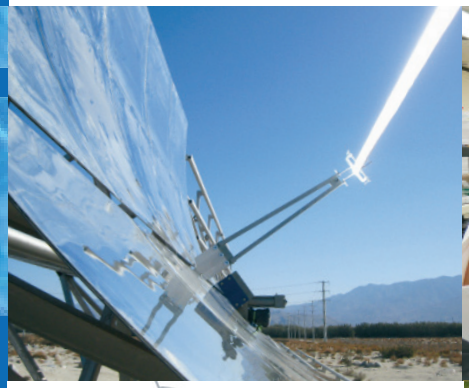
BOURNS COLLEGE OF ENGINEERING – CENTER FOR ENVIRONMENTAL RESEARCH AND TECHNOLOGY









UC RIVERSIDE UNIVERSITY OF CALIFORNIA | CE-CERT

2015 Annual Report

(May 2016)

DIRECTOR'S **MESSAGE**

The aggressive pursuit of cutting edge research and the expansion of our partnerships, both domestic and abroad, are key elements in CE-CERT's continued growth and our expanding impact on real-world environmental solutions. Several examples of this are as follows:

This past year our efforts with the US Department of Energy (USDOE) and the US Department of Transportation (USDOT) are developing and optimizing intelligent transportation strategies, such as eco-driving and vehicle-to-grid charging. Our international efforts on marine engines have resulted in new laboratories that are measuring the impact of diesel and alternative fuels used throughout the world. Within the state, we are teaming with other UC campuses to discover how our applied research can become a substantial component in solving the University of California campus quest for achieving net zero by 2025. As a partner in the $25 million a year USDOE funded Bio-Energy Science Center (BESC), UCR has advanced a potentially game changing technology called Co-solvent Enhanced Lignocellulosic Fractionation (CELF) for overcoming the recalcitrance of cellulosic biomass as the major barrier to low cost biological conversion into liquid transportation fuels.

Another game changing collaboration opportunity has recently unfolded with the California Air Resources Board (CARB) decision to relocate their Southern California facilities to our UCR campus. There are plans to develop an International Center for Air Pollution and Climate Change Research that would also include a world-class facility to support motor vehicle emissions standards development, implementation, and enforcement. The University of California has long been CARB's greatest partner, and we look forward to further strengthening our relationship through this move.

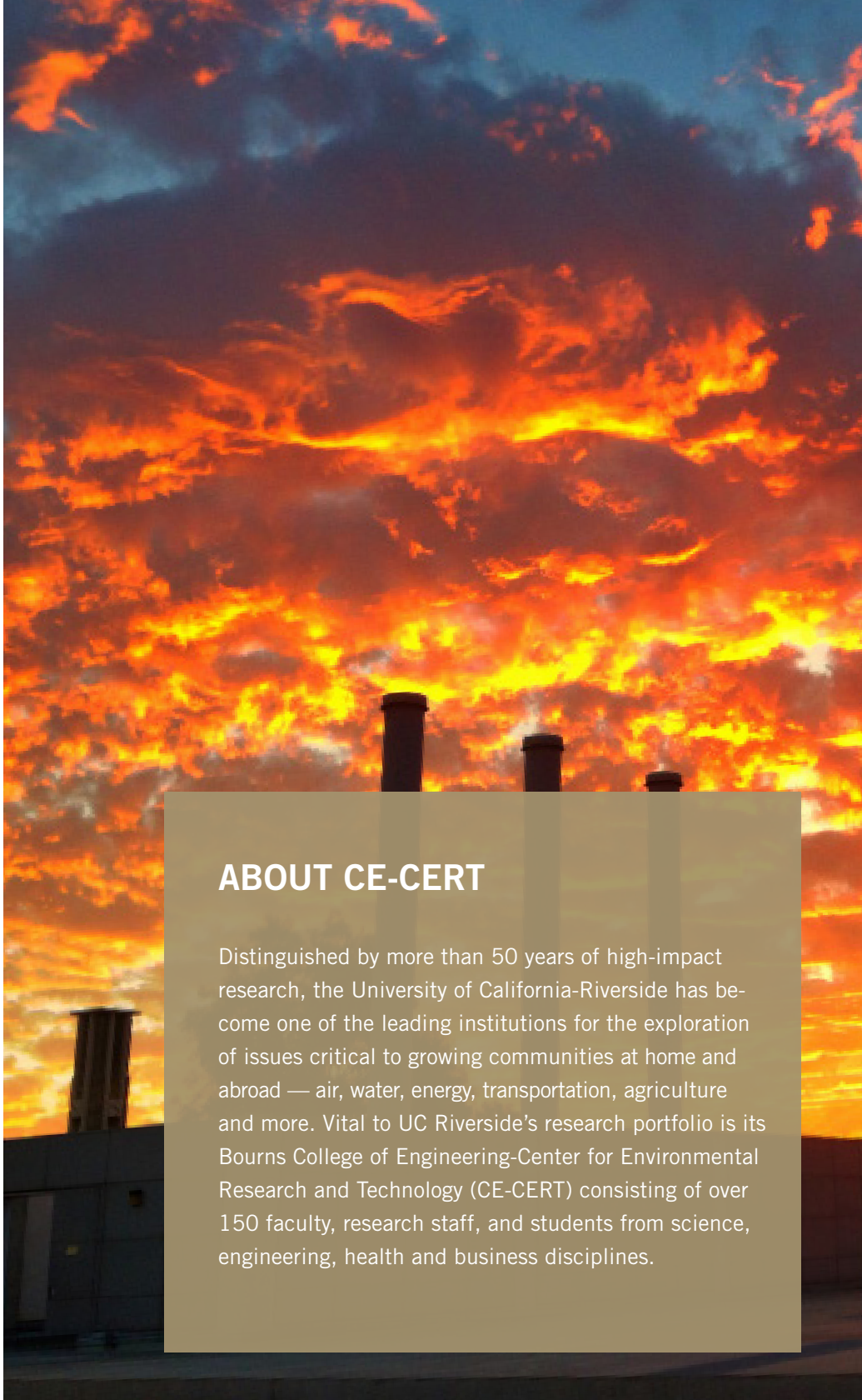
Our focus with CARB and other key partners is to advance our understanding of renewable energy and fuels generation, to optimize technologies to use these energy sources, and to understand the air and health impacts of their use. Our partnerships are being developed through several mechanisms:

- Internships: Our undergraduate and graduate students will have unique internship opportunities to work directly with CARB and other partner facilities.

- Continuing Education: Current staff will have the opportunity to complete graduate level coursework at UCR, addressing subjects such as air quality and climate change, as a part of their life-long learning experience. Earlier this year, SCAQMD pledged a $1 million endowment to CE-CERT to support this effort.

- Joint Research Programs: UCR, CARB and other stakeholders will work to develop joint research programs, shared knowledge bases and research equipment in a number of areas that are of mutual interest. One example is the new BREATHE Center. BREATHE (Bridging Regional Ecology and Aerosolized Toxins to understand Health Effects) aims to develop multidisciplinary research projects to study the health impacts of air quality changes, such as those resulting from chronic drought, climate change, and resulting ecological change.

The success of our innovative research is credited to our students, faculty, researchers, accomplished alumni, donors and committed staff. Together, with the vision and support of campus leaders for advancing UC's mission of education, research and public service, we are embarking on an exciting era for CE-CERT, for our campus, for our state and beyond.



ABOUT CE-CERT

Distinguished by more than 50 years of high-impact research, the University of California-Riverside has become one of the leading institutions for the exploration of issues critical to growing communities at home and abroad — air, water, energy, transportation, agriculture and more. Vital to UC Riverside's research portfolio is its Bourns College of Engineering-Center for Environmental Research and Technology (CE-CERT) consisting of over 150 faculty, research staff, and students from science, engineering, health and business disciplines.

