



# Transportation Innovation and Policy in a Fragmenting World

*16<sup>th</sup> Biennial Asilomar Conference on  
Transportation and Energy*

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# ASILOMAR

The Biennial Asilomar Conference on Transportation and Energy is the premier U.S. event focused on the future of transportation energy. Known to attendees as “Asilomar,” the invitation-only conference is a must-attend gathering for those working at the intersection of transportation technology, innovation, and policy.

Asilomar offers an unparalleled opportunity to learn about global trends in sustainable mobility, hear the latest research findings on technologies and consumer response, explore policy strategies, and discuss creative solutions in a casual coastal setting that fosters open communication and collaboration. At Asilomar, business, government, and NGO leaders who may not always see eye-to-eye find a retreat away from the media spotlight where they are free to exchange ideas, respectfully disagree, and identify common ground.

*“Asilomar is a reflection of what we do every day here at ITS-Davis: We bring together people with diverse perspectives to examine the science and help create policy solutions that advance sustainable transportation.”*

—Dan Sperling, Institute of Transportation Studies, University of California, Davis

*“Out of all of the conferences I attend, this is clearly the best (and I have to attend a lot of conferences)!”*

—John Viera, Ford

# TRANSPORTATION INNOVATION AND POLICY IN A FRAGMENTING WORLD

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Transportation is an energy-consuming juggernaut. Road transport accounted for 20 percent of global final energy demand in 2015, with passenger cars contributing the largest share. In the United States, transportation was the largest source of carbon dioxide (CO<sub>2</sub>) emissions in 2016, surpassing the electricity sector. It is the only sector in the U.S. (and California) with an increasing carbon footprint over the past few years.

Existing policies will not reduce greenhouse gas (GHG) emissions enough to avoid harmful, irreversible consequences. Many Asilomar 2017 speakers called for urgent climate action using strong, science-based policies that incorporate both “carrots” and “sticks.”

Attendees were generally optimistic about the potential for technology and innovation to improve mobility and benefit society, as they were at past Asilomar conferences. At Asilomar 2017, however, there was an undercurrent of uncertainty and apprehension. Speakers noted a growing disconnect between science and politics.

Another disconnect exists between new mobility innovations that are gaining acceptance and the policy surrounding those innovations. Many policies are outmoded, producing results that undermine environmental, economic, and livability progress. Fresh policies on vehicles, low-carbon fuels, land use, and housing are needed, and they must factor in the unpredictable nature of human travel behavior, which is likely to change as new technologies, fuels, and services evolve. Policies need to better serve the broad public interest and address equity challenges.

Fortunately, opportunities abound. Vehicles are becoming more energy efficient, battery and fuel cell costs are dropping, cities are embracing livability and active transportation, and innovation is flourishing. System inefficiencies are increasingly being recognized and addressed through three transportation revolutions: shared mobility, automation, and vehicle electrification. Asilomar attendees agreed that all three revolutions must happen together to deliver benefits.

Attendees also noted that cities are developing and implementing forward-thinking policies around land use, sustainability, and new mobility. In the absence of national government leadership, cities and states represent beacons of hope as policy innovators.

Despite the U.S. uncertainty, some foreign governments are taking steps to address climate change through policy. China and the European Union are advancing zero emission vehicle rules. China has also incorporated the best practices of the U.S., European, and Japanese heavy-duty vehicle standards. Indeed, China’s role in shaping future transportation emerged as another key theme of Asilomar 2017.

Asilomar participants and ITS-Davis affiliates are part of a global community that is working to realize the potential of the rapidly evolving transportation and energy landscapes. These experts are conducting cutting-edge research and developing policies to serve the public interest. In an unpredictable time, gatherings like Asilomar provide needed opportunities to rationally discuss and exchange ideas that will make the world a better place for all.

