U. S. Department of Energy's Federal Energy Management Program
Federal Thought Leaders Roundtable
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UCI Smart Labs Initiative – Transcript

The University of California, Irvine – a partner in DOE's Better Buildings Initiative -- has been ranked among the nation's best universities, noted for its excellent science and research programs. With more than 30,000 students, it is one of the area's largest employers and includes some of the most energy-intensive and complex laboratory space in the world.

I'm Wendell Brase, the administrative vice-chancellor of the University of California, Irvine. I'm also co-chair of the University of California's Global Climate Leadership Council. We work with a number faculty every day who are very concerned about achieving global climate solutions quicker, and we think energy efficiency is the first step in this process.

The University reached its Better Buildings goal through its *Smart Labs Initiative*, a program to demonstrate how "deep energy efficiency" measures can reduce a laboratory's energy use by more than 50% in newly constructed or retrofit facilities.

Here we are at Natural Sciences 2, and this is the building featured in the Better Buildings Challenge.

This is just one of more than a dozen laboratory buildings that have been retrofitted with the smart lab initiative.

It was that initiative that really enabled this campus to achieve the goal of the Better Building Challenge of reducing energy use per square foot by 20 percent by 2020. We actually achieved that seven years early, and because of that, we made the commitment to do another 20 percent by the original goal in the program, which is 2020.

Smart Labs pioneers focused on **7 Essential Smart Lab Components** – all seven must be implemented together to achieve the goal.

With smart air management and ventilation systems in place, UCI was able to lower the velocity of air supply and exhaust systems.

This is a low-pressure drop, where the energy efficiency starts, at the very moment the air enters into this building. This is where energy efficiency begins.

Having a variable speed drive intake on the fan is an important part of every smart building because it what allows the building to be dynamic.

Here it says that right now this fan is running at 55 percent of its rated capacity. That's an enormous savings right here.

A key prerequisite of a Smart Lab involves designing dynamic, digital control systems for air volume, exhaust, thermostats, and other building automation systems.

This is the key technology. This is the brain of the system, which makes the building dynamic and keeps it safe. What we have here is the controller for the Aircuity system. What you see here are little tubes that carry air packets that come from all these lab spaces on this floor.

We actually have one of these Aircuity controllers on every floor of this building and similar buildings. And what happens is they are analyzed by these sensors for total VOCs, for particulates, for carbon dioxide and carbon monoxide.

We're dealing with air changes in laboratories and we have a lot of data to make sure that we can not only manage the energy, but do it in a way that is safe.

A key part of our energy team is our environmental health and safety staff. The reason is that when we set out to deliver just the right amount of energy at just the right time, what we're doing is changing illumination levels and air changes. We're affecting the environment. We want to do that in a way that doesn't compromise anyone's safety at all. It's an absolute cardinal rule as far as we are concerned.

When possible, operators can safely reduce the change rate flow of fume hoods to below 25cfm/ft^2 or 375 air change per hour units.

Here we have the kind of modern fume hood designed according to smart lab retrofit principles. Here you see a zone-present sensor, which has increased the airflow for this hood the minute I walked up and stood in front of it.

You can also see that as I open the sash you can hear that the volume increases. Then it goes back down -- and that's not just me closing the lid that you hear -- it's actually reducing the volume.

So here we are on the roof of Natural Sciences 2. This is the end of the chain for air going through the building.   You see the manifold that runs along the parapet of the building here collects all the rising exhaust coming up through the building.

Every building around here you can see has had an extension on the stack -- that section on top where it looks kind of shinier – that's a new piece of about a three-foot extension and -- believe it or not – that extension made it possible to cut the speed of those fans in half and to close the by-pass dampers, the bypass dampers which were constant energy wasters.

In this exhaust system here, by the way, there is an anemometer. On the rare condition when the wind comes from the opposite direction from our face as we are standing here, this anemometer will sense that condition and at that time it will increase the exhaust discharge velocity from those fans.

So this is what we mean about a smart system. You use the sensors and controls to apply just the right amount of energy at just the right time, rather than, again, as opposed to going to the worst-case condition and running at a fixed volume. It's a dynamic system.

Part of a smart labs retrofit is to make the lighting system smart, the lamps are LED and that saves about half. That savings can be increased a lot also by putting the lighting under the kind of control that offers occupancy sensing, vacancy sensing, daylight sensing, and has a trim adjustment so that when all these features together are used, the lighting system becomes smart enough that the energy savings approach 80 percent.

So you see a light shelf up here about three-fourths of the way up the window. You see here we are using perforated blinds there is still enough daylight to use, and it comes through with no glare. The net effect of this, as you can see, the space I'm in has very little artificial light. There's a daylight sensor right up here, which is cutting way back the amount of light coming out of this fixture over my head.

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Here's an occupancy sensor, which serves two functions in this lab bay of this smart lab. It both controls air changes so the air changes go way down to a standby level when there's no motion in this aisle, and it also controls the lighting in this lab bay.

With digital sensors UCI created a proactive continuous commissioning plan that turns large volumes of data into meaningful analysis and actionable reports.

We now have sensors and software that make it possible to make a building dynamic and to deliver just the right amount of energy at just the right time. This makes it smart.
Taking advantage of these new tools has made a remarkable impact on what's possible to do.

Nothing we have done involves esoteric or bleeding-edge technology. It's just taking a comprehensive look at all the systems in a building that manage or use energy - from the top of the building to the bottom of the building -- and doing it in a synergistic and holistic way.

We now have sensors and software that make it possible to make a building dynamic and to deliver just the right amount of energy at just the right time.

I give credit here to a team of people working here under me, which has in it, very skilled technical people, very imaginative people, people willing to buck the *status quo* and question all the assumptions which have been touted as best practices for not just years, but decades.

And because of that, we have achieved, with our smart labs retrofit program, over 60 percent total energy improvement.