

BUILDING A 100 PERCENT CLEAN ECONOMY: SOLUTIONS FOR PLANES, TRAINS, AND EVERY- THING BEYOND AUTOMOBILES

HEARING BEFORE THE SUBCOMMITTEE ON ENVIRONMENT AND CLIMATE CHANGE OF THE COMMITTEE ON ENERGY AND COMMERCE HOUSE OF REPRESENTATIVES ONE HUNDRED SIXTEENTH CONGRESS FIRST SESSION

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WEDNESDAY, OCTOBER 23, 2019

HOUSE OF REPRESENTATIVES,
SUBCOMMITTEE ON ENVIRONMENT AND CLIMATE CHANGE,
COMMITTEE ON ENERGY AND COMMERCE,
Washington, DC.

The subcommittee met, pursuant to call, at 10:32 a.m., in room 2322, Rayburn House Office Building, Hon. Paul Tonko (chairman of the subcommittee) presiding.

Members present: Representatives Tonko, Barragán, Blunt Rochester, Soto, Schakowsky, McNerney, Ruiz, Dingell, Pallone (ex officio), Shimkus (subcommittee ranking member), Rodgers, McKinley, Johnson, Long, Flores, Carter, and Walden (ex officio).

Staff present: Adam Fischer, Policy Analyst; Jean Fruci, Energy and Environment Policy Advisor; Caitlin Haberman, Professional Staff Member; Brendan Larkin, Policy Coordinator; Dustin J. Maghamfar, Air and Climate Counsel; Peter Kielty, Minority General Counsel; Mary Martin, Minority Chief Counsel, Energy and Environment; Brandon Mooney, Minority Deputy Chief Counsel, Energy; Brannon Rains, Minority Legislative Clerk; and Peter Spencer, Minority Senior Professional Staff Member, Environment and Climate Change.

Mr. TONKO. The Subcommittee on Environment and Climate Change will now come to order. I recognize myself for 5 minutes for the purposes of an opening statement.

OPENING STATEMENT OF HON. PAUL TONKO, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF NEW YORK

Today's hearing is another benchmark in our series examining decarbonization of our economy by midcentury.

Transportation is the largest source of greenhouse gas emissions in America. While debate is often focused on light-duty automobiles, more than 40 percent of the sector's emissions come from other sources, including buses, trucks, ships, trains, and planes.

Much like at our September hearing on the industrial sector, it will quickly become apparent that nonlight-duty segments of transportation have numerous challenges to overcome in order to achieve necessary, ambitious decarbonization targets.

For one, in recent decades there has been growth in Vehicles Miles Traveled, and in many cases this growth is expected to continue.

Second, these vehicles are capital-intensive investments with slow turnover. Investment decisions being made today will impact the emissions profile of the sector and, in turn, our ability to decarbonize it, for decades to come.

Other significant barriers—cost, technology development, and infrastructure needs—will not be news to anyone. We know that we need investments, in research especially, in advanced batteries and fuel cells. We need new infrastructure to enable the transition, including a national network of alternative fueling and charging stations. And we need greater market demand for cleaner fuels.

Transportation emissions are a diverse set of challenges. Transforming the sector will be no easy task. But many of the principles that we have been discussing as part of our broader, economywide approach apply here. We need to ensure that pollution reduction, both climate and traditional air pollutants, occurs in front line communities near ports, near airports, near highways.

We must be open to many different technologies and pathways to decarbonization. And we need a comprehensive, portfolio approach.

Establishing a price signal can be a critical component of our response and can speed up adoption and innovation in low-emissions alternatives. But carbon pricing is not a silver bullet, and that is especially true for our transportation sector. We must look to performance standards and other complementary investments such as in research and infrastructure.

Today we will hear recommendations from across that sector that should push us towards this portfolio approach. And while the challenges seen daunting, there are great solutions already being developed and deployed as we speak. Some are commercially available right now. More are expected to become viable in the near future.

Efficiency remains a top solution across all modes. For medium and heavy-duty vehicles, the National Academies recently found strengthening fuel economy standards can reduce fuel consumption by as much as 30 percent by 2030.

Electrification is also a powerful solution for certain parts of the sector. We have seen the potential of EVs with light-duty vehicles, and today adoption of electric buses is occurring at an even faster rate than passenger vehicles. Public- and private-sector leaders have quickly come to realize that there are opportunities from electrifying transit, and school buses, and delivery trucks—vehicles that take shorter, often predetermined, routes and can take advantage of predictable periods of nonuse for charging.

But electrification is not the only option. In applications facing weight or distance concerns, hydrogen energy is a very promising solution, especially given the speed of refueling. This has enabled fuel cells to find a role in warehouses. They are beginning to be deployed in ports and on tarmacs, and there are great opportunities for long-haul freight trucking powered by hydrogen.

Despite these exciting options, which are rapidly becoming more affordable, there will likely still be a need for lower-emissions liquid fuels for years to come. This is especially true for maritime and aviation, where sustainable fuels are just beginning to be commercialized. Development of cost-competitive, drop-in fuels, largely

compatible with existing systems, is critical for these very difficult-to-decarbonize applications.

I hope today's hearing will help us better understand what we will need to do to help develop demand for new and cleaner fuels. But in all these cases, major innovation in transportation will not happen without our leadership, without our partnership, and without our vision for building the enabling infrastructure.

I thank each and every witness here today for attending this hearing, and look forward to the words of advice that you will share. Your testimony is especially meaningful to our efforts for decarbonization. Thank you all for attending.

[The prepared statement of Mr. Tonko follows:]

PREPARED STATEMENT OF HON. PAUL TONKO

Today's hearing is another benchmark in our series examining decarbonization of our economy by mid-century.

Transportation is the largest source of greenhouse gas emissions in America. While debate is often focused on light-duty automobiles, more than 40% of the sector's emissions come from other sources—buses, trucks, ships, trains, and planes.

Much like at our September hearing on the industrial sector, it will quickly become apparent that nonlight-duty segments of transportation have numerous challenges to overcome in order to achieve necessary, ambitious decarbonization targets.

For one, in recent decades there has been growth in vehicle miles traveled, and in many cases, this growth is expected to continue.

Second, these vehicles are capital-intensive investments with slow turnover. Investment decisions being made today will impact the emissions profile of the sector—and in turn our ability to decarbonize it—for decades to come.

Other significant barriers—cost, technology development, and infrastructure needs—will not be news to anyone.

We know that we need investments in research, especially in advanced batteries and fuel cells.

We need new infrastructure to enable the transition, including a national network of alternative fueling and charging stations.

And we need greater market demand for cleaner fuels.

Transportation emissions are a diverse set of challenges. Transforming the sector will be no easy task. But many of the principles we have been discussing as part of our broader, economy-wide approach apply here.

We need to ensure that pollution reduction—both climate and traditional air pollutants—occurs in frontline communities near ports, airports, and highways.

We must be open to many different technologies and pathways to decarbonization.

And we need a comprehensive, portfolio approach.

Establishing a price signal can be a critical component of our response and can speed up adoption and innovation in low-emissions alternatives, but carbon pricing is not a silver bullet, and that is especially true for transportation.

We must look to performance standards and other complementary investments, such as in research and infrastructure.

Today, we will hear recommendations from across the sector that should push us towards this portfolio approach.

And while the challenges seem daunting, there are great solutions already being developed and deployed today.

Some are commercially available right now. More are expected to become viable in the near future.

Efficiency remains a top solution across all modes.

For medium- and heavy-duty vehicles, the National Academies recently found strengthening fuel economy standards can reduce fuel consumption by as much as 30% by 2030.

Electrification is also a powerful solution for certain parts of the sector.

We have seen the potential of EVs with light-duty vehicles, and today, adoption of electric buses is occurring at an even faster rate than passenger vehicles.

Public and private sector leaders have quickly come to realize the opportunities from electrifying transit and school buses and delivery trucks—vehicles that take shorter, often predetermined, routes and can take advantage of predictable periods of non-use for charging.

But electrification is not the only option. In applications facing weight or distance concerns, hydrogen energy is a very promising solution, especially given the speed of refueling.

This has enabled fuel cells to find a role in warehouses. They are beginning to be deployed in ports and on tarmacs, and there are great opportunities for long-haul freight trucking powered by hydrogen.

Despite these exciting options, which are rapidly becoming more affordable, there will likely still be a need for lower-emissions liquid fuels for years to come.

This is especially true for maritime and aviation where sustainable fuels are just beginning to be commercialized.

Development of cost-competitive, drop-in fuels, largely compatible with existing systems, is critical for these very difficult to decarbonize applications.

I hope today's hearing will help us better understand what we will need to do to help develop demand for new, cleaner fuels.

But in all these cases, major innovation in transportation will not happen without our leadership, partnership, and vision for building the enabling infrastructure.

I thank our witnesses for being here and look forward to your testimony.

Mr. TONKO. With that, I will now recognize the ranking member of the Subcommittee on Environment and Climate Change, Representative Shimkus, for 5 minutes for his opening statement. Welcome, Representative.

OPENING STATEMENT OF HON. JOHN SHIMKUS, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF ILLINOIS

Mr. SHIMKUS. Thank you, Mr. Chairman.

Today, the subcommittee turns to what is possible for decarbonizing transportation beyond automobiles and light trucks. This means aviation, shipping and ports, rail, et cetera. It means that medium and heavy vehicles used in agriculture, industry, transit to move loads of all types on the highways and throughout every size community across the United States.

The transportation sector produces 29 percent of the Nation's carbon dioxide emissions according to the EPA. Medium and heavy vehicles account for just under a quarter of these emissions, which provides a large target for further emission reductions. These vehicles, which are powered mostly by diesel engines, also provide a large role in the economy of the United States.

According to the Diesel Technology Forum, heavy-duty diesel engines were responsible for doing \$4 trillion in economic activity in the first quarter of 2019. This includes agriculture, mining, construction, and transportation, and represents 12 percent of all private sector industry activity.

Last year, more than 1 million new heavy diesel engines were produced on American assembly lines, and provide new, more efficient products for use in future economic activity. In the transportation sector alone, diesel is the most visible in medium and heavy trucking. Of the 14 million commercial trucks on the road, 75 percent are powered by diesel engines. Ninety-seven percent of the Class A tractor trailer fleets runs on diesel. And the Forum and some of our witnesses this morning will testify that the quality of the new engines is providing large environmental benefit.

Between 2010 and 2030, more efficient diesel trucks are expected to save some 130 billion gallons of fuel and 1.3 billion tons of CO₂, more than the emissions from all light-duty vehicles in a given year. This is particularly impressive when you consider that vehicle miles traveled in medium and heavy trucking is projected to increase. The Energy Information Administration projects that vehi-

cle miles traveled just for medium and heavy commercial and freight trucking to increase nearly 60 percent by 2050.

I raise these facts to underscore the point that getting to zero emissions in transportation will not be possible anytime soon, and it will not mean the elimination of the diesel engine anytime soon.

There are a host of reasons for this: the availability and performance of fuels and engines; the technological limits of efficiency improvements; the complex infrastructure for transportation of goods; the affordability of new technology; capital costs; and fleet turnover; the performance of logistical realities of each subsector; and the fundamental need for affordable, reliable engine power in every aspect of our economy and our daily lives.

Congress has to be practical and realistic when it confronts environmental policies concerning the transportation sector. Setting unrealistic goals because it checks political boxes is not how you develop and ultimately enact successful bipartisan policies. A “100 by ’50,” net-zero emissions, clean-energy economy, decarbonization—these are taglines, descriptions. Some may be workable, some may not be workable. But what is not workable or productive is legislation by a tagline.

Instead of taglines, let’s legislate by looking at whether policies will raise costs, lock in policies that constrict innovation opportunities, inhibit transportation, and negatively impact not only commerce but what people rely upon every day.

The good news is trends for improving transportation emissions are positive, as we will hear from industry witnesses this morning. We will also hear several witnesses talk about the ongoing innovation and prospects for cleaner fuels and engines in transportation.

I would like to welcome in particular our witness from the National Association of Truckstop Operators, J.P. Fjeld-Hansen. He can speak about benefits of policies that focus on our existing energy infrastructure, on our renewable fuels policy, and on the innovation that is driven by focusing on needs of consumers, in this case the trucking industry and the driving public.

Tim Blubaugh from the Truck and Engine Manufacturers Association will provide an overview about the success in reducing criteria pollutants and carbon dioxide emissions, and the investments and challenges to developing zero-emission truck technologies.

The testimony from Mr. Eckerle at Cummins and Mr. Baines from Neste also highlight what is possible in other transportation models.

This promises to be an informative hearing. And I look forward to the testimony and to identifying what may be possible to do while preserving the essential roles of heavy-duty engines in our economy and our way of life. And at the conclusion of this, Mr. Chairman, I want my colleagues to make sure they take a look at this chart we placed at their desk from Love’s. It is in response to questions I had for them yesterday. I think it is highly instructive about the challenges we have on cost, fuel capacity, range. And there also is a line for carbon intensity score that I think is just highly educational.

And I know we have noticed a hearing for next week on the renewable fuel standard. That does play a big role into this debate that we are having today. I am glad you called it. And we can use

current public policy and reform some issues around the RFS that could be very helpful, especially in the debate we are having today. So thank you for noticing that hearing, and I look forward to working with you on both of them.

And I yield back my time.

[The prepared statement of Mr. Shimkus follows:]

PREPARED STATEMENT OF HON. JOHN SHIMKUS

Today the subcommittee turns to what is possible for decarbonizing transportation beyond automobiles and light trucks. This means aviation, shipping and ports, rail. It means the medium and heavy vehicles used in agriculture, industry, transit, and to move loads of all types on the highways and throughout every size community across the United States.

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Last year, more than one million new heavy-diesel engines were produced on American assembly lines and provide new, more efficient products for use in future economic activity.

In the transportation sector alone, diesel is most visible in medium and heavy trucking. Of the 14 million commercial trucks on the road, 75% are powered by diesel engines, 97% of the Class 8 tractor-trailer fleet runs on diesel. And, as the Forum and some of our witnesses this morning will testify, the quality of the new engines is providing large environmental benefits. Between 2010 and 2030, more efficient diesel trucks are expected to save some 130 billion gallons of fuel and 1.3 billion tons of CO₂—more than the emissions from all light duty vehicles in any given year.

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Congress has to be practical and realistic when it confronts environmental policies concerning the transportation sector. Setting unrealistic goals because it checks political boxes is not how you develop and ultimately enact successful bipartisan policies. 100 by 50, net zero emissions, clean energy economy, deep decarbonization—these are all tag lines, descriptions. Some may be workable, some may not be. But what's not workable or productive is legislating by tagline.

Instead of taglines, let's legislate by looking at whether policies will raise costs, lock in policies that constrict innovative opportunities, inhibit transportation and negatively impact not only commerce, but what people rely upon every day.

The good news is trends for improving transportation emissions are positive, as we will hear from industry witnesses this morning. We will also hear several witnesses talk about the ongoing innovation and prospects for cleaner fuels and engines in transportation.

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This promises to be an informative hearing. I look forward to the testimony and to identifying what may be possible to do while preserving the essential roles of heavy-duty engine power in our economy and way of life.

Mr. TONKO. The gentleman yields back. And we thank you.

The Chair now recognizes Representative Pallone, chair of the full committee, for 5 minutes for his opening statement.

Mr. Pallone.

OPENING STATEMENT OF HON. FRANK PALLONE, JR., A REPRESENTATIVE IN CONGRESS FROM THE STATE OF NEW JERSEY

Mr. PALLONE. Thank you, Chairman Tonko.

This morning we are holding the fourth hearing in our series on building a 100 percent clean economy. And each of these hearings has focused on a separate sector of our economy. And today we will be discussing key elements of the transportation sector, which is the largest source of climate pollution in our economy. Specifically, we will hear from our witnesses about the challenges and opportunities of decarbonizing medium- and heavy-duty vehicles, aviation, rail, and maritime shipping.

And this hearing and the overall series of hearings are critical as we work to develop legislation to decarbonize the American economy and build a cleaner, more prosperous future for all Americans. It will be one of the most ambitious, challenging, and necessary transformations our country has ever attempted. And our target of net-zero climate pollution by 2050 is founded on science, which tell us we must act with urgency if we are to avoid the worst effects of the climate crisis.

To conquer this challenge, we need the best ideas from all stakeholders and sectors.

And last month, this subcommittee held a hearing focused on decarbonizing the industrial sector. We heard from experts about the challenges to reducing emissions from some of the most difficult-to-decarbonize industrial processes. But more importantly, we learned about the opportunities to overcome those challenges. Today's hearing will shift gears and focus on how we transport the industrial products covered in last month's hearing, as well as people, cargo, and the products we use in our everyday lives.

Transportation is obviously vital to our economy. The fast, efficient movement of people and goods helps businesses grow and communities thrive. Yet, given the size and complexity of this sector, decarbonization presents significant challenges, especially for nonlight-duty vehicles like planes, trains, trucks, buses, and ships. And I look forward to hearing about the different policy solutions for this sector from our witnesses today.

We often hear about the role innovation will play in addressing climate change and transitioning to a 100 percent clean economy. In fact, we can already see how innovation is changing the transportation sector. Manufacturers like today's witness Cummins are developing new products and systems for low- or zero-carbon trans-

portation. And this innovation is critical, but as we have heard at every hearing in our climate series, innovation doesn't happen in a vacuum, it is driven by policy. And I would imagine we are going to hear that same message today.

Any suggestion that policy plays no role in spurring American industry to innovate new technologies willfully ignores the last half-century of American progress. For decades, under laws such as the Clean Air Act, the Federal Government and State leaders have set ambitious standards that spur industry to develop solutions that protect public health and the environment while growing our economy.

And that same formula will work for many aspects of addressing the climate crisis, including in the transportation sector. In fact, it is already working. For example, today's efficiency standards for medium- and heavy-duty trucks are reducing emissions from those vehicles. According to the National Academy of Sciences, even greater efficiency gains are well within our reach, but they do require policy support.

Efficiency standards will similarly play an important role in sub-sectors that cannot be readily electrified, such as aviation, maritime shipping, and rail. Cutting pollution will also require a continued shift to clean fuels, including low- and zero-carbon electricity and liquid fuels. And this transition toward climate-safe fuels is key to decarbonizing the transportation sector, but it comes with its challenges, particularly the need to develop recharging and refueling infrastructure across the country.

Cities and companies are helping to lead the way, deploying electric buses and delivery vehicles throughout their fleets. These vehicles have the dual benefits of improving local air quality while reducing carbon pollution, but the rate at which these clean vehicles are being deployed is woefully insufficient, and we have to act to accelerate that transition.

So I just look forward to hearing from our witnesses as we continue our work to determine the best ways to reach our climate goals and develop the 100 percent clean economy of the future.

I don't know if anybody wants my time. But if not, I will yield back, Mr. Chairman. Thank you.

[The prepared statement of Mr. Pallone follows:]

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Transportation is vital to our economy. The fast, efficient movement of people and goods helps businesses grow and communities thrive. Yet, given the size and complexity of this sector, decarbonization presents significant challenges, especially for nonlight-duty vehicles like planes, trains, trucks, buses, and ships. I look forward to hearing about the different policy solutions for this sector from our witnesses today.

We often hear about the role innovation will play in addressing climate change and transitioning to a 100 percent clean economy. In fact, we can already see how innovation is changing the transportation sector. Manufacturers like today's witness Cummins are developing new products and systems for low- or zero-carbon transportation. This innovation is critical, but, as we have heard at every hearing of our climate series, innovation doesn't happen in a vacuum, it is driven by policy. I would imagine we will hear that same message today.

Any suggestion that policy plays no role in spurring American industry to innovate new technologies willfully ignores the last half century of American progress. For decades, under laws such as the Clean Air Act, the Federal Government and State leaders have set ambitious standards that spur industry to develop solutions that protect public health and the environment while growing our economy. That same formula will work for many aspects of addressing the climate crisis, including in the transportation sector. In fact, it is already working. For example, today's efficiency standards for medium and heavy-duty trucks are reducing emissions from those vehicles. According to the National Academy of Sciences, even greater efficiency gains are well within our reach—but they require policy support.

Efficiency standards will similarly play an important role in subsectors that cannot be readily electrified, such as aviation, maritime shipping, and rail. Cutting pollution will also require a continued shift to cleaner fuels, including low- and zero-carbon electricity and liquid fuels. This transition toward climate-safe fuels is key to decarbonizing the transportation sector, but it comes with its own challenges—particularly the need to develop recharging and refueling infrastructure across the country.

Cities and companies are helping to lead the way, deploying electric buses and delivery vehicles throughout their fleets. These vehicles have the dual benefits of improving local air quality while reducing carbon pollution, but the rate at which these clean vehicles are being deployed is woefully insufficient. We must act to accelerate this transition.

I look forward to hearing from our witnesses as we continue our work to determine the best ways to reach our climate goals and develop the 100 percent clean economy of the future.

Mr. TONKO. The Chairman yields back.

The Chair now recognizes Representative Walden, ranking member of the full committee, for 5 minutes for his opening statement. Welcome.

OPENING STATEMENT OF HON. GREG WALDEN, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF OREGON

Mr. WALDEN. Good morning, Mr. Chairman. And I want to welcome all of panelists. And in advance, a couple of us are on a couple of subcommittees—well, I am actually on all of them, like Chairman Pallone is—so we have another hearing going on downstairs, so we will be bouncing back and forth. But thank you for being here, thanks for your testimony.

I want to thank the chairman for holding this hearing as well, as we review the challenges and opportunities associated with decarbonizing the U.S. transportation sector, and focus on the light-duty portions of that sector today. I very much look forward to the witnesses' testimony, particularly from several panelists who can speak to innovation in engines and fuel, and energy infrastruc-

ture this morning. I will have a question for you about some of that. We have Red Rocks Biofuels in my district, and so we will have some discussion about that when I get back.

There is a lot of underappreciated work toward cleaner engines. And today provides us with an opportunity to take a look at some of those innovation initiatives.

A couple years ago, Daimler Trucks North America opened its High Desert Research Facility and Proving Grounds in my district, Madras, Oregon, which I visited during construction. And that track provides durability and performance tests. And it will be critical for proving new, innovative, and more efficient technologies, and represents a constant effort by the industry to innovate to make cleaner, more efficient engines, as well as to make design changes in the vehicle bodies to improve energy conservation.

Reducing transportation emissions is a large, difficult, and complex topic, one that impacts all Americans, especially those whose livelihoods depend upon the affordable and reliable delivery of products across the Nation's transportation systems, which probably is just about all of us. Last Congress, Republicans worked closely with Democrats on this committee to pass bipartisan legislation setting national standards for the development of autonomous vehicles. We agreed then that national standards would encourage investment in innovation in the United States in this important sector of the economy.

And it is important, I think, we all acknowledge that this innovation would reduce highway accidents, save lives, and increase fuel economy while reducing emissions. In fact, according to the Energy Information Administration, by 2050 you could see as much as a 44 percent reduction in fuel consumption among connected autonomous vehicles, and up to 18 percent reduction among trucks.

The report says, and I quote, "In one representative platooning test, two semi-trucks were platooned at a constant speed of 64 miles an hour at a 36 foot distance. The configuration resulted in an average fuel consumption savings of 4.5 percent to the lead truck, and 10 percent to the following truck." That was their report.

Unfortunately, that bipartisan work went up on the rocks in the Senate. Although it has taken a little longer than we would like, I remain confident that the bicameral, bipartisan staff discussions that have been ongoing for months, this Congress will shortly produce substantial results. So, we can't miss the opportunity for the United States to lead on developing this technology and delivering safety and mobility benefits for Americans, particularly our senior citizens and people with disabilities.

Meanwhile, the administration has outlined a national policy that seeks to ensure people have the cars they want at prices they can afford. That will actually enable a more rapid turnover, I believe, to a cleaner, more efficient fleet. And at the same time, we have seen California seeking an aggressive and expensive standard-setting scheme that would drive up the price of cars and trucks nationwide, which I think would slow the cleaner-emitting vehicles coming to market and being with the uptake.

Republicans believe in putting the consumer first, and encouraging American innovators to do what they do best, which is inno-

vate. In the runup to these series of hearings, we have urged our majority colleagues to avoid resurrecting economically harmful top-down regulatory policies that punish consumers with higher prices and fewer choices.

You know, California frequently chooses this path as a result of their cap-and-trade scheme, unique refining requirements, and gas taxes. California consumers pay about 77 cents a gallon more than the national average. Seventy-seven cents a gallon. They are not really happy about paying \$4.13 per gallon to get to work and take the kids to soccer practice.

Republicans support innovation, conservation, adaptation, and preparation. We believe these policies have caused America to lead the world in carbon emissions reductions. We believe over regulation and high taxation hurts consumers, especially low-income consumers, and that can lead to economic stagnation.

So, in line with this principle, there are bipartisan bills Congress could pass today that would ensure the United States remains the global leader in emissions reduction and economic productivity and clean energy production, bills that focus on what works for Americans and their economic interests and well-being. Earlier this month I expressed in a letter to Chairman Pallone that we are encouraged by his expressed willingness to develop climate policies through a collaborative approach that would ensure every affected community, industry, and stakeholder has a seat at the table. Again, we are eagerly awaiting the opportunity to work together on these important policies to encourage innovation, conservation, and adaptation. There is a lot we can do together in this space to help consumers and reduce emissions.

Today's hearing gives us an overview on the transportation system, some of the initiatives there that would be good for consumers, the economy, and the environment.

Mr. Chairman, thanks again for the hearing. I look forward to the testimony.

[The prepared statement of Mr. Walden follows:]

PREPARED STATEMENT OF HON. GREG WALDEN

Mr. Chairman, thanks for holding today's hearing which seeks to review the challenges and opportunities associated with decarbonizing the U.S. transportation sector and focuses on the nonlight-duty portions of this sector.

And I very much look forward to the witness testimony, particularly from the several panelists who can speak to innovation in engines, fuel, and energy infrastructure this morning. There is a lot of underappreciated work towards cleaner engines and today provides a look at some of that work.

A couple of years ago, Daimler Trucks North America opened its high desert research facility and proving ground in Madras, Oregon, which I visited during construction. This track provides durability and performance testing that will be critical for proving new, innovative and more efficient technologies, and represents the constant effort by the industry to innovate, to make cleaner, more efficient engines, as well as to make design changes in the vehicle bodies to improve energy conservation.

Reducing transportation emissions is a large, difficult, and complex topic—and one that impacts all Americans, especially those whose livelihoods depend upon the affordable and reliable delivery of products across the Nation's transportation systems.

Last Congress, Republicans worked closely with Democrats on this committee to pass bipartisan legislation setting national standards for the development of autonomous vehicles. We agreed then that national standards would encourage investment in innovation in the U.S. in this important sector of the economy.

As important, I think we all acknowledged that this innovation would reduce highway accidents, save lives and increase fuel economy while reducing emissions. In fact, according to the Energy Information Administration, by 2050 you could see a 44 percent reduction in fuel consumption among connected autonomous vehicles and up to 18 percent reduction among trucks.

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Unfortunately, that bipartisan work went up on the rocks in the Senate. Although it has taken longer than we like, I remain confident that the bicameral bipartisan staff discussions that have been ongoing for months will shortly produce substantial results. We can't miss this opportunity for the United States to lead on developing this technology and delivering safety and mobility benefits to all Americans, particularly our senior citizens and people with disabilities.

Meanwhile, the administration has outlined a national policy that seeks to ensure people have the cars they want at prices they can afford, which will also enable a more rapid turnover to a cleaner, more efficient fleet. And at the same time, we had California seeking an aggressive and expensive, standard-setting scheme that would drive up the price of cars and trucks nationwide, slowing the turnover to cleaner emitting vehicles.

Republicans believe in putting the consumer first and encouraging American innovators to do what they do best: innovate.

In the runup to this series of hearings, we have urged our majority colleagues to avoid resurrecting economically harmful, top-down regulatory policies that punish consumers with higher prices and fewer choices.

California frequently chooses this path and as a result of their cap and trade scheme, unique refining requirement and gas taxes, California consumers pay about 77 cents a gallon more per gallon than the national average. And they're not happy about paying an average of \$4.13 per gallon to get to work or take the kids to soccer practice.

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In line with this principle, there are bipartisan bills Congress could pass today that will ensure the United States remains the global leader in emissions reduction, in economic productivity, and clean energy production. Bills that focus on what works for Americans and their economic interests and well-being.

Earlier this month, I expressed in a letter to Chairman Pallone, that we were encouraged by his expressed willingness to develop climate policies through a "collaborative process" that would "ensure every effected community, industry and stakeholder" has a seat at the table.

We eagerly await the opportunity to work together on these important policies to encourage innovation, conservation and adaptation. There's so much we could do together in this space to help consumers and reduce emissions.

Today's hearing will give us all an overview of more efficient, cleaner transportation systems. I am looking forward to realistic, practical policies that will be good for American consumers, our economy, and our environment.

Mr. TONKO. The gentleman yields back.

And now I, as chair, would like to remind Members that, pursuant to committee rules, all Members' written opening statements shall be made part of the record.

Now we introduce our witnesses. And you look like you are quite the team there, shoulder to shoulder.

We will begin with Dr. Emily Wimberger, climate economist of the Rhodium Group. Is that Weimberger or Wimberger?

Dr. WIMBERGER. Wimberger.

Mr. TONKO. Wimberger. I apologize. Wimberger.

Mr. Jeremy Baines, president of Neste US; Mr. J.P. Fjeld-Hansen, managing director and vice president, Musket Corporation, on behalf of the National Association of Truckstop Operators; the Honorable Fred Felleman, commissioner, Port of Seattle and the North-

west Seaport Alliance; Mr. Timothy Blubaugh, executive vice president of Truck and Engine Manufacturers Association; Dr. Wayne Eckerle, vice president, research and technology, at Cummins; and, finally, Mr. Adrian Martinez, staff attorney for Earthjustice.

Before we begin, I would like to explain the lighting system. In front of you are a series of lights. The light will initially be green at the start of your opening statement. The light will turn yellow when you have 1 minute left. Please begin to wrap up your testimony at that point. The light will turn red when your time expires.

At this time, the Chair will now recognize Ms. Wimberger for 5 minutes, please, to provide your opening statement.

STATEMENTS OF EMILY WIMBERGER, Ph.D., CLIMATE ECONOMIST, RHODIUM GROUP; JEREMY BAINES, PRESIDENT, NESTE US, INC.; J.P. FJELD-HANSEN, VICE PRESIDENT AND MANAGING DIRECTOR, MUSKET AND TRILLIUM CORPORATIONS, ON BEHALF OF THE NATIONAL ASSOCIATION OF TRUCKSTOP OPERATORS; FRED FELLEMAN, COMMISSIONER, PORT OF SEATTLE AND THE NORTHWEST SEAPORT ALLIANCE; TIMOTHY A. BLUBAUGH, EXECUTIVE VICE PRESIDENT, TRUCK AND ENGINE MANUFACTURERS ASSOCIATION; WAYNE ECKERLE, Ph.D., VICE PRESIDENT, GLOBAL RESEARCH AND TECHNOLOGY, CUMMINS, INC.; AND ADRIAN MARTINEZ, STAFF ATTORNEY, EARTHJUSTICE

STATEMENT OF EMILY WIMBERGER, Ph.D.

Dr. WIMBERGER. Thank you, Chair, Ranking Member, and distinguished members of the subcommittee. My name is Emily Wimberger, and I am an economist at Rhodium Group, which is an independent firm whose research supports decision makers in the public, financial, services, corporate, and nonprofit sectors. Prior to joining Rhodium, I was the chief economist at the California Air Resources Board. Thank you for convening this hearing today and inviting me to speak.

First I will start, I will reiterate some alarming emissions terms that were mentioned by the Chair. Each year Rhodium provides an independent assessment of U.S. greenhouse emissions and progress made towards long-term climate goals. In July of this year, Rhodium released Taking Stock 2019, which found that by 2025, the U.S. is on track to reduce emissions anywhere from 12 to 19 percent below 2005 levels. This is a far cry to commitments that were made under the Paris Agreement pledge to reduce emissions 26 to 28 percent.

Even more alarming, Rhodium's emissions estimates for 2018 show that greenhouse gas emissions rose last year after 3 years of decline. Rhodium estimates that carbon emissions from fossil fuel combustion increased 2.7 percent in 2018, the second largest annual increase since the year 2000.

The transportation sector remained the largest source of emissions on the back of strong economic growth and demand for diesel and jet fuel.

While these trends put the U.S. farther from achieving long-term climate goals, decarbonizing nonlight-duty transportation presents tremendous opportunities for American innovation and global eco-

nomic leadership. To meaningfully reduce emissions in the sector, we must reduce our dependence on fossil fuels. Federal policies that focus on electrification, low-carbon fuels, and efficiency can create markets for advanced technologies that will reduce emissions and create opportunities for growth across the U.S. economy.

Since 2010, sales of electric passenger vehicles in the U.S. have grown from under 10,000 a year to over 360,000. However, we have not seen that uptake in the nonlight-duty sectors. In the U.S., electric buses have only recently been introduced in very low volumes. And electric trucks have yet to meaningfully reach the market.

There are, however, examples of policies that drive electrification and nonlight-duty applications. Globally, 99 percent of the electric bus fleet is in China, where national mandates have led to widespread electrification.

In California, regulations are driving electrification of buses, marine vessels, offroad equipment, and trucks as the State works to achieve legislatively mandated climate targets and air quality standards. California's policies have created markets for energy-efficient products, low-carbon fuels, and zero-emission vehicles and equipment. The State is home to nearly half of the zero-emission vehicles in the United States, over 40 percent of North American clean fuel investment, and the world's best electric car manufacturer.

There are also important opportunities for low-carbon fuels to complement electrification and nonlight-duty transportation. There are high barriers to electrification in some applications where deployment of advanced biofuels and electrofuels created with clean power will be critical for decarbonization.

Effective policy design can drive long-term deployment of the lowest-carbon fuels by providing clear market signals and certainty to businesses, making investments in fuel development and deployment.

The Federal Renewable Fuel Standard and California's Low Carbon Fuel Standard have been critical in driving innovation in low-carbon fuels. However, biofuels derived from plants and waste make up just 5 percent of current U.S. liquid fuel demand, and advanced biofuels have struggled to reach market.

Efficiency is a third tenet of decarbonizing nonlight-duty transportation, moving more people and goods with fewer emissions. While tremendous efficiency gains have been made in light-duty vehicles, similar gains have yet to be realized in other applications. Federal policies that target engine standards, more stringent locomotive and oceangoing vessel standards, and deployment of cleaner technologies for aircraft will result in cost savings to consumers and American businesses. In addition, policies that increase efficient mobility and transit options can provide health and community benefits.

Technologies that increase fuel economy can also amplify carbon reductions achieved through electrification and the use of low-carbon fuels.

Reducing emissions in nonlight-duty transportation applications presents a tremendous opportunity to drive American innovation and create markets for new technologies that can be exported around the world. It is time for strong Federal leadership through

comprehensive policies that promote electrification, low-carbon fuels, and efficiency. There are examples of cost-effective, comprehensive policies in States, cities, and regions around the globe that reduce emissions and promote economic growth. It is time for the U.S. to lead in this challenge.

Thank you again for the opportunity to testify on such a very critically important topic.

[The prepared statement of Dr. Wimberger follows:]

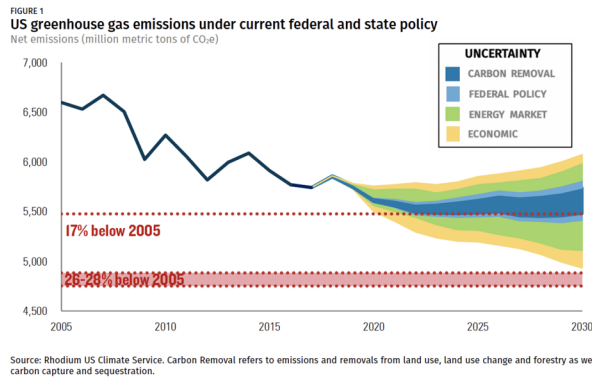
**Written Testimony**

Emily Wimberger, PhD
Climate Economist, Rhodium Group
Subcommittee on the Environment and Climate Change
Building a 100 Percent Clean Economy: Solutions for Planes, Trains, and Everything Beyond
Automobiles
Rayburn House Office Building Room 2322
Wednesday, October 23, 2019

Thank you Chair, Ranking Member, and distinguished members of the subcommittee. My name is Emily Wimberger, and I am a climate economist at Rhodium Group, an independent research firm whose research supports decision-makers in the public, financial services, corporate, philanthropic and non-profit sectors. Prior to joining Rhodium, I was the Chief Economist at the California Air Resources Board. On behalf of Rhodium Group, I want to thank you for convening this hearing today to examine opportunities to reduce emissions from the US transportation sector.

Taking Stock of US emissions

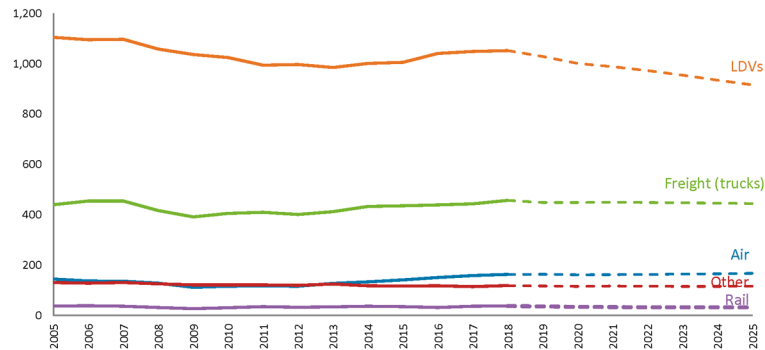
In our annual Taking Stock report, Rhodium provides an independent assessment of US greenhouse gas emissions and progress towards achieving the country's climate goals. In July of this year, Rhodium released Taking Stock 2019 which found that by 2025, the US is on track to reduce emissions anywhere from 12% to 19% below 2005 levels absent major policy changes – a far cry from the US Paris Agreement Pledge to reduce emissions 26% to 28%. Taking into account additional uncertainty in the direction and pace of US economic growth, we project 2025 emissions reductions as small as 11% below 2005 levels, or as great as 21% (Figure 1).



Even more alarming, Rhodium's emissions estimates for 2018 show that greenhouse gas emissions rose last year after three years of decline. Rhodium estimates that carbon emissions from fossil fuel combustion increased by 2.7% in 2018 – the second largest annual increase since 2000. The transportation sector remained the largest source of emissions on the back of stronger economic growth and demand for diesel and jet fuel. This highlights the challenges in decarbonizing the transportation sector beyond light-duty vehicles. Efficiency improvements and electrification in non-light-duty applications are beginning to reduce emissions – but not nearly enough for deep decarbonization. In 2018, US economy wide greenhouse gas emissions likely rose by between 1.5% and 2.5%.

Looking to 2025, Rhodium's projections show that non-light-duty transportation emissions will remain mostly static barring a significant change in policy (Figure 2). Based on the state of current technology, Rhodium projects that transportation will remain the largest source of greenhouse gas emissions in the US through 2030. While these trends put the US farther from achieving long-term climate goals, they present a tremendous opportunity for policy leadership at the federal level.

Figure 2: Transport emissions by mode

Million metric tons

Source: Rhodium US Climate Service

Comprehensive Policy Approach

Decarbonizing non-light-duty transportation presents tremendous opportunities for American innovation and global economic leadership. To meaningfully reduce emissions in the transportation sector, we must reduce our dependence on fossil fuels. Federal policies focused on electrification, low carbon fuels, and efficiency can create markets for advanced technologies that will reduce emissions and create opportunities for growth across the US economy. Transportation policies that promote markets for electric vehicles and equipment, increase the use of clean, low carbon fuels and prioritize efficiency and clean mobility can successfully decouple carbon emissions and economic growth.

Electrification

Since 2010, the cost of lithium-ion batteries has declined by 85%. That has made electric vehicles increasingly competitive in a wide range of applications. Over that period of time annual sales of electric passenger vehicles in the US has grown from under 10,000 a year to more than 360,000. However, electrification in non-light-duty applications has been slow. In the US, electric buses have only been recently introduced in very low volumes and electric trucks have yet to hit the market.

There are, however, examples of policies that drive electrification in non-light-duty applications. Globally, 99% of all electric buses are in China where national mandates have led to widespread electrification. China is also requiring the use of shore power for marine vessels built on or after 2020. In California, regulations are driving electrification of buses, marine

vessels, off-road equipment, and trucks as the state works to achieve legislatively mandated climate targets and air quality standards. California's policies have created markets for energy efficient products, low carbon fuels, and zero-emissions vehicles. The state is home to nearly half of zero-emission vehicles in the US, 40% of North American clean fuels investments, and the world's best-known electric car manufacturer.

Low Carbon Fuels

There are important opportunities for low carbon fuels to complement electrification in non-light-duty transportation. There are high barriers to electrification in some aviation and maritime applications where deployment of advanced biofuels and electrofuels created with clean power will be critical for decarbonization. Through effective federal policy design, the US can create markets for advanced low carbon fuels for applications where electrification is not feasible. Clean fuel policies can drive long-term deployment of the lowest carbon fuels as they provide certainty to businesses making capital investments in fuel development and deployment. Policies promoting low carbon fuels can also benefit sectors outside of transportation including agriculture, forestry, and waste by creating markets for feedstocks. New policies to drive innovation and investment, will reduce costs, and reduce dependence on foreign oil.

Biofuels derived from plants and waste make up just 5% of current US liquid-fuel demand and synthetic fuels made with captured carbon, hydrogen and other inputs are in the demonstration phase. Advanced biofuels have struggled to penetrate the fuel market — current levels are less than 1% of total US liquid-fuel demand. Federal policies that drive research and investment of advanced biofuels can expedite the deployment of the lowest carbon fuels especially in applications where electrification may not be feasible.

The Federal Renewable Fuel Standard and California's Low Carbon Fuel Standard have been critical in developing technologies and driving innovation in low carbon fuels. However, advanced biofuel deployment is nowhere near the scale required for deep decarbonization. Strengthening federal clean fuel standards and providing a strong price signal for the lowest carbon fuels is critical to achieving emission reductions across the transportation sector.

