

We Engineer Excellence

CE-CERT

2025 ANNUAL REPORT



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OVERVIEW

TOTAL ACTIVE FUNDING

\$43,810,748

84

NUMBER OF ACTIVE RESEARCH PROJECTS

69

FACULTY & STAFF

NUMBER OF STUDENTS AT CE-CERT

100 SUPPORTED STUDENTS
39 UNDERGRADUATES
61 GRADUATES



DIRECTOR'S MESSAGE

CE-CERT continued to advance research and partnerships in 2025, addressing air quality, clean energy, and mobility challenges in California and beyond. This work demonstrates the ongoing value of university-based research in supporting policy development, scientific innovation, and environmental planning.

This year, CE-CERT managed more than \$43.8 million across 84 projects in active research funding, supported by 61 graduate students, 39 undergraduate students, and 69 faculty and staff. Our teams conducted field monitoring, laboratory testing, systems modeling, and community-focused studies that produced reliable data for agencies, industry partners, and local stakeholders. We also welcomed two new faculty members, supporting the continued growth of our research capabilities.

Several projects highlighted CE-CERT's expanded role in transportation and energy research. The new multi-year study on ship emissions is one of the most comprehensive efforts to characterize the impacts of maritime pollutants along the Pacific coast. The launch of the Hydrogen Engine Alliance of North America brought together more than two dozen organizations to coordinate research and deployment activities related to hydrogen-fueled engines. These efforts demonstrate how CE-CERT's applied research informs state and regional decision-making.

CE-CERT also continued its commitment to workforce development and community engagement. Programs such as the Community Air Quality Awareness Program and the Riverside Clean Air Carshare provided hands-on opportunities for students and residents to engage with clean mobility and air quality issues, supporting broader regional goals around education and community awareness.

As you read this year's report, I hope you will see a center that is forward-looking, engaged, and committed to delivering research with real impact. Thank you for your continued support and partnership. We look forward to continuing this work together in the year ahead.

Sincerely,
Dr. Don Collins
CE-CERT Director
Professor of Chemical and Environmental Engineering



Discover CE-CERT: Leading the Way in Environmental Research and Technology
[Watch the video](#)

JOIN US IN SUPPORTING CE-CERT'S WORK

We extend our deepest gratitude for your continued support of CE-CERT. Together, we are shaping tomorrow's leaders, innovators, and visionaries. Your donation will enable us to advance critical research, support our students, and develop sustainable solutions that address the environmental challenges of today and tomorrow.



Join us in creating a brighter, more sustainable future by contributing to the **Friends of CE-CERT Fund**.

2025 HIGHLIGHTS



CE-CERT LAUNCHES LANDMARK STUDY ON SHIP EMISSIONS

Supported by \$3.5 million in funding from the Rose Foundation for Communities and the Environment, CE-CERT initiated a 30-month study focused on understanding community exposure to emissions from oceangoing vessels in the San Pedro Bay area. The project is designed to quantify how maritime activity contributes to air pollution in port-adjacent neighborhoods, where residents experience disproportionate environmental burdens. By measuring emissions from oceangoing vessels and pollutant concentrations within port communities, the study will provide critical insight into how ship emissions affect local air quality and public health.



CE-CERT WELCOMES TWO NEW FACULTY MEMBERS

CE-CERT welcomed Dr. Eunjeong Hyeon and Dr. Abhilash Vijayan to its faculty in 2025. Their expertise in connected vehicle technology and climate and air quality research expands CE-CERT's capacity to address a diverse range of environmental and energy challenges.



LEFT TO RIGHT: Dr. Eunjeong Hyeon, Dr. Abhilash Vijayan



For more information, visit www.cert.ucr.edu or contact us to learn how you can get involved. To access a digital version of this report, visit www.cert.ucr.edu/annual-report-2025.

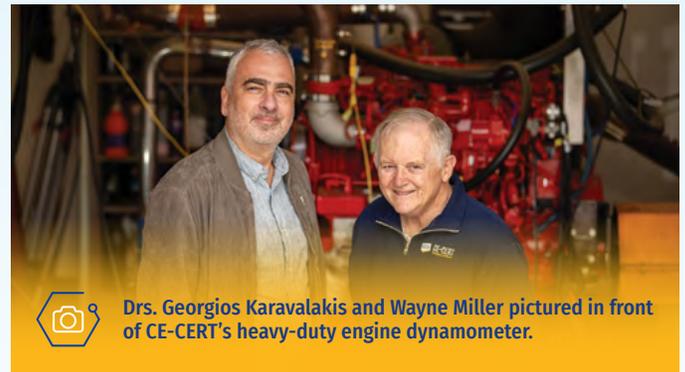


CE-CERT AWARDED \$1.1M TO ADVANCE ZERO-EMISSION TRUCK AND BUS RESEARCH

The California Air Resources Board (CARB) awarded CE-CERT two contracts totaling \$1.1 million to expand research on zero-emission trucks, buses, and off-road equipment in California. These projects will support the state's clean transportation goals by providing research and evaluation to guide the transition to zero-emission heavy-duty vehicles.



CE-CERT AND PARTNERS LEAD HYDROGEN ENGINE ALLIANCE



In collaboration with the University of Michigan, CE-CERT established the Hydrogen Engine Alliance of North America (H2EA-NA) to support the advancement of hydrogen internal combustion engine (H2-ICE) technology for heavy-duty transportation and industrial applications. Since its formation, the Alliance has expanded to more than 27 member organizations, including several Fortune 500 companies. CE-CERT hosted the inaugural H2EA Conference in Riverside in May, bringing together more than 150 experts from academia, government, national laboratories, and industry. The event provided a forum to share research progress, discuss infrastructure and regulatory considerations, and identify priority areas for future work across the hydrogen engine community.

ATMOSPHERIC PROCESSES LABORATORY (APL)



MISSION

The Atmospheric Processes Laboratory (APL) advances understanding of the sources and impacts of air pollution, including particles, air toxics, ozone, and greenhouse gases. The group uses advanced measurements, modeling, and data fusion approaches to characterize air pollution across the United States, with a particular focus on secondary aerosol formation, exposure, and source characterization. Environmental chambers are used to simulate atmospheric conditions and study the evolution of pollution from a wide range of sources.

2025 HIGHLIGHTS

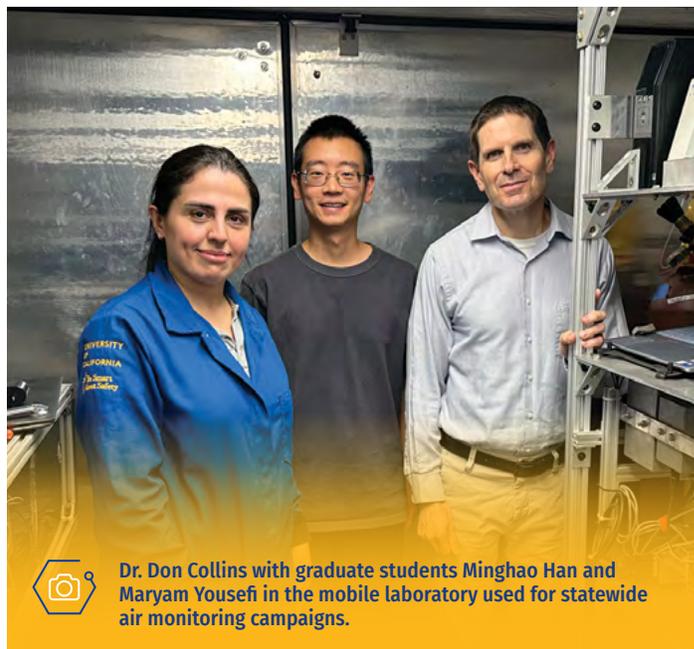
1

CE-CERT COLLABORATES ON MAJOR AIR MONITORING INITIATIVE:

In partnership with the University of Houston and Baylor University, CE-CERT launched a mobile air monitoring campaign across California using advanced, high-resolution sensing systems. The project is designed to detect pollutants that are difficult to measure through traditional monitoring networks and to generate detailed data that can improve understanding of local and regional air quality patterns.



Explore APL's cutting-edge research on air quality and climate using the world's largest atmospheric chamber. **Watch the video**



Dr. Don Collins with graduate students Minghao Han and Maryam Yousefi in the mobile laboratory used for statewide air monitoring campaigns.



Students present air quality projects to community members and guests at CARB.

2

COMMUNITY AIR QUALITY AWARENESS PROGRAM LAUNCHED: CE-CERT partnered with the Riverside Unified School District and Empower You Edutainment to launch the Community Air Quality Awareness Program, a hands-on education and outreach initiative funded by the California Air Resources Board (CARB). The program engages high school students and community members in learning about local air quality, collecting real-world data, and communicating findings, supporting broader environmental awareness and community science.