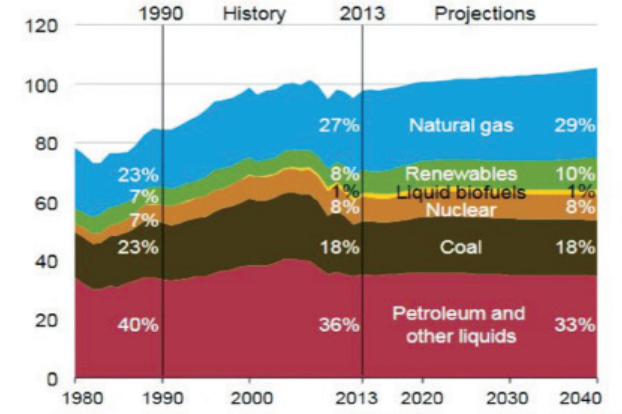
CE-CERT'S VISION

For the past 25 years, CE-CERT has served as a recognized leader in education, an honest broker in research, a creative source of innovative technology, and a strong contributor to solving societal environmental issues.

SETTING **THE SCENE**

The way the US obtains its energy in the future will look very different compared to today. The Department of Energy projects that use of natural gas will increase over the next twenty years, as will renewable technologies, particularly wind and solar (see figure to the right). At CE-CERT we are researching the best ways to accomplish this transition – from renewable energy generation, optimization of the technologies that use these energy sources, and studying the environmental and health implications from its use.

> Creating sustainable solutions requires collaboration amongst the greatest minds and diverse input from across disciplines. CE-CERT's unique structure was created to foster these partnerships - across colleges, universities, industries and government.



Source: Department of Energy Annual Energy Outlook 2015, April 2015
http://www.eia.gov/forecasts/aeo/pdf/0383%282015%29.pdf

CE-CERT'S AREAS OF RESEARCH

CLEAN AIR.
Understanding how pollution sources react in the atmosphere to form toxics, ozone (smog), and particulates that impact human health

RENEWABLE FUELS.
Life-cycle analysis of renewable fuels from creating renewable fuels from landfill waste and biomass (e.g. green waste) to improving technologies that use these fuels to run efficiently and safely

SUSTAINABLE TRANSPORTATION SYSTEMS.
Environmentally-friendly intelligent transportation systems, eco-driving applications, and advanced vehicle integration

RENEWABLE ELECTRICITY AND SMART GRIDS.
Advanced solar energy production, energy storage, energy distribution and management

CLIMATE CHANGE IMPACTS.
Measuring and predicting impacts of man-made (e.g. power plants) and natural (e.g. wildfires) pollution on greenhouse gases and cloud formation

COMMERCIALIZING BIOFUELS

The Department of Energy selected UCR and commerical partner MG Fuels to receive over $1 million in funding through its BioEnergy Technologies Office (BETO) incubator program to further develop CELF, a breakthrough biomass-to-biofuels technology that was invented at CE-CERT.

CE-CERT IS **INNOVATION DRIVEN**

CE-CERT is at the forefront of developing innovative technologies to advance the bioenergy field. Recently, the Aqueous Biomass Processing (ABP) group invented a groundbreaking biomass pretreatment and fractionation process called CELF (Co-solvent Enhanced Lignocellulosic Fractionation) to directly convert organic plant wastes and residues from the agricultural and forestry industry into biofuels and chemicals. CELF is a patented process that brings researchers closer to reaching the long elusive goal of producing renewable fuels and chemicals from biomass at high enough yields and low enough costs to become a viable alternative or replacement for petroleum. Originally, CELF was developed to be a cost-saving front-end technology to be integrated with cellulosic ethanol or other advanced biofuel operations to reduce the scale-up difficulties associated with biomass processing and achieve product yields that were not possible before. Additionally, CELF could also serve as a stand-alone process to directly produce a highly combustible oil called "CELF oil" that is a direct replacement for certain petroleum oils. The CELF process was exclusively licensed by investment company CogniTek and the license was then transferred to a brand new bioenergy start-up, MG Fuels, to commercialize CELF and other breakthrough biofuel technologies. Support for the development of CELF in other bioenergy applications is provided by the Bioenergy Science Center (BESC), one of three national science centers supported by the DOE Office of Science.

PAVING A NEW PATH

CE-CERT'S NEWEST FACULTY MEMBER, DR. KELLEY BARSANTI, is paving a new path developing mechanistic modeling improvements for the prediction of one of the most ubiquitous pollutants in our atmosphere: secondary organic particulate matter. Kelley's groundbreaking research includes conducting measurements of organic compounds with comprehensive two-dimensional gas chromatography (pictured right with Post Docotoral Researcher, Lindsay Hatch) and using process level models to follow the chemical and physical transformations of those compounds as they evolve from gaseous emissions to particle constituents. For many of the recently measured compounds, their role in the formation of particulate matter and other pollutants, such as ozone, is as yet unknown. This year, Kelley will lead a four-year project to investigate the nighttime chemistry of biomass burning emissions; she will also collaborate with researchers from the National Center for Atmospheric Research (NCAR) and Rutgers University to improve models for biomass burning. Findings from combined projects, totaling nearly $1 million dollars, will improve the understanding and model representation of the emissions of semi- and intermediate-volatility organic compounds from North American fires, the chemical transformations of those emissions, and the subsequent local to regional air quality and visibility impacts.

SIGI IN ACTION

Through our applied SIGI testbed, we are helping utilities, industry, and government understand the various ways they can meet their storage and production goals. For example, CE-CERT's testbed (pictured) responded immediately to our local utility's request for help to avoid a brown-out by using our real-time controls to supplement 2MWh to the grid over a 4-hour window.

CE-CERT's Multi-Standard Direct Charging Station (insert picture) can fully charge most electric vehicles (EVs) available today in under 60 minutes.

CE-CERT IS **BUILDING A STRONGER CALIFORNIA ECONOMY**

IMPROVING THE ENERGY EFFICIENCY OF OUR UTILITIES

Most of the water and waste water systems in California have developed over the last 100 years in an ad hoc fashion. For efficient, safe and reliable operation of these water systems, Supervisory Control and Data Acquisition System (SCADA) upgrades are necessary for conducting real-time monitoring and control. Upgrades and modernization efforts face the challenges of integrating control equipment of various vintages along with communication barriers among different vendor protocols. CE-CERT, with $3 million in funding from the California Energy Commission, will upgrade five wastewater systems throughout California with unique energy management and data acquisition supervisory control strategies.

> These demonstrations will serve as a platform for implementation across the state that can improve efficiency while reducing peak loads and electricity costs in the delivery and treatment of water in California.

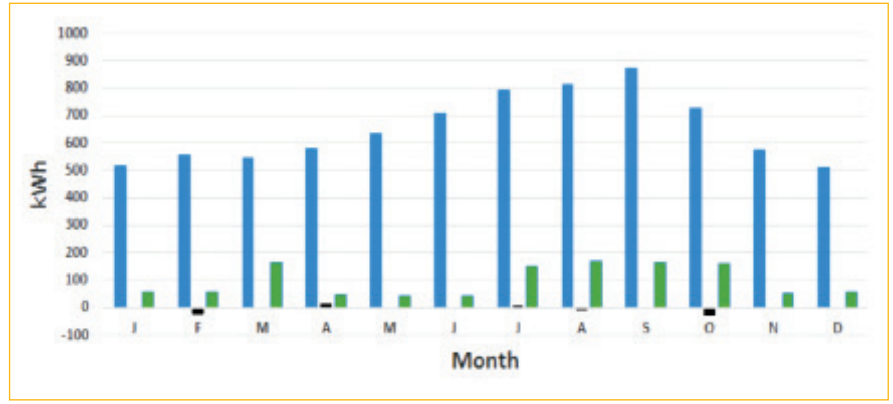
This new system will overlay and incorporate the existing SCADA system without disrupting current operations. The demonstration project will highlight a pathway for water agencies in California to reduce their peak energy consumption substantially with no detriment in service or reliability.

