

# DEUTZWORLD

## REVOLUTIONIZING POWER

HIGH-PERFORMANCE  
ADVANCED DRIVE SYSTEMS.

### INTERVIEW

CEO Dr. Frank Hiller on innovative drive systems, knowledge management and the future of the diesel engine

### MODULAR PRODUCT KIT

How DEUTZ configures different drive systems individually and implements them precisely

### CONVERTING ELEC- TRICITY INTO FUEL

Promote the energy transition with renewable energy from e-fuels

## BAUMA 2019 SPECIAL

The engine company.



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An interview with DEUTZ CEO Dr. Frank Hiller



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# EDITORIAL



## DEAR READERS,

revolution – admittedly a big word. But major political upheavals, such as 1789 in France or 1989 in Berlin, are not the only events that deserve this term. Our industry, machine and engine manufacturing, has also seen many such groundbreaking changes. Almost 150 years after the invention of the combustion engine as a key driving force of the 20th century, we are putting a lot of effort into the search for state-of-the-art drive systems: Digitalization, sustainability and efficiency are changing our business. Expect no less than to experience the dawn of a new era at this year’s bauma trade fair, which has always been the heartbeat of the industry. Therefore, our assertive trade fair claim is “Revolutionizing Power”, emphasizing our contribution to this development and our claim to be the oldest, but more importantly, the most future-shaping engine manufacturer. Our exhibition package: not just a lot of new engines, but a whole system for efficient development of cutting-edge drive systems – from electric to gas to hydrogen (from page 8).

We also take a look at the digital future of the service business (page 22). An overview of globally applicable emission standards, which are not hard for us to meet thanks to our new modular product kit, shows that our business is subject to political conditions.

Have fun reading this edition.

Yours

Dr. Frank Hiller

## IMPRINT

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**DR. HILLER, "REVOLUTIONIZING POWER" IS THE DEUTZ CLAIM FOR BAUMA 2019. A POWERFUL PROMISE – WHAT IS BEHIND IT?**

We actually have many innovations in our repertoire that allow us to confidently appear at the world's largest trade fair for construction machinery. Not least because they provide answers to the big questions of our time and are groundbreaking in terms of emission-free mobility of the future – even in the off-road sector. DEUTZ already offers a large number of new, modular solutions that are tailored to the needs of our customers. From hybrid to full electric motors, from diesel engines that meet the strict EU emissions standard V to state-of-the-art gas engines, with our modular product kit, we develop tailor-made products for our customers, regardless of size and point of use, that will continue to meet all political, economic and ecological requirements in the future. Moreover, they make a significant contribution to our evolution into the world's leading manufacturer of innovative drive systems in the off-highway sector. We reinvent ourselves time and again in order to remain the reliable partner our customers are used to.

**AS A MANUFACTURER OF CLASSIC DIESEL ENGINES, WHERE DO YOU GET THE KNOW-HOW?**

For one, we have to thank our employees for driving forward the electrification of our product range as well as the improvement of all our other products and services with innovation and pioneering spirit, while demonstrating great commitment, openness and incredible flexibility. At the same time, in true DEUTZ tradition, we are constantly focusing on strategic partnerships. For example, we are working on an increasing use of alternative fuels in various research collaborations and are in constant contact with startups.

# TECHNO-LOGICAL PIONEER

HOW DEUTZ IS DEVELOPING FROM A MANUFACTURER OF CLASSIC DIESEL ENGINES TO A LEADING MANUFACTURER OF DRIVE SYSTEMS AND WHAT A BAVARIAN SPECIALIST FOR INTEGRATED ELECTRIC AND HYBRID DRIVES FOR BOATS HAS TO DO WITH IT. A CONVERSATION WITH DEUTZ CEO DR. FRANK HILLER.

And when the situation calls for it, we also integrate other companies into our portfolio. Like 2017 Torqeedo.

**WHAT CAN A 150-YEAR-OLD, TRADITIONAL BILLION-DOLLAR COMPANY LEARN FROM A STARTUP FOR INTEGRATED ELECTRIC AND HYBRID DRIVES FOR BOATS?**

This acquisition is an important component of our E-DEUTZ strategy. It was an indispensable prerequisite for a basic technology transfer: the transfer of Torqeedo's e-know-how to our off-road applications. By 2022, we want to generate 5 to 10 percent of our sales with electric drive systems.

**IN WHAT WAY?** In terms of electrification, we developed in no time at all from an absolute nobody to the fast movers. Through the Torqeedo acquisition alone, we were able to skip five years of development time and quickly develop two prototypes. Customers are already attesting our pioneering role in the field of electric drive systems. That makes me very proud, because it does not just show off the dynamism of our company. More importantly, it shows that DEUTZ, as a technological pioneer, is already in a position to offer marketable electrification solutions. Next, we will transform the technology into series production.

**AND HOW DO YOUR CUSTOMERS BENEFIT FROM IT?**

Quite significantly: Electric drive systems reduce exhaust and noise emissions and reduce operating costs. Above all, dynamically operated machines in the lower to medium power range, such as telescopic handlers, are predestined for the use of electric drive system technology.