KEY PUBLICATIONS

- Carter, W. P. L., Jiang, J., Wang, Z., & Barsanti, K. C. (2025). The SAPRC atmospheric chemical mechanism generation system (MechGen). *Geoscientific Model Development*, 18, 8461–8483. <https://doi.org/10.5194/gmd-18-8461-2025>
- Du, X., Zhang, J., Peng, J., Collins, D. R. (2025). New particle formation potential from gasoline vehicle exhaust under ambient conditions. *Environmental Science and Technology Air*, <https://doi.org/10.1021/acsestair.5c00224>
- Petters, M. D., Han, S., & Mahant, S. (2025). Design and characterization of a modular tunable ring electrode aerosol charge conditioner. *Journal of Aerosol Science*, 190, Article 106670. <https://doi.org/10.1016/j.jaerosci.2025.106670>
- Petters, S. S., Yee, L. D., Zhang, Q., & Nishida, R. (2025). Particulars editorial highlights 2025. *Aerosol Science and Technology*. <https://doi.org/10.1080/02786826.2025.2585055>

FACULTY LIST

- **David Cocker**, Professor of Chemical & Environmental Engineering
- **Don Collins**, Professor of Chemical & Environmental Engineering; CE-CERT Director
- **Markus Petters**, Professor of Chemical & Environmental Engineering
- **Sarah Petters**, Research Faculty
- **Roya Bahreini**, Professor of Environmental Sciences; CE-CERT Affiliate Faculty
- **Will Porter**, Associate Professor of Environmental Sciences; CE-CERT Affiliate Faculty
- **William Carter**, Emeritus Research Faculty
- **Abhilash Vijayan**, Research Faculty; Adjunct Professor of Chemical & Environmental Engineering

KEY SPONSORS AND PARTNERS

- Aclima, Inc.
- Asphalt Institute Foundation
- California Air Resources Board
- California Department of Transportation
- Coordinating Research Council
- Department of Energy Atmospheric Radiation Measurement Program
- Department of Energy Atmospheric System Research Program
- Environmental Protection Agency
- National Science Foundation Atmospheric Chemistry Program
- National Science Foundation Community Instruments and Facilities (CIF) Program
- National Science Foundation Physical and Dynamical Meteorology Program
- South Coast Air Quality Management District

EMISSIONS AND FUELS RESEARCH GROUP (EFR)



MISSION

The Emissions and Fuels Research (EFR) group applies advanced technologies and methods to measure emissions and activities from passenger vehicles, heavy-duty vehicles, off-road equipment, and large engines powering marine vessels and locomotives. These data are critical for understanding how mobile sources affect emission inventories, human health, and the environment. EFR has expanded its research beyond traditional laboratory measurements to focus on real-world conditions using state-of-the-art Portable Emissions/Activity Monitoring Systems (PEMS/PAMS), On-board Sensing and Reporting (OSAR) tools, and assessments of battery-electric and hydrogen-powered vehicles, including high-power charging, hydrogen refueling systems, and hydrogen-natural gas blends.

2025 HIGHLIGHTS

1

Real-World Brake and Tire Emissions Characterized:

As tailpipe emissions decline, brake and tire wear have emerged as important contributors to vehicle-related particulate pollution. A CE-CERT research team led by Professor Georgios Karavalakis, Dr. Zisimos Toumasatos, and graduate students Elizabeth DeFrance, Zixuan Gong, and Ashley Trevino is conducting real-world testing in the South Coast Air Basin using newly developed enclosed sampling systems that capture emissions during urban and highway driving. By analyzing multiple brake pads and tire models under real operating conditions, the team is filling critical data gaps and providing science-based insights to inform future air quality regulations and protect public health.



Portable emissions measurement equipment installed in the trunk of a Toyota Corolla for on-road brake and tire emissions characterization.

2

Studies of Ocean-going Vessels:

Over the past year, CE-CERT has conducted several studies of ocean-going vessels (OGVs), including oil tankers, harbor craft, and container ships operating off the California coast. These efforts focus on measuring criteria pollutants and air toxics from vessels under real-world conditions. CE-CERT also supported commercial partners in verifying that their on-barge technologies remove more than 90% of NO_x, PM, and SO_x from diesel engines while the OGVs are docked. CE-CERT also finalized a new multi-year agreement with port partners to analyze the chemical and physical characteristics of OGV exhaust plumes as they move into nearby communities.

4

Clean Truck Check – CARBTest Referee Program

Expanded: CE-CERT plays a central role in California’s Clean Truck Check (CTC) / Heavy-Duty Inspection and Maintenance Program as CARB’s designated CARBTest referee. Over the past year, CE-CERT expanded the referee network to 10 stations statewide, including California State University, Fresno, and eight community colleges, and continued developing procedures to support consistent, accurate inspections for heavy-duty vehicles. CE-CERT also worked with CARB to develop the CTC Visual Inspection System (VIS), the online platform that will guide reporting and compliance for vehicle owners, supporting statewide implementation of one of California’s most impactful programs for reducing heavy-duty truck emissions.



Miles Mahoney inspects the exhaust side of a heavy-duty engine as part of a Clean Truck Check (CARBTest) procedure.

3

On-Board Sensing and Reporting (OSAR) Programs Advanced: CE-CERT completed and advanced two OSAR-related programs: a CARB-funded study of 100 heavy-duty natural gas vehicles (NGVs) and the Objective Measurement/Monitoring/Mitigation of Emissions from Goods Movement and Impacts on Air Quality (OMEGA) project, supported by the California Attorney General’s Office. The NGV study found that most vehicles demonstrated average NOx emission rates at or below 0.02 g/bhp-hr, substantially lower than typical in-use diesel emissions, indicating the potential for NGVs to reduce heavy-duty transportation emissions. The OMEGA project combined on-board sensor data, air quality measurements, and modeling to evaluate goods-movement emissions and identify mitigation strategies, including optimized truck routing. CE-CERT also continues a separate OSAR project measuring emissions from over 100 heavy-duty diesel vehicles and off-road equipment, with results expected in 2026.



See how EFR is driving change by reducing emissions from vehicles and other mobile sources. **Watch the video**

KEY PUBLICATIONS

- Hurren, T., Durbin, T. D., Johnson, K. C., & Karavalakis, G. (2025). The impacts of improving heavy-duty internal combustion engine technology on reducing NOx emissions inventories going into the future. *Science of the Total Environment*, 986, Article 179781. <https://doi.org/10.1016/j.scitotenv.2025.179781>
- Ma, T., Toumasatos, Z., Tang, T., Durbin, T. D., Johnson, K. C., & Karavalakis, G. (2025). Real-world particle emissions from a modern heavy-duty diesel vehicle during normal operation and DPF regeneration events: Impacts on disadvantaged communities. *Environmental Science & Technology*, 59(1), 699–708. <https://doi.org/10.1021/acs.est.4c12448>
- Frederickson, C., Scora, G., Vu, A., Johnson, K. C., Tan, Y., Yoon, S., Crowder, M., Alexandrou, A., & Durbin, T. D. (2025). Characterization of activity data and patterns of agricultural tractors in the San Joaquin Valley of California. *Transportation Research Record*, 2679(8), 298–307. <https://doi.org/10.1177/03611981251333719>
- Frederickson, C., Vu, A., Makki, M., Johnson, K. C., Durbin, T. D., Burnette, A., Huang, E., Alvarado, E., & Rao, L. (2025). Activity and performance of zero and

near-zero emissions port equipment for emissions reduction in the maritime sector (SAE Technical Paper No. 2025-01-8539). *SAE Technical Paper Series*. <https://doi.org/10.4271/2025-01-8539>

PROFESSIONAL ACTIVITY

- EFR participation in the Coordinating Research Council (CRC) Real World Emissions Workshop
- Wayne Miller**, Judge, Secretary of Defense Environmental Awards
- Wayne Miller**, Co-Chair, Emissions Group, Natural Gas Vehicles for America

FACULTY LIST

- Kent Johnson**, Research Faculty
- Tom Durbin**, Research Faculty
- Wayne Miller**, Research Faculty; Adjunct Professor of Chemical & Environmental Engineering
- Georgios Karavalakis**, Professor of Chemical & Environmental Engineering
- Heejung Jung**, Professor of Mechanical Engineering
- David Cocker**, Professor of Chemical & Environmental Engineering
- Zisimos Toumasatos**, Research Faculty
- Thomas Eckel**, Project Scientist
- Fudong Liu**, Associate Professor of Chemical & Environmental Engineering; CE-CERT Affiliate Faculty

KEY SPONSORS AND PARTNERS

- 3DATX
- AKKA
- AVL
- California Air Resources Board
- California Energy Commission
- CALSTART
- Caltrans
- Cummins, Inc.
- Eastern Research Group, Inc.
- HEAT
- HEM Data
- Horiba
- National Center for Sustainable Transportation
- NGK Sparkplugs
- RA Automotive
- Sensors, Inc.
- South Coast Air Quality Management District
- Southern California Gas Company
- Subaru
- Tetra Tech, Inc.
- The Texas A&M University System
- TSI Incorporated
- U.S. Department of Defense
- U.S. Department of Energy
- U.S. Department of Transportation Maritime Administration
- U.S. Environmental Protection Agency
- United Parcel Service
- Volvo Truck Corporation

TRANSPORTATION SYSTEMS RESEARCH (TSR)



MISSION

The Transportation Systems Research (TSR) group advances shared, electric, connected, and automated mobility systems to address critical environmental and energy challenges in transportation. By leveraging sensing and communication technologies, advanced computing, and control theory, TSR develops mobility systems and infrastructure that enhance safety, mobility, environmental health, equity, and economic outcomes.

2025 HIGHLIGHTS

1

CE-CERT Team Wins Gold at CVPR DriveX Challenge: A CE-CERT research team led by Ph.D. candidate Chuheng Wei, with guidance from Professors Guoyuan Wu and Matthew Barth, earned first place in the international DriveX Challenge at the IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR). Their cooperative perception model, HeCoFuse, demonstrated how connected vehicles can share camera and LiDAR data to improve object detection in complex driving environments, outperforming more than 80 submissions and earning the Gold Award and an invitation to present at the CVPR DriveX Workshop.



