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**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).