DIESEL
INTERNATIONAL

Stage FIVE

CNH Capital Markets Day - Kohler Hybrids - Kubota DOTY 2019

Comparisons: 5 and 16 liters - Interviews: AGCO, Cummins, SAME -

Biogas Mixing Truck - DPE & Agritechnica - MTU - ENI - TOTY

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DIESEL SUPPLEMENT

November 2019

"Volvo Group Venture Capital AB has invested in Upstream Security to develop systems to protect connected vehicles following the introduction of data-driven technologies"

ALTERNATIVE FUELS FOR TRACTORS
New Holland is the first manufacturer to present a tractor with a gaseous fuel drive that is fit for series production among the brand's T6 series

KUBOTA V5009

IT'S JUST A BEGINNING

2019 DIESEL OF THE YEAR KUBOTA V5009

Bauma Munich, Kubota booth, Diesel of the year 2019 awarding ceremony. The winner is... Kubota V5009. Following an excerpt of the jury's motivations: «*The ability to approach the right recirculation rate of the EGR and the engineering capability in complying with IIIB and Tier 4 respecting the engines dimensions and the OEMs needs have been trump cards for every diesel of the year until the 2016 edition. Then the jury evaluation criteria also were step-by-step adapted to the requirements of Stage V. Because since the middle of the last decade, and increasingly starting with the Stage IIIB, the real engine of the internal combustion engine is being compliant with emissions standards.*

No manufacturer has found an alternative to the mandatory couple DPF - SCR. The only element of diversification was the EGR. Kubota's strategy of improving DPF and after-treatment system and combustion parameters proved to be rewarding. This is one of the reasons why we chose the V5009. For the others I rely on the statements made at the announcement of the award, reported by Kubota itself and the specialized media.

The 5-litre displacement will become strategic in both agricultural and construction diesel engines and could become the 'right-sized' ICE of a hybrid package of heavy-duty machines, such as maxi excavators. V5009 is a genuine industrial engine, with a good balance between reliability and performances, power density and an excellent ratio between weight, volume and specific curves. The fact that Kubota broke with traditional Japanese reserve to announce the 5-liter at the 2017 Las Vegas ConExpo, three years ahead of serial manufacture is a sign of just how significant the new engine is to the corporation».

"*We are proud to be the first non-Western winner, but it is not about West versus East, more a reward for Kubota's meticulous engineering standards ranging from initial design to after treatment. The V5009 helps us meet client demand for our widest possible range and scale of engines and we are proud to be able to name the DOTY 2019 as a key part of our offer*"

But where does the success of the V5009 come from? We asked the Kubota management.

Can you tell us about the genesis of the V5009 project?

«To understand the genesis of the V5009 we need to trace our history. Kubota's engines have been the enduring "heart" of agricultural and construction machinery produced by Kubota since 1922, but in recent years, more than half of our sales have come externally from OEM manufacturers. We have become No.1 in the industrial diesel engines below 100 HP range, regularly receiving positive feedback from our customers around the globe, especially with regards to the quality and durability of our products. Many also mentioned their desire to use Kubota engines for larger applications. In order to meet such demands and in turn grow our engine business by developing a new market together with our customers, we made the decision to develop the V5009 large-displacement engine for a wider range of applications, whilst maintaining the reputation for reliability that Kubota has gained over the years. As market leader below 100 HP, the first challenge was to clarify market needs for a large industrial engine that reflected Kubota's quality. There were differences, not only in the manner of thinking, but also in the overall concept that varied significantly from the engines created for small industrial needs. The greatest challenges were related to the strength of engine components and the degree of engine safety. It all came down to accurately calculating engine strength to ensure 'Kubota Durability' as the performance level increased. Due to its significance to customers, there was no room for compromise when calculating the degree of durability required. In the process of increasing performance levels, repeated testing of this durability allowed us to improve the accuracy of input for strength calculations. Another important consideration was accurately discerning what had to be changed and what had to remain unchanged».

JAPANESE HYBRID IN THE SPOTLIGHT

A forklift demo was powered by the Micro-Hybrid system. The interface did not change, thus preserving the accessibility to the existing PTOs. The 10 kilowatts of the 48-volt hybrid are provided during translation and lifting of forks, in addition to the 43.2 kilowatts of ICE. In this case, the downsizing is from from the V2403-Cr-T (2.43 liter 4-cylinder) to the D1803-Cr-T (1.82 litre 3-cylinder). The Micro-Hybrid can be used with any Kubota engine, including LPG and CNG.

«*It is clear that the trend towards down-sizing is increasing, as the need for greater fuel efficiency, durability and total cost of ownership becomes the market focus. A Micro-Hybrid system, which provides power assistance instantaneously is a genuine technological innovation that can make a real difference to our customer's current and future needs*» said Daniel Grant, Marketing Manager of Kubota Business Unit Engine Europe.

Yasukazu **Kamada**, Division General Manager, Engine Division, Kubota Corporation: «*As we enter a new period of demand for efficiencies, emissions compliancy and whole life costs, we must consistently improve everything we do from engine design to supporting our customers*»

EIMA INTERNATIONAL 2020

THE GOLD RUSH

Eima 2020 recorded 620 formalized applications in just over two days, of which 120 were foreign, with a request for exhibition spaces totalling about 60 thousands square metres

The 'race' for Eima International 2020 has started four months in advance. At 11 a.m. on Monday, September 23rd, the Italian exhibition officially opened its registrations on the online platform. What happened? Eima 2020 recorded 620 formalized applications in just over two days, of which 120 were foreign, with a request for exhibition spaces totalling about 60 thousands square metres. A powerful sign of the interest that this exhibition arouses among the industries in the sector, concerned to ensure a space within an event that records in recent years a number of requests exceeding the capacity. In the last edition there were 1,950 participating industries, for a net exhibition area of 150,000 square meters (350,000 gross), a share that could be reached quickly, if in just two days is already booked more than a third of the entire space. Judging by the initial information we have gathered, the engine manufacturers seem to be willing to confirm their presence, among others, Yanmar still 'embraced' Eima 2020. As is known, Sima challenged Eima and the next year it will overlap the Italian one. Isabel Alfano, director of SIMA and Frédéric Martin, president of AXEMA (the association of French manufacturers) addressed the audience of foreign journalists on the occasion of the presentation of the SIMA 2020 edition, held last September 16. Said Alfano: «*In 2022 the SIMa will turn one hundred years old and taking advantage of the important changes that are taking place in the world of agriculture, the event has decided to change the date but, be careful, the overlap will occur only next year, from the following edition we will try to anticipate in order not to repeat the overlap with EIMA*». ■

SAMOTER. The European 'construction place' during 2020

The Samoter Innovation award will be divided into several prizes with different categories of products, at the moment not yet defined. This will replace the unique award we have known in the past, accompanied by some special mentions. The 2017 edition, which saw Samoter, Transpotec Logitec and Asphaltica co-exist under the same roof, registered 84000 visitors from 86 countries, mainly from Europe, with 13.4% from Africa, the Middle East and Central Asia.

CONEXPO-CON AND IFPE ARE READY TO START!

BOTH THE AMERICAN BIG EVENTS HAVE ALREADY SET EXHIBIT SPACE RECORDS AND WILL FEATURE INDUSTRY-LEADING EDUCATION PROGRAMS

Two of the North American big events are coming back in 2020: Conexpo-Con/Agg and IFPE. The news available for the moment are the ones concerning the registrations for the events, official statements confirm that they are already open for both the exhibitions. The co-located Conexpo-Con/Agg and Ifpe 2020 exhibitions are two of North America's premiere events for the construction industries and the fluid power, power transmission and motion control industries. Conexpo-Con/Agg and IFPE 2020 will be held March 10-14 in Las Vegas, Usa. Conexpo-Con/Agg stands out by itself as one of North America's largest construction trade show representing asphalt, aggregates, concrete, earthmoving, lifting, mining, utilities and more. The figures of the event are able to speak for themselves: 2,800 exhibitors, 2,500,000 square feet of space availability and 150 expected education sessions. **J.S.**

MEE DUBAI 2020

The MEE Dubai will take place between 3 – 5 March 2020. This edition already came out regarding the focus on digitalisation and renewables for the combined and expanded product sector. In particular, MEE will have a new dedicated Digitalisation Zone, to give the chance to highlight new technologies to an audience that's looking for ways to digitally transform their operations and business models. In areas such as: industrial automation, digital twin technology, cybersecurity solutions, APM, machine learning, remote monitoring, and many others.

VOLVO GOES AUTONOMOUS

THE GROUP'S OVERALL PERFORMANCE REMAINS GOOD EVEN IN A TOUGH TIME FOR THE MARKET

There is a new business area with Volvo Group. Announced during the periodical press conference about the results of the 3rd quarter, 2019, its name is Volvo Autonomous Solutions and it's supposed to have full focus on developing, commercializing and scaling up autonomous solutions across the Group. «*Our industry is currently in a transformation phase*», said CEO Martin Lundstedt. «*Connectivity will be an important enabler for autonomous solutions and we have decided to create a new business area, Volvo Autonomous Solutions, with full focus on developing, commercializing and scaling up autonomous solutions across the Group*».

In Q3 2019, global sales increased and continued to deliver solid profitability, reaching 99 billion Swedish crowns (SEK). Talking about the markets, there was an increase in terms of net sales for trucks (6 percent) and buses (20 percent as for deliveries).

After a few years of high market levels, demand for construction equipment is slowing down by 9% compared with a year ago.

Last but not least, Volvo Penta's net sales decreased by 2% as engine deliveries decreased compared to last year, when demand in Europe was high due to a pre-buy of industrial engines. The operating margin declined to 12.7% mainly as an effect of the lower volumes and high activities within R&D.

WALVOIL AND THE FORKLIFTS

Walvoil is involved in the electronic integration of the systems and, as regards the electric forklifts, the development of sophisticated electric traction systems. To give an example, the SD8 sectional valve has recently been equipped with a compensator that makes the fork descent speed independent of the lifted load and therefore allows to limit the maximum speed. It has been developed to guarantee an adequate descent speed of the first stage even without load on the forks.

CARRARO DRIVETECH ENHANCES R&D

The new Carraro Group's Research and Development center in Campodarsego (Italy) was recently inaugurated, one year after the kickoff of the building. Over 100 employees, including engineers and technicians, will be hosted within the new center, which has a total area of over 6200 square meters (doubled compared to the previous area). At this location, Carraro drivelines design and development activities are concentrated, from design to functional and reliability validation alongside those of prototyping and mountability verification. it will be possible to further enhance existing partnerships with different customers by working side-by-side on demo vehicles at the Campodarsego site with the possibility of dedicating their development benches to electrical and electronic systems and mechatronics.

JCB RECORD SPEED

A special JCB Fastrac tractor achieved the new speed record. The tractor notched up 166.7 km/h, at Elvington Airfield, near York, with TV presenter and engineering guru Guy Martin behind the wheel. It smashed the previous 87.27 mph record set in March 2018 by Top Gear's Track-Tor. JCB is no stranger to land speed records. In 2006, its DieselMax streamliner set a new diesel land speed record when it reached 350.092 mph on Bonneville Salt Flats in the USA, using two JCB DieselMax engines.

BORGWARNER

AMERICAN WAY OF HYBRID

48V: From an easy & cheap solution to a future as a protagonist. The BorgWarner portfolio starts with the MGU generators (intended for P0 or P1 uses) with 4-quadrant winding, power up to 25 kW and 18,000 rpm max, liquid cooling and the choice between direct drive or chain/belt drive. To better fit the different needs of coupling with the endothermic engine, they are also available in an electronically controlled version.

The family of engines intended for P2 hybrids is more original. Still at 48 V, they can be installed on or off axis. The first one, named P2 On-Axis, allows coupling with any drive train, including manual transmissions, requiring just slight modifications of the vehicle. Extremely compact (less than 17 centimeters long), it's equipped with three clutches and a flywheel and allows all the typical functions of a hybrid vehicle: running in parallel with the combustion engine or, uncoupling it, electric only mode or inertial gear. Start/stop and energy recovery during braking functions are included. The S winding ensures high compactness but also involves considerable thermal loads managed by a water-oil cooling system.

