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German – English**

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8th International VDI Conference

# Powertrain Systems in Mobile Machines 2024

## Key topics discussed:

- Think about energy supply and drive technology holistically
- Alternatives with and without combustion engines
- Electric off-road – with batteries or fuel cells
- Solutions for traction and process drives
- New drive systems in various applications
- Experience reports of successful transformation

### Conference chairman



**Prof. Dr. Ludger Frerichs**, Director, Institute of Mobile Machines and Commercial Vehicles (IMN), Technische Universität Braunschweig, Germany

**+ Free entrance to the parallel event**  
Dritev 2024

**+ Empowering ideas through intensive dialogue:**  
Speakers Corner & Posterexhibition

**+ Networking at the joint evening event**

**+ Exhibition**

### With experts from:



An event organized by VDI Wissensforum GmbH  
[www.vdiconference.com/01TA807024](http://www.vdiconference.com/01TA807024)  
 Phone +49 211 6214-201 • Fax +49 211 6214-154

June 12<sup>th</sup> – 13<sup>th</sup>, 2024,  
 Kongresshaus Baden-Baden, Germany

**1st Conference day**  
Wednesday, June 12<sup>th</sup>, 2024

08:00 Registration

09:00 Joint welcome of the congress and conference



**Dipl.-Ing. Konstantin Neiß**, Director Electric Drive Systems & CoC Electric Drive Units, Mercedes-Benz AG, Stuttgart, Germany



**Dipl.-Ing. Thomas Pfund**, President Business Unit E-Motors, Schaeffler Automotive Buehl GmbH & Co. KG, Buehl, Germany

09:05 We shape the future



**Prof. Dr.-Ing. Rodolfo Schöneburg**, Head of the VDI-FVT Technical Advisory Council on 'Automotive Engineering', CEO, RSC Safety Engineering, Road Safety Counselor, Hechingen



**Plenary speeches**

**Moderation: Dipl.-Ing. Konstantin Neiß**, Mercedes-Benz AG, Germany

09:20 CLEPA President – 163 days in office – an interim assessment

- CLEPA's significant role in the process of shaping more modern and sustainable automotive mobility
- Ensuring that all stakeholders interests are taken into account during this process
- Summary of the first half of 2024
- Outlook on upcoming challenges and potential starting points



**Dipl.-Ing. Matthias Zink**, President of CLEPA, Belgium & CEO Automotive, Schaeffler AG, Germany Herzogenaurach, Germany

09:45 Critical success factor of the mobility turnaround: Market-wide interfaces

- A convincing customer experience is crucial for the success of the mobility transition
- The transportation of the future is purely electric
- It requires a highly complex system from the generation and transportation of renewable energy to simple charging in everyday life and when travelling with digital capabilities and data security



**Jürgen Stein**, Chief Innovation & New Business Officer, EnBW Energie Baden-Württemberg AG, Karlsruhe

10:10 Next Steps – electric mobility

- Technology update of the drivetrain
- Enhancing the customer experience
- Emotionalization



**Dr. Karsten Bennewitz**, Head of Powertrain and Energy System Development, Volkswagen AG, Wolfsburg

10:35 Drivetrain technology in agricultural machines – traditionally innovative

- Development of drivetrain-technology
- Drivetrain challenges in agricultural applications



**Dipl.-Ing. Jan-Hendrik Mohr**, CEO CLAAS Gruppe, CLAAS KGaA mbH, Harsewinkel, Germany

11:00 Plenary discussion  
Dialogue with keynote speaker

11:20 Be interactive – meet & greet in the exhibition area and car presentation

11:55 Opening of  
**8th International VDI Conference**  
**Powertrain Systems in Mobile Machines 2024**



**Prof. Dr. Ludger Frerichs**, Director, Institute of Mobile Machines and Commercial Vehicles (IMN), Technische Universität Braunschweig, Germany (Conference Chairman)



**Energy and propulsion systems**

**Moderation: Prof. Dr. Ludger Frerichs**, Germany

12:00 Use of renewable energies for agricultural machinery

- Fuel demand of agriculture
- Assessment of alternatives to diesel fuels: Electrification, biofuels, paraffinic fuels
- Options for action for a switch to renewable energies: Financial incentives, technical measures, framework conditions