UCR's EcoCAR team during Year 3 testing and technical evaluations in the EcoCAR EV Challenge.

2

UCR EcoCAR Team Advances in National Competition:

The UCR EcoCAR team advanced through Year 3 of the U.S. Department of Energy's EcoCAR EV Challenge, reengineering a 2023 Cadillac LYRIQ electric car to improve efficiency, automation features, and overall performance. The team completed intensive vehicle testing in Yuma, Arizona, and delivered technical presentations in San Diego, earning multiple honors including the Spirit of the Challenge Award, the Excellence in Leadership Award for Nilesh Balusu, and a technical acknowledgment for Will Snyder, while developing strong systems engineering and project management skills.



Learn how TSR is transforming the future of mobility with innovative transportation solutions. [Watch the video](#)

3

Riverside Launches Hydrogen-Powered Carshare Program:

In partnership with the City of Riverside, Mobility Development Operations, CALSTART, CARB, and the California Energy Commission, CE-CERT supported the launch of the Riverside Clean Air Carshare (RCAC) program. The initiative deploys a fleet of hydrogen-powered vehicles to expand access to clean, affordable mobility in underserved neighborhoods, while providing CE-CERT with a unique opportunity to collect data and evaluate real-world use of hydrogen mobility solutions for future planning and community-based clean mobility strategies.

4

SAINT Project Recognized in USDOT Intersection Safety Challenge:

CE-CERT's Safety Assurance System for Vulnerable Road Users at Signalized Intersections (SAINT), led by Professor Guoyuan Wu, received Tier-2 recognition in the U.S. Department of Transportation's Intersection Safety Challenge. Integrating AI, sensor fusion, and V2X communications, SAINT detects potential conflicts and predicts collisions involving pedestrians, cyclists, and other vulnerable road users; the Tier-2 award, which includes \$166,666 in funding, supports continued development and potential deployment within Riverside's Smart Intersection and Innovation Corridor.



City and project partners gather for the ribbon cutting at the launch of the Riverside Clean Air Carshare hydrogen-powered vehicle program.

KEY PUBLICATIONS

- Zhang, Z., Wu, G., Hao, P., Boriboonsomsin, K., Barth, M., Liu, Y., & Farid, Y. (2025). Evaluating the impacts of connected eco-driving technologies on electrified traffic system at the city scale: A simulation approach. In *2025 IEEE Intelligent Vehicles Symposium (IV)* (pp. 2497–2502). IEEE. <https://doi.org/10.1109/IV64158.2025.11097421>
- Zhao, Z., Wu, G., Hao, P., Ye, F., Gao, Z., LaClair, T., Brown, D., Esaid, D., Boriboonsomsin, K., & Barth, M. (2025). Design, implementation, and evaluation of an innovative vehicle-powertrain eco-operation system for plug-in hybrid electric buses. In *2025 IEEE Conference on Technologies for Sustainability (SusTech)*. IEEE. <https://www.google.com/search?q=https://doi.org/10.1109/SusTech63138.2025.11025593>
- Yuan, W., Li, J., Yue, J., Shah, D., Karydis, K., & Qiu, H. (2025). BEVCalib: LiDAR-camera calibration via geometry-guided bird's-eye view representation. In *Proceedings of the 9th Conference on Robot Learning* (pp. 4824–4836). Proceedings of Machine Learning Research. <https://proceedings.mlr.press/v305/yuan25a.html>
- Mo, R., Wu, B., Tan, Z., & Qiu, H. (2025). SEE-V2X: C-V2X direct communication dataset: An application-centric approach. In *Proceedings of the 23rd ACM Conference on Embedded Networked Sensor Systems* (pp. 305–311). Association for Computing Machinery. <https://doi.org/10.1145/3715014.3722077>

AWARDS AND HONORS

- **Chuheng Wei**, Gold Award, CVPR 2025 TUMTraF V2X Grand Challenge
- **UCR TSR Group**, Tier-2 Award, USDOT Intersection Safety Challenge (Stage 1B)

PROFESSIONAL ACTIVITY

- **Guoyuan Wu**, Senior Member, IEEE
- **Guoyuan Wu**, Member, National Academy of Inventors
- **Guoyuan Wu**, Member, Chinese Overseas Transportation Association
- **Hang Qiu**, Member, IEEE
- **Hang Qiu**, Member, ACM

FACULTY LIST

- **Matthew Barth**, Professor of Electrical & Computer Engineering; BCOE Associate Dean for Research & Graduate Education
- **Kanok Boriboonsomsin**, Research Faculty; CE-CERT Associate Director of Finance & Administration
- **Guoyuan Wu**, Research Faculty; Adjunct Professor of Electrical & Computer Engineering
- **Peng Hao**, Research Faculty; Adjunct Professor of Electrical & Computer Engineering
- **George Scora**, Research Faculty
- **Hang Qiu**, Assistant Professor of Electrical & Computer Engineering
- **Eunjeong Hyeon**, Assistant Professor of Mechanical Engineering
- **Konstantinos Karydis**, Associate Professor of Electrical & Computer Engineering

KEY SPONSORS AND PARTNERS

- California Air Resources Board
- California Attorney General's Office
- California Department of Transportation
- California Energy Commission
- City of Rialto
- City of Riverside
- Honda
- James Irvine Foundation
- Leidos
- Mobility Development Operations
- National Science Foundation
- Ohmio
- Riverside County Transportation Commission
- South Coast Air Quality Management District
- Southern California Association of Governments
- Sumitomo Electric
- Toyota InfoTech
- University of California Institute of Transportation Studies
- U.S. Department of Energy
- U.S. DOT: Center for Advancing Research in Transportation Emissions, Energy, and Health
- U.S. DOT: Center for Assured & Resilient Navigation in Advanced Transportation Systems
- U.S. DOT: Center for Emissions Reduction, Resiliency, and Climate Equity in Transportation
- U.S. DOT: National Center for Sustainable Transportation
- Voltu
- Volvo Trucks
- Western Riverside Council of Governments

SUSTAINABLE INTEGRATED GRID INITIATIVE (SIGI)



MISSION

The Sustainable Integrated Grid Initiative (SIGI) advances research and deployment of energy systems that integrate intermittent renewable energy, energy storage, and diverse electric and hybrid vehicle technologies. Current efforts emphasize bidirectional EV charging, microgrid energy management, mobile microgrids, and strategies to address the water-energy nexus, demonstrating practical pathways for more resilient and efficient energy systems.

2025 HIGHLIGHTS

1

SIGI Research Featured at International IEEE Conference: At the International IEEE Conference on Sustainable Energy and Future Electric Transportation held in India, Dr. Miroslav Penchev presented SIGI's research on forecasting solar PV performance during wildfire events. The study applies a hybrid statistical and neural-network approach to improve prediction of solar energy performance under wildfire smoke conditions.

2

Microgrid Dashboard for California Renewable Energy Laboratory (CREL): CE-CERT researchers, led by Drs. Sadrul Ula and Miroslav Penchev mentored a group of Bakersfield community college students in a project supported by the California Renewable Energy Laboratory (CREL). Together, the team developed a microgrid dashboard for Kern Community College District's microgrid, providing real-time visibility into energy generation and use and building workforce skills in advanced energy systems.



CE-CERT researchers Drs. Sadrul Ula and Miroslav Penchev with Bakersfield community college students.





Vehicle-to-grid testing setup featuring a BorgWarner bidirectional charger and an Evolectric Class 4 electric truck.

3 CalTestBed Vehicle-to-Grid (V2G) and Portable Charging Evaluations: Under the CalTestBed Initiative, a CE-CERT research team evaluated vehicle-to-grid (V2G) energy transfer using a BorgWarner 125 kW bidirectional EV charger and an Evolectric Class 4 electric truck. The project demonstrated how V2G can provide much-needed energy storage capacity and support renewable integration. Another CalTestBed project evaluated portable EV chargers developed by ChargePodX, generating performance data to inform future deployments.

Explore how SIGI is accelerating innovation in energy storage, electric vehicles, and smart load management to enable greater renewable energy integration. **Watch the video**

KEY PUBLICATIONS

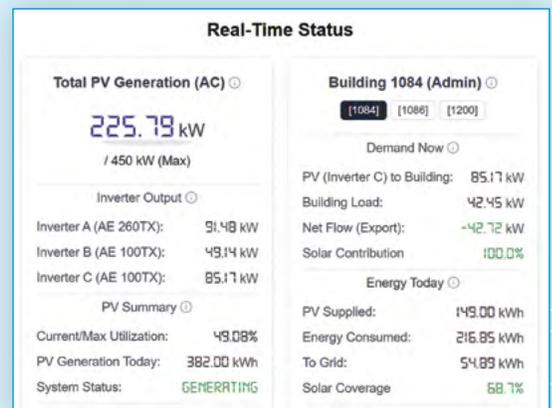
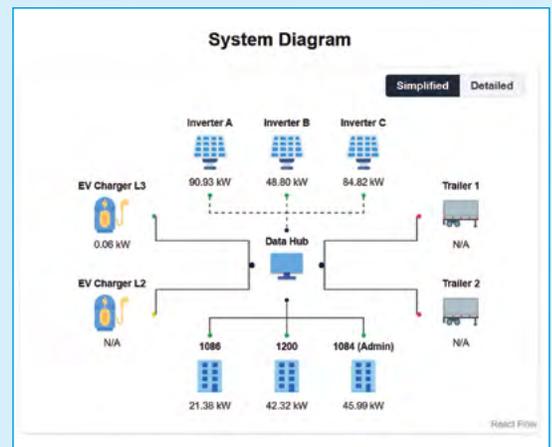
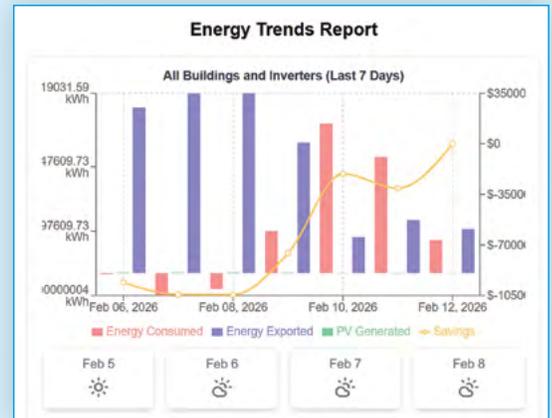
- Lee, S., Martinez-Morales, A. A., Todd, M., Raghunathan, R., Cherukupalli, N., Hewlett, J. O., & Penchev, M. (2025). Forecasting solar PV performance during wildfire events: A hybrid statistical and artificial neural network approach. In *2025 International Conference on Sustainable Energy and Future Electric Transportation (SEFet)*. In press.

