

DPI

DIESEL PROGRESS INTERNATIONAL

November-December 2021

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Also in this issue:

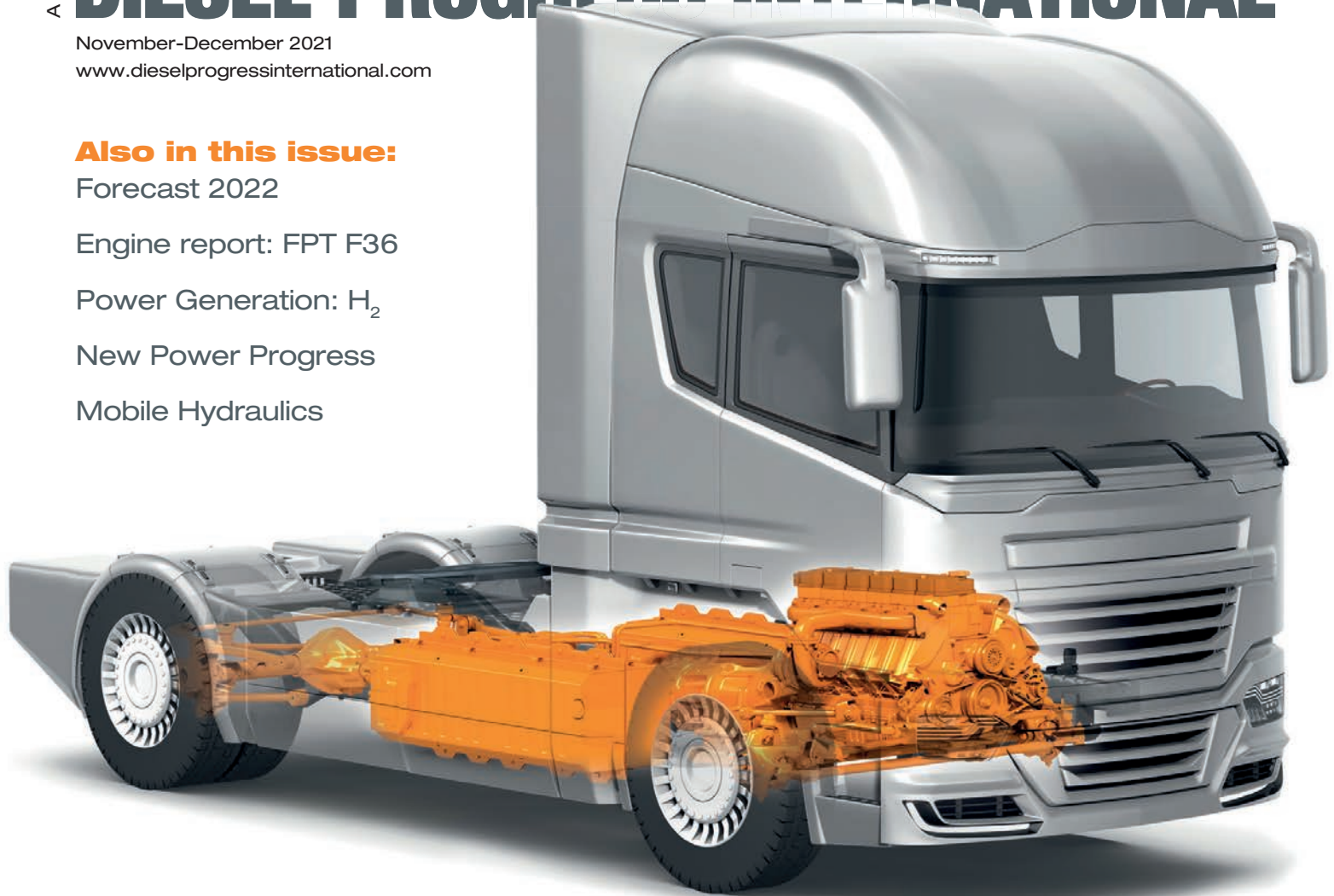
Forecast 2022

Engine report: FPT F36

Power Generation: H₂

New Power Progress

Mobile Hydraulics



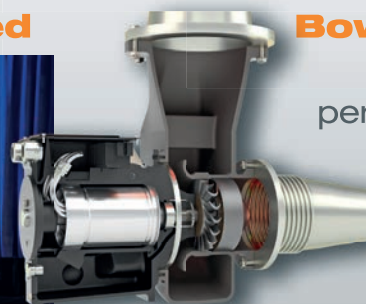
CV diesel hybrids

BorgWarner predicts divergence over convergence

Award winners revealed



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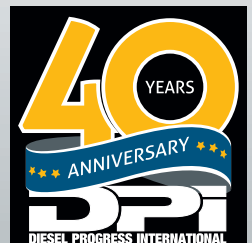


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COMMENT

Beginner's luck

Daunting. This was the word that immediately came to mind when I was offered the role of editor at Diesel Progress International and New Power Progress.

Not that I'm wholly unfamiliar with the territory. Over my career I've edited a series of B2B magazines and websites, most of which have been related to the automotive sector. Each of these has, to some degree, covered global engine development and production. But where the goal with passenger cars is to assemble a lot of the same engine, I have quickly learned that the target of engine providers for on-road commercial vehicles and off-road machinery is to deliver multiple variants of the same engine with the intent of delivering the best solution for a given application.

Under normal circumstances this would mean a new DPI editor would have to quickly familiarise themselves with each of the OEM companies manufacturing those engines and their deep product ranges.

But beginner's luck has struck and I've been given a bit of a break.

Such is the weight behind the push to reduce fuel consumption and emissions that the on- and off-road engine market is in upheaval. Case in point, I join DPI as EU Stage 5 engines are coming to market, largely using diesel particulate filters to reduce emissions and meet required standards.

At the same time, gas-powered engines are gaining market traction for their clean operation. That includes LNG, LPG, methane and hydrogen, or even gas/diesel hybrids. And let's not forget electric hybridisation. Even EVs are now starting to appear in various key sectors.

The need to deliver engines with green credentials in a market once dominated by diesel has seen the market fracture into a vast array of fuelling options. Each of these options must be examined in depth to understand the benefits and drawbacks, which is the right choice in terms of performance and operation.

Perhaps you're on top of these changes, taking them in your stride. You know your H₂ from your CH₄, you're ready for this market change.

Or maybe, like me, you still need more information to understand these changes, their effect on business and ultimately, the bottom line.

If you're in that first category, I wish you well. But if you're in that second group, I invite you to join DPI as we investigate the on-going changes. We'll talk to the right people and ask the right questions as we uncover the latest engine developments. Sum total? We'll get you the information you need to understand the brave new engine world.

Thanks for reading, please enjoy the issue.

Julian Buckley

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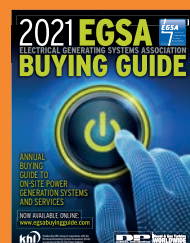
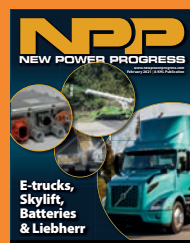


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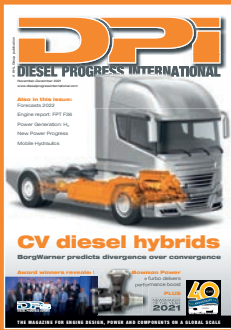
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OUTSIDE

A report on future hybridisation of CV diesel engines from BorgWarner

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NPP
NEW POWER
PROGRESS

15

Honda eGX system is an integrated electrification package

33

Hardware for CNG and LNG fuelling stations

41

Power punch: FPT F36 engine

CONTENTS

Sections

- 6 Industry News:**
A round up of the big news stories
- 12 Product News**
- 18 Newsmaker of the Year:**
Breakthrough year for hydrogen
- 24 Power Generation:**
Hydrogen moves into gen-set market
- 26 eTurbo Systems:**
Bowman Power gets the best from diesel engines
- 30 CV Diesel Hybridisation:**
BorgWarner on the future of diesel electrics
- 33 Mobile Hydraulics:**
New product launches
- 38 Mobile Hydraulics Specs-at-a-Glance**

- 41 Engine Report:**
A closer look at FPT's F36 engine
- 42 Forecast 2022:**
Our experts offer their 2022 market insights

Departments

- 3 Comment**
- 15 **NPP** New Power Progress:**
NEW POWER PROGRESS Honda eGX power system
- 20 Global Trends:**
Excavator market review
- 23 Global Roads:**
Drivers are the key
- 49 South America Notebook:**
Regional bounce after COVID
- 50 North America Notebook:**
Supply chain issues dent engine deliveries



In person: attendees networking at the third Diesel Progress Summit

6

DPS 2021
DIESEL PROGRESS SUMMIT

JCB wins Dewar Trophy for ABH2 hydrogen ICE

JCB has been awarded the Dewar Trophy for development of the company's ABH2 hydrogen internal combustion engine.

The Dewar Trophy, named after Sir Thomas Dewar (later Lord Dewar) has been awarded annually since 1957 to companies and groups which have delivered outstanding technical achievement in engineering over the preceding year.

Unveiled in May this year, the ABH2 engine is intended to help the transportation and off-road machinery industries achieve zero-emissions targets.

Based on a JCB Dieselmex 448 four-cylinder engine, key differences are the common-rail fuel delivery system, port injectors and spark plugs. The hydrogen ICE also features a new induction system and advanced turbocharging technology designed specifically for the engine.

The engine is designed to withstand the rigours of off-road applications, while also being suitable for other vehicle types.

Lord Anthony Bamford, JCB chairman, received the award at the ceremony held at the Royal Automobile Club in



Lord Bamford pictured with the Dewar Trophy (Inset) The JCB ABH2 engine on display at the RAC Club



London, UK.

In his acceptance speech, Lord Bamford highlighted

how the hydrogen ICE will bring the fuel into the mainstream, saying: "A 20-tonne excavator is about £130,000. The same machine with a fuel cell in it is £300,000. In other words, you can't sell it. Beyond that, it's highly sensitive to climate, to dirt, normal things we have to cope with daily with our

products.

"It has been fascinating to see the [ABH2] in development. We have an engine which will be in production by the end of next year. The only thing stopping us is producing it now is suppliers, we need them to support us. That includes questions about fuel transport, getting the fuel to the machine."

There were a series of technical issues which had to be overcome while the ABH2 was in development. Not

least of which was hydrogen embrittlement and how the fuel would react with metal components.

"We had to take into consideration the effect of the hydrogen fuel on the metals in the engine," said JCB Chief Innovation and Growth Officer Tim Burnhope. "We needed to understand the performance of key components in order to deliver the reliability required by our customers."

The byproduct of burning hydrogen as a fuel is primarily water. Even this had to be addressed, with regards steam build up within the engine affecting the engine oil.

He added that during development of the ABH2, the engineering team needed to keep in mind any existing – and even future – regulations. "There are specific regulations covering current engine performance which we have to follow, but this engine is so new that there are few regulations. We needed to anticipate future regulations and engineer to exceed them."

JCB has won two previous Dewar Trophies. In 2007, the company won the award for the Dieselmex 'Streamliner' car, which still holds the land speed record for a vehicle with a diesel engine (350.092 mph). The company won its second award in 2019 for the 19C-1E all-electric mini excavator.

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NEWSBITES

→ **Epiroc**, a Swedish company which provides advanced situational awareness solutions to optimise operations in mining and civil engineering, has acquired the remaining shares in Mobilaris. The company delivers solutions which use personnel and machine data to deliver realtime status

updates using an advanced 3D user interface.

→ **Generac Holdings**, manufacturer of technology solutions and power products, is to acquire ecobee, supplier of sustainable smart home solutions. Valued at \$770 million, the

deal is contingent on meeting performance targets.

→ **Volvo Autonomous Solutions** and **Holcim Switzerland** are jointly testing autonomous electric haulers for quarrying as part of the latter's 'Plants for

Walterscheid Powertrain Group (WPG) has completed the acquisition of IFA Kardan. Located in Irlxleben, Germany, IFA Kardan was founded in 1959 and produces a range of propshafts and related components for the agriculture,





Winners of the DP Awards 2021

Dana ePowertrain took the top honour with an entry which could 'revolutionise the industry'.

- **Engine of the Year (under 175 hp):** JCB 430 Dieselmax
- **Engine of the Year (over 175 hp):** Volvo Penta D16
- **Electric or Hybrid Application of the Year:** Skylift MD6000 E-Series Digger Derrick
- **Employer of the Year:** Anderson Industrial Engines
- **North American Engine Distributor of the Year:** Deutz Power Center South
- **International Engine Distributor of the Year:** Brinkmann & Niemeijer
- **New Power Technology:** Dana ePowertrain
- **Diesel Progress Achievement of the Year:** Dana ePowertrain

(Below) Award winners at the Diesel Progress Summit 2021



construction and special-vehicle markets.

Walterscheid stated that the company is one of the top 10 suppliers for off-road applications in Europe.

"This acquisition is another strategic step for us and will

Deutz set to take 10% stake in Blue World Technologies

Engine manufacturer Deutz has entered into a strategic alliance with Blue World Technologies. The Denmark-based company produces fuel cell stacks and related systems.

The collaboration involves agreements covering the distribution, sale and service of stationary fuel cell gen-sets. Further, Deutz will take a 10% stake in Blue World following a due diligence process. This is expected to be completed by Q4 2021.

In addition to generating

electricity via fuel cells, Blue World also processes liquid methanol into hydrogen fuel.

The company is reported to be developing stationary fuel cell-powered gen-sets and Deutz expects that same tech will also be used in mobile applications in the off-highway segment.

Dr. Frank Hiller, CEO of Deutz, said: "Gen-set users are now expecting zero-emission, climate-neutral technology.



Fuel cell from Blue World Technologies

Fuel cells that run on 'green' methanol provide an ideal solution."

Deutz recently unveiled the TCG 7.8 H2 hydrogen internal combustion engine. Part of the low- and zero-emission drive portfolio, the new engine meets the carbon criteria set by the EU for zero-emissions ICEs.

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Diesel Progress holds successful third summit

Diesel Progress magazine has held its third annual summit in Rosemont, Illinois.

This was the first live event for Diesel Progress after the 2020 summit had to be moved online due to the COVID-19

pandemic.

The event included presentations covering a variety of topics, including off-highway machinery used in agriculture, mining, forestry applications, plus on-highway commercial vehicles.

The event also included the Diesel Progress Summit Awards. This were capped with the Diesel Progress Achievement of the Year, showcasing the 'best of the best' from the individual category winners.

Judges for the awards were: Dave Hoffman, former director, Global Sales, Marketing and Customer

Support at John Deere Power Systems; Steve Neva, International Standards and Regulations manager at Doosan Bobcat North America; and Jim Saunders, business Development at MurCal.

The panel was chaired by Mike Brezonick, vice president of Editorial for the KHL Power Division.

The top prize was awarded to Dana ePowertrain. In making their decision, the judges noted how the submission was "vast and turnkey", and something that could revolutionise the industry.