**BESIDES MODERN ELECTRIC AND HYDROGEN DRIVE SYSTEMS, DEUTZ WILL ALSO SHOWCASE NEW DIESEL ENGINES AT BAUMA 2019. ARE DIESEL ENGINES STILL RELEVANT TODAY?**

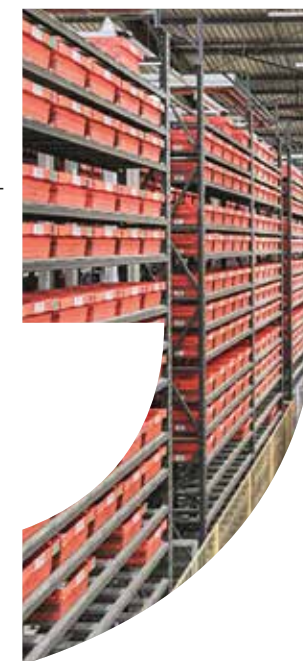
Definitively. Especially in heavy-duty applications, where power density is the deciding factor, diesel engines are still the best solution. In fact, it is currently irreplaceable in heavy tractors and excavators that are used in the off-highway area. Some diesel engines will also be available as liquefied petroleum gas versions. And many variants are based on a common engine platform, which leads to strong synergy effects. At the same time we are also working on the use of alternative fuels. Particularly promising are synthetic fuels, so-called e-fuels. Furthermore, we offer gas engines that are particularly interesting for material handling applications and compact construction machinery. This offer shows that we are diverse and can offer solutions for different requirements.

**ARE A MODULAR SYSTEM AND THE E-STRATEGY ENOUGH TO STAY COMPETITIVE IN THE LONG TERM?**

In addition to our modular and electrification strategy, we are focusing on international growth, especially in China – with the exception of the USA, where we have already been active for a long time. The Chinese market is already the largest in the world for off-road applications. And it is not only continuing to grow, but it is also changing: The environmental regulations are also becoming significantly stricter – which gives us a clear competitive advantage.

**WHAT IS YOUR LONG-TERM STRATEGY TO POSITION DEUTZ AS A LEADING PLAYER IN CHINA?**

With our new three-pillar growth strategy, we can increase production there and be successful in the long term. Therefore we are also relying on the cooperation and joint venture with our Chinese partner SANY. Through another collaboration with China's largest material movement rental company, we will expand our network and advance the digitalization of our service business. After all, without service it simply does not work: We have expanded our service network to more than 800 locations worldwide. We will continue to grow and, with FAR EAST HORIZON, we will massively advance the expansion in the important Chinese market. Our engine business is built on a solid foundation through a nationwide and strong service offering – not just in China, but globally. Therefore, the focus is on expanding our service business: By 2022, we want to generate over €400 million in revenues in the service area. As you can see, DEUTZ is driven by a new dynamic. The impact can be seen in the development of alternative drive systems, international growth and expansion of our service business as well as our digitalization efforts. Because the future is what we make of it.







DEUTZ THIS IS WHAT OUR CUSTOMERS SAY I

### MANITOU GROUP

MANITOU, the leading OEM in the material handling sector, has enjoyed a long and close relationship with DEUTZ that has been built on strong technology. It has become the first E-DEUTZ project partner to have its equipment fitted with DEUTZ technology. One of its telescopic handlers has been fitted with a hybrid drive and a second with an all-electric drive.

# VERY COMPELLING

THIS IS WHAT OUR CUSTOMERS SAY

THE INTEGRATION OF ELECTRIC DRIVES INTO OUR MACHINES IS A VERY ENCOURAGING DEVELOPMENT FOR THE FUTURE. DEUTZ HAS THE NECESSARY EXPERTISE AND IS FAMILIAR WITH THE SPECIAL REQUIREMENTS OF OUR APPLICATIONS. THE POTENTIAL PERFORMANCE OF THE NEW ELECTRIC DRIVES IS EXTREMELY COMPELLING.

**MANITOU**  
GROUP



Michel Denis,  
President & CEO,  
MANITOU GROUP

OUR ROLLERS NEED TO DELIVER A LOT OF POWER WHILE TAKING UP AS LITTLE SPACE AS POSSIBLE. THE AIM IS TO HAVE A COMPACT DESIGN THAT GIVES THEM AS MUCH FLEXIBILITY OF MOVEMENT AS POSSIBLE. DEUTZ ENGINES MEET THIS REQUIREMENT PERFECTLY, DESPITE THE GROWING COMPLEXITY OF EXHAUST GAS AFTERTREATMENT DUE TO EU STAGE V.

### HAMM AG

HAMM and DEUTZ: a partnership dating back more than 100 years. Nowadays, the specialist for road construction and earthworks mainly uses compact DEUTZ engines in the 2.9 to 6.1 liter capacity range, for example in tandem rollers that are used around the world to create high-quality asphalt surfaces for everything from airports to Formula 1 racetracks.

These ultra-modern combustion engines are adaptable to changing needs and emit very low levels of pollutants. HAMM rollers have been presented with multiple awards in recognition of this combination of sustainable engine technology with an ergonomic, user-friendly design.

**HAMM**



Dr. Stefan Klumpp,  
Chief Technology Officer,  
HAMM AG



# DEUTZ IS ONE STEP AHEAD

AS A MANUFACTURER OF INNOVATIVE DRIVE SYSTEMS, DEUTZ HAS TO FULFILL MANY MARKET AND CUSTOMER DEMANDS. MEMBER OF THE BOARD MICHAEL WELLENZOHN EXPLAINS IN THIS INTERVIEW HOW THE COMPANY TACKLES THESE CHALLENGES EFFICIENTLY.

**MR. WELLENZOHN, AS MEMBER OF THE BOARD RESPONSIBLE FOR SALES, MARKETING AND SERVICE YOU ARE VERY CLOSE TO THE CUSTOMERS. WHERE DO YOU SEE THE BIGGEST CHALLENGES FOR DEUTZ?**

Our customers have wide-ranging requirements for drive systems that are defined by their operational areas as well as new noise and emissions legislations. As a technology leader, DEUTZ must face these challenges. The focus of our customers is on total cost of ownership (TCO) of the machine for the end customer. TCOs specify how efficiently the end customer can operate his work equipment, and are thus the key purchasing criterion. That being said, the drive system is one of the big cost items and thus a key factor for the TCO of the machine. Accordingly, it is important that DEUTZ offers a product portfolio that includes competitive drive systems and perfectly covers customer demands.

