

# SAE Heavy-Duty Diesel Sustainable Transport Symposium

## Technical Session Schedule

As of May 09, 2023 19:40:10 PM

Wednesday, May 3

### Day 1 Welcome Opening and Keynote

Session Code HDD100

Room RunAn Session 08:45

Time	Paper No.	Title
9:00 a.m.	ORAL ONLY	<p>Keynote by Lars Stenqvist, CTO, Volvo - Leading Transformation through Technology</p> <p>We are in times of change with the biggest transformation of our industry happening right now. We need to decarbonize road transports by developing 100% fossil free solutions.</p> <p>To enable our customers to reach net-zero, Volvo Group believes in several propulsion technologies for heavy transport: Battery Electric, Fuel Cell Electric, and combustion engine running on renewable fuels.</p> <p>Technology will be the key enabler on this transformation journey.</p> <p>Lars Stenqvist, Volvo Group</p>

Wednesday, May 3

### Challenges of Global Regulations and Standards Outlook

Session Code HDD101

Room RunAn Session 09:30

Moderators - Claus Dieter Vogt, NGK Europe GmbH

Time	Paper No.	Title
9:30 a.m.	ORAL ONLY	<p>Euro 7: A Future Proof Regulation for Pollutant Emissions and Battery Durability</p> <p>The presentation will provide an overview of the Commission proposal on a new Regulation on emissions from motor vehicles, which is fit for the future. The new proposal includes exhaust and non-exhaust emission limits, as well as limits for emissions of particles from brakes and microplastics from tyres. It extends the list of pollutants measured and requires compliance for a much longer period. Sensors will be used to measure continuously the emissions in order to avoid tampering and ensure that vehicles are repaired timely. The proposal also includes minimum performance requirements for battery durability.</p> <p>Ricardo Suarez Bertoa, Joint Research Centre</p>

# SAE Heavy-Duty Diesel Sustainable Transport Symposium

## Technical Session Schedule

As of May 09, 2023 19:40:11 PM

Time	Paper No.	Title
10:00 a.m.	ORAL ONLY	<p>Advanced Clean Trucks: Paving the Way to Zero-Emission Trucks in California and Beyond</p> <p>This presentation will provide an overview of the supply side regulation that is bringing zero emission trucks to 25% of the U.S. truck market. The Advanced Clean Trucks (ACT) regulation takes effect in 2024 and requires at least 40% of all tractor-trailers and 75% of all delivery trucks and vans sold in California to be zero emissions by 2035. The ACT regulation has now been adopted by 8 US states. This regulation will ensure that fleets have access to choice, that communities will be able to reap the clean air benefits that zero emission trucks provide, and will help ensure that private infrastructure providers have certainty for their investments.</p> <p>Sydney Vergis, Chief for the Mobile Source Control Division, CARB</p>
10:30 a.m.		Networking Break with Exhibitors
11:00 a.m.	ORAL ONLY	<p>Overview of Global Regulations for Reduced Emissions from the Heavy-Duty Vehicle Fleet</p> <p>The heavy-duty segment is facing significant regulatory changes in major automotive markets. Increasingly stringent greenhouse gas limits are pushing the industry to adopt high efficiency engines, hybrid and alternate powertrains, and low carbon fuels. On criteria pollutants, the focus is clearly on NOx reduction from diesel powered vehicles, especially under low load, real-world operating conditions. Also required is a further reduction in particulates, motivating development of very high filtration concepts. Other than lower tailpipe limits, we are seeing the introduction of a new low load certification test cycle, extended durability, and limits on previously unregulated species. Tools such as on-board monitoring and telematics are expected to result in improved in-use compliance. Other than the emphasis on cleaner engines, new regulations are also encouraging the sale of zero tailpipe-emitting vehicles. These trends are global, as major markets are beginning to converge on the overall regulatory elements, and these are also being considered for off-road equipment. This talk will attempt to cover the broad regulatory changes being faced by the commercial sector and set the stage for solutions discussed in the subsequent technical talks.</p> <p>Ameya Joshi, Corning Inc.</p>
11:30 a.m.	ORAL ONLY	<p>Propulsion Technology Evolution in the Commercial Vehicle Sector</p> <p>The passenger car and light duty van sectors are moving relatively rapidly towards electrification, mainly through battery technology. This presentation looks at the Commercial Vehicle (CV) sector and considers the drivers and requirements for the transition of CVs to zero emission (and near zero emission) powertrains, which include battery electric vehicles (BEV), fuel cell electric vehicles (FCEV) and hydrogen internal combustion engine (H2 ICE) vehicles.</p> <p>While the Total Cost of Ownership (TCO) is a critical consideration, the likely regulatory requirements, infrastructure needs, potential critical raw material availability and technology evolution within each of the powertrain options are evaluated and an assessment of the most likely global powertrain evolution across the CV sector is presented.</p>