**Dipl.-Geoökol. Henning Eckel**, Teamleader energy, emissions and climate protection, Kuratorium für Technik und Bauwesen in der Landwirtschaft e. V. (KTBL), Darmstadt, Germany; Dr. agr. Edgar Remmele, Head of Department for Renewable Fuels and Materials, Technology and Support Centre (TFZ), Straubing, Germany

12:30 Electrify Africa: A systematic approach to boost mechanization and access to electricity in emerging regions

- Challenges in emerging regions; demography, electricity and mechanization
- Dedicated electric drivetrain of an e-tractor; exploiting the benefits of electrification
- Combination of power generation, consumption and service model to form an ecosystem

**Dipl.-Ing. Holger Lange**, Team leader, Dipl.-Ing. (FH) Gregor Dietz Project lead e-tractor, Go.Fair Ecosystem, Group Innovation, Volkswagen AG, Wolfsburg, Germany

13:00 Time for business lunch – meet & greet in the exhibition area and car presentation



**Powertrain transformation**

**Moderation: Dr.-Ing. Florian Mulzer**, Transmission Specialist, AGCO GmbH, Marktobendorf, Germany

14:30 Infinitely variable transmission development using electric drive system

- Explanation of the electric drive system & technologies: Electric motors and power electronics.
- Transmission design overview and integration into tractor hydraulic and cooling systems.
- Control of transmission & vehicle

**Jake Pence, B. Sc., M. Sc.**, Production & Precision Ag Electrification Manager, **Clayton Janasek, B. Sc.**, John Deere Electric Powertrain Controls Lead, Deere & Company, Moline, Roger Burjes, B. Sc., Chief Technology Engineer, Drivetrain, John Deere Product Engineering Center, Deere & Company, Waterloo, USA

15:00 Introduction of alternative drives in tractors of different performance classes

- Trends and challenges of future zero emission off-road vehicles: Installation space, weight and tank infrastructure
- Electrification and introduction of alternative drives in different performance classes: Methane-, battery-electric-, hydrogen- & Diesel-hybrid-powertrain
- Implemented examples like NH Methan Power, NH T4 electric, Steyr FCTRAC, Steyr Hybrid CVT

**Dr. techn. Jürgen Karner**, Technischer Projektleiter, Advanced Technology & Innovation, Christian Mayer, M. Sc., Tractor Product Engineer BEV, CNH Industrial Österreich GmbH, St. Valentin, Austria; Stefano Fiorati, Ph.D, Director Tractor Innovation, Zero Emission & Advanced Drivetrain, CNH Industrial Italia spa, Modena, Italy

15:30 Construction equipment drivesystems: Focus on hydrogen

- Overview of different drivetrains: Range, emissions, infrastructure
- Operational capability of hydrogen on construction sites: quantity of energy and safety aspects
- Solutions: fuel cells, hydrogen engines and refueling

**Stefan Peters, M. Sc.**, Programm Manager Technology, Liebherr-EMtec GmbH, Kirchdorf/Iller, Germany

16:00 Be interactive – meet & greet in the exhibition area and car presentation



## Implementation of hydrogen fuel cell systems

**Moderation: Dipl.-Ing. Kai Brandhofe**, Vice President SF System Technology, CLAAS Selbstfahrende Erntemaschinen GmbH, Harsewinkel, Germany

- 16:45 High-power fuel cells for heavy-duty hydrogen mobility**
- Fuel cell electric vs. battery electric: when does each make sense?
  - Manufacturing high-power density fuel cell systems
  - Future prospects: Hydrogen eco-systems

**Prof. Dr. Christian Mohrdieck**, Chief Technology Officer, Technology, Hyzon, Bolingbrook, USA

- 17:15 Excavator with fuel cell electric powertrain – challenges of the conversion**
- Setup of a CO<sub>2</sub>-free commercial vehicle powertrain by usage of a fuel cell in a conventional powertrain topology
  - Impact of fuel cell and battery size on the operating strategy
  - Compliance with the specifics of currently available fuel cell solutions in the market

