CELEBRATING 10 YEARS

RESEARCH HIGHLIGHTS

July 2018

UC DAVIS
Western Cooling Efficiency Center

WELCOME

Our mission is to accelerate development and commercialization of efficient heating, cooling, and ventilation solutions through innovation, R&D, stakeholder engagement, education, and outreach.

Welcome to the Western Cooling Efficiency Center's Research Highlights. This was an exciting year as we celebrated 10 years of operations since our founding in 2007.

We are eager to share with you some of our recent accomplishments, including our continued efforts to research and demonstrate key technologies and improve market conditions for increased adoption of energy efficient solutions. These highlights illustrate the diversity and uniqueness of our research—from identifying optimal designs for ground-source heat pumps to developing a laboratory for advanced heat exchangers and testing novel approaches for cooling dairy cows.

Through our work we strive to maximize our impact and value. We continue to strategically assess our activities, partnerships, and priorities.

Looking toward our energy future, the landscape and workforce are changing. Integration across fields, systems, and sectors is critical, as is the need for the commercialization of solutions that work in the real-world, and that broaden the distribution of the benefits of energy efficiency and sustainability.

This past year, we welcomed several graduate students from UC Davis' new interdisciplinary Energy Graduate Group. As part of the UC Davis Energy and Efficiency Institute, we also increased our collaboration with affiliated research centers and programs.

Our successes and innovations are due in large part to the cooperative interests and combined efforts of our network of partners, collaborators, and research sponsors. We look forward to continuing to work with you to achieve a more sustainable energy future.

Mark Modera // Director

Vinod Narayanan // Associate Director

CORE PROFICIENCIES

- Leaders in climate-appropriate cooling technologies
- In-house laboratory with environmental chamber capable of re-creating 95% of California's hot/dry climates
- Leaders in automatic aerosol sealing technology for buildings

EXTENSIVE KNOWLEDGE IN:

- Building energy modeling
- Technology evaluation
- Cooling Hot/Dry climates
- Codes & Standards
- Human behavior in HVAC
- Thermal energy distribution
- HVAC system control
- Market Barriers
- Heat Transfer

WHAT IS WCEC?

The Western Cooling Efficiency Center (WCEC) is an authoritative and objective research center at the UC Davis Energy and Efficiency Institute that accelerates the development and commercialization of efficient heating, cooling, and energy distribution solutions.

Our work is increasingly important as energy policies in the U.S. and California recognize the far-reaching implications of greenhouse gas emissions on our environment and changing climate.

HOW WE WORK

APPLIED RESEARCH

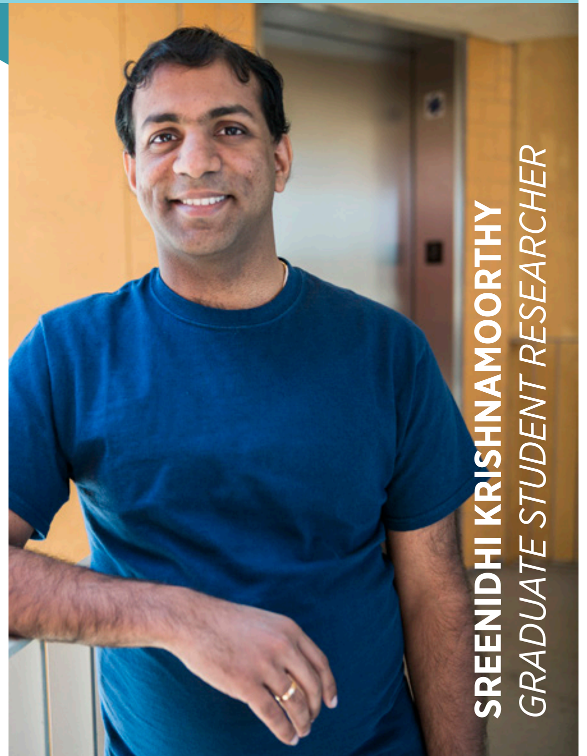
Working closely with manufacturers, policymakers and utilities, WCEC tests new and existing HVAC technologies in our laboratory. We also deploy real world demonstrations that provide objective technology evaluations of field performance. Our engineers recommend and implement performance improvements for the technologies tested.

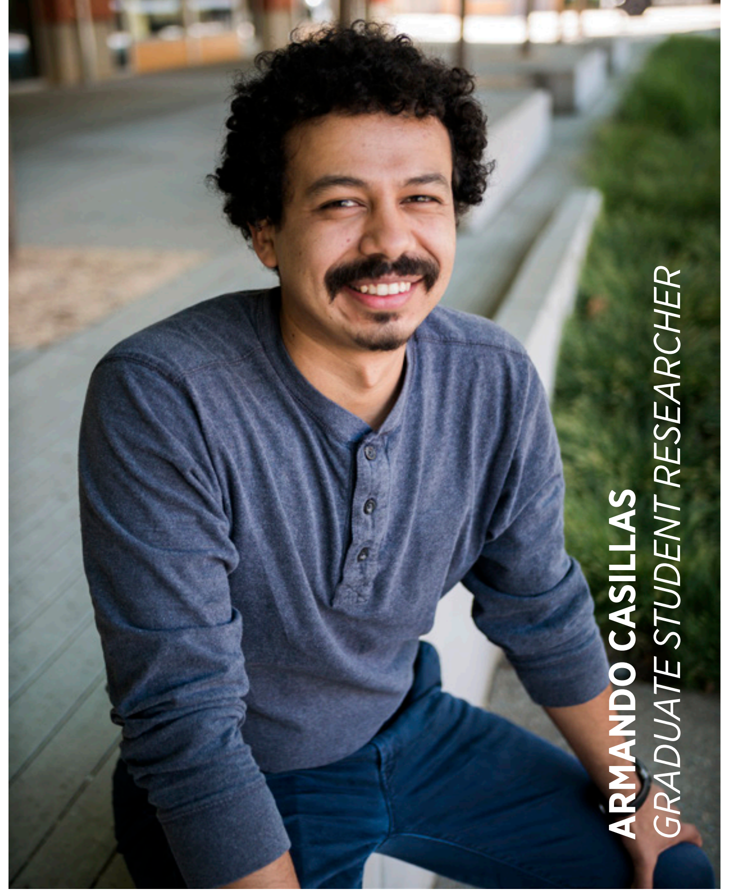
HUMAN FACTORS & POLICY RESEARCH

We understand that even game changing technologies face considerable barriers to adoption that include policy, market and human interaction. WCEC works with policymakers, supporting codes and standards that will save energy and promote new, efficient technologies. We also work closely with our Utility partners, to evaluate technologies for market incentives, and in parallel, address human behavioral factors.

Learn more » wcec.ucdavis.edu

NEW STAFF & STUDENTS





IMPROVING MARKET CONDITIONS FOR INCREASED ADOPTION OF GROUND-SOURCE HEAT PUMPS

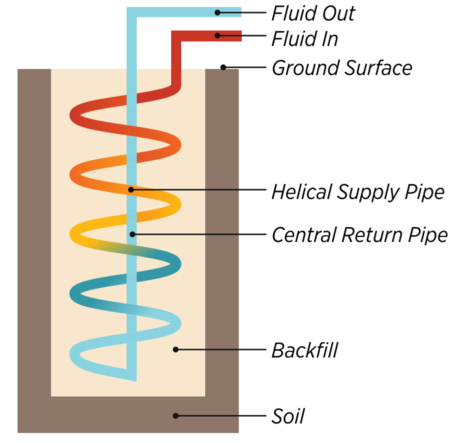
Ground-coupled heat pumps reduce cooling load in summer and heating load in winter by using the relatively constant temperature of the earth as the heat exchange medium instead of the outside air. By exchanging heat with the mild ground temperatures, ground-coupled heat pumps are more efficient than air-source designs and use less power during peak electricity demand.