# SAE Heavy-Duty Diesel Sustainable Transport Symposium

## Technical Session Schedule

As of May 09, 2023 19:40:11 PM

Time	Paper No.	Title
		Andrew Walker, Johnson Matthey Inc.
12:00 p.m.		Networking Lunch with Exhibitors

### Wednesday, May 3

#### Emission Control 1 (Future Systems)

Session Code HDD105

Room RunAn Session 13:30

Moderators - John Goodwin, Johnson Matthey AB

Time	Paper No.	Title
1:30 p.m.	ORAL ONLY	H2 - ICE Emission Control Technology

The current decade is seeing rapid changes in heavy duty powertrains. All manufacturers at IAA were proposing solutions that support a carbon neutral future. Battery Electric (BEV) or hydrogen either in the form Fuel Cell (FCEV) or Internal Combustion Engines (H2-ICE) are being seen as the most exciting options currently. This presentation focuses in on emissions control of H2-ICE systems.

Emissions control of H2-ICE requires close consideration of current and future legislation, as well as meeting new and unique challenges to deliver a sustainable zero carbon solution that the planet requires. H2-ICE SI engines can operate as stoichiometric or lean burn, the direction of emissions control can be chosen based on this.

System components need to consider other factors such as possible H2 embrittlement, oil bypass, other legislative criteria emissions, global warming potential (GWP) as well as higher levels of water in the exhaust from H2 combustion.

This presentation will provide an insight into novel technologies, their positives and differences, as well as what the quickest path to market solutions could be to achieve a carbon neutral powertrain option for next generation vehicles.

Paul Gwyther, Cummins Engine Co., Ltd.

2:00 p.m.	ORAL ONLY	EATS for HD Euro7 Emission Levels
		Jonas Jansson, Volvo Group Trucks Technology

# SAE Heavy-Duty Diesel Sustainable Transport Symposium

## Technical Session Schedule

As of May 09, 2023 19:40:11 PM

Time	Paper No.	Title
2:30 p.m.	ORAL ONLY	<p>Towards Zero-Impact Emissions for a Demonstrator Truck with Active Thermal Management, Dual-SCR, DPF and e-Diesel</p> <p>The European Commission published a proposal for Euro 7, including trucks and buses, and it is also expected that it will publish a review of the heavy-duty CO2 standards soon. It is anticipated these will increase the requirements for heavy-duty vehicles with respect to pollutant and CO2 emissions. The new heavy-duty Euro 7 regulation requires the emissions are minimized over a wide range of on-road operating conditions, including cold-start and low-load operation under urban driving conditions. The measurement procedure for PN will be adapted to count as of 10 nm and requirements will be introduced for secondary emissions like N2O.</p> <p>This study shows the ultra-low pollutant emissions achieved by a heavy-duty diesel demonstrator vehicle over a broad range of operating conditions. The innovative emissions control system implemented on the truck in a first phase, integrates a close-coupled DOC, a catalyzed DPF, dual-SCR system -one in a close-coupled position-, with twin AdBlue® dosing. Both SCR catalysts contain an ammonia slip catalyst. In a second phase, an electrically heated catalyst (EHC) was integrated on the DOC. Focus of this active thermal management is on further reducing the cold-start emissions of the dual-SCR system, and avoiding emissions slip under low-load operation including idle stops.</p> <p>The vehicle was instrumented with a prototype PEMS measuring PN10, NH3 and N2O emissions. Pollutant emissions were evaluated over a broad range of operating conditions to show the emissions reduction potential. The results show the system converts more than 98% of the emission over an ISC (In-Service Conformity) route including the initial cold-start. Near-zero pollutant emissions are measured when the emissions control system is warm. The initial cold-start peak is reduced about 96% by the active thermal management compared to the reference Euro VI-C ISC simulation results. An analysis of the data will be presented according to the methodology of the Euro 7 proposal.</p> <p>The vehicle has also been tested with sustainable renewable fuels, including HVO and e-diesel. The potential CO2 reduction compared to market diesel is investigated on a Well-to-Wheel (WtW) basis. It is shown that HVO already offers today up to 90% WtW CO2 reduction, whereas e-diesel has the potential to nearly eliminate WtW CO2 emissions.</p> <p>The AECC heavy-duty demo work presented today shows the next generation heavy-duty vehicles can operate with ultra-low emissions, whilst maintaining their path towards the required CO2 targets.</p> <p>Joachim Demuynck, AECC</p>
3:00 p.m.		Networking Break with Exhibitors