**CAN YOU BE A LITTLE BIT MORE SPECIFIC?** Imagine the following scenario: A customer asks us to design a specific drive system for his machine. We work with him to define the basic conditions and the performance profile. Then we get to work immediately to configure the optimal drive system. The first step is the power requirement in kW and torque. After that, the basic conditions and the load profile determine the technology. The result can then range from the conventional combustion engine with different fuels to the hybrid or electric drive system. In this process, we advise the customer on the TCO and its argumentation with focus on the drive system. For this phase we use our modular product kit. Conventional combustion engines are particularly demanding, since they must meet the country-specific emissions legislation. With DEUTZ drive systems, we solve this problem by offering compact and modular exhaust aftertreatment systems for basic engines.

In addition to the hardware, the performance profile of the machine is crucial and can be a challenge for exhaust gas after-treatment on the software side. For example, the use of diesel particulate filters can be a challenge as the European Stage V and the upcoming Stage IV for China are becoming compulsory. That's where our many years of DEUTZ expertise comes in handy. Our experts and our customers are looking for the best configuration for the best machine availability, which also has a decisive influence on the TCO.

**THAT SOUNDS COMPLEX. HOW CAN CUSTOMERS KEEP TRACK OF ALL OF IT?** DEUTZ is a strong system partner who thinks about all the issues affecting our customers, so they can rely on us. We supply drive systems from our modular product kit, which gives our customers' machines an innovative and competitive edge. This puts DEUTZ one step ahead of the competition.

**HOW IS DEUTZ PERCEIVED AS A SYSTEM INTEGRATOR?** Very well, after all that is one of the strengths of DEUTZ. We have always been committed

to partnership-based customer relationships with added value for both partners. Over time, this leads to a high level of trust – even with new concepts. Take a look around at the bauma trade fair, and you will see with which customers we have established such partnerships. Even for electric drive systems, which bear a lot of potential for the future.

**WHAT DOES THIS PRODUCT PORTFOLIO ORIENTATION MEAN FOR DEUTZ IN GENERAL?** Our drive systems are based on the modular product kit. This allows us to intelligently combine the benefits of conventional and electric drive system components and offer each customer an ideal solution for any situation, regardless of whether they use diesel, gas, hybrid, hydrogen or electric drive systems. The performance coverage of our engines up to 620 kW facilitates a very wide range of applications. Nevertheless, every drive system configuration benefits from the synergies of the modular product engineering kit and limits the complexity for DEUTZ. This optimizes development costs and efforts.

## OUR TWO NEW



### TCD 5.2

A versatile and powerful drive system for construction machinery: The new 5.2-liter diesel engine is the first DEUTZ in-line engine to not feature exhaust gas recirculation. With its highly efficient SCR system, it easily meets the emission standard EU Stage V. The turbocharged, water-cooled four-cylinder with charge air cooling is the most powerful engine in its class. The engine design is compact and modular: Optional components reduce installation costs and increase the application possibilities. With very low fuel consumption, it also offers low total cost of ownership.

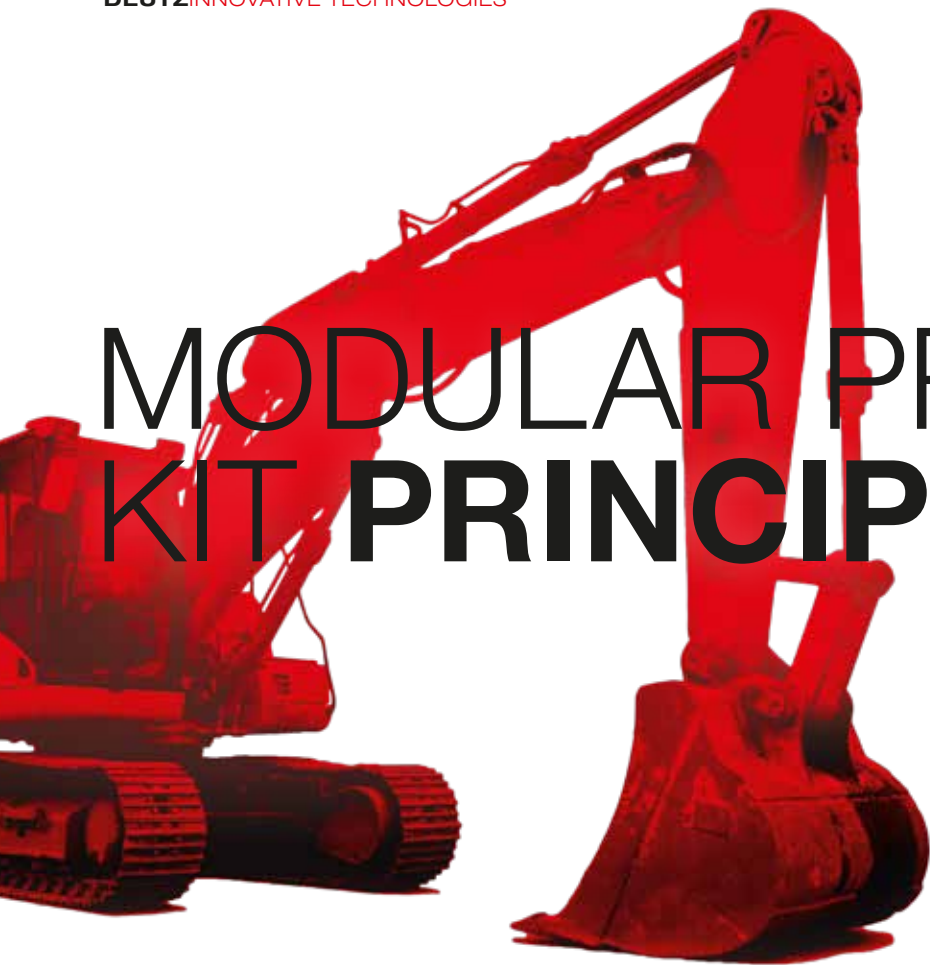


### G 2.2

A robust 3-cylinder with water cooling: The new 2.2-liter gas engine also tackles demanding tasks. The fully electronically controlled LPG system ensures best performance with extremely low emissions, which comply with European emission standard V. Furthermore, this drive system can be cost-effectively supplemented with optional modules, so that it can be used in as many areas as possible.