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smart and connected powertrain solutions for off-highway and industrial equipment manufacturers. The company delivers new technologies and customer solutions to support the agriculture, construction, mining and utility vehicle markets.

expand our driveshaft portfolio even further, and more specifically increase our focus on the main and secondary drives for small- and medium-sized agricultural and construction vehicles," said Wolfgang Lemser, CEO of WPG. WPG is a global provider of

Tomorrow' initiative.

The vehicles are described as the world's first commercially-available CE-certified electric autonomous transport solution for the quarry and cement industries.

The EVs are said to be quieter and more sustainable than conventional haulers.

Cummins Columbus (Ohio)
Midrange Engine plant

Cummins Q3 sales rise 17%

Cummins has reported Q3 2021 revenues were \$6.0 billion (£4.4 billion, €5.2 billion), up 17% from the same quarter in 2020. Sales in North America rose 13% while international revenues increased 22%, driven by strong demand across all global markets outside of

China, compared to the same period last year. “Demand remained strong in the third quarter as the global economy continued to improve, driving strong sales growth across most businesses and regions outside of China, which is moderating in line with expectations,” said chairman and CEO Tom

Linebarger. “Economic trends such as order activity, freight rates, and used equipment prices remain robust across a number of our key end markets which points to strong demand extending into 2022 and beyond.

Based on the current forecast, Cummins is lowering its full year 2021 revenue guidance to be up approximately 20% versus last year, compared to prior guidance of up 20% to 24%.

Looking at the individual business units, sales in the Engine segment were \$2.6 billion (£1.91 billion, €2.25 billion), up 22% over the same period last year. Cummins said on-highway revenues increased 22%, driven by strong demand in the North American truck market. Off-highway revenues increased 21%, driven by strong demand in North American, Asian Pacific, and European construction

markets Sales increased 23% in North America and 19% in international markets, the company said.

Distribution sales were \$2.0 billion (£1.47 billion, €1.73 billion), up 14%. Revenues in North America increased 10%, while international sales were up 21%. Demand increased across the power generation and engine markets in addition to parts and service compared to last year.

Sales in the Components segment were \$1.8 billion (£1.32 billion, €1.55 billion), up 16%, while those in the New Power segment increased 28% to \$23 million (£16.84 billion, €19.87 billion).

Overall, costs associated with the development of fuel cells and electrolyzers, as well as products to support battery electric vehicles ahead of widespread adoption, contributed to an EBITDA loss of \$58 million (£42.48 million, €50.1 million). **dpi**

IPD offers new engine emissions components

IPD, a supplier of replacement parts for heavy-duty diesel engines, has announced a new partnership under its IPD Xtra brand.

IPD Xtra’s new partnership will be with California-based and family-owned Diesel Emissions Service (DES) featuring its Redline Emissions Products brand. Since 2016, Redline Emissions Products has offered DPFs, DOCs, gaskets, clamps, weld bungs, charge air coolers, sensors, brackets, guards, and custom mounting kits.

“IPD Xtra is comprised of carefully selected partnerships with other manufacturers that share our commitment to quality and are a strong fit with the IPD brand. These partnerships have been chosen to expand IPD’s product reach in markets that complement our customers’ needs,” said Michael Badar, president of IPD in Torrance, California.

These products give IPD a full range of aftermarket replacement parts, with diesel particulate filter (DPF), diesel oxidation catalyst (DOC) and associated components for the heavy-duty diesel market.

Z-drive thrusters, hybrid components and controls.

→ **John Deere** has made an equity investment in ClearFlame Engine Technologies, a US-based start-up developing clean engine technology.

The investment is intended to

position John Deere as an industry leader in the low- and zero-carbon powertrain market.

→ **China Yuchai International**, an OEM manufacturer and distributor of engines for on- and off-road applications through its subsidiary Guangxi Yuchai

Machinery Company, has entered into an agreement to develop hydrogen fuel cell powertrain systems for the national market.

Weng Ming Hoh, president of China Yuchai, said the move highlights commitment to sustainable solutions as demand for energy is increasing.

→ **Rolls-Royce** is to deliver eight of its mtu 16V 4000 M65L engines for four 80-tonne pull tugboats to be built by Detroit Brasil.

The new tugs will incorporate a hybrid propulsion system combining the mtu engines and the mtu Blue Vision Generation monitoring system with Schottel



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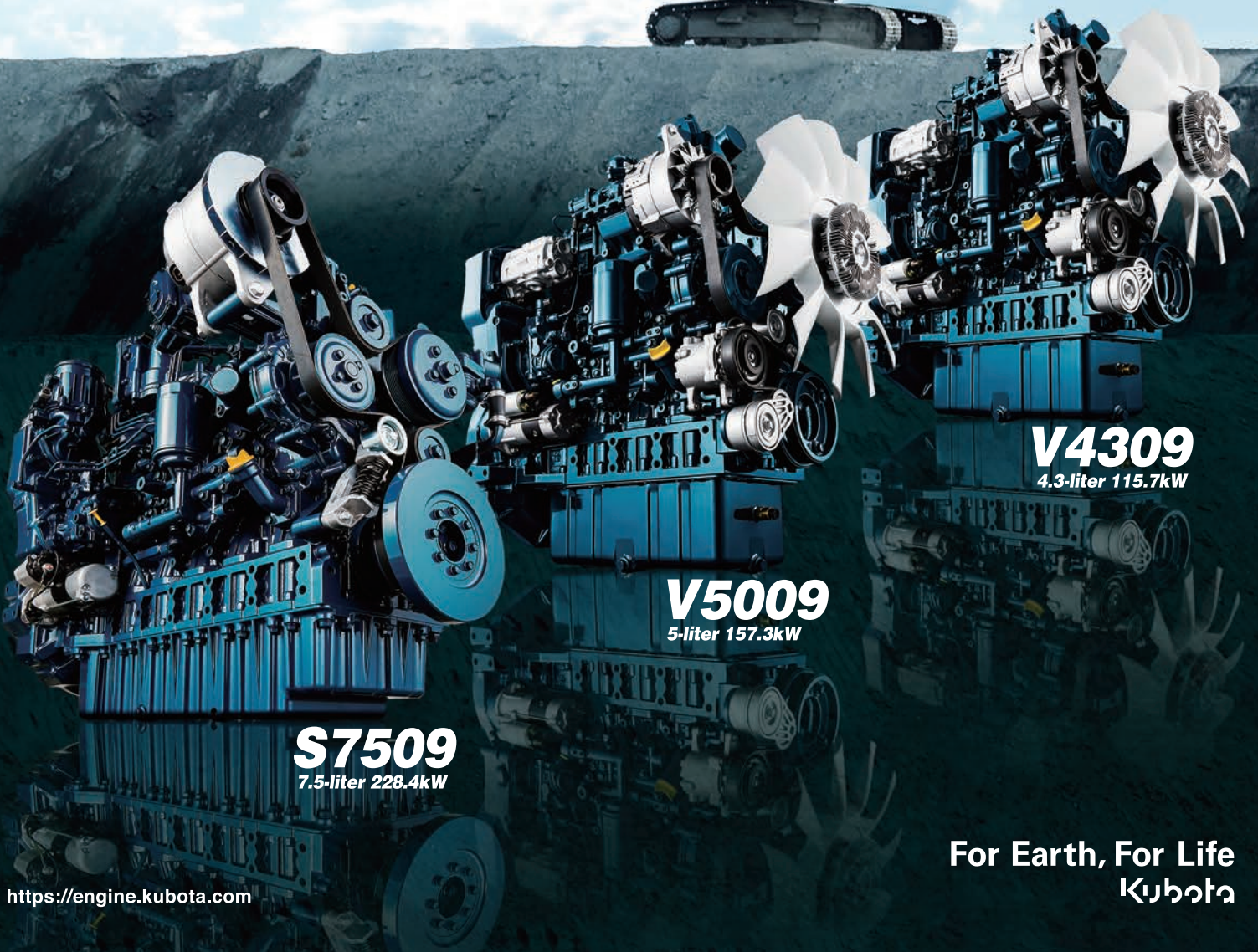


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Stan Park

→ **CNH INDUSTRIAL** has released details covering the new organisational structure at Iveco Group.

The new management structure is intended to support the commercial vehicle, powertrain and specialty vehicle manufacturer as it moves towards independent operation in early 2022.

The company will be led by CEO **Gerrit Marx**. Below the CEO, the company will be split into business units, including: Truck (Iveco); Bus (Iveco Bus and Heuliez); Powertrain (FPT Industrial); Defense Vehicles and ASTRA; Firefighting (Magirus) and Financial Services (Iveco Capital).

Other functions will include Finance, Operations, Technology & Digital and Human Resources & ICT. Further, Corporate functions will deliver support in areas such as Legal & Compliance, Institutional Relations & Sustainability, Communications and Internal Audit. Business unit leaders under the new restructuring are:

- Truck – **Luca Sra**, President
- Bus – **Domenico Nucera**, President
- Powertrain – **Sylvain Blaise**, President
- Defence Vehicles & ASTRA – **Claudio Catalano**, President
- Firefighting – **Thomas Hilse**, President
- Financial Services – **Simone Olivati**, President

HCEA names Park as company president

Hundai Construction Equipment Americas (HCEA) has announced the appointment of Stan Park as company president.

A 27-year veteran of Hyundai, Park previously held various field and executive-level leadership roles, most recently as the vice president of Marketing and Dealer Development.

“Stan is a pillar of HCEA in North America and is

well known throughout the organization, domestically and abroad,” said Mike Ross, vice president of Sales, HCEA.

“Park’s experience and leadership abilities will be essential in driving the success of Hyundai’s brand in North America going forward.”

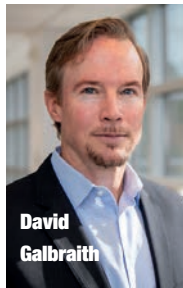
Park said: “For more than 20 years, I’ve been fortunate enough to grow with Hyundai. Today, I’m excited to have the opportunity to lead the company to the next level.”

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Galbraith named VP at Mack Trucks

Mack Trucks has revealed that David Galbraith will become the company’s new vice president of Global Brand and Marketing. In this role, Galbraith will be responsible for marketing strategy, brand management, marketing communications, product marketing and digital marketing.

“David brings a strong and diverse background to our marketing and brand team,” said James Chenier, Mack senior vice president of Strategy and Business



David Galbraith

Development “We welcome David to the Mack team and look forward to working with him to increase brand awareness and communicate the features and benefits of Mack products and services.”

Galbraith formerly worked as the director of experience and brand partnership marketing at Volkswagen of

America from 2019 to 2021. Before that he was director and general manager of Communications and Brand Strategy at VW. Galbraith has also had roles at Dell and IBM.

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Tech new CEO at XL Fleet

XL Fleet, a provider of vehicle electrification solutions for commercial and municipal fleets, has appointed Eric Tech as CEO. He will take over on 1 December.

Tech succeeds Dimitri Kazarinoff, who is stepping down from his position to pursue other career opportunities. As part of the appointment Tech will also join the company board.

Tech has nearly 35 years of automotive and mobility industry experience. He has held senior leadership positions at Navistar International and Ford Motor. He most recently served as senior vice president of Corporate Development at Navistar.

At Ford, Tech held various senior level positions including chief engineer for Superduty Trucks.

“We believe that Eric’s track record in delivering strong operating and financial results, including during challenging and dynamic business environments, makes him the ideal leader to help deliver the next generation of electrification solutions to customers,” said Debora Frodl, XL Fleet’s board chair.

She continued: “He is a forward-thinking and performance-driven executive who brings more than three decades of deep industry experience combined with proven leadership capabilities at world-class companies. On behalf of the board, we are excited to have Eric join the XL Fleet team.”

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→ **Kubota UK** has announced that **FJS Plant Repairs** will become the first Kubota full-line dealer in the Republic of Ireland.

Established in 1993, FJS is based at Timahoe, County Kildare. The company will be responsible for Kubota tractors and ground care equipment. As

part of its growth, FJS is planning to open a second depot at a one-acre site in Naas, including a new showroom and workshop.

“We’re absolutely delighted to have been appointed as a full-line dealer for Kubota,” said Frank Smyth, MD of FJS. “We believe that Kubota has tremendous

potential for market growth in this area, and this move provides us with a range of tractors up to 170 hp, ground care equipment and RTVs to sell to our growing customer base.”

→ **Scag Power Equipment**, a division of Metalcraft of Mayville,

manufacturer of lawn maintenance and debris/turf management equipment, has appointed Power Source Canada (PSC) as its new distributor for Canada.

PSC is a national distributor offering machinery, parts and service for major brands of outdoor power equipment across Canada.

Diesel electric hybrid tractor at EIMA 2021

The Antonio Carraro SRX Hybrid said to cut fuel consumption by more than 25%

Antonio Carraro (AC), which specialises in development of tractors for specialised agriculture, has unveiled what the company claims is the first compact tractor concept featuring a hybrid electric drive system. The tractor was shown for

the first time at the recent EIMA 2021 Agricultural and Gardening Machine show in Bologna, Italy.

The SRX Hybrid has a drivetrain developed by the AC R&D division, working in conjunction with Ecothea, a start-up company from the Turin

Hydreco introduces new heavy-duty EPVJ mini joystick

There are a variety of options when it comes to electrical controls for mobile applications. The best have a strong design and incorporate the latest technology, which is true of the EPVJ mini joystick.

Made in Italy, the new joystick uses a reliable REED magnetic switch (incorporating a neodymium magnet) and has four on-off functions as standard.

The mini EPVJ is suitable for placement in smaller spaces, or for armrest or console mounting. It offers a strong structure and great reliability.

This is a solution for heavy-duty applications in agriculture (small tractors for vineyards, orchards, and fruit/vegetable picking). It can also be used in forestry scenarios, such as firewood processors.

The electric and magnetic technology used in the mini EPVJ delivers a longer working life in all situations, including outdoor operations where the joystick could be subjected to a range of environmental issues, including rain and snow.



EPVJ mini joystick



Antonio Carraro SRX Hybrid at EIMA 2021

Polytechnic, specialising in the design and prototyping of electric vehicles for agricultural applications.

The drivetrain is fitted to the most complex tractor in the Antonio Carraro range, an isodiametric model with reverse drive and articulated frame. The model is intended for use in specialised agriculture where manoeuvrability is critical.

POWERTRAIN INFO

The tractor carries over the standard three-cylinder, 1.8 L diesel engine producing 55 kW, which features a common rail turbo intercooler fuel injection system. This is combined with a 20 kW electric motor for a combined output of 75 kW (102 bhp).

Interaction between the diesel engine and electric traction motor/generator drive is managed by an electronic power control unit developed

specifically for this type of machine. Antonio Carraro says that the architecture of the hybrid diesel-electric powertrain supports continuous traction when working in various situations, such as combined with a forklift or loader.

The electric motor is located between the engine and the gearbox. This design



Cab of the SRX Hybrid tractor, with LCD control panel for powertrain management

Global vehicle invertors from Parker Hannifin

Parker Hannifin has launched a new range of Global Vehicle Invertor (GVI) low- and high-voltage series drives.

