to track real-time savings and number of laps completed by each race car. The Energy Dashboard converted the performance into readily understood measurements such as number of trees planted, gallons of gas saved, and emissions reduced. Automating this process was a technology feat in itself, given the excessive number of real-time data points that were continuously being collected and calculated.



STUDENT ENGAGEMENT

Equally important to the technological processes was the selection of a Pit Crew, made up of student volunteers to motivate, educate, and engage students during the competition. This crew managed a Facebook page accessed through the *Medaille 100* website, developed specialized programming to raise awareness, and motivated residents to reduce consumption and promote the Formula 1 race theme. The Pit Crew developed Pledge Posters, which students signed to show their commitment towards making small changes in their behavior towards saving energy and the environment. They also had the authority to award additional laps to residence halls that completed supplemental student engagement events, such as Dark Dorm Events, energy education booths, and number of students who made the pledge to reduce their energy usage.

In addition to having Pit Crews drive participation, the College developed the following interactive contests to elevate student interaction and engagement.

- YouTube video contest encouraged students to create and post their own videos and show peers the actions they were taking toward saving energy and the environment. See the winning video at <http://www.youtube.com/watch?v=uedLgKrbqo>

- T-shirt design competition that allowed students to develop a *Green* slogan. The winning T-shirt was given to students who lived in the winning residence hall.
- Twelve students directed a 3-minute informational video to inform their peers on strategies to help win the race. Video Link: <http://www.youtube.com/watch?v=S9D6Ua8qqeY>
- Weekly trivia contests on Facebook that had a sustainability focus.

Medaille adopted a holistic approach to the energy competition, with the goal of educating students, engaging them in the process, and ultimately modifying student behavior. The result was a level of participation, engagement, and excitement that has redefined the term *Student Energy Engagement* in Higher Education. The Program extends beyond passive student education to actively involve participants and create “buzz” throughout the campus community—appealing to existing and prospective students alike.

THE PROCESS AND OUTCOME

The *Medaille 100* was a team effort between the college’s staff, faculty, students, and ARAMARK, the institution’s facility services group. Extensive planning and development was involved, which began four months prior to the launch of the event. Overall, the event was conceived, proposed, and executed by the Operations and Facilities departments, with input and support by a number of other campus constituents.

Conceived at one of the college’s quarterly strategic energy planning meetings, the *Medaille 100* attempted to extend energy savings beyond the typical “that’s the Facilities Department’s job” approach that is typical at many campuses and organizations. Nathan Marton, Medaille’s director of operations, Mike Beadling, ARAMARK campus manager, and John Mikullitz, ARAMARK director of engineering solutions, were the key personnel charged with the identification, development, and management of all aspects of the creative and implementation processes. Marton identified the appropriate internal staff resources required and successful strategic plan to take this from concept to reality within four months. In his role, Marton managed staff resources to ensure program success and maintained consistent collaboration across all college constituents. This was accomplished through the scheduling of weekly meetings and conference calls with staff and students leading up to and throughout the six-week event. During these meetings, the group reviewed proposed and upcoming activities, while actively resolving program issues. Kara Kane, Medaille’s director of communications, led the management of all media activities and content, while Jason Perri, the college’s director of residence life, managed the student pit crews and other social activities.

Enthusiasm for the *Medaille 100* built quickly and sustained for the entire six weeks, becoming a major topic of student conversation. Energy consumption during this six-week period was reduced by 7 percent over the same period during the previous year, equating to 158 metric tons of carbon emission reductions.

ABOUT MEDAILLE COLLEGE

With campuses in Buffalo, Amherst, and Rochester, Medaille College (www.medaille.edu) is a dynamic, private college committed to serving the higher education needs of western New York. Medaille is known for its flexible delivery systems, offering master’s, bachelor’s and associate degrees through day, evening, weekend, and online programs.