# MODULAR PRODUCT KIT PRINCIPLE



DEUTZ IS REPOSITIONING ITS DRIVE SYSTEM PORTFOLIO AND WILL BE OFFERING A MODULAR RANGE OF DIFFERENT TECHNOLOGIES IN THE FUTURE. THE NEW MODULAR PRODUCT KIT MAKES IT POSSIBLE FOR DIESEL, GAS, HYBRID AND ELECTRIC DRIVE SYSTEMS TO BE INDIVIDUALLY CONFIGURED AND FITTED PRECISELY. KOBELCO IS AMONG THE FIRST CUSTOMERS AND HAS SELECTED AN E-DEUTZ DRIVE SYSTEM.

The goal of the modular product strategy by DEUTZ is to be able to react more flexibly and faster to technological developments. The benefit of modularization is reflected in a reduction of design and development expenditures while ensuring a shorter “time to market”. In a modular world, only the relevant components or modules that are subject to technological advancement are adjusted – not the entire system.

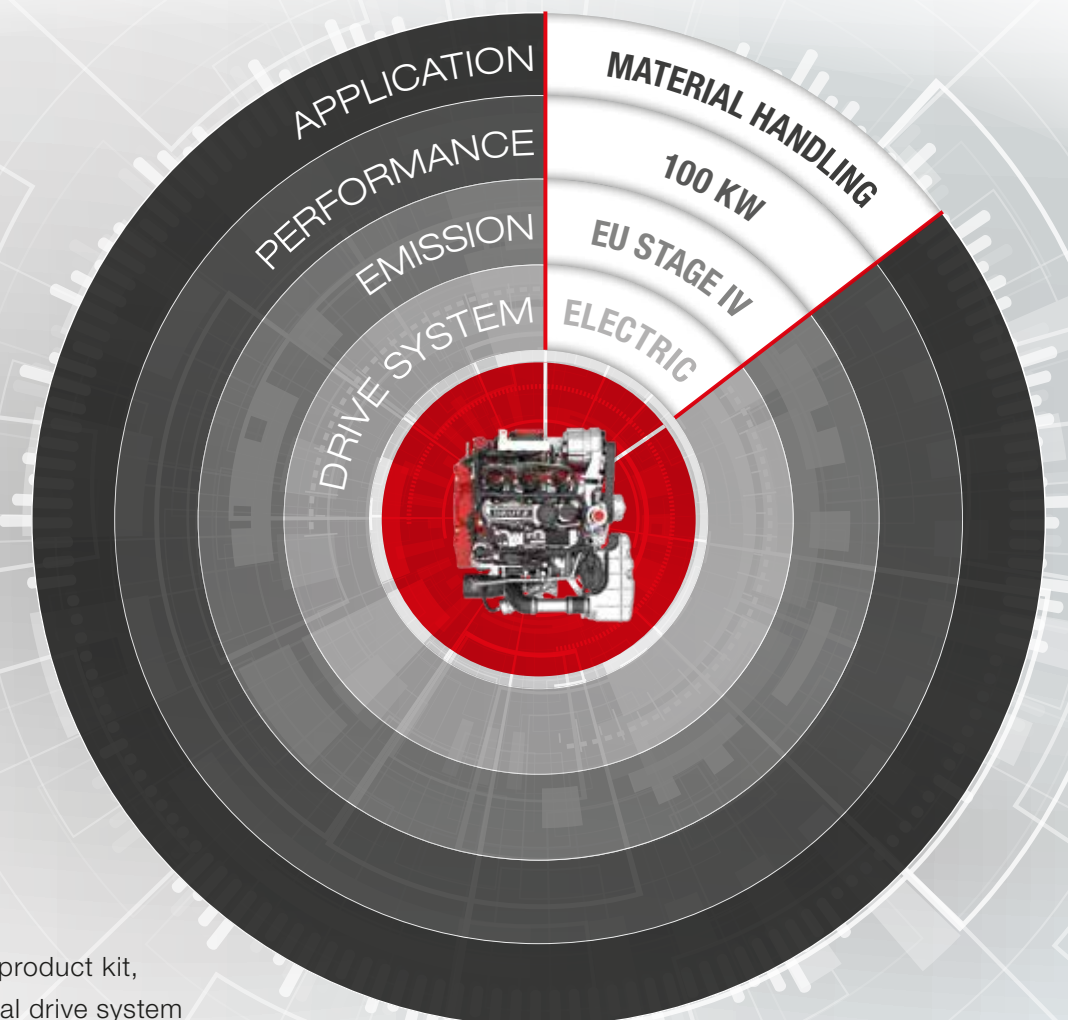
Marco Herre, Head of Global Product Management & Business Development at DEUTZ, explains: “Our approach can also be transferred to the demands of our customers. The drive system is part of, or rather a module of the overall system of the customer application. With the modular product kit, we offer the required flexibility that is necessary to be able to respond quickly to changing market requirements for drive systems.”

## KOBELCO RELIES ON ALL-ELECTRIC

The entry into modularity is no longer selected by the engine, but by the customer’s required power class in kilowatts. In the chosen performance class, the customer can select his favorite drive system technology from the modular product kit of diesel, gas, hybrid and all-electric drive systems. If market requirements change, DEUTZ customers can quickly switch to a different drive system technology. Not only do companies become more flexible and faster, they can also calculate the risk of changing market demands more easily.

