

**Tony Satterthwaite**

**Vice Chairman**

**Cummins Inc.**

Chairman Manchin, Ranking Member Barrasso, thank you for inviting me here today and for your interest in transportation technology innovation. My name is Tony Satterthwaite, and I am Vice Chairman of Cummins Inc. Since our founding more than 100 years ago, technological innovation has been at the core of what we do. I believe that innovating to sustain 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 that emits fewer greenhouse gases and fewer criteria pollutants that contribute to climate change and adversely impact air quality. My role at Cummins is to guide our business to help us meet this growing demand. The challenges before us require investment and collaboration among public and private entities to ensure the solutions are developed and implemented quickly, effectively and affordably. Today, I'd like to tell you how we got here, and how we're innovating to power a more prosperous world including putting forth our own plan for a path to a zero emissions future.

**Cummins Inc.**

Cummins Inc. was founded and is headquartered in Columbus, Indiana. We are 102 years old and have grown from a small diesel engine company to the largest independent producer of power solutions in the world, with a legacy of constant technological innovation.

Cummins advanced diesel and natural gas engines, hybrid, range extended electric vehicles (REEV), battery electric and hydrogen fuel cell platforms are in a wide range of applications including small pickup trucks, delivery trucks and tractor-trailers that move goods across the country, 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 tugboats. 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. Our products are critical to keeping the nation's supplies moving and hospitals running. 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. We also manufacture electrolyzers that produce hydrogen, including at the largest green hydrogen facility in the country in Douglas County, WA.

Globally, we have nearly 60,000 employees and operate in over 190 countries throughout the world. In the United States, we employ over 20,000 people and 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 over 11,000 employees and locations in almost every state.

The technological innovations of our product line and greening of the grid are enabling our products to be an integral part of addressing climate change. Because we serve many markets and applications that are critical to a functioning global economy, we have a keen understanding

of the power they need to get the job done. These relationships with our customers are one of the reasons we believe our path to zero emissions is so credible.

Cummins has long acknowledged that our company is only as strong as the health of our communities. Cummins embraces tough environmental standards and uses our technological expertise and innovation to grow our business, create American jobs and improve communities, taking a leadership role in our industry for our positions on emissions and sustainability.

Cummins always has championed innovation. In 2019, for example, Cummins' technical staff received more than 250 global patents for a fourth straight year. These patents represent our commitment to continual innovation and collaboration with stakeholders in government, academia and industry. They also allow us to export our groundbreaking technology globally, increasing U.S. competitiveness, technical leadership and American jobs.

### **Powering our customers today and in the future**

The future of power requires multi-faceted innovation. Our customers need the right vehicles and equipment to do their work today and in the future. 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. And just as importantly, they need these solutions to be affordable, so our customers in trucking, construction, delivery, rail and inland waterway transportation, can do the work that helps power the economy, make their payroll and continue to create jobs in our communities.

To deliver on our promise of powering a more prosperous world, both economic growth and environmental sustainability must be achieved. 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 efficiency of products and fuels in applications without substitute technologies. Switching to renewable diesel and other low carbon fuels can further build upon those benefits.

We commend the Committee's commitment to facilitate the energy transition of the U.S. economy through innovation and engaging our feedback as a stakeholder. Cummins has committed, through our PLANET 2050 initiative, to emitting net-zero carbon in all our facilities, operations and products in use globally by 2050. Doing our part to address climate change and air emissions is part of our company's mission

### **The path to zero emissions**

To achieve this ambitious goal, Cummins supports an innovation-focused path to zero emissions for commercial vehicles. These include innovations in high efficiency internal combustion engine (ICE) technologies, utilizing low carbon fuels, hybridization, REEV, and ultimately hydrogen fuel cell (FCEV) and battery electric vehicles (BEV) with zero tank-to-wheel emissions. Complementary measures to decarbonize the grid and build out charging and fueling infrastructure are also critical to this path.