PURPOSE

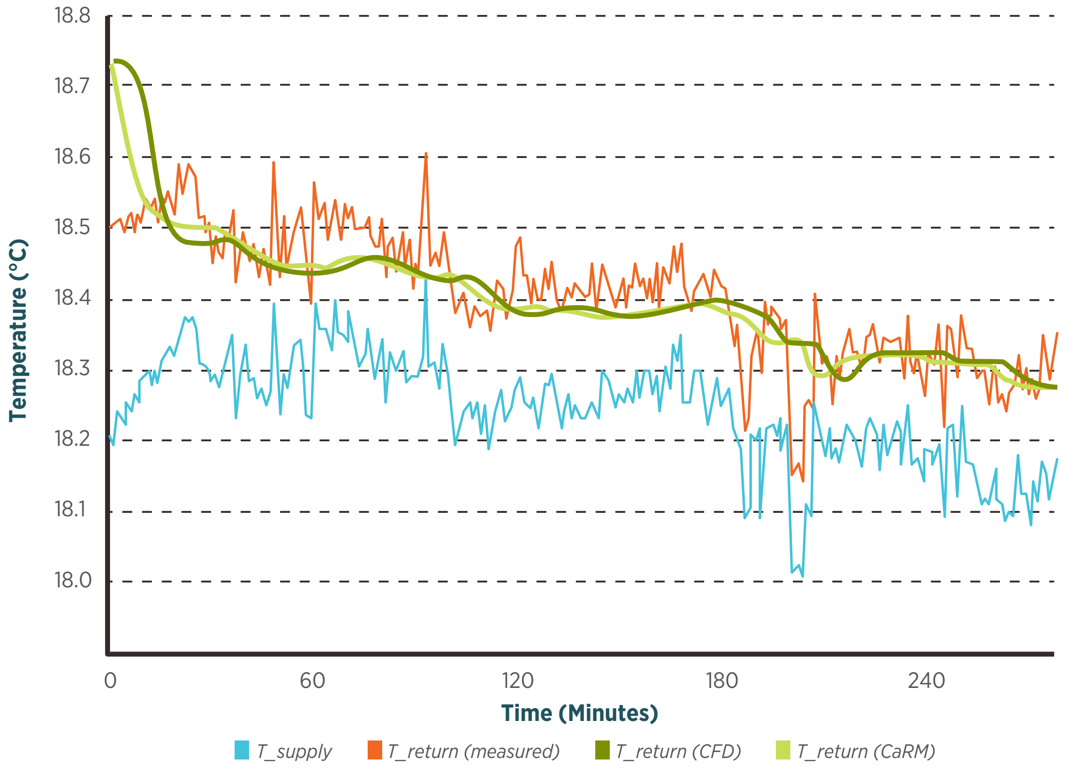
This project, funded by the California Energy Commission, demonstrates a less expensive method for implementing ground-source heat pump technology by using shallow-bore helical ground source heat exchangers (GHEs) instead of deep vertical bores. Our goal is to improve market conditions for increased adoption of ground-source heat pumps in California by identifying optimal designs for low-cost, shallow bore helical GHEs and providing the engineering information and installation guidance that is needed.

PROGRESS

This past year, WCEC researchers and collaborators developed and calibrated a computational model for the shallow bore helical GHE. The model uses electrical analogies of capacitance and resistance (CaRM) to describe the heat transfer in the ground.



Helical GHE modeled in this project



CaRM and CFD model predict return temperatures from the GHE within 0.20% of each other

Researchers validated the model by comparing results with those reported in the literature and from field data, with excellent agreement as shown in the figure above. In addition, researchers developed a computational fluid dynamics (CFD) model to test other design variables that the CaRM model was unable to simulate. In both models, the temperature of water returning from the ground was predicted with an accuracy of 0.1°C .

PATH FORWARD

Once validation of the CaRM model is complete, researchers will prepare and conduct controlled tests of a newly installed GHE design that is based on the model. These tests will be used as a final validation of the model.

USING WASTE-HEAT FROM AN AIR CONDITIONER TO HEAT A HOTEL SWIMMING POOL

29% REDUCTION IN POOL HEATER GAS USE

5% REDUCTION IN COOLING ENERGY USE

12% REDUCTION IN PEAK DEMAND

Air conditioning loads drive peak demand and contribute to overall electric power consumption in California. In the summer, cooling loads are highest in the middle of the day when air conditioners are the least efficient. Rejecting waste heat from an air conditioner to a swimming pool rather than to the outside air can significantly reduce electricity demand. At the same time, pool heating costs can be reduced by supplementing or replacing a natural gas pool heater with heat rejected from an air conditioner.

PURPOSE

In this project, funded by San Diego Gas & Electric, WCEC examined the impact of rejecting air conditioner waste heat to a swimming pool and compared the results to a conventional system that rejected heat to the air. Researchers installed a custom rooftop unit (RTU) at a San Diego hotel. This RTU conditioned a small fitness center while rejecting waste heat to the adjacent pool. WCEC documented energy savings and demand reduction.

RESULTS

The climate in San Diego was mild compared to many inland locations, with maximum outdoor air temperatures rarely exceeding 90°F during the 4-week study period. **Despite these mild temperatures, electricity demand reduction was as high as 12% when switching from the conventional heat rejection mode to pool heat rejection mode. Average electricity savings was about 5% and natural gas savings for pool heating was about 29%.**

PATH FORWARD

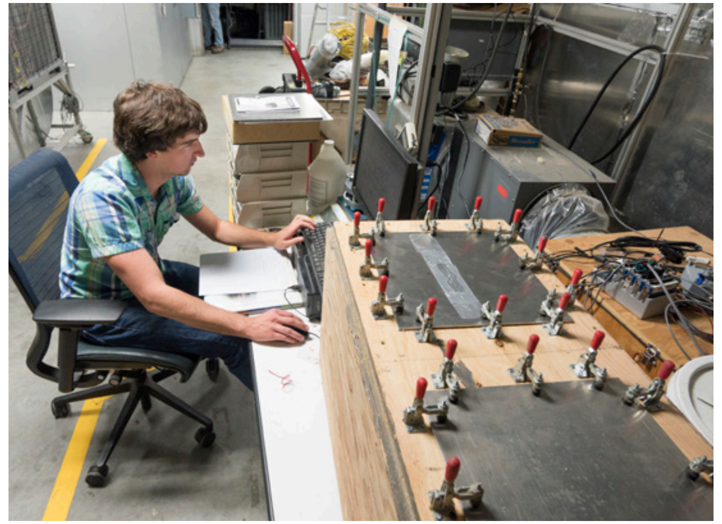
To increase adoption of technology that rejects waste heat to pools and provide appropriate utility program incentives, modeling the impact of the technology as a function of climate, pool size, air conditioner capacity, and air conditioner load factor is needed. The results from this project could provide an excellent data source to verify model accuracy.