> Among the conjugations the one intended for P2 uses, focused on compactness, delivering a peak power of 80 kW and 330 Nm for the On-Axis, 20 kW and 240 Nm for the Off-Axis

The P2 Off-Axis is intended to be coupled directly to the gearbox when the overall dimensions do not allow axle installation. Power rates change according to installation and use: continuous 15 kW at 15,000 rpm and 20 kW peak at 12,000, 80 Nm maximum torque peak and 240 Nm when performing engine start function. The power is transmitted through a HY-VO chain able to ensure reliability, silence and absence of vibrations.

The eDRM or Rear Drive Module is a joint for the rear axle that allows to replace various types of joints in all-wheel drive vehicles with an electric motor integrated in the joint, thus performing the so-called Torque Vectoring. Added

THE RIGHT BALANCE

The choice of 48V voltage is due to the need to increase the power with respect to the classic 12V start-up and auxiliary motors while maintaining the current at still acceptable levels. At the same time, 48V is considered a safe voltage. Yes, because the high voltages of hybrid and electric vehicles can cause concern both for the users and for those who carry out maintenance or rescue operations in the event of road accidents. In fact, the procedures to work on damaged or even worse burned electric vehicles require first of all to disconnect the power supply. Precisely to avoid accidental contact with the cables these are yellow to be easily identified. That's a good safety measure given that 600V, as in many EVs, is the same voltage used for example by tram and buses in many of our cities.
BorgWarner has estimated that working at 48V allows to get 70% of the benefits of a high voltage hybridization with only 30% of the related costs.

Frédéric **Lissalde**, President and CEO, BorgWarner:
«*We offer a broad range of solutions including technologies for highly efficient combustion engines, various hybrid architectures and pure electric vehicle systems*»

to this are the typical hybrid functions such as the acceleration booster, electrical inertia drive and regenerative braking. Compared to traditional systems, all slips disappear and the response becomes more progressive and vivid.
Looking for more sophisticated solutions we find a P4 solution, which includes two electric motors, one of which is at the rear axle to allow all-wheel drive. Here we find again all the typical hybrid functions and no disadvantages in terms of overall mass, and savings in consumption up to 25%. The rear engine is called eAWD: featuring the option of a two-speed gearbox to keep the electric motor always in the range of maximum efficiency (but for now only the single speed gearbox has been tested) it delivers a starting torque of 1,500 Nm, such as to allow a further downsizing of the endothermic engine.
All the control electronics are incorporated, making it easier to install and match the endothermic engine.
Moving on to the latter, BorgWarner offers a series of turbochargers combined with an electric motor called eTurbo. Available powers reach 11kW continuous and 17 peak, and liquid cooling is available as an option. A very interesting feature is the energy recovery from exhaust gases: when mass and enthalpy are right, the electric motor acts as a generator thus obtaining a turbocompound.
Alternatively, an eBooster can be combined with a turbocharger: mounted downstream or upstream of the classic turbocharger it increases air pressure, once again drastically reducing response times. Suitable for both diesel and eight engines, a 12V version is also available for lower powers.
Here we find the already seen advantages – a 5-10% increased engine efficiency, the possibility to use larger compressors thanks to the eBooster response time, further downsizing the engine. During the testing phase a 2 liters VGT was compared with two 1.6 liters, one with eBooster, the other with two-stage supercharging.
Thanks to the very fast response time (eBooster reaches 70,000 nominal rpm in 270 ms, the first solution easily compensates for the 20% reduction in displacement. Conversely, two-stage supercharging can be more efficient in long low power operations. The eBooster also delivers higher EGR recirculation rates, thus helping to reduce NOx emissions.

Alberto Scalchi

CNH INDUSTRIAL@WALL STREET

IT'S SPIN OFF

FPT Industrial came out of Wall Street arm in arm with Iveco. The much talked about spin-off materialized at the NYSE on Tuesday around 11 am local time, in the words of Hubertus Mühlhäuser, CEO of CNH Industrial: Iveco and FPT Industrial become an autonomous entity that will be autonomously quoted on the Stock Exchange from the first quarter of 2021. Highlights of the five-year plan include net sales projected to grow at a compound annual growth rate of 5%. According to CNH Industrial: «*The 'Transform 2 Win' plan will see the Company separate its 'On-Highway' and 'Off-Highway' businesses, a decision that follows the completion of a deep portfolio review process, taking into account, among other things, strategic, investor, and synergy considerations*».

What role will FPT play in this scenario? The mission of the Powertrain division is to expand the portfolio of so-called alternatives; increase margins in investment-heavy environment; continue to consolidate in the free engine market. Powertrain therefore goes along with onroad. CNH Industrial, with its strong agricultural vocation, will remain linked by a long-term supply agreement with the off-road division. But why with Iveco and not Cnh? **Mühlhäuser** replies: «*Because most of the sales are onroad and because the most stringent regulations on emissions come precisely from onroad regulations and then spread to off-road applications*».

Another news from Wall Street: Nikola is part of the family (see box). At the moment, with regard to the possible synergies with Fpt Industrial, we quote the following statement in the press release: «*The fuel cell technology is the next logical step compared to the engines powered by LNG, since it develops from the existing supply network, allowing on-site production of hydrogen in the stations themselves*».

Iveco officially takes an independent path with respect to the agricultural and construction divisions of CNH Industrial. It was not taken for granted that FPT Industrial became part of the spin-off onroad, side by side with Iveco bus and trucks

The next five years will see a 13 billion dollars investment and the prospect of introducing Iveco on the American market, correcting its inertial trend. An exhaustive picture of this operation is in the following statement by Hubertus Mühlhäuser: «*The off-highway business will be focused on becoming the partner of choice to feed and build the world by creating the global leader in sustainable Agriculture with a highly synergistic Construction Equipment business. The pro forma sales will be 15.6bn US$ of wich 75% are in the agricultural space and a pro forma adjusted EBIT of 1bn US$. We also concluded that we needed to spin-off our Commercial Vehicles, Medium & Heavy Trucks and buses as well as our Powertrain businesses. This newly created On-Highway company will build on its leading positions in Europe for CV and worldwide for Powetrain to become the global leader in sustainable transportation and propulsion and will become the partner of choice to connect and power the world with pro forma net sales of 13.1bn US$ with a pro forma adjusted EBIT of 0.5bn*».

Hubertus **Mühlhäuser**, CEO, CNH Industrial «*With our 'Transform 2 Win' strategy we are delivering on our purpose and are truly powering sustainable transformation for all of our stakeholders. We are transforming CNH Industrial to realize its full potential.*»

We conclude with a summary of the speech by Annalisa **Stupenengo**. «*The diesel scenario imposes challenges...*» the answer is in the end of the sentence: «*challenges that we are able to meet*». How? The recipe is the one stated several times, which looks to the future without being influenced by the mainstream of the 'one way' electric: «*We will invest in diesel and gas, as in fuell cell and batteries*». After all, Stupenengo points out that: «*Even in the next decade, diesel will be the dominant fuel both for on-road and off-road applications, thanks to its versatility and widespread distribution*». However, this does not mean being limited to diesel fuel. «*We will invest in e-Mobility*», Stupenengo says: «*both with electric battery propulsion and thanks to hydrogen cells*».

Another quote from Stupenengo's talk speaks of «*both standard and disruptive technologies*».

Finally, a look at the turnover target for 2024: «*The goal is to reach 6.1 billion dollars*».

NIKOLA IS PART OF THE IVECO FAMILY

CNH Industrial will invest about 250 million dollars. The contribution of Nikola will be certainly focused on the field of fuel cells, electric axles, inverters, independent suspensions, hydrogen tanks, remote software update functions, infotainment, vehicle controls, communication protocols between vehicle and refueling stations, electronics for power flow control and access to the hydrogen supply network.

Three projects are in the pipeline: the Nikola One, a heavy-duty sleeper vehicle, compliant with the Class 8 standard, and therefore used in the Nafta markets; the Nikola Two, a heavy vehicle of the 'day-cab' type, also meeting the Class 8 standard for the NAFTA markets; and the Nikola Three, a heavy-duty commercial vehicle featuring an advanced cab that looks instead to Europe. As stated by Trevor **Milton**, managing director of Nikola Corporation: «*Nikola has the technology but needs a partner with an European network to achieve it in a timely manner. By bringing CNH Industrial on board, we now have access to manufacturing know-how, purchasing power, validated truck parts, plant engineering and much more*».

KOHLER HYBRIDS

TWINS BUT NOT IDENTICAL

The two hybrid units are conceptually identical yet, totally different in construction and electric/diesel power ratio. We're talking about FOCS and KDI Kohler hybrids, the first step of the Right Size Theory announced at Bauma. We met Paolo **Fregni**, Advanced Engineering Manager, and Paolo **Zaccarelli**, Product Manager Marketing area.

In addition to the well-known advantages of 48V (e.g. safety, lower cost of electrical components, versatility ...), why did you choose this solution?
In the first phase of development of this project much higher voltages were also evaluated, let's say 2-300 V. Low voltage is not fully defined yet, since it can reach 80 or 100V. Instead, the 48V voltage is already a standard instead, it provides safety and gave us the opportunity to take advantage of the developments underway for automotive mild hybrid, thus being able to focus on high production volumes and on the developments and scale economies provided by these volumes.

Kohler chose for its first hybrid powertrain 48V solution used on two very different engines, the KDW1003, an aspirated 3-cylinders with mechanical injection and 2 valves per cylinder displacing just over a liter, and the KDI2504, an almost two and a half liters 4-cylinders engine featuring four valves per cylinder, turbo and common rail

Since the two engines have similar electrical power and different thermal power, the K-HEM 1003 looks more like a full hybrid while the K-HEM 2504 looks like a classic 48V. What are the typical applications for the two engines?
The profiles are quite similar, in both cases they are power units intended for discontinuous power demand with peaks of few minutes or less. On the 1003 the additional electric 15 kW bring the total power to 33 kW, allowing to avoid DPF because the engine stays below the power threshold imposed by the legislation although providing the performances of much larger engines. Similarly, the 2504 maintains the power of the combustion engine below the threshold, which makes the SCR mandatory, with obvious advantages in terms of ease of installation and lower operating cost.
It is in fact possible to have a power unit with a rated power lower than 56 kW but at the same time able to reach power peaks up to 75 kW. A further benefit is the possibility to take advantage of battery recharge cycles to reach a combustion engine load able to ensure a high temperature of the exhaust gas and, therefore, a very efficient DPF regeneration.

The K-HEM 1003 is a naturally aspirated with mechanical injection, the K-HEM 2504 is a turbo Common Rail: did their different curves lead to a different management mode by the Power Management System?
Being the two diesel engines very different, the management of the two units is different. On the 1003 the mechanical actuator regulator was replaced with an electronic one actuator, optimized to match the Power Management System in terms of power and torque delivered. In the first instance the torque and power values and their respective curves are identical to the standard engines but, like the latter, they can be customized on request.

And what about the electric motor?
It is a synchronous motor with permanent magnets that is very compact and able to work as starter with direct coupling and 1 to 1 ratio thanks to its high pick-up capacity.

Which hybrid configuration was chosen?
Initially the configuration is a P1 with parallel unit directly connected, but we are developing a P2 with intermediate joint that will also allow to operate in electric mode when required.

How is energy recovery done?
Being a hybrid group intended for operating machines, energy recovery is less frequent than in the automotive, and it mainly takes place during low load cycles of the machine by exploiting the residual capacity of the ICE.

Alberto Scalchi

TALKING ABOUT BATTERIES

What kind of batteries do you plan to use from the chemical and sizing point of view?

«Being a product intended for the OEM market, batteries are the most customized component both in terms of type (lead or lithium batteries) and, above all, in terms of size. In fact, the requirements are closely related both to the type of vehicle with regard to mass and space (for example the mass in a forklift is less critical since a vehicle is in any case equipped with ballast), its use and typical working cycle with consequent requirements in terms of autonomy. Specifically, for lithium, a lithium iron phosphate chemistry with integrated BMS was chosen. Usually the battery pack integrates the PMS, since the master ECU must be able not only to manage the combustion engine, but also to communicate with the inverte, above all, with the BMS».