Furthermore, the modular product kit is not limited to a choice between different drive system concepts. Another supplement will be so-called “kits”, which are application-specific. Cooling kits, dust kits or specific kits for agricultural applications are already being planned.

Agile, powerful and quiet: KOBELCO’s mini excavator is particularly suitable for building renovations or for gardening work and landscaping. The challenge for the construction site and its surroundings: keeping the noise and emissions as low as possible. KOBELCO is presenting its first mini excavator (SK17SR) fitted with an all-electric drive at bauma 2019. DEUTZ AG, as KOBELCO’s technology partner, has supplied a state-of-the-art E-DEUTZ drive system for the 1.7 tonne machine. The concept brings together DEUTZ’s electrification solutions with KOBELCO’s experience in the development of ultra-efficient construction equipment for urban applications. The result is a high-performance, zero-emission excavator with extremely low operating noise and reduced lifecycle costs. KOBELCO and DEUTZ are planning to bring the SK17SR to production readiness within the next two years and launch it on the European market in 2021.



With the DEUTZ modular product kit, customers receive the ideal drive system for all segments, performance classes and emission specifications.



# ELECTRIC DRIVE SYSTEMS MADE TO MEASURE

REGARDLESS OF CONVENTIONAL FUEL OR ELECTRICITY, A DRIVE SYSTEM MUST ALWAYS BE SUITABLE FOR THE APPLICATION. DEUTZ OFFERS ITS CUSTOMERS A MODULAR PRODUCT KIT THAT INTELLIGENTLY COMBINES THE ADVANTAGES OF DIFFERENT TECHNOLOGIES. A FIRST STEP IN THIS DIRECTION IS THE ADVANCEMENT OF ELECTRIC DRIVE SYSTEMS.

**AUTHOR:** DR. MARKUS MÜLLER

Machines with DEUTZ technology are used in a wide variety of areas, but mainly in construction machinery or in agriculture. In order to offer the best possible performance in every environment, it is important to adapt each drive system to the individual needs. While all-electric solutions enable locally emission-free operation, hybrid drive systems compel with lower fuel consumption and less complex exhaust gas after-treatment.

The classic diesel engine then covers a medium load, while the connected electric motor supports a “boost function” at peak power. Seamless interaction is ensured by an intermediate flange gearbox that connects the systems with each other.

In order to use these technologies efficiently, DEUTZ has developed a product kit that combines traditional solutions, such as diesel or gas, with electric drive systems. First electric systems in prototype machines were unveiled in September last year. For these prototypes, DEUTZ engineers converted two telescopic handlers, which are powered by default with a 74 kW TCD 3.6 diesel engine, to a hybrid and fully electric drive system in the Cologne development plant. The components of such solutions include batteries and battery management system, electric motors, power electronics, charger, thermal management and a control panel for voltage levels 48 V and 360 V.

The industrialization of these drive systems now follows under the key word E-DEUTZ: The focus hereby is on the interface to the customer. The control panel, diagnostic concept and function interface are designed identically – regardless of whether the drive system is configured purely electrically or as a hybrid drive system in parallel, serial or combined versions. Moreover, DEUTZ offers a modular battery pack to integrate the battery into the machine. Subsequently, the package is designed for the available space. In 2020, a lead system is supposed to be launched on the market.

DEUTZ is thus bringing a modular process to series level that offers each customer an individual drive system: the best possible choice of diesel, gas or electric technologies with the brand promise of high-quality engineering.

*Dr. Markus Müller is Senior Vice President, Product Development & Technical Customer Support*



## FLEXIBLE DRIVE SOLUTIONS: THE WAY INTO THE FUTURE





# AVAILABLE AROUND THE CLOCK

THIS IS WHAT OUR CUSTOMERS SAY

WE CHOSE DEUTZ BECAUSE OF THE PARTNERSHIP AND THE PRODUCTS THEY OFFERED, AND THE EASE OF DOING BUSINESS WITH THEM. WHATEVER WE NEED AND WHENEVER WE NEED IT, DEUTZ IS THERE FOR US AROUND THE CLOCK, JUST AS WE ARE FOR OUR CUSTOMERS.

## SUNBELT RENTALS

Sunbelt Rentals, based in Fort Mill, South Carolina, is one of the largest equipment rental companies in North America. It offers its customers a broad product portfolio ranging from backhoe loaders, telescopic handlers and forklift trucks to pumps and generators. DEUTZ is an important strategic partner and has been supporting the company for many years. Suppliers mean more than just business-to-business, they are real partners. Sunbelt Rentals particularly values DEUTZ's reliability.



Brian Clark,  
Director of  
Product Support,  
SUNBELT RENTALS



FORKLIFT TRUCKS ARE USED FOR A WIDE RANGE OF APPLICATIONS. SOME CUSTOMERS NEED TO MOVE PARTICULARLY HEAVY LOADS, SO THEY NEED A POWERFUL VEHICLE. THANKS TO DEUTZ ENGINES, OUR LINDE FORKLIFTS CAN GIVE THEM THIS POWER.



Dr. Eike Böhm,  
Chief Technology Officer,  
KION GROUP



**KION**  
GROUP

## KION

KION and DEUTZ have enjoyed a long and close relationship. Since 1969, Linde Material Handling, a KION premium brand, has been installing diesel engines made by DEUTZ AG in its forklift trucks. Today, these engines are mainly found in the H60 to H80 Linde models. Thanks to the DEUTZ TCD 4.1 engine that they use, these forklift trucks are able to move goods weighing up to eight tonnes.

