

UCR



LOOKING FORWARD

CENTER FOR ENVIRONMENTAL RESEARCH AND TECHNOLOGY



SETTING THE SCENE FOR SUSTAINABILITY AT UCR

- UCR is uniquely positioned to create a truly impactful, collaborative process for addressing grand challenges in sustainability.
- UCR's effort to reorganize “sustainability” on campus
- The relocation of ARB offers a major new opportunity to leverage our work
- The City, County and UCR are working together to create a *Green Innovation District*



AD-HOC ACADEMIC SENATE COMMITTEE ON SUSTAINABILITY

- Collect information on recent administrative “restructuring” of the UCR Office of Sustainability; analyze overall implications
- Provide a working definition of “sustainability” and examine and inventory all sustainability efforts across campus
- Consider UCR’s 2020 strategic plan and the system-wide UC policy on sustainability
- Create a set of priorities around sustainability at UCR and propose a new “structure” for supporting sustainability on campus

DRAFT SUSTAINABILITY STRUCTURE

Academic (Faculty & Students)

Lead: VPUE (Grad Dean)

Director of Academic Sustainability (faculty)
- Academic Sustainability Officer (academic coordinator)

- Coordinate Academic Senate standing committee on sustainability
- Represent UCR on Global Climate Leadership Council (GCLC)
- Oversee sustainability internships, including CNI & FGI student applicants, projects
- Facilitate student participation in R'Garden
- Collaborate with Student Affairs and Career Center on Sustainability Issues
- Coordinate and reporting for:
 - o AASHE
 - o Sierra Cool Schools (due 2/28)
 - o Green College ranking (2/28)
- Facilitate participation in GreenLabs Initiative (with facilities)
- Develop and Implement Certificate in Sustainability
- Coordinate Implementation of the Bending the Curve Curriculum
- Contribute to publications and maintain the website on UCR Sustainability
- Advise on Sustainability Action Plans (e.g. Water, Waste, Climate, Sustainable food)
- Academic liaison to UCR community at large
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Facilities Services

Lead: Michael Pazzani

Executive Director of Facilities
- UCR Facility Manager
- UCR Energy Manager

- Architects & Engineers: facility maintenance
- UCR Energy Management (Sadrul Ula)
- UCR Water Management
- Liaison to UCOP utilities operations
- UCR Waste management
 - o Coordinate recyclable waste operations and waste diversion
- UCR Campus Operations:
 - o Thermal energy storage
 - o LED light replacement
 - o Additional Deep Energy Efficiency programs
 - o Food waste
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- Coordinate reporting for:
 - o Climate Action plan
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- Contribute to publications & website on UCR Sustainability
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Capital Assets & Planning

Lead: VC Planning and Budget

Associate Vice Chancellor (Jeff Kaplan)
- Sustainability Specialist: LEED
- Sustainability Specialist: Strategies

- Develop and certify LEED buildings
- Long term sustainability growth planning:
 - o North District buildout
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 - o CARB buildout
- Construction Items
 - o Solar greenhouse
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- Monthly coordination meetings between all groups
- Coordinated activities between these three pillars
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UCR's Sustainability Related Research (draft in progress)

Who We Are

Where we are Going

CE-CERT

College of Engineering Center
for Environmental Research
and Technology

- Largest, Self Supporting Center on Campus
 - \$15 million in endowments for student and faculty support, \$ 18 million in active research projects
- 12 unique state of art living laboratories– including
 - World's most accurate atmospheric chamber for measuring smog
 - Lead Institution in Emissions Testing and portable emissions measurement systems
 - Leading academic institution in pretreatment of aqueous biomass to fuel
 - Lead institution for incorporating environmental strategies in transportation infrastructure and vehicle technologies
 - 10 MW of Optimized Renewable Energy and Storage Integrated Systems across the State

- Establishing an Innovation Corridor along University Ave to test new environmental friendly transportation technologies.
- 4 new Faculty in Learning Science, Technology, Engineering and Mathematics outreach
- Campus wide Renewable energy systems infrastructure expansion and energy efficiency staff addition

BCOE

Bourns College of Engineering

- Long standing Water Quality expertise
- Cybersecurity expertise
- Big Data Analytics
- Multi-million Material Science Building established
- 6 new faculty joined in 2015 and 2016 in new materials and devices for next generation technologies 3 (autonomous and Intelligent Embedded systems) 2 (computational Materials) 3 (phonon engineered materials)

- 3 new Faculty in Materials & Control
- 2 new faculty in cybersecurity
- 4 new faculty in Atmospheric Chemistry and Emissions

CNAS

College of Natural and
Agricultural Sciences

- World renowned research in plant path beginning with the citrus experiment station in 1907
- Connection with living laboratories through xx acres of ag land and community R'Gardens and education center
- Ecological Pesticide expertise
- Understanding stress of climate change on plants
- Launch of CAFÉ, EDGE, etc.

- Establishing Genomics to Harvest –
 - The Basic Science, Cultivation, and Production of Plants and Food- hiring 3 new faculty
- Expansion of R'Gardens living laboratory and education center with the community
- Expansion of CAFE

UCR's Sustainability Related Research, Cont. (draft in progress)

Who We Are

Where we are Going

SOM

School of Medicine

- Established in 2012 with the mission “Improving Health of Our Community”
- 2 faculty in environmental Toxicology
- Strong community outreach program through Healthy Communities
- Statistics cluster
- Faculty hire for BREATHE: Bridging Regional Ecology and Aerosolized Toxins to understand Health Effects

SPP

School of Public Policy

- New School established in 2014
- Experts in international water quality & scarcity
- Center for Sustainable Suburban Development
- New center for spatial

SOBA

School of Business
Administration

- Economic Environmental Analysis
- 2 faculty hires for data Science Center
- 2016 launch of EPIC – accelerating commercialization of technologies

CHASS

College of Humanities
and Social Science

- Undergraduate Major in Sustainability
- Media and Arts projects and classes related to Sustainability