FACULTY LIST

- Sadrul Ula, Research Faculty
- Matthew Barth, Professor of Electrical & Computer Engineering; BCOE Associate Dean for Research & Graduate Education
- Michael Todd, Principal Development Engineer
- Miroslav Penchev, Project Scientist
- Seungjin Lee, Postdoctoral Researcher
- Hamed Mohsenian-Rad, Professor of Electrical & Computer Engineering; CE-CERT Affiliate Faculty
- Emily Warmann, Research Faculty

KEY SPONSORS AND PARTNERSHIPS

- CalTestBed – Evolectric, ChargePodX
- Kern County Community College District
- Research Hub for Electric Technologies in Truck Applications (RHETTA) – CALSTART, Electric Power Research Institute (EPRI)
- Southern California Edison
- Western Municipal Water District



The SIGI microgrid dashboard helps researchers monitor renewable generation and energy use in real time to optimize operations and reduce electricity costs.

SUSTAINABLE FUELS INITIATIVE (SFI)



MISSION

The Sustainable Fuels Initiative (SFI) advances energy solutions by developing and applying technologies for producing and utilizing renewable fuels, including hydrogen and renewable natural gas. Focus areas include energy systems analysis, zero-emission vehicle infrastructure planning, waste-to-energy conversion, high-renewable grid management, and techno-economic and life cycle assessment.

2025 HIGHLIGHTS

1

Hydrogen Blending Compendium Report for CPUC:

The SFI research team completed the Hydrogen Blending Compendium Report commissioned by California's natural gas utilities. Submitted to the California Public Utilities Commission (CPUC) as part of Rulemaking R.13-02-008, the report synthesizes technical, safety, and operational considerations for blending hydrogen into natural gas infrastructure. The findings provide a science-based foundation for regulatory decisions on the feasibility and implications of blending hydrogen into California's natural gas infrastructure.



CE-CERT researchers in Mexico City for the launch of the Binational Working Group on Zero Emission Vehicles.

2

Binational Effort on Zero-Emission Infrastructure:

A CE-CERT research team contributed to the Binational Working Group on Zero-Emission Vehicles (ZEVs) meeting in Mexico City, convened by UC Alianza MX, the Mexican Ministry for Science, and UC Davis. The gathering brought together government officials, industry leaders, and researchers from California and Mexico to coordinate strategies for expanding electric and hydrogen transportation. Dr. Arun S.K. Raju was named co-chair of the Infrastructure Working Group, which is developing a joint research agenda to guide policies and investments in charging and fueling infrastructure across freight, transit, and rural applications.

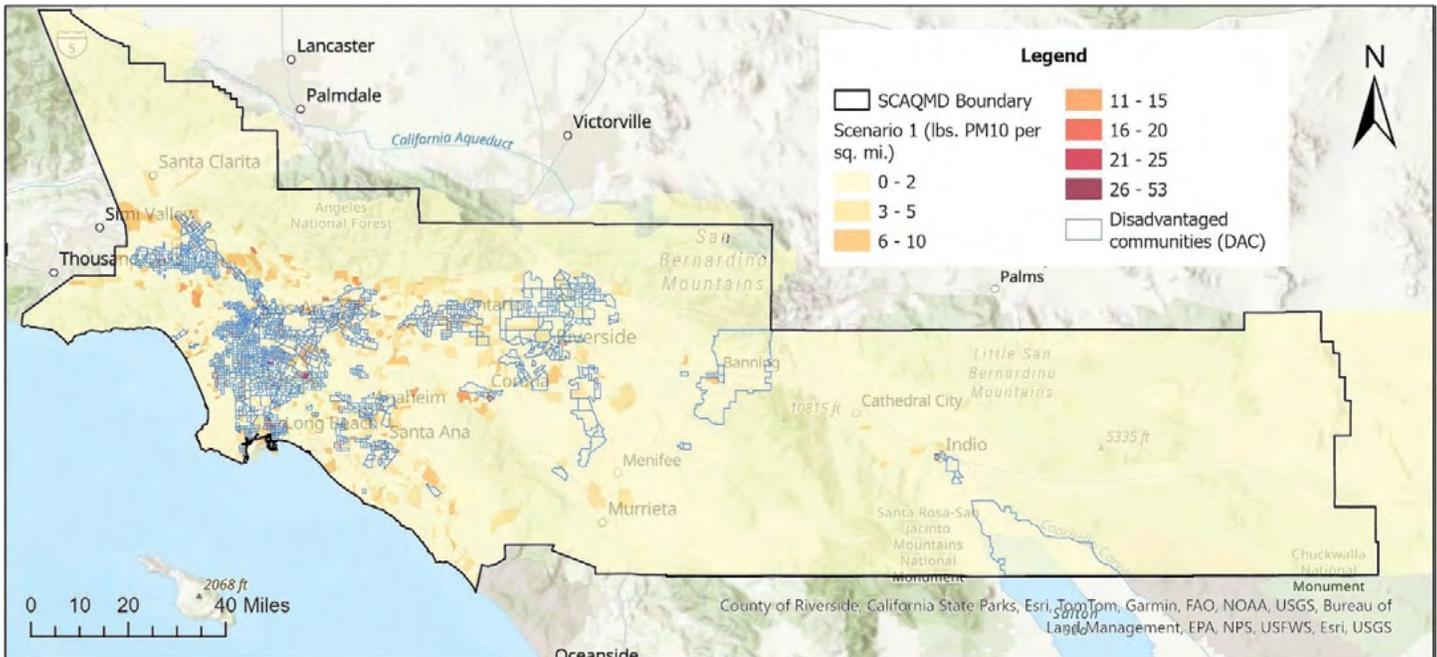


Members of the Binational Working Group on Zero-Emission Vehicles (ZEVs) standing on the stairs of the Casa de California in Mexico City during the binational infrastructure planning meeting.

3

Global Engagement on Zero-Emission Freight and Sustainable Energy Systems: CE-CERT researchers presented their work on the climate and infrastructure benefits of zero-emission vehicle adoption for California–Mexico cross-border freight at the International IEEE Conference on Sustainable Energy and Future Electric Transportation. Dr. Raju also delivered an invited talk on sustainable energy systems for regional development at the 5th International Batman Energy Summit in Turkey, highlighting the role of science-based planning in the transformation to sustainable strategies and technologies.

EXPECTED PM₁₀ EMISSION REDUCTIONS IN 2040



 Projected PM₁₀ emissions per transportation analysis zone, for year 2040, within the South Coast AQMD region under MHD ZEV deployment scenario considering CARB’s ACT and ACF rules.

KEY PUBLICATIONS

- Akinci, T. C., Selcuk Nogay, H., Penchev, M., Martinez-Morales, A. A., & Raju, A. (2025). A hybrid approach to wind power intensity classification using decision trees and large language models. *Renewable Energy*, 250, Article 123388. <https://doi.org/10.1016/j.renene.2025.123388>
- Benmouna, A., Becherif, M., Ebrahim, M. A., Benchouia, M. T., Akinci, T. C., Penchev, M., Martinez-Morales, A. A., & Raju, A. S. (2025). Referential integrity framework for lithium battery characterization and state of charge estimation. *Batteries*, 11(8), Article 309. <https://doi.org/10.3390/batteries11080309>
- Penchev, M., Akinci, T. C., Martinez-Morales, A. A., Todd, M., & Raju, A. K. S. (2025). Evaluating the benefits of zero-emission vehicles adoption for California–Mexico cross-border freight. In *2025 International Conference on Sustainable Energy and Future Electric Transportation (SEFet)*. In press.
- Zhong, J., Lin, J., Penchev, M., Ozkan, M., & Ozkan, C. S. (2025). Epitaxial growth control of crystalline morphology and electronic transport in InSb nanowires: Competition between axial and radial growth modes. *Nanomaterials*, 15(18), Article 1436. <https://doi.org/10.3390/nano15181436>

LIST OF PROFESSIONAL ACTIVITY

- **Arun S.K. Raju, Miroslav Penchev, and Alfredo Martinez-Morales**, Members, Institute of Electrical and Electronics Engineers (IEEE)
- **Tahir Cetin Akinci**, Senior Member, IEEE; Special Issue Editor, *Information* – “Big Data Analytics in Smart Cities”