# SAE Heavy-Duty Diesel Sustainable Transport Symposium

## Technical Session Schedule

As of May 09, 2023 19:40:11 PM

Wednesday, May 3

### Emission Control II (Component Optimization)

Session Code HDD104

Room RunAn Session 15:30

Chairperson - Joachim Demuynck, AECC

Time	Paper No.	Title
3:30 p.m.	ORAL ONLY	<p>Targeting the EUVII PN10 Emission Legislation by Advanced Filtration Technologies in a Dual-Stage Urea-Dosing System</p> <p>Besides the strong attempt for electrification in the commercial vehicle industry for lowering the CO<sub>2</sub> emissions, the diesel engine will still play a major role in the coming decade, especially for those applications without the opportunity for full electrification. Applications with internal combustion engines will be challenged for best fuel economy and more stringent emission legislations in future.</p> <p>The EUVII legislation proposal as communicated in November 2022 does request lower particulate number limits of 5-2E11 #/kWh with expansion to sub-23 nm particulates (PN10) as well as lower NO<sub>x</sub> limits of 350-90 mg/kWh. Achieving the low PN10 tailpipe limits over a wide operation window is only feasible by a full system approach with a deep understanding of the interferences of the single aftertreatment components and the engine, especially when PN10 emissions must be managed for full useful life, at cold-start and hot operation conditions. The EUVII PN limits will require ultra-high filtration efficiency for soot particulates by new filtration technologies. However, the introduction of a dual-stage urea dosing SCR system to tackle the low NO<sub>x</sub> limits may also impact tailpipe PN10 emissions by sub-23 nm secondary urea particles. These circumstances are requesting for a detailed study on DPF soot filtration efficiency at various conditions and the impact of external factors on tailpipe PN10 emissions as a total aftertreatment system approach.</p> <p>This study elaborates the soot filtration performance of next-generation filter materials and filtration technologies as well as their sensitivity to material properties. The impact of a dual-stage SCR system operation on the system tailpipe PN10 emissions will also be discussed guiding the pathway for achieving lowest PN emissions for future emission legislations.</p>

Andre Wolz, NGK Europe GmbH

# SAE Heavy-Duty Diesel Sustainable Transport Symposium

## Technical Session Schedule

As of May 09, 2023 19:40:11 PM

Time	Paper No.	Title
4:00 p.m.	ORAL ONLY	<p>Catalyst and System Development for Euro 7 Optimization</p> <p>The Euro 7 emission legislation proposal demands for more advanced system designs as well as technology improvements on both engine and catalyst side. Experience from full system programs show that there is potential to meet legislation with system based on different catalyst technologies. The selection of V- or Cu-based main technology will be discussed as this dictate some of the system boundary conditions. Recent developments of the different catalyst and filter coating technologies will be reviewed and their improved performance and durability will help widen the system boundaries and meet Euro 7.</p> <p>Mikaela Wallin, Johnson Matthey AB</p>
4:30 p.m.	ORAL ONLY	<p>Umicore's Technology Solutions for Future Heavy Duty EATS</p> <p>The main challenges of Euro 7 HD regulation as well as of the expected counterparts in North America and China will be to meet the significantly tighter limits for NOx and PN. This is to be seen along with the requirements for minimizing CO2 emissions and enabling longer lifetimes. Potential aftertreatment system solutions will be discussed in the light of these challenges. New SCR and filter coating technologies will be introduced that together with advanced system designs and enhanced engine technologies will enable Euro 7 compatible system solutions. New system designs using SCR in close coupled position bring, however, also new durability challenges, which will be investigated.</p> <p>Andreas Geisselmann, Umicore AG &amp; Co. KG</p>