Efficiency

Efficiency is the third tenant of decarbonizing the transportation sector. In non-light-duty applications, efficiency means moving more people and goods with fewer emissions. Since 2004, carbon emissions from light-duty vehicles have decreased 23% and fuel economy has increased 29%. These tremendous gains have yet to be realized in other transportation applications including medium- and heavy-duty vehicles, rail, marine vessels, and off-road equipment.

Federal policies targeting engine standards, more stringent locomotive and ocean-going vessel standards, and deployment of cleaner technologies for aircrafts will result in cost savings to

consumers and American businesses. These policies also create markets for new technologies that can be exported around the world, increasing American competitiveness in the global market.

In addition, policies that increase efficient mobility and transit options can expedite near-term decarbonization while also providing health and community benefits. Technologies that increase fuel economy and reduce the weight of vehicles and equipment can also amplify carbon reductions achieved through electrification and the use of low-carbon fuels.

In closing, reducing emissions in non-light-duty transportation applications presents a tremendous opportunity to drive American innovation and create markets for advanced technologies while putting the US on a path to deep decarbonization. There are examples of comprehensive transportation policies in states, cities, and regions around the globe that have achieved deep emission reductions while promoting economic growth. Thank you again for the opportunity to testify today on such a critically important topic.

Mr. TONKO. Thank you, Dr. Wimberger.

And now, Mr. Baines, you are recognized for 5 minutes, please. Welcome.

STATEMENT OF JEREMY BAINES

Mr. BAINES. Good morning, Chairman Tonko, Ranking Member Shimkus, and members of the subcommittee. My name is Jeremy Baines, and I am the president of Neste US. Thank you for the opportunity to speak here today.

Neste is a publicly traded company headquartered in Finland, and has a rapidly growing presence in the United States. We are the world's largest producer of renewable diesel, and will be the number-one producer of sustainable aviation fuel by the end of the year.

We are also in the business of fighting climate change. And our purpose is to create a healthier climate for our children and for the next generations.

We are all wondering how to provide solutions for these hard-to-decarbonize transportation sectors. We can't, after all, just hook an extension cord to an airplane or a ship. But there are viable, scalable, and sustainable solutions.

Low-carbon liquid transportation fuels must do the heavy lifting to decarbonize these sectors. That's why Neste shifted its business model to focus on making and selling renewable products that can help decarbonize hard-to-abate industries like heavy commercial trucking, marine transport, and aviation.

I will spend my time today talking about the aviation industry, specifically, how sustainable aviation fuel, also known as SAF, can help reduce carbon emissions from air travel. Today, aviation is responsible for around 2.7 percent of U.S. greenhouse gas emissions. By 2050, the United Nations project that the global emissions could triple.

The airline industry recognizes this challenge. They have voluntarily committed to halve carbon emissions from 2005 levels over the next 30 years. I am inspired by this ambition and how they are attacking this challenge by improving efficiency and taking other steps to reduce the industry's climate impact. These are steps in the right direction. But, as the industry acknowledges, even all these steps are not enough to hit the industry goals.

SAF must be part of the solution if we want our children to live in a world where air travel is not limited. SAF is a drop-in fuel and works with today's aircraft engines, as well as existing storage, logistics, and airport infrastructure. SAF can reduce life cycle greenhouse gas emissions by 80 percent or more, and in its significantly less pollutants like particulate matter. This is particularly meaningful to communities that are disproportionately impacted by pollution.

SAF can be made from a wide variety of sustainable, scalable, and renewable low-carbon feedstocks, such as used cooking oils, MSW, forestry residue, or even captured carbon dioxide. Most importantly, SAF is available today. It is not a someday solution that has yet to be proven at scale.

Unfortunately, there are structural and policy challenges that are preventing SAF from taking off. For example, SAF receives less

credits under the renewable fuel standard compared to renewable ground transportation fuels. This means that it is more profitable for a company like Neste to reduce renewable fuels for road transportation compared to SAF.

Congress can help change this dynamic by insuring there is a level playing field for all renewable fuels. Neste sees immense opportunity in SAF. It is the only product available today that can keep planes flying and reduce emissions. To help the aviation industry grow, SAF production needs to start rapidly increasing now. The head of the International Civil Aviation Organization put it like this:

“SAF production capacity needs to double and then double again.”

We think there needs to be several more “agains” in this math. I believe this is a compelling reason for Congress to consider SAF-specific policies. Some promising options include permanent blenders or investment tax credit, exemptions for jet fuel excise taxes, or a RIN multiplier.

When I joined Neste I was skeptical of renewable fuels. I felt at the time they were too complicated, costly, and unrealistic. Today I am in a very different place. I see renewable fuels, and especially SAF, as smart business, and a way to create a better world for our children. With policy support to scale the industry, SAF can provide a large contribution to the big emission reduction challenges we face. Now is the time to start a robust policy discussion to meet these goals.

Neste looks forward to working with Congress and the aviation industry to identify win/win opportunities that can incentivize SAF and decarbonize air travel.

Thank you. And I am happy to answer your questions.

[The prepared statement of Mr. Baines follows:]



Statement of Jeremy Baines

President, Neste US

**House Energy and Commerce Committee, Subcommittee on the Environment and Climate Change
Hearing on "Building a 100 Percent Clean Economy: Solutions for Planes, Trains and Everything
Beyond Automobiles"**

October 23, 2019

Chairman Tonko, Ranking Member Shimkus and Members of the Subcommittee:

My name is Jeremy Baines. I am President of Neste US, and I appreciate the subcommittee's invitation to discuss opportunities to decarbonize the aviation and heavy-duty sectors with drop-in, scalable, renewable, and low carbon liquid transportation fuels. In order to meet science-based greenhouse gas (GHG) reduction targets and reach net-zero emissions by 2050, significant contributions will be needed from low carbon liquid transportation fuels, particularly in long-distance and heavy-duty applications — those other than light-duty automobiles — which cannot reasonably electrify and will rely on liquid fuels for the foreseeable future. As Congress considers pathways to reduce emissions in difficult to decarbonize sectors like aviation, heavy-duty transport, and maritime, it must both maintain and improve existing policies supporting renewable fuels and develop new sector-specific policies to continue to incentivize development of low carbon liquid transportation fuels.

Neste is a publicly-traded international fuel manufacturer based in Finland with a significant and growing presence in the United States. We are the world's largest producer of sustainable, low carbon renewable diesel and jet fuel, with over a billion gallons of capacity today and plans to expand to 1.5 billion gallons by 2022. In 2018, our products helped our heavy-duty on-road customers reduce GHG emissions by 7.9 million tons, and we have a goal of reducing emissions by 20 million tons a year by 2030. And in 2019, Neste placed third on the Global 100 list of the most sustainable companies in the world and was ranked as the most sustainable energy company.

But Neste wasn't always the world's largest producer of renewable diesel and jet fuel. Neste started as a traditional oil company, and we have proven that an oil company can transform into a climate solution provider. In 2015, Neste dropped "Oil" from our company name to underscore the fact that referring to fossil crude oil no longer gave a correct overall picture of the company. Although renewable products now account for the majority of our business, Neste is more broadly in the business of combating climate change and driving the circular economy by developing solutions where carbon is reused, again and again.

Neste has now set its sights on the challenge of decarbonizing aviation. Today, Neste has ramped up its capacity to produce over 30 million gallons of Sustainable Aviation Fuel (SAF), with plans for over 340 million gallons of capacity by 2022. Neste and our partner Texmark have recently received EPA approval for a new pathway to produce SAF in the U.S., and we plan to start domestic production of significant volumes by the end of the year.

Neste is working with several stakeholders in the aviation industry in the U.S. to expand and promote the use of SAF. For example, Neste has entered into collaboration agreements with

Neste US, Inc.

3040 Post Oak Blvd, Suite 1700
Houston, Texas 77054 USA



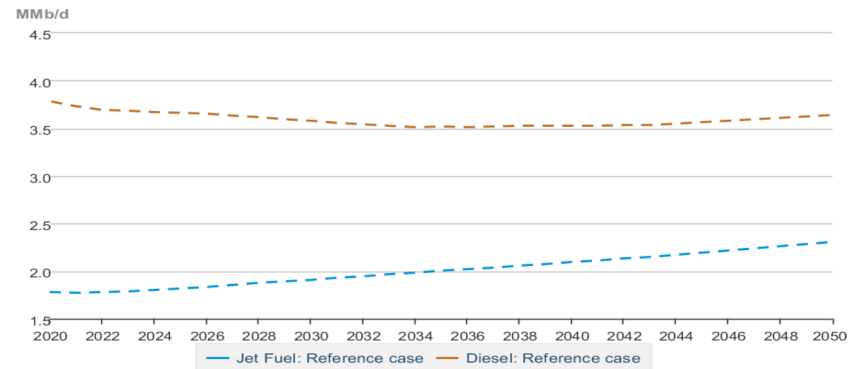
American Airlines, Alaska Airlines, and UPS to develop scalable solutions for seamless and efficient supply of SAF. Similarly, Neste has signed memorandums of understanding with San Francisco International Airport, Dallas Fort Worth International Airport, and the Port Authority of New York and New Jersey to jointly explore how to increase supply of SAF at these airports. We are also working closely with many industry stakeholders, including airframe and engine manufacturers, to expand the portfolio of approved sustainable aviation fuels.

Need for Liquid Fuels is Not Going Anywhere Soon

While the light-duty transportation sector is already beginning to ramp up electrification and other zero emission technologies, medium- and heavy-duty transport, aviation, maritime, and freight rail will continue to rely on a significant percentage of liquid fuels. As shown below, the U.S. Energy Information Agency (EIA) projects that domestic diesel use will remain relatively constant and jet fuel use will grow significantly.¹ Significant volumes of low carbon, drop-in renewable diesel and jet fuel will be needed to displace fossil diesel and jet fuel to meet science-based climate targets.

Figure 1: EIA Reference Case Projections for Domestic Diesel and Jet Fuel Use Through 2050

Liquid Fuels: Liquid Fuels Use: by Fuel



Clearly, electrification is not a panacea for all transportation emissions and a portfolio of technologies will be required. Electrification is a feasible option in the near term for on-road, light-duty vehicles and in niche applications in the medium- and heavy-duty sector, such as urban buses, which have short routes and return to central locations regularly. In the remainder of the medium- and heavy-duty vehicle sectors, electrification is far more challenging. The National Renewable Energy Laboratory's (NREL) Electrification Futures Study found that even in a "high electrification" scenario, only 52% of medium-duty trucks and 37% of heavy-duty trucks would be electric in 2050 due to the significant challenges associated with electrifying larger vehicles — challenges including

¹ See Energy Information Agency, Annual Energy Outlook 2019. For simplicity, only the reference case is shown, but all cases examined by EIA track this general forecast.

battery size, weight, volume, range, and charging duration.² Even if technological breakthroughs somehow were to result in 100% electric sales by 2040 or 2050, significant portions of the legacy fleet would still require diesel.

Renewable diesel and other low carbon liquid transportation fuels (e.g. biodiesel), offer significant climate benefits and can reduce emissions today without any need for infrastructure or equipment upgrades. In California, renewable diesel and biodiesel are currently the single largest contributors to emissions reductions under the Low Carbon Fuel Standard, reducing 4.3 million tons of CO₂ in 2018 — far greater than the 1.2 million tons of CO₂ reduced by electric cars and trucks.³ The recent “100 Percent Clean Future” report by the Center for American Progress also notes that some transportation sectors will not be able to decarbonize from electrification alone and that liquid fuels, like renewable diesel and SAF, will be needed in heavy-duty trucking, aviation, shipping, construction, and freight rail.⁴

The Case for Sustainable Aviation Fuel

Aviation is broadly understood to be one of the more difficult sectors to decarbonize, as electrification is not feasible in the near- to medium-term for anything other than short-haul regional flights. Fleet turnover is also less rapid in the aviation sector, with planes produced today expected to have a useful life of 25 years or more, compared to useful lives in the on-road sector that can be less than half as long. Thus, climate policy for aviation must be built around technologically feasible developments in the industry, and there is widespread consensus that while aircraft can continue to improve efficiency through use of advanced materials and more efficient engines, the vast majority of use cases (i.e. medium- and long-haul and larger short-haul jets) will require liquid hydrocarbon fuels through at least 2050.

Today, aviation contributes roughly 2.7% to U.S. GHG emissions, with a similar share globally, and aviation activity is growing roughly 5% per year. While our aviation industry partners have a strong record with over 2% annual efficiency improvements in recent years, emissions growth is outstripping efficiency improvements. The United Nations’ International Civil Aviation Organization (ICAO) projects that emissions from international aviation could triple by 2050, at which time aviation could contribute a significantly higher percentage of total global emissions.

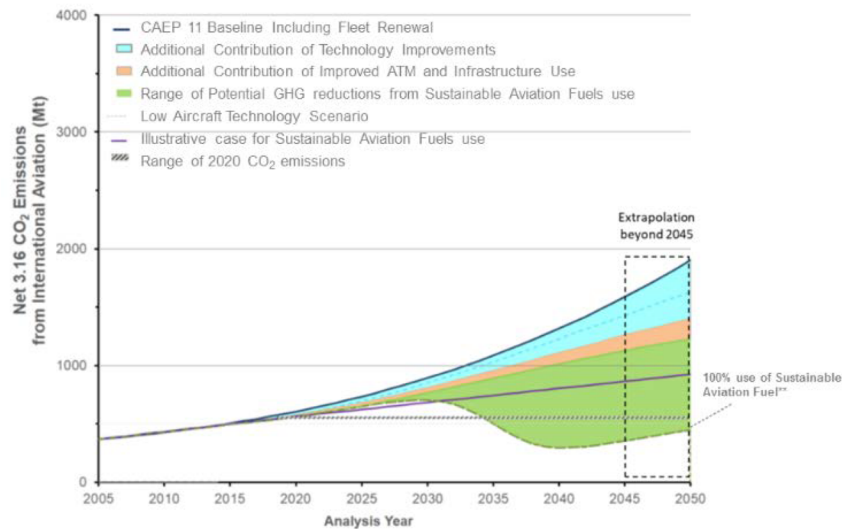
ICAO is addressing near-term growth in aviation emissions attributable to international flights beyond a 2020 baseline pursuant to its Carbon Offsetting Reduction Scheme for International Aviation (CORSIA), which is the first global, sector-wide program to address GHG emissions. The aviation sector should be applauded for the efforts to offset the growth of international aviation emissions. To date, 81 states, representing 76.63% of international aviation activity, have volunteered to participate in both the pilot phase (2021-2023) and the first phase (2024-2026) of CORSIA. But ICAO’s recent analysis of aviation emissions trends, excerpted below, demonstrates the degree to which SAF is a critical “wedge” for long-term decarbonization of aviation.

² See National Renewable Energy Laboratory, *Scenarios of Electric Technology Adoption and Power Consumption for the United States*, p. 45, available at <https://www.nrel.gov/docs/fy18osti/71500.pdf>

³ See Diesel Technology Forum, *Climate Change and Diesel Technology*, available at <https://www.dieselforum.org/policy/climate-change-and-diesel-technology>

⁴ See Center for American Progress, *A 100% Clean Future*, p. 39, available at <https://www.americanprogress.org/issues/green/reports/2019/10/10/475605/100-percent-clean-future/>

Figure 2. ICAO Trends Analysis Presented at 40th ICAO Assembly.⁵



Moving beyond CORSIA, the global aviation industry has committed to reducing emissions by 50% from a 2005 baseline by 2050. Rapid deployment and scale-up of SAF will be critical to achieving this goal or even more ambitious targets.

SAF offers a promising pathway to decarbonization. It is compatible with existing aircraft and infrastructure and can currently be blended with conventional jet fuel as high as 50%. There are currently five approved pathways under ASTM D7566⁶ covering a variety of feedstocks and production processes. Fuel meeting one of the annexes to D7566 is deemed equivalent to the conventional jet fuel specification, ASTM D1655, and is fungible with other jet fuel throughout the fuel distribution system.⁷

SAF can provide substantial lifecycle GHG emissions of 80% or more compared to conventional petroleum jet fuel. In addition, with zero sulfur and no aromatics, SAF also significantly reduces conventional pollutants, which would benefit disadvantaged communities near airports that are subject to high pollution burdens. A recent federally-funded study by the Airport Cooperative Research Program found that a 50% SAF blend could reduce emissions of particulate matter (PM),

⁵ See Council of ICAO, Working Paper 54, ICAO Global Environmental Trends – Present and Future Aircraft Noise and Emissions, available at https://www.icao.int/Meetings/a40/Documents/WP/wp_054_en.pdf

⁶ ASTM International, *Standard Specification for Aviation Turbine Fuel Containing Synthesized Hydrocarbons*

⁷ Comprehensive information on SAF can be found on the website of the Commercial Aviation Alternative Fuels Initiative (CAAIFI), a public-private partnership co-sponsored by the Aerospace Industries Association (AIA), Airports Council International-North America (ACI-NA), Airlines for America (A4A) and the Federal Aviation Administration (FAA). See www.caafi.org. See also Atlantic Council, *Ready for Takeoff: Aviation Biofuels Past, Present, and Future*, available at <https://www.atlanticcouncil.org/in-depth-research-reports/report/ready-for-take-off-aviation-biofuels-past-present-and-future/>; Airlines for America, *Deployment of Sustainable Aviation Fuels in the United States*, available at https://www.airlines.org/wp-content/uploads/2019/08/A4A-Sustainable-Fuel-Report_FINAL.pdf

sulfur oxides (SO_x), and carbon monoxide (CO) from jet aircraft by up to 65, 37, and 11 percent, respectively.⁸ Emerging research further suggests that SAF's PM reductions also deliver additional climate benefits, both from a reduction of black carbon emissions that accelerate Arctic warming⁹ and from reduced contrail formation, as contrails have a radiative forcing impact.¹⁰

SAF can be made from a wide variety of sustainable and scalable feedstocks and technologies. These feedstocks include oily waste and residues like animal fat and used cooking oil, lignocellulosic forestry residues, municipal solid waste, waste steel mill gases, cover crops that do not compete with food production, surplus ethanol (or other alcohols), and even captured CO₂ itself. Many of these feedstocks can also be co-processed at conventional refineries, providing an additional opportunity to scale SAF production.

Widespread deployment of SAF, in conjunction with continuing aircraft technology improvements and operational efficiencies, holds the promise of decoupling aviation emissions from global passenger growth and ultimately significantly reducing global aviation emissions. However, significant policy support will be needed in order to incentivize production and feedstock development.

SAF is a Viable Solution to Decarbonize Aviation

SAF must be a substantial pillar in aviation decarbonization and can do so with technologies that are already commercialized or on the cusp of commercialization. United Airlines, Lufthansa, KLM, Gulfstream, Airbus and others are using SAF in regular operations today. Additional domestic capacity beyond World Energy's Paramount, California, facility is coming online soon, with Fulcrum Bioenergy and Red Rock Biofuels currently constructing facilities in Nevada and Oregon, respectively. And Neste is making commercial quantities of SAF in Europe and will do so in the U.S. this year with our partner, Texmark. Lanzatech, Velocys, Gevo, and World Energy have all announced intentions to expand commercial capacity in the next few years.

SAF is technically proven, safe, and sustainable, but volumes are currently limited and the pace of commercialization, although increasing, is insufficient to put the industry on a glidepath to achieving the scale needed to meet targets to decarbonize aviation. But substantial scale-up is feasible with policy support. Work conducted for the FAA's ASCENT Center of Excellence found that 100% replacement of global jet fuel use with SAF by 2050 is technically feasible but would require significant incentives for bioenergy and waste feedstocks and policy prioritization for aviation.¹¹ A follow-on study specific to the U.S. found that up to 38% of U.S. jet fuel demand in 2050 could be satisfied by SAF from wastes and residues alone.¹² Another analysis led by NREL found that 6 billion gallons of SAF production is possible in 2030 with aggressive policy incentives.¹³

⁸ See Airport Cooperative Research Program, *Alternative Jet Fuels Emissions: Quantification Methods Creation and Validation Report*, available at <http://www.trb.org/Publications/Blurbs/179509.aspx>

⁹ <https://www.neste.com/releases-and-news/sustainability/neste-my-renewable-jet-fuel-wins-award-reduction-black-carbon-emissions>

¹⁰ See Patrick Leclercq and Bruce Anderson, *ECLIF - Emission and Climate Impact of Alternative Fuels and ND-MAX – NASA/DLR Multi-Disciplinary Experiment*, Presentation at CAAFI Biennial meeting, December 6, 2018, available at http://www.caaifi.org/resources/pdf/3.2_SAF_Benefits.pdf

¹¹ See Staples, M. D. et al., *Aviation CO₂ Emissions Reductions From the Use of Alternative Jet Fuels*, Energy Policy (2018), available at <https://www.sciencedirect.com/science/article/pii/S0301421517308224>

¹² See Mark Staples, *Long term CO₂ Emissions Reduction Potential of Aviation Biofuels in the U.S.*, presentation at CAAFI Biennial General Meeting, December 5, 2018, available at http://www.caaifi.org/resources/pdf/2.3_Future_Production.pdf

¹³ See Newes, E., J. Han, and S. Peterson, *Potential Avenues for Significant Biofuels Penetration in the U.S. Aviation Market*; National Renewable Energy Laboratory (2017), available at <http://www.nrel.gov/docs/fy17osti/67482.pdf>

Landscape for SAF

What can the federal government do to help scale the SAF industry? It is important to acknowledge the important work that has already been done. The SAF industry would not be commercialized today without the federal research and development policies that have been critical to deployment, particularly with regard to supply chain development, testing, and technical approvals of SAF. In particular the FAA Center of Excellence for Alternative Jet Fuels and the Environment (ASCENT), the Continuous Lower Energy, Emissions & Noise (CLEEN) program, and the Commercial Aviation Alternative Fuels Initiative (CAAIFI) have been instrumental in developing the SAF industry. These activities should continue as further development and analysis of new feedstocks, technologies, and supply chains will be needed to continue to scale the industry.

But we must not rely only on R&D and “someday” solutions, whether they be aviation electrification or future SAF feedstocks and technologies. As noted above, a suite of scalable feedstocks and technologies can begin to be scaled today, provided there is a supportive, long-term policy framework that incentivizes investment and deployment. That framework can, in turn, facilitate continued improvement and commercialization of future technologies. We cannot wait and must begin to reduce emissions and scale the industry today.

Unfortunately, the existing policy landscape does not adequately incentivize SAF deployment. In fact, there are both structural and policy disincentives to the production of SAF versus on-road renewable fuels. Policies like the Renewable Fuel Standard (RFS) were designed for ground transportation fuels, and while SAF qualifies under many of these policies, SAF generally generates fewer credits. For example, under the RFS, SAF receives 1.6 RINs per gallon while similar renewable diesel receives 1.7. And while states like California and Oregon have also sought to allow SAF to participate on an opt-in, credit-generating basis in low carbon fuel standards, SAF also generates fewer credits under these programs. Diesel historically commands a higher spot price than jet, further disincentivizing jet replacements as compared to diesel replacements. In sum, the significant opportunity costs for renewable fuel producers to produce SAF versus similar ground transportation fuel applications has been a headwind for the SAF industry.

Because of these significant structural and policy disincentives surrounding the production of SAF, the industry is unlikely to sufficiently scale and reach its full potential absent policy and price parity with ground transportation fuels. Given aviation’s dearth of other options to decarbonize, the relative immaturity of the SAF industry, and the need to rapidly scale production, there is a compelling policy justification for additional, SAF-specific policies. Congress is uniquely positioned to develop these policies given its primacy over aviation.

Policy Suggestions

Although an economy-wide price on carbon would be helpful, this alone will not be sufficient to decarbonize transport, much less aviation. Continued policy support for low carbon liquid fuels will be required throughout the transportation sector and targeted, sector-specific policies will also be needed, particularly in aviation where there are many win-win opportunities to incentivize SAF and enable rapid scale-up.

Understanding the need for increased low-carbon fuels for all hard to decarbonize sectors generally, policymakers should consider a long-term extension of the Renewable Fuel Standard (or a similar successor policy) for twenty years or more. Such longer-term stability will send an investment signal that closely tracks the need for continued decarbonization in line with IPCC targets. Such a policy

should focus on emissions reductions rather than volumes and should incentivize maximum GHG reductions. Today, the RFS does not incentivize reductions beyond those necessary to meet minimum lifecycle GHG reduction thresholds. Congress should also eliminate barriers to the use of sustainable feedstocks and develop common definitions for sustainable feedstock across federal programs. Finally, a carbon-reducing fuels policy should be feedstock-neutral and performance-based. Although there is great potential for cellulosic fuels, there are many other feedstocks, some not even biogenic in origin (e.g. waste industrial gases and captured CO₂), that can deliver substantial volumes of low carbon or even carbon-negative fuels. In sum, Congress should consider performance-based policies similar to state low carbon fuels standards and allow the market to determine the most efficient way to achieve reductions.

For SAF, one compelling sector-specific option is tax policy. The ethanol and biodiesel industries were successfully supported by now-lapsed production and blending tax credits.¹⁴ The nascent SAF industry is precisely situated to similarly benefit from a long-term or permanent blender's or investment tax credit which could attract significant investment to the sector, provided the investment signal extends far enough into the future. Another tax policy option to consider is an exemption for SAF from jet fuel excise taxes.¹⁵ Although an excise tax exemption alone would not be sufficient to spur significant investment, it could help close the above-mentioned incentive gap with fuels for the ground transportation sector.¹⁶

Beyond tax policy, there are numerous other policies that can be enhanced to help scale the SAF industry. A **RIN multiplier under the RFS of 1.5 - 2.5x for credits generated from SAF** could significantly increase the pace of SAF commercialization. Indeed, there is precedent under the RFS for such an approach, as Congress directed EPA to give cellulosic ethanol a 2.5x RIN multiplier under the RFS program. In Europe, SAF is currently eligible for a 1.2x multiplier under the EU Renewable Energy Directive (RED II), although this is widely considered to be insufficient to support SAF growth and the International Air Transportation Association (IATA) and other stakeholders advocated for a 2x multiplier.¹⁷ Maximizing SAF volumes under the RFS through a multiplier would have co-benefits from alleviating blend-wall issues associated with ethanol and reducing conventional pollutants. Finally, Congress could incentivize SAF by monetizing the substantial air quality benefits of SAF, potentially through eligibility for the FAA's Voluntary Airport Low Emissions (VALE) program grants, which are currently geared towards equipment and not fuels. There are many other policy options to consider, and it is important to begin a robust discussion of the most efficient way to scale the SAF industry.

Policies Supporting Medium-Duty and Heavy-Duty Transport

For medium- and heavy-duty transport, beyond general policies to increase volumes of low carbon transportation fuels discussed above, Congress should ensure that vehicle and fuel regulations are considered holistically. There are considerable opportunities for renewable diesel to deliver GHG and conventional emissions benefits cost-effectively in the legacy fleet, and Congress should consider including fuel switching as an option in programs like the Diesel Emission Reduction Act (DERA), which like VALE for airports, currently does not include drop-in fuels and only funds

¹⁴ The biodiesel tax credit, active from 2005 through 2017, gave tax credits of \$1/gal for blending of pure biodiesel or renewable diesel into diesel. Similarly, the Volumetric Ethanol Excise Tax Credit (VEETC), active from 2004 to 2011, gave tax credits of \$0.45/gal for blending ethanol in gasoline.

¹⁵ 26 U.S.C. § 4081(a)(2)(C) provides for an excise tax on jet fuel of 4.3 cents per gallon for commercial aviation and 21.8 cents/gallon for other aviation uses.

¹⁶ Exemption of SAF from excise tax would have a negligible impact on the Airport and Airway Trust Fund, as less than 5% of proceeds currently come from jet fuel excise taxes.

¹⁷ See <https://www.iata.org/whatwedo/environment/Documents/SAF-note-to-press.pdf>

equipment upgrades and replacement. In addition, as next generation GHG standards are developed for medium- and heavy-duty vehicles, policymakers should examine the ability of highly-efficient diesel engines to deliver GHG reductions in conjunction with renewable diesel and biodiesel, as recommended by a recent National Academies of Sciences report.¹⁸

Maritime

For maritime, which like aviation cannot electrify long distance use cases, low carbon liquid fuels will need to be a key part of the portfolio. Currently, renewable fuels used in ocean-going vessels are ineligible under the RFS program. Congress should ensure that future low carbon fuels policies include eligibility for maritime uses, which would have substantial conventional emission co-benefits near ports as well.

Conclusion

While heavy-duty, aviation, and maritime are more difficult to decarbonize than light-duty transport in that they cannot easily electrify, there are in fact significant opportunities to decarbonize these sectors without the need for additional infrastructure or new equipment. A low carbon fuels-centered approach for these sectors offers significant advantages, and the needed technologies and feedstocks are available. With appropriate policy support, these sectors can meet science-based decarbonization goals.

Thank you again for the opportunity to testify. I look forward to your questions

Sincerely

Jeremy Baines
President, Neste US, Inc.

¹⁸ See National Academies of Sciences, Engineering, and Medicine, *Reducing the Fuel Consumption and Greenhouse Gas Emissions of Medium- and Heavy-Duty Vehicles, Phase Two: Final Report* (2019), available at <https://doi.org/10.17226/25542>

Mr. TONKO. Thank you, Mr. Baines. We will talk about that extension cord later.

Mr. Fjeld-Hansen, you are now recognized for 5 minutes, please. Welcome.

STATEMENT OF J.P. FJELD-HANSEN

Mr. FJELD-HANSEN. Thank you very much. And I will keep the accents going here.

Chairman Tonko, Ranking Member Shimkus, and members of the subcommittee, thank you for inviting me to testify before you today. My name is J.P. Fjeld-Hansen, and I am the vice president of Musket and Trillium, which are the supply and alternative fuel arms of Love's Travel Stops.

Love's is a family-owned business that has grown from a single community store to the second largest travel center chain in the United States, with more than 500 retail fueling stations in 41 States. Today I am testifying on behalf of the National Association of Truckstop Operators. NATSO is the premier national trade association representing Love's and other highway fuel retailers.

In my testimony today, I hope to demonstrate to you that travel center companies such as Love's are invaluable partners to policy-makers as you seek to minimize the carbon footprint of the transportation sector. Motor fuel retailers are agnostic to the type of fuel we sell. However, our customers' decision are largely driven by price.

The industry is very capable of efficiently bringing the lowest cost fuel to market. At the same time, customers are reluctant to transition to more expensive alternatives. This should be viewed as an opportunity, not as an obstacle.

Motor fuel retailers are effectively surrogates for the customer. If you want to encourage consumers to transition to an alternative fuel, we know based on our experience what types of incentive programs work and what types of policies do not work. We could compete to sell low-cost fuel. If the Government can provide the requisite signals and policy certainty, we can bring actual affordable alternative fuel solutions to market. We are already doing that today.

It is tempting to focus solely on how we want the world to look in 10, 20, or 30 years. I am here today to offer our assistance in this endeavor, and also to urge you not to allow these larger aspirations to distract you from making interim progress. By building on existing policies and infrastructure, we can improve the transportation sector emissions footprint in the short term while also considering more long-term solutions. We should be able to do both.

As detailed further in my written testimony, Love's has invested significant capital to bring alternative fuels to market. Some examples would be our company Trillium agreed to set up a public/private partnership with the Pennsylvania Department of Transportation where we constructed 29 CNG stations serving more than 1,600 transit buses throughout the State.

In Miami-Dade County, we have built two CNG stations that are capable of refueling 600 CNG buses for the Miami-Dade County transit system.

We also provide full-service design, installation, and maintenance for on-site solar and power generation projects, enabling customers to reduce their energy bills and improve resiliency.

Trillium designed, built, and operates the Nation's largest heavy-duty hydrogen refueling station to support the Orange County Transportation Authority's fleet of hydrogen buses.

And Trillium earlier this year completed the successful acquisition of the renewable natural gas production facility at Point Loma Wastewater Treatment Facility in San Diego. And we also operate all four of the San Diego Metropolitan Transit System CNG stations.

This is just a small example. In undertaking these projects, we responded to public policy and the need of our customers. And we are eager to continue playing this role. That is precisely how it's supposed to work.

I encourage the subcommittee to learn from these lessons and apply those lessons to any incentive programs you create going forward. Once the regulatory incentive regime is in place that makes alternative fuel cost competitive, whatever the fuel might be, the private sector will bring those fuels to market most effectively. That is why it would be counterproductive to allow regulated public utilities to use their monopoly to squeeze out private-sector involvement in the EV recharging business.

That is precisely what utilities are trying to do right now in a number of States throughout the country. And if they are successful, it will not only preclude companies such as Love's from participating in that market, it would cement in place stagnant technologies and fueling solutions that at the end of the day will not get consumers what they want.

Fuel retailers have to be cognizant and responsive to their customers' demands in order to succeed; utilities do not. The best path forward is to leverage existing infrastructure and refueling sites that are strategically located where cars and trucks are known to travel, and develop policies that make it profitable for those businesses to invest in alternative fuels.

On behalf of NATSO and the Love family of companies, I look forward to continue working with you to achieve what I believe are mutually compatible goals. And I am happy to answer any questions that you may have. Thank you.

[The prepared statement of Mr. Fjeld-Hansen follows:]



Testimony of

JP Fjeld-Hansen

Vice President and Managing Director

**Musket and Trillium Corporations, part of the
Love's Family of Companies**

On behalf of the

National Association of Truckstop Operators (NATSO)

Before the

U.S. Committee on Energy and Commerce

Subcommittee on the Environment and Climate Change

October 23, 2019

Hearing on

**“Building a 100 Percent Clean Economy: Solutions for Planes,
Trains, and Everything Beyond Automobiles”**

I. SUMMARY OF TESTIMONY

- The National Association of Truckstop Operators (“NATSO”) is the premier national trade association representing off-highway fuel retailers, from multi-billion dollar travel center and convenience store chains to small, single-store operators. The Love’s Family of Companies (“Love’s”), a family-owned business with more than 500 retail fueling stations in 41 states, is one of NATSO’s largest members.
- NATSO members’ sole objective is to sell legal products, in a lawful way, to customers who want to buy them. As new fuels enter the market, retailers want to be able to sell those fuels lawfully and with minimal volatility and risk. NATSO is agnostic as to which fuels we sell to satisfy consumer demand. Our bias is simply that we believe it is best for the American consumer—and America’s industrial position in the world marketplace—to have reasonably low- and stable-priced energy.
- The retail diesel market is the most transparent, competitive commodities market in the United States. Truck drivers are often aware of retail fuel prices when they are 100 miles away from potential refueling sites, and fleet managers use this information to direct drivers to specific retail locations in order to purchase the lowest-priced fuel available. This imposes strong downward pressure on retail fuel prices. The competitive nature of the retail diesel market compels retailers to pass through cost savings to consumers in order to maintain and increase their market share. It is in retailers’ interest to increase the amount of fuel that we sell to consumers.
- If Congress wants to incentivize increased investment in and consumption of more environmentally friendly alternative fuels, it must recognize this fundamental market reality: motorists and truck drivers do not purchase products because NATSO’s members sell them; NATSO’s members sell products because our customers purchase them. When buying motor fuel, our customers very reliably purchase the least expensive product.
- NATSO strongly supports policies that incentivize fuel retailers to invest in bringing alternative fuels to market, and reward businesses that make those investments. Over the past twenty years, the Love’s Family of Companies has made significant investments in bringing alternative fuels to market. These investments have been the direct result of federal and state policies that, if implemented as intended, would increase our customers’ demand for alternative fuels. We responded to those policy signals.
- Although NATSO supports “all of the above” energy strategies that enable its members to sell competitively priced fuels to their customers, it is absolutely essential that any incentive or regulatory regime allows them to do so on a level playing field with our competitors.

- A number of states throughout the country have supported policies that would allow public utility companies to utilize ratepayer dollars to enter the electric vehicle (“EV”) charging business. Where this occurs, the utilities can compete with NATSO’s members for EV customers without putting a single dollar at risk. This shortsighted approach undermines fuel retailers’ ability to compete in a growing market, which in turn undermines the objectives of increasing investment in EV charging infrastructure.

II. INTRODUCTION

Fuel retailers are extraordinarily attuned and responsive to their customers’ preferences. They are fuel-agnostic, governed by a loyalty not to a particular type of fuel, but to low and stable priced energy for their customers.

Congress understood this two decades ago when it developed incentives for biodiesel and ethanol. At that time, NATSO was not vocally advocating for policies that would replace diesel with biodiesel, or gasoline with ethanol. But Congress wisely recognized that if it created incentives, the market would respond accordingly. Regardless of how one may feel about ethanol and biodiesel, the incentives that Congress established have been successful given the amount of petroleum-based fuels that has been displaced by renewable fuel since 2005. And today, maintaining incentives for renewable fuels is a top public policy priority for NATSO and for Love’s.

In the current political and policymaking landscape, it is tempting to paint a picture of how we want the world to look in ten, twenty, or thirty years, and focus solely on getting from here to there. I am here today both to offer the travel center industry’s assistance in this endeavor, but also to urge you not to allow those aspirations to distract you from building on existing policies and infrastructure to achieve tangible, real-world progress next month, and next year, rather than focusing solely on the next two or three decades.

We should be able to do both.

Companies such as Love’s have invested significant amounts of money to bring alternative fuels to market because policymakers such as yourselves essentially *told us* that we would generate a return on our investment. We responded to your policy signals and engaged in behavior that you have determined is beneficial for society at large. We are eager to continue playing this important role.

I encourage the subcommittee to learn from the successes of the last twenty years, and apply those lessons to any incentive programs you create for the next twenty years. Once a regulatory and incentive regime is in place that enables NATSO’s members to gain customers and market share by investing in EV charging, renewable diesel, or renewable natural gas (whatever the fuel may be), the private sector will bring those fuels to market more effectively and efficiently than the government or any government-sponsored monopoly.

I discuss these issues in more detail below.

III. BACKGROUND

A. NATSO and the Travel Center Industry

I am testifying today on behalf of NATSO, which is the premier trade association representing travel centers, truckstops, and off-highway fuel retailers. NATSO represents both large, multi-billion dollar travel center and convenience store chains, as well as small, single-store operators. Given the breadth of its membership, NATSO represents a substantial majority of retail sales of diesel fuel in the United States.

The travel center and truckstop industry is a diverse and evolving industry. Every travel center location is located in close proximity to an Interstate highway and includes multiple profit centers, from motor fuel sales and auto-repair and supply shops, to hotels, sit-down restaurants, quick-service restaurants, food courts, and convenience stores. Although the industry was once tailored solely to truck drivers, it now caters to the entire traveling public, as well as the local population that lives in close proximity to a travel center location.

NATSO members' sole objective is to sell legal products, in a lawful way, to customers who want to buy them. As new fuels enter the market, retailers want to be able to sell those fuels lawfully and with minimal volatility and risk. NATSO is agnostic as to which fuels we sell to satisfy consumer demand. Our bias is simply that we believe it is best for the American consumer—and America's industrial position in the world marketplace—to have reasonably low- and stable-priced energy.

All of NATSO's members, large and small, believe it is imperative that policies designed to encourage investment in alternative fuels must account for the fact that a majority of fuel retailers are small businesses. Any approach to setting policy that does not ensure these businesses are able to continue growing and creating jobs in the 21st Century will be less successful than policies that enable the *entire* retail fuels industry—large companies and small companies—to participate.

B. The Love's Family of Companies

Founded in 1964 and headquartered in Oklahoma City, Love's Travel Stops and Country Stores and its affiliated companies (collectively the "Love's Family of Companies" or "Love's") employ over 25,000 Americans. Our company has more than 500 retail locations in 41 states. We also have 230 truck tire care facilities, 700 fuel transport trucks, 1,000 rail cars, seven fuel terminals, and a growing number of hotels throughout the country. Love's is currently number 16 on Forbes' list of largest privately held companies. Love's is a family-owned business, and includes Executive Chairman Tom Love, Co-CEO Frank Love, Co-CEO Greg Love, and Vice President of Communications Jenny Love Meyer.

I am JP Fjeld-Hansen, the Vice President and Managing Director of Musket and Trillium, two wholly owned subsidiaries of Love's.

Musket Corporation is the supply and trading division of Love's, specializing in commodity supply, trading, and logistics across North America. Headquartered in Houston, Texas with additional offices in Oklahoma City, Oklahoma and Phoenix, Arizona, Musket provides expertise on both a marketing and operational level for our customers. Musket procures and transports virtually all of the diesel, gasoline, biodiesel, and ethanol sold at Love's nationwide. Musket also provides similar trading and logistics services for third party customers across all fuel types, both nationally and internationally. In addition, Musket is extremely active in renewable credit trading, natural gas liquids logistics, crude oil marketing, gasoline blending, and diesel exhaust fluid ("DEF") supply and marketing. Musket handles billions of gallons of these various products nationwide.

Trillium is the alternative fuel arm for Love's. Trillium owns and operates more than 200 compressed natural gas ("CNG") facilities that service heavy duty trucks, municipal buses, trash haulers, and the general public. Trillium also provides design and build operations and maintenance, natural gas procurement, and marketing services to a variety of CNG customers. In addition, Trillium produces and purchases renewable natural gas ("RNG") to meet 100% of our facilities' needs nationwide. Trillium is increasingly active in hydrogen refueling, EV recharging infrastructure, fuel cells, and solar electricity generation on behalf of Love's and many third-party customers.

IV. FUEL RETAILERS ARE FUEL AGNOSTIC

A. Price Flow at Retail

The retail diesel market is the most transparent, competitive commodities market in the United States. Many travel centers' customers—truck drivers and trucking fleets—negotiate fuel discount agreements with retailers and in so doing impose strong downward pressure on the prices retailers charge for diesel fuel. What's more, these drivers are generally more savvy and price-conscious than typical American motorists. (Fuel generally amounts to 30-40% of a motor carrier's overall costs.) Truck drivers are often aware of retail fuel prices when they are 100 miles away from potential refueling sites, and fleet managers use this information to direct drivers to specific retail locations in order to purchase the lowest-priced fuel available. This imposes strong downward pressure on retail fuel prices.

The competitive nature of the retail diesel market compels retailers to pass through cost savings to consumers in order to maintain and increase their market share. It is in retailers' interest to increase the amount of fuel that we sell to consumers. This is not only because those sales directly drive profit opportunity, but also because such sales drive in-store traffic, which is a source of profit for the retailer.