MEETING OUR RENEWABLE ENERGY PRODUCTION TARGETS

CALIFORNIA'S FUTURE 'SMART GRID' SYSTEM will integrate solar, wind, and other renewable electricity generation with energy storage to meet our electricity demands and to support electric transportation. The Sustainable Integrated Grid Initiative (SIGI, pictured left) at CE-CERT combines these elements so that researchers, utility personnel, regulators, and the public can evaluate and optimize a variety of smart grid configurations at full-scale.

California is requiring 33% renewable energy by 2020 and the California Public Utility Commission is also requiring the Investor Owned Utilities to acquire 1,325MW of storage by 2020. While using solar power is now commonplace, coupling solar with storage to achieve optimum economical advantages is a new area of research that requires large-scale system integration and analysis. Serving as a platform for innovative applications, CE-CERT's living laboratory demonstrates our ability to use minimal solar coupled with batteries and a research-grade smart dispatch system to create different scenarios, including a net zero building. The graph on the right shows the electricity purchased the year before and after our testbed was operational. The green bars represent the impact of adding only 5 electric vehicle chargers to our building.

Net Zero Demonstration: CE-CERT Administration Building Daily Average Electricity Usage from Grid



The blue bars represent our electricity usage before renewable smart grid was installed, the black bars (almost zero) represent after the renewable grid was operational, showing net zero operations. The green bars show the extra electricity usage from having 4 Level II and 1 Level III EV chargers connected to the building.

DID YOU KNOW?

Intelligent Transportation Systems (ITS) specifically designed to minimize the environmental impacts of transportation (such as dynamic eco-driving research described on the opposite page) have been shown to reduce energy and emissions on the order of 10% to 20%. Current environmental-ITS research programs in the United States and the European Union are focused on developing and testing applications that take advantage of "connected vehicle" technology, which enables vehicles to communicate with each other as well as with roadway infrastructure, and vice versa. Research is needed to improve our understanding of the connection between environment, mobility, and safety performance of any ITS programs. Research is also needed to quantify the potential induced demand effects of ITS program deployment.

CE-CERT IS
LEADING IN SUSTAINABLE TRANSPORTATION

ADVANCED VEHICLE CHARGING TECHNOLOGIES

The Sustainable Integrated Grid Initiative (SIGI) is a 4 megawatt (MW) testbed that integrates solar, battery storage and electric vehicle charging into a smart micro-grid. Now that the SIGI testbed is complete, we are evaluating and demonstrating a variety of advanced charging technologies and monitoring associated vehicle activity to further demonstrate the effectiveness of Partial Electric Vehicle (PEV) deployment as part of a smart grid system. One particular project, funded by Riverside Public Utilities and South Coast Air Quality Management District, is a vehicle-to-grid (V2G) technology that can help mitigate power glitches by momentarily supplying electricity to the grid, and recharging when the need is less. The project involves the development of the technology in the testbed and optimizing algorithms and on-board vehicle telematics. (Pictured on opposite page.)

> Enabling V2G strategies will yield a number of environmental benefits including improved power quality, greater energy flexibility, and maximization of PEV use.

"ECO-DRIVING" HELPS TRUCK DRIVERS DRIVE SMARTER

THE NATIONAL CENTER FOR SUSTAINABLE TRANSPORTATION (NCST) is one of five national centers funded by the US Department of Transportation's Office of the Secretary for Research and Technology under the University Transportation Centers (UTC) program. NCST brings together six innovative universities with the goal to move the US towards a more economically, environmentally, and socially sustainable transportation system.

One of UCR's key research programs within NCST has been to develop a variety of dynamic eco-driving techniques that show great promise to reduce greenhouse gas emissions from the transportation sector. Dynamic eco-driving is the general concept of modifying driving behavior to reduce fuel consumption, greenhouse gases and pollutant emissions, using real-time traffic information. By driving more smoothly, choosing appropriate speeds, and minimizing sharp accelerations and decelerations, vehicle energy consumption can be significantly reduced. To date, the majority of dynamic eco-driving studies have been focused on light-duty passenger vehicles driven by typical consumers. CE-CERT is now taking what we've learned from light-duty applications and applying eco-driving applications to the goods movement and trucks sector.

Dynamic eco-driving research is demonstrated above with Development Engineer, Daniel Sandez

UNDERSTANDING CLIMATE IMPACTS

Black Carbon (BC) is the second largest contributor to human induced climate warming, after carbon dioxide. Ocean going vessels are thought to be a significant contributor of BC emissions. Although we are beginning to have a better understanding of how to limit these emissions, more work is planned given the paucity of data in this area.

CE-CERT IS **SHAPING THE REGULATORY LANDSCAPE**

RESEARCH IN THE EMISSIONS AND FUELS RESEARCH (EFR) group is a balance of projects looking to fill knowledge gaps on how things are working today and exploring pathways to sustainably-fueled systems, from lawnmowers to earthmovers. One emerging area of interest is understanding fuel and engine parameters that create emissions from marine vessels traveling through the Arctic circle that leave a trail of black carbon on the icepack. Working with California and international partners, CE-CERT conducted a number of emissions tests on a variety of ships last year, preparing for the debate on needed regulations.

The research team — UCR and Environment and Climate Change Canada (pictured left)—built and operated the test cell for a study funded by the International Council of Clean Technology (ICCT). As part of the same study, UCR also collected emissions from ships like the one pictured on the previous page, as they traveled the pacific ocean.

RENEWABLE NATURAL GAS

CE-CERT IS PLEASED TO ANNOUNCE the establishment of a new research center focusing on renewable methane, with the goal of addressing key challenges faced by California in achieving renewable energy and GHG emission mitigation targets. The Renewable Natural Gas (RNG) Center is funded by environmental state regulators, industry and academic partners. RNG is pipeline quality gas that is fully interchangeable with fossil natural gas but is produced from a renewable feedstock and can be used as a 100% substitute for, or blended with, conventional natural gas streams. The focus of the Center, led by Dr. Arun Raju, is to demonstrate and optimize pre-commercial RNG production technologies and to address policy barriers with the goal of expediting widespread commercial RNG production and use.

The new marine test cell under construction.

“MY EXPERIENCE AT CE-CERT HAS BEEN VERY FRUITFUL...

I find myself lucky to have a supportive advisor, motivated and loyal peers as well as a remarkable staff that helps us, UCR students, accomplish what we strive to do.”