**Dipl.-Ing. (FH) Dieter Farthofer**, Lead Engineer Off-Road Powertrain System, Commercial Vehicle Powertrain Systems, DI (FH) Wolfgang Gruber, M. Sc., Manager Commercial Vehicle Powertrain Systems, DI Johannes Pell, System Simulation Engineer CV, AVL List GmbH, Steyr, Austria

- 17:45 From system model to operational environment: Testing H<sub>2</sub>-hybrid drives for mobile machinery**

- Consistent, development-accompanying testing of H<sub>2</sub>-FC drives: Component specification, operating strategy, operating
- Virtual testing of individual subsystems and the entire system based on an interdisciplinary system model: Component specification, operating behavior, lifetime, economic performance
- Testing of FC drivetrain with regard to functional performance and operating behavior on a test bench and on a reference construction site

**Jan de Vreeden, M. Sc.**, Research Assistant, Christian Habermehl, M. Sc., Group Lead Off-Highway, Systems Engineering – Modelling and Simulation, Univ.-Prof. Dr.-Ing. Georg Jacobs, Head, Institute for Machine Elements and Systems Engineering, RWTH Aachen University, Germany

- 18:15 Safety and functional safety in the conception of hydrogen tank systems**

- The role of hydrogen in the energy transition for the mobility sector
- Challenges in the design of an H<sub>2</sub> tank system: Safe storage, controlled release of H<sub>2</sub> and support for the refueling process
- Safety concept for H<sub>2</sub> tank systems from a structural, technical and organizational perspective

**Duy Cuong Nguyen, M. Sc.** Applied Physics, Systems Engineer H<sub>2</sub>-Systeme, Data Driven Software and Sensors, ITK Engineering GmbH, Rülzheim, Germany

- 18:45 End of the 1st conference day**

**ab 18:45 Get-together at the 'Kurhaus Baden-Baden'**

Look forward to an enjoyable evening. Make new contacts and meet colleagues from your industry in an informal atmosphere.



## 2nd Conference day

Thursday, June 13<sup>th</sup>, 2024



## Electric drive concepts

**Moderation: Dr.-Ing. Christof Lamparski**, Vice President Development and Sales Gearbox Technology, Bosch Rexroth AG, Dortmund, Germany

- 08:30 Electrification of the drivetrain of an all-wheel-drive municipal equipment carrier**

- General requirements in municipal use: Multifunctionality, multi-shift operation, instant availability
- Transfer concept from diesel to electric drive: Diesel like performance and usability, electrification of a Diesel-Platform, no Range Extender
- Experience report on technical implementation and outlook: Pro/Cons off-the-shelf components, challenges in thermal management, dos and don'ts

**Dipl.-Ing. Christoph Hornig**, Project Manager, Product Line Municipal Equipment, Dipl.-Ing. Malte Braunschweig, Manager, Hako GmbH, Bad Oldesloe, Germany

- 09:00 Evolution of transmission technology for electric off-highway machines**

- Innovation drivers for transmissions: Efficiency, performance, sustainability
- Modular approach to electric transmission range
- Advanced transmission architectures and controls

**Joachim Van Dingenen, M. Sc.**, Lead engineer technology development, Giacomo Faggiani, M. Sc., Senior engineer systems and processes, Lorenzo Serrao, Ph.D., Lead engineer electrification, Dana Inc., Off-Highway Drive and Motion Systems, Bruges, Belgium and Rovereto, Italy

- 09:30 Local zero emission solution for mobile compact cranes**

- Motivation for local zero emissions and challenges in implementation
- Architecture of the electric drive system: Passive rectification, power architecture, thermal management
- Smart dual utilisation of installed components for mains supply or generator operation in driving mode

**Thomas Speh, M. Eng.**, Head of Construction Machinery Systems, Dipl.-Ing. (DH) Martin Paal, Head, Mobile Switchgear & Systems, Liebherr-Electronics and Drives GmbH, Lindau, Germany