Given the structure of the retail fuels market, therefore, all of NATSO's members are "price takers" at retail. This means we must take the price of fuel that the market sets and compete to gain market share as the transparency of the market exerts a constant downward pressure on retail fuel prices. It is important to remember, however, that there is a long chain of supply before fuel is sold to consumers at retail; any costs that are incurred along the fuel production and supply chain will be passed down to retailers and ultimately absorbed by consumers.

B. Retailers *Respond to Consumer Demand*; We Do Not Create It

Offering a product for sale does not guarantee that consumers will purchase it. Retailers cannot force consumers to buy a particular product. Rather, retailers sell what consumers demand. In fact, the number one trait of any successful retailer is an ability to identify what his or her customers want to buy, and then sell that product at a cost that enables the retailer to earn a profit. In this respect, retailers are quite effective surrogates for consumers in policy debates on Capitol Hill and throughout the country.

If Congress wants to incentivize increased investment in and consumption of more environmentally friendly alternative fuels, it must keep in mind this fundamental market reality: motorists and truck drivers do not purchase products because NATSO's members sell them; NATSO's members sell products because our customers purchase them.

When buying motor fuel, our customers—from families traveling in passenger cars, to national trucking fleets, to cities and municipalities—very reliably purchase the least expensive product.

C. Fuel Retailers are Collaborative Partners in Bringing Alternative Fuels to Market

NATSO strongly supports policies that incentivize fuel retailers to invest in bringing alternative fuels to market, and reward businesses that make those investments.

Because fuel retailers are fuel agnostic, they are invaluable partners for policymakers whose objectives include increasing consumption of alternative fuels. The market is extraordinarily capable of efficiently and expeditiously bringing the lowest-cost fuels to market. Conversely, it is stubbornly reluctant to consume more expensive alternative fuels.

Although one might view this as an obstacle (because the lowest-cost fuels are not necessarily policymakers' most desirable fuels), I would urge you to view it as an asset: In essence, you have at your disposal a nimble, sophisticated industry that is able to adapt to clear policy signals and provide customers the fuels that they want.

All Congress needs to do come up with a combination of financial inducements and regulatory regimes such that *consumers prefer* the alternative fuels; once consumers prefer alternative fuels, retailers will have no choice but to invest in selling those fuels.

And the easiest way to make consumers prefer alternative fuels is to make those fuels cost competitive with diesel (or gasoline).

It is far less expensive to leverage existing infrastructure rather than create entirely new supply chains and infrastructure. Thus, to the extent policymakers can achieve their environmental objectives by harnessing existing infrastructure, it will make it exponentially easier to encourage customers to gravitate to new types of fuels and vehicles. NATSO's members and their upstream partners in the pipeline and terminal industries have spent more than sixty years building out a refueling infrastructure that optimizes logistics and maximizes customer benefits. Deployment of new technology that compliments, rather than competes with, this infrastructure will (all else being equal) be less expensive and thus more likely to generate consumer loyalty. Travel centers that line America's interstate system are strategically located where fueling demand is greatest. The United States has encouraged private investment in refueling infrastructure along its highway system since the system was first constructed in the 1950s. It has led to the most competitive, transparent commodities market in the world. Continuing to apply fair, consistent rules for private investment in new technologies minimizes market disruption from new fuels, and this is invariably the best way to get consumers to gravitate toward those fuels.

i. *Musket and Trillium's Experience Bringing Alternative Fuels to Market*

Over the past twenty years, Love's has made significant investments in bringing alternative fuels to market. These investments have been the direct result of federal and state policies that, if implemented as intended, would increase our customers' demand for alternative fuels. We responded to those policy signals.

Stated more directly, absent policy incentives, the fuels listed below are more expensive than petroleum-based diesel fuel. Thus, in the absence of such incentives, our customers would generally not be interested in purchasing these fuels from us (and we would therefore not be interested in investing in these alternative fuels).

Various federal and state policies however, have made these fuels *less expensive* than diesel fuel in certain parts of the country. In those instances, it makes the resulting product that we sell *less expensive* for customers than 100% diesel fuel, and allows Love's to increase its market share and profits all while engaging in behavior that policymakers deem beneficial for society at large.

Below is a brief overview of some of these investments:

- *Biodiesel and Renewable Diesel* – Biodiesel is made from animal fats, vegetable oils, or recycled restaurant grease. It can be blended with diesel up to 20% (B20) and used as a *drop-in fuel* in diesel vehicles. Renewable diesel is also made from animal fats, vegetable oils, or recycled restaurant grease, but the production process makes it chemically identical to petroleum diesel. This enables it to be

used as a *substitute*, rather than a *blend*. Both of these fuels achieve between a 50% and 90% lifecycle reduction in greenhouse gas emissions. Love's alone sells more than 265 million gallons of biodiesel and 105 million gallons of renewable diesel annually at our truckstops.

- At the federal level, incentives for these fuels consist primarily of the Renewable Fuel Standard ("RFS") and the biodiesel tax credit. Additionally, at the state level, programs such as California's Low Carbon Fuel Standard ("LCFS") provide a significant incentive for biodiesel and renewable diesel. The LCFS both enables Love's to sell these fuels to our customers on a cost-competitive basis, and also incentivizes us to lower the emissions footprint of our own fleet of trucks by maximizing the volume of biodiesel and renewable diesel our trucks consume.
- *Diesel Exhaust Fluid* – Diesel engine manufacturers use DEF in conjunction with Selective Catalytic Reduction ("SCR") technology to reduce nitrous oxide (NOx) emissions from exhaust gases. Love's sells DEF at all of our truckstops and operates 14 DEF production terminals across the U.S. and represents over 20% of market demand.
 - At the federal level, incentives for DEF consist primarily of Clean Air Act and Environmental Protection Agency ("EPA") requirements for mitigating NOx and particulate matter from heavy-duty trucks.
- *Compressed Natural Gas ("CNG") and Renewable Natural Gas ("RNG")* – CNG is a clean-burning fuel produced by harnessing methane from shale formations throughout the United States. RNG is a renewable fuel made from the methane that is released when organic waste (e.g., livestock manure, food waste, etc.) breaks down. CNG and RNG are used to fuel vehicles that are designed to run on natural gas. Love's sells more than 17 million gasoline gallon equivalents ("GGE") of CNG annually.
 - At the federal level, incentives for these fuels consist primarily of the Alternative Fuels Excise Tax Credit ("AFTC") and the RFS. LCFS programs are also prime drivers for these fuels.
- *Electric Vehicle ("EV") Charging* – Love's customizable power portfolio enables fleets to source electricity as a "fuel" from the grid, solar panels, energy storage, or an on-site generator powered by RNG. Love's has supported fleets with EV charging design and installation from California to Florida. Love's also offers EV charging infrastructure for light-duty vehicles at a number of our locations.
 - At the federal level, the Department of Transportation's ("DOT's") Low or No Emission Vehicle Program, which provides competitive funding to state and local governments to purchase zero or low-emission transit busses, is a critical driver of EV charging demand for transit systems. At the state level the LCFS also incentivizes investment in EV charging infrastructure.

- *Solar and Onsite Power Generation* – Love’s provides full-service design, installation, and maintenance for on-site solar and power generation projects, enabling customers to reduce their energy bills and improve resiliency. Love’s currently has 4 solar projects in place, with an additional 7 to be completed by the end of 2020, for a total of more than 5.0MW of production capacity.
 - At the federal level, the Investment Tax Credit (“ITC”) is the most important incentive for solar technology. Additionally, “net metering” throughout the country drives solar economics by crediting solar energy system owners for the electricity they add to the grid.
- *Hydrogen* – Hydrogen is a zero-emission fuel that is used in fuel cell vehicles. Love’s is completing one of the nation’s largest heavy-duty hydrogen vehicle fueling stations and is continuing to expand its portfolio.
 - At the federal level, the DOT’s Low or No Emission Vehicle Program is a critical driver of hydrogen fuel economics.
- *Ethanol* – Ethanol is a renewable fuel made from corn that can be blended into gasoline as an octane booster and to reduce a vehicle’s GHG emissions. Love’s operates three unit train facilities to efficiently distribute ethanol for customers at competitive prices. Love’s also operates manifest supply at multiple terminals, as the market dictates. Most of the gasoline we sell consists of at least 10 percent ethanol.
 - At the federal level, the RFS is the primary policy incentive for blending ethanol with gasoline.

ii. *Examples of Love’s’ Successful Projects*

While Love’s is rooted in the tradition of a small family business, our growing footprint provides us the privilege of leading by example into the future of sustainable transportation. Toward this end, Love’s partners with commercial fleet operators across the nation—transit, goods movement, schools, refuse, municipal delivery and more—to establish customized alternative fuel, EV charging, and on-site power generation and storage solutions based on their unique operating requirements and corporate sustainability goals. Below are some examples of these projects.

(1) *Orange County Transportation Authority (OCTA) – Hydrogen Station (Santa Ana, CA)*

Trillium designed, built, and operates one of the nation’s first heavy-duty hydrogen fueling stations to support OCTA’s transit fleet. The station, opened in 2019, has the ability to fuel transit buses with approximately 35kg of hydrogen per bus in 6-10 minutes simultaneously from two fueling lanes. The hydrogen fueling will take place in the same fueling lanes that Trillium built in 2007 for OCTA’s CNG buses. While OCTA’s hydrogen bus fleet will start out with ten fuel cell electric buses, the Trillium station is capable of providing the same fueling performance for a fleet of at least 50 buses without any further upgrades.

(2) Los Pinellas Suncoast Transit Authority (PSTA) – Electric Bus Charging (St. Petersburg, FL)

Trillium planned, built, installed, and managed the charging infrastructure for the first zero emission all-electric bus service in St. Petersburg. The charging infrastructure has allowed PSTA to reliably charge its growing fleet of electric transit buses. With Trillium's charging infrastructure in place, PSTA was able to secure funding to purchase additional electric buses, doubling its municipal EV fleet. Trillium helped establish PSTA as a transit leader while ensuring St. Petersburg residents have access to safe, reliable, zero-emission transportation.

(3) Love's Store and RV / Boat Storage – Solar Energy (Las Vegas, NV)

In 2017, Trillium designed, built, and installed its first on-site solar canopy system. The solar project helps offset nearly 70% of the electricity costs at our Las Vegas Love's store and 90% of the RV storage facility's energy costs. The 712kW solar system project has generated -3.5GWH of renewable energy—more than 300 times the annual energy use of a typical household. Trillium has since installed additional on-site solar systems at Love's stores in California and Illinois, continuing to offset energy costs and electricity consumption at each location.

(4) Los Angeles Unified School District (LAUSD) – CNG School Bus Fueling (Los Angeles, CA)

In 2000, Trillium partnered with LAUSD to design and build a CNG fueling station that serves as the primary refueling location for the district's 529 CNG school buses—the largest alternative fuel bus fleet in California. Today, Trillium operates and maintains two LAUSD CNG stations that dispense 500,000 GGE annually via 102 time-fill posts and a single fill dispenser.

(5) Pennsylvania Department of Transportation (PennDOT) – CNG Station Construction and Operation

In 2016 Trillium agreed to set up a public-private partnership with PennDOT where Trillium constructed 29 CNG stations throughout the state. These 29 stations service more than 1,600 transit buses throughout the state of Pennsylvania. Trillium is operating these facilities as they come online. A variety of tax incentives, fuel savings, and renewable fuel programs will save PennDOT more than \$10 million per year, paying down the capital costs of this project in less than 10 years.

(6) Miami Dade CNG Facilities (Miami) – CNG Station Construction and Operation (Miami, FL)

In 2017 Trillium agreed to construct two large-volume CNG stations for Miami-Dade County in Florida via a public-private partnership. These two stations will service 500 CNG buses (300 of which Trillium procured on the county's behalf) on a daily basis.

Trillium is operating these facilities as they come online. The Miami-Dade County Metrobus system provides 95 bus routes to local residents, and covers 29 million miles per year.

(7) Volvo LIGHTS Project (Volvo Lights) –EV Truck Demonstration Project (Los Angeles, CA)

In 2018 Trillium agreed to participate in an EV truck demonstration project called Volvo Lights (Low Impact Green Heavy Transport Solutions) that will deploy 23 battery-electric big rig trucks between the ports of Los Angeles and Long Beach in California. This \$91 million project will seek to solve some of the logistical issues that have plagued the EV heavy duty sector. The project will include the development of 1.9 MW of solar power for the EV chargers.

(8) Point Loma Wastewater Treatment Plant (Point Loma) – RNG Production (San Diego, CA)

Trillium completed the successful acquisition of the RNG production facility at Point Loma in the first quarter of 2019. The facility takes raw biogas from San Diego's largest wastewater treatment facility, and cleans it to pipeline quality renewable natural gas. Point Loma was the first facility to flow pipeline-quality RNG directly into California's natural gas distribution system. The RNG is used as a transportation fuel within the state of California, and also by local fuel cells for low-emissions power generation.

D. NATSO Opposes Policies that Undermine Fuel Retailers' Ability to Sell Alternative Fuels on a Level Playing Field with their Competitors.

Although NATSO supports "all of the above" energy strategies that enable its members to sell competitively priced fuels to their customers, it is absolutely essential that any incentive or regulatory regime allows them to do so on a level playing field with our competitors. If NATSO's members are placed at a competitive disadvantage with respect to any alternative fuel, it will effectively eliminate any incentive for them to invest in bringing that fuel to market.

i. Public Utilities' Role in Electric Vehicle Charging

Utility companies have for several years aggressively sought to enter the EV charging business. These utilities have successfully convinced public utility commissions ("PUCs") across the country to allow them to utilize ratepayer dollars to underwrite their investment in EV charging. Where this occurs, the utilities can compete with NATSO's members for EV consumers without putting a single dollar at risk. For this reason, many fuel retailers that may otherwise explore investing in EV charging infrastructure do not bother to do so; they recognize that they cannot compete with the utilities in this manner. As a consequence, there are fewer EV charging stations than there otherwise would be, contributing to consumer range anxiety and depressing EV sales. This undermines the initial objective of allowing utilities to rate-base EV investments.

By way of background, investor owned utilities are granted a monopoly by state regulatory commissions to provide utility service. They are granted a monopoly over the provision of electricity, for example, because it is economically inefficient for multiple companies to build overlapping infrastructure in order to serve the same end-users. In exchange for this loss of market freedom, the “monopoly compact” provides the utility a guaranteed rate of return on commission-approved investments. It further provides for the collection of revenue to cover the utility’s costs through approved rates.

As a general matter, utilities try to keep the cost of recovery of capital investments within the “rate class,” meaning they attempt to assign the cost to those that will benefit from the investment. From time to time, utilities seek to go beyond this practice to accomplish goals outside of the utility’s basic mission. Most economists frown upon such “cost-shifting.” Cost shifting is exactly what is occurring right now throughout the country as utilities seek to utilize their monopoly powers to insert themselves into the refueling space.

Rate based investments made by utilities are not subject to market risk. Once approved by the state PUCs, these investments provide a *guaranteed* rate of return for utility shareholders. The return is independent of how the investment performs, whether it becomes obsolete or not, or even if it is ever used. The rate of return is guaranteed. *Private* companies competing for the same customer have very little chance of effectively competing for business against a utility that has no risk on capital deployed, and no incentive to ensure superior performance.

Utilities deploy their capital investments for customers through approved “tariffs,” which outline the terms and conditions to the customer. By design, utility tariffs are “one size fits all.” This keeps it simple when managing many customers, but it is also very restrictive: once you’re in, you’re in. There is no getting out, and they are very difficult to change after the fact.

By contrast, private market solutions are *flexible* and *responsive to customer needs*. They have to be or a business will lose a customer. Utilities do not have this concern. There is no competition, and there is nowhere else for a customer to go.

What’s more, because tariffs do not allow for changes to the base investment, they are effectively static. In a rapidly developing and evolving marketplace, such as that for EV charging infrastructure, using regulated tariffs to deploy solutions virtually ensures the investment will be obsolete shortly after it is deployed. There is no mechanism to upgrade the investment to keep pace with technology. It is comparable to buying a brand new iPhone for every American in 2010, and then not enabling them to buy a new one for at least a decade.

Unlike regulated utilities, private markets are consumer and solution oriented. Competition drives private companies to develop new products and services to continually improve the customer experience and acquire and retain business. Absent

competition in this space, customers will be left with a single, outdated solution that has little incentive or capacity to innovate, or deliver a continuously improving product.

Trillium has seen firsthand the efficiency gains that the private sector can provide relative to regulated utilities. Love's actually purchased Trillium from a regulated utility (WEC Energy Group) in March 2016. Over the last three and a half years we have stripped off unnecessary overhead, dramatically improved operations performance, created a better customer service experience, and maximized the volume of renewable fuels being supplied to our customers. We have also multiplied the suite of alternative fuel options available to our customers.

Perhaps most troubling from a fairness perspective is the fact that when utilities charge all of their ratepayers more money to underwrite EV charging infrastructure investment, it overwhelmingly benefits the wealthy and punishes the lower and middle classes. Because EVs are far more expensive than most internal combustion engine vehicles, their ownership is largely confined to wealthy households. When utilities rate-base their EV infrastructure investments, it raises the monthly utility bills for all of a particular rate class (both poor and wealthy), even though the benefits are confined to the wealthy. It is patently unfair and inequitable for policymakers to force low-income households to subsidize wealthy households' refueling costs.

Businesses such as Love's are obviously also part of a particular rate class. For most NATSO members, utility bills are one of the highest items on a profit and loss statement. In this respect, when public utility companies charge their entire rate base to recoup the companies' EV infrastructure investments, fuel retailers effectively help underwrite their competition.

For all of these reasons, NATSO has serious concerns regarding one particular provision in the Leading Infrastructure for Tomorrow's ("LIFT") America Act (H.R. 2741), which this Committee favorably reported earlier this year. Specifically, NATSO opposes Section 34304, which advocates for saddling low-income electricity ratepayers with the costs of EV charging infrastructure. This provision should be revised to require states to only consider authorizing regulated utilities to recover from ratepayers any capital, operating expenditure, or other costs of the electric utility relating only to *revising line extension policies* in order to support *private sector deployment of electric vehicle supply equipment* and to mitigate potential distribution grid impacts from electric vehicles. This restricts regulated utilities to fulfilling their underlying purpose without crowding out much-needed private investment in EV charging infrastructure.

ii. Key Principles for Developing EV Infrastructure Incentives

NATSO encourages policymakers to abide by the following principles in developing EV infrastructure incentives:

- (1) *The EV charging market should be inherently competitive.*

The best way to encourage additional deployment of electric vehicle charging infrastructure is to ensure that the private sector can generate a return on investments in EV charging infrastructure. In every state there is an active competitive market for sales of charging infrastructure and services. Many states prohibit the sale of electricity to individual consumers except by price-regulated utilities. This discourages additional deployment of such infrastructure. Utilities that own EV charging stations should not be prohibited from billing other EV station owners more power than the internal transfer price they charge their own operations. This is the only way to provide a level playing field and ensure competitive pricing for individual consumers.

- (2) *Private investment should be the foundation of the electric vehicle charging market.*

Public policy should be designed to stimulate private sector investment in EV charging services. Demand for EV charging services is growing alongside the increasing rate of EV adoption. The private sector is eager to play a role in the burgeoning market. Site hosts that are materially and financially invested in charging stations are motivated to make the EV charging deployment successful and maximize use of assets.

- (3) *EV charging must not be the subject of utility commission regulation.*

Charging infrastructure is operated by non-utility entities that set their own price for providing electricity as a fueling service. Accordingly, these services should not be regulated as public utility activities. States should reduce regulatory uncertainty to permit all charging business models and activities. EV charging providers should not be under utility commission jurisdiction.

- (4) *Utilities should not be permitted to force all of their customers to pay for EV charging infrastructure.*

Regulated monopoly utilities should not be allowed to require all of their customers (ratepayers) to pay for utilities' EV charging infrastructure. If they do, private investment will be pushed out and utilities will be the only viable providers of EV charging. That will undermine the competitive market and result in fewer EV charging options. It will also unfairly burden the majority of utility customers who will not drive EVs and should not be forced to pay for their neighbors to refuel.

- (5) *Incentive or grant programs should be designed to apply to a broad set of EV charging market participants and technologies.*

NATSO encourages the development of incentive or grant programs for EV charging infrastructure that are broadly applicable to enable wide participation by the private sector. These programs should be designed to motivate private investment at key locations, particularly along the Interstate system and in rural areas. Ideal sites include existing fueling facilities, retail locations, or convenience establishments. Under no circumstances should EV charging infrastructure be permitted at Interstate rest areas that

are subject to the commercialization ban found at 23 U.S.C. 111, as this would simply discourage nearby businesses from investing in EV charging infrastructure. In setting eligibility criteria for incentive or grant programs, the establishing entity should not prescribe any technological specifications that are not industry standards, as it may negatively impact innovation, stem competition, and cut off choices for consumers. Public grant programs should not be accessible to regulated monopoly utilities that gather their funds to invest in charging from their ratepayers.

Conclusion

Thank you for the opportunity to present testimony before you today. On behalf of NATSO, I look forward to continuing to work with Congress on these issues, and am happy to answer any questions you may have.

Mr. TONKO. Thank you, Mr. Fjeld-Hansen.

And now we move to Commissioner Felleman. You are recognized for 5 minutes. And welcome.

STATEMENT OF FRED FELLEMAN

Mr. FELLEMAN. Thank you. Good morning, Chairman Tonko and Ranking Member Shimkus, as well as distinguished members of the committee.

I am Fred Felleman, Port of Seattle Commission vice president and managing member of the Northwest Seaport Alliance. The port's diverse business lines include managing commercial fishing and cruise terminals, as well as the Seattle-Tacoma International Airport. In partnership with the Port of Tacoma we also jointly manage the fourth largest container port complex in North America.

We are committed to carrying out our mission in an environmentally sustainable manner while recognizing the needs of disproportionately impacted communities. As founding chair of the port's Energy and Sustainability Committee, I look forward to this opportunity to share the progress we have achieved voluntarily and identify opportunities to collaborate in the future.

In Washington State we are very fortunate to have a green grid powered primarily by hydroelectricity. In addition, we have made significant investments in wind and solar projects, creating additional renewable energy and jobs in the districts of Representatives Walden and McMorris Rodgers.

The aviation and maritime sectors are particularly difficult to decarbonize. According to the International Air Transport Association and International Maritime Organization, air transport and maritime shipping each account for about 2 percent of the global CO₂ emissions and will continue to grow unless action is taken. Nevertheless, the Port of Seattle has a goal of being the greenest and most energy-efficient port in the Nation.

At Sea-Tac Airport we are providing preconditioned air and electricity to power aircraft while they are at the gate, reducing greenhouse gas emissions by more than 40,000 metric tons. We are also installing charging stations on our airfield to support ground-handling equipment.

Off airfield, we are transitioning our bus fleet and central heating plant to renewable natural gas. Our taxi and ride-sharing services are required to meet strict fuel economy standards, and we are providing electric vehicle charging stations to the public.

Our longer-term goal is to fuel every flight at Sea-Tac with 10 percent blend of biofuel by 2028. Sustainable aviation fuels have a life cycle carbon footprint of 80 percent lower than the current jet fuel.

For the maritime sector, the Port of Seattle is one of the first ports in the country to install shore power at a marine terminal, enabling cruise ships to turn off their engines while at berth, utilizing our low-carbon electrical grid.

Plugging container ships into shore power at the Northwest Seaport Alliance's major terminals would also result in emissions reductions of nearly 14,000 tons of greenhouse gas annually. Con-

necting all our cruise ships to shore power would have saved over 10,000 metric tons last year alone.

The Ports of Seattle and Tacoma also require that all cargo trucks entering Seaport Alliance international container terminals are at least 2007.

At the Port of Tacoma they are nearing completion of an LNG terminal to serve maritime vessels. Additionally, the State's ferry service is transitioning to electrification.

Moving forward, our primary strategy is to electrify marine terminals and convert diesel powered drayage trucks and cargo handling equipment to electricity or other clean energy sources.

The job ahead of us is daunting. Maritime and aviation transportation systems and global supply chains are complex, and the port's authority to manage them is limited. Funding is a huge obstacle to faster implementation. And we must also carefully balance our environmental priorities alongside our economic and social responsibilities. Support from the Federal Government is needed to help us overcome these challenges to meet our carbon-emission targets.

We ask that Congress support the transition to sustainable aviation fuels through funding, research, and interagency partnerships, support electrification for marine terminals and other clean-energy solutions for maritime operations, increase funding and expand program eligibility for environmental elements or projects that reduce emissions, and harmonize Federal and global efforts to decarbonize oceangoing vessels while at sea.

Climate change is already impacting our abilities to operate our core business reliably and predictably. But this is also creating opportunities for innovation and job creation. Our ports are supporting the State of Washington's maritime Blue Initiative to drive innovation and advance clean maritime technologies. Creating jobs of the future will enable our region to capture a growing portion of the global maritime blue economy that is expected to reach \$3 trillion by 2030.

Similarly, by supporting the development of sustainable aviation fuels, there will be broad-based benefits for research institutions, refineries, farmers, foresters, and feedstock producers.

Thank you again for the opportunity to join you today. Decarbonization of the maritime sector is a big, bold, and essential goal. The Port of Seattle and the Northwest Seaport Alliance look forward to working with Congress to achieve this goal. Thank you.

[The prepared statement of Mr. Felleman follows:]

**Testimony of The Honorable Fred Felleman
Commissioner, Port of Seattle and The Northwest Seaport Alliance and
Founding Chair of Port of Seattle Energy and Sustainability Committee
U.S. House Committee on Energy and Commerce
Subcommittee on Environment and Climate Change
October 23, 2019**

INTRODUCTION

Good morning, Chairman Tonko, Ranking Member Shimkus and members of the subcommittee. I am Fred Felleman, Port of Seattle Commission Vice President and Managing Member of The Northwest Seaport Alliance (NWSA). Thank you for inviting me to be with you today to discuss our efforts to reduce port-related emissions and to transition to a near zero carbon future.

Founded in 1911, the Port of Seattle is an independent special purpose government representing the people of King County, Washington. The NWSA is a unique partnership formed in 2015 between the ports of Seattle and Tacoma (a special purpose government representing the people of Pierce County, Washington) to jointly manage our marine cargo facilities, including the fourth largest container port complex in North America as well as substantial breakbulk, auto, military, and project cargo operations.

Port of Seattle itself has one of this nation's most diverse portfolios of port operations. In addition to managing marine cargo with the NWSA, the Port of Seattle owns a variety of deep-water terminals and extensive shoreside facilities that serve to home port most of the North Pacific fishing fleet as well as the largest and fastest growing cruise port on the U.S. West Coast. We also manage a variety of recreational marinas, industrial lands, economic development and environmental programs.

The Port of Seattle also manages Seattle-Tacoma International Airport (Sea-Tac), making us one of only a handful of ports that operate both a seaport and an airport. Sea-Tac is the eighth busiest airport in the country, which currently serves over 50 million passengers and is predicted to handle almost an additional million passengers per year for the next decade. It is also a thriving air cargo facility with significant international trade flows. Combined, our maritime and aviation efforts support nearly 200,000 jobs.

The fundamental function of a port authority is to create and support economic activity by building transportation infrastructure and managing operations at our facilities. Yet as a government with elected leaders representing the residents of Washington state's largest county, we also believe it is core to our mission to carry out these functions in an environmentally and socially responsible manner.

In the Pacific Northwest we are very fortunate to have a "green grid," powered primarily by hydroelectricity. In addition, we have made significant investments in wind and solar projects in the districts of representatives Walden and McMorris Rodgers that provide for additional renewable capacity. This has enabled us to direct a great deal of attention to reducing the carbon footprint of transportation through electrification.

However, the aviation and maritime sectors pose an even greater challenge. There are still many difficulties to overcome in order to transition from the liquid fuels that currently power most of the

maritime and aviation sectors to renewables or electricity. Yet it is imperative that we try, and we can make great strides with continued investments in innovation, leveraging our green grid.

According to the International Air Transport Association, air transport accounts for about two percent of total global anthropogenic CO₂ emissions, and passenger travel could double in the next 20 years. The International Maritime Organization (IMO) found international maritime shipping accounted for 2.2 percent of global emissions¹ in the most recent year surveyed and predicts that maintaining the status quo could result in emissions growing by 50 to 250 percent by 2050.²

The Port of Seattle has been actively tackling emissions reduction, above and beyond what is required by local, state and federal law. We were one of the early leaders of the port industry in our efforts and have set aggressive emission reduction targets with a goal of being the greenest and most energy efficient port in North America. Through our partnership under the NWSA, the two ports aim to reduce greenhouse emissions from our cargo operations by 80 percent by 2050 in line with the Paris Accord. For our other business lines, the Port of Seattle plans to be carbon neutral or carbon negative by 2050.

Upon election to the commission four years ago, I championed the creation of our Energy and Sustainability Committee to focus on the reduction of the port's carbon footprint. This work is what motivated me to run for public office. I am honored to have the opportunity to share some of our experiences with this committee. It is my hope we can identify ways we can continue working together to advance such efforts in the future.

CURRENT EXAMPLES OF EMISSIONS REDUCTION PROGRAMS

Aviation

Sea-Tac's carbon reduction efforts are over a decade in the making. In 2007, Sea-Tac was one of the first airports in the country to conduct a comprehensive greenhouse gas (GHG) inventory as a first step in a robust effort to reduce the environmental impact of the facility. The inventory included emissions from both ground and aircraft operations, which then led to reduction targets at the airport based on the inventory. In 2014, Sea-Tac was also the first airport in North America to be certified for reducing carbon through an independent third-party verification program carbon known as Airport Carbon Accreditation (ACA).

While a majority of airport-related carbon emissions are from aircraft operations which are not under our direct control, we have a robust collaboration with our airlines and other tenants to reduce their carbon footprint by saving fuel, which also helps to improve their bottom line.

By providing pre-conditioned air and electricity to power aircraft while they are sitting at the gate, we are working to reduce aircraft engine emissions by more than 40,000 metric tons of GHG, which is more than twice the annual emissions from heating the entire airport terminal. To reduce taxiing times, the airport's ramp tower directs aircraft when they are off the runways, which reduces fuel use by five percent. Finally, we are continuing to install charging stations on our airfield, so that our airlines and ground handling companies can use electric ground support equipment (eGSE). To date, we have installed nearly 300 eGSE charging locations throughout the passenger terminal ramps, with a goal of having them available at every gate by 2021 (561 in total).

¹ International Maritime Organization, "Third IMO GHG Study 2014," 2015, p. 1.

² Ibid, p. 4.

In addition to on-airfield efforts, we have a goal to transition all vehicles at our airport toward cleaner energy sources. We use compressed natural gas buses to our rental car facility and employee parking lot, and are in the process of transitioning both our CNG fleet and our central heating plant to renewable natural gas (RNG). If we can reach scale for RNG in both our airport boilers and buses, we could meet our goal of reducing carbon by fifty percent by 2030, a decade early.

Our passengers travelling to and from the airport are key to these efforts as well. The taxi services and ride-sharing services (e.g., Lyft and Uber) who contract with the airport are required to meet strict environmental standards, and we provide 48 publicly available charging stations in our public parking garage. The port also works with King County Metro to increase transit to the airport and has contributed \$110 million to ensure Sound Transit light rail access at the airport. We continue to make improvements to that service to increase ridership.

FUTURE STRATEGIES FOR CARBON REDUCTION

Aviation

Until there is an ability to electrify air travel, the silver-bullet solution to reducing carbon emissions at Sea-Tac is by powering every flight with sustainable aviation fuels (SAF). Our commission has set an ambitious near-term goal of fueling planes with 10% SAF by 2028.

We define SAF as jet fuel made from renewable sources such as used cooking oil, animal tallow, wood waste, algae, oilseeds, or municipal solid waste, as opposed to sources that compete with food stocks. SAF has a lifecycle carbon footprint 50 to 80 percent lower than regular jet fuel.

This has been a central environmental priority of the port since it began working with state and regional partners like the Boeing Company, Alaska Airlines and Washington State University to create a roadmap to sustainable fuels in 2008, and we've taken a number of important steps toward this goal.

In 2016, we partnered with Boeing and Alaska Airlines to investigate the best locations to store and blend SAF into the airport's fueling systems. We produced a report identifying some key locations on and off the airport's property. Then, in 2017, Rocky Mountain Institute investigated the feasibility of using different airport revenue streams at Sea-Tac to help bring down the cost to all airlines compared to petroleum jet fuel, as well as support the build-out of fueling infrastructure. That report identified a range of funding sources and included ways an airport could be involved without directly paying for fuel. Finally, we were pleased last year to connect feedstock producers, refiners and airlines by hosting a Washington Sustainable Aviation Fuels Summit.

I should take a moment to mention that our airlines partners have been willing and active participants in this effort. Alaska Airlines has flown SAF from our airport using three different feedstocks and was the first airline in the world to fly using alcohol-to-jet fuel; they have also partnered with Neste, who is here testifying today, to work together to design, create and implement solutions that lay the groundwork for the wider adoption of renewable fuels within the airline industry.

Similarly, Delta Air Lines recently announced a feasibility study of a Washington state biofuel production facility to produce sustainable aviation fuel and other biofuel products, which they believe could provide approximately 10 percent of their annual jet fuel consumption in the West Coast region. As part of our most recent lease agreement with our tenant airlines, we have formed a working group with 15 of our air carriers to investigate more ways to achieve our carbon reduction goals.

CURRENT EXAMPLES OF EMISSIONS REDUCTION PROGRAMS

Maritime

For the maritime sector, the framework for our emissions reduction programs is the Northwest Ports Clean Air Strategy (NWPCAS). Chartered in 2007, the NWPCAS is a collaboration between the Port of Seattle, Port of Tacoma, and Port Metro Vancouver in Canada to reduce air emissions from shipping and port operations in our shared airshed. The strategy was the first such international cooperative effort in the port community, and we partnered with state and federal agencies to develop a plan to reduce diesel particulate emissions (DPM) by 80 percent of 2005 levels by 2020 and greenhouse gas (GHG) emissions by 15 percent of 2005 levels by 2020. As of our most recent emissions inventory (2016), we have met our goals four years ahead of schedule, reducing DPM emissions by 80% and GHG emissions by 17%.

One initiative that helped NWSA achieve these reductions is our Clean Truck Program, which has helped trucking partners replace 440 older, polluting trucks with newer models that meet higher emissions standards. Today all drayage trucks entering NWSA international container terminals are required to have model-year 2007 or newer engines. Federal support through the EPA Clean Diesel Program (DERA) and the Congestion Mitigation and Air Quality Improvement Program (CMAQ) were critical to the success of this effort. Given that most of these trucks are owned and operated by immigrant sole proprietors, we were keenly aware of the need to manage the financial burden associated with compliance with port-mandated requirements that exceed state and federal regulations.

The Port of Seattle was also one of the first ports in the country to install shore power at a marine terminal when it opened the Smith Cove Cruise Terminal in 2009. This enables cruise ships to power their ships while at berth with clean hydropower from the City of Seattle's electric grid. Similarly, the Port of Tacoma, our NWSA partner, was also an early adopter of shore power, deploying the technology in 2010 at the cargo terminal serving Totem Trailer Express (TOTE); this was the first use of shore power at a cargo terminal in the Pacific Northwest. Relatedly, the NWSA has successfully helped our tenants replace old, unrated cargo-handling equipment with new Tier 4 diesel and hybrid equivalent versions. State and federal grants have been important to our success in both these areas.

We are also exploring ways to reduce the carbon already in the atmosphere. The Port of Seattle placed native oysters and aquatic plants adjacent to our cruise terminal at Terminal 91. The kelp and eelgrass planted on these 23 acres help sequester carbon from the water into the sediments in what is referred to as our "blue carbon" pilot project. This project also reintroduces our native Olympia oyster and helps restore the marine habitat in a heavily degraded area of Elliott Bay.

However, one of the most significant contributions to meeting our emission reduction targets was a partnership between the port, industry, and state and federal regulators that resulted in the United States exercising its leadership at the IMO. In 2005, the Port of Seattle passed a resolution urging creation of the North American Emission Control Area, which went into full effect in 2015. The resulting improvements in air quality, along with other voluntary and regulatory efforts have allowed us to reduce our DPM emissions by 80% while growing our business.

FUTURE STRATEGIES FOR CARBON REDUCTION

Maritime

We will update the Northwest Ports Clean Air Strategy next year. This will include a range of actions planned to meet our carbon reduction goals. As a result of the significant reduction of sulfur in marine fuels resulting in significant emission reductions to vessels underway, our strategy will focus primarily on electrifying terminals and converting diesel-powered drayage trucks and cargo-handling equipment to electricity or other clean energy sources.

Of the actions we are considering in the short- to medium-term, the NWSA has identified shore power for container ships as the best opportunity for decarbonization. Even with cleaner fuels, ships have the largest engines ever built and there are thousands of people living and working in close proximity to their emissions when at the dock.

We have developed a ten-year plan to introduce shore power at all our international container terminals. Plugging all container ships at NWSA's major terminals into shore power while at dock, rather than burning onboard fuel, would result in emission reductions of nearly 14,000 tons of GHGs annually.

For the cruise business, Port of Seattle is in the design phase of two additional shore power projects: one that will bring shore power to an existing cruise berth and another to build a new, fourth cruise berth that also will be shore power capable. Cruise ships, which can hotel in excess of 5,000 people, have tremendous energy demands. Connecting to shore power will avoid emitting an estimated average of 51 metric tons of CO₂ per call, which last season would have added up to over 10,000 metric tons.

There are also major changes occurring internationally as ship owners are determining which technology to invest in to meet increasingly stringent global air emission requirements. In the near term, the three primary choices are to burn relatively expensive low sulfur fuel, use seawater to "scrub" high sulfur fuel, or to switch to alternatives fuels such as liquefied natural gas (LNG). Puget Sound Energy is in the final permitting stages of completing the construction of an LNG terminal at the Port of Tacoma to serve TOTE Maritime's vessels serving Alaska. While some ferry service has been fully electrified, the use of hybrid technology is being increasingly adopted.

Looking farther into the future, the ports of Seattle and Tacoma are beginning to assess infrastructure needs to support zero emission maritime operations. Tacoma's Electrification Roadmap and the Seattle Waterfront Clean Energy Strategic Plan will forecast the energy demands and infrastructure needs to support electrified terminals, electric cargo handling equipment, drayage trucks, and vessel shore power. In addition, we will investigate strategies for incorporating energy storage, on-site generation, microgrids and other non-traditional methods of energy delivery and management.

Finally, our ports also are supporting the State of Washington's Maritime Blue initiative, which aims to make our state home to the nation's most sustainable maritime industry. As part of that initiative, the Port of Seattle is developing an innovation center at Fishermen's Terminal to bring the best minds to step up to this challenge. We are also funding a maritime innovation accelerator to incentivize such efforts. This is an investment in innovation that we believe will help bring about a new generation of clean maritime technologies while simultaneously promoting the jobs of the future.

HOW CAN THE FEDERAL GOVERNMENT HELP?

The examples I have shared demonstrate that our ports are leading the charge to reduce our environmental impacts. Yet I must admit that when we set goals like this, even if only making a small contribution to the global challenge, the task ahead of us is daunting. We cannot simply flip a switch to decarbonize seaports and airports. Funding is a huge obstacle to faster implementation, and we must also carefully balance our environmental priorities alongside our economic and social responsibilities.

We are operating in a highly competitive atmosphere, meaning that an environmental policy that increases the cost of using our ports can drive business and associated jobs to our competitors who might not be putting an equivalent emphasis on the environment. We are mindful that adopting the wrong environmental policy can put people out of work, while the right policy can not only preserve jobs, but could also create new, green jobs and make our ports the gateway of choice for those businesses seeking to reduce their carbon footprint, which enables them to market to their customers.

In addition, maritime and aviation transportation systems and global supply chains are complex, and our authority to manage them is limited, even within the boundaries of our own properties. Much of what we have achieved and want to achieve relies on incentives and partnerships with the private sector. For them, they are facing technologies that are not yet available or are far from being cost competitive with traditional options. Even when they are available, they may require massive investment that doesn't have a clear or near-term economic return.

And of course, the price disparity between traditional fuels and renewables is a fundamental barrier. Until renewable fuel costs are competitive with traditional fuels, we will be fighting an uphill battle. That is why support from the federal government will be needed to help us overcome these challenges and meet our carbon emissions targets. I recommend this committee explore the following actions:

1. Support airports' efforts to transition to sustainable aviation fuels

At the federal level, we have five requests that we believe can help us achieve this goal:

- Ensuring FAA approval for airports to use airport revenue and federal grant funding (such as the FAA VALE grant program) to support the air quality and carbon reduction benefits of fuel switching;
- Better leveraging of the U.S. Department of Defense (DOD) as a key partner in SAF research and implementation, especially in terms of creating market demand; we have begun this process, working with our congressional delegation to begin a study as part of this year's National Defense Authorization Act
- New and expanded federal funding for research on SAF, through the US Departments of Agriculture and Energy as well as DOD and FAA;
- Federal incentives for SAF feedstock production & processing for a range of options, from municipal waste to woody biomass to oilseeds; and
- Federal incentives for construction or conversion of fuel production facilities for SAF.

2. Create new federal programs to support electrification and other clean energy solutions for seaport operations

We have seen firsthand how federal funding directly translates into reduced emissions. Funding from Environmental Protection Agency's Clean Diesel Program (DERA) and the Department of Transportation's Congestion Mitigation and Air Quality Improvement Program (CMAQ) has enabled our port to transition to cleaner cargo handling equipment and trucks sooner. The ports contributed our own funds to our clean truck incentive program, but an even greater amount came from CMAQ and DERA. It is important that Congress continues to authorize and fully fund these grant programs.

Given the challenges of transitioning to zero carbon, federal support on an even greater scale will be needed in the future. The Department of Energy (DOE) has helped develop many technical solutions for other sectors that could be applied to the aviation and maritime sectors. A concerted effort would dramatically accelerate progress toward decarbonization. Specific areas where DOE support would be helpful include:

- Shore power: Funding for infrastructure and management of electric grids, including research into better load management tools and standardization of marine terminal connections to vessels;
- Cargo handling equipment: Funding for pilot programs that facilitate deployment of electrified cargo handling equipment like forklifts, top picks and yard tractors;
- Trucks: Funding for development, demonstration and deployment of new technologies to support conversion of heavy-duty trucks to electric, hydrogen or other clean power sources; and
- Investigations and infrastructure support to other potential solutions to seaport electrification, such as energy storage to rationalize variable demand, optimization of energy efficiency solutions, battery barges for mobile charging, creating "green" hydrogen for vessels, exploration of microgrids to supply maritime operations, and grid facing management.
- Washington state is home to the nation's largest ferry system. Unlike cargo ships, ferries remain in regions of high population density. As publicly owned vessels that are part of the National Highway System, they are particularly suited for federal support to match the funding the state has already allocated to power the fleet with hybrid engines. Prioritizing within the Ferry Boat Program at USDOT the electrification of vessels and the deployment of shore power at dock will benefit the transition to all-electric operations of ferry systems nationwide.