«48V provides ease of installation and safety, allowing servicing with no need for specific training of personnel on high voltage. In the next future, applications such as plug-ins and range extenders may be feasible.»

A THREE-WAY CHAT @BAUMA

LIVE FROM MUNICH

WAITING FOR THE 2021

Giorgio **Paris**, President Region International & Asia, talks about **Volvo Penta**.

Volvo Bus manufactures only electric urban vehicles. The hybrid IPS made his debut. When will we see it in off-road applications?
Some time ago we announced that from 2021 Volvo Penta will provide electrified solutions both for marine and industrial applications. We've made a commitment to the market and will keep it. We have open talks with potential customers to develop this offer. At the moment I would not go into any detail concerning specific technologies and engines, for example, which will be the first to use hybrid packages. Meanwhile, Volvo CE has developed a full electric excavator, on display right here at Bauma.

Emanuele **Ferrari**, Application engineer of Volvo Penta's industrial engines, gives us **a final note on Stage V**.

The common rail introduced on the heavy duty range is derived from trucks. In the development teams we worked according to a 'cross functionality' vision. Uncooled EGR, fixed geometry turbo, intake flap as in Stage IV and flaps on the exhaust so that the two flaps working together may optimize the efficiency of the exhaust system. We are able to shape the behavior of the combustion and we have improved the intakes, despite the Stage V having technically imposed the use of the DPF the response capacity of the engines was not penalized.

Straight from Bauma Munich we extrapolated some sentences from the interviews with Cummins, Perkins and Volvo Penta. What comes out is a portrait of the 2019 off-road business.
Starting with Alexei **Ustinov**, Vice President Off-Highway Engine Business at **Cummins**.

Can you choose the right applications for the hybrid and the electric applications?
For off-highway I expect smaller excavators up to 7 tons will go electric in the next 5 years, with the bigger excavators continuing to use diesel power. Some of the bigger excavators can go hybrid, because there a number of opportunities for energy recovery in the way they operate, which some of our OEM partners are currently testing. The interesting fact about excavators, relating to hybrids, is almost all of these are diesel hydraulic. They have hydrostatic systems to drive all the components of the machine. So, if you have energy recovery you can make the whole machine much more economical.

We interviewed Alexei USTINOV, Vice President Off-Highway Engine Business at Cummins, Oliver LYTHGOE, Product concept marketing at Perkins, and Giorgio PARIS, Head Industrial and President EMEA & APAC at Volvo Penta

What off-road applications are the best target for Cummins in terms of cycle life, loads and stress?
If you talk about off-highway applications, we hold a quite significant market share in engines for hydraulic excavators. The second segment which we produce in large volumes for is front-end loaders.

Can you explain the recipe to upgrade the performances of Stage V engines, in particular 3.8 litres, the best in class of its displacement range?
We recognized that one of the key trends in diesel engine manufacturing was to increase power density, doing more with less. For Stage V we didn't just adopt the usual solutions of turbocharging and injection systems. We used different materials to enable higher combustion temperatures. We increased the combustion temperature to improve the power density, and managed the NOx emissions through our latest SCR technology.

Oliver **Lythgoe**, Product concept marketing at **Perkins**.
Here at Bauma we find out what Perkins means by hybrids.
There are about 8 different types of hybrid and here at this show we are demonstrating 3 of those kinds. We are developing our hybrid projects across the whole range, from 8 kw to 600 kw but the ones that we are showing here, all three engines, are 55 kw they are all based on the Syncro 2.8 and each one of them has 20 kw of boost. The first one is an electric hybrid and that uses a motor generator and the energy is stored in lithium-ion battery and that has some advantage: the energy in the battery doesn't degrade over one hour or two hours and it is very good when the duty cycle is not predictable. But there are some disadvantages as well: lithium-ion does not release energy very quickly, so you need a big battery and the size can be quite the issue. Lithium-ion is also expensive, and our customers usually don't like 'expensive and big'. The second kind we are showing is mechanical-hybrid and that is where the energy is stored in a flywheel, a high speed flywheel, so it is a completely different technology and this has the advantage in terms of very small space occupation, it is also very simple and very easy to install, it also releases its energy very suddenly but you can only store a small amount of energy and over some minutes the energy will start to decline. So, this solution can be very good for machines that are very cyclical. The third kind of hybrid is a hydraulic one. In many machines you already have hydraulic pumps, implements, motors, valves, electronics and so doing a hydraulic hybrid is not very difficult because the technicians can easily understand the technology behind it and there is also no high voltage involved. But again, you can't store very much energy and it is, therefore, good for machines that have a cyclical operation.

Alexei **Ustinov**, Cummins Vice President Off Highway Business: «*If you talk about electrical drives the systems are stable, but the storage of the electric is more challenging. I think it will take some time for the market to move forward on this due to the economics – cost and capability*»

AGRITECHNICA HANNOVER 2019

THE FARMER'S HOUSE

LIEBHERR: CAMERA AND COMMON RAIL

Liebherr Components is 'projected into phase two'. After structuring the engines portfolio and signing the agreement with Deutz for the 9, 12, 13.5 and 18 liters in line, it's time to promote the other components. Liebherr unveils the digital smart camera and the customisable DC5 display family. «*Thanks to a sophisticated HDR algorithm and the high range of contrast, the driver retains a clear view even in very dark or extremely bright lighting conditions*» says Alexander Bertsch, Head of the Sensor Technology Product Line. Talking about common rail, Liebherr has launched the pilot phase of the service network in Germany to gradually expand it worldwide. Moving to Far East, Shanghai Diesel Engine and Liebherr Components have entered an agreement for the development of new high-performance off-highway engines, included hydraulic common rail injection components. This involves the 6-cylinder in-line engines of the 6KTAA25-G3 series.

Marie **Servais**, Project Manager at Agritechnica: «*Under 2019's guiding theme, 'Global Farming - Local Responsibility', we are discussing solutions for the sustainable future of agriculture in numerous forums, special features and conferences*»

The curtain rises on the 2019 edition of Agritechnica, after the 2,802 exhibitors and the 458,000 tickets of 2017, and an absence is immediately noticed, that of Deutz. After having monopolized Bauma with a Hollywood-style stand, maybe the time has come to catch up, waiting for the serialization of hybrids and electrics designed with Torqeedo. The protagonist will still be another German-speaking manufacturer, MAN. At Bauma the D4276 came forward, overtaking the D3876, Diesel of the year 2016, in terms of power and displacement. After the preview, the time has come to inaugurate the season in the fields. The 6-cylinder in-line engine has been specially designed for heavy-duty off-road applications and is a candidate to equip heavy agricultural machines with challenging load profiles such as combines. The 26.2 liters closes the gap between the 15.3-liter D3876 and the 24.2-liter V12 D2862.

Yanmar will also be exhibiting for the first time the TN series for agricultural applications, which see the Japanese in their natural habitat. Two multi-cylinder have been unveiled at Intermat, both exceeding the physiological threshold of TNV family thus legitimizing Yanmar's ambitions to stand as full provider. In fact, the extreme limit has shifted to 155 kW. In a nutshell, the 4TN101 is a 3.8 liter ranging from 55 to 105 kW and delivering a peak torque of 550 Newtonmeter, the 4TN107 is a 4.6 liter delivering 155 kW and 805 Nm also thanks to the double stage. The attention of Osaka engineering has been mainly focused on power density and specific consumption.

Deutz and some big news are missing. But MAN will introduce the agricultural version of the D4276, its 16.2-liter, 515 kW and 3,280 Nm. Yanmar will show the TN series, featuring the 3.8 and 4.6 liters capable of delivering 155 kW

These are the announced news. Besides that, what can we expect from the upcoming edition of Agritechnica? Certainly hybrids will not go unnoticed, mainly Kohler and Perkins. At the Intermat Kohler doubled EIMA 2018 range. On the eve of Hannover, the K-HEM family includes the 1003 and the KDI2504Tcr. The ingredients of the recipe are known. They say from Reggio Emilia: «*exploit the electric power when a peak is required and use the base of the diesel engine during low-speed cycles*».

Perkins, for its part, launched a veritable hybrid paradigm at Bauma, as Oliver Lyghtoe explained: «*There are about 8 different types of hybrid and here at this show we are demonstrating 3 of those kinds. We are developing our hybrid projects across the whole range, from 8 kw to 600 kw but the ones that we are showing here, all three engines, are 55 kw they are all based on the Syncro 2.8 and each one of them has 20 kw of boost. The first one is an electric hybrid that stores energy in lithium-ion battery. The second kind we are showing is mechanical-hybrid and that is where the energy is stored in a high speed flywheel. The third kind of hybrid is a hydraulic one, which is the easiest to produce*».

FPT Industrial is back from the spin-off that will join it to Iveco. However, the off-road section remains the most rich and diversified. We do not know if the Cursor X will find space in Hannover. Probably we'll find F36, Nef and Cursor. Kubota comes with V5009, Diesel of the year 2019, John Deere is expected with its complete range, the 13.6 liters at the top, Hatz with its electronic mono, Cummins with the structural ones. And, again, Volvo Penta, Caterpillar brand Zeppelin, Liebherr, MTU, AGCO Power.

SDF FARMOTION STAGE V

AROUND THE FIELDS

Manlio Mattei, R&D Powertrain Group Manager «*We focus on diesel*»

The heirs of the 1000 series, the 3 and 4 Farmotion cylinders, have met Stage V requirements in a captive perspective (Same, Deutz-Fahr, Lamborghini trattori, Hürlimann tractors), without closing the doors to free market. In 2016, in the Tier 4 Final era, we met Manlio **Mattei**, R&D Powertrain Group Manager, who introduced us to the prospects of Farmotion.

Farmotion: what is going to change?

We'll keep today's cylinder displacement, with 3 and 4 cylinders. We are setting the Stage V through the feasibility analysis on some technologies, to reach the project target on which it is pre-sized. Power will essentially increase according to the evolution of the middle range.

What will the market expect in 2020?

We have no signs of drastic changes in terms of power supplies. We focus on diesel.

Will diesel have a long life?

Farmotion Project has its roots in 2011 and reaches full maturity with Stage V. Power ratings of the 3 and 4 cylinders by SDF reach up to 75 and 110 kW. We met Manlio Mattei, R&D Powertrain Group Manager of SDF

We believe so, even if the powertrain as a whole could change. In the immediate future, there will be no widespread use of pure electric batteries, except for niche applications, such as in greenhouses. It is possible to think of an electric motor powered by a heat engine which, in our opinion, will be diesel for quite some time.

Three years later we met Mattei to have an update on Stage V. Today's answers are in line with yesterday's picture.

Stage V. What has changed?

Since the initial IIIB project we have planned thermo-mechanical stresses and thermal technical characteristics that could lead the four-cylinder to the target of 120 kilowatts. In Stage V the power has indeed risen to 115 kW at 2000 rpm with a torque of 660 Nm at 1400 rpm and 650 Nm at 1000 rpm at a lower speed, 1.400 rpm, with a torque of 666 Nm.

The research started from the 3-cylinder Stage V, which in the meantime increased its power curve from 71 to 75 kilowatts, and increased the torque curve starting from 1,000 rpm. The Farmotions have maintained the layout of the 1000 series and revolutionized the components, with a long-term perspective. We have been far-sighted in sizing cylinders and other construction features of FARMotion engines, so that they would allow us to position them up to 120 kW/700 Nm of maximum power/torque. In fact these performances are now too low to adequately exploit the 4 cylinders of greater displacement (which are increasingly popular on tractors of the 150 kW class) and difficult to reach by 3.4 liters engines. We have considered these performance and sizing targets since the selection and initial sizing of the systems and key components of our engines, such as the 2,000 bar common rail. We also confirmed the fluid-dynamics and the combustion system that have not changed for Stage V. Some changes to the geometry of the piston and the connecting rod, consequent to the increased combustion pressure of the 115 kW version and to the melting (for example in the pin and in the connecting rod). We adopted the DPF anti-particulate filter (which is mandatory to meet the requirements of stage 5) opting for SCRf (SCR on filter, in which the DPF substrate is coated with the wash coating of the 'SCR) in order to reduce the overall dimensions of this system. Until Tier 4 Final, the (SCR) after-treatment system was only available in a 'long-cabin cab' shape, which will be joined by another layout in Stage V to adapt to different types of chassis tractor platforms. We kept the EGR, which is functional for compact machines. The high efficiency SCR requires to increase the volume of the catalysts and of the technical consumption urea tanks.