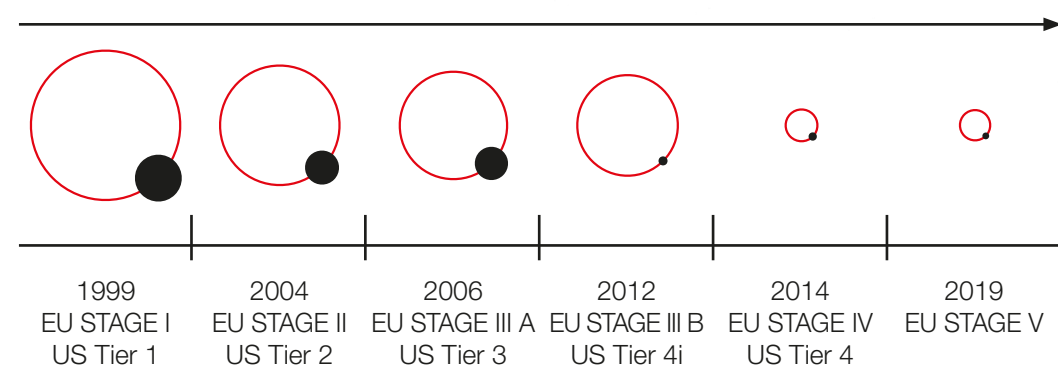


# THIS IS HOW CLEAN IT HAS TO BE

OUTLOOK 2020

- STAGE V
- Tier 4/STAGE IV
- Tier 4i/STAGE III B
- Tier 3/STAGE III A
- Tier 2/STAGE II
- Tier 1/STAGE I
- No regulation

THE DEVELOPMENT OF THE REDUCTION OF NO<sub>x</sub> AND PARTICULATE EMISSIONS FOR THE OFF-HIGHWAY SECTOR FROM 1999 TO 2019

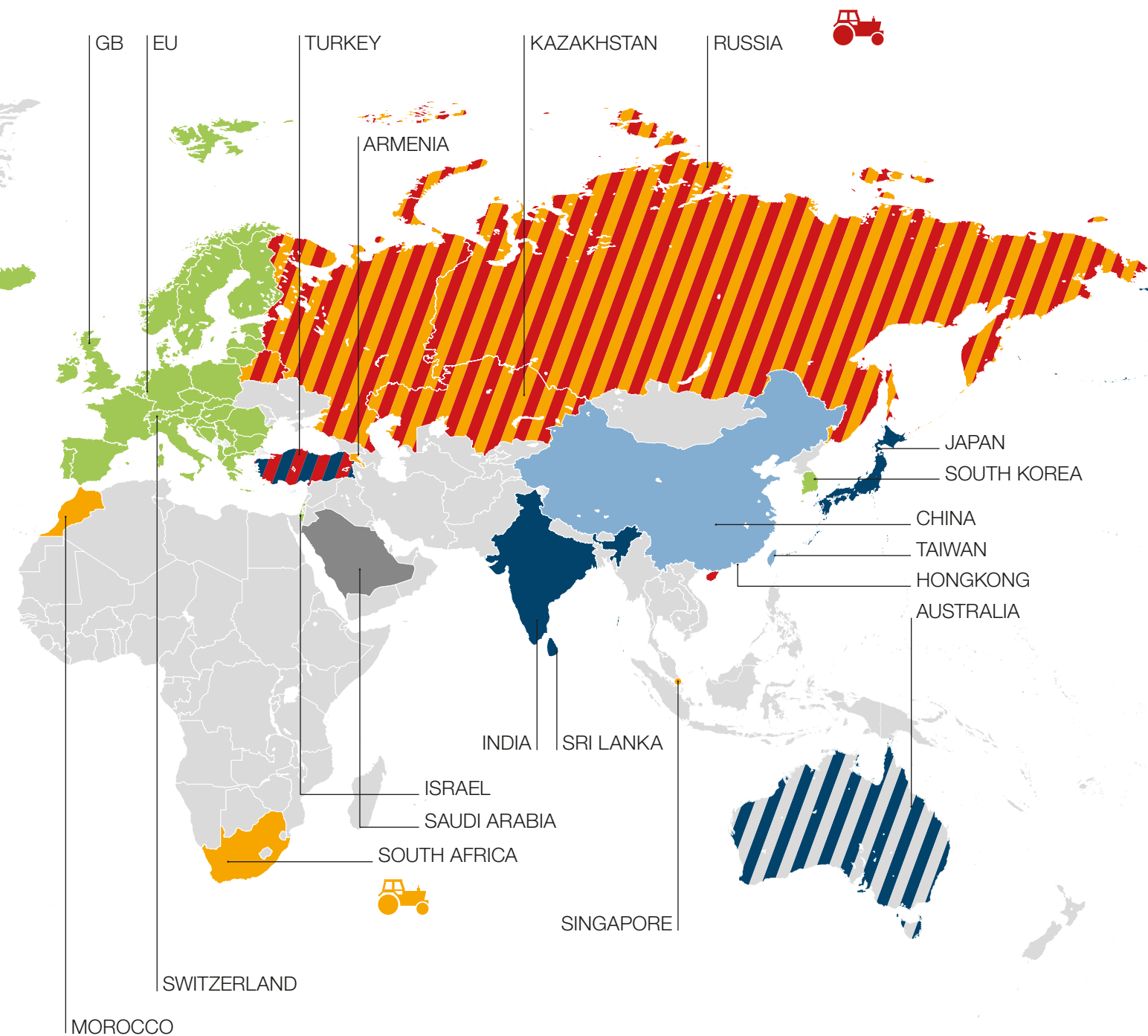


EU STAGE V includes for the first time a limitation of the particle count.