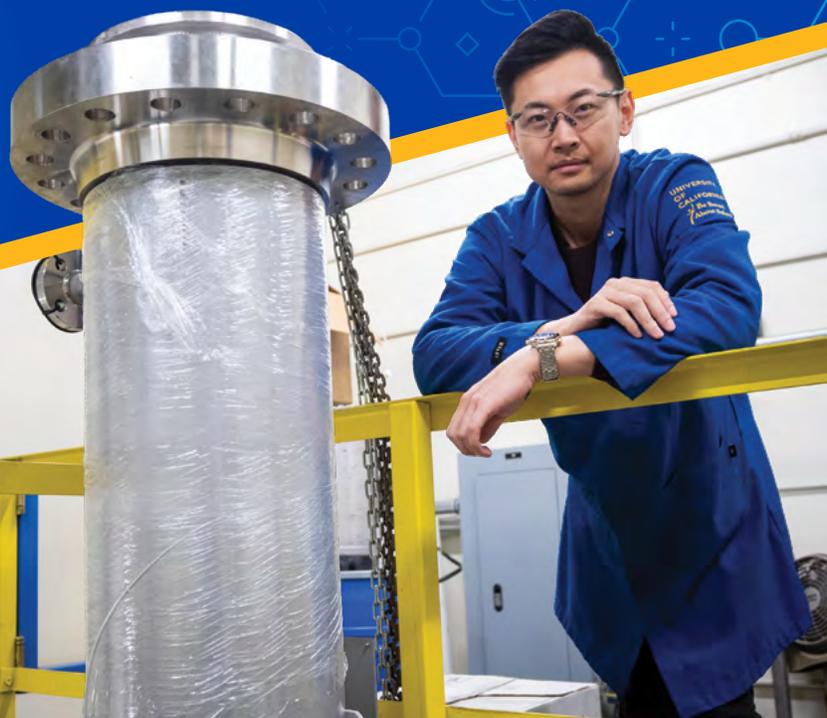
FACULTY LIST

- **Arun S.K. Raju**, Research Faculty; CE-CERT Associate Director of Operations
- **Miroslav Penchev**, Project Scientist
- **Alfredo A. Martinez-Morales**, Project Scientist
- **Tahir Cetin Akinci**, Project Scientist
- **Michael Todd**, Principal Development Engineer

KEY SPONSORS AND PARTNERS

- California Energy Commission
- South Coast Air Quality Management District
- Southern California Gas Company
- Strategic Growth Council and the City of Riverside
- University of California Alianza MX

B³: BIOENERGY, BIOREFINING, AND BIOMATERIALS TEAM



MISSION

The B³ research team focuses on transforming lignocellulosic biomass from agricultural and forestry residues into renewable liquid fuels and bioproducts. The team is recognized for developing low-cost technologies that enhance delignification and biomass breakdown, enabling recovery of cellulose fibers, fermentable sugars, furfurals, and lignin. A signature invention, Co-solvent Enhanced Lignocellulosic Fractionation (CELf), is a mild delignification pretreatment that reduces costs and improves efficiency in biomass pulping, pretreatment, and clean lignin extraction.

2025 HIGHLIGHTS

1

CELf-Derived Lignin Enables High-Performance Insulating Foams:

A CE-CERT research team, in collaboration with the University of Tennessee Knoxville, the State University of New York, and Clark Atlanta University, produced high-performance insulating foams from plant-derived lignin. The resulting rigid polyurethane foams met commercial insulation specifications, demonstrating lignin's potential as a viable replacement for petroleum-based polyols. This work, enabled by CELf-extracted clean lignin, positions CE-CERT's technology for commercial licensing in bio-based materials markets.

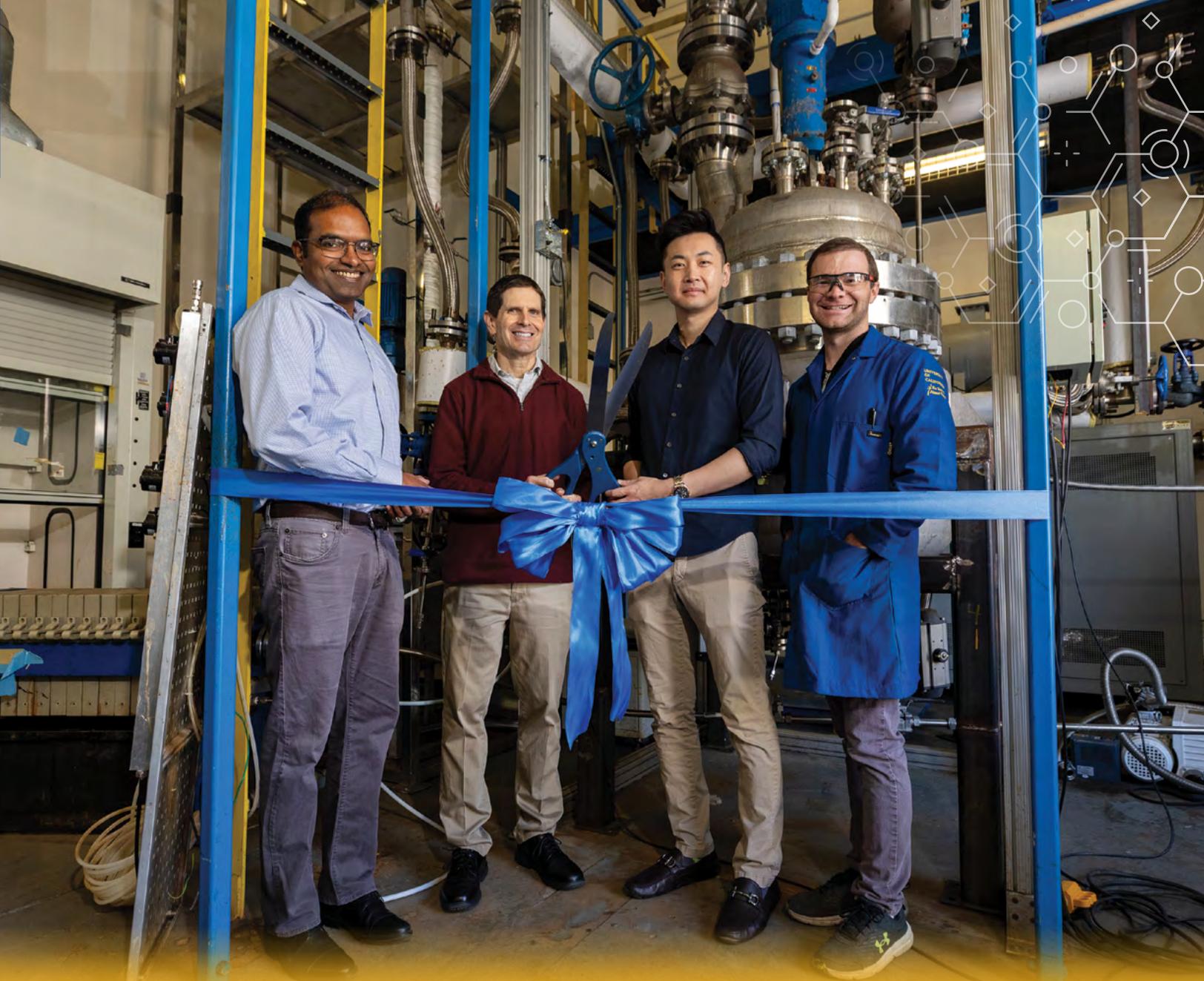
2

New Pilot Demonstration Unit for CELf Biomass Processing:

The B³ team launched a new Pilot Demonstration Unit (PDU), expanding capacity to process 10–40 kg batches of biomass with CE-CERT's patented CELf pulping and pretreatment technology. The PDU produces multi-kilogram quantities of dissolving pulp, clean lignin, and sugar derivatives for research, testing, and commercial evaluation. These materials support applications such as high-strength composites, bio-based packaging, polyurethane foams, furfurals, and low-cost fermentation media, and the unit now offers production services to industry partners exploring bio-based materials.



Discover how B³ is converting plant matter into renewable energy and sustainable materials. [Watch the video](#)



Ribbon cutting marks the launch of the B³ team's new Pilot Demonstration Unit for CELF biomass processing.

KEY PUBLICATIONS

- Jeong, S., Zhang, M., Meng, X., Wang, Y., Scheidemantle, B., Zhang, B., Min, H., Ji, A., Crovella, P., & Cai, C. M. (2025). Properties and performance of lignin-based polyurethane foams from lignin and castor oil as synergistic bio-polyols. *Chemical Engineering Journal*, 520, Article 166159. <https://doi.org/10.1016/j.cej.2025.166159>

PROFESSIONAL ACTIVITY

- **Charles M. Cai**, Member, American Institute of Chemical Engineers; Materials Research Society; and American Chemical Society

FACULTY LIST

- **Charles M. Cai**, Research Faculty; Adjunct Professor of Chemical & Environmental Engineering
- **Arun S.K. Raju**, Research Faculty; CE-CERT Associate Director of Operations

KEY SPONSORS AND PARTNERS

- U.S. Advanced Research Projects Agency-Energy
- U.S. Defense Advanced Research Projects Agency
- U.S. Department of Energy BioEnergy Technology Office

SOUTHERN CALIFORNIA RESEARCH INITIATIVE FOR SOLAR ENERGY (SC-RISE)



MISSION

The Southern California Research Initiative for Solar Energy (SC-RISE) advances research, demonstration, and engagement around solar energy. The Advanced Materials and Energy Devices Laboratory (AMEDL) focuses on fundamental research and technology development, while the Distributed Energy Resources Laboratory (DERL) leads applied work in renewable systems, green infrastructure, and clean technology deployment. The Solar Valley Consortium (SVC) collaborates with policymakers and stakeholders to position Riverside and San Bernardino Counties as California's "Solar Valley."