*“The fact that oil companies are pondering peak oil demand, that every major automaker has multiple electric-drive vehicles available for sale or planned, and that cities are championing a shift to clean mobility and new mobility business models, are all real advances that some might not have thought possible eight or nine Asilomars past.”*

—Anthony Eggert,  
ClimateWorks Foundation

*“One thing that strikes me about the topics of this conference is the immediacy of opportunity. Some of yesterday’s most exciting opportunities for the future are hitting right now.”*

—Peter Kosak,  
General Motors

# SETTING THE CONTEXT

This session highlighted the major domestic and international, political and societal factors affecting the ability to advance GHG mitigation policies.

## Welcome and Motivation:

Dan Sperling, *Institute of Transportation Studies*  
*University of California, Davis*

## Speaker:

David Victor, *University of California, San Diego*

## Panelists:

Mary Nichols, *California Air Resources Board*  
Mark McNabb, *Electrify America*



# HIGHLIGHTS

When it comes to policies to incentivize change, pricing is needed. Price roads, price access, price fuel, price congestion, price vehicle miles traveled (VMT). The car culture is real and the need to drive is real.

*"We are at a point in history as an agency that technology is outpacing our policies. We need new thinking, new tools, and we're in the process of launching some of that thinking... At a time when not much is going on at the national level, we feel like we're in a position to help make things happen."*

—Mary Nichols, California Air Resources Board

Few scientific models embed political realities. Progress requires understanding of real-world rates of change and acceptance of costs and technologies.

What makes the climate problem hard is that no one is really in charge. Government sets policies, but innovation happens in the private sector.

Automakers are embroiled in an ongoing discussion about automation, electrification, and sharing, and are starting to invest in that direction because they see the market shifting. But they also need economies of scale to be profitable.



# VEHICLE AUTOMATION AND SHARED MOBILITY

Automated vehicles coupled with shared mobility could lead to a major restructuring of transportation in the near future. The implications for travel demand, energy use, and GHG emissions could be significant, but will be shaped by technological advances, policies, and behavioral responses.

**Moderator:**

Anthony Eggert, *ClimateWorks Foundation*

**Speakers:**

Lew Fulton, *University of California, Davis*

Joan Walker, *University of California, Berkeley*

Emily Castor, *Lyft*



## HIGHLIGHTS

Vehicle automation will improve efficiency and safety, but not enough to relieve congestion. All signs point to even more VMT with autonomous cars.

There is also a big human component: people are attached to their cars.

*“If we want this future, it really does require behavior change. Will people travel differently and live differently?”*

—Joan Walker, University of California, Berkeley



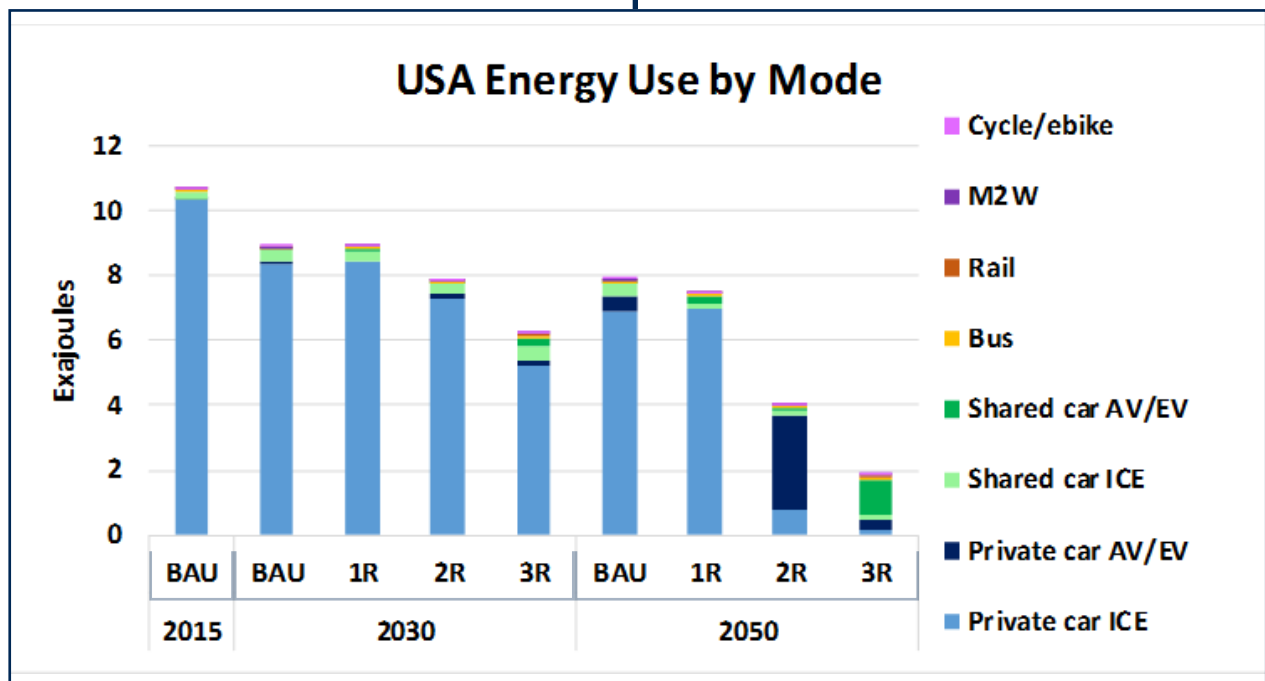
Regulatory enablers for shared mobility include pricing, land use, and uniform rules for automated vehicles.