AEROSOLIZED SEALANT FOR BUILDING ENVELOPES

Air leaks in buildings contribute to energy use by allowing uncontrolled airflow between conditioned and unconditioned spaces. Current methods for tightening building shells have relied primarily on manual sealing methods that are labor intensive and often insufficient, particularly in retrofit applications. WCEC is testing an aerosol envelope sealing process, AeroBarrier, to improve sealing effectiveness, reduce labor costs, and improve consistency of installation. AeroBarrier was originally developed by WCEC with funding from the California Energy Commission and U.S. Department of Energy. This past year, the WCEC demonstrated AeroBarrier in both commercial buildings and new single-family homes.

HOW IT WORKS

AeroBarrier involves pressurizing a building while applying an aerosol "fog" to the interior. As the air escapes through leaks in the shell of the building, the aerosolized sealant is transported to the leaks, and seals them as the particles try to escape from the building.



RETROFIT OF BUILDINGS AT MILITARY FACILITIES

WCEC performed retrofit sealing work for a project funded by the Department of Defense (DoD) ESTCP program. The objective was to validate AeroBarrier as a cost-effective means to meet U.S. Army Corps of Engineers' tightness requirements for military facilities. Researchers sealed various building types, in varied climates, to evaluate the ability of the technology to be applied on a large scale. WCEC also conducted lab testing of seal durability and modeled the impact tighter envelopes have on energy use in these facilities. **Seals could withstand 5,000 Pa of pressure.**

Researchers found that AeroBarrier is very effective at sealing building leaks on DoD facilities. **Ultimately, over 75,000 CFM at 75 Pa of building pressurization was sealed over sixteen demonstrations, cutting the average air leakage of the buildings in half.**

NEW SINGLE-FAMILY HOMES DEMONSTRATION

WCEC demonstrated that AeroBarrier sealed 79% of leaks in single-family homes through a project funded by the Department of Energy's Building America program. The aerosol process also sealed homes 56% tighter than the homes sealed with conventional open-cell spray foam, allowing the builder the flexibility to choose more cost-effective fiberglass insulation material.

The sealing process required access to the home for about four hours with 1-3 hours of actual sealing time.

Considering the level of air tightness achieved with AeroBarrier and the amount of effort currently employed to reduce air leakage in homes, it is likely that other manual sealing efforts could be eliminated—saving on the cost of construction, while also achieving superior and more consistent envelope tightness.

DoD ESTCP Final Report: bit.ly/ESTCPAerosolCPReport

NEXT GENERATION RESIDENTIAL SPACE-CONDITIONING SYSTEM

Space conditioning systems can have a profound impact on comfort and energy efficiency. The Electric Power Research Institute (EPRI), funded by the California Energy Commission, is integrating several advanced technologies into a single space-conditioning system for residential buildings that is cost-effectively optimized for California's climate. As part of this project, WCEC is testing one of these advanced technologies—a variable speed heat pump system.

LABORATORY TESTING

WCEC evaluated the impact that a typical residential duct system, located outside the conditioned space (e.g., in the attic), had on system performance. In Phase I, researchers tested system performance in the laboratory under a single-zone configuration. In Phase II, researchers tested system performance under a multi-zone configuration.

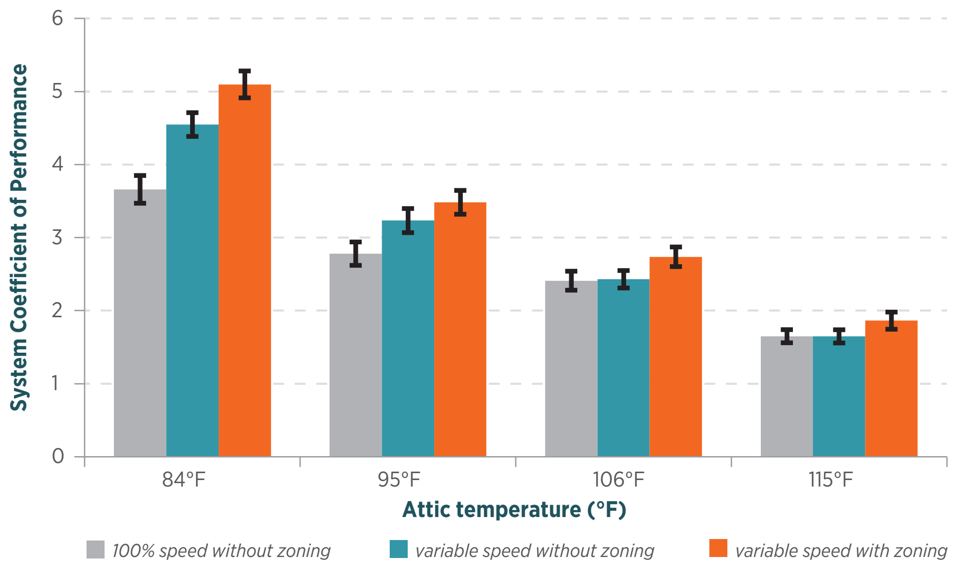
RESULTS

Researchers found that zoning can significantly improve delivery effectiveness, with nearly twice the amount of cooling making it to the conditioned space compared to a non-zoned system at low speed and hot attic temperatures. In addition, researchers found that at low attic temperatures there was an advantage to using variable speed equipment and even more of an advantage when including zoning. At high attic temperatures, there was no advantage to reducing equipment speed since the optimal performance occurred at 100% speed, but there was still a slight advantage using variable speed equipment with zoning controls allowing the system to run at lower power at higher efficiency.

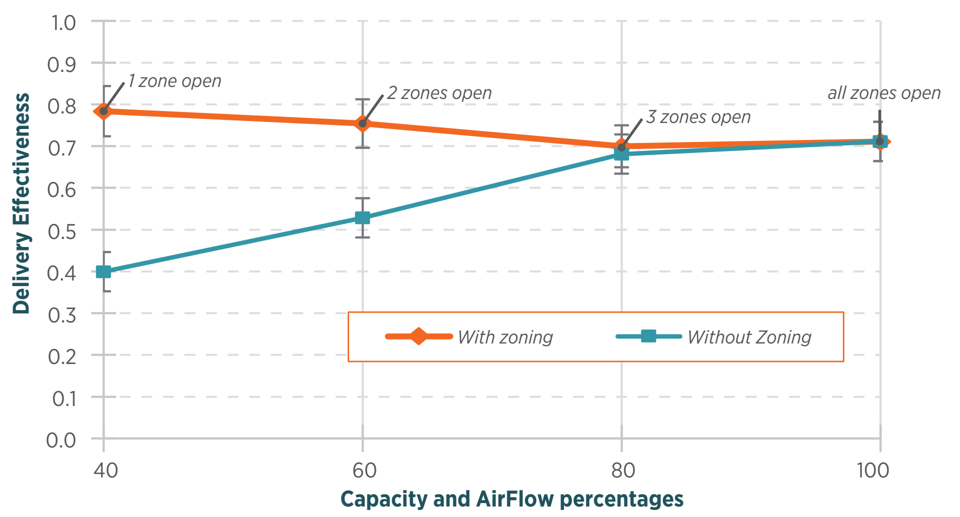
PATH FORWARD

EPRI is currently testing a space conditioning system in three homes in different California climate zones with a variable speed heat pump with zoning system. WCEC is supporting these field test efforts.