Local Partners

- Strong Partnerships with 100 local industries
- Strong Partnerships with government – SCAQMD, City, County, Utilities and Transportation Commission
- Community based participation in sustainability, including the City's Green Action Plan

- 4 new faculty hires for BREATHE
- 2 faculty in multiphase atmospheric Chemical Transformations

- 1 new faculty for spatial research
- Sustainability Curriculum developed for 2018

- 4 hires in supply chain, Logistics and Transportation Management
- 3 hires in UCR data Science Center
- 3 hires in Experimental business Research

- Minor planned in Sustainability

- Welcoming the California Air Resources Board and its \$413 facility
- Establishing a true Green City in Riverside
- Attracting Business R&D related to Sustainability to Riverside with an economic development plan
- Welcoming 300 new faculty and 5000 new students to UCR by 2025

Example of Existing Collaborations

AREA	Pollutant Characterization & Control	Air Quality & Climate Change Science	Health Impacts of Air Pollution and Climate Change	Economic, Social & Policy Impacts of Air Pollution and Climate Change	Sustainable & Intelligent Transportation	Micro-grids & Energy Infrastructure	Renewable Fuel and Power Production	Sustainable Agriculture	Renewable Resource Management (Waste Streams)
UCR FACULTY INTEREST	Marko Princevac	Roya Bahreini	Meera Nair	Ken Baerenklau	Adem Orsdemir	Matt Barth	Charles Cai	Kathryn Uhrich	Arun Raju
	George Karavalakis	Akua Asa-Awaku	David Lo	Ron Loveridge	Akula Venkatram	Sadrul Ula Alfredo Martinez-Morales etc	Charlie Wyman Alfredo Martinez-Morales etc	Timothy Close	Milt McGiffen
	Wayne Miller etc	Ariel Dinar etc	Ann Cheney etc	Barry Wallerstein etc	Amit Roy Chowdhury etc			Philip Roberts etc	Amir Haghverdi etc
KEY AWARDS & PROGRAMS	BREATHE (seed funds)			UCTC (Current NCST & UCCONNECT)		Demonstration of Smart Grid	RNG Center	'Prospective' Resistance Management	
				Frieght ITS		Algorighm development	Advanced Storage	Sustainable Pest Management, biological control	
	Improving Emissions Inventories	CCN	Health impacts of environmental exposure (incl cig smoke)		Automating the Port	SHINES	Sustainable Bioenergy Specialists in Training		
	Measuring Emissions from all sources (including toxics)	Modeling Emissions			Frieght Eco-Driving, Eco-Routing				Organic Agriculture
	ARB COLLABORATION OPPORTUNITIES	Compliance Division	R&D Division	R&D Division, TBD	TBD	ZEV committee			
HD Compliance		Understanding roles of toxics, climate changes.	Frieght Committee						
Emissions Inventories									
		CARB 1 day workshop							
ADDITIONAL OPPORTUNITIES	Proposed Marine Center (ARB, ICCT, DOT, others)			WLC Mitigation Strategies and Land use		Biomass to Energy for Rural Communities (USDA rural development)			
	Proposed Low Cost Air quality Monitoring Program in Riverside			UCTC (New NCST & TIER1)		NSF Human Interaction Training for the			
	ZEV Impacts					Salton Sea and related biomass and water projects			
	VW Compliance Efforts			Disadvantaged Community (DAC)- Sensitive truck routing		Powering Energy To Face the challenges of World Hunger and empowers farmers(grand challenge)			
	Clean Port Center			Making renewable energy economic & secure					
	DOE & VW Clean & Advanced Cities								
								Dynamic Emissions and Energy Controls	

UCR's Proposed Sustainability Institute

Vision:

The vision of the Institute is to *develop solutions for sustainable growth and improved quality of life for our region* through collaborative research, demonstrations and outreach to partners in industry, government and community.

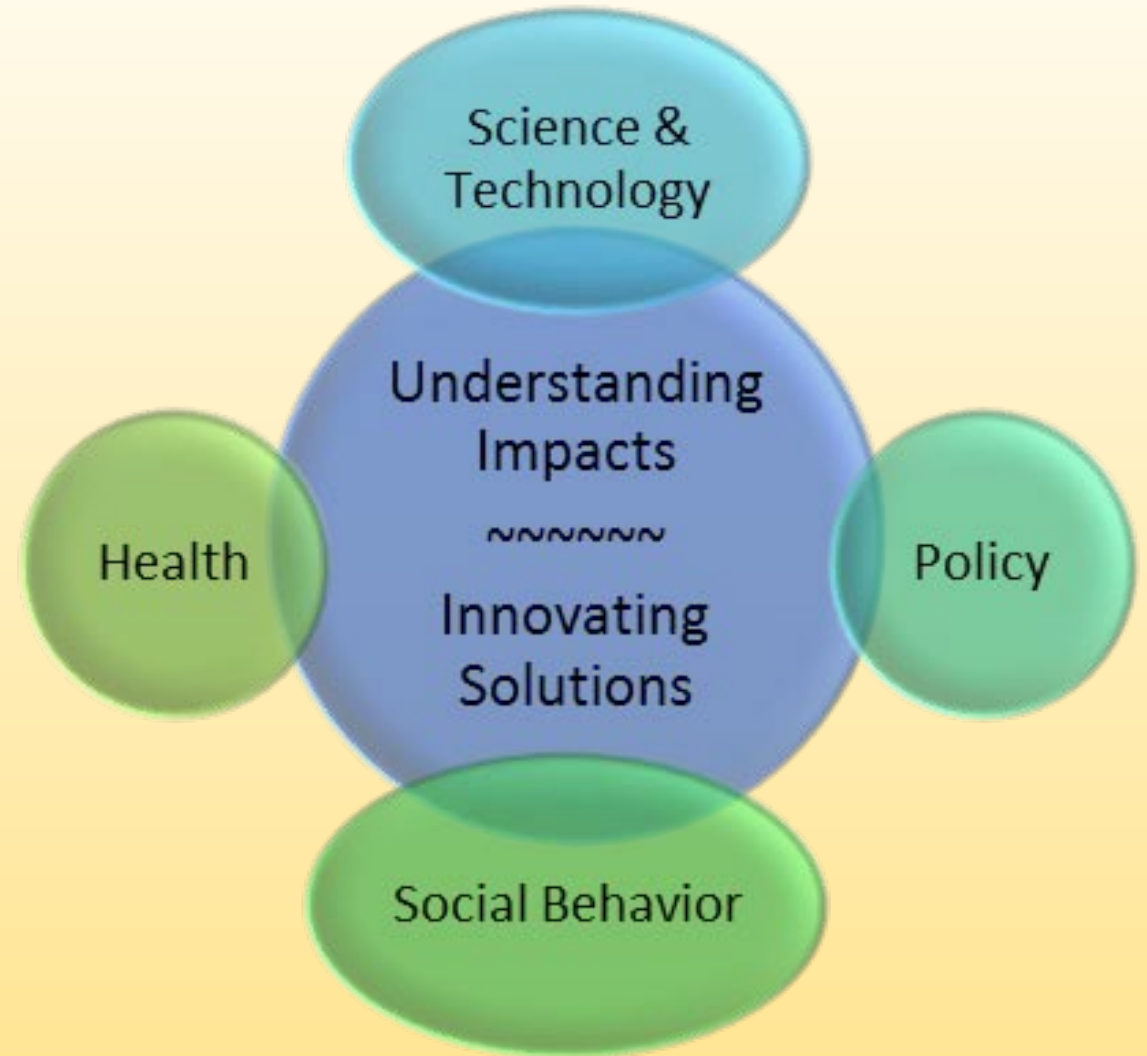
Focus:

- Address challenges that our community is facing now!
- Prioritize challenges that have a broader (worldwide) significance.
- Be applied in nature - lead to a visible outcome in five year timeframe.
- Address challenges that require cross discipline collaboration to solve.
- Focus must be within UCR's existing expertise or planned growth areas.

UCR's Proposed Sustainability Institute

The Institute's Role:

- Serve as the connection point for faculty, industry, regulatory agencies (e.g., CARB) and community
- Administer cross discipline research programs
- House and Fund sustainability curriculum, research and outreach events
- Provide planning input for local sustainability infrastructure



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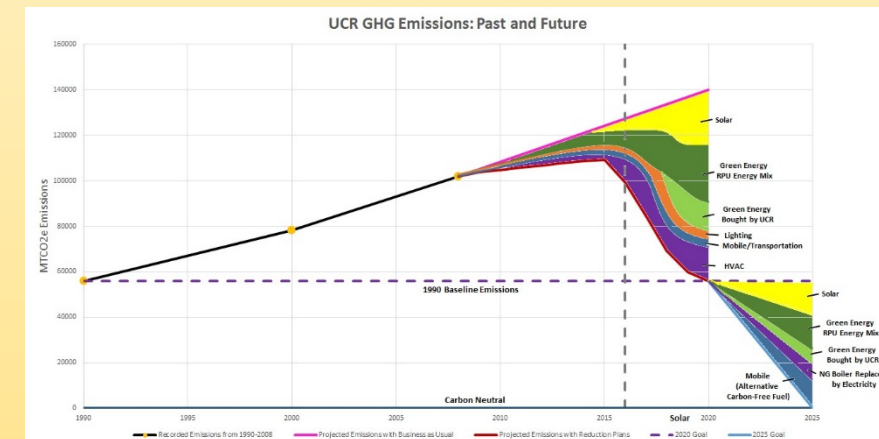
UCR's Proposed Sustainability Institute

Examples of Typical Projects:

Perform comprehensive evaluations of new technologies/processes with experts from engineering, policy, health and business.

Apply promising technologies in real-world demonstrations to evaluate and improve readiness for quick and economically feasible adoption

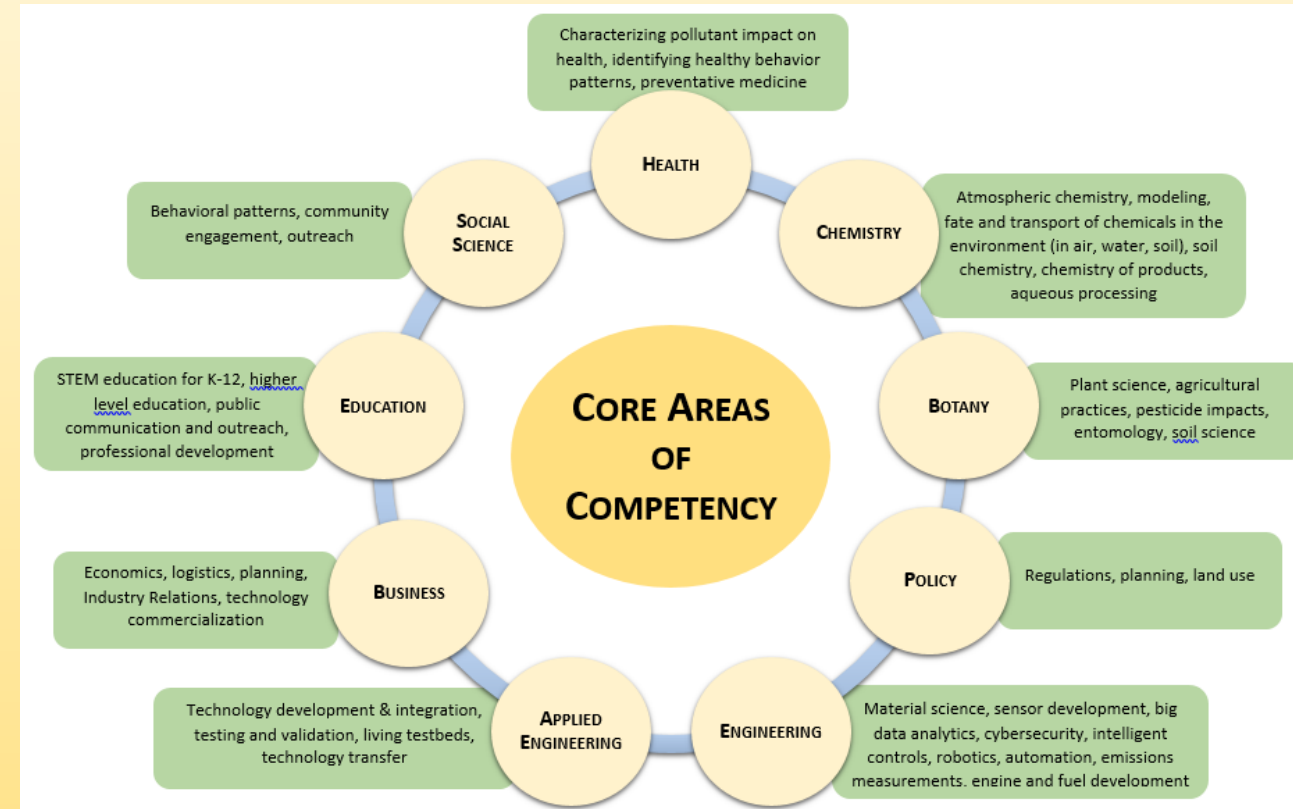
Bring together industry, regulators, students, and the public in forums and events that show with data trends and metrics why one solution is practical as well as sustainable