- Embrace private-sector innovation and allow the public sector to intervene on issues of equity.
- Set pricing strategies to influence consumer behavior.
- Restrict sales of autonomous vehicles to commercial transportation and shared-ride services as long as needed.
- Consumers might be more receptive to dynamic pricing than expected. Improve acceptance by avoiding the term “congestion pricing” and highlighting benefits like shorter travel times.
- Use pricing and policies to promote the most efficient mode of transportation for every transportation need. For instance, shared-ride services may be optimally suited for first- and last-mile travel, paratransit, and late-night rides.

Alternatives to owning a car must be more attractive than driving.

Congestion costs the American economy \$160 billion a year.

The average car is used 4 percent of the time at 20 percent occupancy.



Three Revolutions in Transportation (3Rs) is a global scenario study by University of California, Davis and the Institute for Transportation & Development Policy. The study examines the potential impacts of the 3Rs on CO<sub>2</sub> emissions, energy use, and costs through 2050 for urban transportation in eight regions, including the United States (shown). The 2R scenario (electrification and automation) could lead to deep CO<sub>2</sub> reductions if the electricity grid is decarbonized—but could also create a traffic nightmare. The 3R scenario (electrification, automation, and sharing) could reduce traffic, improve livability, save money, and reduce CO<sub>2</sub> emissions associated with urban transportation by 80 percent or more worldwide by 2050. *Source: Lew Fulton, University of California, Davis*

# ELECTRIFICATION OF VEHICLES IN THE U.S. AND GLOBALLY

Plug-in electric vehicles (PEVs), including battery electric and plug-in hybrid electric vehicles, are becoming ubiquitous. Costs of PEVs are dropping and charging networks are expanding. Countries like China and India are pressuring automakers to electrify, and utilities are exploring opportunities with the fast-changing electricity grid.

## Moderator:

Roland Hwang, *Natural Resources Defense Council*

## Speakers:

Tom Turrentine, *University of California, Davis*

Andreas Klugescheid, *BMW*

Michael Backstrom, *Southern California Edison*

## Discussants:

Huiming Gong, *Energy Foundation China*

Ryan McCarthy, *California Air Resources Board*



## HIGHLIGHTS

Policies that reward vehicle attributes such as battery size may be helping to drive trends toward longer-range PEVs. These policies should be coupled with consumer education. Consumers need to better understand how much range they really need. A PEV with 300–400 miles range may be unnecessary, and, because of its bigger battery, will be more expensive.

Despite growing market interest in PEVs, ensuring a continuing stream of funding to avoid incentive waitlists remains necessary.

A continuing challenge of publicly funded PEV incentives is the perception that they help the wealthy buy expensive cars. New controls, such as limiting rebates to lower income buyers, can help. As more PEV models become available in different market segments consumers purchasing at all price points will be able to take advantage of incentives.