Optimal system performance at various attic temperatures



Delivery effectiveness for non-zoning versus zoning for an attic temperature of 115°F



ADDRESSING MARKET BARRIERS TO EVAPORATIVE COOLING TECHNOLOGY ADOPTION WITH INFORMATIONAL VIDEOS

Many stakeholder groups in the HVAC industry have a negative view of evaporative cooling because of past experiences with low-quality products. One of the barriers to changing these views is lack of knowledge about today's high-quality evaporative cooling products. WCEC tested two different information platforms to identify the attributes that best address this knowledge gap.

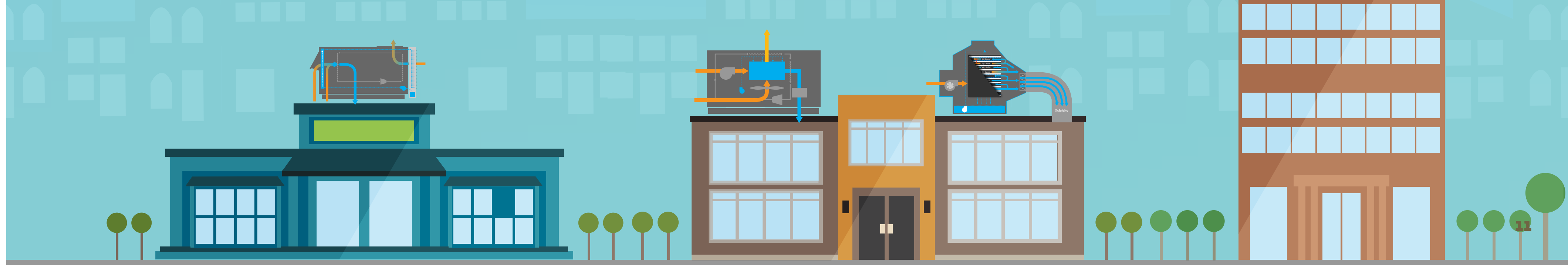
With funding from Southern California Edison, WCEC created a series of three videos, each featuring a single evaporative cooling technology. The videos provided information on how the technologies work, evidence of their technical performance, and cost and energy savings estimates, based on previous research. In addition, each video featured one or two testimonials from individuals who work with the technology.

Individuals from across the HVAC industry in California were recruited to participate in the study. Each was asked a series of initial survey questions, and then assigned to review information on one of the three technologies. Each group was further split, randomly assigned to either watch a video or review the website featuring the technology. After reviewing the information provided, participants answered another series of questions on their awareness, attitude, and interest in the relevant technology. Comparisons of groups, pre- and post- information, revealed that the videos did a better job of making viewers comfortable working with, buying or recommending the technologies than the websites. In other aspects the information sources rated similarly. **These findings suggest that videos are an effective platform for promoting emerging technologies, especially when disseminated through existing professional networks.**

WATCH VIDEO: http://bit.ly/WCEC_ECT1

WATCH VIDEO: http://bit.ly/WCEC_ECT2

WATCH VIDEO: http://bit.ly/WCEC_ECT3



IMPROVING WATER AND ENERGY EFFICIENCY IN CALIFORNIA'S DAIRY INDUSTRY

It is critical to keep dairy cows cool during California's hot summers. Standard cooling methods, however, such as fans and spraying cows with water, require substantial amounts of electricity and water. With the goal of reducing electricity and water consumption, WCEC and the UC Davis Department of Animal Science tested three novel approaches for cooling dairy cows in California. Researchers measured energy and water use and monitored the cows, including body temperature, respiration rate, and milk production, to determine the impact of the cooling methods. This project is funded by the California Energy Commission.

Installation of the convection cooling duct system and direct evaporative cooler

RESULTS

The results indicate that the Conduction Cooling Mats did not effectively reduce early indicators of heat stress in the cows in comparison to the Baseline. In contrast, both Convection Cooling "Ducts" and Optimized Baseline were effective.

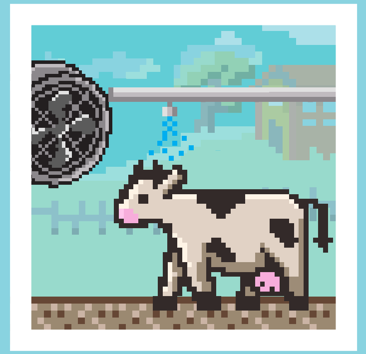
Researchers found that all the cooling methods tested saved water in comparison to the baseline, however, the evaportative coolers used in the Convection Cooling "Ducts" used more electricity than anticipated. Researchers are building and lab testing a higher efficiency evaporative cooler that uses a high-efficiency fan and pump to reduce electricity use.

PATH FORWARD

WCEC will conduct a detailed analysis of the Convection Cooling "Ducts" to determine if energy savings are possible. Researchers will also focus on optimizing traditional fans and sprayers. Additional field testing will take place in summer 2019.

FOUR COOLING METHODS USED

1. Baseline: A fan in the bed area and sprayers in the feed area.



2. "Optimized" Baseline: A fan and sprayers in the feed area.

3. Conduction Cooling "Mats": The bed area is cooled using heat exchange mats. Water flowing through the mats is cooled through a novel evaporative chiller (Sub-Wet Bulb Evaporative Chiller). This method is supplemented by fans and sprayers at high temperatures.

4. Convection Cooling "Ducts": Fabric ducting directs cool air onto the cows in the bed and feed areas. The air is cooled using a high-efficiency direct evaporative cooler. This method is supplemented by sprayers at high temperatures.

VALUATION OF THERMAL ENERGY STORAGE FOR UTILITY GRID OPERATORS

Most air conditioning systems remove heat from a building at precisely the time that cooling is needed. Thermal energy storage (TES) systems operate like air conditioning systems except that they remove heat from an intermediate substance (e.g., water, ice or eutectic salt solutions) at a time when the building doesn't actually need cooling. In this way, cooling is stored before it is needed, giving TES systems the ability to shift demand on the electric grid.

The current method for estimating the electric grid impact of TES is based on a "10-day average baseline," where the value provided by the TES system for a given hour is defined as the difference between the average energy use of the building for that hour over the past ten similar days and the measured energy use for that hour.

SIMULATIONS

With funding from Ingersoll Rand/Trane, WCEC performed simulations for three building types and five types of cooling systems in three California climate zones. Researchers input the cooling loads and ambient weather conditions into a post-processor that calculated the electric-grid impacts incurred from meeting the loads for each type of cooling system, compared to a TES system. Researchers then estimated the accuracy of the "10-day average baseline" electricity-use forecast method.