Using a compact and rugged design, the invertors are intended to meet the requirements of on-road commercial and off-road electric/hybrid electric vehicles. The drives can also be used in non-traction applications, such as electro-hydraulic actuators/pumps for medium- and high-power cylinders found in ariel lifts, construction equipment and material handling sytems, plus refuse trucks, wheel loaders, excavators and mining machinery.

Low-voltage GVI motor controllers are available in 24 volt, 48 volt, 80 volt and 96 volt (nominal) variants, with 230 A to 700 A peak current. Meanwhile high-voltage 650 volt (nominal) variants offer 320 A to 500 A.

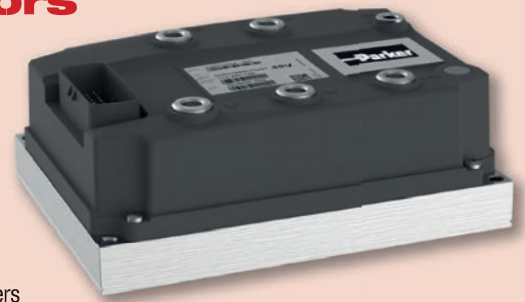
POWER AND TORQUE

GVI drives have been tuned to match the Parker Global Vehicle Motor (GVM) series of permanent magnet (PMAC) motors, delivering high power density and efficiency. Preconfigured and validated combinations of the GVI and GVM are also available, ensuring compatibility, enhancing ease-of-use and reducing development times.

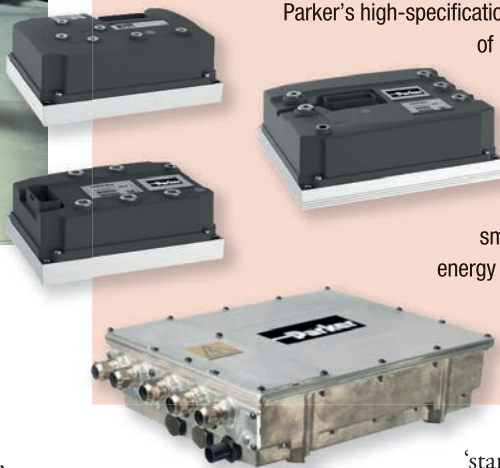
Parker's high-specification GVM motors can deliver continuous power up to 228 kW, peak torque of 1430 Nm and rotational speeds as high as 9800 rpm. Further features of the new drives include standard CANopen and J1939 protocols for reliable in-vehicle communication, while prototype cable assemblies can be supplied in fixed lengths.

As the motors weigh about 50% less than competing units, they can help to improve fuel efficiency. The unit footprint is also 50% smaller, allowing easier integration of the GVM motors. Up to 40% less energy consumption supports extended battery life, or smaller battery sizes, in both EV and HEV platforms.

Global Vehicle Invertors from Parker Hannifin



The invertors feature a compact and rugged design



is now covered with an ACHybrid patent.

FULL ELECTRIC

Benefits of the system include reduced emissions, fuel consumption and overall maintenance costs. The tractor is also quieter in operation. The tractor has the option of working in full electric mode, which makes it ideal

for working in enclosed places, including sheds, greenhouses and stables. Torque delivered from the hybrid powertrain is said to offer exceptional

'starting' performance, particularly when using additional equipment such as sprayers and cutters.

The lithium-ion battery pack also works in tandem with a regenerative braking system which delivers reclaimed charge to the battery pack with each braking event. The pack can also be recharged by diverting power from the diesel engine (user selected), or by using a plug-in cable.

Based on an average work cycle, the hybridised powertrain delivers a CO₂ output reduction translating to a 25% improvement in fuel economy.

Even with the hybrid powertrain and the related battery pack, the Antonio Carraro compact tractor has optimised weight distribution. This delivers maximum stability on rough terrain,

a feature which is further supported by the vehicle's agility.

CHARGE CAPABILITY

A full logic LCD control panel is located in the cab to allow the operator to monitor all related operating data, including electrical power consumption. There is also a dedicated screen to manage recharging. Other features include LED exterior work lights.

Alongside the SRX Hybrid tractor on display at EIMA 2021 was a charging station by On Group, an Italian start up company in which Antonio Carraro is a lead investor. The company builds and distributes charging stations based on Siemens technology for use with various electromobility solutions, including scooters, cars and tractors.

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Honda's new eGX system is designed to be a complete electrification package, incorporating a lithium-ion battery, electric motor, control and monitoring hardware and software and a proprietary battery charger

HONDA'S NEW eGX SYSTEM
COMBINES BATTERY AND MOTOR
FOR DROP-IN ENGINE REPLACEMENT.
BY MIKE BREZONICK

With trends pointing toward an expected growth of electric-powered machines over the coming years, many original equipment manufacturers (OEMs) of compact equipment are investigating paths to electrification. Yet often, those paths are anything but simple or direct, as they can involve batteries and battery controls systems from one supplier, electric motors from another supplier and in some cases, charging technology from yet a different supplier.

But Alpharetta, Georgia-based Honda



Power Equipment, a business unit of American Honda Motor and supplier of general-purpose gasoline engines and outdoor power equipment for commercial, rental industry and consumer applications, is looking to make the path to electrification a lot simpler with the development of its eGX power technology.

The eGX system is a complete electrification package, incorporating a lithium-ion battery, electric motor, control and monitoring hardware and software and a proprietary battery charger. The system is available as an integrated unit with the battery and motor packaged together (GXE 2.0 H) and a version in which the

Honda's eGX system is available as an integrated unit or a separated version in which the battery and motor are separated and connected through a wire harness

battery and motor are separated (GXE 2.0S) and connected through a wire harness.

EASIER FOR OEMS

Honda said its eGX system offers OEMs looking to provide battery-powered equipment options to customers without their having to invest in engineering, testing and manufacturing. The initial applications for the eGX system, which was first unveiled as a prototype at Bauma in 2019, are in equipment such as concrete trowels, vibratory plate compactors and reel mowers, while the separated version targets rammers.

The common thread is that the eGX can potentially serve as a replacement for many of the applications currently using the company's 100 cc and 120 cc GX100 and GX120 single-cylinder gasoline engines.

"We developed the eGX from the ground up," said David Bush, senior marketing strategist, Engines and Industrial Products, >



The eGX system is operated through a push-button control assembly that incorporates power, start/stop and speed change buttons, as well as alert and error lights

The eGX is engineered to have the same cubic configuration and same shaft position as Honda's GX gasoline engine



American Honda Motor Co., Inc. "It's a fully commercial unit, incorporating a lot of technology from our generators, and that's one of our outdoor power product lines where we really excel and where we're continuously innovating. The development of the eGX also spotlights the very distinct Honda advantage in how we build new products – drawing from R&D and technological investments from other parts of the company.

"To explain even better, the motor technology for the Honda eGX is taken from our generators, and the insulation and cooling technology is taken from our generators as well. The motor and battery charger are all built by Honda. We outsource the manufacturing of the battery, but it is designed to our specs.

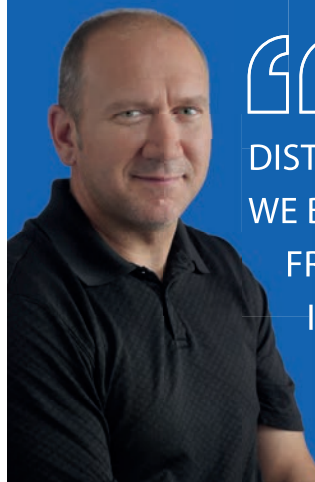
"We're offering it as a whole package solution to the customer, designed and built by Honda."

SIMILAR FOOTPRINT

Both versions of the eGX incorporate a 9.2 in. x 10.6 in. x 5.9 in. lithium-ion battery based on 18650 cells assembled in series and in parallel that provides an energy storage capacity of 748 Wh. The battery is mounted on top of a three-phase, brushless dc motor/power drive unit (PDU) that delivers 2.4 hp (1.8 kW) and 3.5 lb. ft. (4.8 Nm) of torque.

The motor incorporates internal and external cooling fans and the

Honda supplies a high-speed battery charger with each eGX unit. The charger can deliver an 80% charge in less than an hour



“THE DEVELOPMENT OF THE eGX ALSO SPOTLIGHTS THE VERY DISTINCT HONDA ADVANTAGE IN HOW WE BUILD NEW PRODUCTS – DRAWING FROM R&D AND TECHNOLOGICAL INVESTMENTS FROM OTHER PARTS OF THE COMPANY.”

DAVID BUSH, AMERICAN HONDA

integrated motor, power drive unit (PDU) and battery pack are supported by rubber isolation mounts to absorb shock and vibration, which reduces operator fatigue and helps extend machine service life. The battery and PDU are sealed to IP 55, making them capable of operating in dusty or high humidity environments.

Honda said the eGX has a comparable shaft, mounting position and footprint as

the Honda GX100 and Honda GX120 internal combustion engines.

TWO-STEP STARTING

The eGX system is operated through a simple push-button control assembly that is vertically mounted to the side of the integrated unit and can be horizontally mounted to handles on the separated version. The assembly incorporates power, start/stop and speed change buttons, as well as alert and error lights. The control logic includes an interlock function that provides additional safety by preventing the unit from being turned on accidentally – proper motor starting requires a two-step starting sequence.

While temperature extremes can sometimes severely impact battery powered systems, the Honda eGX can sustain a wide range of temperature conditions and can be used in virtually all seasons, the company said. The motor can be optimally operated at temperatures ranging from 5° to 104° F (-15 to 40° C) and optimally stored at 23° to 86°





“Yes, it’s going to cost much more than a standard engine. But I think just having the whole package and not having it be pieced together makes it a lot more acceptable.”

BACKED BY HONDA

The Honda eGX motor has a three-year commercial warranty, while the lithium-ion battery pack and charger offer a two-year commercial warranty. “The eGX is backed by a true commercial warranty,” Bush said, “all backed by Honda.”

Beyond the initial trowel, rammer and

vibratory plate compactor applications, Honda said future applications are projected to include hydraulic power units and compressors. Additionally, a number of other commercial applications are being tested in various market segments, the company said.

“At this point, this is for very specific niche products,” Bush said. “You think about applications where you can’t run an engine inside or you can’t run it at night because of the noise. The Honda eGX addresses all of that.”



F (-5° to 30° C). The battery can be optimally charged from 41° to 86° F (5° to 30° C).

Battery charging is through a charger that is supplied with each eGX unit. The battery is removed from the PDU by unplugging and unlatching a cam-lock and is then set into the charger. “It’s a high-speed charger,” Bush said. “You can get an 80% charge in about 55 minutes.”

The eGX also incorporates a plug-in port that provides connection to Honda’s Dr. H service system that can be used to monitor motor usage status, check and diagnose errors and create service reports. “The eGX is basically maintenance-free,” said Bush. “The battery is sealed, no oil changes are needed, so owning and operating the motor is fairly simple and straightforward.”

WORKING HOURS

One of the major questions about anything electrified concerns operating hours. Honda isn’t citing a specific run time, as Bush noted that working time is really dependent upon the application.

“We don’t really want to quote a time just because there are so many various applications,” he said. “What we can say concerning applications using the eGX is that customers report acceptable run times. Nobody has said the run time was something that was limiting the ability to do a job or limiting productivity.”

Another common question concerning electrification involves the upfront cost, which is particularly an issue because battery electric systems tend to be significantly more expensive than engine systems. “Typically, Honda’s not the least expensive out there,” Bush said. “But in the presentations we’ve had with OEMs, the cost has not been something where they’ve said something like ‘oh my gosh, we can’t do that!’ They’ve been receptive to the cost.”

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Hydrogen takes a big step

NEWSMAKER OF THE YEAR 2021

DPI presents the latest instalment of our annual award highlighting the person, machine or product which made the biggest waves across the year. By **Julian Buckley**

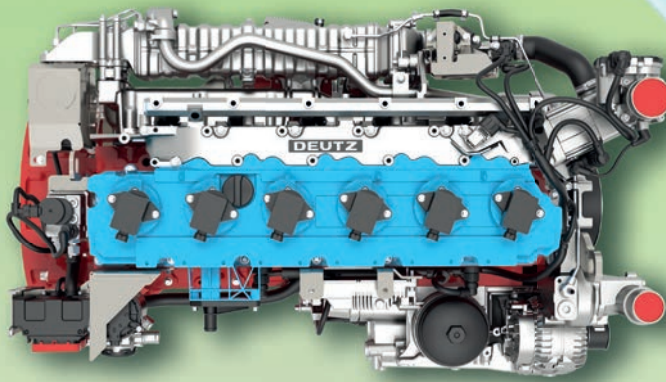
Last year, Diesel Progress International selected COVID-19 as its Newsmaker of the Year. More anti-hero than hero, the virus and the impact of the pandemic on businesses around the world was impossible to ignore.

This year, we're looking forward to better times. With that in mind, DPI has selected Hydrogen as the Newsmaker of the Year for 2021.

After more than two decades of promises that we would see hydrogen tech introduced 'in about 10 years', the push for reduced CO₂ emissions, together with an influx of new technology developments, have elevated hydrogen internal combustion engines (ICEs) to the top of the list of possible successors to conventional diesel engines. That scenario has been brought into yet sharper focus over the last 12 months as nearly all engine manufacturers have unveiled plans for new models designed to operate on H₂.

In August this year, Deutz unveiled its TCG 7.8 H₂, the company's first hydrogen internal combustion engine. Meeting the eligibility criteria set by the EU for zero CO₂ emission engines, the engine is now set to enter production in 2024.

Based on an existing design, the six-cylinder engine produces 200 kW (268 bhp, 271 PS). According to the company, the engine is described as being best-suited for use in stationary equipment,



The Deutz TCG 7.8 H₂ engine

generators and rail applications.

Prior to this in July, Cummins started testing its own hydrogen-fuelled ICE. The company noted that the 'proof of concept' would ultimately help improve power density and thermal efficiency, while reducing friction. Evaluation across on- and off-highway applications will follow.

While these launches preview the potential of hydrogen, Caterpillar is already planning to start marketing H₂-powered ICEs. Following the reveal in early September of a generator set powered by the gas, the company announced that it would be taking orders for turnkey versions of the engines by Q4 2021 (with deliveries starting in late 2022).

Looking at heavy haulage applications, development of hydrogen fuel cell vehicles is continuing to advance. After sharing the 2021 Truck

The Mercedes-Benz eActros (left) and GenH2





London mayor Sadiq Kahn with a new hydrogen bus

CREDIT: GREATER LONDON AUTHORITY

Innovation Award with the company's eActros BEV, in October this year Daimler announced that the Mercedes-Benz GenH2 fuel cell truck had received approval for testing on public roads. This is a major milestone in bringing the technology to market, but we still cannot expect to see customers taking delivery of this new vehicle until 2027.

SOURCING HYDROGEN FUEL

While hydrogen clearly offers excellent performance in terms of emissions reduction, questions remain about how and where the hydrogen fuel will be sourced.

For its part, Cummins has produced its own electrolyzers to produce hydrogen, helping to cut CO₂ and NOx emissions across production to near zero. The company further adds that investment in renewable H₂ will see deployment of hydrogen-powered fleets, using either hydrogen ICEs or fuel cells.