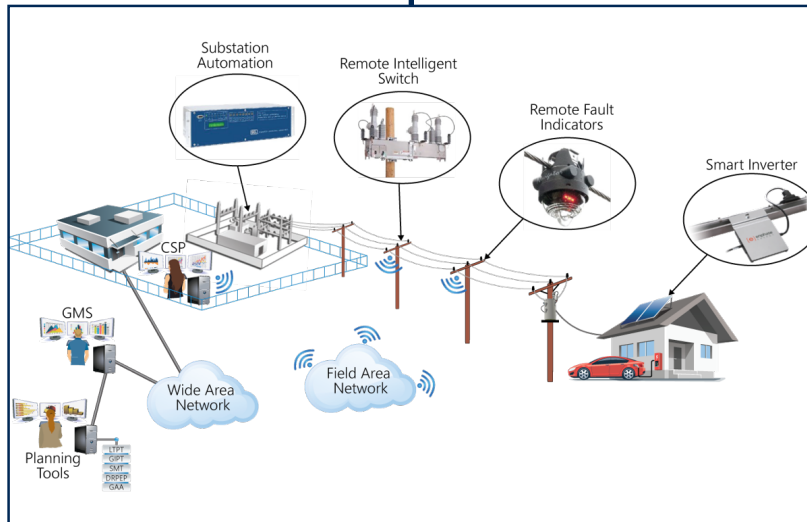
Automakers are under a lot of stress, making big investments, and facing competition from new market entrants who do not have the same legacy burdens. This new world presents challenges and opportunities.

*“There is no way around the electric vehicle. That is no longer the question... It is how we best partner to implement the transition to sustainable mobility.”*

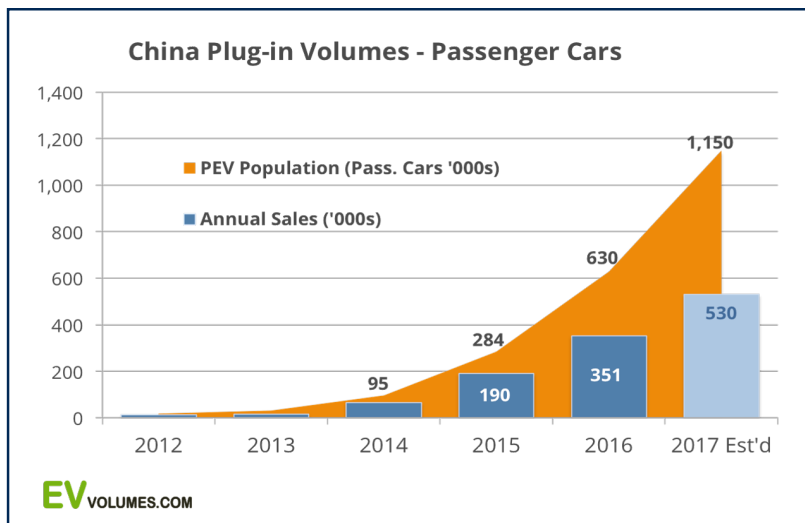
—Andreas Klugescheid, BMW

In recent years, the world PEV market has been growing at a rate of roughly 40–60 percent each year. That high growth rate reflects the comparatively small market, which currently represents just over 1 percent of global light-duty vehicle sales. By the end of 2017, annual PEV sales were expected to top 1.1 million globally, with about 3 million PEVs on the road.





The electricity grid is evolving to support energy storage and managed charging (which allows a utility to remotely control vehicle charging to respond to the needs of the grid). The grid will be increasingly sensor and data driven, further integrating grid and consumer services. This change presents a business case for utilities and potential benefits for customers. *Source: Michael Backstrom, Southern California Edison*



China now has more than 1 million PEVs and accounts for almost 50 percent of world sales. PEVs are a success due to policy and government commitment to address the country's serious air-pollution issue. Subsidies offset PEV purchase prices. In key cities, license-plate restrictions favor PEVs over gasoline cars and PEV manufacturers over conventional car manufacturers. Unsurprisingly, these cities lead China's PEV sales. China's central government is also developing a stringent law modeled on California's Zero Emission Vehicle (ZEV) mandate, and recently announced long-term plans to ban gasoline and diesel cars. However, enforcement of government controls is still an issue. *Source: Tom Turrentine, University of California, Davis*

# SUSTAINABLE FREIGHT

Changes in freight logistics and technology, which can improve energy efficiency and reduce GHGs and criteria pollutants, can affect commercial operations. Understanding these effects and the policies and investments needed to enable these changes is the focus of this panel.