## Thursday, May 4

### Alternative Powertrain Technology I (BEV, Fuel Cell)

Session Code HDD205

Room RunAn Session 08:30

Chairperson - Kelly Senecal, Convergent Science Inc.

Time	Paper No.	Title
------	-----------	-------

# SAE Heavy-Duty Diesel Sustainable Transport Symposium

## Technical Session Schedule

As of May 09, 2023 19:40:12 PM

Time	Paper No.	Title
8:30 a.m.	ORAL ONLY	<p>Fuel Cell – From Prototype to Mass Production</p> <p>cellcentric – a joint venture of Daimler Truck AG and the Volvo Group AB formed in 2021 - develops, produces and commercializes fuel-cell systems for use in heavy-duty trucks and other applications.</p> <p>Its ambition is to become a leading global manufacturer of fuel-cells, and thus help the world take a major step towards climate-neutral and sustainable transportation by 2050. In this presentation, Lars Johansson, COO of cellcentric, will introduce into the fuel cell technology and leads through the company's journey from the first prototypes to the planned mass production.</p> <p>Lars Johansson, Cellcentric GmbH &amp; Co. KG</p>
9:00 a.m.	ORAL ONLY	<p>Energy Transition of HD Duty Transport, Focusing FCEV</p> <p>Presenting the Volvo transition development work towards carbon neutral products, focused on fuel cell electric vehicle development. Discussing and reflecting on the growth of hydrogen infrastructure and hydrogen storage. Exemplifying with development examples, challenges as well as need of firm standards, policies and economic stability.</p> <p>Staffan H. Lundgren, Volvo Group</p>
9:30 a.m.	ORAL ONLY	<p>Model-Based Design of Fuel Cell Systems for HD Trucks</p> <p>Electric trucks that use fuel cells to generate on-board power are seen as the cornerstone of zero-carbon, zero-emission long-haul heavy-duty transportation. Modularization of fuel cell stacks, components and systems is critical for rapid market entry and lower total cost of ownership. To achieve this, efficient development processes must be utilized to handle the large variety of applications and use cases with reduced engineering effort. The goals can be achieved with model-based development across the entire development chain.</p> <p>This publication presents such a holistic model-based process that extends from the fuel cell powertrain level through the system level to the component level. This process is closely interlinked to the thermal integration, the function development of the hybrid system as well as the fuel cell system of the vehicle via the use of model-in-the-loop approaches. Also, a model validation based on experimental data from vehicle benchmarking is presented in the paper.</p> <p>Soeren Tinz, FEV Europe GmbH</p>
10:00 a.m.		Networking Break with Exhibitors