- 10:00 Electrification concepts in the field of tension of the operational business: A practical example**

- Basic electrification concepts – from minimally invasive to fully electric: Diesel emulation, fully electrical vehicle concept, advantages and disadvantages
- Drivers – which concept is the best? Energy efficiency vs. system costs, one-off costs, after-sales
- Realisation of a minimally invasive drivetrain with auxiliary drive for a heavy commercial vehicle: Realisation concept, motivational reasons, operational aspects

**Dr.-Ing. Michael Philipp Schmitt**, CEO, DINTEC GmbH, Kaufbeuren, Germany



- 10:30 Be interactive** – meet & greet in the exhibition area and car presentation



## Implementation of electric drivetrain systems

**Moderation: Philipp Suhm, M. Sc.**, Head of Mobile Switchgear & Systems, Liebherr-Electronics and Drives GmbH, Biberach (Riß), Germany

### 11:15 Electrical machines for mobile machinery – application-specific requirements, design, and layout

- General requirements (environment: e.g. temperature, shock and vibration; system: e.g. voltage and current limits, interfaces) and application-specific requirements (e.g. speed ranges, torques, overload capacity)
- Challenges of mechanical design to fulfill all requirements with full variant flexibility and test scopes necessary for qualification
- Electromagnetic design and optimization: the degrees of freedom and trade-offs

**Dr.-Ing. Thomas Finken**, Product Owner Electrical Machine, Development Electrical Machine, Bosch Rexroth AG, Lohr am Main, Germany

### 11:45 Improved synergies: how to achieve the perfect match between battery, thermal management and drive train

- From analysis to dimensioning: consideration of charging infrastructure- and intervals relative to the battery parameters
- Influence of environmental and machine parameters to the thermal management
- Specification of best matching drive train solution: possible system architectures and how they affect the system efficiency and hence usage of battery system

**Dipl.-Ing. (FH) Stefan Eichler**, Sr. Manager, Editron Sales EMEA, Danfoss Editron Oy, Offenbach, **Christian Kiemer, M. Eng.**, Manager Application Engineering & E-mobility, Customized & Lifecycle Solutions Webasto Thermo & Comfort SE, Gilching, Germany

### 12:15 Immersion cooling battery technology with focus on safety and lifetime

- Modular battery architecture for maximal flexibility
- Thermal propagation prevention for highest safety standards
- Longer battery life by operating all cells at the optimal temperature range

**Dipl.-Ing. Markus Theine**, Global Operations Officer, DI (FH) Helmut Kastler, Head of Development, Dr.-Ing. Norbert Heublein, Senior Thermal Management Engineer, Kreisler Electric GmbH, Rainbach, Austria

### 12:45 Time for Business Lunch – meet & greet in the exhibition area and car presentation



## Electric drives in different application

**Moderation: Dipl.-Ing. Stefan Prebeck**, Head of R&D Off-Highway Systems, ZF Friedrichshafen AG, Passau, Germany

### 14:15 Electrified powertrain for a medium size wheel loader

- Electric central drive with integrated ePTO
- Industrial meets Automotive: SiC Inverter and Hairpin E-machine from the commercial vehicle segment – motivation and effects of performance
- Functional system integration of components with modular approach and reuse

**Dipl.-Ing. (FH) Rico Glöckner**, Technical Project lead, System-Engineer, Electric Systems, ZF Friedrichshafen AG, Passau, Germany

### 14:45 Sustainable powertrains for special foundation equipment

- Hybrid powertrains as a combination of conventional diesel and electric drives
- Electro-hydraulic and direct-electric drive systems with plugged-in or autonomous energy supply
- Perspectives for hydrogen-based energy sources

**Dr.-Ing. Hans-Philipp Otto**, Director Central Development & Design, BAUER Maschinen GmbH, Schrobenhausen, Germany

### 15:15 'An electrification journey' – Developing and fine-tuning a system platform for electric off-highway machines

- Technologies and drive components developed for the system platform: electric motors and inverters, efficient gearbox, Li-Ion battery
- Introduction to the machine architecture wherein the system platform is implemented: component integration, thermal behavior and cooling concepts, drive control software
- An experience report: Application, fine-tuning and validation of realized machines