Sourcing hydrogen created as a waste product can also prove beneficial. In June, as London mayor Sadiq Kahn celebrated the first of 20 fuel cell-powered double decker buses entering service in the UK capital, the hydrogen fuel was being collected at an Air Liquide plant near Liverpool, the by-product of a chlor-alkali process.

That hydrogen then has to be transported via road from source to refuelling site, but there are plans to start local electrolysis in 2023 using power delivered directly from an off-shore windfarm.

Some companies, though, have elected to not drive down the hydrogen highway. Despite considerable investment into hydrogen power, in January Scania revealed that it saw battery-electric vehicles (BEVs) as the primary route to decarbonising transport.



2021 HONOURABLE MENTIONS

COVID-19

COVID-19, last year's NMOY honouree, remained a key consideration in many business decisions this year and as such, was in the running for a repeat nod. But the successful rollout of the vaccine programme helped to reduce its effects on business (semi-conductor availability not withstanding), and the global machine market is now apparently on a COVID-19 bounce.

While that's one in the eye for the virus, infection hotspots continue to flare up. This means that the potential for lockdowns remains, but hopefully this will mark the beginning of the end for the pandemic.

EURO 7

With EURO 7 standards set to come into effect in 2025, companies are already planning how they will respond. In August, Mercedes-Benz and Cummins signed an agreement for production of EURO 7-compliant, medium-duty engines at the vehicle manufacturer's plant in Mannheim, Germany. Assembly is expected to commence in the second half of the decade.

Despite the new regs, OEMs such as TATA DAEWOO are continuing to develop powerplants designed to meet EURO 6C and 6D emissions levels. Such is the level of investment needed to achieve EURO 7 compliance and with such incrementally small emissions reductions, it will be interesting to see which companies attempt to meet those regulations or instead look to leverage alternative fuel strategies to avoid related developmental engineering costs.

DIVESTMENT

Spin offs were also a key element of 2021. From Daimler electing to launch its Truck division as an independent business, through to Rolls-Royce selling Bergen engines and Danfoss Power Solutions losing White Drive Motors & Steering, companies were divesting themselves of divisional assets.

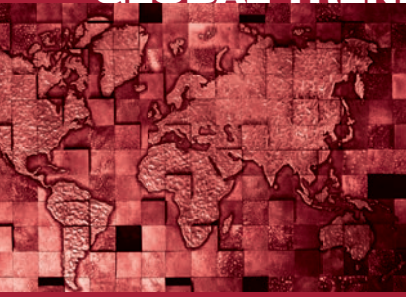
In the case of Daimler, which even mooted changing the company name to Mercedes-Benz, the change was to promote market agility, providing the services and products customers want more quickly. Diesel Progress International will be following the news to see if the divestment trend continues over 2022.



Scania P25 BEV general cargo transport, BEV preferred to H₂

This, based on rapidly improving economics per kilogram, which would ultimately see BEVs surpass the efficiency of fossil and biofuel transport applications.

So, to hydrogen or not to hydrogen. That is the question. It is a polarising choice which has its supporters and detractors. But considering the comparatively minor alterations needed to use the fuel in an ICE, emissions that are a fraction of those produced by a diesel engine (at point of use), and refuelling speeds to match fossil fuels, hydrogen remains one of the few 'alternative' power sources which, as we get closer to mainstream adoption, can deliver power and convenience while helping to meet tighter environmental performance targets. **dpi**



ABOUT THE AUTHOR



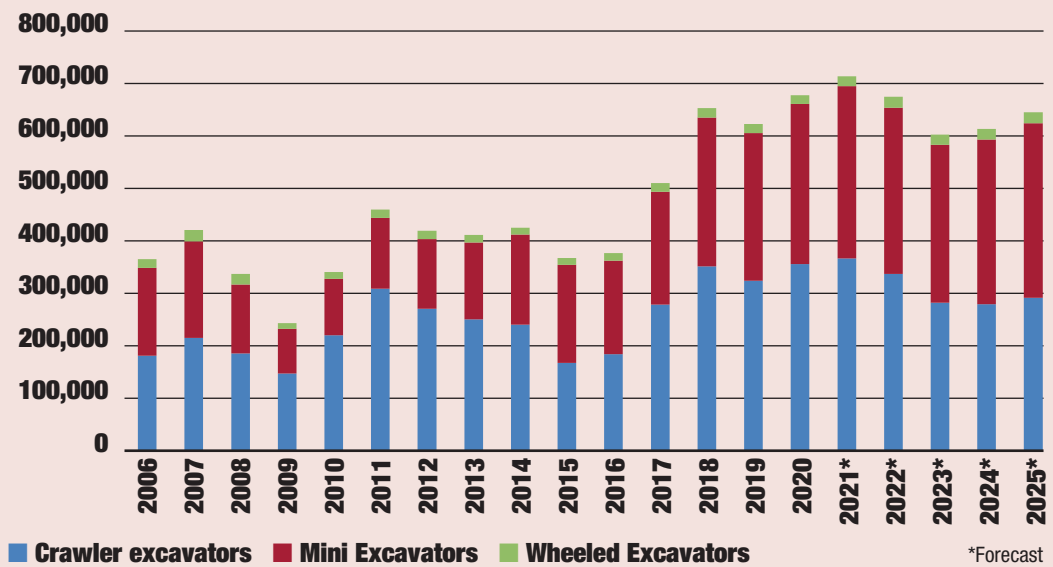
CHRIS SLEIGHT is managing director of Off-Highway Research, a UK-based management consultancy that specialises in the research

and analysis of international construction equipment markets.

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GLOBAL EXCAVATOR SALES (UNITS)



Source: Off-Highway Research

Unprecedented popularity

The boom in global construction equipment sales over the last five years has seen a remarkable number of excavators sold around the world, according to **Off-Highway Research**

During the previous market peak in 2011, just over 1 million pieces of construction equipment were sold around the world. This included some 460,000 crawler, mini or wheeled excavators. In 2021, a record 1.13 million units of construction equipment are expected to be sold but excavator sales are expected to hit an unprecedented 710,000 units, with a retail value of more than \$66 billion.

In other words, the overall peak in equipment sales this year will be about 10% higher than last, but excavator sales will be some 54% higher and account for more than 60% of construction equipment sales. Why is this?

The short answer is that more contractors and rental companies around the world are turning to excavators as a productive and profitable tool

for their businesses.

This is most apparent in China, where the 2010-2011 boom was heavily slanted towards wheeled loaders, the traditional high-volume machine in the country. However, the upswing in demand over the last five years has been all about excavators, including compact machines.

Superficially it is hard to understand why a country of 1.4 billion people, where labour costs remain low, would adopt compact excavators, which are machines intended to replace manual labour.

But this goes back to the point that the productivity of a small excavator can make construction quicker and more profitable, even with an abundance of cheap labour. This is the same in India, where a fledgling mini excavator market has emerged

in recent years.

In the same way, crawler excavators have made inroads against traditional machines, like wheeled loaders in China and backhoe loaders in India (although both still sell in big numbers in their respective markets) because of the productivity gains they can deliver.

ASIAN PRODUCTION

It is a different story with wheeled excavators, which are niche products in the global sense, but important machines in markets where they have a foothold, such as Germany, France and South Korea.

In these countries they are favoured for their mobility and high travel speeds compared to crawler excavators. There is often dispensation to drive them on public roads, saving on cost and inconvenience of transportation between sites

using a truck and trailer. But what the wheeled excavators gain in mobility is a negative when it comes to stability on site. That is why crawler excavators, with the lower ground pressure they exert via their tracks, are universally popular.

Despite the growth in the market over the last decade, the number of companies manufacturing excavators worldwide has fallen overall in that time. This is due to several small manufacturers (less than 1000 units per year) exiting the industry.

Off-Highway Research believes that more than 20% of the excavator brands which were on the market in the early 2000s have since disappeared.

From a trade point of view, the growth in the global popularity of excavators over the last decade is a boon for Asia. In the current market peak (dominated by demand from China), almost 90% of the excavators manufactured around the world come out of Asian factories. This is a combination of the established producers in Japan and South Korea, along with production in China and to a lesser extent India, Indonesia and Thailand.

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PHOTO: REUTERS

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Revealing the root of supply chain woes

Oliver Dixon gives us his thoughts as to why the UK supply chain remains in turmoil

That the global supply chain is a fragile thing should come as no surprise to readers of Diesel Progress International. The automotive industry – within which many of our readers are active and vociferous participants – has long been a benchmark for a global industry sans frontiers and many of those same readers – and more than a few contributors – have deep-rooted and not so fond memories of the times when things got out of balance and stuff didn't get made.

And right now it's all happening again.

But in the midst of the turmoil, there are some aspects of the current situation which are a bit different. Certainly, COVID-19 lockdowns have created a situation whereby manufacturing backlogs are now prevalent. These backlogs cannot be cleared overnight.

Those same lockdowns have also created a global container pool that is

completely out of balance and shipping rates reflect this. Not so many months ago a 40-box across the Pacific was available for the sort of small change usually found behind some sofa cushions. Today that same box, if you can even find one, will be offered at a punitive rate. And those rates look to be staying put for the foreseeable. In sum, if you can find what you want and you can find a means of delivery, then you're doing pretty well.

COVID. AGAIN.

It is hardly surprising that COVID-19 had a material impact upon the supply chain. This is neither the time nor the place to consider the efficacy of the global response to the virus, whether doing things differently would have resulted in a better outcome. The outcome we have is that which we are stuck with. Asking a virus for a do-over isn't on the cards.

But COVID is not everything here and neither for that matter is the

imbalance in container positioning. These two issues are unique and, by their very nature, temporary. COVID will – eventually – become manageable, while a general rule of thumb is that imbalances will in time become balanced.

Yet lurking behind all of this is a long-term, secular trend which is far more serious in terms of its impact on the long-term sustainability of the supply chain. We've covered this before, it's the lack of haulage drivers.

BLAME BREXIT

We need to get into some specifics. While there is clearly a global supply chain problem, there is also clear evidence that many markets have a driver shortage. The latter is driven by a number of issues, including demography, the availability of alternative career choices, plus the simple but absolute truth that there are more pleasant occupations to choose from.

In post-Brexit UK we have only managed to increase this driver shortage, largely through what might charitably be described as a lack of governmental

foresight. In what has clearly come as an unpleasant surprise to the Johnson administration, ending freedom of movement between the UK and Europe served to reduce the number of drivers, which resulted in a reduction of freight carrying capacity.

This may seem an obvious example of cause and effect, but the handwringing being done by the UK government suggests otherwise. That one of the initiatives put into place to remedy this shortfall was to make the occupational driving test easier – what could possibly go wrong? – suggests that Grant Shapps, Minister for Transport, is a man short of ideas.

Those of us who have spent any time around the transportation industry are familiar with having our pessimism confirmed by the actions of the Executive. With the mendacity that appears to reside at the core of contemporary UK politics, it is hard to imagine a satisfactory resolution. In of itself, the driver shortage is an intractable issue; the actions being taken by the UK government serve only to make it very much worse. **dpi**

Caterpillar G3516H 60 Hz hydrogen generator set

Future power delivery

Diesel-powered generator sets have been the go-to choice for decades. But while they offer a robust solution for all but the most niche local power delivery requirements, the environmental and sometimes the reputational impact of using diesel-powered units – even when fitted with the latest emissions scrubbers – has opened the door for gen-sets using alternative fuels.

While gen-set manufacturers have been experimenting with hydrogen as a fuel since the turn of the century, it has for the most part remained the clean alternative that was just out of reach. But issues related to diesel emissions and new research into using hydrogen as a fuel over the past 20 years has seen various OEMs and other companies make plans for hydrogen-

powered gen-sets. How hydrogen generator sets and battery-based energy storage systems might replace diesel power.

By **Julian Buckley**



powered gen-sets.

In September this year, Caterpillar revealed that it would introduce generator sets capable of operating on 100% hydrogen, including renewable H₂. The Cat G3516H gas generator set will be offered with a rating of 1250 kW for 50 or 60 Hz continuous, prime and load management applications.

While initially offered as demonstrators in North America and Europe, market deliveries of the G3516H are set to start in 2022. More imminently, Caterpillar is set to start the staged rollout of the Cat CG132B, CG170B, G3500H, G3500 with Fast Response, and CG260 gas generator sets, all configured to operate on natural gas blended with up to 25% hydrogen.

The company will also offer retrofit kits allowing other generators built on the same engine platforms to use the 25% hydrogen blended fuel. Full production of the machines and kits is set to start in 2022.

CONCEPT LAB DELIVERS

Caterpillar is not the only OEM involved in development of hydrogen-fuelled generator sets. Atlas Copco is also running a hydrogen gen-set programme as part of the company's Future Fuel strategy.

The H2-45 is a 45 kW autonomous power generator which operates on 100% hydrogen. As might be expected, this results in zero emissions, making it ideal for use in ultra low-emissions zones. Weatherproof and fitted with a soundproofing canopy, the unit is intended for short-term or mobile off-grid power requirements, such as electric vehicle charging stations, outdoor events and urban construction sites in ultra-low emissions zones.

Developed by Atlas Copco's Concept Lab, the H2-45 gen-set serves two primary purposes; to prove out the fuel strategy, while also testing market interest in the new technology. The new gen-set concept is expected to be of particular interest to customers with specific sustainability goals, where H₂ can be

Prize winner

In September this year, Atlas Copco Power Technique Belgium showed the Zenergize energy storage system (ESS) at the Matexpo exhibition in Kortrijk. The ESS took home third prize in the Matexpo Innovation Awards.

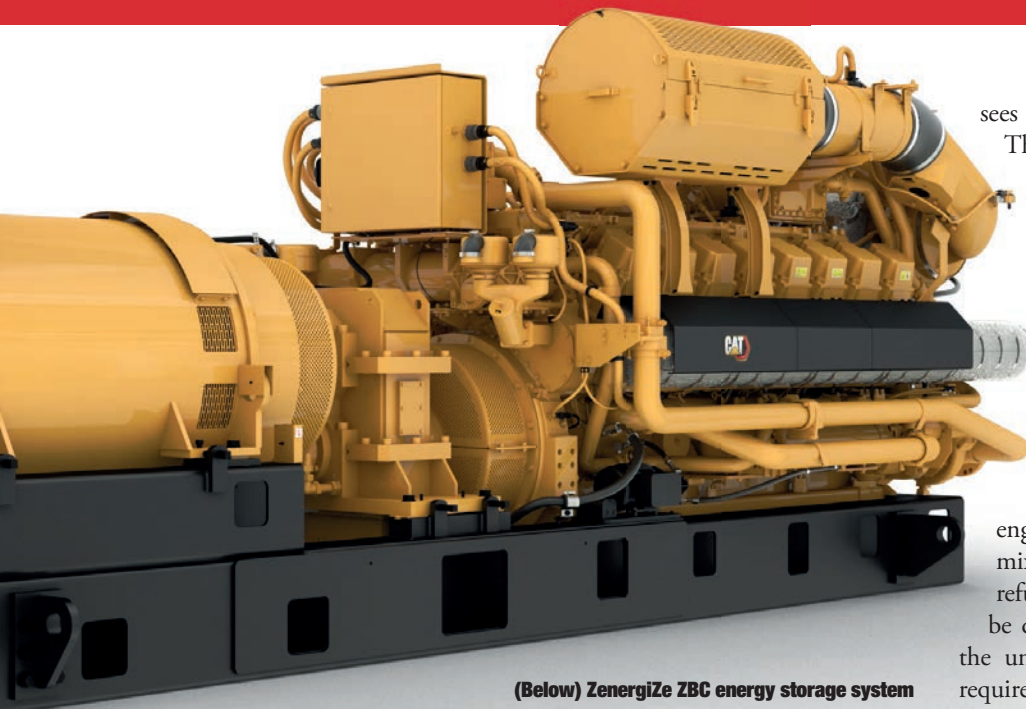
It was noted that the ESS can reduce any related environmental impact through reduced fuel consumption. In hybrid mode, where a Zenergize unit is used in combination with a QAS80 generator, the system could achieve fuel consumption reductions of up to 50% over a 12-hour period, when compared to a standalone QAS125.