# SAE Heavy-Duty Diesel Sustainable Transport Symposium

## Technical Session Schedule

As of May 09, 2023 19:40:12 PM

Time	Paper No.	Title
10:30 a.m.	ORAL ONLY	<p>Developing Next Gen Heavy Duty Battery Electric Vehicle (BEV) with Paris Agreement in Front of the Eyes. Challenges and Opportunities.</p> <p>The overarching challenge for the transport industry is to contribute to the fulfillment of the Paris agreement, that is a reduction of the CO2 footprint by 20%(-units) every decade. Scania has a "toolbox" of measures to be contribute to this challenging goal, for example a highly efficient conventional powertrain, a vehicle with very competitive air drag and the possibility to use bio-fuels. However, the most important action is to electrify the HD Truck and Bus Portfolio. Scania R&amp;D has taken on the challenge to develop a BEV platform in the premium range to fulfil and exceed the customer needs for the coming decade. The lead words have been: "CO2 footprint", "Energy efficiency", "A battery for the complete life length of the truck", "Energy storage performance steps". The presentation will highlight three major challenges to meet the objectives: -CO2-footprint for the production and usage of the Truck -Life length prediction batteries -High power density on electric motor With a self-sustained R&amp;D team and carefully chosen cooperation partners the next generation BEV-platform is now in end validation phase.</p> <p>Hakan Malmstad, Chief Engineer, Scania</p>
11:00 a.m.	ORAL ONLY	<p>Volvo Group Electrification - Story of HD BEV</p> <p>The presentation discusses opportunities and challenges when using Battery Electric Propulsion system on Medium duty and Heavy Duty trucks. BEV is a CO2 free and Zero-emissions alternative when operating. Volvo group are also focusing on the CO2 total reduction in the complete product cycle. Volvo Group roll out strategy for BEV is clear. BEV propulsion system solutions are starting in the lower GCW segments and are expanding towards heavy duty trucks. The race for more energy onboard and energy efficiency has just started now when Volvo During 2022 as the first OEM launched the Heavy Duty BEV Truck in the main segments for regional haul and heavy construction. Since some years Volvo has already been operating Class 8 BEV trucks in US successfully. The electrification journey are accelerating heavily and Volvo group are dedicated to remain in lead.</p> <p>Ola Styrenius, Chief Engineer Electromobility, Volvo</p>

Thursday, May 4

### Alternative Powertrain Technology II (H2 ICE)

Session Code HDD206

Room RunAn Session 11:30

Moderators - Ansgar Wille, NGK Europe GmbH

Time	Paper No.	Title
------	-----------	-------



# SAE Heavy-Duty Diesel Sustainable Transport Symposium

## Technical Session Schedule

As of May 09, 2023 19:40:12 PM

Time	Paper No.	Title
11:30 a.m.	ORAL ONLY	<p>Heavy-Duty Hydrogen ICE and Associated Exhaust Aftertreatment Systems</p> <p>European Union requires, based on the “Green Deal”, a mandatory CO<sub>2</sub>-reduction target of 15% and 30% for heavy commercial vehicles in the years 2025 and 2030 respectively. The target of the commercial vehicle industry is to develop technologies and solutions, which allow a robust target achievement from a technology perspective as well as in a timely manner. The required technology mix will comprise of a fuel consumption reduction on the currently dominant diesel-based powertrain and of a certain penetration rate of alternative, per definition CO<sub>2</sub> neutral, energy carriers. These will contain the direct usage of electricity and of hydrogen as energy carrier. The hydrogen internal combustion engine offers, in comparison to a fuel cell, concrete advantages in view of maintaining of the value creation chain and protection of powertrain and vehicle related investments in production facilities. Considering not only the preservation of base engine and powertrain components, but also the avoidance of a fully electric vehicle configuration, the hydrogen combustion engine is the logical bridge technology towards fuel cells.</p> <p>The ideal combustion of hydrogen in air produces only water vapor as the product. However, when hydrogen as the fuel is combusted in an internal combustion engine, it results in the formation of not only water vapor but also NO<sub>x</sub> emissions, H<sub>2</sub> slip and trace amounts of particulate matter arising out of the burning of engine lubrication oil. The level of these pollutants, especially the raw NO<sub>x</sub> emissions, in the H<sub>2</sub>-ICE exhaust strongly depend on the fuel injection principle. In this presentation, different injection and combustion principles and their impact on NO<sub>x</sub> formation will be investigated. Additionally, the requisite aftertreatment systems for future emission legislation fulfillment will be discussed.</p>