**Moderator:**  
Genevieve Giuliano, *University of Southern California*

**Speakers:**  
Pascal Amar, *Volvo*  
Matt Miyasato, *South Coast Air Quality Management District*

**Panelists:**  
Tim Frazier, *Cummins Inc.*  
Matt Barth, *University of California, Riverside*  
Scott Cramer, *Certified Freight Logistics, Inc.*



## HIGHLIGHTS

To make trucks more efficient, manufacturers are incorporating off-the-shelf improvements and redesigning vehicles before adding new technologies such as electric-drive systems.

Recent announcements of electric-truck demonstrations provide reason for optimism. Zero-emission truck technology can meet many operational needs. Still, air quality problems, like those that plague California's South Coast region, may soon affect other parts of the nation. The South Coast must replace 15,000 trucks per year over the next six years to meet 2023 air-quality goals.

Intelligent, connected, and automated transportation system technologies, including telematics, platooning, eco-routing, and freight signal prioritization, present many opportunities for efficiency and operational improvements in trucking fleets. For example, truck platooning—where a line of trucks closely follows a lead vehicle aided by autonomous technologies—can improve efficiency by 5–15 percent.

A policy that restricts fuel types on certain trucking routes could be counterproductive. If a PEV truck has insufficient range to drive a few miles out of its way to pick up a return load, it could be forced to return empty, which is inefficient.

One way to enable small truckers to survive is a three-way transaction: a large fleet operator gets a subsidy to buy a new truck to replace a reasonably new truck, the reasonably new truck goes to the small trucker, and the small trucker then gets rid of an old, high-impact truck.

Many truck drivers are skeptical of new technology and unwilling to platoon with a stranger.

Because truckers place high mileage and strain on their vehicles, sustainable equipment must be durable.

In general, industry speakers expressed support for existing federal truck rules and concerns about more stringent rules under consideration in California. Industry tends to favor policies that focus on fleet turnover with trade-down programs to get the dirtiest vehicles off the road, and on currently available alternative fuels such as natural gas. By contrast, regulators and environmental speakers tend to favor policies that focus on electrification and fuel cells, which they argue are necessary to meet long-term air-quality and climate goals.



Attendees saw firsthand a prototype hydrogen-fuel-cell drayage (short haul) truck designed for work at the Ports of Los Angeles and Long Beach. Pictured, Mary Nichols, California Air Resources Board and Ed Mantey, Toyota.



# IS OIL DEMAND PEAKING?

For years, the phrase “peak oil” referred to future supply limitations. But now, many scenarios suggest that oil consumption is likely to peak in the next two decades, and then start a steady decline. The implications for the transportation system—which relies on petroleum for over 90 percent of its energy—are huge.