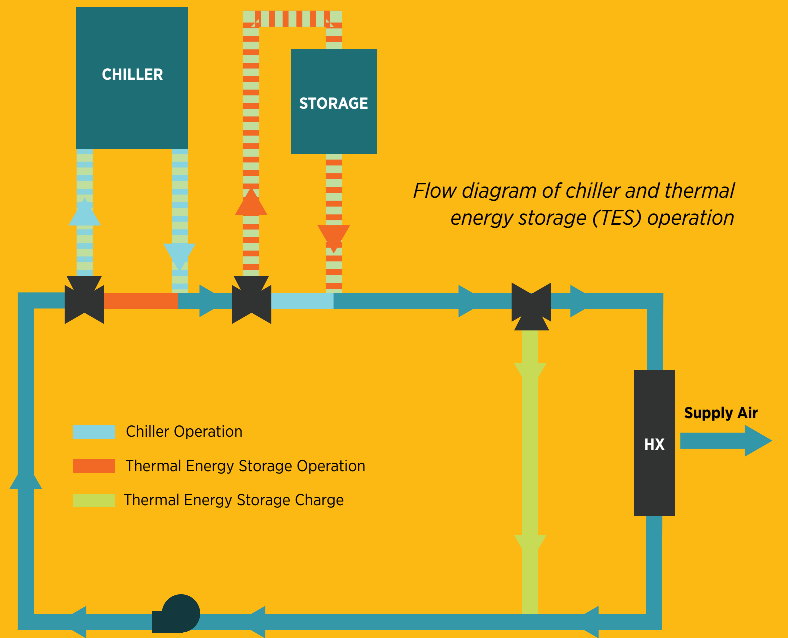
RESULTS

The "10-day average baseline" method consistently **under-predicted the impact that a TES system would have on the electric grid by an average of 38 to 57% .**

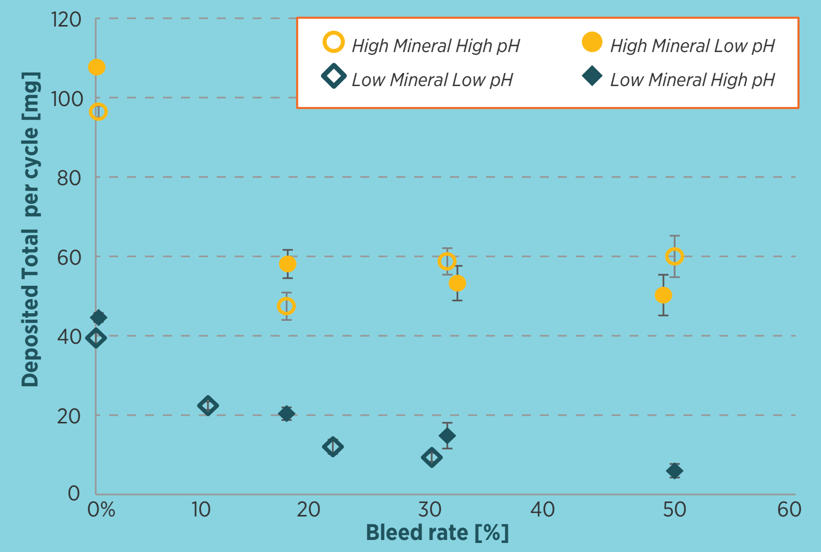
RECOMMENDATIONS

WCEC supports the development of electricity-use forecast methods that more accurately reflect the value of TES, possibly based on real-time monitoring of TES systems.

CASE STUDY: http://bit.ly/WCECcaseStudyTES



Flow diagram of chiller and thermal energy storage (TES) operation



Total deposited minerals as a function of bleed rate for 4 types of water

WATER MANAGEMENT FOR EVAPORATIVE CONDENSING UNITS

There is a huge potential for evaporative cooling systems to reduce both peak electricity demand and energy use in California's hot and dry climate, however the technology is not widely used. Two reasons for this are concerns about equipment maintenance and longevity, and water use in drought-prevalent California.

Water management of evaporative cooling units is essential and particular care must be taken to reduce the effects of hard water on the system, often resulting in the use of additional water (or a bleed-off) to reduce mineral precipitation and maintain longevity.

LABORATORY TESTING

With funding from Southern California Edison, WCEC tested four representative water compositions in California, that varied in their pH and mineral content, with four different bleed rates to determine the impact on mineral deposits in the system. Researchers also investigated whether evaporative cooling makes sense in California by analyzing a worst-case scenario where water used for evaporative cooling was produced using desalination, an energy intensive process. Finally, WCEC analyzed the potential for using rainwater in evaporative cooling systems.

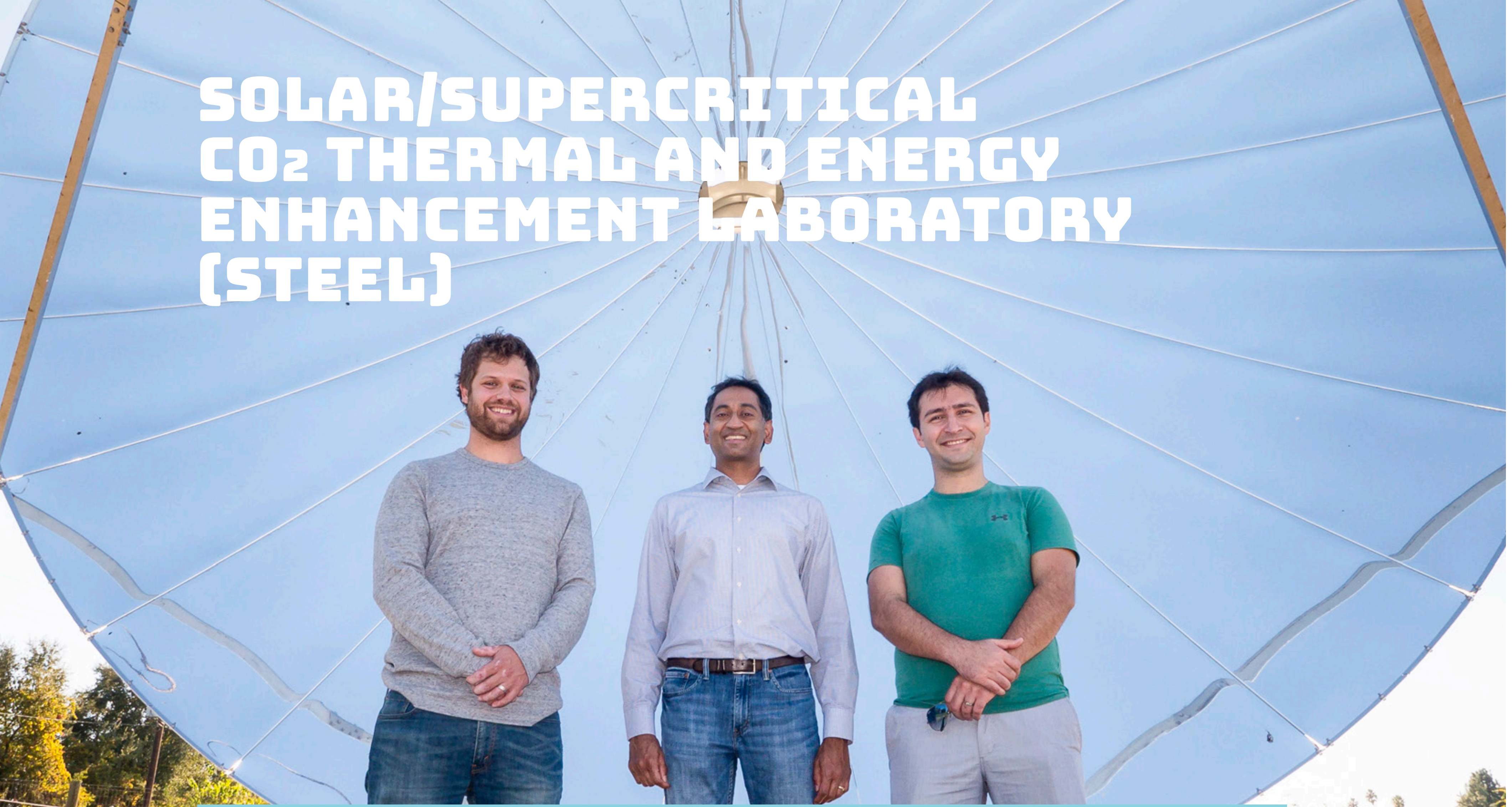
RESULTS

In examining water composition and bleed rates, WCEC found that: **1) the pH of the inlet water does not impact mineral deposition significantly and 2) increasing the bleed rate beyond roughly 15% does not reduce deposited minerals for high-mineral water, and the deposition decreases are probably immaterial for low-mineral water.**