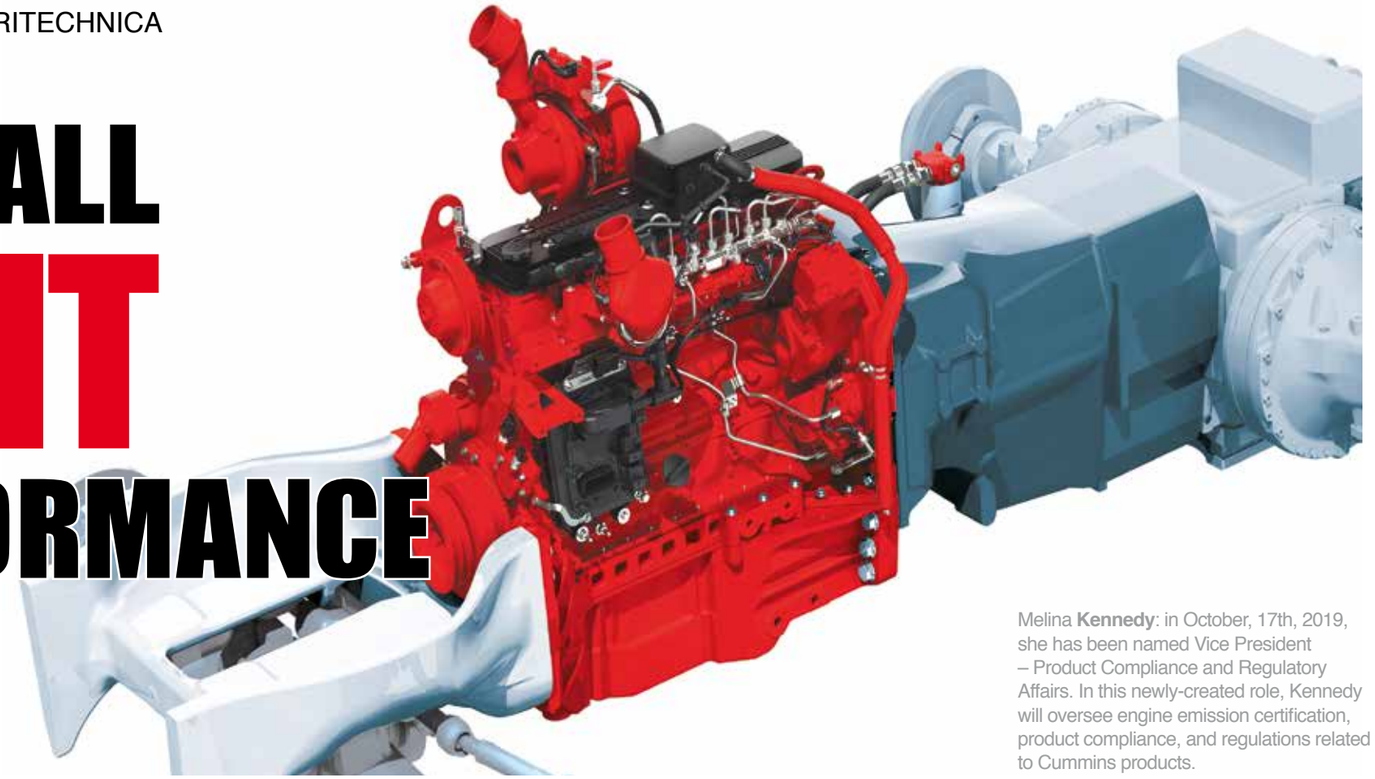
WHAT IS THE GENESIS OF THE FARMOTION PLATFORM?

Manlio Mattei: «*It dates back to 2011 and originates from the need for extreme application flexibility, ease of adaptation to worldwide regulations and modularity with regard to medium-low and specialized range machines. These characteristics of the FARMotion engines have allowed us to customize the application to 7 different tractor platforms, with a very high modularity between the 2 displacements (a widely used approach in the automotive field) and to offer the same tractors from Stage II to Stage V, based on the needs of the target markets. We believe these characteristics are unique in our market.*»

«*Nothing has changed in the engine head, with the 2 valves also featured in Stage V. We have only adapted the supercharging in the range over 100 kilowatts: the 115 kilowatt has a variable geometry turbine, the others have a fixed geometry.*»

CUMMINS@AGRITECHNICA

CALL IT PERFORMANCE



Melina **Kennedy**: in October, 17th, 2019, she has been named Vice President – Product Compliance and Regulatory Affairs. In this newly-created role, Kennedy will oversee engine emission certification, product compliance, and regulations related to Cummins products.

TALKING ABOUT AFTER-TREATMENT...

After-treatment systems over 129 kW. Under the big tractors bonnets there is enough space. What kind of solutions has Cummins to safe space for the driveline?

Increasingly stringent emissions legislation to improve air quality has led to more complex engine and aftertreatment systems. This has thrown up packaging challenges for OEMs to accommodate them into their machines and maintain line of sight for the operator.
Cummins in-house aftertreatment capability has brought about the development of the Single ModuleTM aftertreatment system. Smaller and lighter than its Stage IV predecessor, it is used on Cummins Performance Series engines (F3.8, B4.5, B6.7 and L9). The savings are up to 40 per cent in envelope size and up to 20 per cent in weight. There are a number of flexible configurations to enable our engineers to tailor it to specific installations such as an agricultural tractor. In addition, the higher NOx conversion efficiency enables the required level to be met without the use of EGR, further reducing the complexity of the engines. The system is also effective, removing 99.9 per cent of all PM by weight and count.

Agritechnica 2017, the first time of 6.7 liters with structural cup. Two years later, Cummins reaffirms its belief in penetrating the agricultural segment, having named its Stage V engines the Performance Series. And how to blame him... We asked Steven Nandick, Marketing Communication Director, to tell us more about the potential of Cummins in the fields.

An abstract of the Cummins B6.7 litre structural engine
The structural capability has been designed into the Performance Series B6.7, the latest version of Cummins' B-series engine developed to meet rigorous Stage V standards. With over 13 million B Series units sold around the world it is proven to deliver high performance in challenging duty cycles. In agriculture, they have a long-standing reputation for capability and durability.
For Stage V the B6.7 moves up to 326 hp (243 kW) with a peak torque of 1,375 Nm - a 30 per cent increase over that of Stage IV.
Cummins has the capability to tailor the engine performance for farm work, with the power bulge and torque back up available ideal for agricultural tractor operation. This is achieved through the integration of key in-house technologies such as combustion, turbocharging, fuel systems, exhaust aftertreatment, and electronic control. The B6.7 can use proven variable-geometry or wastegate turbochargers depending on the application needs.

Columbus goes to the fields. The structural sump is a reality and applies to the engines that fulfill the Stage V requirements, renamed the Performance Series. Cummins does things seriously, as Steven Nandick confirmed

What will be the next Cummins structural engine?
Cummins continues to develop its product range based on market and customer needs. This is for clean diesel as well as alternative power solutions. The B6.7 is the first step in our structural range and we expect to add others to the line-up as we move forward.

Stage V features for ag applications: i.e. could the F3.8's excellent power density be a trump card?
Across the industry, manufacturers are striving to build agricultural machines that are more productive. This means lighter and more powerful with a high level of reliability. They can deliver these specifications because next generation engine technology facilitates a 'more with less' approach, engines that deliver much greater power density than previous models, but with fewer components.

«The operational needs of the agricultural industry mean that high-performance and ultra-clean engines will continue to play a major role into the future. Investment in the latest technologies such as the Cummins Single Module TM aftertreatment keep our diesels relevant for some time yet»

Cummins' Stage V Performance Series engines, particularly our 4-cylinder F3.8 and B4.5 models, epitomize this trend. Power and torque are increased substantially when compared to their Stage IV predecessors. They are both leaders in their power categories. Their simpler architecture also means more reliability and improved fuel consumption. OEMs benefit as they have an opportunity to increase the machine capability of their existing machines or select a smaller engine with higher performance – saving weight and money. For farmers it means lower fuel and maintenance costs with no sacrifice in productivity.

Can Cummins also assert its role as a multitasking player in agriculture, involved in both endothermic and after-treatment systems and batteries?
This year marks 100 years of diesel engine development and production for Cummins, which began with engines first used in farming. The industry continues to explore and invest in a suite of power solutions for agriculture and Cummins is already at the forefront of this. We are developing battery packs for automotive and industrial applications following the acquisition of Brammo, Johnson Matthey Battery Systems (JMBS) and Efficient Drivetrains (EDI). Recently we also acquired Canadian hydrogen fuel cell business Hydrogenics. This investment allows us to develop our expertise and bring them to production in a dependable way as we have always done with our diesels.

AGCO POWER & FREE MARKET

A NEW CHAPTER

«Our customers have a direct connection with our engineeering. Every OEM has its own team in our engineering department»

SISU rises like a phoenix from the ashes of the free market and also targets small and medium sized OEMs to reaffirm its position as a provider of propulsion solutions, with a particular focus on construction machinery. AGCO Power in fact preserves the agricultural imprinting of the parent company, AGCO Corporation, and has all the right stuff to make its way through the myriad of earthmoving applications. We asked more from Alexander **Duray**, manager, global engine sales, and Jarmo **Tuorila**, Director, sales and marketing.

Starting from the beginning. AGCO Power and the free market.
We were been SISU Diesel and we were still AGCO SISU Power till 2012. Of course we moved to a different path, our goal in the last fifteen years has been to support AGCO Corporation on the vehicles brands, as the majority of our customers are in the AGCO Corporation. We had few years of silence, regarding the OEM's market when we were not active in searching new customers and applications .In any case our philosophy sounds as: 'We tailor the engines for the OEMs'. AGCO Power doesn't have a standard product, so it won't to be 'take it or leave it!'. We satisfy every kind of request with our engineering efforts, the bigger, like Komatsu and JCB, as well as the smaller ones. The installation of our engines is flexible, we have different options of after-treatment systems and we try to fix the complete package.

> *"We don't see electrification replace diesel in off-highway vehicles. It could be a good option for the light-duty vehicles: if you work for a short period, if you can recharge and recover energy. Obviously a vehicle like an open field tractor can't work with the cables"*

What about AGCO Power engines and the construction applications?
We think our sweet spot is the mobile machinery in the 100 to 250 kW range, focused on Stage V and China 4 emissions standards. Again, AGCO Power also takes care of orders of magnitude of a few hundred units per year. We offer to our OEM customers a very good service and they have a direct connection with our engineering. Every OEM has its own team in our engineering department. Whether it's ten thousand engines or one hundred, our approach doesn't change.

What's your Stage V recipe?
Already in 2008 we were the first agricultural company to utilize SCR technology for Tier 3 regulations. We believe it's really more efficient than EGR because you have to manage another fluid, it's true, but it doesn't have any negative effect on the thermal parameters of the engine and the fuel consumption decreases with AdBlue. Now, at Stage V, EGR is still on the top displacement engines, the 8.4 and 9.8 liters, otherwise there is not EGR. Our aftertreatment strategy includes DOC, DPF and SCR.

Hybridization and electrification?
AGCO Power believes it's very important listening the voice of governments and OEMs as well. We are monitoring the trends, however what we are pointing out is that diesel engine is remaining as primary source in the industrial sector. We're investing more than 100 millions euros for engine development and refurbishing our Linnavuori plant. We're renovating the operations, for a vertical integration and for updating the production facility. Biofuels are getting interesting from waste, diesel is still on the way, OEMs can't use a 10 ton battery for the electrification of the big machines. If anything, we believe in hybridization for the electric drive of some electronic accessories. Last year we setup a new organization for R&D and we start working even more closely with University of Tampere.

Remanufacturing?
Last year we remanufactured 1,500 engines. For OEMs it is the opportunity to give new life to their vehicles. It is AGCO Power's contribution to the TCO of companies. Depending on the conditions on the engine we sell to the customers completely remade engines with similar specifications, with warranty and reimburse for the old engine.