UCR's Proposed Sustainability Institute

Phases:

- Develop Prospectus (16-17)
 - Define research & educational vision
 - Internal collaboration (administration, faculty, and students)
 - Key stakeholder input
 - Define needed Financial, Administrative, and Facility elements
- Implement Prospectus Action Plan (17+)
 - Secure Internal Approval
 - Formalize Collaborations
 - Pursue Development Activities for Institute as a whole
 - Develop Additional Capacity in Themes (Faculty, etc) in phases
 - Develop Additional Funding for Themes in phases



UCR's Proposed Sustainability Institute

Tasks & Timeframe

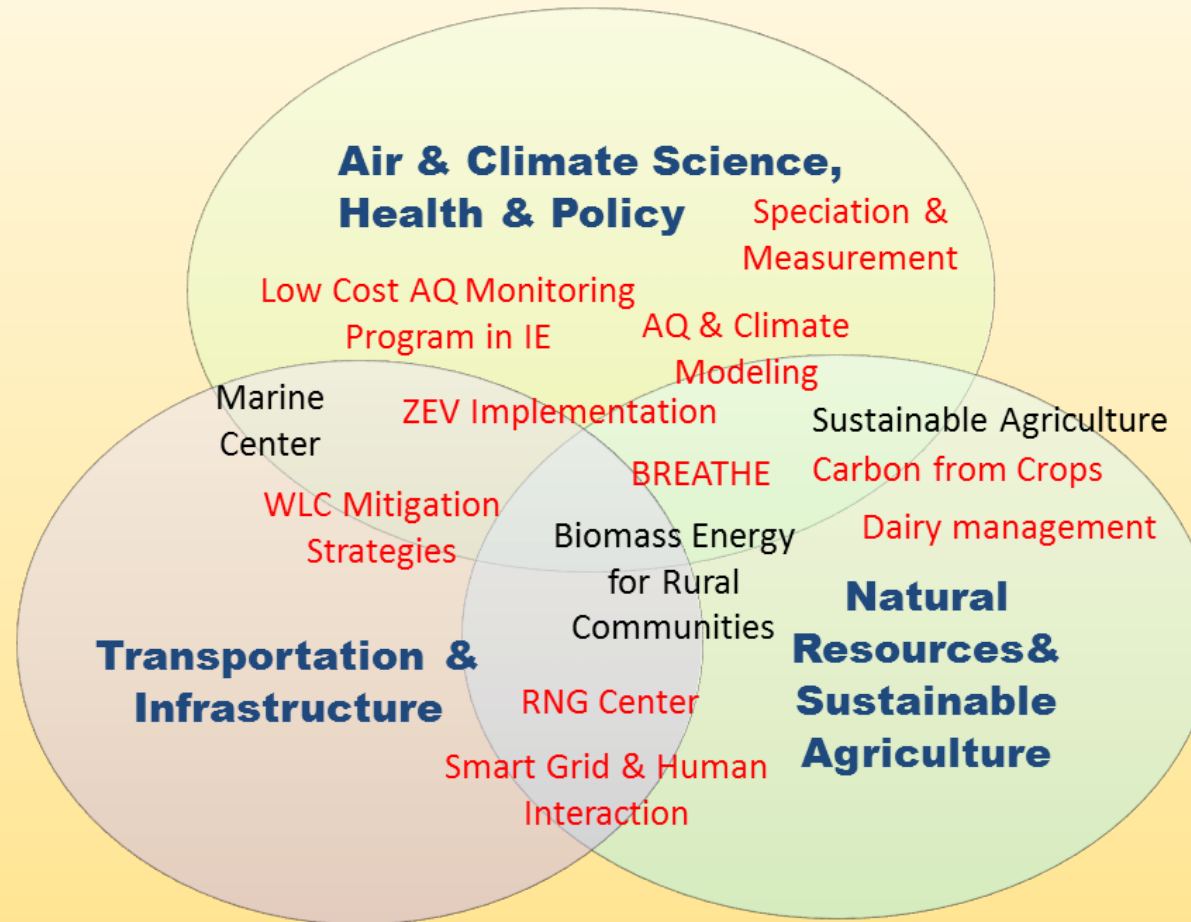
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April 2016-March 2017	April 2017-March 2018	April 2018+
Establish UCR Internal Steering Committee, Research Committee, and Development Committees	Finish Prospectus (contains research, financial, administrative, and location details for the Institute).	Launch Institute
Meet internally to identify interest and skillsets, define “Themes”	Continue Faculty Meetings/Seminars & develop base level interest and support	Ongoing collaborative activities within Themes
Engage the ARB and SCAQMD to determine synergistic activities and interests.	Continue Discussions with Stakeholders & Formalize Agreements	Ongoing activities with stakeholders (seminars, etc)
\$1 million secured through an endowment for training elements within the institute	Work with Consultants to develop the Economic Development Plan and Attraction Plan	Development & Outreach