Purdue University

BRINE & BEET JUICE APPLICATION SYSTEM

BY GARY K. EVANS

Gary Evans is the director of grounds at Purdue University, West Lafayette, IN. He can be reached at gkevans@purdue.edu. This is his first article for Facilities Manager.

The Purdue University Grounds Department uses an effective and innovative brine/beet juice solution and application system to treat campus roadways and walkways in advance of inclement winter weather. The liquid salt and sugar beet juice solution retards the accumulation of ice and snow during the early stages of a storm and allows for an easier removal process—making roadways and walkways safer for campus travelers. Due to the fact that Purdue’s main campus in West Lafayette, Indiana receives an average of 23 inches of snow per year, this supplemental approach to traditional snow and ice removal strategies has resulted in significant, positive operational and customer service outcomes.

The utilization of the brine/beet juice solution and associated application system has yielded several benefits including labor savings, system customization and capital investment savings, enhanced sustainability of snow removal strategies, and positive customer feedback.

LABOR SAVINGS

The use of brine/beet juice solution is a proactive approach to addressing the removal of ice and snow. Grounds staff members apply the brine solution in advance of impending winter weather, minimizing the need for overtime by allowing labor costs to be absorbed during normal operating hours. When conditions are favorable (a temperature of at least 20 degrees, less than 1.5 inches of snow and sunshine), the application of the



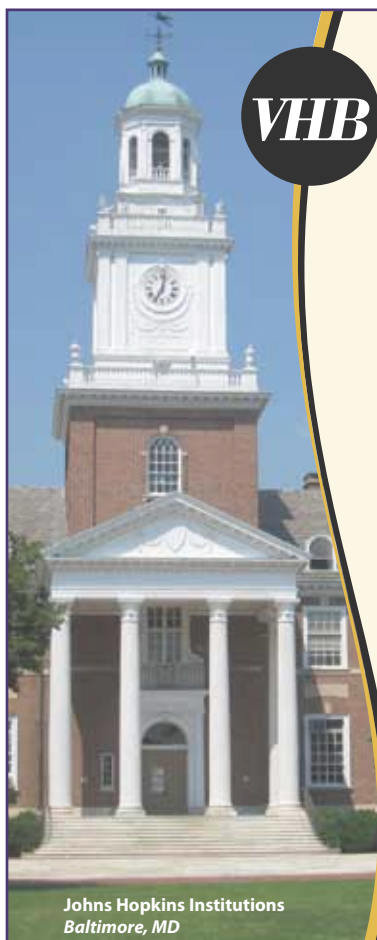
SYSTEM CUSTOMIZATION AND CAPITAL INVESTMENT SAVINGS

Many universities have added brine solution application systems to their snow removal arsenals. The unique and innovative facet of the Purdue Grounds Department's approach to adopting a brine/beet juice application system is the fact that by drawing upon the expertise of staff members, the operation was able to fabricate a custom system that is specifically designed for compatibility with existing snow removal equipment and vehicles. This approach resulted in a significant capital investment savings and also allowed for the creation of a system that directly addresses the Grounds Department's particular needs.

In addition to building brine mixing tanks, Grounds staff members constructed the application tanks for two three-quarter-ton pick-up trucks and one small pick-up truck. All of the trucks have been equipped to apply the solution to the streets and walkways.

Senior management supported the development and fabrication of the brine/beet juice application system by authorizing the time and capital investment necessary to learn about and construct the brine application systems, locating the facility space to house the equipment, and supporting the redesign of snow removal efforts to include the proactive approach of applying brine prior to weather events. Employees have embraced the innovative approach of brine/beet juice solution application as the new standard and participate in the ongoing use of the system.

brine solution eliminates the need to call plow operators into service outside of scheduled working hours. Often, the brine/beet juice solution is effective in removing snow and ice without the need for further clearing. In the cases when additional clearing is required, labor times for snow removal are reduced and operators report the snow is easier to "peel" down to the surface (as compared to non-treated roadways and walkways) after the brine/beet juice solution has been applied.