3. Federal programs should expand eligibility for environmental elements of infrastructure projects

Increasingly, government regulations, community expectations and customer demands require that we build infrastructure in a more resilient and environmentally friendly fashion. This increases costs considerably. Federal infrastructure programs, including the INFRA Grants program, BUILD Transportation Discretionary Grant program, and Port Infrastructure Development Program, should recognize this reality and embrace a triple bottom line approach by making the environmental features of a project fully eligible for government funding and competitive under grant criteria.

4. Continued federal investment in traditional infrastructure will help achieve emissions reductions

Modernizing our nation's congested, aging transportation infrastructure involves a substantial investment that will require federal support. In addition to helping the economy, transportation infrastructure projects can also pay environmental dividend. For example, grade separations and

other freight mobility projects reduce emissions associated with congestion. Channel deepening and marine terminal projects that allow us to accommodate larger vessels reduce emissions too. These newer vessels are greener than the last generation of vessels, and they enable the same amount of cargo to be carried by fewer ships.

5. Harmonize federal and global approaches to decarbonization of ocean-going vessel transit

Great strides have been made in reducing air emissions from ocean-going vessels through the North American Emissions Control Area and International Maritime Organization (IMO) regulations mandating the use of low sulfur fuels. However, rather than uniformly adopting the use of low sulfur fuels, which would help bring down the price differential with cheaper heavy fuel oil, some ship owners have opted to utilize a variety of different technologies to “scrub” the sulfur from the cheaper fuel, often resulting in polluted marine discharges. Not all nations allow these technologies to be operated in their waters. Supporting the adoption of cleaner fuels would improve international uniformity and bring down the cost to shippers.

The IMO is now focused on reducing the industry’s greenhouse gas emissions. Achieving this goal will require development of alternatives to the use of fossil fuels to power ocean-going vessels. Governments can expedite the transition by funding research, pilot programs and other incentives. Yet regulation will be part of the mix as well. Even if the U.S. declines to consider new regulations on emissions from ocean-going vessels, the rest of the world already is moving in this direction.

It is in our economic best interest to participate in the conversation and harmonize our nation’s approach with those at the global and North American level. Especially when it comes to our North American neighbors, having disparate legal and regulatory regimes is not good for our business, and I can give you examples of how this has put our ports at a competitive disadvantage to our competitors in Canada in the past. In addition, federal disengagement might invite more localized regulatory efforts that create a patchwork of regulations and that do not match the realities of our industries.

THE OPPORTUNITY

The Port of Seattle and NWSA know that climate change is real and already here; ports are on the front lines of experiencing how rising water levels, more extreme weather patterns and changes in water quality are impacting our core abilities to operate our business lines reliably and predictably. Ensuring climate resiliency alone will have huge, multi-billion-dollar costs to our port authority.

But let me end on a hopeful and positive note. The costs and urgency of climate change are also creating incredible opportunities for innovation and job creation. Through our Washington Maritime Blue effort, we’re positioning our state to capture a growing portion of the global maritime economy that is expected to reach \$3 trillion by 2030.

Or take sustainable aviation fuels, where we see incredible potential for true statewide benefit. SAF is creating research opportunities at Washington State University and the Pacific Northwest National Labs in Eastern Washington; providing jobs and revenue to farmers, foresters and feedstock producers in Eastern Washington and Eastern Oregon; supporting the transition of our refineries in Northwest Washington; spurring the creation of new production facilities like those underway in South Puget Sound and Eastern Oregon; and then benefitting the Puget Sound economy surrounding our airport.

Decarbonization of the transportation sector is a big, audacious, but necessary goal. It will take investment, creative thinking, strong policy direction and willing participation from public, private and nonprofit partners. However, the benefits are not only significant but also widespread: a cleaner environment, jobs of the future, and technological change that will help us accommodate growing travel demand in a sustainable way. The Port of Seattle and The Northwest Seaport Alliance look forward to working with Congress to achieve these goals. Thank you again for the opportunity to join you today, and I look forward to your questions.

Mr. TONKO. Thank you.

And now we will hear from Mr. Blubaugh for 5 minutes, please. And welcome.

STATEMENT OF TIMOTHY A. BLUBAUGH

Mr. BLUBAUGH. Good morning. Thanks to the committee for having me here today. My name is Tim Blubaugh, and I am with the Truck and Engine Manufacturers Association. I would like to share with you a little bit about our industry, about our successes in reducing both criteria pollution emissions and greenhouse gas emissions, and our investments in zero-emission technology, truck technologies.

EMA is made up of the United States' leading manufacturers of heavy-duty trucks and engines. The products that EMA member companies design and build are not just big cars. The annual sales of heavy trucks in the United States is a small fraction of passenger car sales, yet they come in an extremely wide variety of sizes and configurations. Commercial vehicles are highly customized for many diverse applications, including parcel delivery vans, pickup and delivery trucks, refuse trucks, construction vehicles, regional freight tractors, and long-haul tractors.

Heavy trucks are purchased by sophisticated business entities as a capital investment—one that must return a profit. A commercial fleet will specify the details of the truck they want the manufacturer to build, so that it will serve the needs of their unique trucking operation with the lowest possible life cycle cost.

For more than 50 years, EMA member companies have worked cooperatively with regulators to dramatically reduce the environmental impacts of our products. The emissions from today's heavy-duty trucks and engines have been reduced by 99 percent from those built 30 years ago. That remarkable success does not happen without enormous capital investment and incredible technological innovation.

The success of those investments and innovations were maximized because the target emission regulations were aligned nationwide and provided the regulatory certainty needed for a level competitive playing field. Key to implementing those regulations, government and industry work collaboratively to update the Nation's diesel fuel supply to ultralow-sulfur diesel for particulate matter filters, and to establish a nationwide retail market for diesel exhaust fluid for NOx aftertreatment systems.

After successfully implementing EPA's near-zero criteria pollutant standards, EMA member companies shifted gears to implementing EPA and DOT's historic heavy-duty greenhouse gas and fuel efficiency rules, and we later collaborated again to develop the more stringent Phase 2 rules that will go into effect in 2021, with further reductions in 2024, and yet more in 2027.

Our industry continues to innovate. We have advocated for EPA to pursue the Cleaner Trucks Initiative announced last year, to both further reduce NOx emissions and to modernize the regulatory program. In doing so, we have cautioned that any additional NOx reductions must not undermine the existing greenhouse gas and fuel efficiency program, or the nationwide regulatory alignment that has consistently existed for the heavy-duty program. The

inherent trade-offs between NOx and greenhouse gas reductions demand that any standard to further reduce NOX emissions must be carefully crafted to avoid undermining the Nation's greenhouse gas emission goals.

EMA members are not just working in the regulatory space. Independent of any regulatory push, and on top of the enormous investments needed to meet the stringent Phase 2 greenhouse gas standards, our members are investing billions of dollars to develop zero-emission powertrains and trucks. However, converting a commercial fleet to battery-electric technology is nothing like convincing a consumer to purchase a zero-emission passenger car. Attractive styling or effective marketing will not persuade the trucking fleet's business managers, who are forced to operate on razor-thin profit margins, that battery-electric trucks make financial sense.

Converting the commercial vehicle marketplace to zero emission will require a coordinated effort by government, industry, and other stakeholders. Not only must manufacturers find the resources to develop the battery-electric technology for low-volume sales in a wide variety of vehicle configurations, but fleets need to adapt their entire trucking operations to such paradigm-shifting technology. Fleets may need to adjust truck routes, utilization, maintenance, and other practices; and they will need to invest in training, new maintenance facilities, and new parts inventories. Most importantly, fleets must invest in developing the infrastructure needed to charge the trucks.

The transformation that the commercial vehicle industry went through to convert to ultralow-sulfur diesel and to establish the nationwide availability of diesel exhaust fluid was challenging, but it pales in comparison to the enormous challenge of converting the industry to battery-electric trucks and establishing the infrastructure needed to charge them.

Our members are proud of what they have accomplished in implementing stringent emission standards. And we embrace future challenges. We look forward to continuing to supply the trucking industry with the products they need to cost-effectively and efficiently move freight, while balancing the need to minimize impacts on the environment. While we work to increase the acceptability and deployment of zero-emission commercial vehicles, we also caution that there will be unprecedented challenges. Success will require time, enormous investment, cooperative efforts by all stakeholders, and, ultimately, marketplace acceptance.

Thank you.

[The prepared statement of Mr. Blubaugh follows:]

**U.S. House of Representatives Committee on Energy and Commerce
Subcommittee on Environment and Climate Change**

**Hearing on Building a 100 Percent Clean Economy:
Solutions for Planes, Trains and Everything Beyond Automobiles**

**Testimony of Timothy A. Blubaugh, Executive Vice President,
Truck and Engine Manufacturers Association**

October 23, 2019

Thanks to the subcommittee for having me here today. My name is Tim Blubaugh, and I am with the Truck and Engine Manufacturers Association. I would like to share with you a little bit about our industry, our successes in reducing both criteria pollutant and greenhouse gas emissions, and our investments to develop zero-emission truck technologies.

EMA is made up of the United States' leading manufacturers of heavy-duty trucks and engines. The products EMA member companies design and build are not just big cars. The annual sales of heavy trucks in the United States is a small fraction of passenger car sales, yet they come in an extremely wide variety of sizes and configurations. Commercial vehicles are highly customized for many diverse applications, including: parcel delivery vans, pickup and delivery trucks, refuse trucks, construction vehicles, regional freight tractors, and long-haul tractors. Heavy trucks are purchased by sophisticated business entities as a capital investment – one that must return a profit. A commercial fleet will specify the details of the truck they want the manufacturer to build, so that it will serve the needs of their unique trucking operation with the lowest possible life-cycle cost.

For more than fifty years, EMA member companies have worked cooperatively with regulators to dramatically reduce the environmental impacts of their products. The emissions from today's heavy-duty trucks and engines have been reduced by 99 percent from those built thirty years ago. That remarkable success does not happen without enormous capital investment and incredible technological innovation. The success of those investments and innovations were maximized because the target emission regulations were aligned nationwide and provided the regulatory certainty needed for a level competitive playing field. Key to implementing the regulations, government and industry worked collaboratively to update the nation's diesel fuel supply to ultra-low sulfur diesel (for particulate matter filters) and to establish a nationwide retail market for diesel exhaust fluid (for NO_x aftertreatment systems).

After successfully implementing EPA's near-zero criteria pollutant emission standards, EMA member companies shifted gears to implementing EPA and DOT's historic heavy-duty greenhouse gas and fuel efficiency rules, and we later collaborated again to develop the more stringent Phase 2 rules that will go into effect in 2021 -- with further reductions in 2024, and yet more in 2027.

Our industry continues to innovate. We have advocated for EPA to pursue the Cleaner Trucks Initiative announced last year, to both further reduce NO_x emissions and to modernize

the regulatory program. In doing so, we have cautioned that any additional NO_x reductions must not undermine the existing greenhouse gas and fuel efficiency program, or the nationwide regulatory alignment that has consistently existed for the heavy-duty program. The inherent trade-offs between NO_x and greenhouse gas reductions demand that any standard to further reduce NO_x emissions must be carefully crafted to avoid undermining the nation's greenhouse gas emission goals.

EMA members are not just working in the regulatory space. Independent of any regulatory push, and on top of the enormous investments needed to meet the stringent Phase 2 greenhouse gas standards, our members are investing billions of dollars to develop zero-emission powertrains and trucks. However, converting a commercial fleet to battery-electric technology is nothing like convincing a consumer to purchase a zero-emission passenger car. Attractive styling or effective marketing will not persuade a trucking fleet's business managers (who are forced to operate on razor thin profit margins) that battery-electric trucks make financial sense.

Converting the commercial vehicle marketplace to zero-emission will require a coordinated effort by government, industry and other stakeholders. Not only must manufacturers find the resources to develop battery-electric technology for low-volume sales in a wide variety of vehicle configurations, but fleets will need to adapt their entire trucking operations to such paradigm-shifting new technology. Fleets may need to adjust truck routes, utilization, maintenance, and other practices; and they will need to invest in training, new maintenance facilities, and new parts inventories. Most importantly, fleets must invest in developing the infrastructure needed to charge the trucks. The transformation that the commercial vehicle industry went through to convert to ultra-low sulfur diesel fuel, and to establish the nationwide availability of diesel exhaust fluid, were challenging; but they pale in comparison to the enormous challenge of converting the industry to battery-electric trucks and establishing the infrastructure needed to charge them.

Our members are proud of what they've accomplished in implementing stringent emission standards -- and we embrace future challenges. We look forward to continuing to supply the trucking industry with the products they need to cost-effectively and efficiently move freight, while balancing the need to minimize impacts on the environment. While we work to increase the acceptability and deployment of zero-emission commercial vehicles, we also caution that there will be unprecedented challenges. Success will require time, enormous investment, cooperative efforts by all stakeholders, and, ultimately, marketplace acceptance.

Thank you. I will be happy to answer any questions.

Mr. TONKO. Thank you.

And now we will move to Dr. Eckerle. You are recognized for 5 minutes, please.

STATEMENT OF WAYNE ECKERLE, Ph.D.

Dr. ECKERLE. Thank you. Chairman Pallone, Ranking Member Walden, Chairman Tonko, Ranking Member Shimkus, and members of the committee, thank you for inviting me here today. My name is Wayne Eckerle, and I have been doing research and technology for 43 years, 30 years at Cummins. Sustaining a vibrant economy while preserving the planet for generations to come is a challenge of our time. Cummins and I, personally, have set an aim to meet that challenge.

Cummins celebrated its 100th anniversary this year. Over this 100-year period, Cummins has primarily supplied power to its customers with internal combustion engines. Today there are more than 15 million engines in use by our customers, primarily running on diesel, but also natural gas, renewable natural gas, and biofuels.

Over the past three decades, we have improved efficiency of our diesel engines by 80 percent and have reduced our NOx and particulate emissions by 99 percent. We commend the committee's commitment to facilitate the transition of the U.S. economy to net-zero greenhouse gas pollution by 2050. We also recognize that sectors that Cummins supplies significantly contribute to emissions. And we commit to doing our part to address climate change and air quality, and have adopted science-based climate goals.

We look forward to joining forces in innovating with the broader energy community towards a comprehensive solution by decarbonizing our primary energy sources.

So, what does the path forward to carbon neutrality look like? There has to be a multifaceted approach using multiple technologies. I see internal combustion engines continuing to play an important role to meet this goal. Cummins will continue to grow and apply our power train and vehicle system expertise to optimize power trains and systems of vehicles through connectivity and automation to generate greater energy and fuel efficiency.

Cummins is also investing to enable its engines to use fuel sources that would otherwise be considered waste products, delivering robust power with fuels like landfill gas and digester gases.

To reach the goal of a 100 percent carbon-neutral power supply, the energy source for the internal combustion engine must also be carbon neutral. To that end, Cummins is partnering with the Department of Energy National Labs and other companies to create the decarbonized energy sources needed to operate internal combustion engines in a 100 percent clean economy.

In addition to continuing to innovate on our engine technology, Cummins is putting more focus on battery and fuel cell-powered electric power trains. We are investing heavily in power train electrification through our research and development, and through our recent purchase of several battery and fuel cell companies.

For instance, we are the number-one global provider of hydrogen fuel cells for locomotives. We clearly see batteries and fuel cells as part of our portfolio of solutions to meet a carbon-neutral future. Factors like infrastructure, electricity source, geographic region,

and power needs will often help determine which solution works in a given situation. But to be clear, an electric vehicle is not a zero-emissions vehicle unless electricity is generated from a power plant that also has zero emissions.

Policies need to incentivize low or carbon-neutral technologies to help us reach our goal, otherwise cost will remain a nearly insurmountable barrier. Customers want payback, period—payback on their initial technology investment within a short window of time. Today, without subsidies, the electric powertrains cannot compete on cost with internal combustion engines.

Cummins' continued investment in infrastructure for alternative fuels like natural gas and hydrogen fueling can help deploy these technologies faster. From a policy standpoint, in order to reach a carbon-neutral future and get there effectively and successfully, we need three things:

One, we need government investment in R&D and infrastructure.

Two, we need policies that support the goal and enable us to develop the technologies to get there.

And three, we need national regulations that are uniform, predictable, and enforceable so we can continue to invest in these technologies to meet the national goals.

In conclusion, the heavy-duty vehicle industry is undergoing significant change, and Cummins is leading the way. Of all the challenges that I have personally faced, this is by far the most difficult one. However, I also did not think 43 years ago that we would have been able to reduce emissions in a diesel engine by 99 percent. Because of this past success and the American spirit of innovation and ingenuity, I am confident that, if the right policies are put in place and if the Government and business really do work together, we can develop the technologies to attain this goal.

Thank you for having me here today.

[The prepared statement of Dr. Eckerle follows:]

**Written Statement of Dr. Wayne Eckerle
Vice President, Global Research and Technology, Cummins Inc.**

**Hearing- Building a 100 Percent Clean Economy: Solutions for Planes, Trains and
Everything Beyond Automobiles**

**U.S. House of Representatives Energy and Commerce Committee
Subcommittee on Environment and Climate Change
October 23, 2019**

Chairman Pallone, Ranking Member Walden, Chairman Tonko, Ranking Member Shimkus and members of the Committee, thank you for inviting me here today and for your interest in clean technologies for heavy-duty vehicles. My name is Wayne Eckerle, and I am Cummins Vice President of Global Research and Technology. Cummins has always been committed to improving technology in our industry, and I believe that sustaining a vibrant economy while preserving the planet for generations to come is the challenge of our time. Increasingly, customers are demanding not just dependable power at a fair price, but power emitting fewer greenhouse gases that contribute to climate change. My role at Cummins is to develop technology options to help us meet this growing demand. Today, I'd like to tell you how we got here, and how we're innovating for a healthier, cleaner and more sustainable environment for the future.

Cummins Inc.

Cummins Inc. was founded and is headquartered in Columbus, Indiana. We are celebrating our centennial having become the largest independent producer of power solutions in the world, with a legacy of constant technological innovation.

Cummins diesel and natural gas engines and hybrid and electric platforms are in a wide range of applications including small pickup trucks, tractor-trailers that move goods across the country, delivery trucks, as well as transit and school buses. You will also find our products in refuse trucks, mining equipment, oil-and gas operations, passenger trains and tug boats. We produce power generation equipment in a wide range of applications from mobile power systems that support our military to critical backup power systems that keep data centers and hospitals up and running 24 hours a day, seven days a week. National Landmarks that many Americans see every day, like Wrigley Field and the Statue of Liberty, also rely on Cummins for their backup power needs.

Simply put, our products need to be dependable and reliable to do their job, whether that is hauling critical goods across the country, or delivering our children to school. They also need to work hard, be capable of carrying very heavy loads, and performing in extreme conditions so our customers can get their work done.

We have more than 62,000 employees globally and operate in over 190 countries throughout the world. In the United States, we have manufacturing facilities in Indiana, Minnesota, New York, North Carolina, South Carolina, Tennessee, Wisconsin, California and Oregon. In addition to our manufacturing operations in the United States, we also own all our distributor branches with locations in almost every state.

Most importantly, we manufacture a broad range of powertrain products designed to operate on clean diesel, natural gas, battery powered electricity, hydrogen fuel cells or other alternative fuels. This growing energy diversity in our product line, and the inevitable transition to decarbonized primary energy sources that are renewable, carbon-free, or carbon neutral will enable our products to be an integral part of addressing climate change.

Cummins has long acknowledged that our company is only as strong as the health of our communities. For the past two decades, Cummins has embraced tough environmental standards and used our technological expertise and innovation to drive our business and improve communities, taking a leadership role in our industry for our positions on emissions and sustainability. In 2006, we set our first facility energy and greenhouse gas goal and joined the U.S. EPA Climate Leaders program – firmly stating our commitment to address climate change. In 2009, Cummins technical and policy leaders wrote a white paper for the National Academy of Sciences addressing the regulation of greenhouse gases in commercial vehicles that served as an important reference for regulators. In November 2018, EPA announced the Cleaner Trucks Initiative (CTI), which will include a future rulemaking to establish updated standards to address NOx emissions from on-highway heavy-duty trucks and engines. We strongly support this initiative.

After 100 years in business, Cummins looks to the future with a simple message: “Challenge the impossible.” It is in this spirit that we look forward to working with all stakeholders to find solutions for power needs in a changing world.

The future of power requires a multi-faceted strategy. Our customers need the right vehicles and equipment to do their work. The integrated power solutions must be reliable, efficient, flexible and sustainable to meet the evolving demands for powering our communities and the infrastructure and equipment that shape our world. They also must comply with stringent emission regulations, help address climate change and be part of the solution for the energy and environmental challenges facing the planet.

To deliver on our promise of powering a more prosperous world, both economic growth and environmental sustainability must be achieved. That is why we advocate for policies, laws and regulations that enable the power of choice, recognizing that there is not a one-size fits all solution for every challenge. Our strategy for reducing the greenhouse gas impact of our products is to continue an intense focus on research and development to provide substitute technologies in applications where they work well, and to reduce greenhouse gases by improving the fuel economy of products in applications without substitute technologies.

We commend the Committee’s commitment to facilitate the transition of the U.S. economy to net zero greenhouse gas pollution by 2050 and engaging our feedback as a stakeholder. In fact, we recognize that the sectors powered by Cummins products contribute significantly to these

emissions, and we commit to doing our part to address climate change and improve air quality. This year we are releasing our next companywide sustainability plan including science-based climate goals. Doing our part to address climate change and air emissions is part of our company's mission to power a more prosperous world. We look forward to joining forces and innovating with the broader energy community toward a comprehensive solution by decarbonizing our primary energy sources.

Internal Combustion Engines

While Cummins is proud to offer a variety of alternative technologies, we believe that internal combustion engines will need to continue to provide clean reliable power in the coming years to many applications that require the power density and operational range that only internal combustion can provide. For that reason, we remain committed to making our internal combustion engines as fuel efficient as possible. We also continue to grow and apply our powertrain and vehicle system expertise to optimize powertrains and systems of vehicles through connectivity and automation. These are all critical to delivering the most freight movement per unit of energy consumed.

Commercial trucks haul as much as 80% of the goods transported in the country. Although they only make up 4% of vehicles on the road, they use about 20% of the fuel consumed due to the large amount of work they do and the mass they carry. Increasing these vehicles' efficiency will benefit our economy, but more importantly, it can significantly reduce the carbon emitted from internal combustion engines.

In many instances, it is possible to use a technology to substitute for diesel, but in some applications, the best path forward is to focus on making diesel as clean and efficient as possible. This decade, the 4.9 million new-technology diesel trucks on America's roads have avoided producing more than 26 million metric tons of NOx and 59 million metric tons of carbon dioxide. Currently, across the United States, more than 36% of all registered commercial trucks, classes 3-8, are of the newest near-zero generation diesels, and that number grows each year.

We are not done innovating to make diesel engines cleaner and more efficient. Truck and engine manufacturers like Cummins and other stakeholders are hard at work to develop products that meet EPA and NHTSA's Phase 2 Greenhouse Gas Standards for commercial vehicles. When fully implemented those standards will lower CO₂ emissions by approximately 1.1 billion metric tons, save vehicle owners fuel costs of about \$170 billion, and reduce oil consumption by up to two billion barrels over the lifetime of the vehicles sold under the program. As mentioned above, we are also actively working with EPA, CARB and other stakeholder to take near-zero emissions diesel engines closer to zero through a new engine standard for NOx.

Where infrastructure exists or can be expanded, natural gas is a mature, reliable solution available today for internal combustion engines that can reduce CO₂ emissions, NOx, and particulate matter. Renewable natural gas expands on these benefits and can reduce some of the fugitive methane emissions associated with fossil natural gas production and processing.

Cummins is also investing in enabling its engines to use fuel sources that would otherwise be considered waste products, delivering robust power even with fuels like landfill and digester gases. Capturing landfill gas or biogas for processing into fuel suitable for vehicles or generator sets has significant benefits. Biomethane – obtained by purifying biogas – that is used as fuel in

place of fossil fuels effectively produces less GHG than the fuel it replaced. Biogas can provide a clean, easily controlled source of renewable energy from organic waste materials, replacing fossil fuels with a sustainable carbon neutral fuel option, while can reducing external fossil fuel dependence and promoting energy security.

Internal combustion engines can continue to play a role in a 100 percent clean economy only if the energy source, on a life cycle basis, is carbon neutral. While the innovations discussed above are forming an excellent bridge to the ultimate goal of a carbon neutral product, Cummins is actively partnering with the DOE National Labs to create the decarbonized energy sources needed to operate internal combustion engines in a 100 percent clean economy.

Beyond Internal Combustion Engines

In addition to continuing to innovate on our internal combustion engine technology, Cummins is putting more focus on battery and fuel cell powered electric power trains. Factors like infrastructure, electricity source, geographic region and power needs will often help determine which solution works in a given situation.

Cummins has greatly expanded our technical capability with battery-electric technology offering electrified powertrains for school bus, transit bus and truck applications. Designing and manufacturing battery modules, packs and systems for commercial, industrial and material handling - with a view to supporting all the segments where Cummins traditionally operates today. Cummins can use a range of cell chemistries suitable for pure electric, hybrid and plug-in hybrid applications. On the road to net-zero carbon by 2050, generating electricity from renewable or low-carbon sources to charge these batteries will be necessary to help reduce the well-to-wheels emissions associated with battery-electric powered vehicles.

Applications that require significant power density may fare better with a Proton Exchange Membrane (PEM) fuel cell solution to meet both their environmental and power needs. In fact, right now Cummins is the largest provider of PEM fuel-cell powered locomotives in the world. PEM fuel cells generate electricity through a chemical reaction of hydrogen and oxygen. Hydrogen gas is passed through a fuel cell stack, where the pure hydrogen mixes with atmospheric oxygen to generate electricity, which is used to create electric power. Cummins is investing in PEM fuel cells as well as electrolyzer technology that produces hydrogen to provide a seamless start-to-finish solution to customers. Hydrogen fuel cell power offers performance with no sacrifice in power and absolutely no operating emissions. Hydrogen production is an energy-intensive process. Transitioning to a grid powered by renewable energy will be necessary to reach achieve a well-to-wheel zero emissions with hydrogen fuel cell powered vehicles.

Partnering for Success

One way that the trucking industry has been able to advance emissions reduction goals is through public-private partnerships like the 21st Century Truck Partnership and 50/50 cost-shared R&D projects like the Department of Energy (DOE) SuperTruck II program. SuperTruck II promotes the research, development, and demonstration of a suite of engine, powertrain, and vehicle technologies to improve the freight hauling efficiency of heavy-duty Class 8 long-haul vehicles by more than 100 percent by 2020 (versus 2009 vehicles), with applicability of many technologies to heavy-duty regional-haul vehicles, and an emphasis on cost-competitiveness.

SuperTruck II builds off the success of the SuperTruck I project which demonstrated more than 50% engine brake thermal efficiency, and more than a 50% improvement in vehicle freight hauling efficiency. More than half of the SuperTruck I technology is already available in the marketplace and on its way toward a projected daily savings of 7.9 million gallons of diesel fuel per day, when fully adopted and deployed.

These strategic public-private research partnerships and research projects also leverage the technical expertise and resources of our National Labs and ensure that public funding remains focused on the most critical barriers to technology commercialization, thereby accelerating our progress toward these vital national goals.

While we are endeavoring to manufacture the cleanest power sources available today, our efforts are only effective if the market adopts this technology. Cost and infrastructure readiness are the main barriers to adoption of low-emission technologies for commercial vehicles. From an economic standpoint, customers want technology that offers an acceptable return on investment on the order of 1.5-2 years. Adoption of battery and fuel cell powered vehicles will require significant reductions in the cost of batteries and fuel cell stacks. Improvements to charging infrastructure, advances in cell chemistry that allow for increased energy density in combination with fast charging, and greater modularity of battery packs will all help accelerate the adoption of electric and hybrid vehicles. Continued investment in these areas by the Department of Energy can accelerate this development. Additionally, continued investment in infrastructure for alternative fuels like natural gas and hydrogen fueling, and battery charging can help deploy these technologies faster.

Policy Recommendations

In addition to public-private partnerships like SuperTruck, this Committee should consider policy, regulation and markets to inform the development of comprehensive climate legislation. Any legislation should include national-level emissions targets for product-specific applications, regulatory certainty and implementation schedules, and federal investment that reflects product development timeframes.

National-level emissions policy and regulation is important because a patchwork system across states could result in a proliferation of technologies that is unsustainable and inefficient for business and customers. Manufacturers would not be able to leverage the scale available in national markets to ensure lower cost and wider adoption necessary to reduce emissions.

Regulatory certainty is also important for our industry's long development cycles. Maintaining the current fuel efficiency regulations for heavy duty transportation will ensure tough, clear and enforceable standards for commercial vehicles. This will provide certainty for manufacturers and will enable the scale necessary to promote widespread adoption of the latest efficient technology.

Federal investment in research and development, grant programs for adoption and tax incentives should be robust and consistent to help manufacturers plan. Innovation and product development do not happen overnight; policies need to provide certainty for investment cycles required for sustainable innovation in the commercial vehicle industry. A typical product development cycle in the heavy-duty sector can be three years or more, so having visibility to federal design, development and adoption programs can help manufacturers plan their investments wisely.

Cummins innovates to power success, but innovation demands flexibility. Let the technologies compete to determine the winners. Policies should be free of technology-forcing mandates, ensuring manufacturers' ability to provide options that allow communities to make the best choices that will meet their performance and environmental needs. Successful policies should not be prescriptive but should instead focus on desired outcomes allowing flexibility and innovation to meet goals. Continued federal investment in diverse fueling infrastructure and renewable electricity will help with both adoption and well-to-wheels emissions for these new technologies.

Conclusion

The heavy-duty vehicle industry is undergoing significant change, and Cummins is leading the way. Coordinated and targeted policies across numerous sectors are needed to meet our global energy and environmental challenges. Cummins is committed to investing in an energy diverse future where our customers have a broad portfolio of power options – a future that includes clean diesel, natural gas, electrified power, fuel cell technology and alternative fuels – so they can choose what works best for them.

Enacting policies that promote the power of choice for every market will help ensure that this country and every community within it has the proven technology necessary to serve the economy while meeting air quality and climate goals on the path to net-zero emissions.

Appendix

POLICY RECOMMENDATIONS

As the Committee prepares legislation to address the Heavy-Duty industry, clean energy diversity can be addressed and encouraged in the following ways:

1. Funding

Cummins supports robust funding for the Highway Trust Fund (HTF) to ensure dedicated funds for maintaining and improving highway, bridge and transit infrastructure. The following recommendations will ensure energy diversity and parity across all vehicles with a commitment to reliable and consistent funding of the HTF and modernizing the truck fleet with the cleanest, safest available vehicles.

• Policy Recommendations

- Repeal the 100-year-old 12% federal excise tax on Heavy Duty trucks to incentivize new truck purchases which modernize truck fleets.
- Support a mechanism for equal contribution to the HTF by drivers of all vehicles regardless of power source such as a Vehicle Miles Travelled (VMT) tax.
- Encourage greater public-private partnerships by implementing investment tax credits, raising the cap on private activity bonds and increasing flexibility for the TIFIA program for surface transportation projects so public project sponsors and private investors have the fullest possible range of financing options available.
- Congress should authorize Qualified Tax Credit Bonds for surface transportation projects under Section 54A of the tax code.
- Extend tax credits that promote energy efficiency and diversity: the fuel cell vehicle tax credit, alternative fuels tax credit, the alternative fuel refueling infrastructure tax credit, and the energy production tax credit (Secs. 6426, 30B, 30C, 45 and 48).
- Ensure favorable treatment of R&D expenditures in the Internal Revenue Code (IRC), including a robust R&D Tax Credit and a fair and efficient system of cost recovery for R&D expenses.

2. Innovation

Leadership in innovation is one of the most important factors for the future of US manufacturing. Innovation makes the country and its businesses more productive, dynamic and competitive. At Cummins, innovation is ingrained in our culture, mission, vision and values. Our commitment to innovation dates back a century, to when Clessie Cummins first applied inventive ideas to improvements that advanced the diesel engine. These recommendations seek to increase support for foundational R&D and position America to compete and thrive globally in the innovation race and pursue innovation inclusively.

• Policy Recommendations

- Funding for ARPA-E, EERE, and specifically the DOE's Sustainable Transportation group of Technology Offices (Vehicle Technologies Office, Fuel Cell Technologies Office, and Bioenergy Technologies Office), is invaluable to the goal of decarbonizing our transportation system and should be increased and set to grow at 4 percent per year adjusted for inflation, reversing nearly a decade of decline.
- Support the Fueling America's Security and Transportation (FAST) with Electricity Act to provide a 30% federal tax credit for electric transportation options beyond passenger cars; provide a 30% federal tax credit for recharging and refueling stations and provide loan guarantees to support capital investments in associated domestic manufacturing capacity.

3. Transit and Passenger Rail

Investing in US transportation infrastructure can greatly improve the efficacy and use of public transit and passenger rail. This investment can encourage ridership, promote ease of access and make regional mass transit more sustainable for communities and the environment. Increasing public funding for bus,

commuter and passenger rail systems will release private investments to expand capacity, reduce highway congestion, link rural and suburban communities safely and mitigate the impacts to our environment.

- **Policy Recommendations:**

- Provide predictable, dedicated and sustainable funding for capital investment in bus, commuter and passenger rail systems.
- Include a Phase II of the Alternative Fuel Corridors (AFC) program which supports infrastructure for alternatives to gasoline like natural gas and hydrogen powered vehicles.
 - Include Diesel Exhaust Fluid as a component of AFCs at rail yards to increase adoption of EPA Tier 4 clean locomotives.
 - Provide matching funds to states for installation of clean re-fueling infrastructure along 10 major AFC's annually through 2030.
- Reauthorize the Diesel Emissions Reduction Act (DERA).

Mr. TONKO. Thank you very much.

And then, finally, we will go to Mr. Martinez for 5 minutes, please. And, welcome also.

STATEMENT OF ADRIAN MARTINEZ

Mr. MARTINEZ. Good morning, Chairman and members of the committee. My name is Adrian Martinez, and I am a staff attorney for Earthjustice. Earthjustice is a nonprofit legal organization. And I work out of the Los Angeles office. I have been working on smog pollution for the last 15 years in the Nation's smog capital. And while this has provided great job security, because we have a lot of smog in Los Angeles, it also has shown that we need to move to zero emissions.

I am part of the Right to Zero campaign. And essentially what—the Right to Zero campaign was based out of our air quality work in California. And, in looking at how do we get to meet clean air standards, we looked at all the emissions sources, we kind of look at what regulations were on the books in California and federally, and what else we needed to do. And we came to one conclusion. We came to the conclusion that we need to move to zero emissions in our transportation sector, in our energy sector, and in our buildings, and then eventually in our industrial processes.

And we came to that conclusion for many reasons. But when we look at the amount of air pollution that come from all these sources, there is just this incremental approach of slowly cleaning up engines was not going to work.

In summary, kind of our solution is when we look at our best climate strategy in a place like Los Angeles, the best solution is to actually solve our air quality problems. And the main reason is, to solve our air quality problems we need to move to zero emissions.

The first point I want to make today is that this area is moving very fast. This morning I saw two electric buses on the streets of Washington, DC. Three, even four years ago there would be zero, and I would have never thought I would see an electric bus on the street. We are seeing movement in the trucking sector, in the locomotive sector, and all these sectors. So, I am going to start with transit buses.

On the transit bus sector, this is one area on the larger vehicles where we have seen a lot of progress. There are more than 2,000 buses on the roads or on order in North America. And this is a dramatic increase from years prior. The ways that the Federal Government can continue to support this, we need to continue to support transit agencies purchasing these vehicles. We need to encourage development of large-scale infrastructure to charge. It is one thing to charge one to five buses, it is another thing if you are a large fleet like Los Angeles Metro that needs to charge hundreds of buses at a depot at a time.

This is an area where we are going to learn a lot of information. We like to focus on public agencies because, as they are figuring out charging and how to operate larger vehicles, this is information that can be transferred to private industry too.

Second point, second sector I would like to focus on, is school buses. This is an area we are seeing a lot of progress nationally. There is a lot of interest in how do we transport our children to

school in a zero-emission way. School districts need a lot of support for buses in general, but moving to electric school buses is a critical area.

The one positive of school buses is, because of their operational profile where they are operating for very limited times of the day, and then some are even dormant during the summer, they could provide an additional greater resources for energy utilities. We are seeing energy utilities even as close as Virginia get into this, the game of electric buses, because they see it as a way to deploy electricity in a flexible manner.

I want to focus on refuse trucks. We are starting to see more on electric refuse trucks nationally, and we are seeing it all over the country from New York to Carson, California, to Ada County, Idaho. We are starting to see deployments of electric refuse trucks. These are electric vehicles that inherently are popular. Whenever we talk to people about the potential for a quieter refuse truck, they are very excited in their neighborhoods.

I want to close to talk about ports. One of the areas where we spend a lot of time focusing are on our ports. Los Angeles and Long Beach have the two busiest ports in the Nation, and these are some of the areas most impacted by air pollution in the region. The ports provide an important opportunity for advancing zero emissions. Mayor Garcetti of Los Angeles and Mayor Garcia of Long Beach have committed to achieving 100 percent zero emissions in cargo handling equipment and drayage trucks by 2030 and 2035, respectively. We are starting to see a lot of technology deployments.

The Port of Los Angeles just deployed a top pick that is 100 percent zero emissions. And just for context, this has a 1 megawatt battery, so it is a big piece of infrastructure.

Infrastructure is key, and this is a place where this committee and the Federal Government can play a big role.

[The prepared statement of Mr. Martinez follows:]

TESTIMONY OF ADRIAN MARTINEZ
STAFF ATTORNEY, EARTHJUSTICE

HEARING "BUILDING A 100 PERCENT CLEAN ECONOMY: SOLUTIONS FOR PLANES, TRAINS AND
EVERYTHING BEYOND AUTOMOBILES" BEFORE THE SUBCOMMITTEE ON ENVIRONMENT AND
CLIMATE CHANGE, ENERGY AND COMMERCE COMMITTEE
U.S. HOUSE OF REPRESENTATIVES

October 23, 2019

Thank you, Mr. Chairman and members of the Committee for the opportunity to testify today. My name is Adrian Martinez, and I am a staff attorney for Earthjustice. Earthjustice is a nonprofit environmental law organization. We wield the power of the law and the strength of partnership to protect people's health; to preserve magnificent places and wildlife; to advance clean energy; and to combat climate change. I work out of Earthjustice's Los Angeles office on the Right to Zero campaign. The Right to Zero campaign seeks to transform the way we use energy and transport goods, services, and ourselves across California. From our power grid to ports to buses to garbage trucks, the Right to Zero program works with our partners to the shift California to zero-emissions.

I have spent the last fifteen years working on smog pollution issues in Los Angeles. And while being a smog lawyer and advocate in Los Angeles may provide incredible job security, it has been a frustrating experience knowing that each year thousands of people die prematurely from air pollution and thousands of children, elderly, and adults get sick simply from the simple act of breathing. It has also been frustrating as climate change has made it harder to meet federal and state clean air standards in the region. This journey working on the intractable issue of air pollution in the nation's smoggiest area has led me to one conclusion: A rapid and robust shift to zero-emissions is necessary if we finally want to close the chapter of dirty air in the

nation's smog capital. In fact, moving away from combustion in the parts of the transportation sector discussed today is critical to the success of beating air pollution in many communities throughout the country. Prior incremental approaches of implementing policies of simply cleaner combustion will not solve the air pollution problems in places like Los Angeles, and we should spend significant efforts forging a path towards a zero-emissions future.

While a shift to zero-emissions in the transportation sector is a significant change, we can accomplish this big vision just as the United States has tackled other major challenges. Importantly, this transformation will take a lot of people working hard to achieve a retreat from burning large quantities of fossil fuels in vehicles. From the electric truck manufacturing facility of the nation's largest truck maker outside of Portland, Oregon, to the worker installing charging infrastructure for electric refuse trucks in Ada County, Idaho, to the driver of an electric bus at Alabama A & M University, we have the opportunity to address climate pollution, reduce air pollution, and put people to work in the clean energy economy all across the nation.

I. Emissions from the Transportation Sector Remain a Critical Issue That Must Be Addressed.

Transportation is the largest source of greenhouse gas emissions in the United States.¹ And while light duty vehicles (i.e. cars) represent the largest source of greenhouse gas emissions within the transportation sector at 59%, other types of vehicles represent a large portion of transportation emissions with medium- and heavy-duty trucks representing 23% of transportation-related greenhouse gas emissions, aircraft representing 9%, rail representing

¹ EPA, *Fast Facts on Transportation Greenhouse Gas Emissions*, available at <https://www.epa.gov/greenvehicles/fast-facts-transportation-greenhouse-gas-emissions>.

2%, and ships and boats representing 3%.² As such, reducing transportation greenhouse gas emissions requires moving to zero-emissions in vehicles beyond just cars.

In addition to greenhouse gas emissions, the transportation sector imposes significant traditional air pollutants (i.e. ozone, fine particulates, etc.) on communities throughout the United States. EPA estimates that the transportation sector is responsible for approximately 55% of the Nitrogen Oxides (NOx) – a precursor pollutant that leads to ozone formation – nationally.³ Heavy-duty trucks alone are projected to be responsible for one-third of the transportation NOx emissions nationally despite being a small percentage of vehicles overall.⁴

In the South Coast Air Basin, which is home to the worst ozone pollution in the nation, large vehicles currently comprise a significant portion of the NOx emissions.