Reduction from 1999 to 2019: ● NO<sub>x</sub> 95,7 % ○ particulate emissions 97,9 %

The driving force behind engine development in the recent past has usually been the introduction of new emissions standards that limit the emission of environmentally hazardous pollutants, such as soot or nitrogen oxides. The efficiency and emission levels of the engines are being successively optimized through this process and have already reached a level that

seemed unattainable just a few years ago. For mobile work machines – the core business of DEUTZ AG – EU STAGE V currently applies in Europe. This infographic shows which different emission requirements engine and equipment manufacturers have to consider in their product design worldwide.



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# CONVERTING ELECTRICITY INTO FUEL

IF GERMANY WANTS TO ACHIEVE ITS CLIMATE PROTECTION GOALS, IT MUST ALSO CONVERT THE TRANSPORT SECTOR ALMOST COMPLETELY TO RENEWABLE ENERGIES. USUALLY, THE FOCUS IS ON DIRECT ELECTRIFICATION OF VEHICLES. BUT WHAT ABOUT E-FUELS? OBTAINED FROM RENEWABLE ELECTRICITY, THEY ARE BECOMING AN INCREASINGLY IMPORTANT COMPONENT OF A SUCCESSFUL ENERGY TRANSITION.

**AUTHOR:** DR. DAVID BOTHE

Plug instead of fuel nozzle – this is how it looks in practice today when private car owners or companies switch to electric or hybrid vehicles. But the electrification of automobile traffic can also be carried out indirectly via the use of so-called e-fuels. With the help of current-based chemical energy sources, such as synthetic diesel, methane or hydrogen, electrical energy can be converted into chemical energy sources and used in conventional combustion engines.

## DEPLOYMENT COSTS BEAT EFFICIENCY

Converting electricity into fuel? In energy policy discussions, e-fuels are often criticized for the enormous amount of energy lost through the additional conversion steps. However, the key criterion for use of renewable energies is ultimately not physical, but economic efficiency: Since renewable energy is by its nature inexhaustible, efficiency is not the key factor. Instead, the essential factor is which energetic utilization path carries the least cost.

The entire supply chain from the energy source and the intermediate storage to the vehicle must always be considered – and we should never forget to consider which technologies gain the acceptance of the population.

## EXISTING PATHS FOR NEW ENERGY SOURCES

“Covering the energy demand for more mobility while combating climate change is a major challenge,” proclaims a study published in 2018 by the Austrian Association for Automotive Technology. “Power-to-liquid fuels offer a variety of benefits, including high energy density, good shelf life and ease of use.”

Another benefit: Existing infrastructure and applications for liquid and gaseous energy sources can continue to be used, i.e. the well-established supply of fuel and gas as well as the use of traditional combustion engines. This partly helps avoid costly and time-consuming expansion in the electricity sector, for example for the temporary storage of renewable energy.

In comparison: Based on energy consumption, the storage volume of gas and liquid fuels available in Germany today corresponds to the battery capacity of more than 23 billion BMW i3 vehicles. Such advantages of e-fuels more than outweigh possible disadvantages due to higher conversion losses.

*Dr. David Bothe is the associate director of the business consulting firm Frontier Economics*

## THIS IS WHERE THE ENERGY IS STORED: STORAGE VOLUMES FOR OIL, GAS AND ELECTRICITY IN GERMANY

Storage of crude  
oil/oil products  
in Germany  
> 500 TWh

Gas storage  
in Germany  
> 260 TWh

Power storage  
0.04 terawatt hours



# CO<sub>2</sub>-NEUTRAL ALTERNATIVE

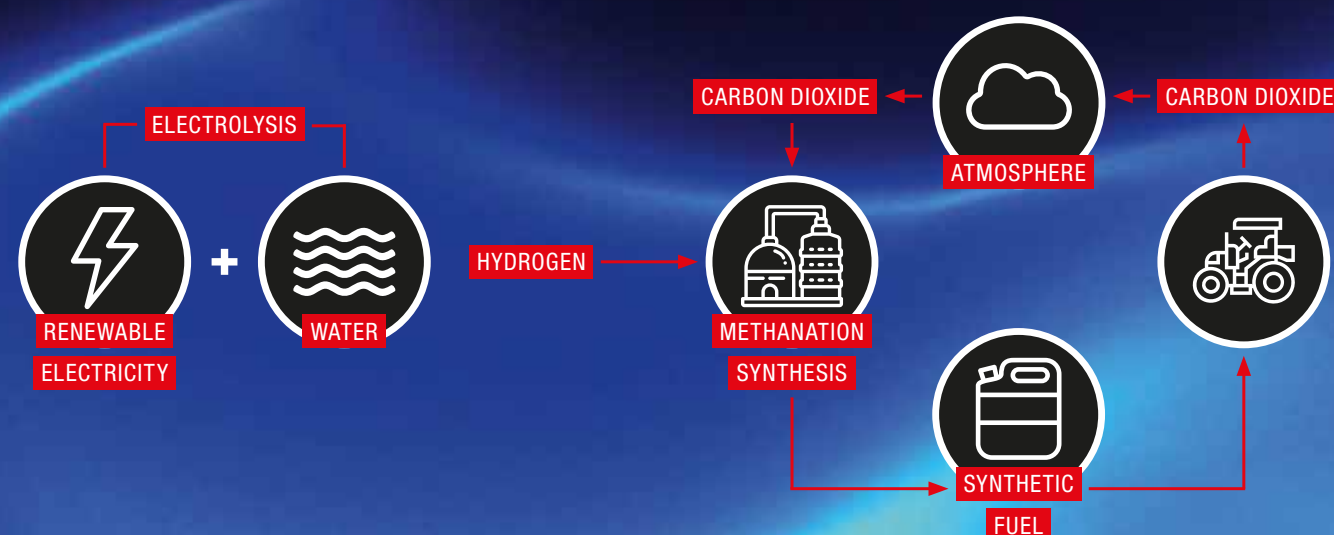
SYNTHETIC FUELS HAVE WHAT IT TAKES TO BECOME ONE OF THE DRIVE SYSTEM TECHNOLOGIES OF THE FUTURE. WE ARE INTRODUCING THE TECHNOLOGY BEHIND IT.