In the next 10 years, innovation in high efficiency ICE with mild hybridization and low carbon fuels can immediately reduce both CO<sub>2</sub> and criteria emissions to improve air quality for disproportionately impacted communities today. Natural gas engines offer performance and reliability while offering near-zero emissions. Our natural gas spark-ignited combustion engines provide emissions lower than current EPA standards – 90% below on particulate matter and nitrogen oxides and 16% below on GHGs. They can achieve sub-zero emissions when using renewable natural gas (RNG). Natural gas engines are also the most mature, proven, and least disruptive alternative power technology available today.

Natural gas engines fit current transportation, people and goods movement models; are powered with abundant, low-priced domestic fuel; don't require radical changes in vehicle technology, transportation or support infrastructure; contribute to energy independence initiatives and deliver a reduction in carbon intensity. Continued innovation in spark-ignited natural gas engines can further improve on these benefits. As these technologies improve and renewable electricity and alternative fuel infrastructure come online at scale, REEVs can make a dramatic improvement in well-to-wheels carbon intensity while offering customers flexibility and resilience to improve on these benefits. Further research on ICE range extended solutions can take full advantage of low carbon fuels and significantly leverage the available infrastructure that supports the market today.

Advanced internal combustion with low carbon fuels, hybrids and REEVs can and should be deployed in the interim to significantly reduce emissions. For zero- tailpipe emissions, battery-electric and hydrogen fuel cell powered vehicles will work in tandem, with batteries well-suited for light-duty, last-mile delivery and urban applications, and hydrogen fuel cells as a power-dense option for applications like long-haul trucking, rail and mining. We should also consider the impact of upgrading large installed fleets of old technologies to current state of the art power options. The fast upgrade of America's extensive freight locomotive, fracking and drilling equipment to the latest technology can make a significant impact to reduce emissions today.

### **Robust funding for innovation**

The path to zero emissions for commercial vehicles should promote innovation for infrastructure through robust funding for research, development, demonstration and deployment of decarbonized hydrogen production and distribution; development and distribution low and net zero carbon liquid and gaseous fuels to maximize the utilization of existing fuel infrastructure; and deployment of a decarbonized electrical grid and implementation of fast charging networks. This is critical to success on our path to zero emissions. If the U.S. is to achieve this path to zero in a way that is cost effective, timely and promotes U.S. jobs and manufacturing, significant public support is needed from DOE, our national labs and other research institutions to innovate in infrastructure, development and deployment.

We were encouraged by the Department of Energy's (DOE) recent Notice of Intent announcement on a variety of research, development, demonstration and deployment (RDD&D) programs focused on trucks, and the scope of the RDD&D will not be exclusive to one fuel source or vehicle type. By improving energy efficiency and reducing emissions across the entire transportation sector, DOE can help ensure that the benefits of this work are equitably distributed to all Americans.

## **Hydrogen should be an important area of investment**

Hydrogen technologies are also ripe for government and industry investment in innovation. Cummins has invested significantly in the entire hydrogen value chain because it has shown to be one of the most effective enabling technologies for broad and deep decarbonization of hard-to-abate sectors where Cummins' products operate. Europe and East Asia have an early lead in this space, having committed hundreds of billions of dollars respectively to promote decarbonized hydrogen production and fuel cell equipment deployment. The recently published [U.S. Hydrogen Roadmap](#) provides a robust analysis of areas of needed investment for the U.S. to be a technology leader. Congress can increase the U.S.' international competitiveness by calling for a U.S. national hydrogen strategy to coordinate needed innovation, investment and activities throughout the government and private sector.