**Dipl.-Ing. (BA) Florian Madlener**, System technology engineer e-mobility, drive technology, Dipl.-Ing. Michael Kurz, Head of Systems Engineering, Andreas Meyer, M. Sc., Team Leader Drive Technology, Kramer-Werke GmbH, Pfullendorf, Germany; **Luca De Pascali, Ph.D.**, Mechatronics Engineer, Dana Inc., Off-Highway Drive and Motion Systems, Rovereto, Italy

### 15:45 Closing remarks by Prof. Dr. Ludger Frerichs (conference chairman)

### 15:50 End of 8th International VDI Conference Powertrain Systems in Mobile Machines 2024

## Joint plenary session

**Moderation: Dipl.-Ing. Thomas Pfund**, President Business Unit E-Motors, Schaeffler Automotive Buehl GmbH & Co. KG, Buehl, Germany



### 16:00 Awarding of the best presentation for junior engineers

### 16:05 Common closing remarks

### 16:15 End of the International VDI congress Dritev 2024

## Advisory board



1st row from left to right:

**Dipl.-Ing. Kai Brandhofs**, Vice President SF System Technology, CLAAS Selbstfahrende Erntemaschinen GmbH, Harsewinkel, Germany

**Dr.-Ing. Ettore Cosoli**, Vice President, Global Heavy Vehicle Engineering, Off-Highway and Commercial Vehicle Drive and Motion Systems, Dana Incorporated, Maumee, USA

**Prof. Dr. Ludger Frerichs**, Director, Institute of Mobile Machines and Commercial Vehicles (IMN), Technische Universität Braunschweig, Germany (Conference Chairman)

**Dr.-Ing. Christof Lamparski**, Vice President Development and Sales Gearbox Technology, Bosch Rexroth AG, Dortmund, Germany

2nd row from left to right

**Dr.-Ing. Florian Mulzer**, Transmission Specialist, AGCO GmbH, Marktobendorf, Germany

**Dipl.-Ing. Stefan Prebeck**, Head of R&D Off-Highway Systems, ZF Friedrichshafen AG, Passau, Germany

**Dipl.-Ing. (FH) Marco Reinards**, MBA, Engineering Manager Tractor Drivetrain & Hydraulics, John Deere GmbH & Co. KG, Mannheim, Germany

**Philipp Suhm, M. Sc.**, Head of Mobile Switchgear & Systems, Liebherr-Electronics and Drives GmbH, Biberach (Riß), Germany

## Questions, to be answered at the conference:

1. What are the challenges of electric drivetrain systems and possible solutions?
2. What is the status of fuel cell systems for heavy-duty machinery?
3. How are electric drivetrains implemented and what do they look like in various heavy-duty applications?
4. What are challenges related to infrastructure for mobile machines: Energy supply, tank design and mobile source?
5. How do we get the energy to the application?

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## Parallel congress

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### International VDI Congress Dritev 2024

Visit for free!

#### Main Topics:

- Design and architecture of vehicle drive systems
- Thermal management, operating behavior, acoustics
- E-machine and power electronics
- Methods and simulation
- Gearbox and fluids
- CO<sub>2</sub> neutrality and sustainability

#### Conference chairman:

**Dipl.-Ing. Konstantin Neiß**, Director Electric Drive Systems & CoC Electric Drive Units, Mercedes-Benz AG, Stuttgart, Germany

#### Vice Chair

**Dipl.-Ing. Thomas Pfund**, President Business Unit E-Motors, Schaeffler Automotive Buehl GmbH & Co. KG, Buehl, Germany

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### Design und Entwicklung nachhaltiger technischer Systeme

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### Digital Twins zur Virtualisierung in der Fahrzeugentwicklung

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**8th International VDI Conference  
Powertrain Systems in Mobile Machines 2024**

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Development of energy-efficient, high-performance, and environmentally friendly propulsion solutions for the heavy-duty sector.

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