— Pedro Piqueras

CE-CERT IS **EDUCATING STUDENTS THROUGH REAL-WORLD RESEARCH EXPERIENCES**

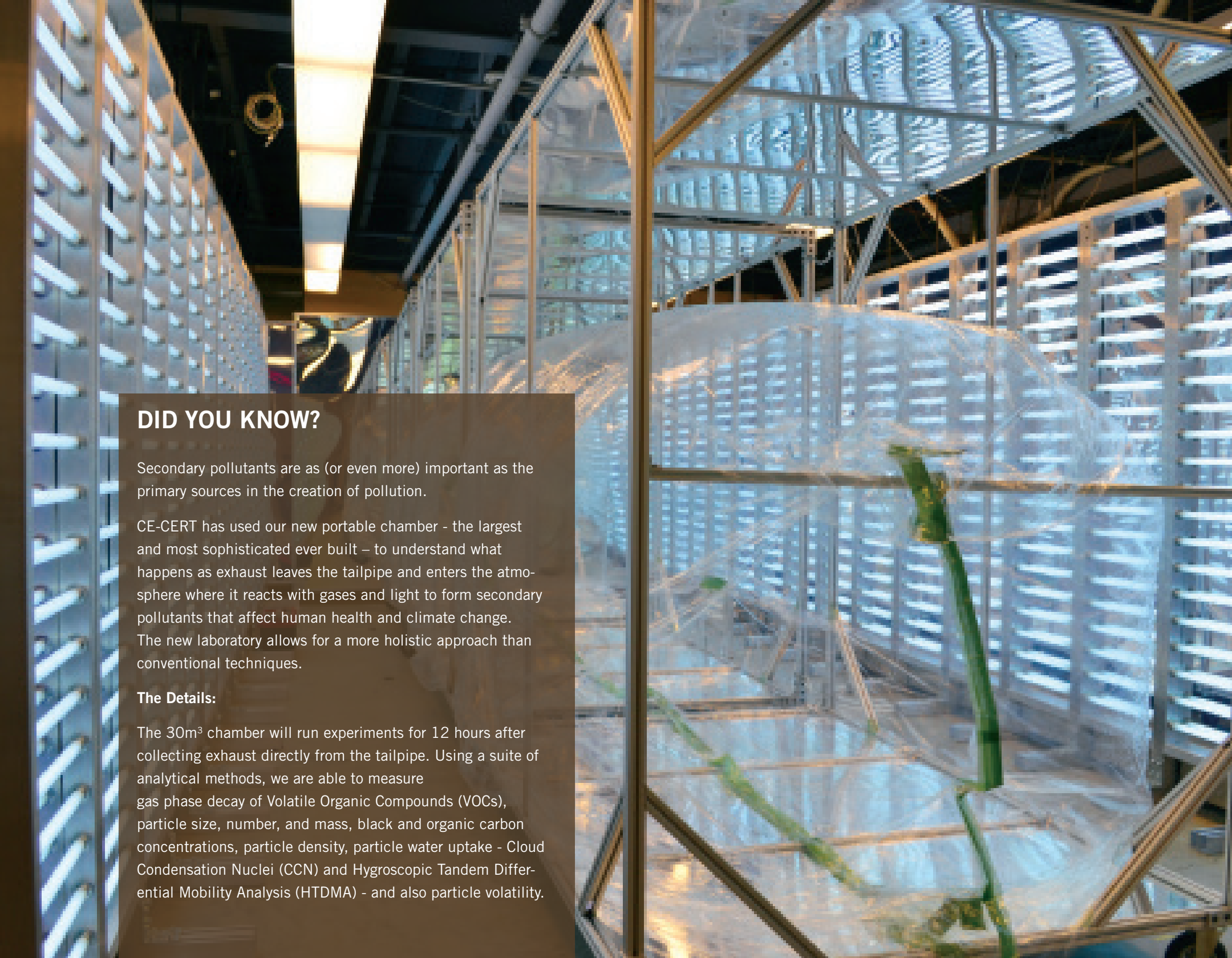
PEDRO PIQUERAS – As a Ph.D. Candidate in Chemical and Environmental Engineering, Mr. Piqueras saw how pressing air pollution is the on local as well as the global scale. He launched a clean air campaign, named fAIR4all, at the United Nations and had the honor of going to the California State Capitol to speak with senators and assembly members about the environmental research conducted in CE-CERT's laboratory. "CE-CERT has provided opportunities for me to grow academically and professionally. It has given me the resources to carry on with my research and to learn about its real life applications. While being here, I discovered how pressing of an issue air pollution is on a local and global scale, and how I can add my little grain of sand to the science community to help educate citizens about its health and climate implications. I have always been encouraged and given a reason to keep pushing and do what I do for the betterment of society and the planet as a whole." Pedro's quest for improving our world continues with his newest project. Under the direction of Dr. Akua Asa-Awuku, this project will for the first time look at the real-time size and number distribution of particulate matter, including potential virus-size particles and toxics, that may be emitted during the wastewater treatment process.

CURRENT GRADUATE STUDENT

JADE (YU) JIANG is a 3rd year Ph.D. candidate who works in the Emissions and Fuel Research Group (EFR) under the direction of researchers Dr. Kent Johnson, Dr. Thomas Durbin and Professor David Cocker. Her recent projects include improving measurement methods for capturing black carbon emissions from marine going vessels, verification of the new 0.02 g NOx/bhp-hr heavy duty natural gas Cummins engine, and understanding in-use after treatment effects of newer model year on-road diesel vehicles. "The most exciting part of working at CE-CERT is the application of the engineering principles I have learned in class. Here, I have the opportunity to help conduct measurements from ship engines to alternative fueled truck engines, an experience that I would not get anywhere else as a 3rd year grad student."

POST-GRADUATE STUDENT

DANIEL SHORT graduated with his Ph.D. in Chemical and Environmental Engineering in 2014. As a student, Dr. Short worked primarily on vehicle emissions testing of current and emerging fuels and vehicle technologies in the CE-CERT laboratories, preparing him for his post-graduate career with the 4th largest refining company in the United States. His current position, Fuel Technologist at Marathon Petroleum Company (MPC), includes advising MPC on new fuel technologies and staying abreast of future fuel and engine technology trends. Dan currently serves as the Coordinating Research Council (CRC) emissions committee co-chair, the CRC life cycle analysis panel chair, and the American Petroleum Institute life-cycle analysis group chair. He has recently been appointed by the EPA administrator as the fuel producer's representative to the EPA Mobile Source Technical Review Subcommittee (MSTRS).



DID YOU KNOW?

Secondary pollutants are as (or even more) important as the primary sources in the creation of pollution.

CE-CERT has used our new portable chamber - the largest and most sophisticated ever built – to understand what happens as exhaust leaves the tailpipe and enters the atmosphere where it reacts with gases and light to form secondary pollutants that affect human health and climate change. The new laboratory allows for a more holistic approach than conventional techniques.

The Details:

The 30m^3 chamber will run experiments for 12 hours after collecting exhaust directly from the tailpipe. Using a suite of analytical methods, we are able to measure gas phase decay of Volatile Organic Compounds (VOCs), particle size, number, and mass, black and organic carbon concentrations, particle density, particle water uptake - Cloud Condensation Nuclei (CCN) and Hygroscopic Tandem Differential Mobility Analysis (HTDMA) - and also particle volatility.

CE-CERT IS **ENGAGING THE PUBLIC**

STUDENT HOSTED CONFERENCE – "UCCONNECT"

University of California Center on Economic Competitiveness in Transportation, http://ucconnect.berkeley.edu/

CE-CERT students organized the 2016 UCCONNECT conference, the first ever to be held at the University of California, Riverside in February 2016. UCCONNECT is dedicated to the proposition that economic competitiveness comes by mobilizing society in general, and the workforce in particular; and by delivering goods and services in the most efficient ways possible. Our Center recognizes that achieving these goals requires innovative ideas for reducing congestion and its associated costs.

A big thank you to the student organizing committee: David Kari, Xuewei Qi and Nigel Williams. They did an amazing job organizing and facilitating this conference!

"FREIGHT AND SUSTAINABLE COMMUNITIES POLICY FORUM"

National Sustainable Transportation Center, http://ncst.ucdavis.edu/

On May 12, 2015, the Center hosted a policy forum with local freight industry officials, government planning leaders, community advocates and sustainability researchers on the future of goods movement in the Inland Empire. The policy forum included four in-depth panel discussions relating to economic and job prospects, traffic impacts, pollution and environmental impacts and land use planning. "As freight transportation continues to grow, it will play an increasing role in shaping the economy, the environment, and our communities," said Matthew Barth, director of CE-CERT. "This forum is designed to engage industry, community and regulators to illuminate where research can help identify how we can enhance livability in the Inland Empire without impeding the growing goods movement."

IN-USE EMISSION MEASUREMENTS

THE 2016 PORTABLE EMISSION MEASUREMENT SYSTEM (PEMS) CONFERENCE on March 17th and 18th was attended by 200 people from over 50 different companies, agencies and institutions representing 10 countries from around the world.

PEMS are a key resource in identifying real-world emissions, which don't always agree with laboratory results. PEMS systems are revolutionizing how we measure, report and enforce emissions and fuel economy standards from many sources. The presentations provided a comprehensive discussion on PEMS: regulatory development and trends; approaches for measuring in-use PM; current and future research developments; and development of new instrumentation for in-use testing. This year, Professor David Cocker taught a short course on the formation of secondary particulate tailpipe emissions, measured with PEMS instruments such as the chamber (pictured on the opposite page).