PROVENTIA HELPS 'DOWNSTREAM'

Diesel International: Your partnership with Proventia?

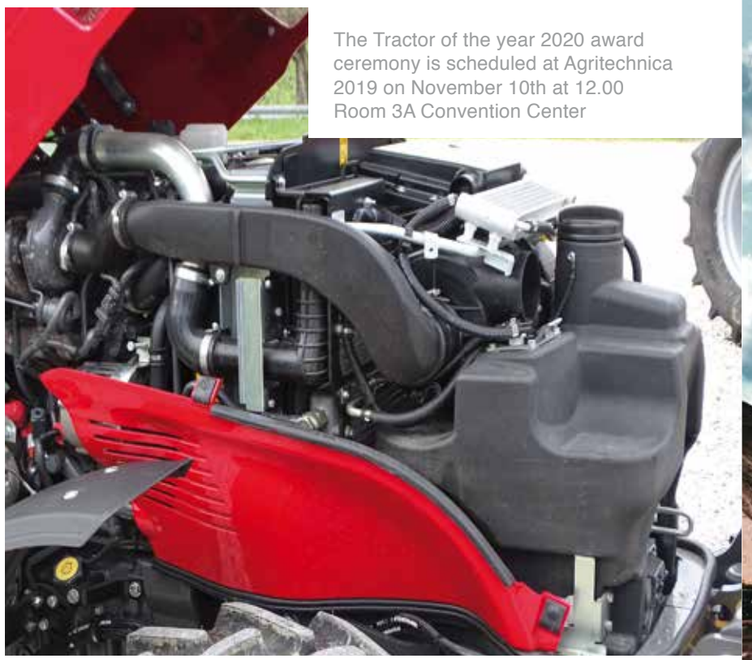
AGCO POWER: «*Proventia is supplying many of AGCO aftertreatment systems, our engineering departments have been working together for a long time. We see mutual benefits and we share a common mindset. AGCO operates in a glocal dimensions. In one hand we have four plants in the world: in Finland, in Linnavuori, in the town of Nokia, in China, in Brazil and in Argentina. In the other hand we work closely with our local partners. In Finland 90% of components come from the European region and it's the same in China, where the 75% of components come from China. The common denominator is the focus on quality: we are not aiming to save few euros and compromise the quality.*»

Diesel International: Regeneration?

AGCO POWER: «*We us DPFs with platinum coating and a very advanced thermal management system. Our target is no active regeneration during the cycle work of the machine but only during service intervals, otherwise we manage just with passive regeneration. The customers can't and should not need to stop in the middle of the working day.*»

TOTY FREE MARKET ENGINES

FIVE TO FOUR



The Tractor of the year 2020 award ceremony is scheduled at Agritechnica 2019 on November 10th at 12.00 Room 3A Convention Center

If Utility tractors include only captive finalists, Tractor of the year and Specialized of the year include five out of nine free market engines. The majority is in the hands of FPT Industrial with three candidates, the Cursor 9 for the Claas Axion 960 Terra Trac and the NEF N67 for the McCormick X7.624 VT-Drive. Man equips the Fendt 942 Vario with its D1556. Among the specialized still FPT, with the F34 for the Massey Ferguson 3709 Alpine. Deutz equips the Carraro Tractors V75 with the smallest of the Made in Cologne units, the TCD2.2, TCD2.9's three-cylinder sibling, Diesel of the year 2010 (the two under 2 liters engines Kukje-based, 1.2 and 1.7 liters, were announced at World of Concrete in Las Vegas). Deutz is the only pure engine maker, but FPT is confirming the trend that sees 'no captive' winning on the market. A trend that falls within the objectives of the business plan presented on Wall Street. MAN, for its part, can be considered neutral when it comes to construction and agricultural. The partnership between FPT and the ARGO Group is a known fact: Landini and McCormick have basically split the line of fire into two, around 100 kilowatts: under Deutz, above FPT. The Axion 960 by Claas engine, equipped with the 8.7-liter Cursor family, capable of a peak power of 320 kW and a torque of 1,850 Nm, was less publicized. The D1556 is part of the renewal program of the high range, which gave birth to the D3876 (Diesel of the year 2016) and the D42, the 16.2 liters that will know the agricultural baptism at Agritechnica and has already known the fields in the kinematics chain of AGCO Ideal.

Ps: there is a new entry among the finalists, the Sustainable Toty class. Fendt E-100 and Rigitrac KE5, and the New Holland Methan Power.

Among the finalists of the Tractor of the year OEM oriented engines prevail over captives. FPT Industrial marks a hattrick thanks to Cursor 9, NEF 6.7 and F34. MAN boasts its D1556, Deutz its TCD2.2. Debut for the Sustainable Toty class, featuring two electrics and a CNG engines

TOTY 2020 finalists:
CASE IH Magnum 380 CVX Drive,
Claas Axion 960 Terra Trac,
Fendt 420 Vario

5 LITERS OFF-ROAD

GERMAN SPEAKING NEWS

From Bauma 2016 to Conexpo 2017 5 liters engines sent their first inputs to the audience of OEMs. After the Munich edition recently ended we've seen the stabilization of this segment. Deutz is still a very dynamic player, boring the cylinder and shaping more aggressive curves on its 5 liters increased to 5.2. Kubota holds the Diesel of the year 2019. The other protagonists are Isuzu, JCB Power Systems, MTU and Volvo Penta.

Two years ago we wrote about Deutz's TCD5.0, now increased by 170 cc: bore also increased from 169 to 170 millimeters, stroke from 134 to 136 millimeters. In short, a cylinder more similar to that of MTU than to that of AGCO Power, although these are almost 'aesthetic' considerations due to the limited range of the comparison. The stabilization of the displacement of the 'red' from Cologne brings further news, whose relevance exceeds that of the simple adjustment of the cylinder. The technical data sheet, next to the power range estimated from 110 to 170 kW, explicitly shows the absence of recirculation. We quote a two years old interview with Michael Wellenzohn: «*We have tested systems with and without EGR on our test benches. We have identified the optimal solution for each engine based on various factors, such as overall fuel and urea consumption, installation constraints, urea tank dimensions, engine dynamics and robustness. We see obvious advantages in using EGR on engines intended for small and medium-sized machines. For larger machines, the balance moves towards engines without EGR*».

Looking at the figures included in the DIESEL table, although the official data regarding weight and dimensions are not available at the moment, we are however able to evaluate specific curves. The result of the 'soft' increase in the cylinder is flattering: specific power rises from 29.9 to 32.8 kW, specific torque from 178.3 to 183.9 Nm. Maximum torque has indeed increased from 898 to 950 Nm between 1,300 and 1,500 rpm. Another interesting topic for OEMs is the maintenance interval, set at 1,000 hours.

Kubota sealed the Las Vegas run at Bauma Monaco. The Japanese 5-liter is a successful compromise between the reliability parameters that make up the Kubota family feeling and the need to raise the performance bar to make it attractive to mobile machinery manufacturers, until now used to other engine partners. The MEP shows a less conservative attitude

Tony **Tonegawa**, Vice President Business Unit Engine Europe: «*Kubota has decided to enter into the 'real' farming market which corresponds to a power range above 200 HP (147kW)*»

The gestation of Deutz 5-liter has finally given birth to the TCD5.2, officially introduced at Bauma last spring. Compared to the 5-liter introduced in Munich during the 2016 edition there's a gap of 20 kW and 52 Nm. Engineering stripped the EGR from this displacement. Kubota sports the V5009, Diesel of the year in charge. AGCO Power, Isuzu, JCB, MTU and Volvo Penta are also in the competition

BRAND MODEL	AGCO POWER 49 LFTN-D5	DEUTZ TCD5.2	ISUZU 4HK1-T	JCB ECOMAX 4.8L	KUBOTA V5009	MTU R4 1000	VOLVO PENTA TAD572VE
I. D.							
B x S mm - S/B	108 x 134 - 1,24	110 x 136 - 1,24	115 x 125 - 1,09	106 x 135 - 1,27	110 x 132 - 1,20	110 x 135 - 1,23	110 x 135 - 1,23
N. cil. - dm³	4 - 4,91	4 - 5,17	4 - 5,19	4 - 4,76	4 - 5,01	4 - 5,13	4 - 5,13
Maximum power kW - rpm	148 - 2.200	**170** - 2.300	147 - 2.100	129 - 2.050	157 - 2.200	**170** - 2.200	160 - 2.200
Mep at max power bar	16,8	17,5	16,5	16,2	17,4	18,4	17,3
Piston speed m/s	9,8	10,4	**8,8**	9,2	9,7	9,9	9,9
Maximum torque Nm - rpm	800 - 1.500	**951** - 1.300	686 - 1.500	755 - 1.500	882 - 1.500	**951** - 1.400	902 - 1.200
Mep at max torque bar	20,9	23,6	**16,9**	20,3	22,5	23,8	22,5
% power at max torque (kW)	44,1	46	36,6	48,7	46	46	**46,3**
Torque at max power Nm	637	706	666	598	686	**735**	696
% power at max torque (kW)	85,0 (126)	**93,50** (130)	73,40 (108)	92 (119)	88,30 (139)	82,10 (140)	70,90 (113)
Work range rpm	700	1.000	600	550	700	800	**1.000**
DETAILS							
Specific power kW/dm³	30,1	32,8	28,3	27	31,3	**33,1**	31,2
Specific torque Nm/dm³	162,9	183,9	132,1	158,4	175,7	**185,3**	175,7
Areal spec. power kW/dm²	40,44	**44,74**	35,42	36,54	41,32	**44,74**	42,11
RULES AND BALANCE							
Dry weight kg	490	n.a.	470	590	620	540	560
L x W x H mm	902x656x887	n.a.	1.019x776x1.034	841x697x911	898x656x972	818x755x1.033	772x859x995
Volume m³	**0,52**	n.a.	0,82	0,53	0,57	0,64	0,66
Weight/power kg/kW	3,3	n.a.	**3,2**	4,6	3,9	**3,2**	3,5
Weight/displacement kg/dm³	99,8	n.a.	**90,5**	123,8	123,6	105,2	109,1
Power density kW/m³	**284,6**	n.a.	179,3	243,4	275,4	265,6	242,4
Total density t/m³	0,94	n.a.	0,57	1,11	1,09	0,84	0,85
Displacement/volume dm³/m³	**9,44**	n.a.	6,33	8,99	8,80	8,02	7,78

MAN&MTU: For a few centimeters less ...