Bernhard Raser, AVL LIST GmbH

# SAE Heavy-Duty Diesel Sustainable Transport Symposium

## Technical Session Schedule

As of May 09, 2023 19:40:12 PM

Time	Paper No.	Title
12:00 p.m.	ORAL ONLY	<p>Challenges and Opportunities in H2 ICE Development</p> <p>The presentation discusses opportunities and challenges using hydrogen as fuel in an internal combustion engine (H2-ICE). Since there is no CO<sub>2</sub> in the fuel, the emissions of the green-house gas CO<sub>2</sub> from the combustion itself will be zero. H2-ICE is thus a near-zero CO<sub>2</sub>-emissions alternative. The H2-ICE combustion might take place at high temperature, thus producing nitrogen oxide (NO<sub>x</sub>) emissions. An exhaust aftertreatment system (EATS) for controlling NO<sub>x</sub> is therefore needed. There are some sources for a minor production of CO<sub>2</sub> which originate from lubrication oil and urea-dosage during operation of the EATS. These drawbacks need to be handled.</p> <p>An H2-ICE can be designed for port-fuel H<sub>2</sub> injection (PFI) or low-pressure direct injection (LPDI) pre-mixed combustion as well for high-pressure DI (HPDI) diffusion-controlled combustion. On PFI and LPDI H2-ICE, fuel air mixing is a key factor to reach a combustion process free of abnormalities and controlling NO<sub>x</sub> emissions. A too stratified fuel-air mixing distribution can lead to existence of fuel rich pockets that can lead to NO<sub>x</sub> and knock. So, in the development of any of these types of H2-ICE, central activities are virtual methods like 1-dimensional engine simulations and detailed 3-dimensional computational fluid dynamics (CFD) assessing fuel injection, fuel air mixing and combustion. In order to validate and develop these tools, fuel jet experiments in optical chambers , single-cylinder and full-scale engines experiments are used. These activities take place as pure research at universities, as well as at the engaged engine manufacturers, their suppliers and consultant companies. These activities are the focus of this presentation.</p> <p>Jan E. Eismark, Volvo Group Trucks Technology; Rickard Ehleskog, Volvo Powertrain Corporation</p>

# SAE Heavy-Duty Diesel Sustainable Transport Symposium

## Technical Session Schedule

As of May 09, 2023 19:40:12 PM

Time	Paper No.	Title
12:30 p.m.	ORAL ONLY	<p>Hydrogen for Heavy Duty Engines with a Focus on the HPDITM Combustion Approach</p> <p>As climate change has become of increasing concern, the global transportation industry has been challenged to achieve significant reductions in Greenhouse Gas (GHG) emissions. In Europe this has been driven by specific CO2 legislation and penalties for OEMs who miss these targets, while in the US these have been embedded within the EPA regulations. Similar concerns have been expressed in other markets such as China. OEMs have identified multiple potential de-carbonization technologies for mobile-source applications; however, for Heavy Duty trucking and higher horsepower applications in particular, there is a recognition that the required combination of power density, fuel efficiency and durability are challenging with some of the less mature technologies. Therefore, for certain segments of the transportation sector, zero or near-zero carbon Internal Combustion Engines (ICE) continue to be evaluated as one of the key, cost-effective solutions. While Renewable Natural Gas-fueled ICEs remain an attractive option on a Well-To-Wheels basis, the strongest customer focus (OEM and end-user) is currently on Hydrogen fueled ICEs. Numerous manufacturers have shown that hydrogen systems can be deployed successfully on ICEs; many of these approaches have involved spark ignited systems with both port and low pressure direct injection systems, using many of the lessons from Spark Ignited Natural Gas (SING) engines.</p> <p>WFS' approach for natural gas, High Pressure Direct Injection (HPDITM), offers a different approach by using late cycle high pressure injection of gas. Over the last two years, WFS has demonstrated that the same basic system can be easily adapted to hydrogen and achieve CO2 reductions up to 97% [Vienna 2021, 2022], with efficiencies exceeding the base diesel engine and power/torque equivalent to, or higher than, the base diesel engine.</p> <p>This presentation will review the HPDITM system architecture from fuel injectors through to the hydrogen fuel storage, touching on both compressed and cryogenic onboard solutions. WFS' experience with H2 demonstration trucks will also be covered.</p> <p>David K. Mumford, Westport Fuel Systems</p>
1:00 p.m.		Networking Lunch with Exhibitors