**Power-to-Liquid:** This is the name given to the process for the production of synthetic fuels, so-called e-fuels (see also page 18). The benefit for the environment: The fuel generation binds the same amount of CO<sub>2</sub> from the atmosphere that the combustion process emits.

And this is how it works: Using electricity, water is broken down into hydrogen and oxygen by electrolysis. For a CO<sub>2</sub>-neutral balance, this electricity must come exclusively from renewable sources such as wind or solar power. In the next step the resulting hydrogen reacts with CO<sub>2</sub> to form a synthesis gas. Most common method: the Fischer-Tropsch synthesis (FTS). This method, known since the 1920s, has so far been used mainly to liquefy coal. The power-to-liquid fuel can then be produced based on the synthesis gas (see infographic).

## CLEAN CYCLE:

### SYNTHETIC FUEL FOR COMBUSTION ENGINES



## THE MOST IMPORTANT COMPONENTS OF THE POWER-TO-LIQUID PROCESS:

### ELECTRICITY

is needed for the electrolysis, but also for the operation of the facilities in the various process steps. All in all, one liter of PTL fuel uses between 82 and 99 MJ of power.

### HYDROGEN

is another key component of the process: Between 0.41 and 0.5 kg of hydrogen is needed for 1 liter of PTL fuel. Hydrogen can be obtained, among other things, by splitting water into hydrogen and oxygen. Currently around 5 percent of total hydrogen is produced worldwide using this sustainable method.

### CARBON DIOXIDE

can be obtained directly from the air or used as an industrial waste product.

### WATER

is important as a source material, but also for heat integration. Producing 1 liter of PTL fuel in a PTL facility that uses large amounts of cooling water requires between 3.7 and 4.5 liters of water as the starting material. When the treated water is returned to electrolysis, the net intake of water is 1.3 to 2.0 liters per liter of PTL fuel.

### LAND

In the future, PTL production facilities will be located where renewable energies and usable land are abundant – for example in desert areas.

Source: Study on "The path to sustainable fuels for emission-neutral mobility" by the Austrian Association for Automotive Technology, 2018



## PIONEERING SPIRIT TO THE NTH DEGREE

### DEUTZ PREPARES THE WAY FOR CARBON-NEUTRAL MOBILITY WITH HYDROGEN DRIVE SYSTEMS.

The production of e-fuels starts with hydrogen, which can also be used as fuel – for example for a fuel cell drive system. However, this is a relatively complex technology. In cooperation with the Munich-based startup KEYOU, DEUTZ is creating an alternative with the development of a hydrogen combustion engine. DEUTZ is combining its expertise with combustion engines with KEYOU's inside technology, which was developed for the combustion of hydrogen in conventional series production engines. This concept can be offered as original equipment as well as in form of a retrofit solution. The target market is also significantly larger than hydrogen-based fuel cell technology.



AFTER THE PURCHASE IS BEFORE THE SERVICE: HOW DEUTZ USES DIGITALIZATION TO ENSURE A SIMPLE AND FAST SERVICE FOR DEUTZ ENGINES.

# FROM APP TO ALGORITHM



**reddot award 2018**  
winner

Suddenly the telescopic handler breaks down – right in the middle of work. Reason for panic? Not at all! Thanks to the DEUTZ Connect app, the driver can retrieve his engine data and send it directly to the nearest DEUTZ dealer in the area for diagnosis with just one click on his smartphone or tablet. After a quick call-back, he immediately prepares the service with the right spare parts.

## THE ENGINE OF THE FUTURE IS DIGITAL

Digital tools, such as the DEUTZ Connect app, are currently revolutionizing the after-sales market – making service much more efficient and thus increasing the availability and cost-effectiveness of a machine. DEUTZ customers are already accustomed to the fact that they can access the digital parts list of their engine and order spare parts via the DEUTZ service portal.

“The engine of the future is digital,” says Dr. Matthias Szupories, Senior Vice President of Central Sales & Marketing at DEUTZ. “Digitalization offers enormous potential for machine manufacturers, especially in the service division, and we are working hard to expand this even more for ourselves and, above all, our customers. As a systems supplier, we face a challenging conflict area for which we will provide attractive solutions for our OEM customers and the end users of our products, thus offering significant added value.”

## ALGORITHMS FOR PREVENTIVE SERVICE

This includes the electronic service book as well as preventive measures based on engine data and their logical connection. “For us, this is an evolutionary process, starting with basic tools such as an electronic service book to a fully integrated telemetry solution,” says Andreas Schmidt, Senior Vice President of Central Service at DEUTZ. “The latter enables ongoing monitoring as well as preventive service measures – including on the basis of intelligent algorithms. In a way, even mechanical repairs will become digital: We are working on a supporting augmented reality system that will provide technicians in the field with all the information they need digitally at the right time.”



**DIGITALIZATION IN THE SERVICE SECTOR IS UNSTOPPABLE – VISIT US AT THE DEUTZ SERVICE LOUNGE AT BAUMA 2019 AND SEE FOR YOURSELF!**

## DEUTZ CONNECT APP AT A GLANCE

### ENGINE

- Fast coupling of DEUTZ motors via Bluetooth
- Clear presentation of the engines
- Management of engines and setting of individual maintenance windows

### DIAGNOSIS

- Analysis dashboard with live data display of engines
- Perform power measurements and record measurement series
- Read error log and send to dealer with 1-Click

### SERVICE

- Direct search for local service contacts by map
- Quick contact established with dealer via email or phone
- Easily send report with measurement data by email





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