In addition to hosting conferences and policy forums, donor contributions allow CE-CERT to teach hundreds of junior and high school students and their teachers each year the real-world applications of STEM subjects, such as how to create a dye sensitized solar cells from berry juice.

FULLY ELECTRIC TROLLEY

CE-CERT's 32-passenger trolley is powered by a 155kWh battery pack. This trolley was fully converted from a diesel engine, as part of the Sustainable Integrated Grid Initiative (SIGI).

OUR DONORS ARE **MAKING AN IMPACT**

CE-CERT'S long standing commitment to outreach is connecting people with life-changing learning experiences in STEM fields.

CE-CERT has a long-standing commitment to outreach as part of the three-pronged mission of the university. The applied nature of our research helps connect people with real world applications and to provide insight into future careers in science and mathematics. As the US now trails in the amount of science and engineering degrees offered internationally, there is no better time to improve the participation and performance of younger students in STEM. Equipping young students with the inspiration, initiative and curiosity to pursue STEM fields is a top priority.

MAJOR DONORS:

Esther Hays
ExxonMobil
William Pierson
Colin and Nora Hackett
William Johnson
Jim Guthrie
Salim Khan
Ford Motor Company
El Sobrante
Packard
Roberta Nicholas
Yeager Family
Winston Chung

SCHOLARSHIP WINNERS – 2015-2016

Ford Motor Company Undergraduate Scholarship	Omar Osman
Jim Guthrie Research Award	Min Kang and Sultan Khan
Esther F. Hays Graduate Fellowship	Mary Karacab
William R. Pierson/Ford Graduate Fellowship	Lijie Li
Colin E. Hackett Endowed Engineering Research Graduate Award	Taehoon Lim

FELLOWSHIP RECIPIENT:

DIEP VU a two-time recipient of the fellowships offered here at CE-CERT and UCR; the Esther Hays Fellowship in 2014-2015 and the UCCONNECT Fellowship in 2015-2016. With these fellowships she was able to study the relationship between aerosols from different anthropogenic and biogenic sources and their ability to modify the microphysical properties of clouds.

Dr. Vu is now research engineer for Ford Motor Company (Vehicle Emissions Research Laboratory at the Research and Innovation Center) in Dearborn, Michigan.

"The guidance and support of the faculty and donors, in conjunction with the collaborative environment at CE-CERT, provided me with the opportunity to pursue and achieve my research goals."

CE-CERT celebrating the Bourns College of Engineering's 25th Anniversary (pictured left) on May 16, 2015.

From left, top: Kathy Vang, Kiran Jayaram, Kent Johnson, Wayne Miller, Maryam Hajbabaei, Seyedehsan (Eshan) Hosseini, and William (Bill) Welch

From left, bottom: Varalaskshmi (Lakshmi) Jayaram, Mohammad (Yusuf) Khan, Nicholas Gysel and Chi Scheel

WHO'S **WHO?**

2015 CE-CERT FACULTY & RESEARCH MEMBERS

Akua Asa-Awuku
Alfredo Martinez-Morales
Arun Raju
Chan Seung Park
Charles Cai
Charles Wyman
David Cocker
George Scora
Georgios Karavalakis
Guoyuan Wu
Heejung Jung
Jay A. Farrell
Joseph Norbeck
Kanok Boriboonsomsin
Kelley Barsanti
Kent Johnson
Matthew Barth
Nanpeng Yu
Qi Zhu
Rajeev Kumar
Richard Arnott
Robert Russell
Sadrul Ula
Thomas Durbin
Wayne Miller
Wendy Goliff
William Carter

2015 CE-CERT GRADUATE STUDENTS

Abhishek S. Patri
Andrew Kenneth Yu
Ashley Vizenor
Chia-Li Chen
Christian Alcaraz
Danyang Tian
David Kari
Desiree Smith
Diep Vu
Devin Cavero
Emmanuel A. Fofie
Farzana S. Rahman
Fei Ye
Fei Gu
Glen Svenningsen
Jiacheng Yang
Ji Luo
Joshua Buli
Keerth Baskaran
Kichang Jung
Liem Pham
Lijie Li
Mary Kacarab
Mayling Lu
Nigel S. Williams
Nikhil Nagane
Ninad Kothari
Pankaj Ramnani
Parker Williams
Partho S. Roy
Patrick R. Roth
Paul S. Van Rooy
Pedro Piqueras
Rachna Dhir
Samarthya Bhagia
Taehoon Lim
Trupti M. Terse
Vanessa A. Thomas
Weihua Li
Xinze Peng
Xuewei Qi
Ye Li
Yu Wei Han
Yu Jiang
Yun Xue

2015 CE-CERT UNDERGRADUATE STUDENTS

Alexander Larcheveque
Allen Jacinto
Ashley Lee
Ashley De Leon
Brian Cruz
Brian Perdomo
Carola Acurio
Celine Chau
Chantell Williams
Chao Wang
Colin Eckerle
Corin Jones
Christopher Connors
Danh Alkurdi
Darren Kwee
Eli Brewer
Evelyn Rocha
Evan Scott
Hira Yoshihara-Saint
Jackson Dulla
Jasmine Alice Moreno
Javier Beingolea
Jesse Coronado
Jesse Mendoza Jr.
Jessica Fu
Jinyu Xu
Joseph Fan
Justin Orourke
Kevin Duc Harvard
Kyle Daly
Kyle Schaefer
Kyle Wesley Hunter
Maria Sanchez-Reyes
Matthew Ealy
Michael Teyong Han
Min Ho Kang
Nhi Nguyen
Nishantha Fernando
Osten Anderson
Otto Castillo
Priyanka Singh
Rachael Hirst
Rachael Lomax
Reem M. Jaber
Robert Vangrin
Russell Perry
Ryan Cheng
Sirina Nabhan
Shannon E. Lopez
Shawn Miata
Sultan Khan
Stanley Chang
Timothy Chow
Tyler Berte
Vincent Van
Wilson Aleman
Yingjing Zhu
Yujie Cao
Yun Tsai


“THE SCIENCE OF TODAY
IS THE TECHNOLOGY OF TOMORROW.”
— Edward Teller

2015 CE-CERT **BOARD OF ADVISORS**

THE CE-CERT BOARD OF ADVISORS is an invaluable group of leading engineers and scientists from industry, academia and government whose expertise helps to increase the Center's effectiveness as a research and teaching arm of the University of California.

Gordon Bourns	Chairman of the Board & C.E.O./Bourns, Inc.
Leo Breton	Technology Development Manager/US Department of Energy
Virginia Field	Board Vice President/Clean Air Now
Weijian Han	Manager of Research, Ford Asia Pacific/Ford Motor Company
Jeff Jetter	Principal Chemist/Honda R&D Americas
Timothy Johnson	Director, Emerging Technology & Regulations/Corning Inc.
David Kittelson	Professor, Center for Transportation Studies/University of Minnesota
Ching Liu	Executive Vice President/SolarMax Technology
Tahmid Mizan	Senior Technical Advisor, Corporate Strategic Planning/ExxonMobil
Ed Nam	Director, Air Quality Modeling/US Environmental Protection Agency
Larry Orcutt	Chief, Division of Equipment/Caltrans
Mitchell Pratt	Executive Vice President, Business Development/Clean Energy
Bob Sawyer	Professor, Mechanical Engineering/UC Berkeley
Rashid Shaikh	Director of Science/Health Effects Institute
Dan Sperling	Director, Institute for Transportation Studies/UC Davis
Richard Wagner	Director, Global Product Environmental Management/Cummins, Inc.
Barry Wallerstein	Executive Officer/South Coast Air Quality Management District
Paul Weider	Technology & Innovation/Shell Global Solutions, Inc.

2015 PUBLICATIONS

SELECT JOURNAL ARTICLES

D. Bae, M. Yun and C. Park. "Hydrodynamics of a Hybrid Circulating Fluidized Bed Reactor With a Partitioned Loop Seal System," *Korean Journal of Chemical Engineering*, vol. 32, no. 7, pp. 1440-1447, 2015.