2025 HIGHLIGHTS

1

California–Baja California Regional Sustainable Development Summit: Dr. Alfredo Martínez-Morales participated in the California–Baja California Regional Sustainable Development

Summit in Ensenada, a high-level binational forum organized by the Baja California Ministry of Economy and Innovation, UC Berkeley's Center for Law, Energy and the Environment, and UC Alianza MX. Co-leading the Energy Transition and Efficiency working group, Dr. Martínez-Morales helped guide discussions from regional needs to concrete project concepts, including proposals for a Binational Technical Training Program in Electromobility and community-focused resilience and renewable deployment initiatives.

2

Annual Solar Valley Consortium Conference:

SC-RISE organized and co-hosted the Solar Valley Consortium Annual Conference, a virtual gathering of state and regional leaders to discuss the future of solar and energy storage in Southern California. The event featured keynote remarks by California Energy Commission Vice Chair Siva Gunda and sessions on climate urgency, land and transmission constraints, community solar, and cross-sector integration strategies. Dr. Martínez-Morales's "Community Solar+: From Access to Economic Empowerment" session highlighted models that pair bill savings with workforce development, resilience hubs, and community ownership, strengthening SC-RISE's role as a convening hub for equitable solar deployment.

3

Solar-Powered Bike Pathways White Paper:

SC-RISE researchers completed the National Center for Sustainable Transportation white paper *Shifting Gears to Sustainability: A Deep-Dive into Solar-Powered Bike Pathways*. The study evaluated solar canopies over bike paths as a strategy to pair clean generation with active transportation, developing a conceptual 1 MW solar bike path along the Santa Ana River Trail in Riverside. Modeling showed the system could generate about 2,022 MWh annually, offset roughly 734 metric tons of CO₂, and achieve a 12.64 cents/kWh real levelized cost of energy with positive returns, while creating local jobs and offering detailed recommendations on siting, financing, permitting, and community engagement.

4

ANPACT Decarbonization Forum: On March 25, 2025, Dr. Alfredo Martínez-Morales participated as an invited expert at the ANPACT Forum

"Decarbonization of Passenger and Freight Road Transport in Mexico" in Mexico City. Representing CE-CERT, he joined federal officials, industry leaders, and policy experts to shape a national roadmap for decarbonizing Mexico's heavy-duty transport sector, emphasizing the importance of binational coordination on charging and hydrogen infrastructure, grid capacity, and incentive design so that zero-emission trucks are viable for fleets of all sizes.

KEY PUBLICATIONS

- Khaleel, M., Yusupov, Z., Kilic, H., Moftah, A., Hesri, A., Ahmed, A. A., Nassar, Y., Yilmaz, M., & Martinez-Morales, A. A. (2025). Battery technologies in electrical power systems: Pioneering secure energy transitions. *Journal of Power Sources*, 653, Article 237709. <https://doi.org/10.1016/j.jpowsour.2025.237709>
- Alkhanafseh, Y., Akinci, T. C., Martinez-Morales, A. A., Seker, S., & Ekici, S. (2025). MH-WMG: A multi-head wavelet-based MobileNet with gated linear attention for power grid fault diagnosis. *Applied Sciences*, 15(20), Article 10878. <https://doi.org/10.3390/app152010878>
- Alkhanafseh, Y., Akinci, T. C., & Martinez-Morales, A. A. (2025). A comparative analysis of time series forecasting models and the novel ELSTMD approach for renewable energy generation. *IEEE Access*. <https://doi.org/10.1109/ACCESS.2025.3558120>
- Ekren, N., Sensoy, M., & Akinci, T. C. (2025). Smart buildings using web of things with .NET Core: A framework for inter-device connectivity and secure data transfer. *Information*, 16(2), Article 123. <https://doi.org/10.3390/info16020123>

AWARDS AND HONORS

- Alfredo A. Martinez-Morales, Invited Panelist (multiple high-level forums on decarbonization and sustainable development)
- Tahir Cetin Akinci, MDPI Top 1000 Reviewers
- Tahir Cetin Akinci, *Tomography* Outstanding Reviewer Award
- Musa Yilmaz, Invited Panelist, “The Present and Future of Artificial Intelligence”

PROFESSIONAL ACTIVITY

- **Alfredo A. Martinez-Morales**, Co-Chair, Solar Valley Consortium
- **Alfredo A. Martinez-Morales** and **Miroslav Penchev**, IEEE Members
- **Musa Yilmaz** and **Tahir Cetin Akinci**, IEEE Senior Members
- **Tahir Cetin Akinci**, Special Issue Editor, “Big Data Analytics in Smart Cities,” *Information*

FACULTY LIST

- **Alfredo A. Martinez-Morales**, Project Scientist
- **Miroslav Penchev**, Project Scientist
- **Tahir Cetin Akinci**, Project Scientist
- **Musa Yilmaz**, Affiliate Visiting Researcher

KEY SPONSORS AND PARTNERS

- California Clean Energy Fund
- California Department of Transportation
- California Energy Commission
- Opportunity to Advance Sustainability Innovation and Social Inclusion
- University of California Alianza MX
- **Solar Valley Consortium Members:**
 - EDF Renewables
 - GRID Alternatives
 - Intersect Power
 - Riverside County
 - Riverside Public Utilities
 - San Bernardino County
 - Southern California Edison
 - Sunrun
 - Western Riverside Council of Governments



Dr. Alfredo Martínez-Morales speaks at Mexico's ANPACT Forum on decarbonization of passenger and freight transport.

GREENHOUSE GAS EMISSIONS LAB



MISSION

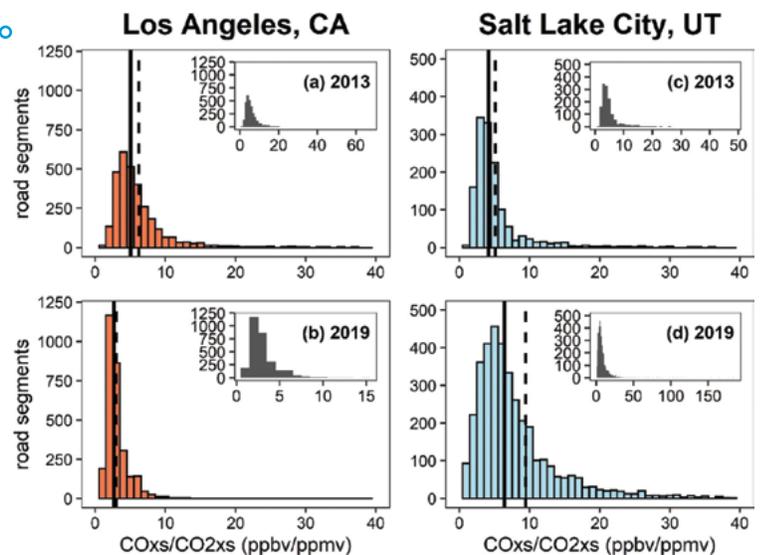
The Greenhouse Gas Emissions Lab advances understanding of climate- and air quality-related emissions to support science-based mitigation strategies. The lab focuses primarily on methane emissions from anthropogenic sources, while also studying carbon dioxide, nitrous oxide, carbon monoxide, and ammonia. Using mobile lab field studies, isotope measurements, spatial mapping, and atmospheric and soil science techniques, the team investigates emission sources to improve inventories and guide reduction efforts.

2025 HIGHLIGHTS

1

Roadway CO/CO₂ Emissions Published in *Environmental Science & Technology*: A multiyear evaluation of roadway CO and CO₂ across Los Angeles and Salt Lake

City was published in *Environmental Science & Technology*, providing rare long-term observations of changing vehicle emissions. Los Angeles continued its expected -8% per year decline in CO/CO₂, while Salt Lake City—and Los Angeles in 2020—showed counterintuitive increases driven by higher vehicle speeds from low traffic volumes and local speed-limit changes. These findings demonstrate how real-world measurements are essential for validating modeled emissions trends and assessing the effectiveness of vehicle-emission policies.



Roadway CO/CO₂ On-road CO/CO₂ emission trends across Los Angeles and Salt Lake City from 2018–2022.

2

First Field-Based Assessment of Anaerobic Digesters on a California Dairy:

Published in *Global Change Biology Bioenergy*, this study represents the first on-farm measurement campaign evaluating methane reductions from an anaerobic digester on a California dairy. Repeated, year-round measurements before and after installation revealed that digester operation reduced manure-management methane emissions by more than 75%, providing the first observational confirmation of reductions assumed in state climate planning. The work demonstrates the importance of direct measurement to understand seasonal variability and to verify the performance of technologies central to California's methane-reduction strategy.



Graduate researcher Diana Rodriguez Amezcuita, Best Poster Presentation, XVI Simposio Internacional del Carbono en México (Mexican Carbon Program 16th International Symposium)

3

National Wastewater Emissions Survey Published in *Nature Water*: In collaboration with Princeton University, the lab contributed to one of the most extensive measurement-based surveys of methane, nitrous oxide, and ammonia emissions from U.S. wastewater treatment plants, published in *Nature Water*. The data reveal substantially different emission patterns than those currently used in national inventories, offering a new paradigm for accurately estimating wastewater-sector greenhouse gas contributions. These findings have the potential to reshape how wastewater emissions are quantified and inform future mitigation and regulatory strategies.