Thursday, May 4

### Sustainability of Truck Mobility

Session Code HDD203

Room RunAn Session 14:00

Moderators - Jonas Jansson, Volvo Group Trucks Technology

Time	Paper No.	Title
------	-----------	-------

# SAE Heavy-Duty Diesel Sustainable Transport Symposium

## Technical Session Schedule

As of May 09, 2023 19:40:12 PM

Time	Paper No.	Title
2:00 p.m.	ORAL ONLY	<p>A Life-Cycle Comparison of the Greenhouse Gas Emissions from Combustion, Electric, and Hydrogen Trucks and Buses</p> <p>There is potential to reduce GHG emissions in the HDV sector through different powertrain options (electric batteries, fuel cell batteries, and combustion engines), and different fuel or energy choices (hydrogen, biofuels, natural gas). The climate impacts of these technologies and fuels vary over the lifetime of the vehicle model. From extracting and processing raw materials to operation and maintenance, some powertrain options are more energy intensive to build than their counterparts, and some fuel sources can produce higher emissions during their production or use.</p> <p>The study uses a life-cycle assessment to analyze the options to allow policymakers and manufacturing companies to compare which powertrain and fuel options provide the largest GHG emissions reductions. This analysis evaluates the lifetime emissions of different powertrains on a fully harmonized basis, comparing both the emissions attributable to fuel production and use as well as the emissions attributable to vehicle manufacturing. It investigates the current best-in-class diesel models against their natural gas and zero-emission alternatives in the European and US markets.</p> <p>J. Felipe Rodriguez, International Council On Clean Transport</p>
2:30 p.m.	ORAL ONLY	<p>How Renewable Fuels Can Help to Reduce GHG Emission in the Heavy Duty Transportation Sector Already Today</p> <p>When aspiring towards more climate-friendly solutions, all emissions during the vehicle's life, a Life Cycle Analysis ( LCA ) approach are mandatory and need to be taken into consideration, from the raw materials, manufacturing up to the recycling. Many of us may be surprised by the results of comparing the LCA from an electric versus diesel vehicle and the resulting GHG emission. An electric vehicle running with 100% wind power may easily sound like the best solution. But how much renewable electric energy is or will be available in the EU? When comparing LCA emissions, a diesel vehicle running with 100% renewable fuel can already perform as well or even better than a BEV in view of GHG reduction. Examples of HDD applications and others ( Aviation ect. ) will be presented under today's real world application and use.</p> <p>None of the alternatives available, e.g. electrification or renewable fuels will be sufficient alone, especially not according to the required schedule. Remaining to focus on a single solution would be a grave mistake. A technical neutral approach to reduce GHG with existing and upcoming global vehicle fleet ( &gt; 2 billion ) is needed. The necessary technical breakthroughs for renewable fuels already exist, capacity and adjustment of existing infrastructure need to be further expanded. All we have to do is to create an operating environment, required specification and culture that allows us to make optimum use of technologies to reduce GHG emission.</p> <p>Mats Hultman, Neste Oyj</p>
3:00 p.m.	ORAL ONLY	<p>A Renewable Fuel Retro-Fit Solution for Compression Ignition Engines</p> <p>Marc Sens, IAV GmbH; Paul Cooper, Chairman, Gane Energy &amp; Resources Pty Ltd</p>

# SAE Heavy-Duty Diesel Sustainable Transport Symposium

## Technical Session Schedule

As of May 09, 2023 19:40:12 PM

Time	Paper No.	Title
3:30 p.m.		Break
3:40 p.m.	ORAL ONLY	Trucking Toward Zero: The Outlook for Sustainable Transport
		<p>In this talk, I will discuss the role of internal combustion in current heavy-duty applications and explain why it will still be required for decades to come. Particular focus will be placed on engine technologies and fuels needed for improved efficiency and reduced emissions and how modeling can help us achieve these goals. A discussion of the outlook of the ICE's competitive technologies, such as fuel-cells and battery electric vehicles, will be given. The importance of LCA to achieve sustainable trucking will be discussed.</p> <p>Kelly Senecal, Convergent Science Inc.</p>

Thursday, May 4

### Panel Discussion on Sustainable Transport

Session Code HDD204

Room RunAn Session 16:10

[Learn more about the Participants](#)

Moderators - Addy Majewski, DieselNet

Panelists - Mats Moren, Volvo; Claus Dieter Vogt, NGK Europe GmbH; Andrew Walker, Johnson Matthey Inc.;