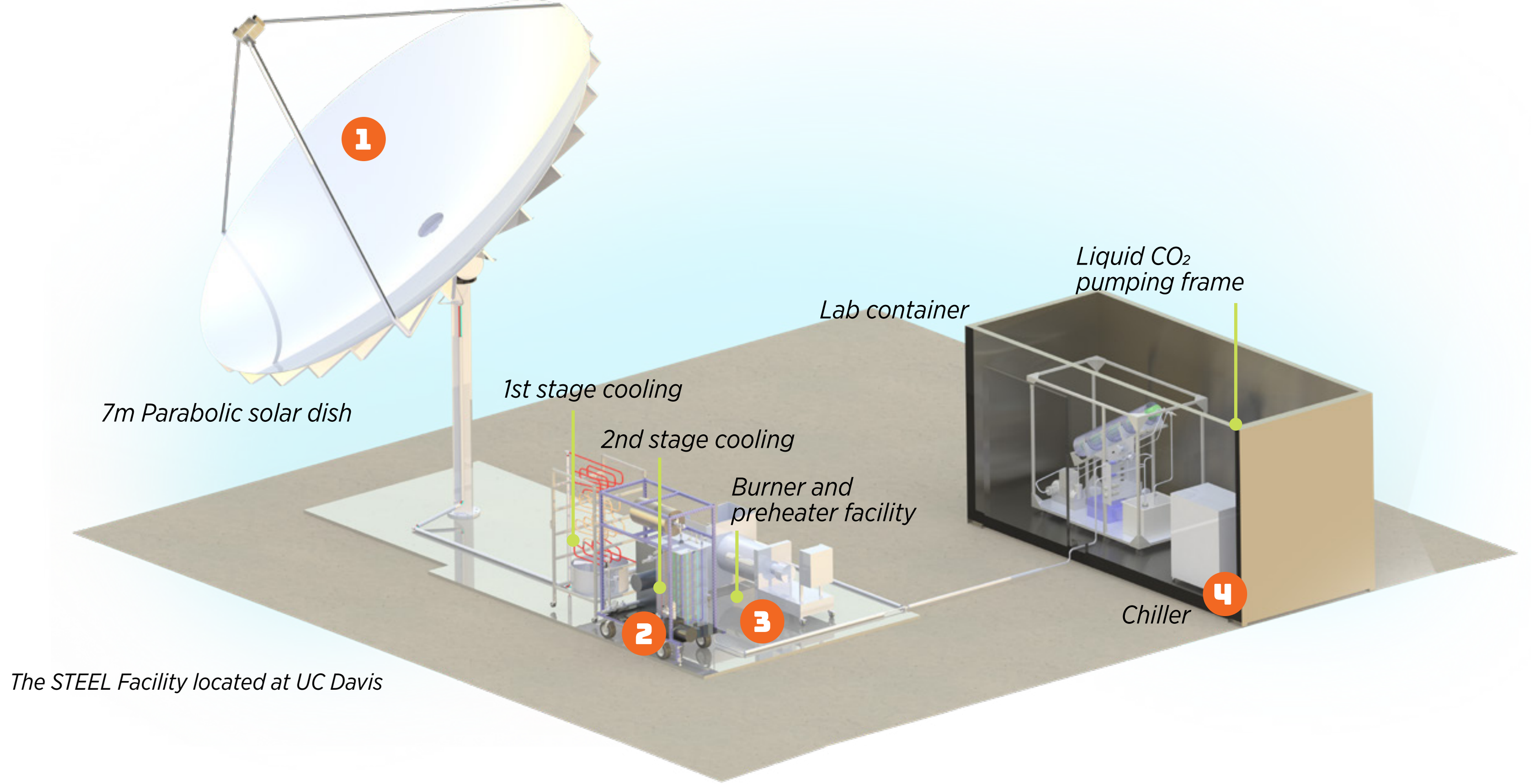
Researchers also found that **evaporative cooling does make sense in California, even when desalinated water is used. Investing 1 kWh of electricity into desalination, followed by reinvesting that water in evaporative condensers, yielded roughly 7 kWh of electricity savings (including 15% maintenance water usage).**

WCEC also found that, in most California locations, enough rainwater can regularly be captured and stored to cool a single-family home with an evaporative condenser.

SOLAR/SUPERCRITICAL CO₂ THERMAL AND ENERGY ENHANCEMENT LABORATORY (STEEL)



WCEC developed the Solar/Supercritical CO_2 Thermal and Energy Enhancement Laboratory (STEEL) to advance research in heat exchanger technology for a variety of applications such as solar power generation, thermal desalination, waste heat utilization, and solar fuels. The STEEL facility is equipped with a 7-m parabolic solar dish that is capable of concentrating sunlight by nearly 1,000 times at the focal area. The facility is also home to a high pressure (200 bar), high temperature (up to 700°C) supercritical carbon dioxide (sCO_2) flow loop. The combination of the parabolic dish and the sCO_2 loop give the STEEL lab a unique set of capabilities in the area of high temperature and high pressure heat transfer research, along with heat exchanger technology development.



The STEEL Facility located at UC Davis

ONGOING PROJECTS AT THE STEEL SITE

Microchannel solar receiver development

With funding from the Department of Energy's SunShot initiative, Oregon State University (OSU) developed a solar thermal receiver based on flow of sCO_2 through microchannel pin fin arrays. WCEC characterized the heat transfer performance of flow through the arrays using surrogate fluids and developed correlations to predict the thermal performance. Researchers are currently preparing to test a 15 cm x 15 cm receiver developed by OSU.

Microchannel waste heat recuperator for sCO_2 cycles

With funding from the Office of Naval Research, US Department of Energy, UC Davis and Carnegie Mellon University researchers collaborated to design and fabricate a novel additively-manufactured heat exchanger for waste heat recovery and for indirect fossil-fired sCO_2 cycles.

PATH FORWARD

WCEC will test multiple recuperator modules together to address scalability of the design.

Conference Paper:
http://bit.ly/AdvancedWasteHeatRecoup

Conference Paper:
http://bit.ly/AdvancedHX

Journal Article:
http://bit.ly/PitchAspectMicroscale

FIELD PERFORMANCE OF DISPATCHABLE PRE-COOLERS

Condenser-air pre-coolers evaporate water into the airstream used for heat rejection from an air conditioning system. The evaporative process reduces the air temperature and allows the air conditioner to operate more efficiently at higher outdoor air temperatures. WCEC's previous work has illustrated the energy and demand savings potential of condenser-air evaporative pre-coolers in the hot, dry California climate. In this project, researchers evaluated the performance of condenser-air pre-coolers being used as a dispatchable asset to reduce electrical demand during peak demand events.