ARB & UCR RESEARCH INTERESTS

Many areas of existing UCR targeted research growth overlaps with ARB's interest in the 2020-2040 timeframe (shown in red):



UCR



INSTITUTE RESEARCH THEMES

UCR SUSTAINABILITY INSTITUTE



UCR's Proposed Sustainability Institute - *Themes*

STATUS ON DEVELOPING THEMES

THEME	Vetting of Theme	Secure Faculty & Collaborations	Establish infrastructure & labs	Identify funding entities	Pursue major initiatives	Execute major initiatives
Mobility Solutions	Completed in 16-17	Completed in 16-17	In Progress		In Progress	>\$15 million in projects
Microgrid & Energy Infrastructure	Completed in 15-16	Completed in 16-17	Completed in 15-16	Completed in 16-17	Completed, more to be done	>\$9 million in projects
Air Pollution, Climate Change & Health Effects	Completed in 15-16	In Progress	In Progress	In Progress	In Progress	>\$6 million in projects
Renewable Energy Economy	Completed in 16-17	Completed in 16-17	Completed in 16-17	Completed in 16-17	In Progress	>\$10 million in projects
Sustainable Agriculture	17-18					

MOBILITY SOLUTIONS FOR INLAND SOUTHERN CALIFORNIA

Solutions to improve cost, efficiency, travel time & environmental Impacts through

Smart Infrastructure

Intelligent Transportation

Low and Zero Emission Vehicles

Challenge Addresses:

How should we deploy automated vehicles in a sustainable way?

How will Inland Southern California deal with increased freight traffic?

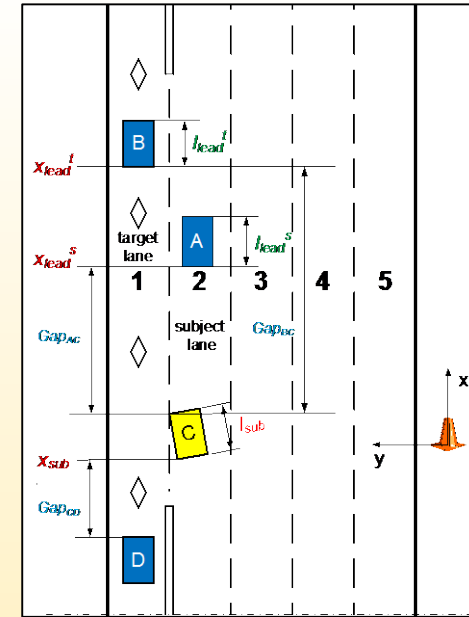
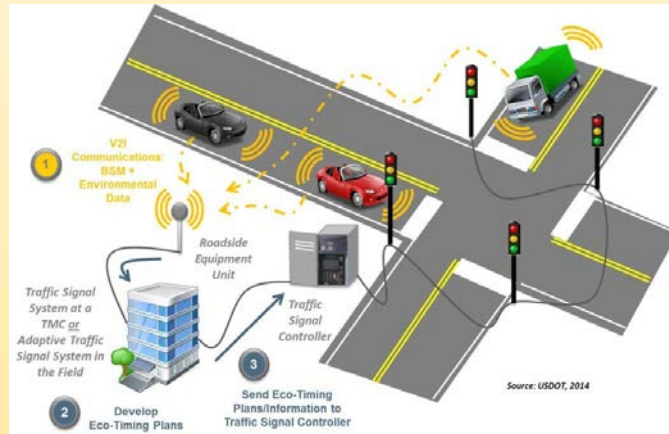
With industry growth in the area, how do we attract high paying jobs?

MOBILITY SOLUTIONS

Existing Research Efforts:

Eco-Friendly Intelligent Transportation Systems

- examining the environmental, mobility, and safety impacts of intelligent transportation systems, connected and automated vehicle
- Major research projects with ARPA-E, USDOT, USDOE, NCST, CARTEEH
- Faculty Partners: Matt Barth, Jay Farrell, Kanok Boriboonsomsin, Guoyuan Wu, Peng Hao



Sustainable Freight Systems

- Developing new technology and techniques to reduce the impacts of Heavy-Duty Vehicles
- Major research projects with SCAQMD, CARB, CEC, NCST, CARTEEH
- Faculty Partners: Kanok Boriboonsomsin, Kent Johnson, Tom Durbin, Matt Barth, Guoyuan Wu

MOBILITY SOLUTIONS

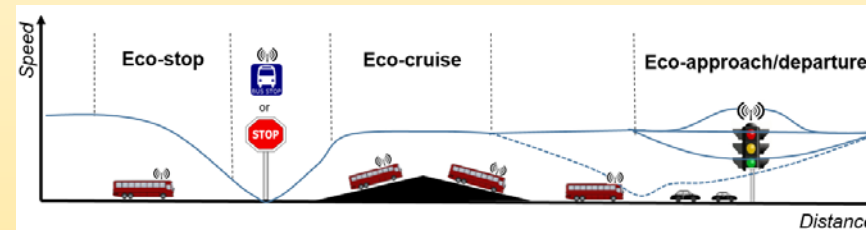
Future Research Efforts:

Connected, Automated, and Shared Systems

- Working with NCST and others on designing larger integrated mobility systems
- Funding targets: local cities and regions, USDOT, USDOE, Caltrans, CARB, CEC

Innovative Emissions & Energy Regulatory Processes

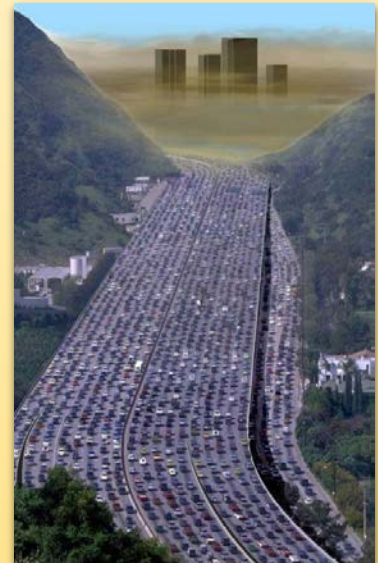
- Leverage massive connected vehicle data sets for fleet-wide energy and emissions inventories
- Implement a pilot program with an OEM



Transportation Solutions for the Inland Empire

- Goods movement, warehousing, supply chain logistics
- New three-way MOU between Inland Southern California Universities
- Funding targets: local cities and regions, RCTC, WRCOG, SCAG

Future Collaboration: SOBA supply chain faculty cluster hires; SPP economics; Center for Healthy Communities; recent AQ & CC faculty hires



MOBILITY SOLUTIONS

Questions to the Board:

How do we better integrate with our fellow transportation institutions on important transportation research themes?