4

Public Engagement for the 5th California Climate Assessment – Deserts Region:

As contributors to the Deserts regional report for the 5th California Climate Assessment, team members participated in public presentations, interviews, and outreach to communicate climate risks across Inland Southern California. In partnership with Alianza Coachella Valley, the lab helped lead a community workshop in Coachella focused on the impacts of extreme heat, supporting local preparedness and adaptation planning and ensuring that regional scientific assessments translate into actionable information for residents, stakeholders, and policy-makers.



Mobile laboratory mapping of on-road CO/CO₂ ratios across Los Angeles, used to evaluate long-term vehicle emission trends and the effectiveness of air quality regulations.

KEY PUBLICATIONS

- Rodriguez, M. V., Rojas Robles, N., Carranza, V., Thiruvengkatachari, R., Reyes, M., Preble, C. V., Pexton, J., Meyer, D., Anderson, R. G., Venkatram, A., & Hopkins, F. M. (2025). Anaerobic digester installation significantly reduces liquid manure management CH₄ emissions at a California dairy farm. *Global Change Biology Bioenergy*, 17, e70047. <https://doi.org/10.1111/gcbb.70047>
- Yáñez, C. C., Bares, R., Czimczik, C. I., Lin, J., Zhang, S., Bush, F. M., & Hopkins, F. M. (2025). Contrasting trends in vehicle combustion efficiency in Los Angeles, CA and Salt Lake City, UT. *Environmental Science & Technology*, 59(2), 1287–1297. <https://doi.org/10.1021/acs.est.4c11701>
- Ding, Y., Saeidi, A., Wang, T., Huang, H., Halseth, O., Hopkins, F., & Venkatram, A. (2025). Using the AP-42 model to estimate dust emission factors for high traffic roads. *Atmospheric Pollution Research*. <https://doi.org/10.1016/j.apr.2025.102727>
- Moore, D. P., Li, N. P., Song, C., Zhu, J.-J., Yi, H., Tao, L., McSpirt, J., Sevostianov, V. I., Wendt, L. P., Rojas Robles, N. E., Hopkins, F. M., Ren, Z. J., & Zondlo, M. A. (2025). Comprehensive assessment of the contribution of wastewater treatment to urban greenhouse gas and ammonia emissions. *Nature Water*. <https://doi.org/10.1038/s44221-025-00490-z>

AWARDS AND HONORS

- Alyssa Valdez, UC-Hispanic Serving Institutions Doctoral Diversity Initiative Graduate Fellowship

- Diana Rodriguez Amezcuita, Best Poster Presentation, XVI Simposio Internacional del Carbono en México (Mexican Carbon Program 16th International Symposium)
- Juliana Guerra, National Science Foundation Graduate Research Fellowship Honorable Mention

PROFESSIONAL ACTIVITY

- Francesca Hopkins, Member, City of Riverside Climate Action and Adaptation Plan Advisory Committee, advising city actions on emissions, impacts, and public communication
- Francesca Hopkins, Member, California Air Resources Board Research Screening Committee

FACULTY LIST

- Francesca Hopkins, Associate Professor of Environmental Sciences; CE-CERT Affiliate Faculty
- Abhilash Vijayan, Research Faculty; Adjunct Professor of Chemical & Environmental Engineering
- Luat Vuong, Associate Professor of Mechanical Engineering

KEY SPONSORS AND PARTNERS

- California Air Resources Board
- California Energy Commission
- Sonoma Technologies/U.S. Department of Energy
- USDA/California Dairy Research Foundation
- Caltrans

ENGAGEMENT & PARTNERSHIPS

CE-CERT continues to expand its role as a regional and national hub for collaboration, professional development, and community engagement. In 2025, the center strengthened partnerships across academia, government, industry, and local communities through research training programs, conferences, seminars, and hands-on outreach, linking environmental innovation to education, policy, and public impact.

AIR QUALITY & CLIMATE TRAINING PROGRAM (ACT)

Supported by an endowment from the South Coast Air Quality Management District, the Air Quality & Climate Training Program (ACT) addresses workforce development needs in air quality and sustainability. Designed and taught by CE-CERT researchers, ACT will offer courses on a range of topics that will be open to the public. The program provides training for students, professionals, and community members, complementing existing UCR offerings while preparing a skilled workforce in environmental and climate-related fields. The first four courses to be launched in 2026 are:

- Introduction to Emissions and Performance of Mobile Sources
- Introduction to Atmospheric Chemistry and Air Quality
- Introduction to Sustainable Transportation and Associated Community Impacts
- Introduction to Electric Grid and Renewable Energy



For information, see:
<https://www.cert.ucr.edu/ACT>

SPEAKS NSF GRADUATE STUDENT RESEARCH TRAINEESHIP

The SPEAKS (Science to Policy Education: Activating Knowledge for Sustainable Transportation) Graduate Student Research Traineeship, funded by a five-year grant from the National Science Foundation and led by Dr. Matthew Barth, provides a multidisciplinary training platform for doctoral students addressing the scientific and policy challenges of transportation decarbonization.

In 2025, SPEAKS welcomed its third cohort, expanding participation to 25 students across engineering, environmental science, and political science, and celebrated the graduation of its third SPEAKS scholar, Dr. Yejia Liao. Through academic coursework, professional development workshops, and exposure to real-world policy environments, the program equips students to translate scientific research into actionable policy solutions. SPEAKS continues to strengthen its partnerships with the UCR Science to Policy Program, the National Science Policy Network, and collaborators across academia, government, and industry.



The 2025 SPEAKS Graduate Student Research Traineeship cohort at CE-CERT.





Dr. Matthew Barth delivers opening remarks at the 2025 ITS Forum, hosted at The Cheech in Riverside.

CONFERENCES, SEMINARS, AND WORKSHOPS

Throughout 2025, CE-CERT organized and hosted a number of conferences, technical forums, seminars, and professional development events that strengthened collaboration among researchers, industry partners, and government agencies. These events played a key role in advancing scientific dialogue and informing policy and technology development in California and beyond.

- **ITS Forum**

The 2025 ITS Forum brought more than 110 global transportation researchers, local agencies, and industry partners to discuss innovations in intelligent transportation systems, freight efficiency, and connected mobility. Presentations highlighted ongoing collaboration across UC campuses and showcased emerging tools and technologies that support safer, cleaner, and more efficient transportation networks.

- **14th Annual International OSAR Conference**

CE-CERT hosted the 14th Annual OSAR Conference, which brought together more than 100 researchers, regulators, and industry professionals to explore cutting-edge advancements in onboard sensing technologies for emissions monitoring. Sessions focused on real-time emissions reporting, regulatory compliance, and the future of sensor-enabled air quality management.

- **Inaugural North American Hydrogen Engine Conference**

Held at the California Air Resources Board in Riverside, this milestone event convened over 150 experts from 90+ organizations to discuss hydrogen internal combustion engine (H2-ICE) research, infrastructure challenges, and deployment pathways. The conference established a new regional hub for cross-sector collaboration in hydrogen-fueled mobility.



H2EA-NA Founding Members gather at the Inaugural Conference at CARB (photo credit: Bombarda Media).

- **Solar Valley Annual Conference 2025**

CE-CERT co-hosted the Solar Valley Annual Conference, uniting energy leaders and policymakers to examine clean energy funding challenges, solar equity, and grid resilience. The event included keynote presentations from the California Energy Commission and UC Berkeley, helping shape regional strategies for accelerating solar adoption.

- **OMEGA Project Dissemination Workshop**

CE-CERT hosted the OMEGA Project Dissemination Workshop to share findings from the multi-year OMEGA initiative (Objective Measurement/Monitoring/Mitigation of Emissions from Goods Movement and Impacts on Air Quality). The workshop brought together regional and state stakeholders for a full day of technical exchange focused on the air quality impacts of goods movement in Inland Southern California. The program featured presentations on field measurement campaigns, freight activity and emissions modeling, and the evaluation of mitigation strategies. Discussions centered on the implications of these results for planning, regulatory decision-making, and future

research. By convening researchers and practitioners from across the freight, transportation, and air quality sectors, the workshop strengthened collaboration and helped inform data-driven approaches to improving freight efficiency and reducing emissions.

- **Research Seminar Series**

CE-CERT hosted a robust lineup of research seminars featuring speakers from academia, national laboratories, and industry. Topics included methane monitoring technologies, the evolution of diesel engine systems, connected and automated vehicle research, and new insights into the physicochemical behavior of secondary organic aerosols.

- **Professional Development Workshops**

Workshops such as “Unlock Your Career Potential with MyIDP” and “Research in the Public Eye: Media Training” equipped faculty, researchers, and graduate students with valuable tools for career development and science communication. These sessions support CE-CERT’s commitment to preparing researchers for leadership roles across sectors.

COMMUNITY ENGAGEMENT AND OUTREACH

CE-CERT’S COMMUNITY-FOCUSED PROGRAMS AND OUTREACH ACTIVITIES CONTINUED TO GROW IN 2025, EXPANDING ACCESS TO ENVIRONMENTAL EDUCATION AND ADVANCING CLEAN MOBILITY INITIATIVES ACROSS THE REGION.