R. Bahreini et al. "Characterizing Emissions and Optical Properties of Particulate Matter from PFI and GDI Light-duty Gasoline Vehicles," *Journal Aerosol of Science,* vol. 90, pp. 144-153, 2015.

M. Barth, G. Wu and K. Boriboonsomsin. "Intelligent Transportation Systems and Greenhouse Gas Reductions." *Current Sustainable/Renewable Energy Reports*, Special Issue on Transportation Sustainability, 2015.

K. Boriboonsomsin et al. "Fusion of Vehicle Weight and Activity Data for Improved Vehicle Emission Modeling," *Transportation Research Record*, vol. 2503, pp.153-162, 2015.

J. Camacho et al. "Mobility Size and Mass of Nascent Soot Particles in a Benchmark Premixed Ethylene Flame," *Combustion and Flame*, pp. 3810-3822, 2015.

T. Cao et al. "A Comprehensive Evaluation of a Gaseous Portable Emissions Measurement System with a Mobile Reference Laboratory," *Environmental Science and Technology,* submitted, 2015.

T. Cao et al. "A Generalized Approach for Characterizing Emissions Benefits of Hybrid Off-Road Equipment via Physical Activity and Engine Work: A Case Study for Excavators," submitted, 2015.

T. Cao et al. "Evaluations of In-Use Emission Factors from Off-Road Construction Equipment," *Atmospheric Environment*, submitted, 2015.

W.P.L. Carter. "Development of a Database for Chemical Mechanism Assignments For Volatile Organic Emissions," *Journal of the Air & Waste Management Association*, vol. 65, pp. 1171-1184, 2015.

J.D. DeMartini et al. "How Chip Size Impacts Steam Pretreatment Effectiveness for Biological Conversion of Poplar Wood into Fermentable Sugars," *Biotechnology for Biofuels*, vol. 8, p. 209, 2015.

T. Durbin et al. "Material Compatibility Evaluation for Elastomers, Plastics, and Metals Exposed to Ethanol and Butanol Blends," *Fuel*, submitted, 2015.

W.S. Goliff et al. "Nighttime Air Quality Under Desert Conditions." *Atmospheric Environment*, vol. 114, pp. 102-111, 2015.

P. Hao, X. Ban and J. Yu. "Kinematic equation based vehicle queue location estimation method for signalized intersections using mobile sensor data," *Journal of Intelligent Transportation Systems*, vol. 19, no. 3, pp. 256-272, 2015.

P. Hao and X. Ban. "Long Queue Estimation Using Short Vehicle Trajectories For Signalized Intersections," *Transportation Research Part B*, vol. 82, no. 1, pp. 54-73, 2015.

P. Hao et al. "Modal Activity Based Stochastic Model for Estimating Vehicle Trajectories from Sparse Mobile Sensor Data," IEEE Transactions on Intelligent Transportation Systems, submitted, 2015.

P. Hao et al. "Probabilistic Model for Estimating Vehicle Trajectories Using Sparse Mobile Sensor Data," IEEE Transactions on Intelligent Transportation Systems, submitted, 2015.

M. Hong et al. "An Energy Scheduling Algorithm Supporting Power Quality Management in Commercial Building Microgrids," *IEEE Transactions on Smart Grids*, pp. 1-13, 2015.

Q. Jin et al. "Power-Based Optimal Longitudinal Control for a Connected Eco-Driving System," IEEE Transactions on Intelligent Transportation Systems, submitted for publication, 2015.

N.Y. Kado et al. "Soy, Animal Biodiesel, and Renewable Diesel: Analyses of Blends with Diesel Fuel and Mutagenic Emissions of the Particle and the Vapor Phases from a Heavy-Duty Vehicle Tested on a Chassis Dynamometer." *Environmental Science and Technology*, submitted, 2015.

G. Karavalakis et al. "Evaluating the Effects of Aromatics Content in Gasoline on Gaseous and Particulate Matter Emissions from SI-PFI and SI-DI Vehicles," *Environmental Science and Technology*, vol. 49, pp. 7021-7031, 2015.

G. Karavalakis et al. "Regulated, Greenhouse Gas, and Particulate Emissions from Lean-Burn and Stoichiometric Natural Gas Heavy-Duty Vehicles on Different Fuel Compositions," *Environmental Science and Technology*, submitted, 2015.

D. W. Kwee, T. Lim and A. Martinez-Morales. "Analysis of LiFePO4 Cathodic Active Material Synthesized in Open Environment Condi-

tions through Ionic Medium," MRS Proceedings, Vol. 1774, 2015.

L. Li, P. Tang and D. Cocker. "Instantaneous Nitric Oxide Effect on Secondary Organic Aerosol Formation From M-xylene Photooxidation," *Atmospheric Environment*, vol. 119, pp. 144-155, 2015.

T. Lim and A. Martinez-Morales. "Template-free and Low Temperature CVD Synthesis of Vertically Aligned 1-D ZnO Nanostructures for Photovoltaic Devices by Precursor Oxidation Protection," *MRS Proceedings*, vol. 1785, 2015.

Y.T. Nguyen et al. "Co-solvent Pretreatment Reduces Costly Enzyme Requirements for High Sugar and Ethanol Yields from Lignocellulosic Biomass," *ChemSusChem*, vol. 8, pp. 1716-1725, 2015.

J.F. Pankow et al. "Molecular View Modeling of Atmospheric Organic Particulate Matter: Incorporating Molecular Structure and co-condensation of water," *Atmospheric Environment,* vol. 122, pp. 400-408, 2015.

H.O.T. Pye et al. "Modeling the Current and Future Roles of Particulate Organic Nitrates in the Southeastern United States," *Environmental Science and Technology*, vol. 49, pp. 14195-14203, 2015.

X. Qi et al. "Data-Driven Reinforcement Learning-Based Real-Time Energy Management System for Plug-in Hybrid Electric Vehicles with Charging Opportunities," *Transportation Research Record*, vol. 2572, 2015.

X. Qi et al. "Development and Evaluation of an Evolutionary Algorithm-Based On-Line Energy Management System for Plug-In Hybrid Electric Vehicles," IEEE Transactions on Intelligent Transportation Systems, submitted, 2015.

X. Qi et al. "Empirical Study of Lane-changing Characteristics on High-Occupancy-Vehicle Facilities with Different Types of Access Control based on Aerial Survey Data,"*ASCE Journal of Transportation Engineering*, Vol. 142, No. 1, 2015.

D. Quiros et al. "Measuring Particulate Emissions of Light Duty Passenger Vehicles Using Integrated Particle Size Distribution (IPSD)," *Environmental Science and Technology,* pp. 5618-5627, 2015.

D. Quiros et al. "Particulate Effective Density and Mass during Steady-State Operation of GDI, PFI, and Diesel Passenger Cars." *Journal of Aerosol Science,* pp. 39–54, 2015.

P. Roy et al. "Steam-biogas Reforming Over a Metal-foam-Coated (Pd-Rh)/(CeZrO2-Al2O3) Catalyst Compared With Pellet Type Alumina-supported Ru and Ni Catalysts," *Journal of CO2 Utilization,* 13p., 2015.

P. Roy, A. Raju and K. Kim. "Influence of *S/C* ratio and Temperature on Steam Reforming of Model Biogas Over a Metal-Foam-Coated Pd–Rh/(CeZrO2–Al2O3) Catalyst," *Fuel*, pp. 314-320, 2015.

D. Short et al. "Components of Particle Emissions from Light-Duty Spark-Ignition Vehicles with Varying Aromatic Content and Octane Rating in Gasoline," *Environmental Science and Technology*, vol. 49, pp. 10682-10691, 2015.

D. Short et al. "Particle Speciation of Emissions from Iso-Butanol and Ethanol Blended Gasoline in Light-Duty Vehicles," *Journal of Aerosol Science*, vol. 84, pp. 39-52, 2015.