What niche can we capitalize on with the recent explosion of automated vehicle research?

MICROGRIDS & ENERGY INFRASTRUCTURE

*Quantifying impacts and identifying solutions for Smart Growth
Improving Efficiency & Reducing Environmental Impacts from Growth*

Challenge Addresses:

How will UCR (and others) get to net zero, and how do we do this while still growing?

How we can enable widespread electrification and need for rapid storage and dispatch of distributed generation through technology improvement?

MICROGRIDS AND ENERGY INFRASTRUCTURE

Existing Research Efforts:

Expansion of Microgrids to other locations across California:

- Cucamonga Valley Water District, Inland Empire Utilities Agency Regional Plan 4, Olivenhain Municipal Water District, Victor Valley Wastewater Reclamation Authority, Chemehuevi Hotel & Casino
- Major research projects with CEC, local cities and regions; expansion to other parts of UCR campus
- Faculty Partners: Hamed Mohsenian-Rad, Sadrul Ula, Alfredo Martinez-Morales, Mike Todd



Future Efforts:

UCR Mobility Hub

- New Design for operating transportation options at UCR (bus transit, carsharing, bikesharing, etc.)
- Major project with UC Riverside, Riverside Transit Agency, City of Riverside

UCR Campus Buildout

- Propagate microgrids across campus to satisfy UC Carbon Neutrality Initiative
- SIGI Consortium



MICROGRIDS AND ENERGY INFRASTRUCTURE

Questions to the Board:

How valuable would it be to build a *Consortium* around this effort?

How do we stay ahead of our competition?

AIR POLLUTION, CLIMATE CHANGE & HEALTH EFFECTS

Understanding the science and quantifying sources and impacts of air pollution in Inland Southern California, which still has some of the worst air quality in the nation

Challenge Addresses:

What is the impact of our growing logistics and other growth on the air quality of the region?

Given the changing environment (such as global warming impacts) how will this change our future air quality?

Can we develop better tools to monitor and predict air quality and understand health impacts of new fuels and emission sources?

AIR POLLUTION, CLIMATE CHANGE & HEALTH EFFECTS

Existing Research Efforts:

Air Pollution Research

- Long Standing Research in this area, now expanding (next slides).

BREATHE Initiative

- School of Medicine growing, now expertise developed for health effects research

Environmental Dynamics and GeoEcology (EDGE) Institute, Center for Conservation Biology

- CNAS effort to understand emissions from soil & plants

Future Efforts:

Ambient Measurement Campaigns

- Efforts with RUSD, SCAQMD and others

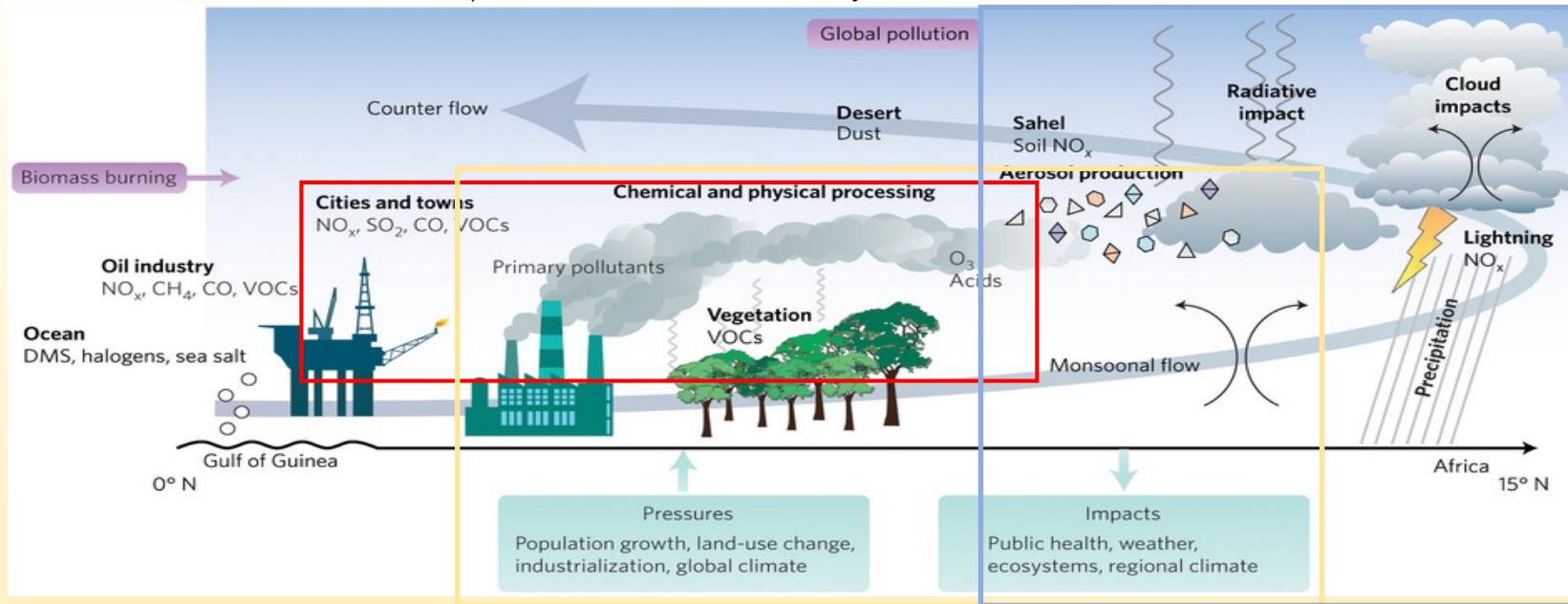
School of Public Policy Interest

- Understanding impacts of logistics, land use and trade offs from health impacts and economic impacts (faculty growth)