- **STEPCon and Student Engagement**

CE-CERT continued its longstanding involvement with the STEP Conference, the region’s largest K-12 STEM education event, providing hands-on demonstrations, interactive exhibits, and guided laboratory tours for visiting students. Through its participation in STEPCon, CE-CERT engaged hundreds of middle, high school, and community college students, introducing them to real-world air quality measurement and improvement technologies, renewable energy technologies, and sustainable transportation research. These experiences offer students direct exposure to university-level research environments and help cultivate early interest in science, engineering, and environmental problem-solving.

- **Annual Open House 2025**

CE-CERT welcomed students, families, community members, and regional partners to its Annual Open House, offering guided laboratory tours, hands-on demonstrations, and interactive conversations with researchers across air quality, energy systems, and clean mobility. The event also featured engagement tables from programs such as the Riverside Clean Air Carshare (RCAC), Inland Empire Regional K-16 Education Collaborative, UCR EcoCAR, and other CE-CERT initiatives, giving visitors a comprehensive look at the center’s partnerships and community-focused projects. The event, open to the public, strengthened connections with local stakeholders while highlighting the breadth of CE-CERT’s research, education, and outreach activities.



UCR’s EcoCAR team members guide students through hands-on activities at STEPCon.

STUDENTS & SCHOLARSHIPS

In 2025, CE-CERT supported **61 GRADUATE** and **39 UNDERGRADUATE** students across its research programs. Through hands-on research and faculty mentorship, students contributed to projects in air quality, energy, and transportation systems.

CE-CERT 2025-2026 SCHOLARSHIP RECIPIENTS

CE-CERT is proud to announce the recipients of the 2025–2026 Scholarship Awards, totaling \$47,000. We congratulate each awardee for their hard work and achievements, and we extend our sincere appreciation to the generous donors who made these scholarships possible.

\$47,000
IN SCHOLARSHIP AWARDS

Learn more about the students at www.cert.ucr.edu/2025scholarships

ESTHER F. HAYS GRADUATE FELLOWSHIP



CHUHENG WEI
Electrical Engineering



SUNANDAN MAHANT
Chemical and Environmental Engineering



DONGBO PENG
Electrical Engineering



YANYU ZHANG
Chemical and Environmental Engineering

ESTHER F. HAYS GRADUATE FELLOWSHIP



YING ZHOU
Chemical and Environmental Engineering



ZIYAN ZHANG
Electrical Engineering

JIM GUTHRIE RESEARCH AWARD RECIPIENT



CHRISTOPHER SOLARES
Environmental Engineering



HELEN NGUYEN
Environmental Engineering



ERIC PANG
Mechanical Engineering



JONATHAN SETIABUDI
Computer Engineering



FIDELIA LOPEZ
Chemical Engineering



SARAH ZOHARY
Environmental Engineering

COLIN F. HACKETT GRADUATE AWARD RECIPIENT



ELIZABETH DEFANCE
Chemical and
Environmental Engineering



LINTONG CAI
Chemical and
Environmental Engineering

PIERSON/FORD GRADUATE AWARD



TROY HURREN
Chemical and
Environmental Engineering



ZACHARY JOHNSON
Chemical Engineering

MILLER DURBIN GRADUATE RESEARCH AWARD RECIPIENT



GRACE JOHNSON
Mechanical Engineering

TRANSPORTATION SYSTEMS RESEARCH (TSR) GRADUATE STUDENT AWARD



MIKE STAS
Electrical Engineering

SALIM KHAN GRADUATE AWARD



MINGHAO HAN
Chemical and Environmental
Engineering

ACTIVE PROJECTS LIST

CE-CERT continues to expand its research portfolio across a broad range of air quality, energy, and transportation initiatives supported by federal, state, local, and industry partners. In 2025, CE-CERT's active research portfolio included over **84 PROJECTS**, totaling more than **\$43 MILLION** in sponsored funding.

AIR QUALITY

A Network of Optical Particle Spectrometers for Distributed Long-term Aerosol Size Distribution Measurements | Department of Energy/Miscellaneous Offices and Programs | Sarah Petters

Assessment of greenhouse gas and air quality benefits of dairy digester installation in California | California Energy Commission | Francesca Hopkins

CDS&E: Harnessing Graphical Processing Units (GPUs) to Accelerate the Computational Efficiency of Air Quality Modeling Systems for Four-Dimensional AI | National Science Foundation | Bryan Wong

CIF: An Ice Nucleation Cold-Stage for Research and Teaching | National Science Foundation | Markus Petters

Collaborative Research: Aerosol Properties and Autoconversion during Cold-Air outbreak Experiment in the Sub-Arctic Region (CAESAR) | National Science Foundation | Markus Petters

Collaborative Research: BEAR-oNS: Biogenic Emissions and Aerosol Response on the North Slope | National Science Foundation | Kelley Barsanti

Collaborative Research: Coastal Cloud Chemistry during the Eastern Pacific Cloud Aerosol Precipitation Experiment (ECAPE-CCC) | National Science Foundation | Markus Petters

Development and Evaluation of Databases and Estimation Methods for Predicting Air Quality Impacts of Emitted Organic Compounds | Coordinating Research Council | William Carter

Empowering Community-based Air Quality Monitoring through the South Coast AQMD Sensor Library Program | Environmental Protection Agency | Don Collins

Impact of Hazardous Air Pollutants on Community Air Quality | The Rose Foundation for Communities and the Environment | David Cocker

Investigating the role of secondary formation of ethylene oxide | South Coast Air Quality Management District | Don Collins

Laboratory Studies Investigating the Influence of Particle Diameter on Viscosity | National Science Foundation | Markus Petters

Mobile Air Quality Mapping in New Jersey Communities | New Jersey Department of Environmental Protection | Abhilash Vijayan

Modeling Plastic GHG Emissions Field Measurement Along Caltrans ROW | California Department of Transportation | David Cocker

Partnership Agreement For The Collaborative Stakeholder Structure For The Casa Blanca Collaborative - U.S. Environmental Protection Agency's Community Change Grants Program Initiative | City of Riverside | Don Collins

Scalable Chemical Mechanisms of Emerging Sources for Community Air Quality Predictions | Environmental Protection Agency | Kelley Barsanti

Statewide Mobile Monitoring Initiative | Air Resources Board | Don Collins

TRACER-MAP: Mapping Aerosol Processes across Houston during convective cell events | Department of Energy Office of Science/Biological and Environmental Research | Don Collins

Ultrafine aerosol particle formation and impacts in Houston during TRACER | Department of Energy Office of Science/Biological and Environmental Research | Don Collins

Understanding the impact of pollution aerosol from Los Angeles/Long Beach on clouds and radiation in and upwind of the ECAPE study domain | Department of Energy Office of Science/Biological and Environmental Research | Don Collins

Understanding the Sources and Formation Regimes of Present-day PM_{2.5} to Mitigate Particulate Pollution in California | Air Resources Board | Don Collins

EMISSIONS AND FUELS

BAR Smog Check Performance Report | California Department of Consumer Affairs | Tom Durbin

Brake, Tire, and Road Wear Literature Review - CRC Project No. E143 | Coordinating Research Council | Zisimos Toumasatos

CARB Emissions Compliance Testing | Air Resources Board | Tom Durbin

Characterization of Tire-Wear and Brake-Wear PM Emissions Under On-Road Driving Conditions | Air Resources Board | Georgios Karavalakis

Characterization Of Tire-Wear Gaseous Emissions from On-Road Vehicles | Air Resources Board | Georgios Karavalakis

Characterization of Train Brake-Wear and Wheel/Rail-Wear PM Emissions | Air Resources Board | Georgios Karavalakis

Characterizing Unfiltered Exhaust Leaks During Heavy-Duty Vehicle Operations and their Impacts on Disadvantaged Communities | Air Resources Board | Kent Johnson

Collaborative Research: Understanding Fundamental Mechanisms in Plasma-enhanced Electrostatic Precipitation | National Science Foundation | Heejung Jung

Data Collection and Analysis under the California Air Resources Board (CARB) Zero-and-Near-Zero Emissions Freight Facility Grant | Air Resources Board | Tom Durbin

Demonstration of Sensor Technologies for On-Road and Off-Road Heavy-Duty Diesel Vehicles | Air Resources Board | Kent Johnson

Electric Truck Research and Utilization Center (eTRUC) | California Energy Commission | Georgios Karavalakis

Electrification Needs for Agriculture Sector in California | California Energy Commission | Tom Durbin

Emission Testing and Test Method Development for Commercial Harbor Craft and Ocean-Going Vessels | Air Resources Board | Kent Johnson

Environmental, Analytical, Research, Technical, and Hybrid (EARTH) Support Services | Environmental Protection Agency | Tom Durbin

Evaluation of Hydrogen-Natural Gas on Engine Performance and Durability | Pacific Gas and Electric Company | Georgios Karavalakis

H2NG-RICE0 - Hydrogen Natural Gas Reciprocating Internal Combustion Engine Generator with near Zero emissions | California Energy Commission | Georgios Karavalakis

Heavy-Duty Inspection and Maintenance Referee Program | Air Resources Board | Tom Durbin

Smog Check Performance Report | California Department of Consumer Affairs | Tom Durbin

SYMBIO One – California Hydrogen Fuel Cell Manufacturing Facility | California Energy Commission | Georgios Karavalakis

Zero Emission Yard Tractor Activity and Emissions Data Collection and Analysis | Los Angeles Harbor Department | Tom Durbin

RENEWABLE ENERGY

Advancing the National Bioeconomy through Regional Sun Grant Centers | National Institute for Food and Agriculture | Charles Cai

Building Resiliency with Adaptive Vehicle-to-grid Integration | California Energy Commission | Alfredo Martinez-Morales

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