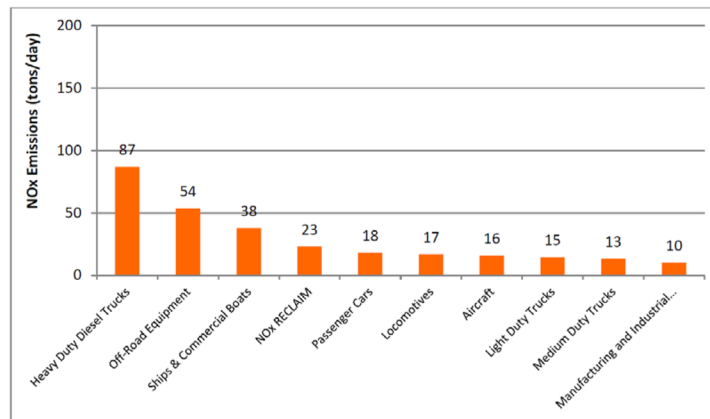


FIGURE 3-14

TOP TEN EMITTER CATEGORIES FOR NOx IN 2019 (SUMMER PLANNING)

² Id.

³ EPA, *Smog, Soot, and Other Air Pollution: Transportation*, available at <https://www.epa.gov/transportation-air-pollution-and-climate-change/smog-soot-and-local-air-pollution>.

⁴ EPA, *News Release*, (Nov. 13, 2018) available at <https://www.epa.gov/newsreleases/epa-acting-administrator-wheeler-launches-cleaner-trucks-initiative>.

*** South Coast Air Quality Management District, *2016 Final Air Quality Management Plan*, at p. 3-33, available at <http://www.aqmd.gov/docs/default-source/clean-air-plans/air-quality-management-plans/2016-air-quality-management-plan/final-2016-aqmp/final2016aqmp.pdf?sfvrsn=15>.

Finally, many of the larger vehicles being discussed today also impose additional localized health threats from emitting vast amounts of diesel exhaust. In 2012, the International Agency for Research on Cancer, a division of the World Health Organization, listed the exhaust emanating from diesel engines as “carcinogenic to humans.”⁵ In addition, California labeled diesel exhaust a toxic air contaminant in 1998.⁶ Many facilities that have a large concentration of diesel vehicles such as ports and railyards impose serious health threats to adjacent communities.

II. A Zero Emissions Future Is Coming, And Government Can Facilitate This Transition.

This last spring in Long Beach, California, at the ACT-Expo, a leading conference and showcase of clean technology in the transportation sector, the President and CEO of Daimler, North America, the largest truck seller in North America, shocked the freight and logistics world with a speech about Daimler’s future. In a blog post after the fact about the experience he posited the following: “This is the beginning of the post-internal combustion engine era for commercial vehicles.”⁷ This is just one of many statements signaling the move away from combustion to a zero-emission future for vehicles like trucks and buses. In addition, we have seen many companies, including some incumbent manufacturers and even newcomers, enter

⁵ IARC, Press Release: Diesel Engine Exhaust is Carcinogenic, (June 12, 2012), available at https://www.iarc.fr/wp-content/uploads/2018/07/pr213_E.pdf.

⁶ See generally, Title 17 California Code of Regulations § 93000.

⁷ Roger Nielson, *The Future is Electric*, (April 24, 2019) available at <https://daimler-trucksnorthamerica.com/company/blog/the-future-is-electric/>.

into the markets for selling zero-emission vehicles. One of the key hurdles to deployment of these vehicles is infrastructure. We need vast quantities of charging and other fueling infrastructure if we want to achieve the necessary zero-emissions future.

The following sections outline some additional details on specific types of equipment where the federal government should be facilitating the movement to zero-emissions.⁸

A. Heavy-Duty Vehicles

Heavy-duty vehicles are prime for electrification. The large fuel used for trucks, buses and other equipment make them a prime place to pursue greenhouse gas and traditional air pollution reductions through zero-emissions technologies.

i. Transit Buses

A key market segment to propel cleaning up the transportation sector in the near-term is the transit bus fleet. We have seen remarkable progress in deployments of zero-emission transit buses over the last five years. Currently, there are either zero-emission buses (electric or fuel cell) in all but five states.⁹ In fact, CALSTART, a vehicle think tank found “[z]ero-emission buses nationally have grown to over 2000 buses on the road or on order, an increase of 36 percent over the last calendar year.”¹⁰ As the number of electric and fuel cell buses increase on the road, we will learn very important information about operating fleets of large vehicles.

⁸ This is not an exhaustive list of the vehicles Earthjustice is working to advance zero-emissions, but rather this testimony highlights some of the best opportunities for advancing zero-emissions in the near term.

⁹ Fred Silver, John Jackson, and Bryan Lee, *Zeroing on ZEBs*, at pp. 5-6 (October 17, 2019), available at https://calstart.org/wp-content/uploads/2019/10/Zeroing_In_on_ZEBs_Final_10182018-10.21.19.pdf.

¹⁰ *Id.* at p. 3.

This committee and the federal government at large could help with the electrification of the bus fleet in several important ways. First, the federal government should continue support for zero-emission buses. Programs to support transit agencies are vital to encourage replenishing bus fleets with the cleanest technologies. Second, the federal government can provide support for transit agencies related to scaling up fueling for zero-emission buses. Fleets are figuring out how to deploy 1 to 5 of these vehicles with somewhat ease. But, as we see fleets of hundreds of electric vehicles needing to charge at a depot, there is significant planning that needs to take place, which could be supported by energy agencies and other agencies at the federal level.

B. School Buses

Significant interest has been expressed in electrifying school buses throughout the nation. This makes sense because the vehicles that transport our children to school should be as clean as possible. One of the most robust zero-emission school bus programs is not too far from here. Dominion Energy announced a major electric school bus program where they will partner with Virginia schools to deploy 50 electric school buses this year and 200 a year for the next five years.¹¹ Con Edison is also partnering with the school district in White Planes to deploy electric school buses.¹²

¹¹ Dominion Energy, *Electric School Buses*, available at <https://www.dominionenergy.com/ourpromise/innovation/electric-school-buses>.

¹² Con Edison, *Electricity from School Bus Batteries Will Support Con Edison Grid Reliability*, (June 19, 2018), available at <https://www.coned.com/en/about-us/media-center/news/20180619/electricity-from-school-bus-batteries-will-support-con-edison-grid-reliability>.

A particularly important place where the federal government can help in the transition to zero-emission school buses is through support for planning by states and utilities on how to increase deployments of electric school buses. In addition to transporting kids to school, electric school buses can be an immensely valuable asset for utilities as a grid resource as we've seen identified in New York and Virginia. As vehicle to grid integration gets better, these school buses can provide a really flexible power supply at times when utilities need additional electrical capacity. Entities like the Department of Energy should identify ways to further support and catalyze this approach. Robust deployments of electric school buses is a win-win for school districts and utilities.

C. Locomotives

In addition to the dire need for EPA to set cleaner locomotive standards beyond Tier IV for locomotives, the railroad industry needs to advance zero-emissions. We have already seen some positive signs in the pursuit of an electric locomotive by Burlington Northern Santa Fe railroad.¹³ The federal government should support and encourage the deployment of zero-emission locomotives with a focus on line haul and switcher locomotives. This strategy will go a long way to bringing clean air to communities who are disproportionately impacted by air pollution.

D. Refuse Trucks

The operational profile - with stop-and-start operations, high idle time, low speeds, defined routes, and trucks that return to the same location to fuel at the end of a shift - is the

¹³ BNSF, *BNSF leads the charge on testing battery-electric locomotive*, (August 7, 2019), available at <https://www.bnsf.com/news-media/railtalk/service/battery-electric-locomotive.html>.

ideal operational profile for electrification. The California Air Resources Board, the agency responsible for mobile source regulation of trucks in California, released a draft Technology Assessment that explained why refuse trucks have the optimal characteristics for truck electrification:

- Defined routes and depots make charging stations simple;
- Urban drive cycles help optimize the use of regenerative braking, which captures energy; and
- Lower average speeds have less power requirements and routes under 100 miles are both optimal to limit the size and weight of the battery.

As the California Air Resources Board explicitly noted, there are “great opportunities for battery electric vehicle penetration [in] urban vehicles ... like transit buses, school buses, and refuse collection vehicles.”¹⁴

We are starting to see more deployments of electric refuse trucks nationally. For example, Ada County Idaho is using some of the VW scandal dollars to replace three diesel refuse trucks with electric refuse trucks.¹⁵ In addition, Palo Alto, California, New York, New York, Chicago, Illinois, Carson, California, and Los Angeles, California, are also seeking to deploy electric refuse trucks or already have electric refuse trucks in service.

¹⁴ California, Draft Technology Assessment: Medium- and Heavy-Duty Battery Electric Trucks and Buses, at p. VII-1, available at https://www.arb.ca.gov/msprog/tech/techreport/bev_tech_report.pdf.

¹⁵ Idaho DEQ, *Volkswagen 2019 Program*, available at <https://www.deq.idaho.gov/media/60183250/vw-app-summary-table.pdf>.

For many neighborhoods, refuse trucks are the largest and most polluting vehicles going through the neighborhood. As such, advancing zero-emission refuse trucks is critical to addressing neighborhood level pollution. In addition, we have experienced many communities excited about electric refuse trucks because they are likely quieter than their combustion counterparts. The federal government should explore how to increase the deployment of zero-emission refuse trucks through supporting planning efforts. Often charging infrastructure given tight spatial constraints in refuse truck depots can pose hurdles to zero-emissions refuse trucks. Cities need planning support and technology support to help achieve the transformation to zero-emission refuse trucks. In addition, the federal government should explore ways to support cities in purchasing zero-emission refuse trucks for sanitation collection.

E. Ports and Cargo Equipment

For too many years communities in the shadow of the freight and logistics industry have suffered the health consequences of the internal combustion engine. While the freight industry brings economic benefits to regions throughout the nation, the trucks, ships and trains that move cargo impose immense health burdens on communities throughout the nation. Our nation's ports provide another key sector that is prime for zero-emissions. There is already precedent of two ports committing to a zero emission future in the San Pedro Bay Ports in California. The Mayors of Long Beach, Robert Garcia, and Los Angeles, Eric Garcetti, created an executive directive in July of 2017 directing the port staff at these twin ports to pursue 100% zero-emission cargo equipment by 2030 and 100% zero-emission drayage trucks by 2035. This ambitious directive should be the norm for ports across the country because of the acute risks these facilities pose on communities.

There is a lot that the federal government can do to support the transition to zero-emission ports. This Committee should work with other legislators and regulators at the Environmental Protection Agency to implement the suggestions recommended by Angelo Logan of the Moving Forward Network during his testimony before the United States House Select Committee on the Climate Crisis delivered on July 16, 2019.¹⁶ In addition, this Committee should explore how agencies like the Department of Energy can be helpful in supporting port authorities and states plan for and deploy charging infrastructure at our ports. While zero-emission cargo equipment and trucks are starting to be deployed at ports, often having a way to charge or fuel this equipment is a big constraint. In addition, there is significant work that can be done to ensure more resiliency at our ports through the deployment of clean energy resources (e.g. battery storage, microgrids, etc.). These are efforts that will not only make our ports safer and better operationally, but much cleaner.

III. Conclusion

I don't come here today to say that the transformation to a truly clean economy will be easy. Rather, I come to state that we can do it, and we need all the levers of government at the federal, state, and local levels to push in the direction of zero-emissions. In particular, the federal government plays a critical role in setting the tone nationally to address vehicle pollution. This committee should continue to support zero-emissions with a particular focus on providing additional resources for planning and deploying larger numbers of vehicles in fleets.

¹⁶ Angelo Logan, *Testimony Before House Select Committee on the Climate Crisis*, (July 16, 2019) available at <https://docs.house.gov/meetings/CN/CN00/20190716/109789/HHRG-116-CN00-Wstate-LoganA-20190716.pdf>.

The vehicles are coming and manufacturers at least initially appear to be up to the challenge of producing zero-emission vehicles. The main impediment that could squelch progress is a lack of infrastructure, which this Committee in concert with others can help alleviate.

Mr. TONKO. Thank you very much.

We will now move to Member questions. I will start by recognizing myself for 5 minutes, and we will go across the panel.

Dr. Wimberger, let me start with you. This morning we have heard a lot of potential solutions, including some that are in the early stages of being deployed. But we also know we are working against the clock to achieve major emissions reductions. With that urgency in mind, what are the most important things the Federal Government can do to ensure these emerging solutions are commercialized at scale?

Dr. WIMBERGER. That is a great question. I think there is a great role for the Federal Government to have technology-neutral fiscal incentives to really drive research and development and early deployment of some of these advanced technologies. There is, we have heard a lot about sort of the expense of the up-front capital costs, and some of the uncertainty that businesses face when thinking about deploying specific technologies. So I think there is a real role for the Federal Government in the near term to see—technology neutral is really important, but to keep fiscal incentives on the table as a really important driver to overcoming some of those market barriers to getting technologies into market.

Mr. TONKO. Thank you very much.

And let me go down the panel and ask each of you, what is most needed from us, from the Federal Government, to scale up the solutions you have highlighted in your respective industries? Mr. Baines.

Mr. BAINES. Yes. Well, I think a comprehensive approach is necessary. And there are a lot of policy options out there. Like was indicated, I think incentives for these nascent industries could be quite important. There can be, through the RFS program, there can be RIN multipliers. There are opportunities through the tax code as well. There are exemptions, investment exemptions or blenders incentives.

So, I think there are many, many different policy options out there that the Federal Government can take a position on.

Mr. TONKO. Thank you.

Mr. Fjeld-Hansen.

Mr. FJELD-HANSEN. I think in that—I think the most important thing for us to make meaningful investments in this is that we get some horizon and some certainty around the regulations, and especially the tax credits or RIN mechanisms or LCFS mechanisms. So I think that is the really number one.

And I also think it is important that we focus on all the all-of-the-above solution. I think if we get really pigeonholed into certain specific things, then that slows the efforts down.

And I think also, if we are looking at existing regulation, like the RFS, I think Mr. Shimkus has brought forward, a cleanup of some sort of the RFS. And I think we should always make sure that these existing regulations are current. And I would like just to use one little example.

We addressed the ethanol blend world really aggressively by lowering the mandate for ethanol because the market could not absorb more ethanol blending. So we took that down. I think, if we look at the cellulosic category, there we had very, you know, we had

really aggressive goals, and the industry couldn't meet them. So we took the mandates down well through RNG. And that was based on switchgrass and all these other, you know, exotic things.

But I think RNG has now come in and solved that. And there is a lot of runway to increase that one, so.

Mr. TONKO. Thank you.

Mr. FJELD-HANSEN. If I might.

Mr. TONKO. Thank you.

And, Mr. Felleman.

Mr. FELLEMAN. Well, certainly, the comprehensive approach makes the most sense. But in the near term, the idea that, whether it be cash credits or other incentives, the level playing field, as we have heard, is to start with. We need to fund research and innovation because a lot of these solutions have not been made. But there are a lot of smart people in the tech field that just haven't applied themselves to this world.

Obviously, interagency coordination is critical. Public investments in, as we were speaking, we can be the guinea pig to try out things. We can justify at the port investing in programs that will ultimately create jobs at the same time as creating these innovations.

But, ultimately, with the aviation biofuels, which is really one of the great challenges—and I got to visit Neste's facility in Rotterdam to take lessons learned there—but we need a market demand. And if DoD committed to a certain percentage that would basically—the refineries would come if they knew there was a guaranteed market for their fuels.

Mr. TONKO. Thank you.

And Mr. Blubaugh.

Mr. BLUBAUGH. With the medium- and heavy-trucks commercial vehicle industry, we have to pay attention to the diversity, all the different products in the industry, and think about systems in a holistic approach, thinking about tractors and trailers, manufacturers and fleets, and infrastructure. I think the incentives help overcome the marketplace barriers to the higher cost. The incentives should be technology neutral.

And I think we have to pay attention to barriers to deployment of greater greenhouse gas reduction such as more stringent NOx emissions, or things like the Federal excise tax that tax these enhanced technologies at a 12 percent rate.

Mr. TONKO. Thank you.

Dr. Eckerle.

Dr. ECKERLE. As I mentioned, Government investment in R&D as well as in the infrastructure. Having sound policies that are aligned with the goal is really important because that will develop a fundamental technology that we can take forward.

And, finally, national regulations that are uniform so that we are all rowing in the same direction.

Mr. TONKO. Thank you very much.

And, finally, Mr. Martinez.

Mr. MARTINEZ. I think on of the big things that needs to happen is research and development and support for public agencies, figuring out how to charge larger number of vehicles. We have transit

agencies that will have a lot more vehicles. We have ports. These types of investments we will learn a lot of information.

Mr. TONKO. Thank you to each and every one of you for your advice.

And now we will recognize Mr. Shimkus, our ranking member of the subcommittee, for 5 minutes to ask questions, please.

Mr. SHIMKUS. Thank you, Mr. Chairman.

If the staff would put up the chart from Love's produced to us. And, hopefully, we are going to have that passed out to you all too, if you have it.

Mr. Fjeld-Hansen, will you briefly—and it is hard to see, I get it, but you all have it there——

Mr. FJELD-HANSEN. Yes.

[The information appears at the conclusion of the hearing.]

Mr. SHIMKUS. Can you just briefly highlight—I mean, I found this very, very helpful. You have questions marks here for the, you know, the cost of infrastructure or the vehicles you have, CI scores across the board, and range issues that I think are very, just very instructive. So, briefly, can you highlight some of these points?

Mr. FJELD-HANSEN. Yes. So what we really tried to achieve here was, you know, we are talking a lot about policy, and research, and R&D. We tend to talk very little about how this needs to look from the consumer's perspective.

So what we were trying to do is say, kind of saying, "Well, if we set all these other things aside, what does it look like from the consumer perspective, and what are the real carbon score savings?"

So, I have listed the existing fuels, being diesel, B20, and RD, renewable diesel, where we really don't need any infrastructure investments at all. Friends like Neste are building plants and we are getting access to the fuel. And it follows the existing logistic chain.

CNG and RNG, there is a lot of existing infrastructure there as well, in our natural gas infrastructure. The investments there would really be to upgrade the fleets to CNG engines. It is a different engine altogether, so you need to have a unique engine in your truck. And you also need to develop, obviously, we have a lot of natural gas already coming out of the ground. We can supplement that with renewable natural gas. But that is a fairly established business already.

Then you have all these new technologies that requires significant infrastructure investment.

So, if we look at the price, yes, a CNG truck is a little bit more expensive than a diesel truck. When it comes to EV and hydrogen trucks, there really aren't any commercial options available on the market today. We hear a little about Tesla, Nikola, but these are not commercialized operations. So I really can't comment on any of the price.

And I don't know if our friend from Cummins has any thoughts on it.

Mr. SHIMKUS. Well, let me just jump in because I want to get to three points.

Mr. FJELD-HANSEN. Yes.

Mr. SHIMKUS. But I do want to highlight, in our discussions yesterday you talked about range. I think range is a big issue too.

Mr. FJELD-HANSEN. Yes.

Mr. SHIMKUS. Especially we have our colleague here from the Port of Los Angeles. And if you have a warehouse that is 500 miles away, an electric tractor trailer that goes 300 miles, and then you have to stop for a charge, that raises the cost of the good. That is really challenging.

Mr. FJELD-HANSEN. Yes. So, two things happen with range. In order to achieve range in the EV, you need to add battery capacity. And if you add battery capacity, you increase the weight.

So, if you want to have an electric vehicle that goes 500 miles, you will lose 40 percent of your payload just because of the weight of the battery.

Mr. SHIMKUS. Yes, thank you. And I don't mean—I do mean to cut you off because I—

Mr. FJELD-HANSEN. Yes, yes. No, no, no.

Mr. SHIMKUS [continuing]. Want to get to some other questions.

I also like the importance of this hearing on we are tapping around the renewable fuel standard and the bucket, cellulosic bucket, or what we call the advanced bucket, that industry then moved into the RNG debate, which I think is really critical and important.

Mr. Baines, Feldhausen, Mr. Eckerle, talk about that real quick, about the—maybe not Eckerle as much, but as far as the RIN issue debate on this portion.

Mr. BAINES. Sir, if we look at the sustainability of aviation fuels, that RIN, it's a multiplier of 1.6. For renewable diesel, it is a multiplier of 1.7 today. I think that is, those are the—these kind of policy options, they really incentivize producers to go one way or another.

Mr. SHIMKUS. Yes, and let me drop in now with a question on you have mentioned the word “drop-in fuels.” Let me go to Mr. Eckerle because I haven't asked him, the importance of drop-in fuels?

Dr. ECKERLE. Yes. I mean it—

Mr. SHIMKUS. And a definition of it real quick?

Dr. ECKERLE. Yes. Drop-in is, you know, basically you could run on our current petroleum fuel, that fuel with no change in our engine system. And so, you know, we are all in favor of that. It—

Mr. SHIMKUS. So that would cut down maybe a huge infrastructure cost if you dealt with a different debate or—

Dr. ECKERLE. If there is enough supply.

Mr. SHIMKUS. Let me stay with you and finish with Mr. Blubaugh.

You both in your testimony talk about a national regulatory environment, I think Mr. Blubaugh's statement. And Mr. Eckerle, you mentioned national-level emissions policy and regulations.

What do you mean by that?

Dr. ECKERLE. Well, what I mean by that is, for us, as we develop our products, if we have to develop them for different regulations, it really divides the resources that we have. And—

Mr. SHIMKUS. Mr. Blubaugh?

Mr. BLUBAUGH. The same. All EMA members supply vehicles nationally and globally. If we have one national program, we can develop those products much more efficiently, provide them at a lower cost, higher—

Mr. SHIMKUS. So, I will finish with my—I got 1 second left—and just say I think you are addressing the concern that there will be a Balkanized market based upon regional differences and rules and regulations. And I think that is an important point to be made.

Thank you, Mr. Chairman. I yield back.

Mr. TONKO. The gentleman yields back.

The Chair now recognizes Chairman Pallone, full committee chair, for 5 minutes to ask questions, please.

Mr. PALLONE. Thank you, Chairman Tonko.

I wanted to first ask Mr. Martinez. I appreciate your being here today, and thank you for your work on behalf of the front line communities in Southern California. How would you describe the nexus between climate pollution and other pollutants, like ozone and particulate matter? And how will addressing the climate crisis help communities like the ones that you have worked with, if you will?

Mr. MARTINEZ. Yes, there is a big nexus, because when you look at a lot of the climate pollution there is also air pollution associated. So, in Los Angeles and communities throughout the Nation, the ports, airports, they are a large source of emissions. And what we are seeing, a really effective tool is to address the air-quality problems as a way to push the air emissions. And we are seeing ports and other entities move that way, albeit it is a difficult approach, but it is something that is needed.

And I just want to put a plug in. The Moving Forward Network has provided some recommendations on how to move forward, some national standards on these types of equipment to advance zero emissions. And I think those will be important issues to address.

Mr. PALLONE. Thank you.

As I discussed in my opening statement, smart policy plays a critical role in driving American innovation. And this is especially true for the transportation sector. So I wanted to move to Mr. Eckerle.

In your testimony you highlighted Cummins' legacy of innovation. In your experience, how has ambitious and predictable policy helped to fuel this innovation at Cummins? And how would Federal climate policy affect your work for the products of the next decade?

Dr. ECKERLE. Having predictability around regulations is very, very important. Our product development cycle is on the order of 3 to 6 years. And so, as we do that work, when we have an eye on where we have to be and when, it just drives our investment. And so it really allows us to focus and be able to do the products that are needed.

From a climate change standpoint, it is very similar. To the extent that we have a national regulation, we understand it. We will tailor our investments appropriately and be able to hit the goal line much more efficiently.

Mr. PALLONE. Thanks.

And in my opening statement, again, I mentioned that certain transportation subsectors can't be readily electrified and are going to need transition to low- and zero-carbon fuels, and that Congress can play a key role in this transition as part of the 100 percent clean economy of the future. So let me ask Mr. Baines, how has California's low-carbon fuel standard influenced your investment

decisions and strategy for developing and commercializing innovative liquid fuels?

Mr. BAINES. Well, I think the low-carbon fuel standard provided a really clear and robust policy for us to be able to build our production around, and to be able to develop it as a market.

It is a long-term policy, so there is a transparency for us to be able to make the kind of investments that are needed to produce low-carbon fuels.

Mr. PALLONE. Then let me ask you, and also maybe Dr. Wimberger, what should the Federal Government be doing in the near term to help drive the market for low, for zero-carbon fuels in aviation, and for oceangoing vessels? I'll ask Mr. Baines and then will ask Dr. Wimberger.

Mr. BAINES. Well, I think it goes, again, to this comprehensive approach with there are many different policy options that are out there. Incentivizing the research and the production of these fuels, incentivizing the incorporation or the blending of those fuels are different options.

There are some options that we can have in the RFS program around the RIN multiplier, like I mentioned earlier on. And the tax code can also play an important role in that.

Mr. PALLONE. Thanks.

Dr. Wimberger.

Dr. WIMBERGER. I would echo a lot of the statements about consistent policies and having a really strong price signal. Through a clean fuel standard that opens up to, that incentivizes fully the lowest-carbon fuels across different applications, so not just focusing on liquid fuels but thinking about electrofuels, and thinking about really innovative ways that we can have a really strong price signal that will drive innovation and technology in these areas.

Mr. PALLONE. All right. Thanks a lot.

Thank you. Thank you, Chairman, I yield back.

Mr. TONKO. The gentleman yields back. The Chair now recognizes Representative McKinley for 5 minutes, please.

Mr. MCKINLEY. Thank you, Mr. Chairman.

I think this whole concept of 100 percent renewables by 2050 is interesting. As an engineer, it is going to be great: full employment for engineers and scientists for the next 30 years. But I think it is delusional to think that in some aspects that we are ever going to achieve that. So I am curious to see how this language gets worked out.

I want to focus on airplanes as much as I can, because the other things maybe it is more doable. Airplanes, teach me. I can learn about this because I am just curious. Jet fuel, the specific energy of jet fuel is 50 times the density capacity for batteries, with lithium ion batteries. I am curious how we are going to do that, to move into that arena on that, especially given that, for a Tesla car using lithium ion batteries, it is 1,000 pounds for an automobile.

Can any of you give me an idea of what is the size? If it is 1,000 pounds for a Tesla car, what is it going to be for an Airbus 320? Anyone have an idea? I don't have that. I am not—please.

Mr. FELLEMAN. Well, I do know that there is a company in the Seattle area that is in the process of getting certification for a modification of a Beaver. It is an older plane, but they are using

one engine as an electric engine and one as a traditional jet engine. And they are able to demonstrate the ability to do, in a relatively small plane, the ability to actually fly. So——

Mr. MCKINLEY. I am fine with the smaller planes——

Mr. FELLEMAN [continuing]. The technologies are getting there.

Mr. MCKINLEY [continuing]. We have right now. We know the capac—we can do that. The Purdue engineers at their aeronautical program have put something together. MIT is saying “small planes, yes, we can do that.”

But I’m talking about the 320s, the 747s, the 737s, you know, how we are going to be able to do that? So I am curious, what is the size? And it is one thing to say the size, whatever that might be, but then I want to go to the airports. What is going to happen if you exhaust your battery so it is at the end, are you going to—how long is the plane—if we complain now about our length of time waiting for traffic, how long is it going to be to recharge that battery to fly that plane back to Pittsburgh or back to San Diego or wherever that might be? Or are we going——

Mr. FELLEMAN. Sorry.

Mr. MCKINLEY. Or are we going to replace the battery, which might be the faster way to do, pull it out and replace it? That is fine. What happens in small towns? What happens foreign when we fly to Honduras or we fly to Guatemala, are they going to hold our batteries for us so that we can move them in? I don’t think so. I think we are going to be—we are going to create a problem for ourselves that are going to have consequences as a result of this because we are just, quite frankly, we are not there yet.

I think that I want us to do it. I love the idea. I think it is—for an engineer I think it is fabulous to be able to have this kind of aspirational goal where we might go with this. But I would think that, quite frankly, instead of doing these delusional concepts, why aren’t we spending the time to develop batteries better than we are right now, putting funding into research at National Energy Technology Laboratory to find out how?

How are we going to find ways to replace lithium? Because we know it takes 500,000 gallons of wastewater to produce one ton of lithium. And that will only generate enough batteries for 10 cars. We have to find a replacement for lithium.

So I am hoping over the next 30 years is we use our engineering technology or science and find new batteries, new ways of doing it, or cobalt where the increase—where we are dealing with a terrorist activity, a terrorist government in Congo, and their increased price on cobalt was 142 percent last year. Do we want to do business with people trading in red, in blood diamonds? I think we should be spending more time, instead of passing legislation like this, putting more money into research to find out how we can do, how we can actually achieve this.

Because this, there is a great article in Aviation Week, just came out in January, that it isn’t going to happen, folks. We can do it on small planes, but when we get to larger planes, we don’t have it. It is going to take more than 30 years or longer.

But I am looking at posing a challenge to you. What do we do in a small airport? What are we going to do to them when they land on that? What are we—can any of you give me an idea?

Well, my time has expired. How are we going to deal with this in Peoria, Illinois?

Thank you. I yield back my time.

Mr. MCNERNEY [presiding]. The gentleman yields. And the acting Chair recognizes himself for 5 minutes.

Mr. SHIMKUS. No, you are the chair. You are the chair.

Mr. MCNERNEY. The chair, the real chair.

First of all, I want to say, very encouraging testimony. I see we are really committed to moving in the right direction, and I really appreciate that.

Commissioner Felleman, the Port of Stockton is in my congressional district, so finding ways to reduce port-related emissions is very important to me and my constituents. You mentioned how Federal support for the development of electrified cargo handling equipment is essential to decarbonizing the sector. At the Port of Stockton we have seen how State and local partnerships can make a real difference.

Can you speak to some of the hurdles that are facing widespread adoption of electrified cargo-handling equipment at ports across the country?

Mr. FELLEMAN. Thank you. In fact, you know, the Port of Seattle has been beneficiary of some of California's hand-me-downs because they have been taking the initiatives to make progress on the technology that we are now advancing from there.

But one of the challenges is just the power for the top picks. There is, like, a lot of—well, it hasn't been designed for actual commercial utilization. But there are—basically it is the terminal operators that have to shoulder the response.

Our port is a landlord port, so we basically lease to the terminal, and terminal operator then, you know, assumes all those costs. So, initially, changing over from a Tier 4 is like what we are doing right now. We are getting to the better diesel operations. But to go from that to electrification is primarily an expense.

We do have the shore power. That infrastructure is getting put in place. And the discussion about battery change-out, in Long Beach we know that, you know, the cars coming in, they swap out the battery packs. That is not the challenge. Storage and electricity isn't a challenge. It is, you know, primarily an expense cost. And actually the technology of not all of it has been electrified.

Mr. MCNERNEY. Can you speak to how to power demand is managed at ports and how electrification of machineries impacts that?

Mr. FELLEMAN. Well, we are sort of lucky in the Seattle area. We have the green grid from hydropower.

Mr. MCNERNEY. Right.

Mr. FELLEMAN. And City Light has its own dam.

But if we really had a huge requirement we—Bonneville Power Authority can route power to our thing, that is the Columbia River system. But I think ultimately it is going to require storage so that we can use, you know, like, cruise ships are only at our dock for, like, 10 hours. And they are a huge demand. So, we can sort of schedule, you know, having storage in place or when the demand varies.

So, I am hoping that, like with the electronic world, that we will have a Moore's Law of batteries. That, I would agree very much, that that's where we have to continue to invest, but——

Mr. MCNERNEY. Right. Battery storage is key to this. And they are making investments and improvements now, I think. I don't know if we are going to see Moore's Law, though. That is, that would be pretty optimistic.

Mr. ECKERLE, can you discuss how we can best deploy zero- or low-carbon fuel systems at ports across the various types of transportation systems to serve them?

Dr. ECKERLE. Well, it is really a matter of getting infrastructure from our standpoint as those fuels become available. You know, we are ready and able to utilize those in our engine systems.

Mr. MCNERNEY. So it is really the investment in Federal dollars needed in your opinion for that?

Dr. ECKERLE. Yes. In the infrastructure, yes.

Mr. MCNERNEY. Thank you.

Dr. Wimberger, I want to thank you for your work at the CARB. Basically you have set standards for the country, and it has made a lot of difference in our district.

I mean, it is clear that in the Central Valley the tule fog that used to be a real problem is now dissipating and not appearing because there is less particulate pollution in the air to attract that fog. So you have made a lot of difference in people's lives.

Ports are a major hub for heavy-duty trucks. In mid-November 2018, the U.K. announced the Cleaner Trucks Initiative focused on modernizing regulations for heavy-duty trucks relative to heavy NOx emissions. But to date the EPA has not proposed a single regulation under that initiative, and it is not likely to do so until the spring of next year.

How are we going to reduce NOx and greenhouse gas emissions on a tight schedule to protect public health and reduce greenhouse emissions?

Dr. WIMBERGER. That is a great question. I think the chair of Air Resources Board, Mary Nichols, just responded to EPA, the head of EPA, there are challenges in California in achieving our 2031 and 2032 NOx requirements in the south coast. And a lot of that does deal with emissions that are covered under Federal regulations, so including trucks, and ports, and locomotives. And there were commitments made to work together collaboratively to see reductions in those areas.

And I think there are ongoing conversations to think about how we can reduce NOx emissions in that time frame that are required. There is only so much I think the State can do. And we are seeing huge declines in California for NOx emissions in nonattainment areas under California-specific regulations. But there are mobile sources where EPA does have preceding jurisdiction, and we are seeing increases in those emissions in the future.

So there is ongoing—it is going to be tricky, it is going to be tough, but we have reduced emissions tremendously in California and will continue to do so to protect public health.

Mr. MCNERNEY. Thank you. My time has expired. And I am going to recognize the gentleman from Ohio, Mr. Johnson.

Mr. JOHNSON. Thank you, Mr. Chairman. I, you know, I think this idea, this notion of 100 percent clean energy for our transportation network, is a very noble, a noble goal. And I also think that it is a mischaracterization for those that think that my Republican colleagues and I don't support green energy initiatives. We simply don't believe that you can ground our economy to a standstill in order to get there. You have to have an economy that will support market-driven solutions to accomplish these things if we want to get there.

And, you know, technological innovation has unlocked a vast supply of natural gas in the shale plays in my district in eastern and southeastern Ohio. And as we are all aware, these shale plays have helped to drive down the price of natural gas, making the fuel a very affordable option for our energy and manufacturing needs.

So, Mr. Fjeld-Hansen, how has the current price point of natural gas influenced Trillium's decision to build projects reliant on compressed natural gas?

Mr. FJELD-HANSEN. I would say there was a wave kind of converting over-the-road engines to CNG back in 2012, 2013 when you had, you know, crude at a hundred-and-some dollars, and natural gas was still \$2.50. The fact that crude has come down since then has lessened those incentives. But you still have the fuel mixer credit, which is part of RFS, I guess, or the tax extenders that would, you know, incentivize more usage. But we see tremendous progress on the transit side.

So, if I look at the over-the-road trucker, the guy who bought the CNG truck in 2014, he probably is buying a diesel truck today based on the incentive structure that is available.

But on the transit side, where you have the asset that depreciates a little over time, it is still an economic advantage. And as you can see on the schedule, just compressed natural gas using fossil natural gas gives you a 21 percent reduction in carbon intensity. So, it is not zero, but it is 21 percent.

Mr. JOHNSON. It is moving in that direction.

Mr. FJELD-HANSEN. Yes.

Mr. JOHNSON. As you know, continuing with you, the U.S. is also exporting liquefied natural gas to our allies across the world because of our vast supplies and resources.

Mr. FJELD-HANSEN. Yes.

Mr. JOHNSON. Do you feel this increasingly global supply of gas could influence the greater use of CNG transportation projects throughout the rest of the world?

Mr. FJELD-HANSEN. I think you are seeing natural gas increasingly becoming a fuel source in other parts of the world as well.

Mr. JOHNSON. Good. Good.

Mr. Eckerle, continuing along this line, I understand Cummins produces engines that run on CNG. Can you talk about the prospects of that business, the research you are doing to improve the performance and application of natural gas-fueled engines?

Dr. ECKERLE. Yes. And we work on improving performance by natural gas engines just like our diesel engines. And so we are continually working on technology that is going to reduce the emissions. And we are increasing the efficiency of those engines substantially as well.

Mr. JOHNSON. OK. So, how can your work advancing technological innovation in the United States engine market translate to clean engine and fuel advances that are affordable in other nations that are much higher in their greenhouse gas emissions than the United States are?

Dr. ECKERLE. Yes. You're probably aware Cummins is a global company, and last year we produced 1.5 million engines, many of those in countries outside North America. And the technology that we are applying in North America we are applying in those countries as well. So, the efficiency benefits are global. And all of our projects, we are working to meet lower greenhouse gas in all those countries.

Mr. JOHNSON. OK. Mr. Blubaugh, do you have any thoughts along those lines?

Mr. BLUBAUGH. Yes. The heavy-truck industry does export quite a bit, as Dr. Eckerle said. Some of the challenges are we have tried to export the cleanest diesel trucks. And what you need, you need ultralow-sulfur diesel to do that, and you need diesel exhaust fluid.

We have just gotten Mexico moving forward to where they could adopt the cleanest trucks, the 2010 trucks, but you need that infrastructure to support those vehicles.

Mr. JOHNSON. Sure. OK.

And, Dr. Eckerle, I apologize. I couldn't see your name tag through your cup. I didn't—I called you Mr. Eckerle instead of Dr. Eckerle, so I apologize.

Dr. ECKERLE. No need to apologize. I can be Wayne.

[Laughter.]

Mr. JOHNSON. I yield back.

Mr. TONKO [presiding]. The gentleman yields back. The Chair now recognizes Representative Barragán for 5 minutes, please.

Ms. BARRAGÁN. Thank you, Mr. Chair. I appreciate the conversation and you all being here. I happen to represent America's Port. It is the busiest port by container volume in the country. We have a lot of jobs, and our economy is heavily, heavily dependent on it.

And with that said, my district is one of the most heavily polluted districts in the country. It has the Port of L.A., including the Port of Long Beach right next door, and it is surrounded by three freeways. And so this topic of what can we do is critically, critically important to me and my constituents.

Now, the ports combined are right across in a part of my district, and they are responsible for significant amounts of local air pollution, so from sulfur dioxide particulate matter and nitrogen oxide levels, which is exacerbating the environmental disparities in my district, a district that is a majority minority, almost 90 percent Latino/African American. And they are on the front lines of the pollution that is resulting.

There has been some discussion about the ports and what has been done. Now, although the ports have actionable clean air plans which have reduced emissions, there is so much more work to do. And the purpose of these hearings is to try to get ideas on what we can do, and legislation we can add so that we can do our part.

Now, the climate crisis is urgent. It is urgent. And we are seeing people marching and people recognizing that. And we, as legislators, need to as well. And so I appreciate the work you are doing,

Mr. Martinez, in my community and in the area to address the issues. You talked a little bit, Mr. Martinez, about some of the work you have done with pollution and environmental justice issues in Los Angeles County and California. Can you speak—and you spoke a little bit to the progress of what is being done to reduce emissions—but can you maybe give us some concrete steps that can be taken to build on that progress?

Then we can consider trying to put into either this legislation that we are going to come up with on the 100 percent by 2050 and/or the LIFT America Act, which is our committee's infrastructure portion of the bill.

Mr. MARTINEZ. Yes. If you look at the examples of the Port of L.A. and the Port of Long Beach, it started out with an emissions inventory. To the extent ports haven't done one of those, they should, because you need to know where your emissions are coming from.

Second, they developed what are called Clean Air Action Plans. You know, these are strategies for each category of equipment.

And then the third thing is I think the Ports of L.A. and Long Beach have their zero-emission goals for at least two big parts of their operations, trucking and cargo equipment. I think that is important.

One thing that the Port of Long Beach did that was particularly important was an EV Blueprint process where they spent some time bringing all stakeholders from industry, from community, and the kind of the best thinkers on how do we get to electrify their cargo equipment. And I think that pursuing that at ports across the Nation to allow them to figure out how do they get to zero emissions would be a good strategy.

Ms. BARRAGÁN. OK. According to information from the Clean Air Task Force, marine shipping is 2.6 percent of the global greenhouse gas emissions and could account for 17 percent of these emissions by 2050. Equally concerning is that existing fueling solutions are either marginally cleaner or face technological obstacles.

Mr. Baines, are Federal programs to invest in and support the development of emerging energy technologies in shipping sufficient? And can you expand on recommendations in your testimony for how we can do more to support innovation to drive down emissions?

Mr. BAINES. Thank you for the question. Neste does focus mainly on the road transportation and the adjacent sector. Our fuels can be used in marine applications. Our renewable diesel is being used today in California in some of the ferries where it already reduces emissions.

I think one of the beauties of the fuels that we produce is that it is a drop-in fuel. So it is the existing engines, it is the existing infrastructure, it is existing technology today. So there are no investment costs required to be able to benefit from lower greenhouse gas emissions, from lower environmental pollutants.

So, I think that is a great advantage of these kind of fuels that we produce today.

Ms. BARRAGÁN. One of my concerns is we talked a little bit about the natural gas and the calls for low-sulfur substitutes but, you know, I think we need to think bigger than that, and we need to

think bolder than that in figuring out how do we get to the zero emissions, how do we get to that place given the urgency that we have, so that we can make sure that we are doing enough to avoid the warming of the 1.5 degrees Celsius.

So, I just wanted to thank you all for your work. And, hopefully, we can continue the discussion. Five minutes is nowhere near enough time to have this conversation.

I yield back.

Mr. TONKO. The gentlelady yields back.

The Chair now recognizes Representative Long of Missouri for 5 minutes, please.

Mr. LONG. Thank you, Mr. Chairman. And the transportation sector represents the largest source of greenhouse gas emissions in our economy. And we have a lot of room for improvement to reduce emissions. That being said, I think it is important that this committee works together to put forward practical and commonsense solutions rather than proposing pie-in-the-sky deals that are unrealistic and would harm our economy.

That is why I was proud to work with my good friend Congresswoman Matsui from California on a bill to reauthorize the Diesel Emissions Reduction Act, which I was glad to see passed the House with bipartisan support.

Our bill provides grants to States to upgrade older diesel engines with cleaner, American-made technology. This is a great example of bipartisan solution that makes real differences in the real communities like mine. My home State of Missouri is using the DERA grant money to upgrade school buses to make sure our children are breathing cleaner air on their rides to and from school. Diesel engines can have a long working life with a slower turnover rate, which allows older engines to operate for a longer time.