Linkages Between Emissions-Chemistry-Air Quality-Climate

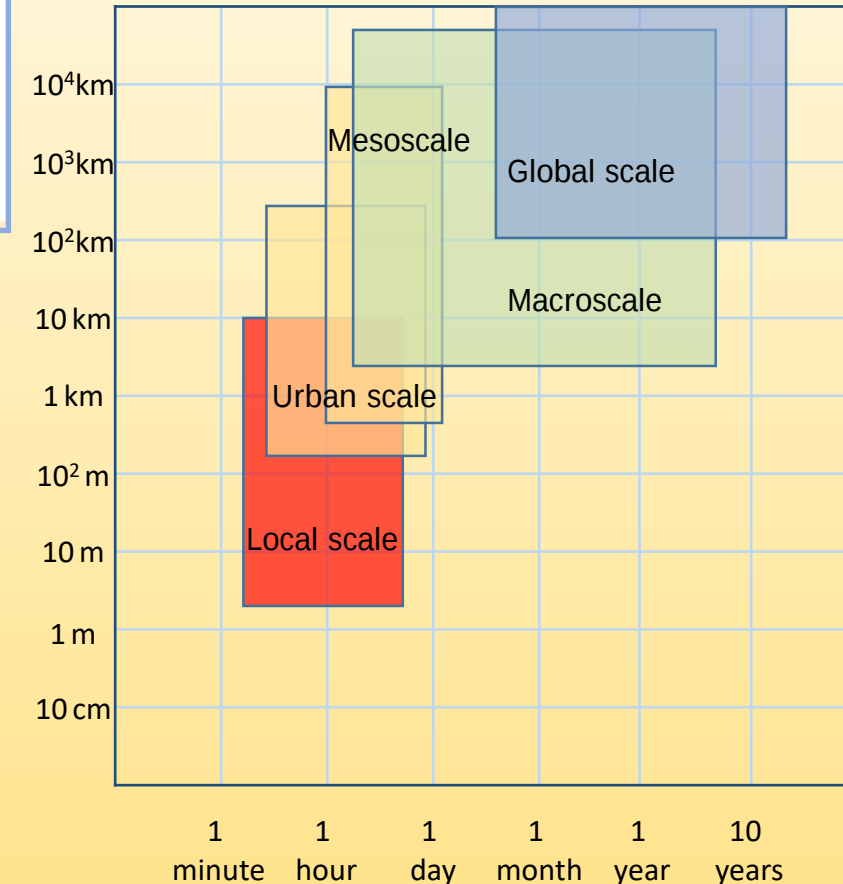
<http://www.nature.com/nclimate/journal/v5/n9/full/nclimate2727.html>



AIR QUALITY & CLIMATE CHANGE

Model Spatial and Time Scales

Monks et al., *Atmos. Environ.*



Fundamental gas-phase, particle-phase, and heterogeneous chemistry and processes (NOAA, NSF, ARB)

Lab – Barsanti, Cocker, Lin Y.-S., Zhang H., Zhang J.

Field –

Theory – Barsanti

Regional air quality, transport, and health (DOE, NOAA, NIH, ARB, NSF, USDA)

Lab – Cocker, Jung, Lin Y.-S.

Field – Bahreini (anthro, particles)

Modeling – Venkatram

CNAS
BCOE

Regional and global climate, transport processes (DOE, NASA, NOAA)