With funding from Southern California Edison, WCEC evaluated the transient response from turning on a condenser-air pre-cooler to achieve load reduction in a laboratory and field setting. Response time is a key factor in deciding if pre-coolers are a practical tool for achieving dispatchable demand reduction. Laboratory testing measured the time response impact of a pre-cooler installed on a 4-ton RTU during startup, operation, and shut down of the pre-cooler. Researchers conducted field testing between July-October 2017 on a big box retail store in Corona, CA. The store had six RTUs with existing pre-coolers and an additional five RTUs were retrofitted with condenser-air pre-coolers as part of the project. WCEC simulated 25+ demand events that lasted from 60 – 240 minutes at times when outside air temperature was 95°F or higher.

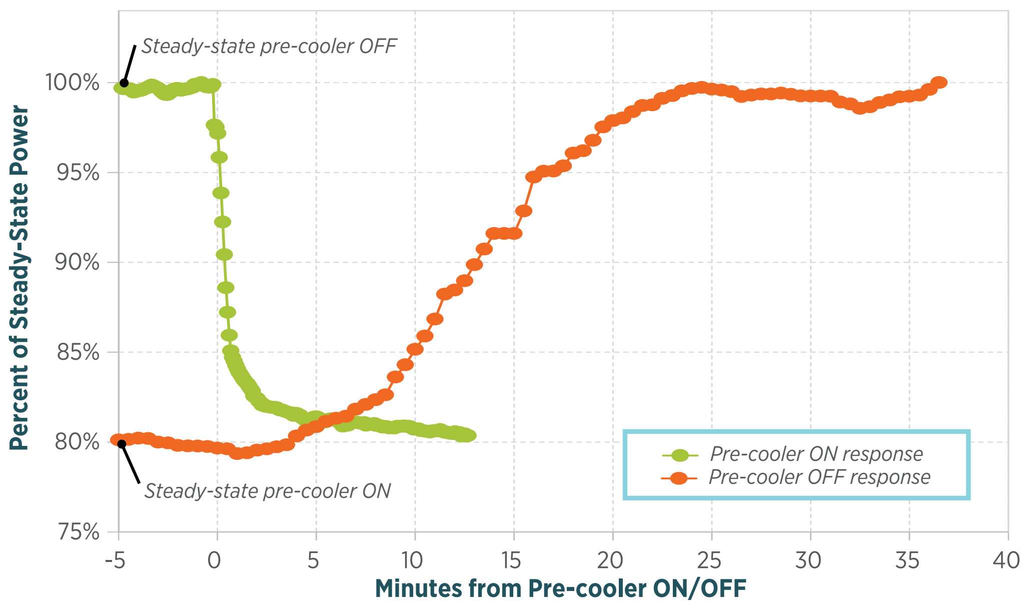
RESULTS

When the pre-cooler was activated, laboratory testing showed the power (with respect to the steady-state power draw) was reduced by 15% within 16 minutes. When the pre-cooler was turned off, partial cooling benefits remained for up to 20 minutes.

PATH FORWARD

WCEC will analyze field test data to study the aggregate transient response of dispatching pre-coolers on 11 RTUs on a single rooftop.

Laboratory testing of response from turning the pre-cooler on and off



Response time of dispatchable pre-coolers

Test Outdoor Air Dry Bulb/Wet Bulb °F	Time to achieve 50% of maximum power reduction (min)	Time to achieve 75% of maximum power reduction (min)	Time to achieve 100% of maximum power reduction (min)
OA 95/70	0.6	1.6	13.4
OA 105/73	0.6	0.9	12.5
OA 115/76	0.6	1.1	13.3

FIELD PERFORMANCE OF AN RTU OPTIMIZATION PACKAGE

Packaged compressor-based air conditioning and heating roof top units (RTUs) provide a significant amount of the cooling for commercial spaces in California. Optimizing the efficiency of RTUs can reduce the strain put on the California electric grid from compressor-based cooling.

With funding from Southern California Edison, WCEC developed a combined retrofit optimization package that can increase the efficiency of RTUs, reduce peak electrical demand, and maintain net capacity at peak. The optimization package includes a variable frequency drive (VFD) to reduce the compressor speed and a condenser-air pre-cooler. Researchers field tested this package at a big box retail store in Corona, CA. A 10-ton RTU, that served part of the store room, was selected and retrofitted with two VFDs (one for each compressor) and a condenser-air pre-cooler. The performance of the RTU with optimization package was compared to the performance of the same unit without the optimization package.

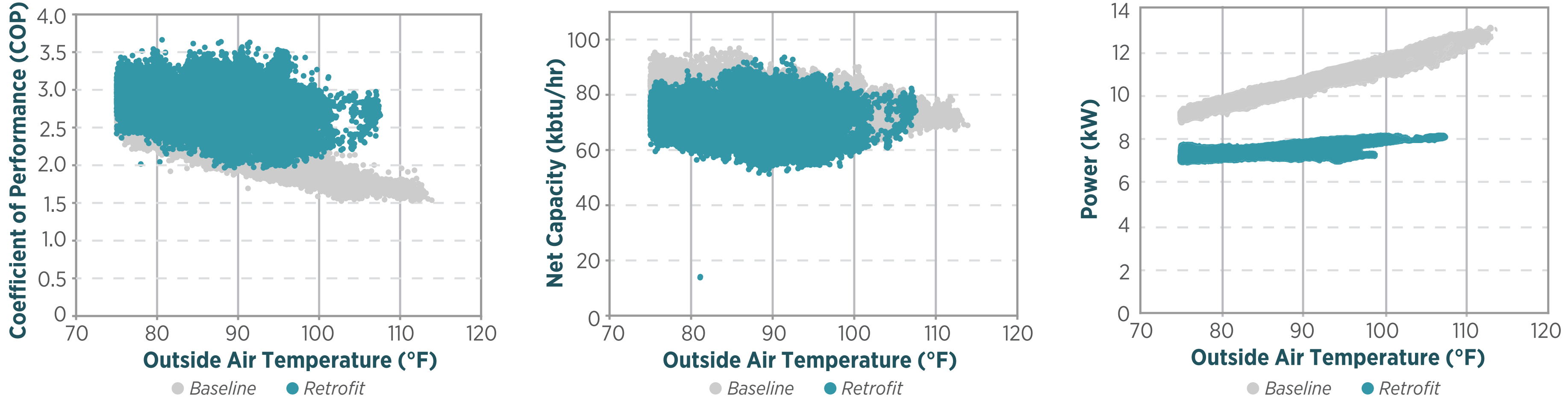
RESULTS

Field testing illustrated that the combined retrofit package has the potential for significant energy savings. On average, while operating both compressors, the efficiency increased by 23%, the net capacity decreased by 9%, and the power draw decreased by 26%. Additionally, the characteristic performance of the combined retrofit had very little dependence on the outside air temperature. Therefore, the biggest performance improvement was measured at the hottest outdoor air conditions: **33% increase in efficiency, no change in net capacity, and 33% decrease in power use.**

PATH FORWARD

Future work should investigate the performance of the combined package on higher capacity RTUs and the impact to RTU performance when only a subset of the available compressors are reduced to 48Hz operation.