With roughly 10 million old diesel engines still in operation today, it is important that we continue to make sure of homegrown technologies to upgrade these engines and improve our environment.

Mr. Fjeld-Hansen, the Diesel Emissions Reduction Act of 2019 reauthorizes the program through 2024. As EPA Administrator Wheeler notes, this is an effective and innovative program to improve air quality across the country. DERA fund has proven to be a cost-effective tool to help communities meet their air quality implementation plans and reduce carbon dioxide emissions.

My question: What is your view of the program, and is this an example of the practical use of existing policies to drive for cleaner transportation?

Mr. FJELD-HANSEN. I would say typically we look at our role as really adapting to the programs. And we rely on gentlemen like yourself to really come up with a lot of the call it politics behind it. And our job is really to bring it to market effectively and cheaply.

And I think turning a little example on that is, I think you brought up the DEF there earlier, which I think is the great story where you are seeing an implementation. I think we are about 60 percent implemented today with these new modern engines that are low emission. So, it is working for sure.

Mr. LONG. Good. OK. Well, you answered the second part of my question in that, so I appreciate that.

And in this series of climate hearings I have tried to focus on how we can reduce carbon dioxide emissions while keeping energy and commodity prices low, particularly for rural agricultural communities like those that I represent where two of the biggest industries are farming and trucking. From what I have seen, the Green New Deal and other decarbonization efforts seek to replace fossil fuels entirely with renewable energy.

Mr. Blubaugh and Mr., or I guess Dr. Eckerle, I just learned, do you have any tech—do we have the technology to decarbonize the farming and trucking industries while continuing to produce and move goods to market without raising costs on farming, trucking, or consumers?

Mr. BLUBAUGH. First I would like to say, with DERA less than 50 percent of the trucks are current technology, because trucks are durable and the new trucks are expensive. DERA is an excellent way to overcome that hurdle and get more to the newer greatest, latest and greatest technology.

As far as farming equipment, upgrading farming equipment is a challenge. It can be done. We are working on the technology to do so. But the cost of the technology is often a barrier, and similar to the benefits of DERA, allowing farmers or other people who use that equipment the ability to afford the new technology is critical.

Mr. LONG. OK. And can we do it without limiting the mobility inherent in diesel engines?

Mr. BLUBAUGH. It depends on what technology. We can't—there is no broad-brushed approach to this. It depends on what is the application and what is the technology.

Obviously, current, latest, the clean, near-zero-emission diesel technology can do that without limiting its performance of its electrification.

Mr. LONG. OK. And for you or Dr. Eckerle, either one, what would be necessary for electrification to work for heavy-duty vehicles and farm equipment?

Dr. ECKERLE. The more power that a piece of equipment or a piece of transportation uses, the more difficult it is going to be to replace it with true electrification. Now, there are certain applications where carbon-neutral fuels are going to be the right answer, you know, from an internal combustion engine. So, one size does not fit all here.

Mr. LONG. OK, thank you. I have no time to yield back, but if I did I would yield it.

[Laughter.]

Mr. TONKO. We understand your kindness, sir. The gentleman yields back.

And we now recognize for 5 minutes the Representative of Delaware, Representative Blunt Rochester.

Ms. BLUNT ROCHESTER. Thank you, Mr. Chairman, for this very important hearing today. The science is clear: We must transition to a 100 percent clean energy economy as quickly as possible and if we are going to avert the impacts of climate change.

I hear every day from my constituents in Delaware about the impacts that they already feel. Whether it is a farmer whose crops are

suffering from extreme weather, or a small business owner who relies on the tourism of our Delaware beaches, or young students just worried about the future, Delawarians know all too well we must address the climate crisis.

The transportation sector will play a key role in solving this problem as it is our now, is our country's largest source of carbon pollution. We have an opportunity to transition our transportation sector to zero- or low-carbon fuels, but we must do it in a just and equitable way. All too often, the communities that are hit first and worst by the impacts of climate change are communities of color, that suffer from some of the worst air quality in the Nation, and floods any time that it rains.

Thank you to the panelists for your testimony today. I am especially excited about today's hearing because we have a modernizing and expanding port in Wilmington, Delaware, where we have a real opportunity to innovate during this expansion to reduce our emissions. Already as part of this expansion our port will have electric cargo-handling equipment.

My first question is to Mr. Felleman. You detailed the great strides that the Northwest Seaport Alliance is taking to reduce emissions. And following along on Ms. Barragán's questions, what steps can Congress take to accelerate these efforts at ports across the country?

And, absent Federal action, do you think that we will be able to really see progress in terms of transitioning to low- and zero-carbon fuels at ports? Will it happen on its own?

Mr. FELLEMAN. I really appreciate the point. If we don't have a national policy, a commitment to doing this, then it all falls apart.

If you look at our greatest competitor to the north, Canada has a national policy to move freight across the country. And, in fact, they are serving Chicago at a cheaper cost than we are at the Port of Seattle because they have a unified national policy to do that.

There are efficiencies that we can achieve. One of them, most importantly, is on-dock rail. And so you eliminate trucking to a portion of your use. So, that is one way to be very efficient.

Unfortunately, the rail lines right now are just a little bit of a monopolistic challenge is we are \$300 a container at a cost disadvantage to Canada because of disparitous rail rates. So, while we want to get this cargo onto rail, at the same time it is an asymmetric situation for us.

But there are other efforts like idle reduction measures that you can—you know, scheduling a truck to get to the dock when the container is ready to pick up. But the ScRAPs program, the DERA program that was spoken of, we have taken great advantage of that. And I only think that that is one way in which we can, as I said, turn over these long-lived trucks and get onto the next phase.

So—

Ms. BLUNT ROCHESTER. Thank you.

Mr. FELLEMAN [continuing]. But I think, just as Mr. Martinez said, you know, you have to measure what you care about. So you have to have an inventory. We are on our third round of inventories. We are watching the relative parameters go down. As we

win some things, trucks become a greater portion of the pie. So, I think that is a critical way to be strategic.

Ms. BLUNT ROCHESTER. So I am going to shift to Mr. Martinez.

How will the steps taken by the Port of L.A. to reduce emissions improve air quality for communities near the port?

Mr. MARTINEZ. Yes. So, the Ports of L.A. and Long Beach have been doing programs for many years. I am part of a coalition that is pushing them to do more because the air pollution crisis in the communities is still very high.

One thing they did that I think is important, they are working to advance zero emissions in cargo-handling equipment. And one of the biggest challenges there is on infrastructure. How do you plan for adding a significant amount of new equipment, and how do you charge it in an effective and safe way?

And I think helping them figure that out, and support for that will be important.

Ms. BLUNT ROCHESTER. Well, thank you for that.

I want to say I was fortunate to be on a bus, one of our electric fleets in Delaware this year. We did kind of a ribbon cutting, and it was really nice. They had "It's Electric," you know, on the bus, for Electric Slide. But it made me think as you were talking, you know, Mr. Martinez, and I guess I am going to ask this of Mr. Eckerle, can you elaborate on why a national policy rather than a patchwork of different efforts is really necessary?

Dr. ECKERLE. Because it allows us to focus on the right technology. The more we are divided, the more different technologies we have to invest in, we can't do a great job for everybody.

Ms. BLUNT ROCHESTER. Thank you so much. And I yield back.

Mr. TONKO. The gentlelady yields back.

The Chair now recognizes the gentleman from Georgia, Representative Carter, for 5 minutes, please.

Mr. CARTER. Thank you, Mr. Chairman. And thank all of you for being here, ladies and gentlemen.

I have the honor and privilege of representing the 1st Congressional District of Georgia, which includes two major seaports: the Port of Savannah, the number-two container port on the Eastern Seaboard, and the Port of Brunswick, the number-two roll-on/roll-off port in the country. So, very familiar with what we are talking about here. And very appreciative of all your initiatives to make sure we are doing everything we can to decrease emissions.

I wanted to ask you, Mr. Felleman, I wanted to ask you about the Port of Seattle. Because I know that you mentioned that the port has done quite a few things to decrease emissions in electrification, increasing the efficiency of the diesel engines, even as much as, from what I understand, putting out mussels and oysters to help in carbon sequestration. What a great idea, and what a great initiative. That is wonderful.

But what I have a question about is about mandates versus incentivizing. Because the Port of Savannah and the Port of Brunswick—the Georgia Ports Authority runs both of them—have done a great job by themselves in making sure that they have decreased emissions, and making sure that they have done all of the above in making sure that they are taking care of our environment. And I just found, you know, there was an announcement earlier this

year that you were investing in technology to improve traffic flow at the terminal. How is that going?

Because the city, the port in Savannah, is one of the least congested ports in America, which I think makes it very attractive to a lot of the users, the fact that it is the least congested, one of the least congested around.

Mr. FELLEMAN. Well, with all due respect, your ability to have started to outcompete the Port of Seattle makes me reluctant to give you our tricks. But I do very much appreciate your interest.

You know, one of the challenges the Port of Seattle has is that we are really embedded into the city. So our last mile is a particular challenge. So that advantage that you have as a less, uncongested area is a great advantage.

The benefits of getting trucks on appointment is a huge thing. So having smart gates has been something that we have been investing in. So trucks can actually sit and wait in a parking lot and get called on appointment. So this is a big advantage.

Mr. CARTER. And that decreases idling time, would it?

Mr. FELLEMAN. Yes. Yes. And it is a better condition for the drivers.

One of the things we didn't speak to is really kind of a trucking model. For those folks that are lucky enough to be in a fleet, the fleet can make a major investment and amortize it over a long time. The drayage fleet is an independent operator. So they only—these guys, mostly immigrants, very disadvantaged, are only paid per container they move. And so it is greatly in their advantage as well to have a faster turnaround.

And all these things that we have talked about, the business model, anything that saves fuel is good for the bottom line. So this is ultimately everybody's best interest to find ways of doing that.

I don't know that—I think the throughput was the primary thing. But I don't know if you have on-dock rail, because that is one of the great efficiencies—

Mr. CARTER. Yes.

Mr. FELLEMAN [continuing]. That you can move so much more cargo through.

Mr. CARTER. Absolutely.

Mr. FELLEMAN. And then the train engines we have heard about are also—

Mr. CARTER. Right.

Mr. FELLEMAN [continuing]. Getting quite a bit cleaner.

Mr. CARTER. Right. And that has been something. And another thing that we worked on in Georgia is the inland ports. Now, that has really helped us where we can rail the cargo to the inland ports and then disperse them out. That has helped with the congestion, and it has also helped with the efficiency of the port as well.

I am, as you can tell, I am very proud of the job that the Georgia Ports Authority has done. I think it is they have done an outstanding job. So a lot can be learned there.

But my main point I wanted to get at is that, you know, they have done a lot of things on their own without having to be mandated on it. And that is what I am really proud of and really want to see us do. I hate for us in Washington, DC, to be mandating everything that has to be done to increase efficiency.

Mr. FELLEMAN. Well, I appreciate that. I am sorry I missed that point in the first part.

Mr. CARTER. Right.

Mr. FELLEMAN. The fact is that Washington State, and probably you as well, are in attainment. Like, we are not breaking the law yet, as in California they have to do this if they want to stay in business.

Mr. CARTER. Exactly.

Mr. FELLEMAN. But our goal, elevated self-interest, we don't want to fall out of attainment. So by taking these initiatives proactively before the law requires it enables us to grow responsibly.

Mr. CARTER. Absolutely. And I think in a much better way.

Mr. FELLEMAN. Yes. So, some of these things need some investments federally for innovation to get us to the next level. But as long as we realize that, if our future is to serve this greater growing market, we have to take these initiatives before the hammer comes down.

Mr. CARTER. Absolutely.

Well, thank you. And thank all of you very much for all your initiatives. And I yield back.

Mr. TONKO. The gentleman yields back.

The Chair now recognizes the gentlelady from Washington. Representative Rodgers is recognized for 5 minutes, please.

Mrs. RODGERS. Thank you, Mr. Chairman. And I, too, want to thank the panel for being here today as we look to reduce emissions in the transportation sector. It is important we pursue policies that reduce transportation-related emissions, that are realistic, technology neutral, and make economic sense.

Government mandates, as my previous colleague just mentioned, whether at the Federal, State, or local level, can often have drastic unintended consequences. In Washington State right now some politicians and special interests, for example, are threatening to breach the four Lower Snake River dams that are in my district. Governor Inslee is currently spending almost \$1 million of taxpayer money to justify doing it.

Setting aside the significant negative impact on our clean, renewable hydropower generation, breaching the dams would also significantly increase light-duty vehicle emissions. Many farmers and other businesses in eastern Washington rely on barging on the Snake River and on the Columbia River to ship their products west to the ports. Barging is one of the most efficient, eco-friendly methods of cargo transportation. If the dams were breached, farmers would have to look at other shipping methods.

We export 90 percent of the wheat that is grown in my district. We export 50 percent of the potatoes. We export peas, lentils, garbanzo beans. It would have taken, in 2017 alone it would have taken 135,000 semi trucks to move the cargo shipped on the Snake River, additional. This would drastically increase emissions in Washington State, not to mention the additional congestion that we already face at the port.

I believe instead of wasting taxpayer dollars on an expensive effort to increase carbon emissions and decrease clean energy production, we should be encouraging the development of new tech-

nologies and efficiencies that decrease emissions in the transportation sector. One of the biggest challenges in decreasing emissions from vehicles is turning over fleets and getting older, less efficient vehicles off the roads.

I am concerned about costly, government-imposed mandates and policies that significantly increase the cost of new vehicles. You can mandate the most fuel-efficient, green car or truck in the world, but if no one can afford it, it is not going to decrease carbon emissions. Right now the average car in America costs \$38,000. A lot of people cannot afford that, even though we would especially want our teenagers to be driving the most efficient and safe cars. But they can't do it because they can't afford it.

So what are we doing? Our cars are getting older. Average car in America is now 12 years old. In my district, it is 15 years old.

Mr. Blubaugh, approximately how much more does a new truck cost today as the result of all the new emission reduction technologies? And are there any barriers, for example, a 12 percent Federal excise tax, to purchasing newer, cleaner trucks that Congress could address?

What are the risks if we impose even more costly emissions requirements? If we were just able to fully turn over existing medium- and heavy-duty fleets in the current and near term, what would the emission reduction impact be?

Mr. BLUBAUGH. Thank you. As I said before, I think less than 50 percent of the trucks on the road today are to the latest emissions standards that went in place in 2010, almost 10 years ago, and we still haven't gotten 50 percent.

The benefits of turning the fleet over to those new cleanest diesel engines would be tremendous. It is hard to measure exactly what it would be. If it is a truck that was 30 years old, the benefits would be dramatic. If it was a truck that was 15 years old, less dramatic but still a huge improvement.

And one of the barriers that we see is, that you pointed out on passenger cars, we see that on the heavy-truck world, we call it a pre buy and a low buy. Before the 2007 emissions standards went in place, truckers bought a lot of vehicles. We ramped up production to sell the older vehicles. It is not an efficient way to produce vehicles. It causes us to hire people and then turn around and lay them off later. The pre-buy and low-buy cycle is not advantageous, and it doesn't help the environment before it increases the number before the standard.

So we think mechanisms like the FET that adds 12 percent to the cost of this—it adds 12 percent to the cost of the vehicle. So, if we add \$20,000 to \$40,000 worth of emissions reduction equipment, that is \$2,400 to \$4,800 in tax on top of that increased expense.

Mrs. RODGERS. OK, thank you.

I am really excited about the sustainable jet fuels program also. And I didn't allow enough time for you to talk about it, Mr. Felleman. I am sorry.

I yield. I ran out of time.

Mr. TONKO. The gentlelady yields back.

I have received a number of documents for the record. And so we will ask, request unanimous consent to enter the following into the record.

They include a letter from the Association of American Railroads; a letter from Securing America's Future Energy, or SAFE; a letter from the American Public Gas Association; a letter from the Diesel Technology Forum; a letter from the Advanced Engine Systems Institute, including the executive summary of a June 2019 report from the Manufacturers of Emission Controls Association. We have a letter from NGV America and, finally a chart provided by Mr. Fjeld-Hansen comparing various truck engines.

So, I request unanimous consent to enter the following. Without objection so ordered.

[The information appears at the conclusion of the hearing.]

Mr. TONKO. I see we have been joined by our colleague from Illinois, the gentlelady from Illinois, Representative Schakowsky. Take a moment. When you are ready. Settle in. I will recognize you for 5 minutes, please, a devoted member, I would say, of Energy and Commerce.

Ms. SCHAKOWSKY. Thank you. I want to apologize to the panel. It is just there are all these other hearings and negotiations going on. So I thank you for being here. I thank you for your testimony. I do have a few questions.

So, I am from Chicago. And Chicago area is home to five airports, including two major ones, O'Hare and Midway. And last year O'Hare International Airport was the busiest airport in the world in terms of takeoffs and landings. And we know that aircraft account for about 9 percent of transportation emissions. And, you know, while that doesn't sound huge, it has also increased more than any other subsector in 2017 in terms of emissions.

Globally, passenger traffic increased about 6.4 percent last year. With air traffic increasing, it is important that we ensure that that aircrafts transition to clean energy and renewable fuel.

So, Mr. Baines, and where are you? Mr. Baines, in your testimony you mentioned the importance of sustainable aviation fuel. So I am wondering if you could talk a little bit about that. Where does the United States stand compared to other countries in terms of the development and deployment of sustainable aviation fuels?

And let me just ask a second question. In your opinion, why has the United States been so slow in developing and using sustainable aviation fuels?

Mr. BAINES. Yes, good questions, actually. Sustainable aviation fuel is a drop-in fuel. I think that is the big advantage of the fuel today, so you just drop it into the existing infrastructure.

I think one of the reasons why it hasn't been used very much yet is it is really a nascent industry. There are a number of players in the market today. Neste has the capability today of being the largest producer of sustainable aviation fuels.

Different countries have adopted different policies. In Europe they have taken more of a mandate approach. In the United States there are different policy options, where it is going to be maybe more incentive based. The point is to have this comprehensive approach. That is the most important. And to have the transparency of, what is the direction you would like the industry to go?

I think it is fair to say that the aviation industry wants to have sustainable aviation fuels. They are committed to reducing their greenhouse gas emissions. So this is really a solution that can work today.

Ms. SCHAKOWSKY. Thank you. I want to go on to a different issue.

Airport and air traffic systems also have massive impact on the communities that are around them. Often these are disadvantaged communities who are disproportionately affected by noise and conventional pollution. So, Mr. Martinez and Mr. Felleman, what steps can port authorities take to protect these communities that are near airports?

Mr. FELLEMAN. One of the things we found that, just within the last few years, is the implementation of NexGen. And so, what it has done is taken what was a diffuse impact and concentrated it so that the planes are flying in a much more singular route. And so this really makes for winners and losers.

And so, the way in which FAA implements that is some communities have it more diffuse, some communities have it direct on. And we find that it doesn't seem to be necessarily with a rhyme or reason, like why it is implemented and some places they are not. There are efficiencies associated being able to move planes, you know, in a quicker descent and/or closer spacing. Because, like I said, there is tremendous disproportionate impacts associated with that.

The flight patterns themselves, if we can put more over the water for longer periods of time, Puget Sound is kind of an unusual water body—

Ms. SCHAKOWSKY. I am going to cut you off with that, and maybe we could get something in writing from you. But Mr. Martinez, I want to give him a second to answer that.

Mr. MARTINEZ. Yes. I would just point out that L.A. World Airports is moving to zero emissions in all, in its buses and other fleets, and then trying to figure out additional aircraft. And I will provide some follow-up afterwards.

Ms. SCHAKOWSKY. OK. I appreciate that. It is an important issue in the Chicago area, so we want to be able to help the communities surrounding the airports.

Thank you. And I yield back.

Mr. TONKO. The gentlelady yields back. And we know you appreciate it.

Mr. SHIMKUS. You should thank the ranking member, too.

Mr. TONKO. Did you want to thank the gentleman from Illinois, too?

Ms. SCHAKOWSKY. I certainly do. I want to thank Mr. Chairman and Mr. Ranking Member.

Mr. SHIMKUS. Thank you.

Ms. SCHAKOWSKY. I really do appreciate the opportunity to participate here, a little bit anyway. Thank you.

Mr. TONKO. OK. Well, we thought you might have been the last person today, but we are also following by Dr. Ruiz, Representative from California. You are recognized for 5 minutes, please.

Mr. RUIZ. Yes. Thank you, Mr. Chairman and Mr. Ranking Member. Thank you. And thank you to all the witnesses here today to

discuss how we can decarbonize the American transportation sector.

In the face of our current climate crisis, it is urgent and imperative to drive our transportation system towards cleaner fuels and technologies. We must also address the threat that medium and heavy-duty transportation poses to clean air and our public's health.

As an emergency medicine physician, I have seen the human face of the public health consequences of air pollution. Air pollution causes asthma, stunted lung development in children, respiratory infection, heart attacks, strokes, premature death. Mortality in polluted areas is higher than in other areas.

A study published in April of this year on the proceedings of the National Academy of Sciences estimates that over 100,000 Americans die each year of illnesses caused by human-caused particulate matter pollution in the air. Particulate matter are tiny particles, as you know, emitted from chemical factories and transportation vehicles that can penetrate the lung-blood barrier, entering the bloodstream directly and poisoning our community members' lungs.

Ms. Wimberger, in addition to the personal suffering caused by the health effects of air pollution, there are significant monetary costs to individuals and society. Can you speak about these costs and the burdens they impose on communities?

Dr. WIMBERGER. Yes. I think this is a really important point. We talk a lot about the costs of taking action, and the capital costs and the up-front costs of equipment and fuels and vehicles. We don't talk about the cost of not taking action and thinking about the health impacts that we are seeing, not only from increased levels of criteria pollutants and toxics, but also carbon emissions, and looking at the social costs of carbon and the health impacts associated with it.

There are very dire consequences that we are already facing in California. We are seeing exacerbated wildfires. We are seeing non-attainment areas and increased cases of asthma and premature mortality. So there are very real costs to not taking action, which is the flip side of the coin, that I think we do need to—as an economist, I think we do need to consider that. It is a really important point.

Mr. RUIZ. Absolutely.

As we know, air pollution is particularly worse in low-income communities and communities of color. Riverside County where I am from, and now represent, ranks among the worst in the Nation for ozone pollution. And the Inland Empire in Southern California, of which Riverside County is a part of, also has some of the country's highest level of particulate matter. The fact is, respiratory illnesses caused by air pollution are preventable if we commit to upholding proper safeguards to achieve a 100 percent clean economy and decarbonize areas of our economy like our transportation sector.

Mr. Martinez, the Environmental Protection Agency's own website acknowledges that low-income neighborhoods, Tribal populations, and communities of color that live in urban areas may be disproportionately exposed to air pollution, which is barrier to economic opportunity and security. Do you think the Federal Govern-

ment is doing enough to protect these disproportionately vulnerable communities?

Mr. MARTINEZ. No. I think there is a lot more that needs to happen.

Mr. RUIZ. Can you explain or expand on how Congress can help address these environmental injustices as we consider pathways to decarbonize our transportation sector?

Mr. MARTINEZ. Yes. And Riverside is kind of the hotbed of air pollution in California. They get the regional smog, the fine particulate, and the localized health effects from hundreds of thousands of diesel trucks operating in Riverside each day.

There is a lot more that can be done to set additional standards for trucks, locomotives, and other equipment that would be beneficial. There is a lot of work—

Mr. RUIZ. But those are general, they don't really specifically address the environmental injustices. In fact, I recently introduced a bill, H.R. 3923, the Environmental Justice Act of 2019, which requires agencies consider the environmental justice implications of the programs, policies, and activities, such as transportation programs, helping ensure that we protect our communities and vulnerable populations.

So, I definitely look forward to working with you on the committee, and everybody else here, toward a 100 percent clean economy that protects our Nation's health and ensures all individuals have clean air regardless of income, race, or ZIP Code.

And let me just, since I have 40 seconds left, right now in my district we are experiencing an extreme environmental injustice where a company who had not had permits to function had a fire on its mulch where there is other debris on there as well. It has polluted the air with smoke for 8 days now, 4 days of an entire school district shutting down, 25 students getting sick enough to go to the hospital, 6 transported via ambulance.

In addition to the pollution that we are facing in Riverside County, primarily because the 10 runs through there, this is a rural, underserved community of farm workers of which I am part of. I am a result of this community. I grew up in a farm worker trailer park. I understand the environmental hazards that lack of consideration of environmental justice issues can have on the health, and the long-term viability, outcome, wellness, education, and development of children who have to breathe the pollution.

So, I look forward to working with you to getting this done.

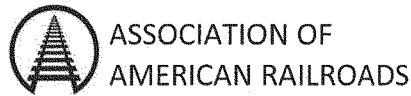
Mr. TONKO. The gentleman yields back. I thank all of my colleagues for participating today in what I think was a very important hearing. And certainly and most importantly want to thank all of our witnesses who have been a tremendous force on behalf of innovation and change. And we thank you for joining us at today's hearing.

I remind Members that, pursuant to committee rules, they have 10 business days by which to submit additional questions for the record to be answered by our witnesses. I ask each witness to respond promptly to any such questions that you may receive.

And at this time, the subcommittee is adjourned.

[Whereupon, at 12:41 p.m., the subcommittee was adjourned.]

[Material submitted for inclusion in the record follows:]



Ian Jefferies
President and Chief Executive Officer

October 23, 2019

The Honorable Paul Tonko
Chairman
Subcommittee on Environment and Climate Change
Committee on Energy and Commerce
2125 Rayburn House Office Building
Washington, DC 20515

The Honorable John Shimkus
Ranking Member
Subcommittee on Environment and Climate Change
Committee on Energy and Commerce
2125 Rayburn House Office Building
Washington, DC 20515

Dear Chairman Tonko and Ranking Member Shimkus:

On behalf of the Association of American Railroads, thank you for the opportunity to write to you and supply a statement for the record for the “Building a 100 Percent Clean Economy: Solutions for Planes, Trains, and Everything Beyond Automobiles” hearing on October 23, 2019. AAR members account for the vast majority of freight railroad mileage, employees, and traffic in Canada, Mexico, and the United States.

Greenhouse gas emissions in transportation are directly related to fuel consumption, which means the key to reducing transportation-related greenhouse gas emissions is reducing fuel consumption in transportation. America’s freight railroads offer a simple, cost-effective, and meaningful way to do this, thereby helping to ensure a sustainable future for our planet.

Railroads, on average, are three to four times more fuel efficient than trucks. That means that moving freight by rail instead of truck reduces greenhouse gas emissions by up to 75 percent. We estimate that if just 10 percent of the freight that moves by Class 7 or Class 8 (the

Page 2

largest) trucks moved by rail instead, fuel savings would be more than 1.5 billion gallons per year and annual greenhouse gas emissions would fall by more than 17 million tons — equivalent to removing some 3.2 million cars from the highways for a year or planting 400 million trees.

As an added benefit, moving more freight by rail also reduces highway congestion. According to the Texas Transportation Institute's 2019 Urban Mobility Report, highway congestion cost Americans \$166 billion in wasted time (8.8 billion hours) and fuel (3.3 billion gallons) in 2017. Lost productivity, cargo delays, and other costs add tens of billions of dollars to this tab. A single freight train though can replace several hundred trucks, freeing up space on the highway for other motorists and eliminating greenhouse gas emissions from wasted fuel. Shifting freight from trucks to rail has the added bonus of reducing highway wear and tear and the pressure to build costly new highways.

According to data from the Environmental Protection Agency, freight railroads accounted for just 2.0 percent of transportation-related greenhouse gas emissions in 2017 and just 0.6 percent of total U.S. greenhouse gas emissions.

Over the years, America's freight railroads have taken a variety of steps to reduce how much fuel is needed to transport a given amount of freight. These steps include:

- Acquiring thousands of new, more fuel-efficient locomotives and removing from service thousands of older, less fuel-efficient locomotives;
- Developing and installing highly advanced fuel management systems that, among other things, calculate the most fuel-efficient speed for a train over a given route, determine the most efficient spacing and timing of trains on a railroad's system, and monitor locomotive functions and performance to ensure peak efficiency;
- Installing idling-reduction technologies, such as stop-start systems that shut down a locomotive when it is not in use and restart it when it is needed, and expanding the use of distributed power (positioning locomotives in the middle of trains) to reduce the total horsepower required for train movements;
- Increasing the amount of freight in rail cars and on trains due to improved freight car design and other factors. The amount freight railroads carried in an average train in 2018 was 3,661 tons, up from 2,923 tons in 2000, a 25 percent increase;
- Enhancing operating practices and rail car components to reduce fuel use, including using advanced lubrication techniques to reduce friction and improving the aerodynamic profile of trains to reduce drag;
- Providing employee training to help locomotive engineers develop and implement best practices and improve awareness of fuel-efficient operations; and
- Increasing the use of zero-emission cranes to transfer containers between ships, trucks, and trains at ports and rail facilities.

Thanks to railroads' efforts, in 2018, one gallon of fuel moved one ton of freight by rail an average of 473 miles — roughly the distance from Albany to Pittsburgh, or from Collinsville, Illinois to Knoxville, Tennessee. This 2018 figure represents a 101 percent improvement since

Page 3

1980 and a 19 percent gain since 2000. From 2000 through 2018, U.S. freight railroads consumed 9.0 billion fewer gallons of fuel and emitted 100 million fewer tons of carbon dioxide than they would have if their fuel efficiency had not improved.

Railroads respectfully suggest that the cause of reducing greenhouse gas emissions would be well served if policymakers removed impediments to moving freight by rail and supported policies that incentivize shippers to ship by rail.

First, policymakers could adopt a more equitable system of funding non-rail transportation infrastructure. With respect to federally-funded capacity investments in public road and bridge infrastructure, the U.S. has historically relied upon a “user pays” system. Until relatively recently, that system worked well. Unfortunately, the user-pays model has been eroded as Highway Trust Fund (HTF) revenues have not kept up with HTF investment needs and have had to be supplemented with general taxpayer dollars. General fund transfers to the HTF since 2008 have totaled almost \$144 billion, according to the Congressional Budget Office, and will require another \$191 billion between 2020 and 2029 to keep the HTF solvent.

Unfortunately, moving away from a user-pays system has distorted the competitive environment by making it appear that trucks are less expensive than they really are and has put other modes, especially rail, at a disadvantage. America’s freight railroads, which are almost entirely privately owned, operate overwhelmingly on infrastructure that they own, build, maintain, and pay for themselves. Congress could help ameliorate this modal inequity by reaffirming the “user pays” requirement, preferably through a vehicle miles traveled fee or a weight-distance fee.

Second, policymakers should retain existing commercial truck length and weight limitations. The taxes and fees that heavy trucks pay are already far less than the cost of the damage those trucks cause. This huge underpayment would only become even greater, and the freight transportation marketplace would become even more distorted, if truck size and weight limits were increased.

Third, greater use of rail-related public-private partnerships—under which public entities devote public dollars equivalent to the public benefits that will accrue from a project, while railroads contribute resources commensurate with the private gains expected to accrue—would also lead to more freight moving by rail. Without such partnerships, many projects that promise substantial public benefits (such as reduced greenhouse gas emissions by taking trucks off highways by increasing rail capacity for use by passenger trains) are likely to be delayed or never started at all because neither side can justify the full investment needed to complete them. Cooperation makes these projects feasible.

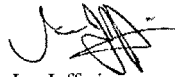
Fourth, policymakers should keep the existing system of balanced rail rate and service regulation. Today’s balanced rail regulatory system has worked extremely well for railroads and their customers. However, some want to again give government regulators control over crucial

Page 4

areas of rail operations. That would be a profound mistake because it would prevent America's railroads from making the massive investments a best-in-the-world freight rail system requires and would inexorably lead to less freight moving by environmentally-friendly rail.

Thank you again for providing me with the opportunity to provide a written statement.

Sincerely,

A handwritten signature in black ink, appearing to read 'Ian Jefferies', with a stylized flourish at the end.

Ian Jefferies
President and Chief Executive Officer

SECURING AMERICA'S
FUTURE ENERGY

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October 23, 2019

The Honorable Frank Pallone
Chairman, House Energy & Commerce
Committee
2125 Rayburn House Office Building
Washington, DC 20515

The Honorable Greg Walden
Ranking Member, House Energy & Commerce
Committee
2322 Rayburn House Office Building
Washington, DC 20515

The Honorable Paul Tonko
Chairman, Environment Subcommittee
of the House Energy & Commerce Committee
2369 Rayburn House Office Building
Washington, DC 20515

The Honorable John Shimkus
Ranking Member, Environment Subcommittee
of the House Energy & Commerce Committee
2217 Rayburn House Office Building
Washington, DC 20515

Chairman Pallone, Ranking Member Walden, Chairman Tonko, and Ranking Member Shimkus:

Thank you for holding today's hearing, "Building a 100 Percent Clean Economy: Solutions for Planes, Trains and Everything Beyond Automobiles," examining opportunities to incorporate alternative fuel technologies into the U.S. transportation sector. Securing America's Future Energy (SAFE) appreciates the opportunity to submit this letter for the Hearing Record.

SAFE is a nonpartisan, nonprofit organization committed to reducing U.S. oil dependence to improve U.S. economic and national security. In 2006, SAFE formed the Energy Security Leadership Council (ESLC), a nonpartisan group of business and former military leaders in support of long-term policy toward this goal. The ESLC is co-chaired by Frederick W. Smith, Chairman and CEO of FedEx, and General James T. Conway, 34th Commandant of the U.S. Marine Corps (Ret.). SAFE's sister organization, the Electrification Coalition (EC), helps execute this mission by promoting policies and actions that help to facilitate the deployment of electric vehicles (EVs) on a mass scale.

As the Subcommittee examines energy solutions in the transportation sector, SAFE encourages you to consider the broader benefits of alternative fuel technologies – particularly EVs – for our national and economic security.

[Overcoming U.S. Oil Dependence](#)

The United States consumes 20 million barrels per day (Mbd)—making it the largest oil consumer in the world—more than 70 percent of which is used to power a transportation system that is 92 percent dependent on oil-based fuels. Volatile, and subject to a myriad of factors as diverse as the weather and market manipulation from the Organization of the Petroleum Exporting Countries, U.S. exposure to oil jeopardizes our economic sovereignty and constrains our foreign policy.

Last year, SAFE's analysis found that the U.S. spends approximately \$81 billion per year to protect the global oil supply—amounting to 16 percent of recent Department of Defense base budgets. Spread out over the 19.8 million barrels of oil consumed daily in the U.S. in 2017, the implicit subsidy for all

petroleum consumers is approximately \$11.25 per barrel of crude oil, or \$0.28 per gallon.¹ Until the U.S. transportation sector is no longer beholden to oil, the country will be vulnerable to oil price volatility and American troops will be put in harm's way to defend access to this commodity.

EVs present one of the greatest opportunities to dramatically reduce our nation's oil dependence. By utilizing electricity to charge rapidly-improving battery technology, we can diversify our transportation sector with a domestic and fundamentally-scalable energy supply for which the prices are relatively stable. In addition, this approach is fundamentally cleaner than petroleum-based fuels for internal combustion engines, especially as the mix of fuels that are used to produce electricity continues to get cleaner. Fewer moving parts means there are lower maintenance costs for EVs, while also allowing local and state governments to address air quality challenges like alleviating non-attainment zones.

Accordingly, SAFE urges you to consider policy measures in the following areas that will help to reduce U.S. oil dependence while advancing EV adoption—which will ultimately serve to enhance U.S. national and economic security:

1. Preparing the grid for the proliferation of electric vehicles;
2. Encouraging the electrification of medium- and heavy-duty electric vehicles; and
3. Preserving strong fuel efficiency standards.

Preparing the Electric Grid for EVs

While the shift to transportation electrification will enhance our energy security through fuel diversification, it likely also will increase our reliance on the electric grid, upon which we already rely to power our economy as well as our homeland defense and national security installations. Thus, SAFE recently launched a new initiative, known as the Grid Security Project (GSP), to support more cost-effective, market-based solutions to simultaneously benefit consumers and defend our nation.

GSP is helping to ensure that the grid is secure, reliable, and resilient as transportation electrification expands across our society. It is critical that Congress enact federal energy policies that will allow electric transportation options to benefit from the reliability and resilience of the power system without eroding market forces fundamental to the electricity sector.

SAFE has previously expressed its support for H.R. 2741, the *Leading Infrastructure for Tomorrow's America (LIFT America) Act*, which was introduced by Chairman Pallone.² SAFE appreciates the Subcommittee and full Committee's leadership on the LIFT Act, which will help to strengthen America's energy security in the coming decades through: grid modernization, resilience, and security; transportation electrification; and electric transmission.

Accordingly, SAFE wishes to reiterate its support for the following provisions that address EV procurement and infrastructure, and provide recommendations for strengthening them:

¹ SAFE: "The Military Cost of Defending Global Oil Supplies," September 2018, <http://secureenergy.org/wp-content/uploads/2018/10/Securing-Americas-Future-Energy-Comments-on-EPA-HQ-OAR-2018-0283-0756.pdf>

² SAFE: "Comment Submission by Securing America's Future Energy Regarding the House Energy & Commerce Committee's Clean Economy Agenda," September 2019, http://secureenergy.org/wp-content/uploads/2019/10/SAFE_Response_EC_Committee_Request-091319-1.pdf

Section 32502 – Reauthorization of Clean School Buses Program

SAFE strongly supports this provision. Electric vehicle technology is well-suited for school buses in many areas. Every diesel bus purchased today will be on our roads for 12 to 15 years, which commits our school districts and communities to years of highly-volatile fuel costs and other emissions.

We want to highlight the need for technical assistance to be provided for the charging infrastructure that supports buses and other medium- and heavy-duty vehicles. In the course of procuring vehicles, entities should be prepared to install concurrently the infrastructure that is necessary for their deployment.

Section 33304 – Technical Assistance and Grant Program; and Section 34305 – State Transportation Electrification Planning Grants

SAFE supports these provisions and, particularly for the latter provision, encourages the Committee to consider having DOE examine the current landscape of different approaches to rate design and managed charging and to share this information with states, as they undergo regulatory or legislative processes regarding rate structures, including with respect to EV charging.

Medium- and Heavy-Duty Vehicle Electrification

While much attention has been paid to the electrification of passenger vehicles in recent years, EV adoption in the freight and logistics sector also holds significant potential for reducing U.S. oil consumption.

Trucks account for approximately 22 percent of U.S. transportation energy usage, even though they represent approximately five percent of vehicles on the road today. Moreover, in noticeable contrast to the light-duty vehicle segment, energy and oil use by medium- and heavy-duty vehicles is forecast to rise, not fall, 8 percent over the next three decades from 2.8 Mbd to approximately 3.0 Mbd in 2050.³ This rise in demand is attributable to an expected increase in the number of medium- and heavy-duty vehicles on U.S. roads, and corresponding increase in total vehicle miles driven.

As you consider opportunities to encourage the adoption of alternative fuels across all modes of transportation, SAFE encourages you to consider additional federal policies that could advance research and development, manufacturing, and commercial adoption of electric vehicles in the medium- and heavy-duty sectors.

In addition, while outside of the jurisdiction of this Committee, SAFE would like to highlight the significant opportunity for Congress to accelerate freight electrification by creating a tax credit that would incentivize the domestic manufacturing and uptake of medium- and heavy-duty EVs. Since its enactment nearly a decade ago, the Plug-In Electric Drive Vehicle Tax Credit (30D) has helped to foster the growth of light-duty EVs in the U.S. As U.S. companies, such as Workhorse and Rivian, seek to compete in a global market for MDEVs that is currently dominated by highly-subsidized Chinese companies, it is essential that Congress enact policies that encourage domestic competitiveness of this nascent industry.

³ SAFE analysis based on data from EIA.

Fuel Efficiency Standards

In August 2018, the National Highway Traffic Safety Administration (NHTSA) and Environmental Protection Agency (EPA) issued a Notice of Proposed Rulemaking (NPRM) to roll back fuel economy standards that were set by NHTSA and EPA in 2012, and maintain the MY 2020 standards through MY 2021-2026. On October 2018, SAFE submitted extensive comments to the NPRM emphasizing that strong fuel economy standards are imperative to economic and national security, and that rolling back the existing standards would run counter to American national interests.⁴

As SAFE highlighted in a previous letter to this Subcommittee on June 20, 2019, strong fuel efficiency standards are a central pillar of the United States' energy security strategy.⁵ In the months since, the Trump administration stated its intention to withdraw California's authority to set its own fuel economy rules under the Clean Air Act. This followed an announcement that California had reached a separate agreement with four automakers—Ford, Volkswagen, Honda, and BMW—that would still maintain strong fuel economy targets.

SAFE continues to advocate for California and the Trump administration to reach a compromise that would implement stable and realistic improvements in fuel economy. Accordingly, we look forward to continuing to work with you, your colleagues, and fellow stakeholders to pursue a resolution that will contribute to strong fuel economy standards that serve as a bulwark against the economic and national security dangers of oil dependence.

Conclusion

As you examine measures to diversify the fuels used in the U.S. transportation sector, we also encourage you to consider the tremendous national and economic security benefits of reducing our oil dependence. The United States must seize the opportunity to disrupt oil's virtual monopoly over the transportation sector—and, in the process, adopt solutions that will enable the movement of American consumers and goods using electricity and vehicles produced by Americans, for Americans.

We would like to thank you for your continued leadership on this critical issue. We look forward to working with you and your colleagues to advance policies that will allow the U.S. transportation sector to thrive in the decades to come.