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ENVIRONMENTALLY FRIENDLY SOLUTION

Brine, which is a mixture of salt and water, is most effective at precisely 23.3 percent salinity. This ratio of salt to water gives the mixture the lowest possible freezing point of -5.8 degrees Fahrenheit. It takes only 2.8 pounds of salt per gallon to achieve the optimum solution. In comparison to rock salt, brine reacts more quickly and has a lesser environmental impact due to the fact that it stays in place on the roads and walkways to which it is applied. Conversely, rock salt bounces from the roadways into turf areas and storm sewer systems. Additionally, cost analyses have demonstrated that applying brine is 50 percent less expensive than applying the equivalent amount of rock salt.

Adding sugar beet juice to the brine solution increases the solution's effectiveness by an additional five degrees. The advantage of the environmentally friendly beet juice additive is the fact that it is a natural product that adds the



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stickiness to the brine solution. Beet juice-treated brine has less “bounce” upon application and will remain in place on the roadways for up to three days, as opposed to a single day for a normal brine solution.

POSITIVE RESPONSE FROM CAMPUS CUSTOMERS

Customer feedback to the adoption of the brine/beet juice application process has been very positive. The transition to the proactive approach of applying the brine/beet juice solution prior to winter weather events has been seamless to the university community and there have been fewer customer reports of extremely icy campus areas.

For more information about the brine/beet juice application system, please contact Gary Evans at the Purdue Grounds Department by telephone at 765-494-3087.



San Diego Community College District

LEAN ENTERPRISE PROCESSES IN FACILITIES MANAGEMENT

BY ANDREW SCHWEIZER

Andrew Schweizer is communications liaison for the Propositions S and N Construction Bond Program at Gafcon, San Diego, CA. He can be reached at aschweizer@gafcon.com. This is his first article for Facilities Manager.

As California’s second largest community college district, the San Diego Community College District serves more than 142,000 students at three main colleges and six Continuing Education campuses. The District will complete a \$1.555 billion build-out by 2016 that will double its facilities from two million square feet to approximately four million square feet.

With the state’s ongoing fiscal crisis, it is clear there are no means to double the custodial and maintenance budget, prompting the District to pursue strategies to reduce operating costs associated with the build-out while continuing to deliver value.

By applying lean principles to custodial and maintenance functions, the SDCCD eliminated the need to add 20 positions, shaving off \$813,000 in the first year of a seven year process.



Additional efficiencies implemented over the next six years will increase projected savings to \$20 million. At the time of the lean practices assessment, more than 85 percent of maintenance work was reactive – responding to requests for service as they came in. With the use of three key lean tools – a priority matrix, work flow processes, and a Computerized Maintenance Management System (CMMS), more than 87 percent of maintenance work can now be planned and scheduled.

By utilizing lean principles to identify causes of waste and improve processes, the SDCCD has:

- Benchmarked custodial square footage cleaned and targeted goals to increase square footage per custodian over a three-year period
- Reduced reactive work flow and leveraged a new centralized work flow process in conjunction with the CMMS to reduce the volume and aging rate of open work orders
- Established lean custodial practices including custodial beat load leveling; implementation of uniform cleaning standards; and benchmarking and progress metrics via Management by Walking Around (MBWA) data collection
- Established clear Service Level Agreements (SLA) with all stakeholders served
- Improved practices to increase technicians’ time on tools guiding material/supply management by implementing the delivery of work orders via handheld wireless devices

In its quest to be “service oriented” the SDCCD previously had no formal work prioritization process. Work was reactive, with the list of open work orders exceeding 1,600 and a higher per-square foot cost for cleaning compared to industry benchmarks (APPA Facilities Performance Indicators).

In the first year of the program, the cleanable area per custodian has increased from 13,000 square feet to 17,000 square feet while cleanliness has improved. Under the previous system, work orders were open for more than 75 days on average. Under the new program, and despite a fourfold increase in volume, work orders are now closed out within 20 days.