In addition, over its 40,000-hour lifetime the Zenergize emits 50% of the emissions of a standalone generator, which represents a savings of approximately 100 tonnes of CO₂ – the savings can reach 100% if the unit is recharged using renewable energy.

"Advances in lithium battery technology mean that we are now able to deliver a product with the high reliability our customers have come to expect from us," said Pieter Willems, business line manager for Service and Capital Equipment at Atlas Copco. "We are pleased to receive the Matexpo Innovation Award as it recognised the Zenergize innovation."



Atlas Copco's Zenergize ESS at the Matexpo event



(Below) Zenergize ZBC energy storage system



generated on-site to achieve green credentials and build cost competitiveness.

Kris Herremans, marketing manager at Atlas Copco Speciality Rental Division, had this to say about the hydrogen-powered gen-set. “The H2-45 prototype is currently in an extensive test and certification phase. That means our go-to-market date isn’t set in stone. Atlas Copco Speciality Rental wants to remain one step ahead of regulations and have the safest, most efficient temporary H₂ solution on the market. That’s why we’re thinking – sometimes overthinking – every bolt and screw on the machine.”

He continues by saying that the H2-45 has been well-received by customers and the company is already receiving requests for more information and even orders to rent the unit.

“While H₂ isn’t the cheapest option, the moral conviction of our customers closes the price gap between electric- or diesel driven solutions. Applications such as construction sites in cities or music festivals, we see it all,” he says.

But it is vehicle charging stations where Herremans

sees the most potential for the hydrogen gen-set. There are areas where the electric grid cannot manage the pull created by vehicle charging. In some of those cases, the required charge is delivered by diesel generators.

“We find that quite ironic,” he says. “We saw the problem and thought we can come up with something better.”

While the H2-45 has the potential to deliver zero-emissions power, fuelling the generators could still be a problem. While OEMs have launched off-road machinery with internal combustion engines adapted to use 100% or a percentage mix of hydrogen as a fuel, these machines can be refuelled at a fixed base where the hydrogen can be delivered and stored. In the case of gen-sets, the units could be in remote sites which would require delivery of the hydrogen fuel to disparate locations.

“It’s one of the biggest issues, transportation of fuel,” says Paul Webster, business development manager at Atlas Copco. “But despite the problems, I still think it is the way forward.”

That is not to say that future gen-sets will all use hydrogen to the exclusion of other fuel types. Webster says Atlas Copco is about to launch EU Stage 5-compliant diesel generators, while also looking at other ways to deliver electric power where it is needed.

“In September 2020, we launched the Zenergize energy storage system. It’s literally a box with lithium-ion batteries, a standalone battery unit. It can be charged using a standard gen-set, solar or mains power. It’s another route to achieving our net-zero goal,” he says.

BATTERY BOX

Three models of the Zenergize system are available, medium ZBE and ZBP models and full-size ZBC. In the case of the ZBC, it can deliver power outputs ranging from 100 kVA to 1000 kVA and energy storage capacity of 250 kWh to 2000 kWh. They can serve as primary power units when used in island mode, or they can be combined with standard generators to create a hybrid solution. There is even an option to create a microgrid. When in island mode, the energy storage system emits virtually no CO₂ or NO_x at point of use, with and is almost silent.

Webster says that while Atlas Copco will continue to market diesel engines, the company sees energy storage as a key component in the company’s future power delivery portfolio.

Does the rolling battery pack as a power supply solution signal the beginning of the end for diesel generators?

“The diesel engine is becoming the elephant in the room, the dirty diesel,” says Webster. “The way we get around that and achieve low emissions is by using batteries. The ideal scenario at this time is to pair the two together.”

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While H₂ isn’t the cheapest option, the moral conviction of our customers closes the price gap.”

KRIS HERREMANS,
Atlas Copco Speciality
Rental Division

Performance enhancer

Julian Buckley visits Bowman Power to find out how their eTurbo systems can improve engine power and reduce emissions



“We are in a transition period when it comes to efficiency and the environment,” says Paul Dowman-Tucker, CEO of Bowman Power. “While we actively prepare for the next big thing in terms of fuel strategy, we also have to do the best we can with what we have.”

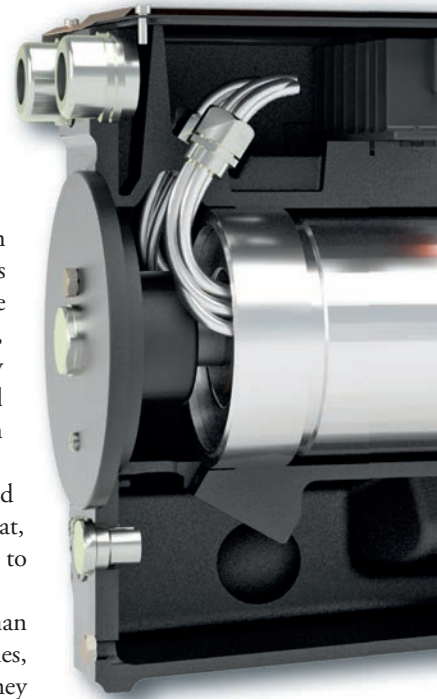
The hardware developed and assembled by Bowman Power is designed to do just that, maximising the conversion of fuel energy to power, while also reducing related emissions.

Based in Southampton, UK, Bowman is a developer and assembler of e-turbines, e-compressors and e-turbochargers; together they make up the eTurbo Systems business. The units are primarily intended to improve the efficiency and performance of internal combustion engines (ICEs), from stationary and mobile generator sets, through to tractors, HGVs and locomotives, burning various liquid and gas fuels, although the technology is also being adapted for other power systems in the future, such as hydrogen fuel cells.

Founded in 2004, the company started out producing micro turbo systems. Moving forward to the present day, Bowman counts most leading diesel engine producers and OEMs as partners, including Daimler, Volvo, FPT, John Deere, Cummins and Aggreko.

Looking at the current product range, the technologies boost performance in different ways: the Bowman eCompressor acts as a bolt-on boost assist; the eTurbine is a bolt-on heat recovery unit; the eTurbo can act as an integrated boost assist or heat recovery unit, or a full eTurbo can deliver boost assist and heat recovery.

While companies such as BorgWarner and Garrett Motion dominate the low-power, high-



“Fitting an eCompressor can overcome the inherent turbo lag and deliver equivalent responsiveness to a diesel engine.”

PAUL DOWMAN-TUCKER,
Bowman Power

Paul Dowman-Tucker, Bowman Power

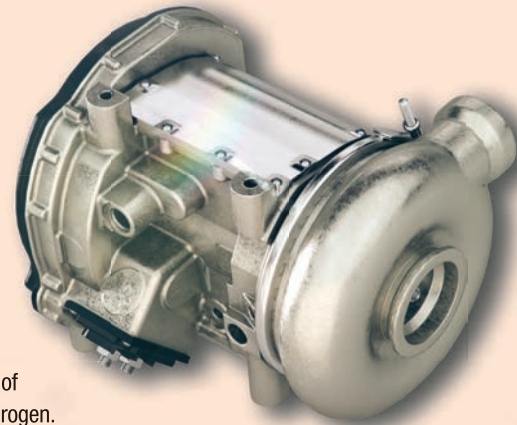
Making the most of hydrogen

Paul Dowman-Tucker, CEO of Bowman Power, is not overly concerned with bans which might affect diesel engines being used in some applications. The hardware delivered by the company can be applied to engines using a range of fuels, including LPG, natural gas and hydrogen.

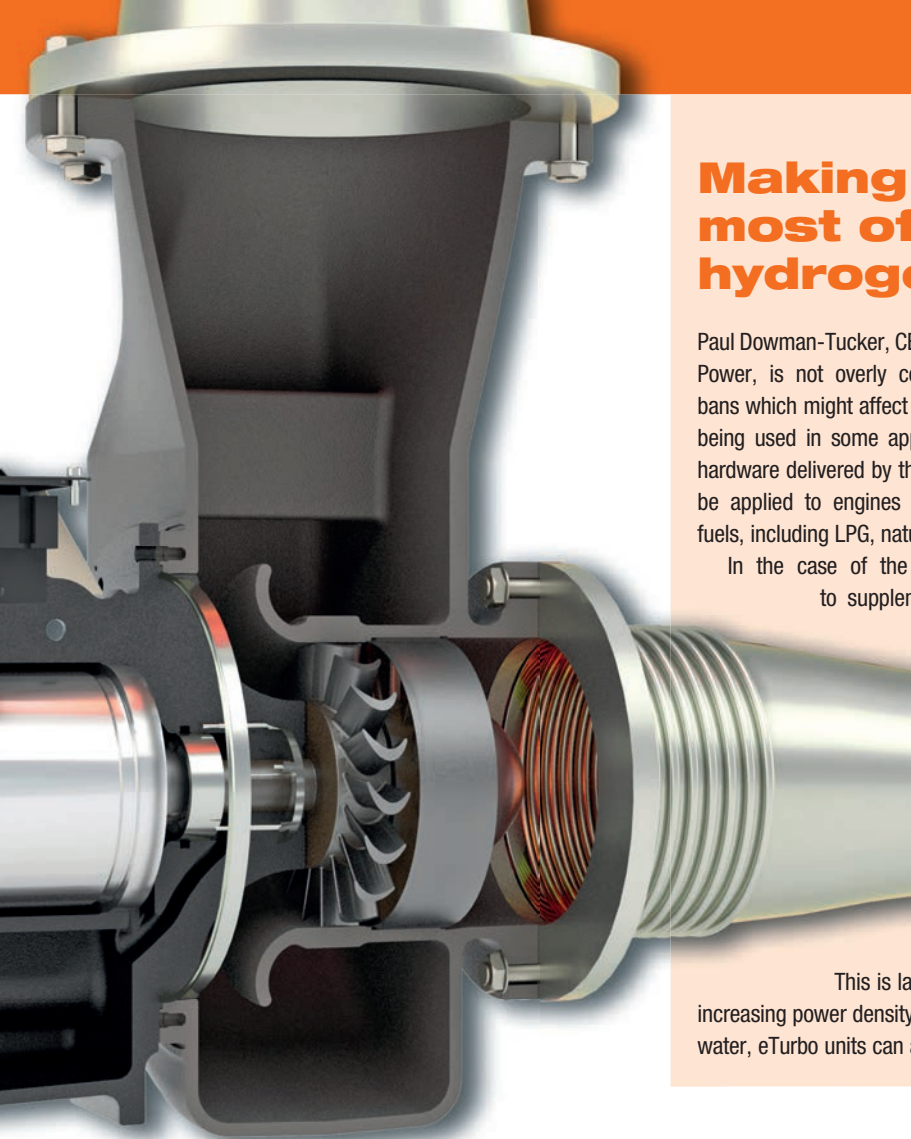
In the case of the eCompressor, the unit is used to supplement the pressure of a standard turbocharger. This is critical when considering hydrogen as a fuel, as air-to-fuel ratios required for low NOx combustion are excessively high compared to a conventional ICE, so supplementing the air delivery during transients and even at steady state improves the power return versus that possible with conventional turbos.

While each of the standalone units produced by Bowman can be applied to internal combustion engines using hydrogen, the eCompressor and eTurbo can also be used to improve the energy output of hydrogen fuel cells.

This is largely achieved by boosting the volume of air brought into the unit, increasing power density. In addition, with the only byproducts of a fuel cell being heat and water, eTurbo units can also capture that heat to help continue the virtuous energy circle.



An eCompressor can also work with hydrogen ICEs



speed turbo market serving customers primarily in the automotive sector, Bowman develops units with higher power outputs, applications producing from 300 kW up to 20 MW.

Perhaps most importantly, the eTurbo Systems products can deliver flexible, adaptive and responsive performance in real time, helping to reduce fuel usage, cut emissions and lower operating costs. Dependent on the powertrain type (diesel ICE through to hydrogen fuel cell), emissions can be reduced by between 10% and 100%.

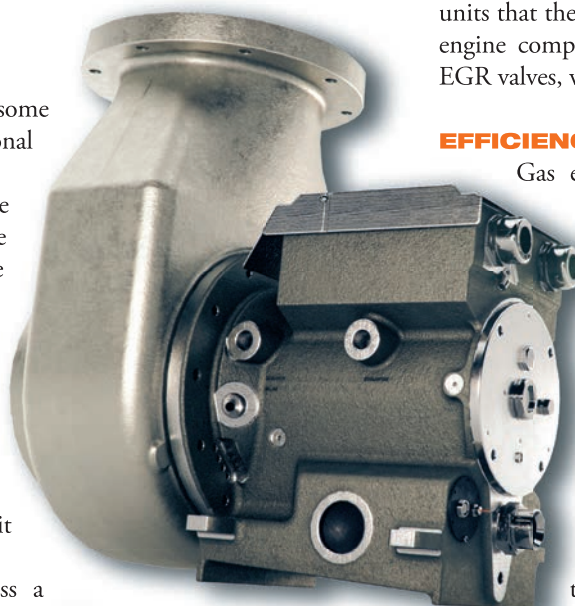
STRUCTURE OF AN E-TURBO SYSTEM

Dowman-Tucker says there are some key differences between a conventional turbocharger and an electrified unit.

Unlike a conventional automotive turbo, which has the turbine and the compressor linked on the same shaft, the e-turbo links these two impellers with a motor. The motor can either feed in or bleed out electrical power based on engine conditions. Retaining the mechanical shaft means there is just one set of power electronics, resulting in a smaller unit and reduced cost, while also keeping redundancy and the chance of unit failure to a minimum.

This setup supports customers across a

Fitting an eTurbine can deliver fuel efficiency gains of up to 10%



variety of industries. For example, a locomotive engine manufacturer in the United States uses the eTurbo as a heat recovery system. In marine applications, boost assistance from an eTurbo or eCompressor is more important when considering manoeuvrability and emissions in port. The ultimate example of this, says Dowman-Tucker, is an energy-in or energy-out system in a single electric turbocharger, an idea Bowman is planning to test in the near future.