A large group of engineers relies on the 1.1-liter cylinder on 4-cylinder in-line engines to equip the machines in the compact range close to 4-liter and 6-liter, from Cummins to John Deere, FPT Industrial and Perkins. We also find MAN, out of the comparison for a handful of cubic centimeters. Just like the R41000 for MTU, the D0834 is the entry model, 4.6 liters (BxS 108 x 125 mm). In Tier 4 Final the performances are absolutely good, delivering a peak of 162 kW at 2,400 rpm and 830 Nm between 1,400 and 1,800 rpm. Weight figures are also good, 490 kg. For a visual comparison with the 5 liters the dimensions are the following: LxWxH are 937x882x926 mm.

able to optimize performance without impacting on materials and pistons, valves and valve guides wear.
JCB currently does not push on the accelerator and stops at 129 kW and 750 Nm, a lot more torque and a few HP less than Isuzu. For Tier 4 Final Isuzu chose waste gate, very used in this range, EGR, DOC and SCR.
AGCO Power is represented here by its 49 LFTM-D5, one of the spearheads of the former SISU portfolio. The 4.9 liter is able to win both power/displacement ratio and that between the same displacement and the volume of the engine.
MTU and Volvo Penta are characterized by the brilliance of their curves. At the same speed the German delivers 170 and 160 kW and 951 Nm at 2,200 rpm, while the Swedish shows 902 Nm at 1,200 rpm. The MTU 4-cylinder is the entry level of the industrial range, Volvo confirms the overhead camshaft and the VGT, which leaves behind the strictly industrial approach of those who feature the waste gate. ■

BRAND MODEL	AGCO POWER 49 LFTN-D5	DEUTZ TCD5.2	ISUZU 4HK1-T	JCB ECOMAX 4.8L	KUBOTA V5009	MTU R4 1000	VOLVO PENTA TAD572VE
INDEX							
Torque	9,8	n.a.	8,4	8,2	9,9	11	**12,8**
Performance	6,2	6,8	5,4	6	6,5	6,8	6,5
Stress	10,2	11,3	**8,6**	9,8	10,7	11,2	10,8
Lightness	12,5	n.a.	11,3	14,7	15,4	12,7	13,5
Density	19,2	n.a.	10,3	18	18,9	17,8	16,3
DIESEL INDEX	7,3	n.a.	6,9	6,7	7,2	7,6	7,1

1 MTU

2 KUBOTA

3 AGCO POWER

16 LITERS AND AROUND

THE ECHO OF THE ROAR

Nuremberg confirms its two lions in the savannah of 16 liter industrial engines, together with other eleven competitors. The D28 is replaced by the D4276 recently introduced at Bauma 2019. Cummins brings in the X15. Three DOTY: FPT, MAN and MTU

Man replaced the D28 with the D42, 515 kW at 1,800 rpm and 3,280 Nm at 1,100. Same displacement, a gap around 50 kW, but maximum torque is 80 Nm higher, digging a gap of 400 rpm between 1,100 and 1,500. Pickup, power density and acceleration are suitable for large new-generation construction machines. It was in fact at BAUMA 2016 that Cummins unveiled the identikit of its Stage V range. The X15 has thus lost the Q and the S of its original initials while keeping the EGR unlike the smaller ones, from 12 liters to 2.8. This grid shows a peculiarity: three Diesel of the year, the Cursor 16 by FPT Industrial, the MAN D3876 and the MTU 6R 1500. The algorithm used for our comparisons based on specific figures and the curve profile awards a quartet ex aequo: the Cursor 16 and the D38 are two of the four, the other ones are Volvo and Liebherr, which features the same cylinder as the D28. The MEP of the three Diesel of the year stands between 21.7 and 23.1 bar despite the different genesis of each of these engines. In the top quartet Volvo is the oldest and the one that least embodies the concept of 'flagship'. The 16 liters wins the onroad record performance, being together with Scania the only truck able to cross the 700 HP threshold. The TWD1683 proves itself as a balanced engine, which nonetheless benefited from common rail in terms of performance. The in house comparison in Gothenburg is interesting, being the TAD 1672 in line with the lighter fraction of the competitors while curbing its volumetric exuberance. Both power and torque curve show a gap of about 14 percent compared to its common rail brother. The 1672 relies on pump injectors, albeit electronically controlled, and provides for a fraction of exhaust gas recirculation (light-EGR), the Twd1683 features common rail and technical urea. The 16 liters from Cologne is the ensign of V-units, stripped of its leadership by the 18 liter in line developed together with Liebherr. The

MAN, FPT and Volvo lead the DIESEL Index. FPT Industrial Cursor 16, Diesel of the year 2014 chose the **double re-entrant piston bowl**: *The piston crown architecture is made of 2 distinct bowls, a smaller one at the bottom and a larger one at the top, with a lip structure to prevent the fuel from being pushed above the piston.*

BRAND MODEL	CATERPILLAR C15 ACERT	CUMMINS X 15	DEUTZ TCD16	FPT INDUSTRIAL CURSOR 16	LIEBHERR D9508 A7	MAN D3876	MAN D4276	MTU R61500	PERKINS 2506J-E15	SCANIA DC16 85	VOLVO PENTA TWD 1683 VE
I. D.											
B x S mm - S/B	137 x 171 - 1,25	137 x 169 - 1,23	132 x 145 - 1,10	141 x 170 - 1,21	128 x 157 - 1,23	138 x 170 - 1,23	142 x 170 - 1,20	139 x 171 - 1,23	137 x 171 - 1,25	130 x 154 - 1,18	144 x 165 - 1,15
N. cil. - dm³	6 - 15,12	6 - 14,94	8 - 15,87	6 - 15,92	8 - 16,16	6 - 15,25	6 - 16,15	6 - 15,56	6 - 15,12	8 - 16,35	6 - 16,12
Maximum power kW - rpm	433 - 2.100	503 - 2.100	520 - 2.100	570 - 1.900	570 - 1.900	485 - 1.800	515 - 1.800	480 - 1.700	433 - 2.100	566 - 1.800	**585** - 1.900
Mep at max power bar	**16,7**	19,6	19,1	23,1	22,7	21,6	21,7	22,2	**16,7**	23,5	23,4
Piston speed m/s	12	11,8	10,2	10,8	9,9	10,2	10,2	9,7	12	**9,2**	10,5
Maximum torque Nm - rpm	2.656 - 1.400	2783 - 1.400	2891 - 1.400	3322 - 1.500	3126 - 1.000	3000 - 1.100	3280 - 1.100	3097 - 1.300	2655 - 1.400	3100 - 1.450	**3.650** - 1.200
Mep at max torque bar	**22,5**	23,9	23,4	26,8	24,8	25,2	26	25,5	**22,5**	24,3	29
% power at max torque (kW)	51,3	45,3	45,6	48,3	44,9	51,8	53,7	**54,5**	51,3	44,7	52,4
Torque at max power Nm	1.970	2.283	2.362	2.862	2.862	2.577	2.734	2.695	1.970	**2.999**	2.940
% power at max torque (kW)	90 (390)	81,20 (408)	81,60 (424)	91,60 (**522**)	57,50 (328)	71,30 (346)	73,40 (378)	87,90 (422)	90 (389)	83,20 (471)	78,50 (459)
Work range rpm	700	700	700	400	**900**	700	700	400	700	350	700
DETAILS											
Specific power kW/dm³	28,6	33,6	32,7	35,7	35,2	31,8	31,8	30,8	28,6	34,6	**36,3**
Specific torque Nm/dm³	175,6	186,1	182,1	208,5	193,4	196,6	203	198,9	175,5	189,5	**226,3**
Areal spec. power kW/dm²	48,98	56,90	47,49	**60,83**	55,39	54,07	54,21	52,75	48,98	53,30	59,88
RULES AND BALANCE											
Dry weight kg	1.542	1.365	1.260	1.320	1.600	1.337	1.280	1.235	1.542	1.340	1.762
L x W x H mm	1.438x943x1.239	1.443x1.032x1.298	1.150x945x1.170	1.378x951x1.326	1.692x1.112x1.350	1.484x978x1.137	1.464x978x1.131	1.315x1.180x1.215	1.438x955x1.248	1.410x1.149x1.289	1.490x894x1.351
Volume m³	1,68	1,93	**1,27**	1,74	2,54	1,65	1,62	1,89	1,71	2,09	1,80
Weight/power kg/kW	3,6	2,7	2,4	**2,3**	2,8	2,8	2,5	2,6	3,6	2,4	3
Weight/displacement kg/dm³	102	91,3	79,4	82,9	99	87,6	**79,2**	79,3	102	81,9	109,3
Power density kW/m³	257,7	260,6	**409,5**	327,6	224,4	293,9	317,9	254	253,2	270,8	325
Total density t/m³	0,92	0,71	0,99	0,76	0,63	0,81	0,79	0,65	0,90	0,64	0,98
Displacement/volume dm3/m³	9	7,75	**12,50**	9,15	6,36	9,25	9,97	8,24	8,84	7,82	8,96

DC16 and Miller cycle

About the V8, which celebrates its 50th anniversary, it's worth noting that the 382.2 kW (520 HP) Dc16 is based on the Miller cycle. Special camshaft profiles ensure that the intake valves remain open a little longer during the compression phase. The most significant variation of the truck range is the separation of the exhaust manifolds to the turbocharger, whose turbine side is now fed separately by the 2 cylinder banks through separate intakes (Rotated Twin Scroll FGT). The new generation of Scania V8 Euro 6 engines features a fully integrated exhaust silencer for after-treatment, which contains an oxidation catalyst, an AdBlue mixer, 2 short DPFs with asymmetric frames to reduce back pressure, 3 parallel SCR catalysts and 3 ASC catalysts. Despite all these components, the entire unit is only 900 mm wide. The turbocharger has a fixed geometry, mounted between the cylinder banks for greater resistance to vibrations.

interval between the displacement in this range ant the 18 liters brings Deutz together with Caterpillar and Perkins. While the 15 liters in yellow shows the most brilliant performance of the ACERT family, the 18 liters delivers 588 kW at 1,800 rpm. Specific curves are not the brightest of the comparison, but recalibrating the mep parameters could deliver a few more kilowatts. Actually, that's what the 9.3 liter from Peterborough brilliantly did. Another 'sub-cluster' of the comparison is the 8 cylinders trio. The aforementioned Deutz and Liebherr are joined by Scania, which is about to celebrate its half-century of life and unveiled its 'bio' soul in Dubai. The OC16, in the power generation nomenclature, is in fact powered by biogas. Stationary today, and tomorrow? The V8 is in the upper area of the ranking, isolating the values of specific curves. ■

BRAND MODEL	CAT C15	CUMMINS X 15	DEUTZ TCD16	FPT C 16	LIEBHERR D9508 A7	MAN D3876	MAN D4276	MTU R61500	PERKINS 2506J	SCANIA DC16 85	VOLVO TWD 1683
INDEX											
Torque	10,3	10,4	10,2	7,9	**12,1**	10,4	10,5	7,6	10,3	6,9	10,9
Performance	6,8	7,2	6,8	7,8	7,3	7,3	7,5	7,3	6,8	7,1	8,1
Stress	11,5	11,9	**11,2**	12,5	11,6	11,8	12,1	11,7	11,5	11,2	13,2
Lightness	14,6	13,5	10,7	12,1	13,2	12,6	11,1	11,2	14,6	11,3	15,4
Density	7,4	7	**9,7**	8,7	5,2	8,4	8,9	7,4	7,2	6,2	9
DIESEL	7,2	7,6	7,6	7,8	7,7	7,7	7,9	7,3	7,2	7,3	7,8

1 MAN

2 FPT

3 VOLVO

FPT INDUSTRIAL AND ECOMOTIVE

LET'S GO BIOGAS

"Bravo switches its Rotomix5 ECO to gas feeding. The conversion of the 6.7 liter FPT NEF by Ecomotive Solutions keeps its performance while reducing emissions and noise, exploiting at the same time the advantages of biomethane self-production"

Biogas is taken seriously both by the engine industry and by specialists in the conversion of traditional fuel engines. Among its applications, those in the agricultural area allow to exploit the self-production of this innovative fuel, allowing the vehicles to keep the same functionality as a diesel engine, with the economic and ecological advantages of natural gas. And this is exactly the idea on which relies the Rotomix5 ECO mixing truck, a machine developed by Bravo in collaboration with Ecomotive Solutions, a company of the Holdim group specialized in propulsion systems based on alternative fuels and renewable energies. Starting from one of the most successful models of the brand, the Rotomix 6000, this new synergy has built a self-propelled mixing truck equipped with the six-cylinder, 6.7 liter Fpt Nef N67Mnt converted to biomethane, which keeps the advantages of the particular blade milling system combined with the rotating barrel with counter-mixing auger developed by Bravo.

FPT Industrial N67

The acronym NEF has kept over time its ability to improve. Together with the Cursor platform, the transition to Tier 4 Final stripped of exhaust gas recirculation, keeping this direction in the Stage V phase. Applications are transversal, from captive use on Case and New Holland agricultural machines, to atomizers, feeders and heavy-duty versions of tractor by manufacturers such as Argo Group or telescopic handlers like Dieci. The 6.7 liter is at ease also on construction sites, under the hoods of generators, and under the deck in the transmission lines of yachts and light commercial ships. In the gas converted version installed on the Rotomix 5 Eco of Bravo, the 6 cylinder in line delivers 129 kW at 2,300 rpm and 700 Nm at 1,400 rpm. In this application the injection is mechanical.

Ecomotive Solutions takes care of gas

Ecomotive Solutions provides the compressed biomethane supply while keeping performances as close as possible to the original ones on constant work cycles and supplying the power requested and selected by the user through a four-position selector. The conversion required a series of mechanical changes, such as the reduction of the compression ratio (due to the switching from diesel compression ignition to spark ignition); the original pistons were suitably machined to obtain a new profile and compression ratio required for this specific application. Other mechanical changes involved the engine head to house the spark plugs and the spark plug cables, and the replacement of valves and exhaust valves seats using stellite. Another important change involved the engine lubrication with a special oil providing higher performances to ensure good lubrication even with gaseous fuels. Coming to the mechanical-electronic area, the original injection system was removed to install the spark plugs and an electronic throttle body in place of diesel injectors. Finally, the control unit has been replaced with a dedicated unit and wiring for engine management. The result was a huge emissions and noise reduction.