The need to perform a thorough analysis of custodial practices created an unprecedented opportunity for the custodial team members to really study how time was spent. Supervisors found

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that over time, they performed services for faculty and staff that were not in keeping with their core mission. As an example, the study showed the custodial crew spent an inordinate amount of time responding to faculty and staff that needed doors opened. Concurrent with the development of the new Priority Matrix, the team developed a new Door Opening Policy that helped reduce door-opening tasks from 17 FTE days per month to fewer than two. Using APPA's "Five Levels of Cleanliness," new Cleaning Standards were adopted which led to renewed value for cleanliness and higher levels of customer service.

A maintenance priority matrix was developed based on the work requested and its impact on the district's core mission. Work flow processes were then developed to "map" the progression of a work order, assuring accountability for each step from initiation to closing-out. The Computerized Maintenance Management System (CMMS) replaced piles of work orders with no clear organization or priority assignment with a clear automated system that enabled team members to meaningfully plan, schedule and maximize efficiencies. Open work orders and aging work orders dropped dramatically. With the capability of the CMMS to cluster work orders together by priority, campus or project, maintenance trades found that their 'windshield time' was reduced dramatically, enabling them to improve delivery of services while improving time management. The Regional Facilities Officers overseeing each campus' custodial and maintenance operations are particularly pleased with the CMMS, citing the enhanced ability to track workers' workloads.

A new Management by Walking Around (MBWA) program was implemented that allowed Supervisors to perform focused and strategic inspections. The inspections focused on areas requiring attention within a space. Supervisors quickly found the inspections helped leverage the new Cleaning Standards to raise performance. The walk-around inspections also revealed that some problems were maintenance issues rather than custodial, such as a wall which may have required repainting rather than extensive cleaning.

Using the custodial load leveling, many custodians found themselves reassigned from first and second shift to third, where the allocation of resources was in greatest demand. For some employees, this was a difficult change. If the District had maintained its previous approach to custodial delivery, the custodial ranks would have grown from 104 to 187 by 2016, far exceeding available funding resources. With the lean processes in place, the custodial ranks will still increase (to 127 by 2016), a powerful motivator for the current custodians who know their part in practicing lean facilities management is a key to the District's saving \$20 million over the eight-year plan.



University of California Irvine

SMART LABS ENERGY RETROFITS

BY MATT GUDORF, LEED AP

Matt Gudorf is campus energy manager at the University of California Irvine. He can be reached at mgudorf@uci.edu. This is his first article for Facilities Manager.

The Smart Labs program is an integrated approach to laboratory energy retrofit and new construction projects. UC Irvine's Energy Team has developed a roadmap to look at each system and break it down into its basic components to reduce the energy used to operate that system by 50%. The energy savings are used to pay for the retrofit over time, but the emissions reductions are realized immediately ensuring that the university meets its greenhouse gas emission reduction goals. A distinct benefit of instituting the Smart Lab concept as a retrofit project is the impact the program can have on unfunded deferred maintenance projects. Replacing aging, worn, or neglected systems with new high efficiency components nets a maintenance and reliability increase. Energy savings that provide enhanced reliability result in increased safety for operations within the lab building. The decreased down time from failures increases productivity and ensures students and researchers are provided with the best possible facilities for their research and teaching mission.

UC Irvine has determined that deep energy efficiency programs, as opposed to the 20 to 30 percent typical savings of past retrofit projects, are the only currently feasible route to meeting our climate goals. "Low-hanging," fast-payback projects at most institutions are already completed and now more sophisticated retrofits usually exceeding payback of eight years are required. These projects are not without risk, and the Smart Lab design that has now been tested is being deployed across UC Irvine's lab inventory and can be repeated by other intuitions to achieve similar results.

UC Irvine has assembled an Energy Team with representation and participation from all relevant units of the campus. The group meets regularly during the project development, construction, and analysis phases to ensure that safety and customer satisfaction are not compromised in the name of energy savings. Environmental Health and Safety experts and the Campus Fire

Marshals have thoroughly reviewed each component of the Smart Labs concept; recommendations have been made and procedures implemented to maintain the highest level of safety while challenging previous best practices.