Thank you,



Robbie Diamond
President and CEO
Securing America's Future Energy

⁴ SAFE: "Fuel Efficiency Standards Should be Modernized to Expand the Use of Advanced Fuels, Promote Driverless Technologies, and Strengthen U.S. Energy Security," October 2018, <http://secureenergy.org/wp-content/uploads/2018/10/Securing-Americas-Future-Energy-Comments-on-EPA-HQ-OAR-2018-0283-0756.pdf>

⁵ SAFE, "Letter for the Record for House Energy & Commerce Fuel Economy Hearing," June 2019, <http://secureenergy.org/wp-content/uploads/2019/06/SAFE-Letter-for-the-Record-Fuel-Economy-House-EC-6-20-19.pdf>



AMERICAN PUBLIC GAS ASSOCIATION

October 22nd, 2019

Congressman Paul Tonko
2369 Rayburn House Office Building
Washington, DC 20515

Congressman John Shimkus
2217 Rayburn House Office Building
Washington, DC 20515

Re: Hearing on "Building a 100 Percent Clean Economy: Solutions for Planes, Trains and Everything Beyond Automobiles"

Dear Chairman Tonko and Ranking Member Shimkus,

APGA represents roughly 1,000 retail natural gas distribution entities owned by and accountable to the citizens they serve. They include municipal gas distribution systems, public utility districts, county districts, and other public agencies that own and operate natural gas distribution facilities in their communities. Public gas systems' primary focus is on providing safe, reliable, and affordable energy to their customers. APGA members serve their communities in many ways. They deliver natural gas to be used for cooking, clothes drying, and space and water heating, as well as for various commercial and industrial applications.

APGA is appreciative of the Subcommittee and the full Committee for considering all stakeholder input, as it works on comprehensive climate legislation. Public natural gas utilities continue to play a role in reducing greenhouse gas (GHG) emissions in all sectors. Our members are good stewards of their systems and the environment; they also take seriously their role in providing affordable and reliable energy. In addition to the residential and industrial uses most are more familiar with, natural gas is used for medium- and heavy-duty transportation. As the Subcommittee is engaging stakeholders on transportation emissions, APGA would like to add some commentary on the value of natural gas in this sector.

Many APGA members are heavily invested in natural gas transportation fuels, mostly via compressed natural gas (CNG). This fuel has proven to be safe, clean, abundant, and affordable, and our members are proud to distribute. Natural gas vehicles (NGVs) increase fuel diversity, spurring economic growth and potential for expanded application across the country. NGVs also provide two specific benefits that other fuels cannot: unmatched fuel delivery reliability and the ability for communities to reach attainment status under the National Ambient Air Quality Standards (NAAQS), as set forth in the Clean Air Act.¹ Municipalities take advantage of these characteristics by running and maintaining their own natural gas fleets, including maintenance and utility trucks.

¹ "Clean Air Act" Sections, P.L. 91-604, Sec. 109.

As well, CNG is resilient. Its delivery is only dependent on the availability of the natural gas via underground pipelines. Gasoline and electricity, on the other hand, can only be used so long as gasoline supply remains uninterrupted, and the electricity infrastructure remains functional. However, these are often disrupted in severe weather events. For example, the 2017 hurricane season resulted in widespread power outages and major gasoline shortages. Fortunately, natural gas was fully functional through it all. NGVs proved resilient for two reasons. One, the supply could be delivered relatively uninterrupted. Natural gas pipelines, being underground, were mostly protected from debris, wind, and storm surges. Second, CNG can be pumped without the use of electricity. The fueling stations are run on generators that are fueled by natural gas. With no need for electricity, the pumps were able to flow CNG to stations reliably.

There is an environmental benefit to NGVs, too. They offer the fastest path to reducing heavy-duty vehicle emissions.² As an example, California has the most rigorous emission standards for NOx, but the Cummins Westport 8.9-liter ISL G NZ engine is certified to meet the California Air Resource Board (CARB) standard. As well, this same manufacturer has an engine with near-zero NOx emissions. Generally speaking, these innovations from Cummins Westport are 90% cleaner than what the current EPA standard requires.³ Everyone is discussing electricity as the next transportation fuel, but why dismiss natural gas so quickly? Even in states like California, Oregon, and Washington that have the cleanest electrical grids in the nation, the NOx emitted through emissions is much worse than the direct use of natural gas in a heavy-duty vehicle with a natural gas engine.⁴

The US may soon face challenges of how to properly dispose of spent vehicle batteries. If electric vehicles are to be the future of transportation, the grid will likely need significant upgrades. Research by the Smart Electric Power Alliance (SEPA), shows that 75 percent of all electric utilities in the United States are not prepared to meet expected future demand in terms of grid capacity and distribution needs.⁵ As proponents of full-fuel-cycle metrics, APGA also wants to highlight that the Union of Concerned Scientists has provided it takes so much energy to make batteries that electric vehicles with a 250-mile range have a carbon footprint 68 percent higher due to manufacturing.⁶

There are additional emissions reductions opportunities if renewable natural gas (RNG) is utilized in the transportation fuel market. Both APGA members, as well as private companies, are investing in this technology. The United Parcel Service (UPS) is making significant investments in RNG and CNG transportation initiatives. They recently announced plans to purchase more than 6,000 natural gas-powered trucks between 2020 and 2022, a commitment representing a \$450 million investment in the company's alternative fuel program to reduce emissions and a complement to its current RNG commitments.⁷ APGA and its members support RNG technologies in the transportation sector and all others. RNG is derived from the breakdown of organic wastes and processed for use in existing natural

²"Environment," NGV America, Accessed October 21, 2019, <https://www.ngvamerica.org/environment/>.

³"Report Overview One Sheet," NGV America, Accessed October 21, 2019, <https://cdn.ngvgamechanger.com/pdfs/game-changer-graphic-onesheet.pdf>.

⁴"Report Overview One Sheet," NGV America, Accessed October 21, 2019, <https://cdn.ngvgamechanger.com/pdfs/game-changer-graphic-onesheet.pdf>.

⁵"Utilities and Electric Vehicles: Evolving to Unlock Grid Value," Smart Electric Power Alliance, Accessed October 21, 2019, <https://sepapower.org/resource/utilities-electric-vehicles-evolving-unlock-grid-value/>.

⁶"Cleaner Cars from Cradle to Grave," Union of Concerned Scientists, Published Oct 29, 2015, <https://www.ucsusa.org/resources/cleaner-cars-cradle-grave>.

⁷"UPS adding 6,000 NGVs," Shale Directories, Accessed October 22, 2019, <https://www.shaledirectories.com/blog/ups-adding-6000-ngvs/>.

gas infrastructure, interchangeable with geologic natural gas in homes, businesses, vehicles, manufacturing, and industrial applications. RNG, a low-carbon pathway, takes an existing carbon-emitting waste stream, either from waste or agriculture, and recycles into a usable product. In some applications, it is a negative-emission technology. APGA members' support for RNG demonstrates their investment in balanced energy solutions as it lessens environmental impacts. The Committee should consider federal support for this valuable technology.

Again, APGA appreciates the opportunity to provide this input, and we look forward to working with the Subcommittee more in developing balanced energy solutions, allowing for affordable medium- and heavy-duty transportation that can positively impact the environment.

Respectfully submitted,



Bert Kalisch
President & CEO
American Public Gas Association



October 22, 2019

Rep. Paul Tonko
Chairman
Subcommittee on Environment and Climate
Change
Committee on Energy and Commerce
U.S. House of Representatives
2125 Rayburn House Office Building
Washington, DC 20515

Rep. John Shimkus
Ranking Member
Subcommittee on Environment and Climate
Change
Committee on Energy and Commerce
U.S. House of Representatives
2322 Rayburn House Office Building
Washington, DC 20515

Dear Chairman Tonko and Ranking Member Shimkus,

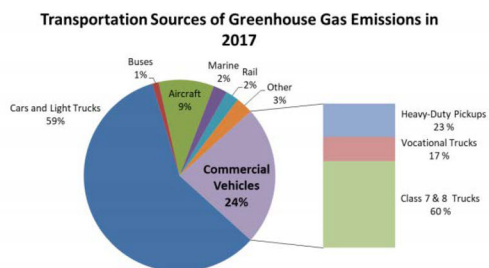
On behalf of the Diesel Technology Forum, we would like to submit the comment concerning the hearing before the subcommittee titled *Building a 100 Percent Clean Economy: Solutions for Planes, Trains and Everything Beyond Automobiles*.

Diesel technology has undergone a significant transformation over the past decade and half and the latest generation diesel technologies that power heavy duty trucks and off-road equipment are now near-zero in emissions. The leaders in diesel technology are engaged to refine the technology to further drive these emissions closer to zero in the near term while generating significant fuel savings and greenhouse gas emission reductions. While emerging zero-emission heavy-duty technologies are on the drawing board today, and a few are available currently, introducing the latest diesel technology will do the most to deliver immediate term benefits to the communities where these vehicles and equipment operate.

By way of background, the Diesel Technology Forum ("DTF") represents the leaders in diesel technology including engine, vehicle, equipment and component manufacturers and biofuel producers. The Diesel Technology Forum is a not-for-profit organization that conducts research and educational outreach about the economic importance, energy efficiency and clean air and climate benefits of diesel technology of all kinds.

1. Transport Sector Contribution to Greenhouse Gas Emissions

Transportation sources of greenhouse gas emissions are now the leading source of emissions in the U.S. While passenger cars contribute the most to transportation emissions, commercial vehicles rank as the second leading contributor while rail and marine vessels represent 4 percent collectively.

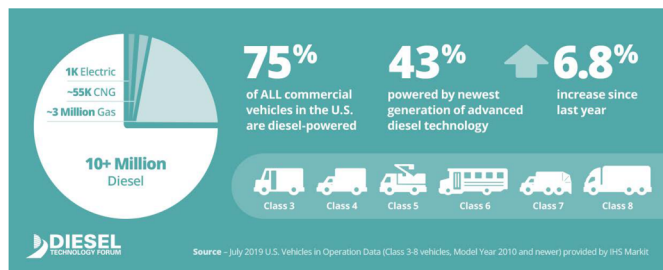


Within the large population of commercial vehicles, the larger Class 7 and 8 trucks – large straight trucks and tractor trailer combination units are responsible for the majority of emissions. Efforts to encourage the replacement of older Class 7 and 8 vehicles with new cleaner technologies will do the most to reduce commercial vehicle greenhouse gas emissions.

2. New Technology Diesel Growing in the Transport Sector

Diesel technology is the leading technology and fuel type powering commercial vehicles today and is expected to be the predominant fuel and technology type in the future. 75% of all Class 3-8 commercial vehicles are diesel today while 98 percent of the larger Class 8 trucks are diesel. Today, According to research commissioned by DTF, diesel remains the dominant technology in [long-haul trucking](#), powering 97 percent of Class 8 big-rig trucks in the United States. A growing percentage of diesel-powered commercial trucks rely on the newest-generation diesel technologies, which [deliver near-zero emissions performance while using less fuel](#); [more than 43 percent of commercial Class 3-8 vehicles are of this newest-generation technology](#) (2011 and newer model years), up by 6.8 percent over 2017. These more than 4.9 million new-generation commercial diesel trucks have removed more than 26 million tonnes of NOx and 59 million tonnes of carbon dioxide (CO2), compared to previous generations.

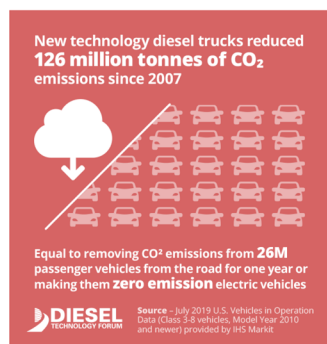
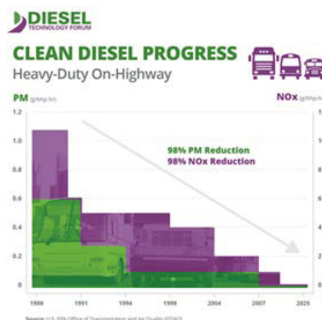
While alternatives, primarily natural gas, have been available for over a decade, these alternatives do not comprise more than 5 percent of the total commercial vehicle fleet. Other zero-emissions technologies are available today, primarily in smaller vehicle types in niche applications such as school and transit buses and inner city delivery vehicles, these vehicles do not represent a sizeable portion of the fleet inventory.



3. Significant Transformation to Near Zero Emissions Across the board for all Diesel engines

Over the last decade-and-a-half, diesel technology has undergone a significant transformation to near-zero emissions. Cleaner fuel along with modern engine designs and aftertreatment technologies yield near-zero levels of fine particles and oxide of nitrogen. As of 2019, 43 percent of the diesel commercial vehicle fleet in operation since 2011 utilize the newest generation of near-zero emissions technologies, generating significant emission reduction benefits to the communities where they operate. A single near-zero emissions Class 8 truck, for example, generates 2.3 fewer tons of oxides of nitrogen than an older generation truck. U.S. Environmental Protection Agency finds that a new Class 8 diesel truck and an all-electric truck can reduce about the same amount of fine particle emissions as most emissions are generated by brake and tire wear and not from tailpipe emissions.¹

¹ <https://www.epa.gov/ports-initiative/national-port-strategy-assessment-reducing-air-pollution-and-greenhouse-gases-us>



Benefits of Diesel Technology in the Pacific Northwest Port Communities

New diesel technology provides significant benefits to communities including those communities surrounding seaports that are often proximate to a large concentration of industrial activity including truck traffic. Replacing older trucks with the latest near-zero emissions diesel technology has been identified as one of the most cost effective strategies to deliver the most clean air benefits to these near-port communities.

Recently, the Northwest Seaports Alliance representing the ports of Tacoma and Seattle, received the Association of American Port Authorities' Environmental Improvement Award for its Clean Truck Program that requires that all trucks serving the port come with technology to meet near-zero emissions technology. The overwhelming majority of these benefits have been delivered to

communities through near-zero emissions diesel trucks.²

4. New Technology Diesel Delivering significant Greenhouse Gas Reductions

One of the benefits of the diesel platform is its impressive track record for continual improvement. While the current generation of diesel commercial vehicles deliver near-zero emissions, truck and engine manufacturers are hard at work developing much more fuel efficient diesel trucks that will deliver significant fuel savings. Fuel economy rules are now required of the large variety of commercial vehicles from larger pickups to the largest Class 8 trucks. More efficient diesel trucks are expected to save **130 billion gallons** of fuel and reduce **1.3 billion tons of greenhouse gas emissions** between 2010 and 2030, according to research commissioned by the Diesel

² <https://www.nwseaportalliance.com/news/10172019/nwsa%E2%80%99s-clean-truck-program-earns-aapa-environmental-award>

Technology Forum. These are significant benefits that are equivalent to removing all cars on U.S. roads for a year or eliminating the emissions generated from electricity used by 22 million homes.³

5. Reducing Transportation Emissions Requires a Variety of Clean Technologies Including Diesel

As emerging technologies will be the focus of much attention to reduce heavy-duty transportation emissions, significant and near-term benefits can be realized by replacing older trucks with newer diesel options to help contribute to achieve climate goals.

While zero-emission technologies are available today in some commercial vehicle and bus types, and others are on the drawing board, diesel technology is expected to continue to dominate the larger commercial vehicle fleet through 2030, particularly Class 8 trucks that are responsible for most of the greenhouse gas emissions from the entire commercial vehicle sector. As these emerging zero-emissions technologies will make in-roads into the fleet, so too will more efficient diesel commercial vehicles and their benefits are substantial as noted above. IHS Markit estimates that 75% of commercial vehicle truck sales will include a diesel engine by 2030.⁴ Meanwhile, the work truck industry and the National American Council for Freight Efficiency estimate that all-electric technologies may not prove out for larger commercial vehicles until at least the 2030 time frame.⁵ This outlook is shared by the Truck and Engine Manufacturers. As these technologies become available in the future, a recent analysis conducted by the National Academies of Science concludes that the relatively longer turn-over of older vehicles in favor of new trucks results in a further timeframe for these technologies to enter the fleet in any sizeable number to generate benefits.⁶

6. More Efficient Off-Road Technologies- Marine and Rail

Diesel is the technology of choice for marine and rail applications, where engine horsepower ratings and power demands are measured in thousands of HP. New generations of diesel engines are more fuel efficient than older technology, allowing boat or rail operators to achieve reductions in fuel consumption that translates into lower greenhouse gas emissions.

Replacing older engines that power marine vessels and locomotives may provide substantial greenhouse gas emission reductions, particularly in localized communities. Unlike commercial vehicles, off-road equipment including rail and marine that is responsible for about 4 percent of transportation greenhouse gas emissions, are not subject to fuel economy standards. Engines that power these applications must meet stringent emissions standards for criteria pollutants including fine particles and oxides of nitrogen. New technology diesel engines developed to meet the most recent standard required by the U.S. Environmental Protection Agency reduce these emission by upwards of 90 percent. Maximizing fuel efficiency in marine and rail applications has long been a key customer attribute for engine manufacturers, however replacing older and longer lived engines with new more modern designs frequently results in substantial fuel economy benefits that translate directly to greenhouse gas emission reduction.

For example, one rail operator in the New York City region replaced an older diesel switch locomotive manufactured before emission controls were required with the new diesel technology and saved 26,000 gallons of fuel per year.⁷ Similarly, a tug boat operator in the Puget Sound region replaced an old uncontrolled propulsion

³ <https://www.dieselforum.org/policy/climate-change-and-diesel-technology>

⁴ <https://ihsmarkit.com/products/reinventing-the-truck.html>

⁵ <https://naef.org/future-technology/electric-trucks/>

⁶ <https://www.nap.edu/catalog/25542/reducing-fuel-consumption-and-greenhouse-gas-emissions-of-medium-and-heavy-duty-vehicles-phase-two>

⁷ https://www.epa.gov/ports-initiative/new-york-city-locomotive-repowers-collaborative-efforts-improve-air-quality?fbclid=IwAR2wJx2848cmG_PDQcrY9llclL_Q2pTcgXvpfDcO-Q_J5V1y0-FNPYpZU5U#outcomes

engines with new diesel models to realize 1,000 tons of greenhouse gas emissions.⁸ These are benefits generated by a single project and are equivalent to converting thousands of automobiles to zero-emissions technologies.

7. Significant Benefits From Use of Advanced Renewable Biofuels

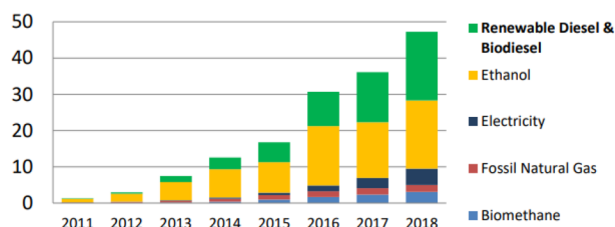
Expanding on the fuel efficiency advantages of diesel, significant additional and immediate term greenhouse gas reduction benefits can be realized through the use of low-carbon advanced biofuels including biodiesel and renewable diesel fuel. These two fuels are considered advanced biofuels capable of reducing greenhouse gas emissions by at least fifty percent and in the case of renewable diesel fuel, greenhouse gas emissions can be eliminated by more than 80 percent.

Unlike other alternatives, the use of biodiesel and renewable diesel fuel can be used in various blends, according to manufacturer specifications in most all existing diesel engines and does not require the purchase of a new engine, vehicle or equipment. The use of these renewable fuels also does not require additional and expensive investments in refueling or recharging infrastructure.

These low carbon biodiesel fuels have provided the most greenhouse gas reductions in the transportation sector in California, according to the California Air Resources Board.⁹ As a result of California's requirement to reduce the carbon content of transportation fuels sold in the state, biodiesel and renewable diesel fuel have eliminated the most greenhouse gas emissions even exceeding the benefits generated by all-electric cars and trucks by almost 4:1.

Cumulative CO2 Reductions (million tons)

SOURCE: California Energy Commission, Low Carbon Fuel Standard Dashboard



Interest in these fuels is growing outside of California. The City of New York, with its fleet of 13,000 heavy-duty vehicles and equipment announced its efforts to replace 17 million gallons of diesel fuel with renewable diesel fuel that is expected to be the leading contributor to the City's greenhouse gas reduction strategy.¹⁰ The Port Authority

⁸ : <https://www.epa.gov/sites/production/files/2019-05/documents/diesel-tech-forum-large-engine-research-2019-mcdi-mtg-12pp.pdf>

⁹ <https://www3.arb.ca.gov/fuels/lcfs/dashboard/dashboard.htm>

¹⁰ <https://www1.nyc.gov/assets/dcas/downloads/pdf/fleet/Press-Release-DCAS-to-Expand-Use-of-Renewable-Diesel-in-City-Fleet-Vehicles.pdf>

of New York-New Jersey announced its partnership with Neste, the global leader in the supply of renewable diesel fuel, to use this advanced biofuel in the Port's fleet of heavy-duty vehicles and equipment.¹¹

Conclusion

Decarbonizing the transportation sector is a complex challenge without a one-size fits all solution, particularly in the goods movement sector that relies predominately on diesel engines which range from less than 100 hp in smaller trucks up to 110,000 hp in ocean going vessels.

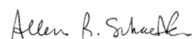
Technologies like the newest technology diesel engines, particularly when coupled with the expanded use of advanced renewable biofuels, delivers an important near term/long term opportunity for reducing greenhouse gas emissions benefits and decarbonizing the transport sector.

Alternatives to diesel – whether electric, fuel cell or other alternative fuels- must be fully explored in the context of benefits over the comparable generation of diesel technology, and evaluated in the context of timeliness of impact, market acceptance and penetration. Any transition to new fuels and technologies are likely to take considerable time to reach commercial scale and market acceptance, perhaps on the orders of decades or more. In the interim, progress must be sustained.

Across all sectors of the economy, Americans are benefitting today from the new generation of advanced diesel technology in the form of cleaner air and lower greenhouse gas emissions with more benefits set to come in the future.

Please feel free to contact me with any questions or concerns at (301) 668-7230.

Sincerely yours,



Allen R. Schaeffer
Executive Director

¹¹ <https://bioenergyinternational.com/biofuels-oils/neste-and-the-port-authority-of-new-york-new-jersey-collaborate-to-facilitate-the-use-of-sustainable-transportation-fuels>



October 23, 2019

The Honorable Frank Pallone, Jr.
Chairman, House Committee on Energy and Commerce
2125 Rayburn House Office Building
Washington, DC 20515

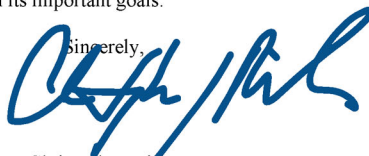
Dear Mr. Chairman:

I am writing to request that a recent report (or its executive summary, both attached) from the Manufacturers of Emission Controls Association (MECA) be included in the record of today's full Committee hearing on "Building a 100 Percent Clean Economy: Solutions for Planes, Trains, and Everything Beyond Automobiles."

The report makes clear there is available and cost-effective technology to dramatically and quickly reduce nitrogen oxides (NOx) from heavy-duty vehicles in a way that complements continuing and deeper reductions in greenhouse gases. The so-called "tradeoff" raised by opponents of tighter NOx regulations can be overcome with technologies like cylinder deactivation, hybridization, and others.

Swift and significant NOx reductions from heavy-duty engines and vehicles is essential for achieving the 2015 national ambient air quality standards for ozone by mandated attainment dates, particularly because their emissions are a growing proportion of NOx inventories. These reductions are critical for protecting public health in the Northeast, California, the Midwest around Chicago, Houston-Galveston and elsewhere, but are even more important in severely congested urban corridors and port regions where economically disadvantaged people are more heavily exposed to pollution.

Thank you for your consideration. My trade association stands ready to help you and your staff as the Committee moves forward on its important goals.

Sincerely,


Christopher Miller
Executive Director

TECHNOLOGY FEASIBILITY FOR
MODEL YEAR 2024
HEAVY-DUTY DIESEL VEHICLES
IN MEETING LOWER NOX STANDARDS

June 2019



Manufacturers of Emission Controls Association
2200 Wilson Boulevard * Suite 310 * Arlington, VA 22201
www.meca.org

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Executive Summary

The transportation sector was responsible for over 7 million tons of NO_x emissions in the U.S. in 2014, with 50% of this sector's NO_x attributed to heavy-duty on- and off-road vehicles and equipment. NO_x is a precursor for both ground level ozone and secondary PM_{2.5} which are regulated under the National Ambient Air Quality Standards (NAAQS) because of their adverse effects on human health and the environment. Due to the continued exposure of millions of Americans to poor air quality, both the United States Environmental Protection Agency (EPA) and California Air Resources Board (CARB) have announced rulemakings focused on revising the heavy-duty truck emission standards, with a particular focus on tighter limits for oxides of nitrogen (NO_x). EPA is targeting implementation in the 2027 timeframe while CARB is focusing efforts on phasing in more stringent standards in 2024 and again in 2027 with the hope of aligning with EPA as a national standard.

In this report, MECA provides our assessment of technologies being commercialized by component suppliers, including MECA members, to help their customers comply with future lower NO_x standards. We present dynamometer test results and emission models from fully aged aftertreatment systems installed on heavy-duty on-road engines to offer several compliance paths that are technologically and economically achievable by model year (MY) 2024 without significant changes to today's engines or aftertreatment. The models used have been optimized over decades of testing of accelerated aged commercial catalysts and validated against real world emission control systems. The technologies outlined in this assessment are either commercial or market ready options that can be deployed on vehicles by model year 2024 to achieve 0.05 gram per brake horsepower hour (g/bhp-hr) on the heavy-duty FTP certification cycle and approximately 0.2 g/bhp-hr in low load operation using the proposed low load certification cycle being developed at Southwest Research Institute under a contract from CARB. It is important to state that there are several technology paths to achieve these levels of emissions, and some of them can simultaneously lower greenhouse gas emissions, such that the NO_x reductions do not compete with the CO₂ reductions.

The following assessment is based on the implementation timeline presented by CARB staff at the January 23, 2019 public workshop as well as the assumptions laid out in the CARB staff white paper released on April 18, 2019 (CARB, 2019). In the latter, CARB staff signaled a plan to align the regulatory provisions for the first phase of NO_x tightening with the second implementation stage of the Greenhouse Gas Emissions and Fuel Efficiency Standards for Medium- and Heavy-Duty Engines and Vehicles - Phase 2 (hereafter "Phase 2 GHG regulation") in 2024. Assumptions include that the OEMs will have to meet a Federal Test Procedure (FTP) certification standard with current cold start and hot start weightings, a Ramped Modal Cycle Supplemental Emission Test (RMC-SET) and the proposed Low Load Cycle (LLC) based on profile LLC-7 (CARB, 2019). Included, as part of future requirements, is a revised heavy-duty in-use testing (HDIUT) protocol that replaces the current not-to-exceed (NTE) based protocol with a moving average windows method with a 10% low power exclusion, similar to that required under Euro VI-D. Finally, the technologies considered in this assessment are assumed to be designed to meet a 435,000 mile full-useful life (FUL) and a 350,000 mile or 5 year warranty, with the latter going into effect in 2022 in California.

The conclusions in this paper can be summarized as follows:

- 1. Compared to emission controls on MY 2010 U.S. diesel trucks, today's compact aftertreatment systems are 40% lighter, 60% smaller, and substantially less expensive.**

Manufacturers continue to optimize diesel emission controls, such as DOC, DPF and SCR, in order to promote uniform catalyst coating, improve NO_x conversion efficiency, reduce back pressure on the engine, and reduce thermal mass. New substrates are designed with thinner walls or higher porosity, which allows the coating of better catalysts without sacrificing durability. This has resulted in higher catalyst loading per volume of substrate and led to downsizing of systems from those available in 2010. Furthermore, catalyst development has produced higher activity catalysts that can provide higher NO_x conversion with lower catalyst loading. While the cost of new heavy-duty trucks has increased at approximately 1% per year, the cost of emission controls has come down, representing a lower percentage of the cost of a new truck. These advances have brought higher compliance margins and lower certification levels while still meeting future GHG standards. Advanced catalysts and substrates combined with better engine and urea dosing calibration can be readily employed to meet tighter NO_x limits in 2024 without any significant changes to today's system design. Based on a survey of MECA's members, we estimate the cost of emission controls on a future ultra-low NO_x truck to be similar to the cost of emission controls on a MY 2010 truck.

- 2. Several vocational engine families have demonstrated the capability of achieving NO_x emissions 50-75% below today's standards, while also meeting future heavy-duty greenhouse gas limits for vocational engines.**

Since 2010, setting stringent emission targets for both CO₂ and NO_x through realistic regulations and expanding the calibrator's tool box from the engine to the powertrain has allowed engineers to achieve simultaneous NO_x reductions and engine efficiency improvements. A review of EPA's heavy-duty certification tables (U.S. EPA, 2019) indicates that a number of diesel engine families certified since 2010 have shown the ability to achieve 0.1 g/bhp-hr and lower tailpipe NO_x levels over the composite FTP certification cycle. Of those engines, several have demonstrated the ability to meet future Phase 2 GHG regulation limits for vocational engines that go into effect in 2021, 2024 and 2027. History has shown that once emission control and efficiency improving technologies were required on engines, the traditional trade-off relationship between CO₂ and NO_x emissions at the tailpipe has been overcome and reductions of both pollutants could be achieved simultaneously.

- 3. A wide variety of technology options can be deployed on heavy-duty engines and vehicles to reduce engine-out NO_x while improving fuel economy to reduce the total cost of ownership of trucks.**

The number of on-engine technology options and strategies that OEMs may choose to deploy to meet both a 2024 NO_x standard and the 2024 CO₂ standard has grown dramatically in recent years, as a result of the Phase 2 GHG regulation. Technologies such as cylinder deactivation (CDA), high efficiency variable geometry turbochargers with exhaust gas by-pass, and start-stop systems are only some of the commercially available fuel saving technologies that

can be implemented by 2024. Some of these strategies can be deployed on cold-start to heat up aftertreatment and keep it hot under low engine load operation. Other technologies that are being demonstrated on vehicles include 48V electrical architectures combined with regenerative braking and small batteries that can electrify auxiliary components on the engines such as air conditioning compressors, water and oil pumps, EGR pumps, electric assist turbochargers, electrically heated catalysts, 48V motor-generators, 48V electric fans and auxiliary power units to take the load off the engines. Technologies like CDA and 48V mild hybridization can enable simultaneous NO_x and CO₂ reduction, and once implemented, these technologies will deliver fuel savings to truck owners.

4. Strategies for reducing emissions during periods of low load operation, combined with improved engine calibration and control of urea dosing, can be applied to heavy-duty trucks by 2024 to enable emission control systems to achieve an FTP emission limit of 0.05 g/bhp-hr and a Low Load Cycle (LLC) limit below 0.2 g/bhp-hr.

Engine calibration and thermal management combined with advanced catalysts and substrates have improved to the point where a current engine plus aftertreatment system can achieve FTP emissions below 0.05 g/bhp-hr NO_x with compliance margins that OEMs need for full useful life durability. During cold-start and low-load operation, engine calibration and thermal management, including the technologies listed in (3) above, can be applied to reduce engine out NO_x emissions and provide additional heat to aftertreatment systems. Better catalysts and urea dosing systems can achieve high NO_x conversion during lower temperature operation. Further compliance margins can be achieved through modest increases in catalyst volume, while still maintaining the size of future emission controls below those on model year 2010 trucks. Some engine manufacturers may choose to include a light-off SCR catalyst before the DOC in a twin SCR system arrangement with dual urea dosing, to gain experience with the types of strategies that may be needed for lower NO_x limits in 2027. The approaches discussed for meeting 2024 NO_x limits utilize improvements in thermal management and engine calibration, and existing aftertreatment system designs that employ newer high efficiency catalysts and coating strategies. Simulations of commercial catalysts over a low load cycle show that low temperature ammonia delivery through the use of heated urea dosing can deliver NO_x emissions below 0.2 g/bhp-hr over the LLC, representing extended low-speed operation and idling.

NGVAMERICA

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October 22, 2019

The Honorable Paul Tonko
Chairman
Energy and Commerce Subcommittee on
Environment and Climate Change

The Honorable John Shimkus
Ranking Member
Energy and Commerce Subcommittee on
Environment and Climate Change

Dear Chairman Tonko and Ranking Member Shimkus,

NGVAmerica contacts you today to provide comments related to the October 23rd Environment and Climate Change Subcommittee hearing on "Building a 100 % Clean Economy: Solutions for Planes, Trains and Everything Beyond Automobiles". NGVAmerica is a national trade association dedicated to creating a profitable, sustainable and growing market for compressed natural gas (CNG)- and liquefied natural gas (LNG)-powered vehicles. NGVAmerica represents more than 200 companies, including vehicle manufacturers; natural gas vehicle component manufacturers; natural gas distribution, transmission, and production companies; natural gas development organizations; non-profit advocacy organizations; state and local government agencies; and fleet operators. NGVAmerica and our member companies represent all parts of the natural gas vehicle industry, including light-duty vehicles, trucks, buses, trains, marine vessels, and transport services.

NGVAmerica and our member companies view natural gas in transportation as key to building a 100% clean economy. Increased use of natural gas in transportation reduces greenhouse gas emissions (GHGs) while reducing other negative impacts of traditional transportation fuels, including particle pollutants, SOx and NOx. Despite the tremendous environmental successes of natural gas in transportation, deployment of NGVs in the United States falls far behind other countries around the world. With the help of federal policymakers, it is possible to support a growing market for clean, abundant, domestic, affordable natural gas and renewable natural gas in our transportation market. As such, we would ask the Committee to include natural gas vehicles in any policy intended to create a 100% clean economy.

There are two main reasons to support increased natural gas in transportation as part of our clean transportation future:

- Renewable natural gas (RNG) offers the most drastic, immediate carbon reductions of any transportation fuel;
- Natural gas offers fuel solutions for a variety of high fuel-use vehicle types required of a clean economy, including heavy-duty trucks, buses, locomotives, marine vessels, construction and specialty equipment.

Advocating the increasing use of NGVs where they benefit most.
For the economy. For the environment. For health. For security. For America.

Natural Gas & Renewable Natural Gas: Carbon Reductions in Transportation

As Chairman Pallone stated in the hearing announcement: “The transportation sector is the largest source of greenhouse gas (GHG) emissions in the United States, accounting for 29% of total emissions.”¹ The hearing announcement also included a claim the natural gas industry disputes, stating “Liquified or compressed natural gas may also play a role in fuel-switching. However, the climate benefits of switching to natural gas are significantly lower in heavy-duty transportation than in other industries, such as from coal to natural gas for electricity generation.” With advanced engine technology, and most importantly, the tremendous growth in deployment of vehicles powered by renewable natural gas, the climate benefits of switching to natural gas-powered vehicles are evident, and these benefits can be realized today.

The number one source of urban emissions are vehicles such as short-haul, long-haul, refuse, school and transit buses. 74% of heavy-duty trucks are not certified to latest NOx emissions standards. These high polluting trucks are diesel trucks, but newer technology offers affordable, clean options offering a big impact when it comes to clean air. In fact, replacing 1 traditional diesel-burning heavy-duty truck with 1 new Ultra Low-NOx natural gas heavy-duty truck is the emissions equivalent of removing 119 traditional combustion engine cars off our roads. Utilize renewable natural gas in this Ultra Low-NOx engine and the emissions reductions are even more dramatic.

Renewable natural gas (RNG) is a domestic, renewable, clean fuel derived from organic waste resources (agriculture, landfills, waste water treatment plants, and municipal solid waste). Some of these sources result in a fuel that can have a negative carbon intensity. In other words, using RNG as a transportation fuel is actually removing GHGs that would otherwise be emitted to the atmosphere. RNG use in the NGV industry continues to grow. A fleet or individual who makes the transition to operating vehicles on natural gas is reducing the amount of carbon dioxide that could exist in the atmosphere for millennia.

Using natural gas in transportation provides an immediate reduction in long-lived carbon dioxide emissions. Carbon dioxide (CO₂) is the primary long lived pollutant, and while much of the CO₂ can be absorbed by the oceans within centuries, the remaining CO₂ can stay in the atmosphere for thousands of years.² The US EPA states that, “Atmospheric CO₂ is part of the global carbon cycle, and therefore its fate is a complex function of geochemical and biological processes. Some of the excess carbon dioxide will be absorbed quickly (e.g., by the ocean surface), but some will remain in the atmosphere for thousands of years, due in part to the very slow process by which carbon is transferred to ocean sediments.”³

¹ U.S. Environmental Protection Agency, Sources of Greenhouse Gas Emissions ([epa.gov/ghgemissions/sources-greenhouse-gas-emissions](https://www.epa.gov/ghgemissions/sources-greenhouse-gas-emissions)) (Sept. 13, 2019).

² Archer, D., Eby, M., Brovkin, V., Ridgwell, A., Cao, L., Mikolajewicz, U., . . . Tokos, K. (2009). Atmospheric lifetime of fossil fuel carbon dioxide. *Annual Review of Earth and Planetary Sciences*, 37, 117-134. doi:10.1146/annurev.earth.031208.100206 (http://climatemodels.uchicago.edu/geocarb/archer.2009.ann_rev_tail.pdf)

³ Overview of greenhouse gases. Retrieved from <https://www.epa.gov/ghgemissions/overview-greenhouse-gases#CO2%20lifetime>

Methane on the other hand is a short-lived climate pollutant (SLCP), which during its brief lifetime has a greater potential to capture heat, but remains in the atmosphere for a much shorter amount of time. This is a crucial distinction policymakers must bear in mind when considering the future of transportation policy; the focus should be on reducing carbon dioxide, which can stay in the atmosphere for thousands of years. The NGV industry is demonstrating its ability to dramatically reduce the amount of methane emitted along the whole supply chain, minimizing the short-term impact of methane and leading to a stronger contribution to overall climate change mitigation than many other currently available fuels used in the transportation sector.

Natural gas vehicles are key to reducing these dangerous emissions as we battle against climate change, and deploying cleaner technology can reduce this significant source of GHGs. The newest heavy-duty natural gas trucks are 90% cleaner than the EPA's current NOx standard and 90% cleaner than the latest available diesel engine.⁴ Fueling with natural gas reduces CO2 and greenhouse gas emissions compared to comparable diesel. If fueling with LNG, the well-to-wheels GHG emissions reduction is 11%; fueling with CNG is a 17% reduction.⁵ However, fueling with renewable natural gas (RNG) provides even greater CO2 and greenhouse gas emission reductions, anywhere from 40-125% on a well-to-wheels basis depending on food stock.⁶ When it comes to carbon intensity, the California Air Resources Board's Low Carbon Fuel Standards Pathways certified carbon intensity values for RNG (Bio-LNG or Bio-CNG) as the lowest Energy Economy Ratio-Adjusted Carbon Intensity, as low as -400 CI.⁷

Utilized in heavy-duty NGVs and incentivized through the Renewable Fuels Standard, Low Carbon Fuel Standards, and the Alternative Fuels Tax Credit, RNG use as a transportation fuel has increased 577%, displacing 7+ million tons of carbon dioxide equivalent (CO2e).⁸ In 2018 alone, 32%, of all on-road fuel used in natural gas vehicles was RNG, which is over 200 million gasoline gallon equivalents. Over the past five years, RNG as a Transportation Fuel lowered greenhouse gas emissions equivalent to removing 1,539,565 gasoline passenger cars from our roads for one year, reduced CO2 emissions equivalent to 815,950,377 gallons of gasoline or 712,313,458 gallons of diesel consumed, which is equal to the total energy used by 868,321 U.S. homes for one year.⁹

Fleets are using RNG at rapidly increasing volumes. For example, UPS's alternative fuel and advanced technology vehicles now exceed 10,000 vehicles globally. Using renewable fuels, UPS trucks are achieving up to a 90% reduction in lifecycle greenhouse gas emissions when compared to conventional diesel trucks.

Since 2014, UPS has used 28 million gallons equivalent of renewable natural gas (RNG) in its CNG or LNG powered trucks. In May 2019, UPS announced the largest U.S. purchase of

⁴ <https://www.ngvamerica.org/wp-content/uploads/2018/12/NGV-VW-HD-Trucks.pdf>

⁵ Source: NGV America Emissions Whitepaper based on CARB LCFS **Numbers compared to diesel emissions (well-to-wheel)*

⁶ Source: www.arb.ca.gov/fuels/lcfs/fuelpathways/pathwaytable.htm, CARB, February 2017. Adjusted for heavy-duty truck applications.

⁷ <https://www.arb.ca.gov/fuels/lcfs/fuelpathways/pathwaytable.htm>

⁸ <https://www.ngvamerica.org/wp-content/uploads/2019/04/RNG-Driving-Down-Emissions.pdf>

⁹ <https://www.ngvamerica.org/wp-content/uploads/2019/04/RNG-Driving-Down-Emissions.pdf>

renewable natural gas in history, a seven-year agreement to purchase 170 million gallons-equivalent of RNG through 2026 with annual purchases of 22.5 million to 25 million gallons equivalent. This will reduce UPS GHG emissions by more than 1 million metric tons. In October 2019, UPS announced plans to invest \$450 million during 2020 to 2022 to buy 6,000 natural gas powered trucks, all capable of operating on renewable natural gas. Continued federal policy support for RNG will encourage other fleets to decarbonize through this abundant, affordable fuel.

Unfortunately, cost of RNG production remains high. California, through a diesel tax and Low Carbon Fuel Standard, has created a viable market for RNG use in transportation. For the rest of the country to follow suit and reap related economic and environmental benefits, the cost of utilizing RNG needs to be reduced and further deployment is needed. Before accounting for RNG use, and with remaining incremental costs on NGVs, they still remain the most cost-effective mechanism of NOx reduction across several vehicle applications. On a heavy-duty truck, the life-cycle NOx emissions are greater than both diesel and electric trucks, and when comparing the cost of NOx reduction, natural gas heavy-duty trucks are 53% more cost effective than diesel alternatives and 47% more cost effective than electric options. Similarly, when comparing the cost of NOx reduction for refuse trucks, natural gas refuse trucks are 86% more cost-effective than diesel alternatives and 54% more cost effective than electric options.¹⁰

Natural Gas: A Solution Across Vehicle Types

While heavy-duty trucks are a significant contributor of transportation-related emissions, if the goal of the Committee is to move to a 100% clean economy, there are other vehicle types that will need to be made cleaner. For most of these vehicles, there are natural gas options on-road today, providing measurable and significant emissions improvements.

School and Transit Buses

Every day, 25 million children in the U.S. spend an average of an hour and a half on public school buses. School districts and health advocates have recognized the importance of reducing students' exposure to harmful diesel exhaust emissions, but this also represents an opportunity to reduce harmful climate pollutants from these vehicles.

There are now more than 150 school districts operating approximately 5,500 natural gas-powered school buses. Replacing older diesel buses with new cleaner natural gas buses to achieves the greatest amount of emissions reduction and air quality benefit per dollar spent. When comparing the cost of NOx reduction, natural gas buses are 95% more cost effective than diesel alternatives and more than 50% more cost effective than the limited availability of electric options.¹¹

Transit agencies, particularly transit agencies in non-attainment zones or in areas where weather conditions do not permit effective deployment of electric buses, have increasingly

¹⁰ Emission comparisons are based on results using Argonne National Laboratory's HDVEC tool (<https://fleet-web.ex.anl.gov/hdv-emissions-calculator/>) and include modeling of new low-NOx natural gas engines and the diesel in-use emission option.