Initial pilot programs to achieve scale and bring down cost for hydrogen and fuel cells should be launched by DOE in regions like the Gulf Coast with low-cost hydrogen already deployed for refining purposes, or in closed ecosystems with pressing air quality concerns like the Port of LA. These are also locations where road, rail and marine transportation intersect – offering a great chance to advance hydrogen adoption into multiple complementary applications with a single fuel infrastructure. By developing these regional hydrogen hubs, the U.S. can demonstrate the capability and leverage scale to achieve a cost parity with traditional technologies. Further public investment is also needed in the areas of larger scale electrolyzer plants for decarbonized hydrogen production, and hydrogen fuel cell fleet management. Research is needed in reduction of precious metals and expensive materials in electrolyzer stacks and fuel cell systems for heavy duty trucks. All of this should be supplemented with purchase incentives and work force development for a robust domestic energy, manufacturing and job market. The U.S. should also support the innovation in the domestic membrane manufacturers who supply an integral part of the Proton Exchange Membrane (PEM) technology for both the electrolyzers which produce the hydrogen from electricity and the fuel cells which convert the hydrogen to power for vehicles, in the same way the government is promoting domestic battery cell manufacturing.

Hydrogen fuel cells are also recognized as one of the innovative solutions necessary for rail, generating enough energy to power passenger trains. Rather than using the overhead wiring, hydrogen fuel cell technology is an alternative approach to electrifying passenger trains using existing rail infrastructure. In this case, hydrogen fuel cell power modules on the top of the train car are at the heart of the system and provide enough energy by combining hydrogen and oxygen. The fuel cells work by extracting oxygen from the ambient air, while the storage tanks supply the hydrogen demand. The fuel cells and the hydrogen tanks are mounted on the roof of the train. When in motion, the fuel cell powered passenger train emits only water vapor, which is the only by-product of the hydrogen and oxygen reaction in the fuel cell, a truly clean energy conversion. Today, Cummins is the largest provider of hydrogen fuel cells for passenger trains in the world, with trains already in operation in Europe.

Research, development and demonstration programs from the Department of Energy are needed to optimize cost and performance for all the technologies listed. Investment in this space will ensure continued American leadership in technologies and exports needed for decarbonization.

Investing in these technologies will promote U.S. economic competitiveness by strengthening domestic manufacturing and technical capability.

Overall, with the right investment in innovation, the U.S. will continue to lead the way globally in technology, jobs, domestic manufacturing and energy supply. Hydrogen and fuel cells are a critical piece of the puzzle in the hard-to-abate sectors.

### **An exemplar of public-private partnership: SuperTruck**

Strategic public-private research partnerships with industry like SuperTruck, led by the Department of Energy (DOE), leverage technical expertise and prevent duplication of efforts. They also ensure public funding remains focused on the most critical barriers to technology commercialization and accelerate progress.

SuperTruck promotes the research, development, and demonstration of a suite of technologies, improving the freight hauling efficiency of heavy-duty Class 8 long-haul vehicles and the demonstration of applicability of these technologies to heavy-duty regional-haul vehicles as well – with an emphasis on cost-competitiveness.

The commercialization of the technologies developed under the SuperTruck I initiative will save 7.9 million gallons of diesel fuel per day with the associated economic, energy security, and greenhouse gas emissions benefits. The project initially reduced CO<sub>2</sub> emissions by 33% from the 2009 baseline. SuperTruck II was recently able to demonstrate a further 50% reduction in CO<sub>2</sub> emissions, doubling the efficiency from the 2009 baseline and included additional performance and cost effectiveness requirements to foster a more rapid market adoption of new energy efficient technologies.

A new SuperTruck III program will build upon these improvements with the focus on CO<sub>2</sub> reducing technologies such as efficiency improvements, low carbon fuels, hybridization, battery electrification and fuel cell optimization for entire fleets. Examining the full commercial vehicle ecosystem and efficiencies will make a substantive reduction in the energy it takes to deliver the nation's goods.

### **Conclusion**

The heavy-duty and non-road vehicle industry is undergoing significant change, and Cummins is leading the way by investing and innovating in a broad portfolio of power including advanced diesel, natural gas, hybridization, electrified power, fuel cell technology and alternative fuels – so our customers can have the right solution to get the job done. However, industry working alone will not get us where we need to be in a time frame that is feasible. Government supported innovation is needed to meet our global energy and environmental challenges.

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. We appreciate the opportunity to have a further dialogue on the most important technologies for innovation to improve the U.S. competitiveness and create high quality jobs.