D. Short et al. "Select Particle Compositions from Spray and Wall-Guided GDI and Flex Fuel Vehicles Operating on Various Ethanol and Iso-butanol Gasoline Blends," *Science of the Total Environment*, submitted 2015.

S. Singh et al. "Comparison of Different Biomass Pretreatment Techniques and their Impact on Chemistry and Structure," *Frontiers in Energy* Research, vol. 2, 2015.

A.C. Srivastava et al. "Loss of Function of Folylpolyglutamate Synthetase 1 Reduces Lignin Content and Improves Cell Wall Digestibility in Arabidopsis," *Biotechnology for Biofuels*, vol. 8, no. 1, pp. 1-18, 2015.

Z. Sun, P. Hao and X. Ban. "Trajectory-based vehicle energy/emissions estimation for signalized arterials using mobile sensing data," *Transportation Research Part D*, vol. 34, no. 1, pp. 27-40, 2015.

H.L. Trajano et al. "Recalcitrance and Structural Analysis by Water-only Flowthrough Pretreatment of 13C Enriched Corn Stover Stem," *Bioresource Technology,* vol. 197, pp. 128-136, 2015.

H.L. Trajano et al. "Xylan Hydrolysis in *Populus trichocarpa x P. deltoides* and Model Substrates during Hydrothermal Pretreatment," *Bioresource Technology*, vol. 179, pp. 202-210, 2015.

C. Vogel et al. "Inflammatory Marker and Ah Receptor Responses in Human Macrophage Cells Exposed to *Soy* and Animal Biodiesel and Renewable Diesel Emissions Blended with California Diesel Fuel,", submitted, 2015.

D. Vu et al. "Integrating Cloud Condensation Nuclei Predictions with Fast Time Resolved Aerosol Instrumentation to Determine the Hygroscopic Properties of Emissions Over Transient Drive Cycles," *Aerosol Science & Technology.*, vol. 49, pp. 1149-1159, 2015.

T. Wei, Q. Zhu and N. Yu. "Proactive Demand Participation of Smart Buildings in Smart Grid," *IEEE Transactions on Computers, Selected Topics in Smart City Computing,* 2015.

G. Wu, K. Boriboonsomsin and M. Barth. "Comparative Analysis of Empirical Capacities Between Freeways with Different Types of High-occupancy Vehicle Access Control," *Transportation Research Record*, vol. 2484, pp. 149-158, 2015.

C.E. Wyman and B.E. Dale. "Producing Biofuels via the Sugar Platform," *Chemical Engineering Progress,* vol. 111, no. 3, pp. 45-51, 2015.

C.E. Wyman and A.J. Ragauskas. "Lignin Bioproducts to Enable Biofuels," *Biofuels, Bioproducts and Biorefining,* vol. 9, pp. 447-449, 2015.

J. Xu et al. "Simulated Impact of NOx on SOA formation from oxidation of toluene and m-xylene," *Atmospheric Environment*, vol. 101, pp. 217-225. 2015.

J. Xue et al. "Comparison of Vehicle Exhaust Particle Size Distributions Measured by SMPS and EEPS During Steady-State Conditions," *Aerosol Science and Technology,* vol. 49, no. 10, pp. 984-996, 2015.

Q. Yang et al. "A Novel Arterial Travel Time Distribution Estimation Model and Its Application to Energy/Emissions Estimation," Journal of Intelligent Transportation Systems," submitted, 2015.

T. Zhang et al. "Xylose Yields and Relationship to Combined Severity for Dilute Acid Post-Hydrolysis of Xylooligomers from Hydrothermal Pretreatment of Corn Stover," *Green Chemistry*, vol. 17, no. 1, pp. 394-403, 2015.

SELECT TECHNICAL PAPERS AND REPORTS

T.D. Durbin et al. "Alternative Fuels/Mixed Alcohols Testing Program Prepared for the California Energy Commission," University of California at Riverside, Riverside, CA, Contract 500-09-051, Final Rep., Jan. 2015.

T.D. Durbin et al. "Emissions Test Report for AGRON Bioenergy LLC – Test #3, Prepared for AGRON Bioenergy LLC," University of California at Riverside, Riverside, CA, Final Rep., Jan. 2015.

T.D. Durbin et al. "Heavy-Duty Chassis Dynamometer Test Program, Final Report for the Engine Manufacturers Association," University of California at Riverside, Riverside, CA, Final Rep., 2015.

H. Jung et al. "Very Low PM Mass Measurements (E-99-1). Final Report for the Coordinating Research Council," University of California at Riverside, Riverside, CA, Project E-99-1. Final Rep., Jul. 2015.

G. Karavalakis and T.D. Durbin. "Fuel Economy Testing for Two Heavy-Duty Vehicles Operated with Alternative Diesel Formulations, Final Report for the Neste Corporation," University of California at Riverside, Riverside, CA, Final Rep., 2015.

G. Karavalakis et al. "Biodiesel and Renewable Diesel Characterization and Testing in Modern LD Diesel Passenger Cars and Trucks prepared for the Coordinating Research Council," University of California at Riverside, Riverside, CA, Project AVFL-17b. Final Rep., Nov. 2015.

G. Karavalakis et al. "A complete assessment of the emissions performance of ethanol blends and iso-butanol blends from a fleet of nine PFI and GDI vehicles," SAE Technical Paper No. 2015-01-0957, 2015.

G. Karavalakis et al. "Evaluation of the Performance and Air Pollutant Emissions of Vehicles Operating on Various Natural Gas Blends – Phase 2, Final Report for the California Energy Commission," University of California at Riverside, Riverside, CA, Contract 500-12-009, Final Rep., Mar. 2015.

R. Russell et al. "Emissions, Fuel Economy, and Performance of a Class 8 Conventional and Hybrid Truck," SAE Technical Paper No. 2015-01-1083, 2015.

G. Wu, X. Qi, D. Kari, and M. Barth. *Development of Agent-Based On-line Adaptive Signal Control (ASC) Framework Using Connected Vehicle (CV) Technology*. UCCONNECT working paper, December, 2015.

SELECT CONFERENCE PAPERS

J. DeHart et al. "Performance and Durability Assessment: Two Emission Control Technologies Installed on a Legacy High-Speed Marine Diesel Engine," in *World Maritime Technology Conference,* November 2015.

P. Hao et al. "Developing a Framework of Eco-Approach and Departure Application for Actuated Signal Control," in 2015 IEEE on Intelligent Vehicles Symposium, Seoul, Korea. June 28 – July 1, 2015.

P. Hao, G. Wu and P. Saikaly. "Evaluation of sampling strategies for vehicular emission estimation using probe vehicles," in Proceedings of the 94th Annual Meeting of Transportation Research Board, Washington, DC, 2015.

P. Hao et al. "Preliminary Evaluation of Field Testing on Eco-approach and Departure Application for Actuated s\ Signals," in Proceedings of the 4th International Conference on Connected Vehicles & Expo, Shenzhen, China, October 19-23, 2015.

X. Qi et al. "A Novel Blended Real-time Energy Management Strategy for Plug-in Hybrid Electric Vehicle Commute Trips," in 2015 IEEE Conference on Intelligent Transportation Systems, Las Palmas, Spain, 2015.

X. Qi et al. "Comparative Study of Lane Changing Characteristics on Different Types of HOV Facilities Using Smoothed Aerial Photo Data," in 94th Transportation Research Board Annual Meeting, Washington D.C., January 11-15, 2015.

X. Qi et al. "Evolutionary Algorithm Based On-Line PHEV Energy Management System with Self-Adaptive SOC Control," in 2015 IEEE on Intelligent Vehicles Symposium, Seoul, Korea. June 28 – July 1, 2015.

Z. Sun, P. Hao and X. Ban. "Fine-grained Modeling of Arterial Traffic: A Data Fusion and Information Integration Approach," in Proceedings of the 94th Annual Meeting of the Transportation Research Board, Washington, DC, 2015.