The machine provides the same performances as its diesel sister without the typical problems of a combustion engine in closed or semi-closed environments. The flagship of the Rotomix5 Eco is its exclusive cutting process based on a high-power mill combined with a supplementary knife cutter with adjustable knife, and the transfer of the silage in a rotating barrel with counter-rotating auger, providing a soft, omogeneous ration with a minimum use of energy also thanks to a very high cutting speed. The operating cycle allows several option for ingredients loading: loading of the flour through the hopper or directly on the ground with the silage cutter, loading of trace elements via an electric belt elevator, loading of liquid products through a special circuit with quick coupling, loading of long fibers (hays, banded, straw) with a variable-length net cut.

The hydraulically controlled system loader arm/silage cutter/mill developed by Bravo respects the structure and integrity of fodder silage, has particularly low consumption and easy management even in closed environments, thanks to the possibility of mounting a spraying system in the milling area and seal the mixing drum to minimize dust. The mixing is managed by a rotating barrel with counter-rotating auger. The mixture is pushed towards the bottom of the barrel by the system of spirals placed on the inner wall, while a central auger turning in the opposite direction brings the mixture to the exit; the two simultaneous movements ensure that the mixture moves without falling back on itself and constipate. The result is a perfectly mixed product that fully complies with the organoleptic characteristics of the individual components. The conversion of the diesel engine for biogas feeding provides important advantages. First of all, the use of biomethane radically reduces polluting exhaust fumes of the diesel cycle, with immediate benefits for the environment and the livestock when the machine is used in relatively closed environments. Even noise pollution is significantly reduced.

Danfoss provides hydraulic pumps, motors and the power steering units, while Comer Industries and Reggiana Riduttori provide differentials and reduction gears, Walvoil and Dana Brevini deal with hydraulic distributors

DISTRIBUTED POWER EUROPE

HERE WE GO!

MIDDLE EAST ELECTRICITY DUBAI 2020

Middle East Electricity will celebrate its 44th edition and will do so with a name change. The final 'E' will be officially the initial of the word Energy. Strategic both for its geographical position and for its attractiveness to buyers, MEE Dubai focuses on the theme of digitization. The emirate will therefore no longer only be the audience for the launch of the great engines for power generation (during the 2019 edition we witnessed the launch of Cummins' HSK78G, Baudouin's 16M55, the Perkins 1706A upgrade, the biogas V8 by Scania and the G-Drive by Doosan Infracore).
«*This is much more than a name change*» explained Claudia Konieczna, Exhibition Director, Middle East Energy. «*Driven by extensive outreach and stakeholder engagement, this strategic move builds on the legacy of Middle East Electricity and takes the event to a new level to better reflect the industry we serve, an industry that continues to evolve well beyond the traditional electricity segment.*»

IEA: «*Investment in new LNG liquefaction plants (which are by nature long-term) have skyrocketed in 2019, with a new record for the amount of new LNG capacity sanctioned in just one year. To date, almost 90 bcm of liquefaction capacity reached final investment decision (FID)*».

The world is hungry for energy. It is necessary to start from this premise in order to understand the reasons that led to the Italian Exhibition Group and to support the DPE with the consolidated green event Key Energy - Ecomondo. According to IEA (International Energy Agency): «In 2017, world gross electricity production was 2.5% higher than 2016. Year-on-year, global electricity production has grown continuously since 1974, except for between 2008 and 2009, when the global financial crisis caused an appreciable decline in production. In 2017, the share of production of non-OECD countries reached 57.0% of world electricity generation – more than double the share they held in 1974. Annual production growth between 2000 and 2010 averaged 1.1% in OECD countries, compared with 6.4% in non-OECD countries. In 2017, generation from combustible fuels accounted for 66.8% of total world gross electricity production. Combustible fuels include coal and coal products, oil and oil products, natural gas, biofuels including solid biomass and animal products, gas/liquids from biomass, industrial waste and municipal waste».

DPE, the power generation has found fertile ground on the Adriatic coast. The synergy with Key Energy and cogeneration will allow to set up a scenario where heat and electricity generation will find a complete kit, for any application

Focusing on Europe in 2018, the use of rental for power generation grew by 5 percent. We are talking about a sector that, more than others, is subject to Regulation 1628/2016, the one we conventionally identify as Stage V. The global market for traditional diesel generators, which still remain the predominant part but will be gradually affected by electrification and by less impacting fuels (gas, biomethane and biodiesel), recorded instead a value of 17.35 billion dollars in 2017, and an installed power of 64 GW (source: Global Data Energy).

DPE will take place at Rimini Fairs from 5 to 8 November and can boast a strategic asset, which could make the event strategic in the future: the synergy with Key-Energy, which actually lays the foundations of a common home for generation. An opportunity to redeem diesel from the anathema thrown by the mainstream media. There are many usable solutions for "harm reduction": the example of vegetable oil used on Scania engines for BioBrent cogeneration is one among many. We start, however, as always, one step at a time. Among the engine partners that have embraced the cause of DPE are Bu Power, which represents Perkins' leadership among stationary applications, Doosan (with Socoges distributor), which will bring the hybrid, FPT Industrial, which has propped up the range on the extremes, and Volvo Penta, evenly spread among PG OEMs in EMEA.
Contributions from the power generation supply chain will come, among others, from AB Trasmissioni, Bruno, CGM Gruppi Elettrogeni, Coelmo, Elcos, Gen Set, Green Power Systems GT Silenziatori Industriali, Linz Electric, Mecc Alte, Orefice SICES, VISA.
Speaking of Sices and hybrids, an example of a medium-sized hybrid on a mobile station will end up in the spotlight. Used as a load bank the batteries increase the efficiency of the Stage V engine, which suffers low loads, and are rechargeable from renewable sources, connecting to a PV system.
Among the company speeches, those by Meccalte on 'Tension control on the alternator and on new applications', and by SICES on the aforementioned project of 'Hybrid mobile station'; the Strategic Committee of BBV Inoflex Group, will talk about ´A new generation of high performance expansion compensators, designed for primary propulsion of new ships with liquefied natural gas turbine. Soga Energy Team will talk about ´Generators at low and high speeds for mini wind farm´.
On the other hand, coming to academic speeches, Prof. Jose Antonino Daviu of the Universidad Politécnica of Valencia, Prof. Vassilios G. Agelidis of the Technical University of Denmark, Prof. Paolo Mattavelli of the University of Padua (Department of Management and Engineering) and Prof. Giuseppe Cantore of the University of Modena and Reggio Emilia (Engineering Department 'Enzo Ferrari').

MTU TAKES STOCK OF PG

CHP AND MICROGRID

During this hot summer, some refreshing news came in from Friedrichshafen. The main topic is one of the most discussed right now, i.e. energy solutions, and the protagonist behind it is, of course, MTU. But let's proceed with order.

At the beginning of July, MTU Onsite Energy held its 3rd Power Generation Symposium back at home, where around 600 experts from the energy sector came together to discuss present and future strategies to handle the rushing river of growing energy demands, while keeping an eye on the increasingly needed environmental and climate-friendly arrangements.

Andreas Görtz, Vice President Power Generation of the Rolls-Royce Power Systems business unit, didn't hide his enthusiasm during the presentation of the edition of this year, both regarding the results achieved by the company up to this summer and for the quantity of experts that the symposium was able to attract, as a confirmation of the relevance of a topic such as power generation within the professional community. An enthusiasm that was surely justified by the presence of names such as John Murray, from the energy research and consultancy services company Delta-ee, that presented the current trends on the global energy markets; or like Quinous, a start-up company with which Rolls-Royce entered into a partnership last year, that should be already known to Diesel International website readers, that presented its innovative ideas for storage systems in microgrids. During the event there was also time to listen to some of the perspectives on the challenges facing the data centre industry given by Stijn Grove, the Director of the Dutch Data Center Association. Of course, within such an environment, the representatives of MTU brand for power generation could not be missing. In fact, MTU decided to showcase it's gensets and components for microgrids and data centers, to let participants observe how the German company is already focusing on answering the requests of the global market. In fact, as a reminder, MTU's portfolio currently includes diesel gensets with outputs of up to 4,000 kVA or 3,250 kWe, respectively for 50 and 60 Hz markets, natural and non-natural gas gensets delivering up to 2,500 kW of power and battery containers. A range of products developed to serve in contexts such as healthcare, data centers, airports, manufacturing plants, independent power stations, emergency standby, baseload and peak load applications, cogeneration plants and microgrids and more. Speaking of Power Generation, there are probably more suitable applications than not. MTU took another step further this summer, by making an agreement with the energy provider GETEC for the improvement of decentralized energy supply systems in Europe. The aim of the collaboration is, clearly, to supply and operate more and more efficient and environmentally friendly decentralized energy systems, such as CHP plants, on and off-grid microgrid solutions, in addition to further energy-related services. «*The energy world of tomorrow is decentralized, efficient and innovative. These are characteristics that both GETEC and Rolls-Royce embody to the same degree. With this cooperation agreement we intend to provide our joint customers with optimum economic and sustainable solutions and in this way reduce their carbon footprint*», said Thomas Wagner, CEO of the GETEC Group.

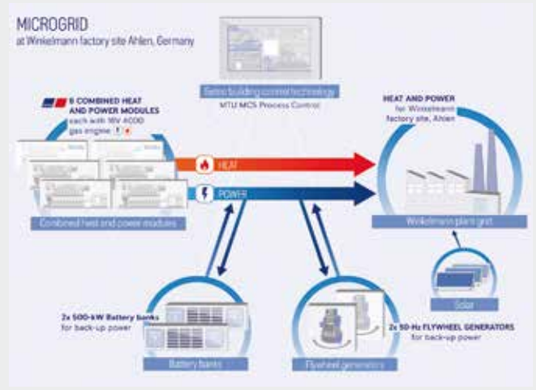
A partnership that already allowed the German automotive components supplier Winkelmann to disconnect itself completely from the public grid. This was done thanks to the helping hand of six tailor-made (as most of the systems in the power generation environment) CHP plants. In total, more than 9 MW of electrical power and just under 10 MW of thermal output are now available for the operation of the company's facilities.

MTU spent quite an eventful summer, focusing on its power generation division, a topic worth of a dedicated symposium held in Friedrichshafen. In the meanwhile, also GETEC made its appearance in the equation to help MTU's development

Andreas **Görtz,** Vice President Power Generation, Rolls-Royce Power Systems: *«The Power Generation Symposium has become a key industry meeting point in the course of the last few years. We are proud that we managed to attract eminent experts, who gave us an insight into the energy future»*

MTU AND GETEC

MTU, together with GETEC, decided to intervene in the automotive sector for a particular task. The client was the German automotive components supplier Winkelmann and the objective was to allow it to become independent from the public grid. The chosen solvers for this issue were six combined heat and power (CHP) modules, in combination with the right instrumentation and control technology like MTU Go! Act and MTU Go! Manage digital tools. The plant has been tailor-made, with each of the CHP plants equipped with a 16V 4000 gas engine that delivers up to 1,600 kW of thermal output and 1,500 kVA of electrical power, more than enough to allow Winkelmann to become energetically autarkic. In fact, the plants normally operate at 75 per cent capacity, to leave enough of a buffer zone. In addition, a solar plant is to be added in future as a renewable source of energy.



ENI. BIODIESEL & SO ON

KEY WORD? BIO

Enidiesel+ is fully compliant with the EN590 standard. Propeller engine tests carried out on engine test stands showed a reduction in consumption (-3.7%) as well as a significant reduction of soot, in line with previous testing runs

The percentage of HVO in fuel blends can be increased up to 30-35%. A fuel blended with 50% green diesel has already been successfully tested on the ships of the Italian Navy, but HVO could even be used pure – that is the whole 100%

In our interview, ENI's Chief Refining & Marketing Officer Giuseppe **Ricci** explores the diesel cycle in its many conceivable forms, the conversion of their Sicily-based Gela refinery, and much more.