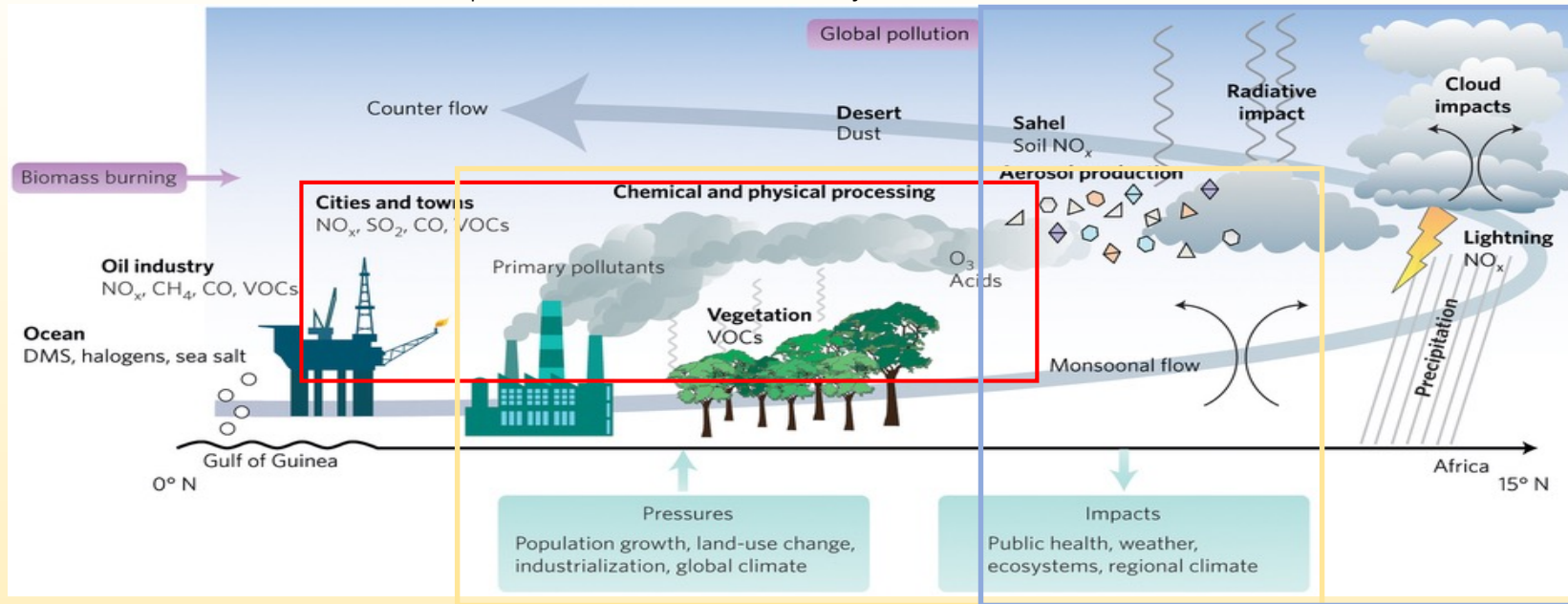
Lab – Bahreini, Hopkins

Field –

Modeling –

Linkages Between Emissions-Chemistry-Air Quality-Climate

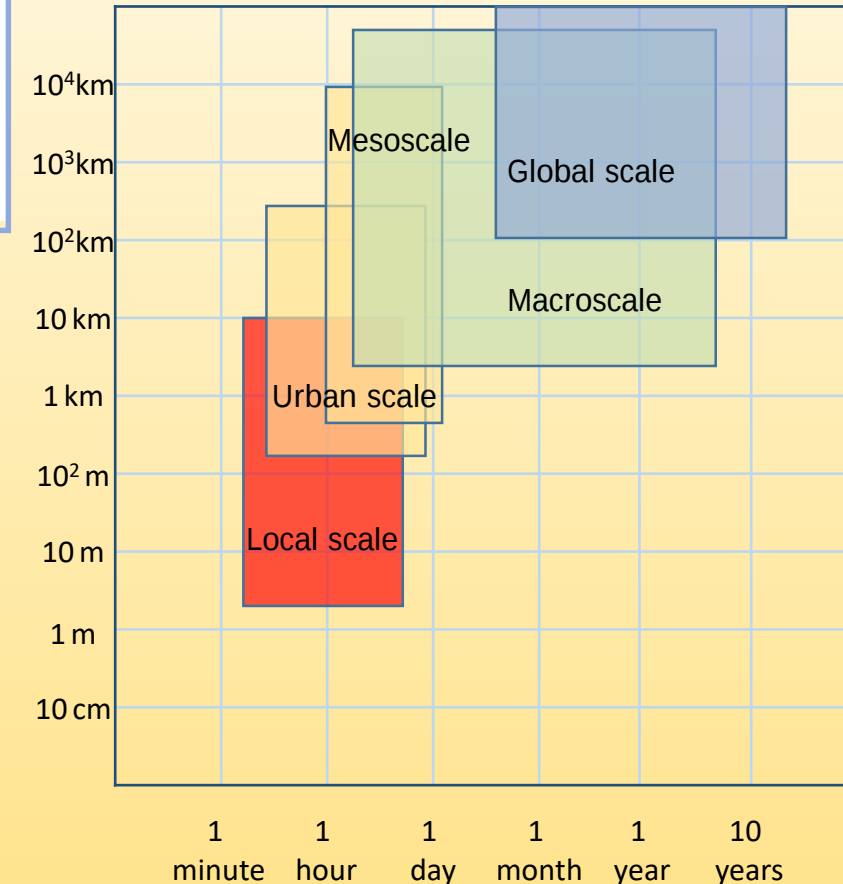
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Fundamental gas-phase, particle-phase, and heterogeneous chemistry and processes (NOAA, NSF, ARB)
 Lab - [Barsanti](#), [Cocker](#), [Davies](#), [Lin Y.-S.](#), [Zhang H.](#), [Zhang J.](#)
 Field – [Lindsay Yee](#)
 Theory-[Barsanti](#), [Berkemier](#)

Regional air quality, transport, and health (DOE, NOAA, NIH, ARB, NSF, USDA)
 Lab-[Cocker](#), [Jung](#), [Lin Y.-S.](#)
 Field - [Bahreini](#) (anthro, particles), [Lindsay Yee](#) (bio, gas and particles)
 Modeling - [Sunni Ivey](#), [Venkatram](#), [Porter](#)

CNAS
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Regional and global climate, transport processes (DOE, NASA, NOAA)
 Lab – [Bahreini](#) (CNAS), [Hopkins](#) (CNAS)
 Field – [Jian Wang](#) (sensors, aircraft, nanoparticle and CCN instrument development)
 Modeling – [Porter](#)

AIR QUALITY & CLIMATE CHANGE FACULTY LIST

BCOE

- [Barsanti, Kelley](#) (CEE)
- [Cocker, David](#) (CEE)
- Ivey, Sunni (CEE) (2017)
- [Jung, Heejung](#) (ME)
- [Venkatram, Akula](#) (ME)

CNAS

- [Bahreini, Roya](#) (Env. Sci., Chem.)
- [Hopkins, Francesca](#) (Env. Sci.)
- [Lin, Ying-Hsuan](#) (Env. Sci.)
- [Porter, William](#) (Env. Sci.) (2017)
- [Zhang, Jingsong](#) (Chem.)
- [Zhang, Haoifei](#) (Chem.)

AIR POLLUTION, CLIMATE CHANGE & HEALTH EFFECTS

Questions to the Board:

With the recent air quality and climate change faculty hires in both BCOE and CNAS, how do we organize ourselves to regain our “SAPRC” preeminence?

What should our funding strategy be, in light of the current federal government administration?

RENEWABLE ENERGY ECONOMIES

Using landfill and agricultural waste to produce eco-friendly fuels and electricity locally

Challenge Addresses:

How can we create locally supplied renewable fuels more economically to help meet our climate, economic and growth goals?

How do we help landfills divert waste?

With industry growth in the area, how do we attract high paying jobs?



RENEWABLE ENERGY ECONOMIES

Existing Research Efforts:

Aqueous & Thermochemical Processing technologies

- CELF technologies, RNG technologies
- Alternative fuel use and emissions optimization

Lifecycle Evaluations, Distributed Generation, Storage



Future Efforts:

Pilot scale applications of waste to energy systems

Policy and economic evaluations