The Smart Lab concept has many individual features that UC Irvine has piloted over the last three years before being incorporated into our design guide. In order to make the deep energy cuts that are required to meet a 50 percent savings goal, theories must be tested, perceptions changed and results evaluated.

- Exhaust Stack Discharge Velocity Reduction (ESDVR) looks to reduce laboratory exhaust stack velocity and eliminate bypass air by reevaluating the original building wind tunnel study and performing additional wind tunnel testing to avoid re-entrainment and contamination of occupied spaces. Exhaust stack height may be modified to allow for increased plume dispersion and decreased energy consumption. Resulting energy savings of 40 to 50 percent have been achieved.
- Centralized demand controlled ventilation looks at real-time indoor air quality in the occupied spaces and varies the ventilation rates accordingly. This allows for significant air change rate setbacks during times of low process activity and lab space non-occupancy. UC Irvine has adopted a 4 air changes per hour minimum occupied and 2 air changes per hour unoccupied standard versus the previous 6 air changes per hour. The fan energy, chilled water, and hot water energy reduction approaches 40 percent during occupied hours and 60 percent during unoccupied periods. In addition the system provides real-time feedback of lab air change rates, contaminant levels, and in the event of a chemical or particulate excursion in the lab notification to environmental health & safety personnel.
- Smart lighting in laboratory space with daylighting opportunities uses controls to reduce light levels when adequate natural light is available. Perforated blinds are used in these spaces to diffuse direct sunlight but allow for partial daylight penetration. Occupancy sensing is used in a bay-by-bay configuration for maximum segmentation while incorporating an auto on to 50 percent manual on to 100 percent auto off sequence. In addition all linear fluorescent lighting at UC Irvine has been re-lamped with 25 watt T8 lamps and reduced light output ballast.
- Lab buildings campus wide that are not Variable Air Volume with Direct Digital Controls are retrofit with lab air control valves, digital thermostats, and occupancy sensors. Office and support space within lab buildings air flows are reduced by 80 percent when unoccupied.
- Air Handlers are retrofitted with VFD drives, premium efficiency motors, static pressure reset control sequences, and low pressure drop filters. Sound attenuators are removed and in combination with the new filtration media required fan energy to meet static pressure requirements is reduced by 15 percent
- High performance fume hoods allow for improved contain-

ment with the potential to reduce face velocity from 100 FPM to approximately 70 FPM based on a study conducted at UC Irvine in conjunction with CAL-OSHA.

- UC Irvine purchasing policy requires that new equipment be Energy Star certified. This includes freezers, refrigerators, ice machines, and copiers. All energy saving features are enabled to increase plug load savings. PC Power Management software is installed on desktops and in computer labs. Smart Labs are also only as effective as the people who operate and use them. This is why as part of our Smart Lab concept at UC Irvine we have incorporated an extensive training program. The program consists of training for the building technicians that must work on the more sophisticated systems ensuring that they possess the skills required to troubleshoot and repair system failures. We also provide occupants training as they are the front line of defense not only when systems fail, but they also have the greatest impact on realizing the savings of the Smart Lab design.



The renovation and retrofit projects often take place in operating research labs throughout campus. UC Irvine Facilities Management has included students and staff throughout the process. Facilities Management conducts town hall meetings to share the Smart Lab concept with building occupants prior to construction. This not only keeps occupants informed of construction activities taking place in their lab it also opens a dialog that has led to additional energy savings. Lab users often locate energy waste in lab spaces that may go unnoticed until retro commissioning can take place.

After completion of a Smart Lab renovation or new construction project, building occupants are again contacted by Facilities staff with on-site training and handouts are disseminated throughout the building to provide occupants with information on how to use the newly installed features. Training leads not only to increased lab safety but carbon and energy savings through sash management, best lighting practices, and knowledgeable use of the HVAC system. ☺