**Moderator:**

David Greene, *University of Tennessee*

**Speakers:**

Stefan Knupfer, *McKinsey & Co.*

Joel Couse, *Total*

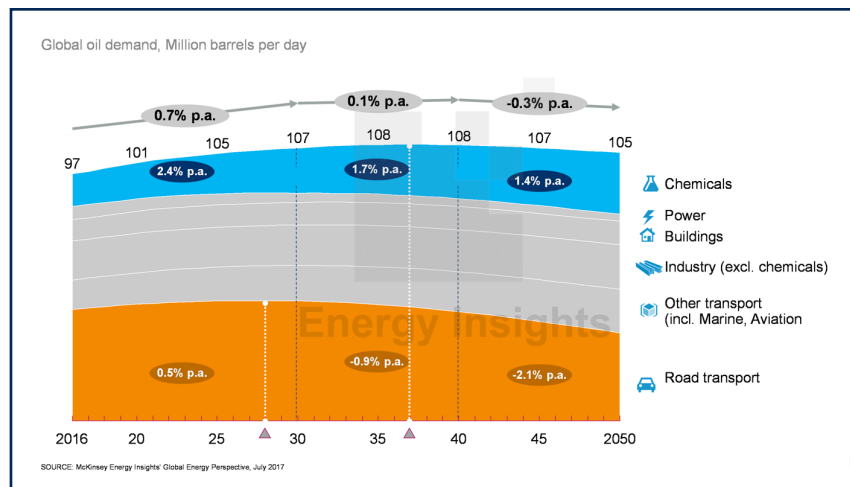
**Discussants:**

Niel Golightly, *Shell*

Amy Jaffe, *University of California, Davis*



## HIGHLIGHTS



McKinsey & Co. projects that global demand for liquid fuels will peak by 2037, road transport will peak in 2028, and car ownership will peak between 2025 and 2035. A key factor in global oil demand is migration to cities, where four key trends—new mobility services, increased availability of real-time information, vehicle electrification, and vehicle automation—are converging. *Source: Stefan Knupfer, McKinsey & Co.*

The future energy system will be much bigger and more diverse. Oil companies need to steer a path through this transition.

*“It’s really about how we can be resilient to markets that will look very different in the future. What can we do now to be competitive and create value for our shareholders in those future markets?”*

—Niel Golightly, Shell

# INFRASTRUCTURE IMPLICATIONS OF MOBILITY- AND ENERGY-SYSTEM CHANGES

This session examined progress on infrastructure development for clean fuel vehicles, and shared-mobility system interactions with vehicle fueling infrastructure.

**Moderator:**

Timothy Lipman, *University of California, Berkeley/ Lawrence Berkeley National Laboratory*

**Speaker:**

Joan Ogden, *University of California, Davis*

**Discussants:**

Michael Berube, *U.S. Department of Energy*  
Janea Scott, *California Energy Commission*  
Matthew Tipper, *Shell International*  
Peter Kosak, *General Motors*



## HIGHLIGHTS

Although most industry experts believe the majority of PEV charging will likely occur at home, a public charging network is a necessary market enabler, and industry is focused on installing high-power direct current (DC) fast chargers. However, DC fast charging can cost the equivalent of \$6–\$8 per gallon gasoline due to utility demand charges. If shared PEVs rely on DC fast charging instead of home charging, as early demonstrations indicate is the case, their fuel costs could be significantly higher. Collaboration with utilities and utilizing technology, such as on-site energy storage, can mitigate demand charges and make DC fast charging more economical.

California has just over 30 hydrogen stations now, and needs 200–500. Increasing utilization of existing stations and incentivizing heavy-duty vehicle and stationary fuel cell markets will help bring down costs. In turn, these markets become more attractive as the fuel price drops.

Each transition needed to limit global warming—new types of vehicles, a shift to zero-net-carbon fuel pathways, and widespread adoption of efficient new mobility systems—will require major infrastructure investments, raising questions of financing, ownership, and operation.

*“Just as we’ve been talking about how shared mobility can make use of excess transportation capacity, we should think of plug-in cars as a way to use excess grid capacity, to improve the utilization of the grid, which is a shared asset.”*

—Max Baumhefner,  
Natural Resources Defense Council

Researchers Joan Ogden and Lew Fulton of the ITS-Davis Sustainable Transportation Energy Pathways (STEPS) program find from 2015 to 2035, investment in vehicles, refueling stations, and charging infrastructure could total \$300–\$750 billion. That investment is modest—roughly 1.5-3 percent of total expected U.S. consumer spending on new light-duty vehicles and fuels of roughly \$1 trillion per year, or \$19 trillion by 2035. Benefits could far outweigh costs in the long term.

# POLICY AND REGULATORY ENABLERS

This session examined ways that vehicle policies can be modified to control emissions, enable innovation and create incentives for new transportation technologies, and manage environmental impacts in response to shifts in fuels and vehicle usage.