Performance graphs comparing the retrofit optimization package to the baseline RTU



2018 UPCOMING PROJECTS

ADVANCING ENVELOPE AND DUCT LEAKAGE SEALING

WCEC will conduct two projects to advance state-of-the-art envelope and duct leakage sealing solutions by developing diagnostic screening technology/methodology to identify buildings with leakage problems. This new technology/methodology will use advances in internet-connected technologies. As part of a project for the National Institute of Standards and Technology, WCEC will further validate the developed leakage measurement technique for widespread applicability and scalability, investigate the use of different sensors to reduce cost and installation time, and pursue commercialization.

EVALUATING SCHOOL VENTILATION TECHNOLOGIES

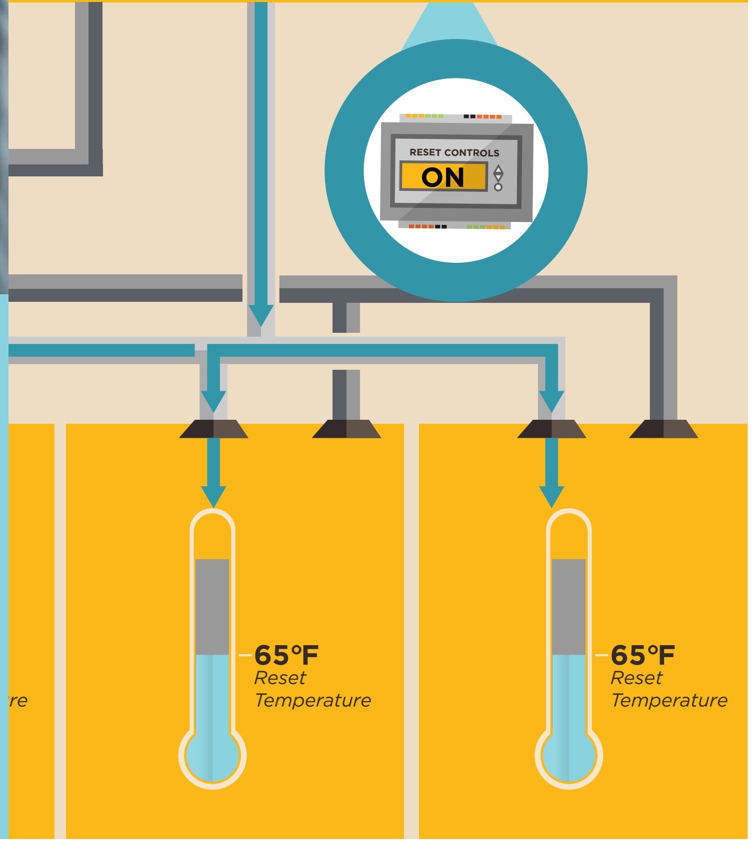
WCEC will conduct a ventilation and energy efficiency field study at two school sites in the Central Valley through a grant from the California Energy Commission. The study includes 13 portable classrooms with wall-mounted HVAC units. The goal is to evaluate the benefits and limitations of ventilation technologies, both from an indoor air quality and energy efficiency perspective. The study will also evaluate how ventilation technologies and their implementation impact compliance with the ventilation requirements in California's Building Energy Efficiency Standards.

PARTICIPATING IN CALTESTBED INITIATIVE

CalTestBed—a collaboration of California Clean Energy Fund and the University of California—will setup a voucher program to provide access for clean energy entrepreneurs to use testbed facilities to test and/or certify prototypes of pre-commercial, customer-side technologies and provide feedback to help entrepreneurs refine their product designs for future pilot demonstrations.

DEVELOPING INSTRUCTIONAL VIDEOS FOR CALIFORNIA'S 2016 BUILDING ENERGY EFFICIENCY STANDARDS

WCEC received funding from the California Energy Commission to develop video-based courses on the 2016 Building Energy Efficiency Standards for non-residential HVAC systems. This project builds off of our work creating video-based courses for residential HVAC systems.



WORKING WITH MEXICO ON ENERGY EFFICIENCY IN NON-RESIDENTIAL BUILDINGS

UC Davis received three awards from Mexico's Ministry of Energy and its National Council for Science Technology to work in partnership with Mexican research institutions on energy efficiency projects. WCEC is leading one of these projects and will work with Tec de Monterrey to develop a consortium for demonstrations of energy efficiency in non-residential buildings.

INCREASING ADOPTION OF EMERGING CLEAN ENERGY TECHNOLOGIES THROUGH PROCUREMENT

With few rigorous product evaluations to inform purchasing decisions, large commercial and institutional customers face enormous uncertainty and high costs associated with purchasing advanced energy-related products. With funding from the California Energy Commission, WCEC will work as part of a UC Davis team to develop the California Energy Product Evaluation (Cal-EPE) Hub, which will improve adoption rates of these products by providing comprehensive product reviews via an online Buyer's Guide targeted to institutional customers.

NOTABLE OUTREACH AND EVENTS 2017

JAN.
- Presented at Daikin's Konwakai in Napa, CA
- Attended California Climate Change Symposium, Sacramento, CA
- Presented and chaired a subcommittee at ASHRAE's Winter Conference in Las Vegas, NV

FEB.
- Sheet Metal Union SMART visit and tour
- California Energy Commission tour

MAR.
- Participated in the ASHRAE talk in Sacramento, CA
- Daikin meeting and television interview filmed at WCEC

APR.
- Attended the ET Summit in Ontario, CA

MAY
- Attended meetings with Daikin and ESTCP in Washington, DC
- WCEC Affiliates Forum
- WCEC Steering Committee
- Participated in ONR NEPTUNE's biannual presentations at MIT

JUN.
- Participated, presented and chaired a subcommittee at ASHRAE's Annual Conference in Long Beach, CA

JUL.
- Mandela Washington Fellows visit and tour

AUG.
- World Bank tour
- Participated, presented and chaired a session at the International Conference on Nanochannels, Microchannels and Minichannels in Cambridge, MA

SEP.
- Presented at ESTCP's Symposium Session
- Attended the Aeroseal Success Summit in Chicago, IL
- UC Davis Energy Graduate Group is launched
- Presented proposal at the DoD selection meeting in Washington, DC

OCT.
- Presented aerosol sealing research at the EEBA conference in Atlanta, GA

NOV.
- Meeting with the Office of Naval Research in Annapolis, MD
- Participated in the SERDP and ESTCP Symposium in Washington, DC

DEC.
- Exploratorium visit and tour
- Siemens visit and tour
- Global Green visit and tour
- Mark Modera becomes interim director of the Energy and Efficiency Institute at UC Davis
- Energy Commission workshop in Sacramento, CA

Thank you to our Affiliates

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California Energy Commission
Carrier Corporation®
Coolerado®
Daikin Industries, Ltd.®
Integrated Comfort, Inc.®
Munters® Corporation®
Pacific Gas and Electric Company®
Portacool™
Sacramento Municipal Utilities District
Seeley International Pty. Ltd.®
Sempra Energy® Utilities
Sheet Metal Workers International Assoc.
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Southern California Edison®
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