What critical issues affect your biomass-based diesel in terms of viscosity, impurities, wearing of piston crown, combustion chamber, and more in general, of cylinder head? Any other possible contraindications?

The HVO produced at the Eni biorefineries of Venezia Porto Marghera and Gela has no contraindication. It is made of 100% paraffin and isoparaffin, does not contain oxygen, it' s nonpolar and fully hydrophobic. Differently than FAME, its processing technology produces an impurity-free, high cetane number fuel whose combustion is more controlled (with the flamefront behaving more evenly with no peaks in temperature, hence producing less soot) and more efficient (less CO2 emissions).

To reconcile ICE efficiency with pollutant reduction, ENI has set out an array of solutions encompassing the conversion of existing refineries to biodiesel, producing HVO in Italy at the Gela and Venice biorefineries, the Ecofining technology, and spent oils

Ecofining: is there more than just palm oil? What are the other suitable feedstocks for this processing technology?

With Ecofining™ , all types of vegetable oils and animal fats – including spent oils and fats – can be processed into top quality diesel. In addition, Eni's R&D department is working on two more technologies for producing second- and third-generation bio-oils from forestry and crop residues (lignocellulosic biomass) and achieving CO2 biofixation by microalgae. The bio-oils obtained from both technologies are suitable for use as feedstock in Ecofining™ .

What's the realistic production potential of algal cultivation in photobioreactors? Can this be used as a microscale solution for widespread application on our territory?

Microalgae have a high potential for CO2 sequestration and tranformation into biomass, from which we can extract a vegetable oil that can be suitably used as feedstock in the Ecofining process. The main advantage of algae cultivation lies in its yield per hectare, higher than that of conventional oil crops. If cultivated in open ponds, they can yield up to 30 tonnes per hectare of algal oil, which is by far higher than the most efficient oil crop - palm oil - that gives about 4 to 5 tonnes per hectar a year.

The Venezia case study: what are the plant key features and potential? Spent oils...but what's next?

The current capacity of the Eni biorefinery of Venice is equal to 250 Kt/y of feedstock (e.g. palm oil and other vegetable oils, all certified, including with regard to sustainability) which includes a 20% of spent vegetable and cooking oils, animal fats and advanced feedstocks. Its capacity could grow up to 540 Kt/y with the addition of a hydrogen production unit to maximize production levels. In this regard, we are currently exploring the possibility of building a waste-to-hydrogen plant for municipal solid waste gasification. One litre of oil alone can generate up to 4 kg of sewage sludge that have to be treated as waste; oil can percolate into the groundwater making the water undrinkable and it also pollutes surface waters, such as lakes, rivers and even the sea, severely damaging the ecosystem and harming plants and animals. Oil spilled into water will spread out to form a film that blocks out sunrays, thus severely affecting the environment.
Now just a few more facts and figures on the Eni Venice Biorefinery: in 2018, spent vegetable and cooking oils accounted for 20% of the total feedstock; karite oil accounted for 2.5%, while 1% was made of Matrilox, a green chemistry residue from biodegradable plastic manufacturing. **Fabio Butturi**

DEUTZ SERVICE PORTAL

JUST IN TIME

DEUTZ GENERAL MEETING

At the Annual General Meeting in Cologne of this year, the shareholders of Deutz voted in favour of the management's proposals for the trajectory to follow. Frank Hiller, Chairman of the Board of Management of Deutz, and the shareholders looked back at the development so far. Hiller said: «*As well as delivering a strong operating performance in 2018, we were able to lay crucial foundations. Our new strategy for China, the further expansion of our service business and the initiatives put in place to boost our profitability. All this will ensure we remain on a successful course going forward. In our product portfolio, we are continuing to embrace new technologies that will help us move closer to our overarching objective. We want to become the world's leading manufacturer of innovative drive systems and a pioneer in eliminating carbon emissions in the off-road segment*».

Franck **Hiller:** «*We use 'scrum' techniques at DEUTZ that enable us to rapidly design new electric and hybrid drives. The individual parts of the project are broken down into short cycles, known as sprints, that make the work more agile and efficient.*»

The Deutz Service Portal came online in mid April 2019. We've browsed the website with the help of Deutz Italy.

Why the name Service Portal?

This platform generates e-mail-based requests (the user ID can only be an e-mail address) with an associated customer-specified part list code that are forwarded to the back office and processed in our SAP system.What we are talking about here is not a B2C but a B2B system, since the platform is not meant to generate sales documents. Also, customers who manage multiple Deutz powered vehicles such as fleet owners or rental businesses are offered a strategic service in that they can register all of their engine serial numbers into their personal account.

Featuring a three-tier architecture with its Webshop, Connect App and Advanced Service levels, the portal is primarily intended to provide users with simple access to the Deutz universe and is set to be followed by Connect App2, a further step towards delivering predictive maintenance

What about the other two levels of digital service?

The Connect App simply works with a bluetooth dongle. You just need to plug it into the ECU connection socket to be able to dialogue with the engine, download data, while simultaneously getting access to the Deutz service world with your mobile phone.
As for the Advanced Service, it will be available as of late 2020. It's a software that contains all service-related information for a given engine. The software can recognize an engine if the engine itself, its serial number or any of its details are framed with a smartphone camera. By entering the serial number one can get access to spare parts documents, service and operating manuals, engine log, and recommended maintenance schedules for three levels of user competence : entry-level, user authorized to carry out basic maintenance, or master-level technician.
The Webshop, Connect App, and Advanced Service levels shall enable our service to go digital, thus making it available to users on a web platform based on the relevant set of skills, with clear, straightforward onscreen instructions.
Summary information for a given engine serial number will also be displayed on screen, with engine running hours, service performed, type of maintenance and materials used, as well as the amount of time needed – the so-called manpower hours. The entire engine history will be found in the same place.
We will start with those engines that were "born digital", so to speak, such as the TCD 2.2, TCD 2.9 e TCD 3.6 that were designed with CAD tools and whose data were transferred on digital media.
Each engine can feature up to 500,000 pages of service-related documents ranging across a variety of platforms and types, including technical information letters, maintenance manuals, wiring diagrams.
In addition, the registration of engine serial numbers can surely provide us with data on the engine population that is up and running on our territory. After all, we can only keep track of our engines until they get to the manucfacturer, and as long as their warranty is valid, after which all those bits of engine-related information remain in the shadows until we stumble upon them randomly, at a manufacturer, rental businesses, or end usæeœr's site.

What's the next step, then?

The next substantive adaptive step will be the evolution of our Connect App into the ConnectApp2, on the way towards predictive maintenance. It will feature a logarithm-based calculations of the number of start-ups, working hours, and engine load, that might even lead to an extension of warranty.
In all likelihood, we will be ready for this next step already in 2020.

Markus Bierhoff

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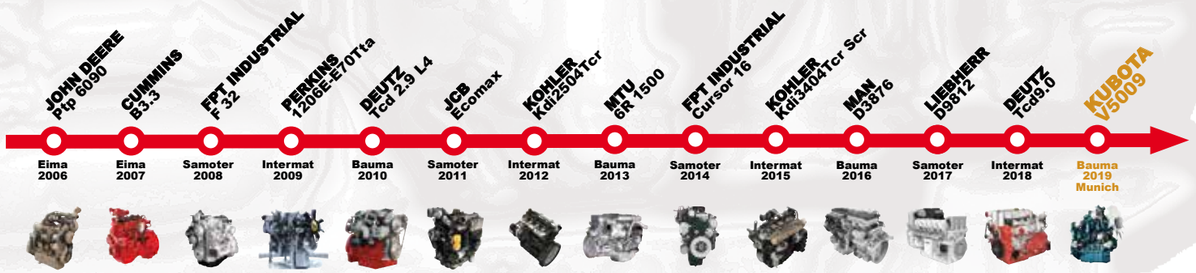

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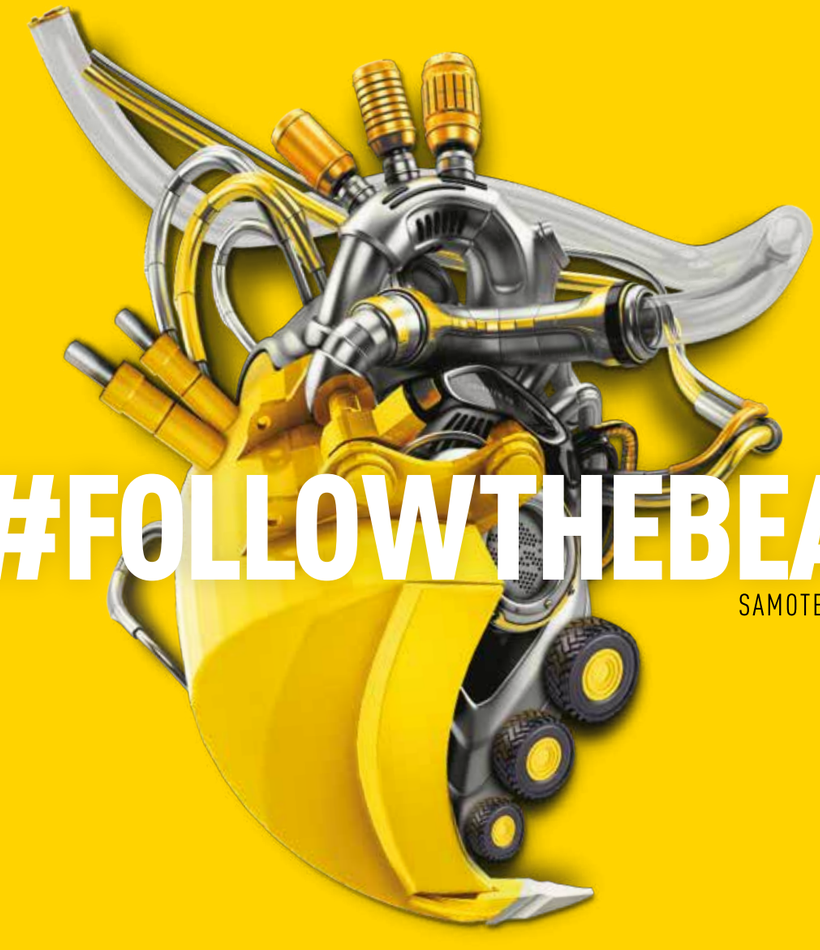

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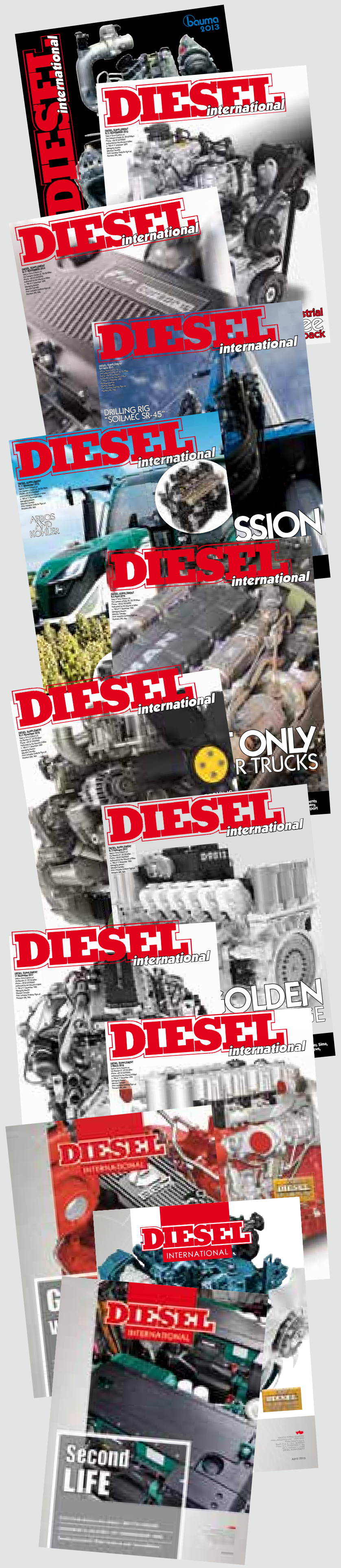

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