**Moderator:**

Dan Sperling, *Institute of Transportation Studies, University of California, Davis*

**Speakers:**

- John Viera, *Ford*
- Bill Charmley, *U.S. EPA*
- Brian Mormino, *Cummins Inc.*
- William Todts, *Transport & Environment (Europe)*
- Drew Kodjak, *ICCT*

## HIGHLIGHTS

Only about one-quarter of today’s U.S. commercial vehicle fleet is operating at the current EPA standards. Accelerating fleet turnover to the current standards and using clean diesel would bring rapid air quality improvements. Beyond the truck engine is a need for infrastructure, ultra-low sulfur diesel, and urea. Electric powertrains are coming, but they will cost two to three times more than a diesel engine. Policy needs to be performance-based, achieve real-world emissions reductions, and be supported by robust technology-enabled enforcement programs. The certification process for new engines and technologies can be burdensome. Successful policies and technologies need to be exported to India, China, Brazil, and Mexico.

Several speakers over the course of the conference expressed frustration that climate change is not a priority of the current federal administration, in contrast to California’s leadership on the issue. Stakeholders expressed commitment to begin conversations with California regulators on post-2025 light-duty vehicle standards.

The final session at Asilomar 2017 tackled the politically charged process surrounding the re-opened midterm evaluation of federal light-duty vehicle GHG and fuel economy standards.

Each automaker’s position is nuanced. In general, however, manufacturers contend they do not wish to roll back the standards, though they do seek relaxed stringency or reduced compliance burden. They are asking for closer harmonization between all agencies and a single national program.

U.S. EPA staff stand behind the comprehensive technical analysis that underpins the final determination released in January 2017, and is open to receiving new information. Automakers have asked EPA to focus especially on consumer data in this review.

In Europe, climate change is not a partisan issue. The region is roiling from the Volkswagen diesel scandal, cities are considering banning diesel vehicles, and a regulatory offensive with CO<sub>2</sub> policies and real-world monitoring is underway. Light-duty vehicle carbon standards—currently 95 g/km by 2021 (comparable to current U.S. 2025 standards)—will drop to 70–80 g/km in 2025 and below that level in 2030. There is a sentiment that the EU needs a “policy shock.”



# ASILOMAR 2017

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Alberto Ayala, Sacramento Metropolitan Air Quality Management District

Steve Cliff, California Air Resources Board

Anthony Eggert, ClimateWorks Foundation

Dawn Fenton, Volvo Group North America

Genevieve Giuliano, University of Southern California

Niel Golightly, Shell Oil Company

David Greene, University of Tennessee

Roland Hwang, Natural Resources Defense Council

Amy Myers Jaffe, University of California, Davis (now Council on Foreign Relations)

Paul Leiby, Oak Ridge National Laboratory; Chair of Energy Committee,  
Transportation Research Board

Tim Lipman, University of California Berkeley/Lawrence Berkeley National Laboratory;  
Chair of Alternative Fuel Committee, Transportation Research Board

Robert Noland, Rutgers University

Lisa Snapp, U.S. Environmental Protection Agency

Tom Turrentine, University of California, Davis

John Viera, Ford Motor Company

John Wall, Cummins Inc. (ret.)

Michael Q. Wang, Argonne National Laboratory

Jacob Ward, U.S. Department of Energy

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9 LOCAL GOVERNMENTS

57 CORPORATIONS AND PRIVATE BUSINESSES

26 ACADEMIC AND RESEARCH INSTITUTIONS

22 NONPROFIT ORGANIZATIONS

11 PROFESSIONAL AND INDUSTRY ASSOCIATIONS

5 PRIVATE FOUNDATIONS



The Asilomar Conference is organized under the auspices of the  
Energy and Alternative Fuels Committees of the  
U.S. Transportation Research Board, and hosted by  
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# SAVE THE DATE

## 17<sup>TH</sup> BIENNIAL ASILOMAR CONFERENCE

JULY 9–12, 2019

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