Efficiency improvements of between 6% and 10% can be achieved by installing an eTurbine on a diesel engine. But such is the flexibility of eTurbo units that they can also eliminate the need for other engine components, including throttle valves, hot EGR valves, wastegates and other actuators.

EFFICIENCY GAINS

Gas engines (including LPG and natural gas) are known to be cleaner than diesel equivalents. In some cases, gas-powered engines can produce up to 25% less CO₂ emissions and 90% less NOx than an equivalent diesel unit.

“The issue is that standard gas engines can’t respond quickly to rapid load demands,” says Dowman-Tucker. “But fitting an eCompressor can overcome the inherent turbo lag and deliver equivalent responsiveness to a diesel engine.” Blend in biogas,

28>

Component assembly at Bowman Power

synthetic gas, or even various grades and percentages of hydrogen (through to pure H₂) and emissions are reduced still further.

“Electric turbochargers offer fuel flexibility,” he continues, “with power assist delivered to suit the fuel composition. Combustion parameters can be sensed and altered to achieve best efficiency.”

He adds that Bowman has completed tests on gas engines running anaerobic digester and landfill gases where the calorific values can change over time. The e-turbo can respond to that by varying the electrical power generated from the shaft, continually controlling its speed, delivering the exact amount of air required to efficiently combust the fuel as its composition varies. This is important for emissions control, but also ensures the heat recovered from the exhaust gas is optimised, minimising fuel consumption on a second-by-second basis. Beyond this, the ability to additionally monitor the eTurbo means much larger swings in fuel composition, including switching from 100% methane to 100% hydrogen, can be accommodated without any need to derate the ICE. Such swings cannot be overcome with conventional turbochargers as the air demand and exhaust enthalpy (system heat content) resulting from the combustion are so hugely different that ICE performance is massively compromised.

Essentially, standard turbochargers are optimised for a fixed operating point. The electrified versions support dynamic input to create the ideal conditions for optimum boost. This opens the door for low-emissions solutions across a variety of applications and drive cycles, such as meeting Euro 7 emissions standards to ensure consistent power levels needed by data centres.

Proposed government bans on diesel engines could mean worrying times for Bowman. But Dowman-Tucker points out that eTurbo Systems hardware can be successfully applied to internal combustion engines using hydrogen, or even hydrogen fuel cells. It all boils down to the eTurbo Systems helping to create predictable engine operating parameters.

“It’s easy to define, designing engines for transient behaviour results in sub-optimal efficiencies, or vice versa. eTurbo Systems allow transient performance and efficiency to be decoupled and optimised concurrently,” he points out.

UNITS IN OPERATION

Bowman hardware operates in some of the harshest environments, with units consistently exposed to exhaust gas temperatures of up to 700°C. Additionally, the very high rotational speeds create centrifugal forces that require the electric machine rotor to be wrapped



We don’t directly target lower NOx, but where there’s a fuel saving there’s already a reduction.”

PAUL DOWMAN-TUCKER,
Bowman Power

in carbon fibre to keep the magnets in place. Since they were first introduced, experience gained in the field has helped to improve reliability; collectively, the units now have more than 20 million hours of operation, with maintenance costs calculated at pennies per hour.

Data collected from related sensors in the unit can support a programme of preventative maintenance, rather than scheduled downtime.

In cases such as a truck engine, sensor requirements may be reduced. “Once an eTurbo is mapped to an engine and you know the load point and related parameters, the airflow going to the engine can be accurately estimated. This negates the need for mass flow and other sensors,” he says.

Order of magnitude reductions in drive cycle emissions can be achieved even with limited operation. For HGV engines the cycle is only nine seconds on, 27 seconds off, resulting in a very minor parasitic load on the electrical system.

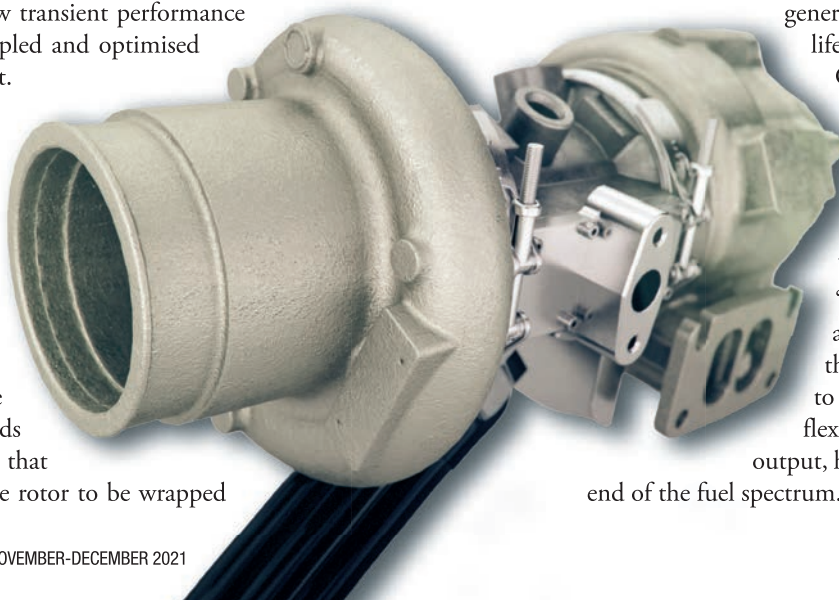
Another bonus is the reduction of NOx produced by the diesel engine, as Dowman-Tucker explains: “We don’t directly target lower NOx, but where there’s a fuel saving there’s already a reduction.” He adds that fitting an eTurbine to a 1 MW gas-fuelled generator can, over its operational

lifetime, deliver the equivalent CO₂ savings as switching 1330 fossil-fuel cars for electric models.

“If you need to use a diesel engine, then we can make that a bit better,” he says in closing. “But we can go further, allowing a gas engine that’s equivalent in power to respond swiftly, be fuel flexible and have a stable power output, helping to replace the dirtier end of the fuel spectrum.”

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Engine mapping negates the need for sensors when using an eTurbo

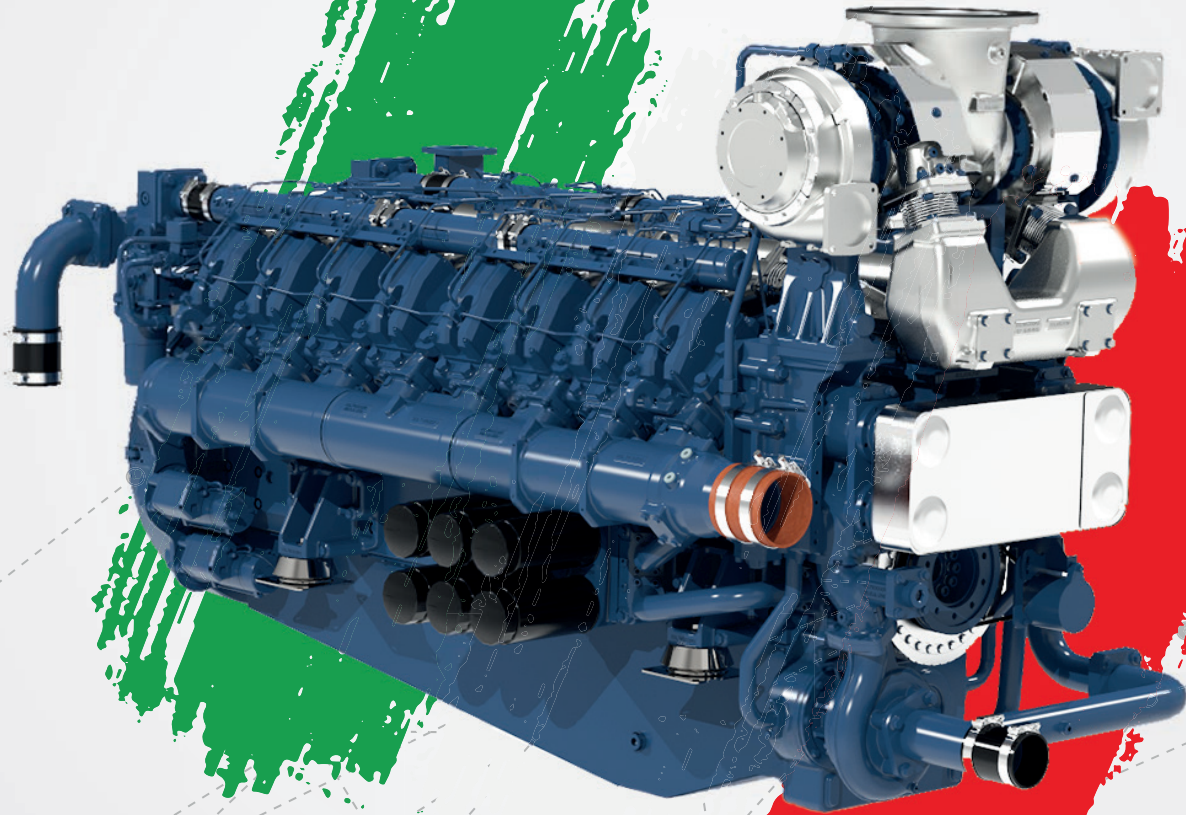




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DISCOVER THE POWERS



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A look at how BorgWarner is developing CV diesel hybrid tech. By **Julian Buckley**

Limitless

In June 2021 it was reported that shareholders at battery systems manufacturer Akasol, based in Darmstadt, Germany, had accepted the voluntary public takeover offer by ABBA BidCo, a subsidiary of vehicle systems specialist BorgWarner (BW). The initial deal would see BW take 89% of outstanding shares in the company, with the later goal of acquiring 100% of shares bringing the company into the BW fold.

Dr. Wolfgang Wenzel, senior technology specialist at BorgWarner, told Diesel Progress International that the technology from Akasol would help to drive forward development of hybrid diesel engine powertrains.

“I think the electrification of commercial vehicles (CVs) will continue to develop across different levels,” he explains. “Hybridisation will be part of that, it’s what we already see in trucks and buses and we’ll see more of that in the future. We’re looking at providing a complete battery portfolio for CVs and Akasol’s products will be a part of that. It’s a clear path to combining the propulsion system and related storage systems into one package.”

E-MACHINES

While the battery technology from Akasol will help to broaden the BorgWarner product offering, the German Tier 1 supplier has already brought two of its own hybrid diesel engine powertrain solutions to market.

“BorgWarner has developed components [for hybrid powertrains] which are now in series production. For example, we produce an e-machine for parallel architecture, that’s for a European OEM. Also, there’s an e-machine for a hybrid bus application,” says Wenzel.

Continuing, he explains that the term ‘e-machine’ covers the electrified portion of the hybrid powertrain. The specific solutions developed by BW for these customers are parallel powertrains, meaning that the e-machine can be linked to the engine or decoupled for pure electric drive.

The bus powertrain is for a city bus rather than a long-distance coach. This required e-motors which could withstand the strains of city traffic, including delivery of increased power for repeat standing starts and the ability to assist while negotiating challenging terrain, such as uphill gradients.

This means the powertrain in the bus is different from that used in a passenger vehicle application. “It is a plug-in solution developed especially for commercial vehicles,” says Wenzel. “Dependent on



[Hybrids] need components with more durability to support torque increases.”

DR. WOLFGANG WENZEL,
BorgWarner

battery size and capacity the vehicle can operate on electricity alone. You also need components with more durability to support torque increases.”

Whether it is financially viable to develop additional unique components for use with hybrid diesels is almost solely dependent on finished vehicle volumes, says Wenzel. “A truck OEM has to plan their investment. If the volume of hybrid trucks is low then, specification wise, dedicated investigations into hybridisation is perhaps limited.”

But he adds that the level of hybridisation, mild, full, or plugin, is key to supporting adaptations across the powertrains. “For example, 48V allows electrification of components, but not energy regeneration, while engine support would also be limited. Higher voltage machines, maybe in the 100 kW range, could support the engine when under acceleration or going uphill,” says Wenzel.

He points out that that investigations into hybrid powertrain efficiency gains could achieve those results by targeting



HVH410
motors from BorgWarner come in various configurations

combinations

other components, including transmissions. “With more electric support you could reduce the number of gears in the transmission, maybe from 13 to eight, or even fewer. That simplifies things, plus the reduced number of gear changes and related friction reduction could build fuel efficiency.”

But he adds that just as with other features, the possibility of such developments would depend on vehicle volumes.

Looking further into the transmission issue, Wenzel says another option could involve using a CVT transmission. Using a stepped transmission ratio works well with the combination of combustion engine and electric motor, but the disadvantage for CVs would be that they need energy to build pressures on the torque-activated transmission devices.

The fundamental mass of CVs also supports hybridisation of the diesel powertrain. The succession of braking events completed by urban buses makes the most of energy regeneration systems.

“For the city bus application, this was a clear benefit. Braking in such a large vehicle returns a lot of energy that was originally used for propulsion back to the battery pack. People are trying to push recuperation efficiency to a higher level than propulsion efficiency.”

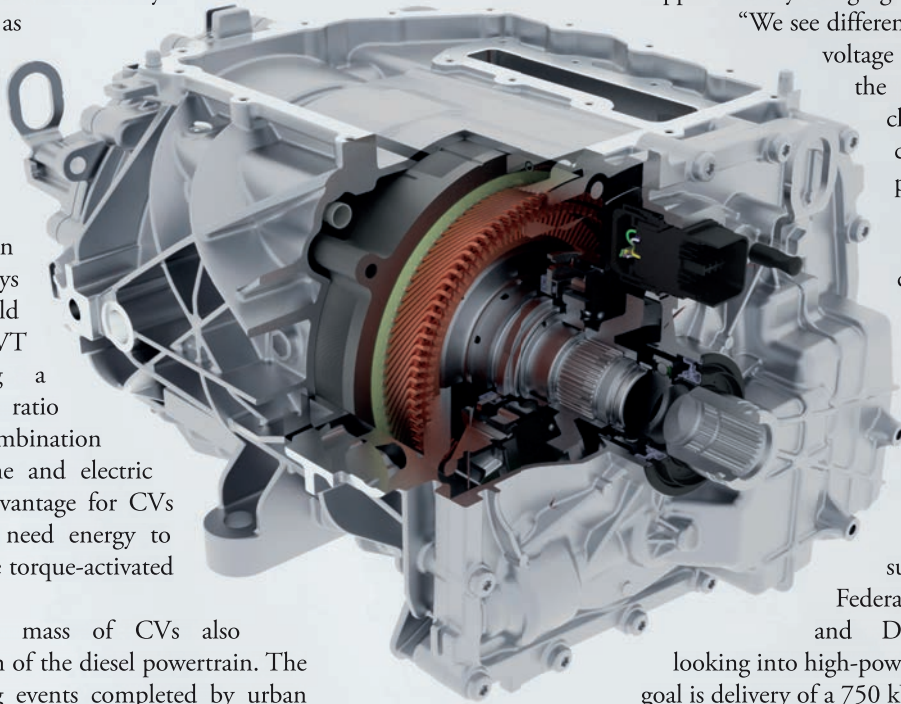
Wenzel says that battery pack sizing is influenced by potential energy recuperation, with the pack needing to be of a sufficient capacity to accept all the available charge. In the case of trucks operating in hilly or mountainous regions, the system should be aware of the topography. In practise this would see a greater percentage of electric power used prior to a downhill run, making storage capacity available for the anticipated regenerated power.