Z. Taylor et al. "Battery-Assisted Distribution Feeder Peak Load Reduction: Stochastic Optimization and Utility-Scale Implementation," in IEEE Proceedings of Power Energy Systems Conference, 2015.

J. Vreezwijk et al. "Operational Perspectives on Eco-Traffic Signals," in *Proceedings of the International Scientific Conference on Mobility and Transport-Technologies, Solutions, and Perspectives for Intelligent Transport Systems*, 2015.

G. Wu et al. "Developing and Evaluating an Eco-speed Harmonization Strategy for Connected Vehicles," in *Proceedings of the 4th International Conference on Connected Vehicles & Expo,* Shenzhen, China, October 19-23, 2015.

N. Yu, T. Wei and Q. Zhu. "From Passive Demand Response to Proactive Demand Participation," in *The Eleventh Annual IEEE International Conference on Automation Science and Engineering*, Gothenburg, Sweden, August 2015.

SELECT BOOK CHAPTERS

M. Barth, G. Wu and K. Boriboonsomsin, "Intelligent Transportation Systems and Greenhouse Gas Reductions," in Current Sustainable/ Renewable Energy Reports on Transportation, MV Chester Ed., Springer International Publishing, 2015.

F. Reza and K. Boriboonsomsin, "Pavements made of concrete with high solar reflectance," in *Eco-efficient Materials for Mitigating Building Cooling Needs*, F. Pacheco-Torgal et al. Ed. Massachusetts: Elsevier, 2015, pp. 37-62.

PATENT

Online Wobbe Sensor for the Natural Gas by Indirect Measurement with Chemo-metric Data. 2015.

SELECT SYMPOSIA

G. Karavalakis et al. "A complete assessment of the emissions performance of ethanol blends and iso-butanol blends from a fleet of nine PFI and GDI vehicles," SAE Technical Paper No. 2015-01-0957, 2015.

P. Roy et al. "Aspen Plus Simulation of Steam-Biogas Reforming and Comparison with Experimental Data Obtained over a Metal-Foam-Coated Pd-Rh Catalyst," AIChE Spring Meeting and 11th Global Congress on Process Safety. April 1, 2015. (Refereed).

G. Wu et al. "GlidePath: Eco-friendly automated approach/departure at signalized intersections," Automated Vehicle Symposium, Ann Arbor, MI, 2015.

CONTRACTS AND GRANTS

Richard J. Arnott. Towards Inferring Welfare Changes from Changes in Curbside Parking Occupancy

Kelley Barsanti. Synthesis of Comprehensive Emissions Measurements and Multi-Scale Modeling for Understanding Secondary Organic Aerosol Chemistry in Wildland Smoke Plumes

Kelley Barsanti. Toxicant Production and Mitigation in the Electronic-Cigarette Reaction Vessel

Matthew J. Barth. Connected Vehicle Early Deployment Application Analysis

Matthew J. Barth. Eco-Approach and Eco-Departure Planning Study

Kanok Boriboonsomsin. Evaluating Alternative Design of Geometric Configuration for HOV Facilities in California

David Cocker. Collaborative Research: Aerosol Formation from Agricultural Volatile Organic Compounds

David Cocker. On-Road Real-time Sensing for Select Atmospheric Cations and Gaseous Species

David Cocker. Ozone and SOA Formation from Gasoline and Diesel Compounds

Mark Durbin. ARB - NCST NG Infrastructure Study

Mark Durbin. Certification and In-Use Compliance Testing for Heavy-Duty Diesel Engines to Understand High In-Use NOx Emissions

Mark Durbin. National Deployment of Portable Emissions and Activity Measurement Systems in Support of the Development and Improvement of Mobile Source Emissions

Mark Durbin. NO Quantum Cascade Tunable Diode Laser Evaluation

Kent Johnson. Collection of Tractor-Trailer Activity Data

Kent Johnson. Marine Black Carbon Emissions Testing

Kent Johnson. The Measurement of Criteria Pollutant Emissions from Carnival's PM Reduction System

Kent Johnson. UCR NTK proposal

Kent Johnson. Ultra-Low NOx NG HD Project

Kent Johnson. Very Low PM Mass Measurement Phase 2: Evaluation of Partial Flow Dilution

Kent Johnson. Zero/Near-Zero Emission Drayage Truck Testing & Demonstration Guideline Plan

Georgios Karavalakis. Fuel Economy Testing for Two Heavy Duty Vehicles Operated with Alternative Diesel Formulations

Georgios Karavalakis. Secondary Organic Aerosol (SOA) Forming Potential from Light-Duty Gasoline Direct Injection Vehicles

Alfredo Martinez-Morales. Chemehuevi Indian Tribe Micro-Grid

Alfredo Martinez-Morales. Demand Reduction, Economic Benefits Analysis, And Micro-Grid Demonstration of an Optimization-Based Control Strategy, at City Hall in Rancho Cucamonga

Alfredo Martinez-Morales. MRPI-UC Solar Institute

Alfredo Martinez-Morales. Outdoor Performance Test of Anti-Reflective Anti-Soiling Coatings

J Wayne Miller. Foss Maritime Company

Chan Seung Park. Gasification and Reforming Methods Enabled by Pulse-Detonation-Engine Technology

Arun Satheesh Kumar Raju. Development of Lifecycle Data for Hydrogen Fuel Production and Delivery

George Scora. Fleet Replacement Model Evaluation and Refinement

Michael Todd. Evaluation of Equipment Production and Procurement Practices

Sadrul Ula. Bringing Energy Efficiency Solutions to California's Water Sector with the Use of Customized Energy Management System (EMS) and Supervisory Control and Data Acquisition System (SCADA)

Guoyuan Wu. Developing an Agent-Based On-Line Adaptive Signal Control (ASC) Framework Using Connected Vehicle (CV) Technology

Charles Wyman. THF Co-Solvent Biomass Fractionation to Catalytic Fuel Precursors with High Yields

MAKE A DIFFERENCE

The financial support from our donors are an important part of the Center's success. Please consider making a donation in support of CE-CERT in our efforts to engage and educate our youth.

Please contact Kathy Vang, kathyv@cert.ucr.edu

DISSERTATIONS AND THESES

C. Cai, "Co-Solvent Enhanced Production of Platform Fuel Precursors from Lignocellulosic Biomass," Ph.D. dissertation, Che. Env. Eng.

C. Chia-Li, "Secondary Organic Aerosol Formation from Select Volatile Organic Compounds," Ph.D. dissertation, Che. Env. Eng.

N. Gysel, "Strategies for Improvement in Air Quality Around Ports and Urban Communities," Ph.D. dissertation, Che. Env. Eng.

U. Ibrahim, "Connected Vehicle Technology," M.S. thesis, Elec. Eng.

Q. Jin, "Eco-Friendly Agent Based Advanced Traffic Management Techniques in a Connected Vehicle Environment," Ph.D. dissertation, Elec. Eng.

Z. Liu, "Development of a Sorption Enhanced Steam Hydrogasification Process for In-Situ Carbon Dioxide (CO2) Removal and Enhanced Synthetic," Ph.D. dissertation, Che. Env. Eng.

J. Luo, "Intelligent Transportation System Strategies to Mitigate Human Exposure to Mobile-Source Pollutants," Ph.D. dissertation, Che. Env. Eng.

I. Miller, "Ionothermal Synthesis of Lithium Iron Phosphate Composite Nanoparticles as a Cathode Material for Li-ion Batteries," M.S. thesis, Mat. Sci. and Eng.

D. Price, "Environmental Chamber Studies of Reduced Nitrogen Compounds Observed in Anthropogenic Emissions," Ph.D. dissertation, Che. Env. Eng.

Y. Xue, "Real-time Battery Control Method for Microgrid Energy Management," M.S. thesis, Elec. and Com. Eng.

H. Zhang, "Mobile Positioning and Mapping with Range Sensor Aided DGPS/INS," Ph.D. dissertation, Elec. Eng.


UC
1084 Columbia Avenue
Riverside, CA 92507
www.cert.ucr.edu
UCR