¹¹ <https://www.ngvamerica.org/wp-content/uploads/2018/12/NGV-VW-School-Buses.pdf>

invested in clean, natural-gas powered transit buses. Road tested and ready to deploy, there are over 12,000 natural gas transit buses on U.S. roads today. In one example, a transit fleet began converting its entire bus fleet to natural gas in 2017. With over 310 CNG buses today, they plan to add 240 more by 2020. These buses average a 600-mile range on a single fill. Upon entire fleet conversion, this transit agency should realize annual fuel savings of \$8.5 million and reduce its NOx emissions by 97%.

The Los Angeles County Metropolitan Transit Authority (LA Metro) operates the largest natural gas transit fleet in North America with more than 2,250 CNG buses. In the fall of 2016, LA Metro began deploying and testing near-zero-emission natural gas engines. In May 2017, LA Metro signed a multi-year contract with Clean Energy to purchase renewable natural gas (RNG), with plans to run on 100% RNG within five years.¹² When comparing the cost of NOx reduction, natural gas transit buses are 96% more cost effective than diesel alternatives and 36% more cost effective than limited and cost-prohibitive electric options. The availability of natural gas-powered buses has enabled transit agencies to modernize their fleets while maintaining consistent passenger prices due to the affordability of natural gas.

Off-Road Vehicle Applications: Rail, Marine, and Specialty Equipment

Another benefit to natural gas and to RNG in transportation is the opportunity to begin displacing diesel fuel and marine oil in high fuel-use, off-road applications. Use of natural gas in rail applications is increasing in popularity due to a wide array of benefits. The top 7 Class 1 railroads (line-haul freight) consume over 3.6 billion gallons of diesel fuel per year, which translates to 10 million gallons per day, representing 7% of all diesel consumed in the U.S. LNG-powered locomotives offer 900 miles of heavy-haul service range¹³ and a 60 mph heavy-haul speed capability while also providing 50% fueling cost savings over diesel¹⁴.

It is estimated that an LNG locomotive costs \$1 million more than its diesel counterpart. Because trains are kept in service for relatively long periods of time and consume huge amounts of fuel, they represent an application ripe for transitioning to natural gas. Further, once incremental costs of implementation has been paid back, the price spread between the fuels allows for tremendous long-term savings in utilizing LNG over diesel. These savings can seriously impact the bottom line of rail operators because the industry's fuel costs represent an average of 23% of its total operating expenses. While there are pilot tests for LNG locomotive technology, further research, development, and deployment of CNG and LNG locomotives will aid in energy security and clean air goals for decades to come, offering a significant reduction in consumption of diesel. There is a significant role for federal investment in incentives and related research and development for LNG use in rail applications.

¹² <https://www.ngvamerica.org/wp-content/uploads/2018/12/NGV-VW-Transit-Buses.pdf>

¹³ <http://www.chartindustries.com/Energy/LNG-Solutions-Equipment/End-Use-Applications/Rail-Fueling>

¹⁴ <http://files.chartindustries.com/FEC-LNG-FloridaEastCoastRailwayCaseStudy.pdf>

In marine applications, LNG offers another clean alternative for high fuel-use vessels. For LNG-powered cargo freighters, there are 30% fewer CO₂ emissions¹⁵ and 0 equivalent NO_x/SO_x emissions¹⁶. It is estimated that 32% of total shipping energy use by 2050 will be LNG¹⁷. In specialized construction and mining equipment, LNG offers 17% reduction in CO₂ and GHG emissions, 50% fueling cost savings over diesel, 120+ octane equivalent.¹⁸

Conclusion

The need for clean air is clear, and we are in a crucial time for reducing greenhouse gas emissions and carbon intensity due to increased concerns over climate change. As a clean, domestic fuel option, natural gas is an American solution, delivering the largest and most cost-effective reductions in transportation-related pollutants than any other powertrain option commercially-available today. And when fueled by renewable natural gas captured from agricultural, food, landfill, or wastewater waste, even greater CO₂ and greenhouse gas emission reductions are achieved, with the fuel burning carbon neutral or even carbon negative.

Natural gas delivers more new vehicles and far greater emission benefits for the investment than any other alternative. No other transportation fuel is as sustainable, adaptive, and competitive across all vehicle classes. Natural gas currently powers passenger vehicles, medium-duty work vehicles, short- and long-haul trucks, school buses, transit buses and shuttles, refuse trucks, construction and mining equipment, marine vessels, and locomotives. Yet despite the overwhelming evidence that NGVs make an excellent alternative fuel choice, there remain less than 175,000 NGVs on U.S. roads today. Compared to over 26 million natural gas vehicles on roads worldwide, there remains an untapped opportunity for improved environmental and economic results from alternative fuel vehicles such as NGVs.

There remains a substantial role for the federal government in promoting further deployment of NGVs and RNG. Reinstatement of the \$0.50/gallon Alternative Fuels Tax Credit (AFTC) and support for policies encouraging development of RNG and RNG-powered vehicles are but two ways Congress can help clean up non light-duty vehicles through policy in support of solutions that are on-road, commercially available today.

Thank you for the opportunity to provide input as the Subcommittee considers the future of clean transportation.

For additional information concerning this statement, please contact:

Allison Cunningham

Director, Federal Government Affairs

NGVAmerica

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202.824.7363 acunningham@ngvamerica.org

¹⁵ <https://www.marineinsight.com/tech/10-noteworthy-lng-fueled-vessels/>

¹⁶ https://www.enr.com/en/technology_en/lng-fuel-shipping-sector/

¹⁷ <http://www.seatrade-maritime.com/news/asia/conditions-right-for-lng-to-set-sail.html>

¹⁸ NGVAmerica Emissions Whitepaper based on CARB LCFS; *Numbers compared to diesel emissions (well-to-wheel)

Vehicle Comparison – Diesel, CNG, EV, and Hydrogen

Infrastructure	Fuel Type	Cost of Truck	Fuel Capacity	Range	CI Score	Payload
No Infrastructure Investment	Diesel	\$ 116,000	100 gallons	800 mi	100.45	
	B20	\$ 116,000	100 gallons	800 mi	88.35	100%
	RD	\$ 116,000	100 gallons	800 mi	36.00	
Modest Infrastructure Investment	CNG	\$ 172,000	135 gallons	810 mi	79.21	
	RNG - Landfill	\$ 172,000	135 gallons	810 mi	43.00	96%
	RNG - Dairy	\$ 172,000	135 gallons	810 mi	-254.94	
High Infrastructure Investment	EV - Grid	??	600 kWh	300 mi	81.49	76%
	EV - Solar	??	600 kWh	300 mi	0.00	76%
	EV - Long Range	??	1000 kWh	500 mi	81.49	59%
	Hydrogen - Natural Gas	??	250 kWh + 80 kg	600 mi	146.38	98%
	Hydrogen - Solar	??	250 kWh + 80 kg	600 mi	10.51	98%

- Vehicle prices are estimates based on publicly available information for trucks available in the marketplace
- CI Scores as established by the California Air Resources Board
- Payload estimates relative to traditional diesel truck and trailer weight – 80,000 lbs max, with deductions for estimated battery weight





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October 23, 2019

The Honorable Paul Tonko
Chairman, Subcommittee on Environment
and Climate Change
Committee on Energy & Commerce
U.S. House of Representatives

The Honorable John Shimkus
Ranking Member, Subcommittee on Environment
and Climate Change
Committee on Energy and Commerce
U.S. House of Representatives

Subject: Hearing on "Building a 100 Percent Clean Economy: Solutions for Planes, Trains and Everything Beyond Automobiles"

Dear Chairman Tonko and Ranking Member Shimkus:

The Air Line Pilots Association, Int'l (ALPA), which represents more than 63,000 airline pilots who fly for 35 airlines in the U.S. and Canada, applauds the subcommittee for holding this hearing to help aviation build on our proactive and positive record of increasing efficiencies while decreasing our carbon footprint. According to the Eno Center for Transportation, "Aviation is part of the lifeblood of modern economies, moving people and goods around the nation and the globe. The American economy literally could not function without it and a tremendous collaborative effort of industry and government maintains the safest airspace in the world."¹

Fortunately, aviation is a "good news" story when it comes to protecting the environment. Jet fuel is expensive, and just a \$1 increase in the cost of a barrel of oil creates \$450 million of additional expenses for the industry. In order to be competitive, therefore, the airlines continually strive to renew their fleets with the newest, most fuel-efficient and least-polluting aircraft

¹ <https://www.enotrans.org/issues-and-modes/aviation/>

possible. It's not only good for the environment and the airlines' profitability, but their customers and stockholders expect the companies to be good stewards of the environment. Airlines have voluntarily adopted numerous programs to reduce greenhouse emissions. As an example, one legacy carrier has publicly committed to reducing emissions by 50 percent from today's levels by 2050. Airlines have also instituted tree-planting programs, purchased electric-powered tugs to reduce fuel consumption by aircraft and ground vehicles while taxiing, and instituted operating procedures which reduce fuel consumption, among other activities. U.S. airlines have also supported a global approach to limiting aviation's production of carbon dioxide. The International Civil Aviation Organization (ICAO) created a global market-based measures scheme in the form of the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) in 2016 which will help achieve carbon-neutral growth by 2020. Since 2006, the Commercial Aviation Alternative Fuels Initiative (CAAFI, www.caafi.org), a coalition of airlines, aircraft and engine manufacturers, energy producers, researchers and others has worked to develop and deploy alternative "drop-in" fuels for use in commercial aviation. CAAFI's stated goal is to "promote the development of alternative jet fuel options that offer equivalent safety and favorable costs compared with petroleum-based jet fuel, while offering environmental improvement and energy supply security for aviation."

The industry, in partnership with the Federal Aviation Administration (FAA) has also worked to improve operating efficiency in the air traffic control system. The Next Generation Air Transportation System (NextGen) is the FAA's airspace system modernization project that is implementing new technologies and procedures that reduce fuel burn, curb emissions, and streamline operations. Based on the FAA's 2016 NextGen Implementation Plan, there are numerous initiatives underway that will further reduce aviation's impact on the environment. The table below is a summary of the activities underway in NextGen, that will benefit the global environment.

Environment and Energy	
Integrated Environmental Modeling Phase I/II	By providing better modeling capabilities, better assessment of noise and emissions can be performed, leading to better airspace and operating decisions for reduced environmental impact.
NextGen Environmental Engine and Aircraft Technologies Phase I/II	This initiative performs engineering research and development into directly improving the fuel efficiency and reducing the noise produced by aircraft engines and airframes.
Sustainable Alternative Jet Fuels Ph I/II	This initiative looks to develop acceptable non-fossil fuel alternatives for powering jet engines such as biofuels, leading to lower net carbon emissions.
Improved Surface Operations	
Revised Departure Clearance via Data Comm	By enabling reroutes to be transmitted via data communications to aircraft already taxiing, time is saved by eliminating voice transmission and readback, and the need

	for flight crews to manually type in clearances, reducing the amount of time needed. This reduces the amount of additional fuel burned. Benefits June 2016 – May 2019: estimated 7.88M kg of CO2 emissions prevented by use of Revised Departure Clearance.
Surface Traffic Management	By using departure runway scheduling, aircraft can enter a virtual departure queue while remaining at the gate with engines off, reducing fuel burn, carbon emissions, pollutants, and noise. Aircraft taxi times are reduced to the minimum required to move from gate to the runway and stage for departure.
Enhanced Departure Flow Operations	By maximizing the ability to depart aircraft over departure fixes, fewer aircraft wait in departure taxi queues, and taxi out times are reduced, leading to reduced fuel burn and associated carbon and pollutant emissions. Smaller departure queues also lead to less noise in the surrounding airport community.
Improved Approaches and Low Visibility Ops	
Ground Based Augmentation System, Enhanced Flight Vision System, Synthetic Flight Vision System	These NextGen capabilities improve the likelihood that an aircraft will be able to land at an airport regardless of weather conditions, reducing diversions to alternate airports. The reduction of time in holding and in flying to alternate airports reduces fuel burn, carbon emissions, and pollutants.
Performance Based Navigation	
Optimized Profile Descents, RNAV Arrivals	These initiatives provide the capability to allow for descents that are shorter and minimize periods of level flight, reducing use of vectoring, and allowing for lower engine power settings and minimized fuel burn, carbon emissions, and pollutants.
Metroplex	By better optimizing flows in geographical areas, this enables the implementation of Optimized Profile Descents and RNAV arrivals rather than using ATC vectors, leading to fuel burn, carbon emissions, and pollutant benefits.
Time Based Flow Management	
Time Based Metering using RNAV/RNP Routes	The goal of managing NAS flows using Time Based Metering (runway scheduling) is to maximize the runway throughput while allowing aircraft to minimize the fuel used. By managing traffic flows over all of the sectors feeding an airport rather than just the closest ones, aircraft can fly efficiently with minimized vectoring and level altitudes. This leads to reduced fuel burn, carbon emissions, and pollutants.

TBM in Terminal, Improved Arrival/Surface/Departure Flow Operations, ADS-B Interval Management	Extending metering into the terminal and surface area ensures the integrity of the strategic flow, and that the benefits gained are not lost in the terminal area by vectoring, long final approaches, and level-offs. ADS-B Interval Management helps ensure that the schedule is met at the runway threshold. Departure Metering also reduces taxi out times. This contributes to reduced fuel burn, carbon emissions, and pollutants.
Collaborative ATM	
Full Collaborative Decision Making, Traffic Management Initiatives with Flight-Specific Trajectories, Initial Flight Day Evaluation, Advanced Flight Day Evaluation	The NAS operates most efficiently when there are no ceiling/visibility issues at airports and no severe weather. Since these weather conditions are a daily occurrence, these NextGen capabilities help ensure that flights operate into airports with sufficient capacity. These capabilities help operators choose the most fuel-efficient routings around severe weather, and to delay aircraft before they leave the gate, which contributes to reduced fuel burn, carbon emissions, and pollutants.
Separation Management	
ADS-B In-Trail Procedures, Oceanic Climb/Descent Procedures, Approval of User Requests in Oceanic Airspace, Preferred Routing in Constrained Oceanic Airspace	These initiatives allow aircraft flying in oceanic airspace to cruise at their most efficient altitudes more frequently, thereby minimizing fuel burn, carbon emissions, and pollutants
On-Demand NAS Info	
On-Demand NAS Information, Provide NAS Status to FOC/AOC, Improved Management of Special Activity Airspace	These capabilities give operators the most current information about potential constraints to their route of flight, thereby allowing efficient flight plans and routes to be filed. This reduced fuel burn, carbon emissions, and pollutants

Source: https://www.faa.gov/nextgen/media/NextGen_Implementation_Plan-2016.pdf

The subcommittee's stated objective to replace petroleum-based fuels with low- and zero-carbon fuels can help place additional impetus on the creation of new fuels for aviation and complements the work of CAAFI, the airlines and manufacturers to continually strive to reduce the impact of aviation on the environment and operating costs.

As the aviation safety "conscience of the industry," we take very seriously any proposals which might encroach on available safety margins. It is imperative that we work together to ensure that future recommendations made by your committee do not unintentionally compromise the

safety and security of our national airspace or work environment. Please consider us a resource as our operations and protocols are unique and consider safety above all else.

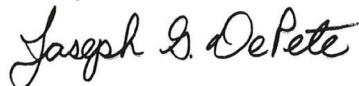
ALPA is proud of the significant role it has played over its 88-year history to help make commercial aviation the safest form of transportation in the world. ALPA's member pilots fly to all corners of the globe every day of the year safely delivering passengers and cargo to their intended destinations. ALPA employs a vast array of expertise in the area of safety and environmental committee work to include: aircraft design group, air traffic services group, aviation sustainability and environmental group, all working under the oversight of our National Safety Coordinator.

Our aviation safety subject matter experts are available to provide guidance and knowledge in these areas as requested. Aviation needs and deserves the special consideration which your committee is giving it to help ensure its sustainability and profitability for the long term, which will in turn create good jobs for thousands of pilots well into the future.

For additional information on ALPA's views regarding energy and the environment, please see our white paper, ["Aviation Sustainability and the Environment."](#)

Thank you for the opportunity to share our views on this important subject in advance of your hearing. We would be pleased to provide any additional information on request.

Sincerely,



Capt. Joseph G. DePete
President

Subcommittee on Environment and Climate Change
Hearing on
“Building a 100 Percent Clean Economy: Solutions for Planes, Trains and Everything
Beyond Automobiles”
October 23, 2019

Mr. J.P. Fjeld-Hansen
Managing Director and Vice President
Musket Corporation

The Honorable Greg Walden (R-OR)

1. I recently visited an innovative project in Lakeview, Oregon, where [Red Rock Biofuels](#) is constructing a gasification facility that will turn woody biomass into jet and diesel fuel. This is the first gasification project in the world to use woody biomass from forest thinning and related activities. It may serve as a blueprint for producing advanced renewable biodiesel and at the same time, helping to keep forests health and more resilient to wildfires.

I understand it already has contracts with Southwest, FedEx, and DOD. One problem is, due to RFS and tax credit prohibitions, the project is cannot take biomass from federal lands or woodchips from the local mill. From the mill, there is no way to determine whether the chips are from federal or private land, since the mill sources form both.

- a. From your perspective, what are the prospects that innovative projects like this can provide additional fuel sources for your aviation and heavy-duty trucking, and what will be the impact on greenhouse gas emissions?

RESPONSE: *Projects such as this have the potential to dramatically improve the emissions characteristics of transportation fuel in the United States. The Red Rock Biofuels project is extraordinarily ambitious and, with the right policy incentives, can be scalable to allow wood-to-liquid technologies to make a more substantial dent in the heavy-duty fuel market similar to the role that biodiesel, renewable diesel, compressed natural gas and renewable natural gas play today.*

From our perspective, some near-term policy improvements that would better enable the Lakeview gasification facility to thrive include (a) EPA refraining from its recent practice of aggressively issuing small refinery exemptions under the Renewable Fuel Standard; (b) more long-term certainty and mandate-growth for the total advanced, biomass-based diesel and cellulosic mandates under the RFS; and (c) utilizing the tax code to improve the economics for retailers that buy, blend, and sell biofuels. This type of policy certainty, with a clear, forward-looking regulatory path, will not only better enable the further proliferation of gasification facilities, but will lead to the research and development that is necessary for these facilities to produce at scale.

J.P. Fjeld-Hansen, Managing Director and Vice President
Musket Corporation

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- b. Does it make sense to inhibit access to federal lands, particularly if the access relates to forest management that would reduce fire risks?

RESPONSE: *This question goes beyond the scope of NATSO's and Musket's expertise. It is important for policymakers to strike the appropriate balance in developing alternative fuel policy incentives that stakeholders can count on being in place for multiple years without fear that it will be consistently reexamined and potentially repealed. Such uncertainty invariably stifles investment and innovation.*

- c. Would this be an example using available resource infrastructure to make meaningful gains in reducing emissions?

RESPONSE: *It is far less expensive to leverage existing infrastructure than to create entirely new supply chains and infrastructure. Thus, to the extent policymakers can achieve their environmental objectives by harnessing existing infrastructure, it will make it exponentially easier to encourage customers to gravitate to new types of fuels and vehicles. Deploying new technology that complements (rather than competes with) existing infrastructure will (all else being equal) be less expensive and thus be more likely to generate consumer loyalty.*

**Subcommittee on Environment and Climate Change
Hearing on
“Building a 100 Percent Clean Economy: Solutions for Planes, Trains and Everything
Beyond Automobiles”
October 23, 2019**

**Mr. Fred Felleman
Commissioner
Port of Seattle and the Northwest Seaport Alliance**

The Honorable Greg Walden (R-OR)

QUESTION:

1. I recently visited an innovative project in Lakeview, Oregon, where [Red Rock Biofuels](#) is constructing a gasification facility that will turn woody biomass into jet and diesel fuel. This is the first gasification project in the world to use woody biomass from forest thinning and related activities. It may serve as a blueprint for producing advanced renewable biodiesel and at the same time, helping to keep forests health and more resilient to wildfires.

I understand it already has contracts with Southwest, FedEx, and DOD. One problem is, due to RFS and tax credit prohibitions, the project is cannot take biomass from federal lands or woodchips from the local mill. From the mill, there is no way to determine whether the chips are from federal or private land, since the mill sources form both.

- a. From your perspective, what are the prospects that innovative projects like this can provide additional fuel sources for your aviation and heavy-duty trucking, and what will be the impact on greenhouse gas emissions?

RESPONSE:

The Port of Seattle greatly appreciates the pioneering work of the Red Rock facility and your leadership in helping assure it has access to a sustainable feedstock. The use of sustainably harvested forest residuals is a promising feedstock option that Oregon and Washington have in great abundance on state, federal and private lands. Once harvest methods have been certified, there is no reason that all these sources cannot be made available for such use.

Powering passenger flights with sustainable aviation fuels (SAF) is the most promising solution available today for significantly reducing carbon emissions in the aviation sector. The impact of transitioning to SAF is significant. SAF has a lifecycle carbon footprint 50 to 80 percent lower than regular jet fuel. To meet Port of Seattle’s near-term goal to fuel planes with 10 percent SAF by 2028, as well as to realize broader adoption, it is essential to create greater supply and to bring down the costs. We are committed to exploring initiatives and projects that achieve these ends.

QUESTION:

Fred Felleman, Commissioner
 Port of Seattle and the Northwest Seaport Alliance
 Page 2

- b. Does it make sense to inhibit access to federal lands, particularly if the access relates to forest management that would reduce fire risks?

RESPONSE:

Currently, the port is working with WSU to produce a report focused on analyzing all available feedstocks for sustainably produced fuels in the Pacific NW. Forest residuals show encouraging promise and have the potential to provide multiple benefits to communities in Oregon and Washington. We will be sending you the current report which will be completed shortly. As with every feedstock, however, we need to proceed in a responsible manner, acknowledging forest health and the multiple roles forests serve for fish, wildlife, as well as the need for the long-term sustainable management of timber lands. We welcome further analysis to include Federal Forest lands and stand ready to work with you to expand on the soon to be released report by WSU to that end.

Should further exploration determine that responsible harvesting of forest residuals be sustainable and responsible, residual harvests on federal lands should be expressly permitted and incentivized to the benefit of forest health, the climate and economy of rural communities.

QUESTION:

- c. Would this be an example using available resource infrastructure to make meaningful gains in reducing emissions?

RESPONSE:

Developing the fuels that can reduce emissions in the maritime and aviation sectors requires exploring the viability of a wide range of available resources. Multiple feedstocks will be required to produce a sufficient amount of fuel. In addition, different feedstocks have different attributes when it comes to cost effectiveness and the social and environmental impacts of their production and/or harvest. We need to cast a wide net to find the right balance. Your ongoing leadership will be key to our success.

The Honorable Cathy McMorris Rodgers (R-WA)

QUESTION:

1. At the end of your testimony you mention the good work that Washington State University and PNNL are doing in the Sustainable Jet Fuel space. I am a big supporter of this program and worked with Congressman Dan Newhouse to save it during the most recent FAA reauthorization. Can you expand on some of the work WSU and PNNL are doing and how they're helping advance sustainable jet fuel research and development?

RESPONSE:

The Port of Seattle very much appreciates your and Congressman Newhouse's invaluable

Fred Felleman, Commissioner
 Port of Seattle and the Northwest Seaport Alliance
 Page 3

support for these WSU and PNNL programs. This is truly an “Eastern Washington / Western Washington” collaboration that provides economic benefits throughout our state and environmental benefits even more broadly.

The Port has been partnering with both organizations for over a decade as key partners in our goal to fuel every flight at Seattle-Tacoma International Airport (Sea-Tac) with sustainable aviation fuels. We are fortunate to have such industry leaders as Alaska Airlines and Boeing at the table. Achieving broader use of sustainable jet fuels requires long-term investments in research and supply-chain development, as well as the adoption of new policies to support a transition to these more environmentally friendly fuels.

Washington State University (WSU) is recognized as a global trailblazer in this effort. WSU is a co-leader of the Aviation Sustainability Center, also known as ASCENT. ASCENT is a coalition of 16 leading US research universities and over 60 private sector stakeholders committed to reducing the environmental impact of aviation. The Port has been a member of its advisory committee since its inception. Producing sustainable aviation fuels at commercial scale is one of their main missions. WSU also leads the Northwest Advanced Renewables Alliance (NARA), a coalition of 32 organizations in industry, academia, and government laboratories. NARA’s focus is on developing alternative jet fuel derived from post-harvest forest residuals that otherwise often are burned after timber harvests such as the Red Rock facility in Representative Walden’s jurisdiction.

PNNL is another key player. Their researchers are working on methods for converting bio-based materials to aviation fuels, producing finished product for testing and verification, and working with various partners to demonstrate performance and drive down costs. PNNL recently helped develop a process that converts ethanol to jet fuel—a potential solution that can reduce greenhouse gas emissions by more than 60 percent compared to fossil-based jet fuel.

The Port of Seattle has a unique role to play in bringing sustainable aviation fuels to reality. We can serve as a bridge between the producers and users of aviation fuels, and we have the ability to exercise the policy leadership that can help to create the market demand for alternative fuel use. Besides setting our goal to use a 10 percent mix of Sustainable Aviation Fuels (SAF) in the jet fuel used at Sea-Tac within 10 years, our efforts include committing resources to identify regionally-sourced sustainable feedstocks. We will be sending you the report we commissioned WSU to produce shortly.

Yet success in this arena requires much more than what we can do alone, especially when it comes to identifying feedstocks and producing the fuels needed to achieve our vision. We also need to recognize the need for federal and state incentives, such as a clean fuel standard, if the fuels produced in Washington state are to be cost competitive enough to be used locally. The work WSU and PNNL are doing is essential, and we look forward to their continued partnership and collaboration. Thank you again for your continued support.

**Subcommittee on Environment and Climate Change
Hearing on
“Building a 100 Percent Clean Economy: Solutions for Planes, Trains and Everything
Beyond Automobiles”
October 23, 2019**

**Mr. Timothy A. Blubaugh
Executive Vice President
Truck & Engine Manufacturers Association**

The Honorable Greg Walden (R-OR)

1. Would you please speak to innovation in the internal combustion engine; you see a strong future of clean and efficient diesel trucks, is that correct?

RESPONSE: Diesel engines are the predominant powerplant for medium- and heavy-duty trucks, and most likely will continue to dominate the commercial vehicle marketplace for the foreseeable future. Powered by ultra-low sulfur diesel fuel, modern heavy-duty on-highway engines emit near zero levels of pollutant emissions and are highly fuel-efficient with low greenhouse gas emissions. The high energy density of diesel fuel plus the high thermal efficiency of diesel engines make them the most financially efficient option for most commercial truck operators. Additionally, diesel engines are highly reliable, provide long service life, may be rebuilt to extend that life, and provide the buyer predictable and strong residual values. All those factors make diesel engines a favorable economic choice for trucking businesses.

- a. The performance of diesel power for hauling loads is important for agricultural and ranching areas in my district—and the districts of other members on this Committee. What do you tell farmers and ranchers about the future of medium and heavy diesel engines?

RESPONSE: Diesel engines produce a great deal of torque at low speed, making them the preferred source of power for doing work. Looking to the future, manufacturers are continuously developing new technologies to improve diesel engine performance, fuel efficiency and reliability. Advances include, to name a few, optimizing fuel combustion, improving turbocharging and air handling systems, reducing friction and other parasitic losses, and increasing exhaust aftertreatment efficiency.

2. You indicate engine makers are investing billions of dollars to develop zero-emissions trucks. What type of trucks is this most likely to work most cost-effectively?

RESPONSE: Truck and engine manufacturers are developing and bringing to market zero-emission products that will meet their customers’ needs in specialized applications. Battery-electric zero-emission trucks will perform best in applications with lighter loads (so less battery power is needed to move the vehicle); with little or no auxiliary loads such as

Timothy A. Blubaugh, Executive Vice President
Truck & Engine Manufacturers Association

Page 2

refrigeration, pumps, and lift gates (that require power to operate); that operate shorter distances (so less battery capacity is needed); and are in operations where they dwell at a central location each day (to enable recharging). Additionally, batteries perform better in warm weather, so temperate climates are optimal, and stop-and-go operation enhances the regenerative charging performance of a battery-electric truck. Commercial vehicle applications that have all those characteristics are most suitable for battery-electric technology.

- a. What are the challenges to overcome for zero-emissions trucks to become an economical, and performance reality?

RESPONSE: Significant obstacles must be overcome before a fleet will consider converting its trucks to battery-electric technology. Since the purchase of a commercial vehicle is a capital investment that must return a profit, to be viable battery-electric trucks must be able to perform the work needed by the fleet with competitive life-cycle costs. A fundamental challenge with battery-electric trucks is that their initial purchase price is significantly higher than that of a diesel truck, and residual prices are much lower. Additionally, depending on battery life, the fleet may need to plan for replacing the batteries during a truck's life. (Battery replacement may be especially unfavorable when compared to a diesel engine that, when nearing the end of its useful life, may be rebuilt to its original specifications to extend the utilization of the asset.)

To deploy battery-electric technology in trucking operations, fleets will need to adjust their routes so the batteries are never depleted and be sure to never use the truck for special uses that may involve longer routes or heavier loads. Additionally, fleets will need to train drivers and maintenance technicians on the new technology, establish unique maintenance facilities, and stock additional new replacement parts. Most challenging, fleets must install the expensive and complicated infrastructure needed to charge the vehicles, plan for expanding the infrastructure for additional battery-electric trucks, and plan for obsolescence of the charging electronics. Of course, fleets also must make long-term financial plans for powering their trucks with electricity, the cost of which may fluctuate by the time of day and the number of trucks being charged. (The charging infrastructure and electricity costs may present the greatest challenges to a fleet that historically has purchased diesel fuel – as most fleets currently do -- at relatively stable prices and without the need to invest in any infrastructure.)

Fleets also must consider the possibility that battery-electric trucks, and the charging infrastructure, could become a stranded technology with the potential advent of hydrogen fuel cell technology. Such a potential future evolution could significantly chill the industry's willingness to invest capital in battery-electric technology.

3. You make reference to the scale of the challenge for actually converting the commercial vehicle market-place to zero-emissions trucks. Is the technology available today to do this?

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RESPONSE: Medium- and heavy-duty vehicles are highly customized to perform in a broad range of unique applications including, to name a few, parcel delivery vans, intracity pickup and delivery trucks, buses, utility trucks, dump trucks, concrete mixers, refuse trucks, fire trucks, regional freight tractors, heavy-haul tractors, and long-haul tractors. Battery-electric truck technology is being developed for the most suitable commercial vehicle market segments, such as applications that have the characteristics identified in the response to question 2. However, the technology (and the necessary infrastructure) is not available for applications such as dump trucks, concrete mixers, fire trucks, heavy-haul tractors, and long-haul tractors.

- a. What would a major transformation look like in terms of performance of trucks, behavior change, routes, the cost of goods and services?

RESPONSE: To deploy battery-electric trucks, fleets must analyze the weight and distance of the freight they haul and carefully specify their new trucks so that sufficient battery capacity will be available. Fleets must also ensure that the operation of their vehicles will always stay within that predicted range and loading, and that they schedule enough downtime each day to recharge the batteries. Fleets also will need to be able to pay for the higher purchase price of battery-electric vehicles and account for lower residual value at the end of their planned use of the vehicle. Fleets will need to invest in new maintenance facilities, parts inventory, and driver and maintenance technician training. Most importantly, fleets will need to make significant investments in the necessary charging infrastructure. Finally, fleets will need to account for electricity costs, including hour-by-hour variability and long-term cost trends.

- b. Given the benefits of power and efficiency from existing diesel engines, would the tradeoffs from forcing electric prematurely be worth it for the public?

RESPONSE: Before a fleet begins the process of converting its trucks to battery-electric – which may take over a decade to complete – it must carefully analyze all of the associated operational issues and costs. Compared to diesel, battery-electric trucks require higher up-front acquisition investments, changes that may decrease a fleet's operational efficiency, and will require significant investments in developing, maintaining, and expanding the necessary charging infrastructure. Sufficient and sustained government incentives are absolutely necessary to overcome the unfavorable life-cycle costs of battery-electric trucks – and make them financially viable for commercial truck operators. The life-cycle costs of hydrogen fuel cell technology are higher still, and would require even greater incentives.

Subcommittee on Environment and Climate Change

Hearing on

“Building a 100 Percent Clean Economy: Solutions for Planes, Trains and Everything Beyond Automobiles”

October 23, 2019

Dr. Wayne Eckerle

Vice President, Research and Technology

Cummins Inc.

The Honorable Greg Walden (R-OR)

1. Would you please speak to innovation in the internal combustion engine; you see a strong future of clean and efficient diesel trucks, is that correct?

RESPONSE: Cummins is committed to the continued advancement and innovation of diesel technology, and we see a strong future of clean and efficient diesel vehicles in the near and long term for many markets, and in a range of applications. Cummins is a leader in advanced diesel technology that continues to significantly reduce emissions. In the near term, clean diesel is the combination of today’s ultra-low sulfur diesel fuel, advanced engines and effective emission controls. Together, these elements result in a highly efficient engine, which can achieve extremely low emissions and reduce greenhouse gases (GHGs). Clean and efficient diesel benefits from low upfront costs and an existing and mature infrastructure. Truck and engine manufacturers like Cummins and other stakeholders are hard at work to develop products that meet EPA and NHTSA’s Phase 2 Greenhouse Gas Standards for commercial vehicles. When fully implemented, those standards will lower CO₂ emissions by approximately 1.1 billion metric tons, save vehicle owners fuel costs of about \$170 billion, and reduce oil consumption by up to two billion barrels over the lifetime of the vehicles sold under the program. Our ability to meet these goals is supported by cooperative research programs like the SuperTruck program at the Department of Energy. We are also actively working with the EPA, CARB and other stakeholders as they develop new engine standards for NO_x. As we announced in November of 2019, Cummins is committed to and working toward a carbon neutral future.

Moving forward this decade, advanced diesel technology will be combined with hybrid technology in truck powertrains that will provide additional efficiency to reduce carbon footprints and to improve air quality. The hybrid technology, if integrated with appropriate batteries or fuel cells will enable a zero emissions operating mode within city limits.

Carbon emissions associated with trucks and equipment goes beyond tailpipe emissions. To address the carbon footprint, the total carbon emitted over the life cycle of the energy source must be considered. For example, the carbon emitted in the extraction and processing of

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petroleum, or the production of electricity to charge a battery, or to produce hydrogen for a fuel cell is just as important as the tailpipe carbon emissions.

Transitioning to low-carbon and renewable fuels provides a significant opportunity for the internal combustion engine to continue to be the ideal power source of choice for trucks and equipment. Fuels that can be used in the internal combustion engine in the future include biodiesel, biomethane, cellulosic ethanol, renewable diesel, and biomass to diesel. These fuels either produce no tailpipe emissions, offset any carbon emitted in the tailpipe with reductions in naturally occurring carbon emissions, or the production process sequesters carbon from the atmosphere. Estimates are showing that moving to these fuels can abate the lifecycle carbon emissions in commercial vehicle applications by more than 80% from today's levels, while emitting ultra-low criteria pollutants. The added benefit is the architecture used in today's vehicle powertrains may be similar or more easily adapted to use these low-carbon or renewable fuels. Transitioning to these fuels will require alignment of research, regulations, and infrastructure development. The current efforts by the Department of Energy are identifying the pathways for the production low-carbon/renewable fuels. Extensive efforts will be required in infrastructure development to realize this opportunity.

- a. The performance of diesel power for hauling loads is important for agricultural and ranching areas in my district—and the districts of other members on this Committee. What do you tell farmers and ranchers about the future of medium and heavy diesel engines?

RESPONSE: Farmers, ranchers, and others that rely on the power density, capability and economics that diesel engines provide can continue to expect superior performance from medium and heavy-duty diesel engines for decades to come. Cummins continues to innovate and advance the range of its diesel engines to lower emissions while improving performance, fuel efficiency and reliability.

In fact, the past decade, the 4.9 million new-technology diesel trucks on America's roads have removed more than 26 million metric tons of NOx and 59 million metric tons of carbon dioxide from the air. Currently, across the United States, more than 36% of all Classes 3-8 registered commercial trucks are of the newest, near-zero generation diesels, and that number grows each year. In addition, agricultural regions present a significant ecosystem to supply renewable fuels for power due to the availability of feedstocks for diesel and ethanol.

2. You indicate engine makers are investing billions of dollars to develop zero-emissions trucks. What type of trucks is this most likely to work most cost-effectively?

RESPONSE: Cummins has committed to investing \$500M by the end of 2020 in the development of electrified power. We are committed to providing a broad portfolio of power solutions depending on truck application from advanced diesel, near-zero natural gas, fully electric, hydrogen, hybrids and biofuels. Different zero tailpipe emission technologies will work depending on the duty cycle, freight and route the truck is working. The adoption of battery

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electric vehicle systems for heavy duty transportation is dependent on the availability of charging infrastructure capable of meeting the energy demands of heavy-duty applications. City bus and urban pickup and delivery trucks are great examples of applications where electrification technology works today. These duty cycles, with frequent stops and starts, are ideally suited for electrified powertrains and makes this technology viable for reducing emissions in traffic congested areas. Material handling applications are being electrified to reduce emissions in ports, distribution hubs and warehouses. And while the energy density of batteries continues to improve, it is not yet viable for all applications. Currently, the weight of batteries negatively impacts payload capacity, making electric trucks impractical for many applications. Creating hybrid technologies that combine diesel and electric can be part of the solution to help meet regulatory requirements for some applications.

From an economic standpoint, for an electric vehicle system to offer an acceptable return on investment, battery prices must decline to a reasonable level that allows for payback without the use of incentives. Improvements to charging infrastructure, advances in cell chemistry that allow for increased energy density in combination with fast charging, and greater modularity of battery packs will all help accelerate the adoption of electric and hybrid vehicles. Continued investment in these areas by the Department of Energy can accelerate this development.

Globally, there is an increased focus on hydrogen-based technologies and infrastructure. Advancements in fuel cells have made the technology more suitable for commercial use. Improving proton-exchange membrane (PEM) and solid oxide fuel cell (SOFC) technology performance characteristics, life, efficiency and cold weather capabilities could make fuel cells a credible alternative for commercial and industrial applications. The application of PEM fuel cells to commercial vehicle applications is exciting, particularly in those applications with productivity or longer daily range needs that cannot be accomplished by batteries.

Finally, as noted previously, liquid and gaseous renewable fuels can be an important energy source for trucks to achieve significant life cycle carbon reduction from today's levels. For many of the commercial applications, the significant benefit of high energy density fuels which will be used in powertrains similar to today's system, will make liquid renewable fuels quite attractive.

- a. What are the challenges to overcome for zero-emissions trucks to become an economical, and performance reality?

RESPONSE: The main challenges to adoption for zero tailpipe emissions vehicles are infrastructure, cost and outsourced emissions.

Trucks and machinery are our customers' livelihoods. Today, they depend on broadly available and easy to operate infrastructure for diesel fueling. Adoption of new technologies among fleets requires a similar ease of fueling along with comparable capital and operational costs. This requires infrastructure and the reduction of costs associated with the new technologies. While the costs of the new technologies will undoubtedly continue to improve as the technology and scale accelerate, subsidies, grants and tax policy must be aligned to accelerate the adoption curve.

To be clear, to reach carbon neutrality we must address it across the entire transportation ecosystem, not just at the tailpipe. If energy is being provided from the grid to produce hydrogen,

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charge batteries, or produce renewable fuels, the grid needs to be either carbon neutral or offset in another manner, otherwise we are not solving the problem.

3. You make reference to the scale of the challenge for actually converting the commercial vehicle market-place to zero-emissions trucks. Is the technology available today to do this?

RESPONSE: The technology exists for many applications to convert to zero tailpipe emissions, but as mentioned previously, creating the infrastructure, reducing technology cost, and eliminating the outsourcing of carbon via regulation are central to that conversion. The more energy-dense an application is, the more difficult it is to decarbonize. Hydrogen fuel cell technology as compared to battery electric is very promising for these applications, like construction and mining equipment, as are renewable fuels. Producing hydrogen for fuel cell powered vehicles can be energy intensive. Ensuring a robust supply of zero-emissions electricity to produce hydrogen will ensure that zero-emissions trucks are truly not emitting. Creating an infrastructure for renewable fuels is also a key challenge we need to overcome.

- a. What would a major transformation look like in terms of performance of trucks, behavior change, routes, the cost of goods and services?

RESPONSE: Many factors are transforming the trucking industry. Increased capability of data analytics and predictive technology are making trucks and routes safer and more efficient. These technologies will also better enable trucks using new technologies such as batteries to better predict when and where to optimally charge, thus reducing the cost and strain on infrastructure. Improved communications are enabling an interactive engagement between fleets, depots, and customers. Hub and spoke approaches are becoming more prevalent which reduce the energy carrying capacity needs in vehicles and are more compatible with lower density energy sources like batteries. With continued investment by the government and private sector into infrastructure and technology adoption, scale will eventually minimize any cost increase in goods and services associated with the new technology.

- b. Given the benefits of power and efficiency from existing diesel engines, would the tradeoffs from forcing electric prematurely be worth it for the public?

RESPONSE: Cummins supports technology-neutral policy that would not force battery-electric powertrains on applications where the technology does not meet economic, performance, or environmental requirements. By setting technology-neutral environmental goals that fully encompass the carbon life cycle, technologies can be adopted to the applications where they are the most effective with the least, or zero, emissions. Cummins is committed to investing in a future where our customers have a broad portfolio of power options – including advanced diesel, natural gas, electrified power, fuel cell, hybrids and renewable fuel technology – so they can choose what works best for them. Further, investment in R&D to improve the weight and life of batteries, reduce cost for battery and fuel cell technologies, and ensure products are compatible

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with renewable fuels can help overcome some of the challenges zero-emissions vehicles face in comparison to diesel or natural gas vehicles. Enacting policies that promote the power of choice for every market will help ensure this country and every community within it has the proven technology necessary to meet air quality and climate goals, and serve the economy.