CHARGING SOLUTIONS

In June 2021, a consortium including truck makers Volvo, Daimler and Traton, announced that it would invest €500 million (£421 million and \$580 million) to construct a network of 1700 dedicated superfast charging stations across Europe for haulage vehicles and coaches.

At the time, Traton chief executive Matthias

**800 volt electric motor
from BorgWarner**



Gründler told the Financial Times: “We only have 10 charging stations in the whole of Europe right now, so there’s a hell of a lot to do.”

In addition to diesel hybridisation solutions, BorgWarner is also developing technologies to support battery charging.

“We see different power levels on different voltage levels,” says Wenzel, “but the general direction for CV charging is 800 volts. That could be higher in later phases. But even an 800 volt capability is dependent on battery type, what the cells can accept. On the CV side we see big batteries can take more due to their relative charging rates being lower. I think that would support 500 kW charging.”

He adds that the HoLa project, which is supported by Germany’s Federal Ministry of Transport and Digital Infrastructure, is looking into high-power charging for trucks. The goal is delivery of a 750 kW charge level

DIVERGENT, NOT CONVERGENT

Wenzel says that he expects to see competition between those different powertrain solutions being offered for commercial vehicles. These would include hybrids, hydrogen internal combustion engines or fuel cells, through to fully-electrified models. “It depends on the use case, whether it’s urban, long-haul. We already have pure electrification solutions for urban buses and delivery vehicles. Volvo is already installing packs of 540 kWh in big trucks; one company has even retrofitted a 900 kWh pack.”

So what’s next for diesel engine hybridisation? Wenzel says that there are a lot of different directions the technology could take, with improvements driven by total cost of ownership (including energy costs). There will be more levels of hybridisation, dependent on the battery pack capacity and the internal combustion engine being used. The Euro 7 emissions discussion will also play a part in the direction development takes.

But Wenzel says that he sees a more divergent than convergent market for diesel hybrids. “I think there will be a solution for every application, ranging from light delivery vehicles through to 44-tonne trucks, every vehicle and every application, based on load weight, location. There will be more solutions instead of less, which will allow us to deliver the best solution.”



People are trying to push recuperation efficiency to a higher level than propulsion efficiency.”

**DR. WOLFGANG WENZEL,
BorgWarner**

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New pumps and new production facility for Hydreco

Hydreco Hydraulics Italia MD talks to DPI about new products and expanded production capability.

By **Roberta Prandi**

Hydreco, part of the Duplomatic Group, has introduced the new HY2 range of external gear pumps for mobile applications, including earth-moving, construction, agricultural, forestry and municipal machinery.

“There are two groups in the new pump range, called HY1 and HY2. Group HY2 will be the most widely used and is already in production,” says Michele Guiati, Hydreco’s managing director.

Guiati says that a new assembly plant was opened at the company’s Parma location in 2021 to manage production of the new pump series and the related motors. The factory will double production capacity in Italy.

He adds that Group HY1 pumps will be the first to enter production, while two further HY2 pump versions are under development; a low noise version and one which features a cast iron outer casing.

“We have undertaken an important investment plan to expand and improve the Motion Control solutions package we offer,” says Davide Vaccina, managing director of Hydreco Hydraulics Italia. “The new facility in Parma incorporates a production plant that, when fully operational, will have three production lines. We expect to conclude the launch



HY2 tandem external gear pump from Hydreco

of the new gear pump range at the beginning of 2022 with the Group HY3 units.”

The investment will further include a new series of directional control valves, HIC blocks and joysticks, completing the full product range.

According to the two managing directors, one of the most important capabilities of Hydreco is product customization. It’s a customer offering that demands flexible manufacturing, a feature which will be supported by the new production facility in Parma.

GOING GLOBAL

With headquarters in Poole, UK, Hydreco has a global footprint which extends to locations in the US, India and Australia, in addition to Italy. Hydreco Hydraulics Italia is the company’s key competence centre for the development of new products and solutions within the group.

The company produces advanced motion control solutions for mobile operating machines, including joysticks and hydraulic pedal boxes, power units and electric/electronic pedals, together with CANbus machine control systems, banked valves and hydraulic cylinders.

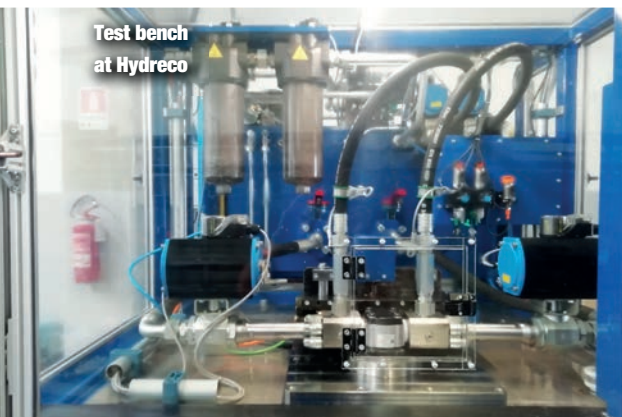
With the addition of the new pumps, Hydreco can offer a full range of external gear pumps featuring aluminum bodies and cast-iron flanges and covers. These are available in multiple configurations and with different flange types, with connections for suction, delivery and shafts.



We have undertaken an important investment plan to expand and improve the Motion Control package we offer.”

DAVIDE VACCINA,
Hydreco Hydraulics Italia

Test bench at Hydreco



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Pumps by Vanzetti Engineering can be used in LNG and L-CNG filling stations serving the public and private fleets

Cryogenic pumps by Vanzetti Engineering selected for conversion of municipal waste fleet to LNG fuel. By **Roberta Prandi**



LNG and CNG pumps for filling stations

Italy-based Vanzetti Engineering has been awarded part of the project that will see a retrofit of the diesel truck fleet at Contarina, a municipal waste collection operator in the Treviso province of Northeast Italy, to using LNG fuel.

Vanzetti Engineering contributed to the setting up of storage and tanking systems for liquified natural gas (LNG) and compressed natural gas collected from the regasification of LNG (L-CNG). The storage system will support conversion of 60% of Contarina's diesel vehicles to LNG.

As part of the project, Vanzetti Engineering delivered two reciprocating pumps from the VT-55 series for the L-CNG supply, together with an Artika 160-25 cryogenic submersible pump for the LNG supply. The firm supplied various other components for the cryogenic operation.

This project is viewed as an important step towards an environmentally-friendly company fleet. Contarina is planning to produce biomethane from organic waste collected by the trucks on a daily basis, which in turn will provide the gas used by its vehicles.

Vanzetti Engineering has acquired detailed know-how covering the processes behind LNG and L-CNG filling stations and now offers customised solutions for public stations and private fleets.

In these types of filling stations, LNG is stored in a cryogenic tank. The fuel is then delivered to a cryogenic centrifugal submerged pump. The pump carries out two main functions in the fuelling process, providing the fuel to the LNG dispenser for

the cooling of the lines and for supply to the trucks, while also pumping the liquid to the LNG saturation heat exchanger for conditioning and preparation before refuelling.

FILLING OPERATION

In L-CNG filling stations, liquid natural gas is stored in a cryogenic tank which provides the fuel to a high-pressure reciprocating pump. Compressed LNG is pumped through an ambient vaporizer, where it is warmed and transformed into CNG. To complete the process, the CNG is stored in a gaseous buffer, ready for refueling vehicles.

Vanzetti Engineering's scope of supply also covers components needed to manage the whole process. These include the high-pressure ambient vaporizer intended to regasify the LNG; a cold charge group to optimize the CNG temperature and, optionally, the gaseous storage efficiency; the high-pressure ambient vaporizers for vents; a distribution and safety panel to protect non-cryogenic components from excessively low temperatures and high pressures; and an optional electrical control cabinet for remote system monitoring.

Pumps by Vanzetti Engineering can be used for new stations or retrofitting existing sites. The company is also active in the marine sector, delivering cryogenic pumps for LNG ships (to convert from diesel to LNG propulsion), or external pump skids with an electric motor for the transfer of LNG from vessel to shore and vice versa.

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SPEAKERS



Tifenn Brandily

Senior Associate at
BloombergNEF



Marko Dekena

Executive VP Global Sales,
Product Management
& Project Execution for
INNIO Jenbacher



Peter Hoeflich

Director of Generation
Technology, Duke Energy's
Generation and Transmission
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The new S6 valve for SAHR brakes by Italian company Safim has been developed for vehicles with high standard braking requirements, such as underground mining vehicles which are operated under demanding and dangerous conditions.

In environments such as underground mining, vehicles are required to stop suddenly and maintain position in some challenging locations, on ramps, steep gradients or slopes. They must also be able to do this even when fully loaded. A failure in the braking systems under these circumstances risks causing serious injury.

These types of vehicles are not equipped with both stationary and service brakes because functions are integrated in the system and managed by SAHR brakes, usually integrated into the axles. This enables automatic braking in case of hydraulic system failure.

BETTER THAN THE REST

The new SAHR valves incorporate some important features, such as pressure stability to meet the very low tolerance rates required by axle manufacturers when looking at pressure fluctuation. The Safim valve keeps the maximum pressure range fluctuation to within 5 bar.

Testing of the Safim S6 valve



New valve for SAHR brakes from Safim

The new valves are intended to ensure high braking performance in dangerous conditions.

By **Roberta Prandi**



The new S6 valve from Safim

The S6 valves are also capable of handling a high rate of oil flow in a very short time. This is a key feature, as faster build up of oil pressure results in a shorter response time and faster braking action. The setup of the Safim valve offers improved flow management; testing by the manufacturer delivered better results than those returned by similar valves on the market.

Safim also noted how braking modulation is strictly related to the kiss point. The faster this is reached the more precise the braking modulation, due to a wider pedal stroke. The Safim valve has a special pressure modulating curve with a “near-zero” kiss point rate. In action, this means the complete pedal stroke is always available, allowing the operator a greater degree of comfort and better control of the pedal action used for braking.

CUSTOMISATION OPTIONS

Safim also reports that the S6 valve returned good results in hysteresis and leaking, two very important characteristics that must be maintained in order to maintain peak braking performance.

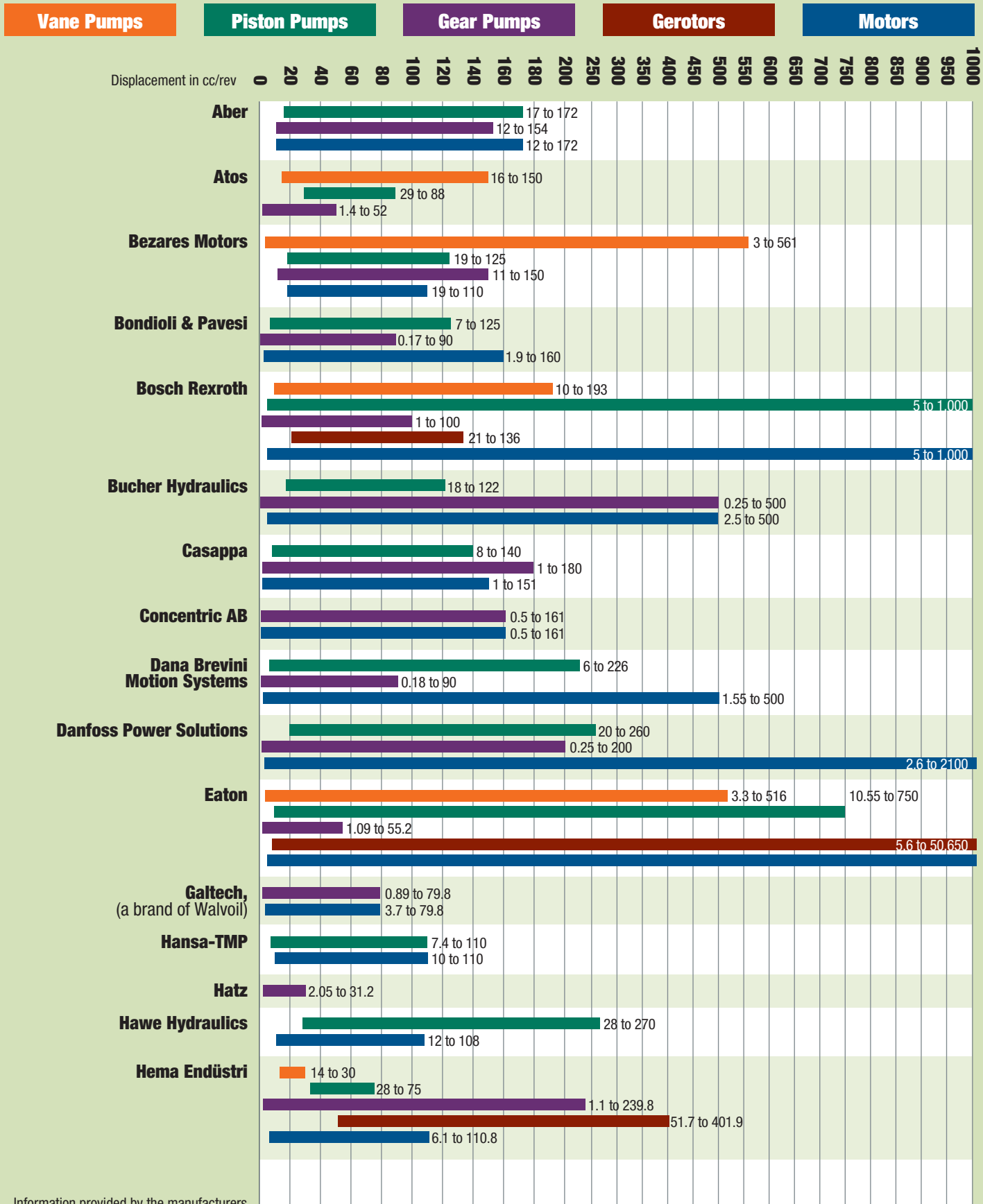
The S6 valve for SAHR brakes is available with several optional and customisation choices, which allow the manufacturer to adjust the product according to customer requirements.

Among the available options are hydraulic remote control, a sensor for push rod position and inching function coupled with the transmission, and customisation of pedal force. The available brake pressure is 110 bar (+5/-3 bar), adjustable on request.

The port dimensions are larger than the standard used by Safim (M18 x 1.5) to reduce any sudden pressure drop. An additional pressure port is available on request, which helps to control brake output pressure.

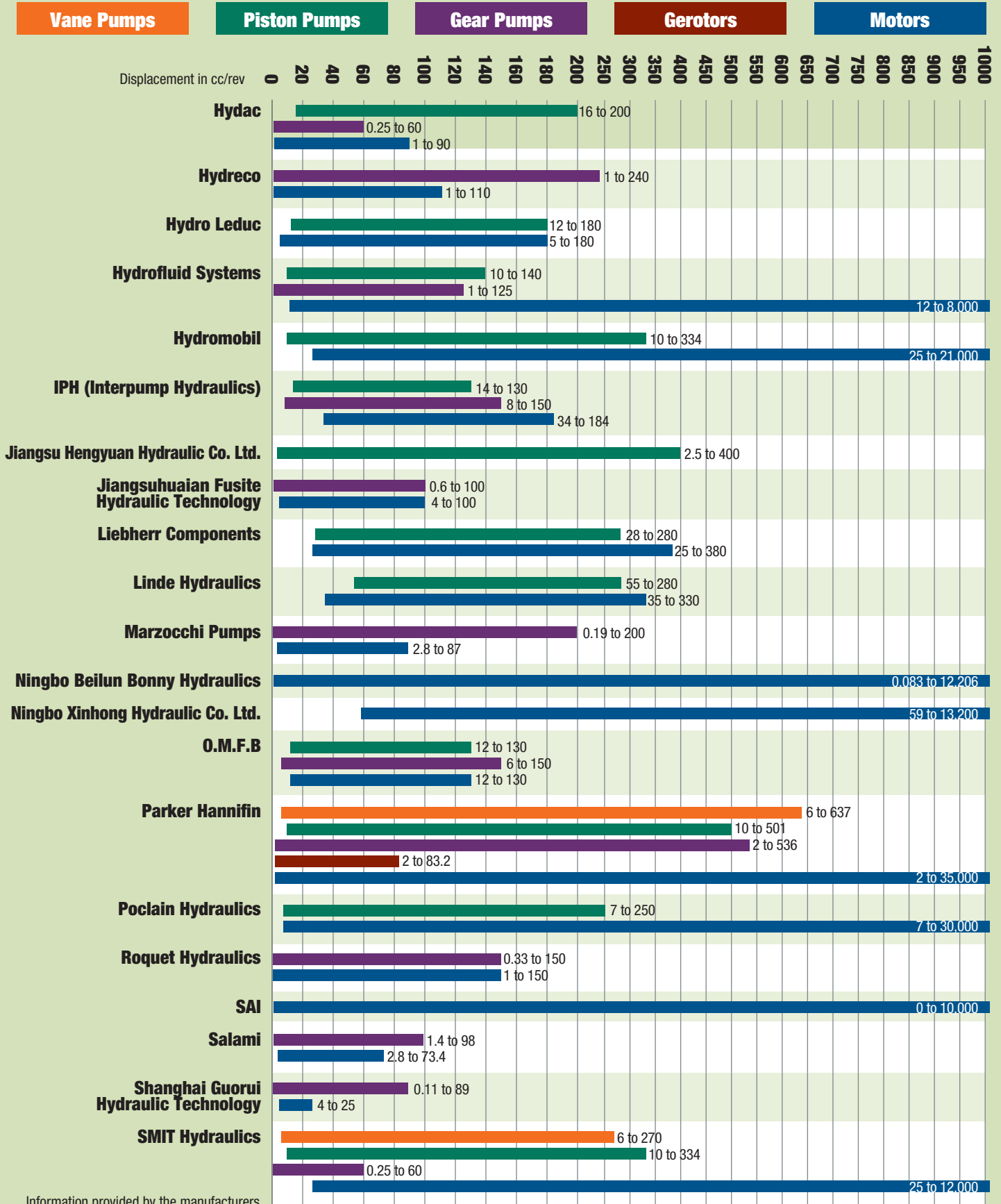
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2021 MOBILE HYDRAULIC SPECS-AT-



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Chris Sleight
Managing Director
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Research

 **Tuesday 14th December**

 **10.00 am EST | 3.00 pm BST | 4.00 pm CET**

Changing buying patterns for construction equipment in Europe

The webinar will focus on data drawn from the company's new Customer Group Database Service. It will look at the market from the point of view of broad customer groups such as contractors, extraction industries (mining & quarrying) and rental, and look at how the proportion of equipment sold to these customer groups has changed over the last decade.

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**CONSTRUCTION
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DPI takes a closer look at the F36 engine from FPT Industrial

Clean bill of health

In October this year, Case Construction Equipment unveiled the latest in the company's SV series of backhoes. This is one of the first applications using the new F36 engine from FPT Industrial. To find out more about the new engine's specifications and capabilities, Diesel Progress International spoke with Umberto Celestini, product manager at Case Construction Equipment, and Giorgio Strata, product marketing manager, Construction, at FPT Industrial.

The new F36 engine is based on the previous F34; the latter was introduced in 2007. As the naming convention suggests, the former 3.4 L version now has a 3.6 L displacement. Featuring a cast-iron block and head, the four-cylinder engine has a bore and stroke of 102 x 110 mm. The 1800 bar electronic fuel injection system was carried over from the F34, while the turbocharger is supplied by BorgWarner. Total dry engine weight is 320 kg (705 lb).

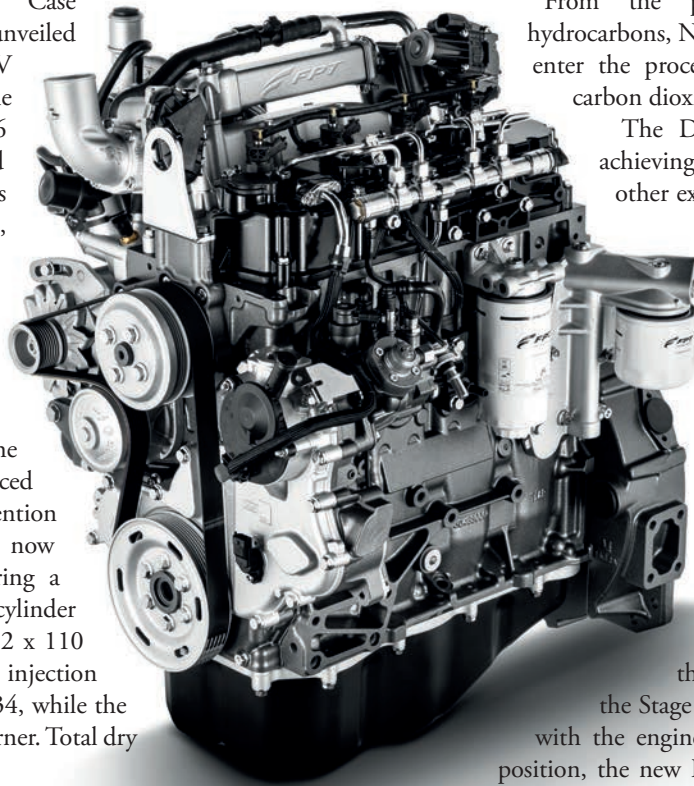
While the F36 delivers up to 82 kW (110 bhp) and 460 Nm (339 lb ft) of torque in the SV backhoe, the engine can produce up to 105 kW (140 bhp) and 600 Nm (442 lb ft) of torque, a 14% increase in power and a 20% increase in torque over the F34.

"The F36 has been designed to address customer requirements across a variety of applications which require higher performance from a compact engine," explained Strata.

CUTTING EMISSIONS

The engine features what is billed as the HI-eSCR aftertreatment system to achieve EU Stage 5 compliance, but as Celestini pointed out, the additional hardware required to meet the stringent emissions levels has not increased the overall engine size (L: 714 x W: 601 x H: 852 mm).

"We achieved emissions reductions using three key additions to the engine; a selective catalytic reduction (SCR) filter, urea treatment and a diesel particulate filter (DPF)," he said. Going into more detail, he outlines how the exhaust gas first enters a diesel oxidation catalyst, after which urea/AdBlue is injected into the stream. The emissions flow then passes through a particulate filter and the SCR for NOx reduction.



The F36 engine powers the new SV backhoes from Case Construction Equipment

From the particulate matter, unburned hydrocarbons, NOx and carbon monoxide which enter the process, the end result is nitrogen, carbon dioxide and a small amount of water.

The DPF is the key component to achieving Stage 5 compliance. "As with other examples, the system will burn off the captured particulates in a burn cycle," said Celestini. "But our system uses a lower temperature which helps to avoid clogging in the DPF."

"The low temperature also suits the stop-and-go nature of the work cycles the engine will support in off-road applications," added Strata.

Another feature is the system is the SCR, which while critical to delivering Stage 5 compliance, is the same size as the equivalent component from the Stage 4B F34 engine. This means that with the engine mounting points in the same position, the new F36 engine is effectively a plug-and-play replacement for the F34, which Celestini says had total sales of about 500,000 units since 2007.

MAINTENANCE SCHEDULE

Chemical components and the logic software controlling the ECU are delivered by suppliers, as are system sensors. But the emissions reduction system features 13 patents related to parts and functions developed in-house by FPT.

Despite the new tech, the F36 carries over the same maintenance schedule as the engine it replaces. Celestini: "[The engine] is rated for 600 hours agricultural and 500 hours construction and other light applications. Other engines have 1000-hour schedules, but we think our schedule and the total operating costs will suit end users. It's still 20% longer than the market average."

Despite the hardware additions, the engine retains the one-side access for all consumables, allowing maintenance to be completed on site.

With the launch of the F36 in the SV series of machines, Case and FPT Industrial are now looking forward to the market launch of the smaller F28 2.8 L engine, a modular power unit which will offer diesel, diesel hybrid and natural gas-powered versions.

dpi



The F36 has been designed to address customer requirements across a variety of applications."

GIORGIO STRATA,
FPT Industrial

FORECAST 2022

While markets generally remain on an upswing, the changes brought about by COVID and part supply issues could still have an effect on machine markets

Buoyancy

Off-Highway Research's forecast prior to the global COVID-19 pandemic was for a modest decline in sales from 2020-2022, before the resumption of growth. Rather startlingly, the forecast for 2021 and beyond is now generally better than was expected prior to the COVID outbreak.

The fundamental components of this are continued high volumes in China in 2021, a result of the stimulus put in place in March and April 2020, combined with a sales bounce back in other countries around the world, generally in the order of 5% to 15%. These increases should take global construction equipment sales to a record high in 2021.

The buoyancy is such that it is not so much whether there will be a demand for equipment, but whether manufacturers will be able to meet that demand. History has shown that a global volume of 1 million units or more can equate to supply shortages in critical components, particularly hydraulics. Then there are the complications of shipping capacity, costs and waiting times.

LATEST FORECASTS

China had been expected to experience a modest 3% growth in unit sales in 2021. The updated forecast foresees a 2% decline. Having experienced an extremely buoyant first quarter of 2021, the Chinese market clearly started to cool from April onwards. Even so, the volume of machines sold in the country this year will still be very high in absolute terms.

While China is performing slightly worse than previously expected, the

Low interest rates and the expectation of stimulus spending will see a record number of construction machines sold this year. **By Chris Sleight**

rebound in many other parts of the world is proving more robust than was anticipated at the start of the year. The European market is now projected to rise 15% in 2021, while North America will grow 13%.

A 1% rise in construction equipment sales is now forecast for Japan in 2021, as opposed to the expected downturn. This rise will build on the modest increase in sales seen in 2020 as the government increased spending on public works. This will take the market to its highest since the early 2010s, when a combination of stimulus measures and reconstruction following the 2011 earthquake and tsunami caused a sharp spike in equipment demand.

The forecast for India has been downgraded from the expected 15% increase to an 11% rise in sales this year, compared to the low seen in 2020. This

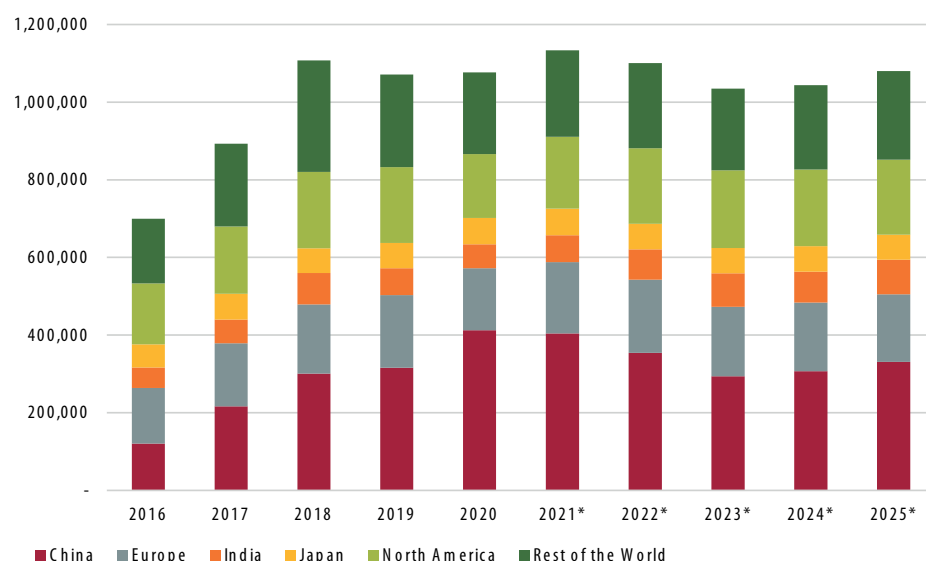
is largely due to the second COVID wave which swept through the country in the second quarter of 2021.

The outlook for the rest of the world remains unchanged, with the expectation of a 6% rise in sales this year.

Beyond 2021, the forecast is for equipment sales to remain high worldwide. This is broadly based on the premise that residential markets will remain buoyant, driven in part by ultra-low interest rates, while stimulus spending around the world will be a trigger for sales of larger equipment.

On the other hand, Off-Highway Research has concerns about the non-residential building segment in the aftermath of the COVID pandemic. With so many office workers around the world adopting home working and video conferencing technologies since the pandemic took hold, there are questions as

GLOBAL SALES OF CONSTRUCTION EQUIPMENT BY REGION, 2016-2025*(UNITS)



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remains

to whether this 'new normal' will remain once the health issues recede.

It seems likely that many will wish to continue working from home. Many employers will likely be open to this idea, particularly if it means they can save money on expensive office space. Similarly, business travel may be permanently reduced, replaced by the much cheaper and less time-consuming practice of video conferencing.

This would all equate to a much lower requirement for various types of non-residential structure, from offices to travel hubs (both international and commuter)

and all that goes with it, such as restaurants and hotels. The reduced need for these structures will impact on the equipment used to build them, although many of the key types such as foundations equipment, concrete machinery, tower cranes and materials hoists are outside the scope of Off-Highway Research's coverage.

MEDIUM TERM OUTLOOK

Prior to the pandemic, a downturn was expected in global construction equipment sales. But the peak of 2018-2019 has been extended for at least an additional two years. This could mean

that when the slowdown comes there will be excess late-model equipment in fleets around the world, with much-reduced construction activity to occupy it. This could act as a barrier to new equipment sales, exacerbating the slowdown.

To what extent this affects the market remains to be seen. The difficulty in forecasting in this area is that the deciding factor will be government policy in the months and years ahead. This is a challenge at the best of times, but even more so when governments themselves are in uncharted territory and can only react as the situation unfolds.

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Baby steps to recovery

On-going supply constraints across the global truck and bus markets present an uncertain outlook for commercial vehicle (CV) markets through the remainder of 2021 and into 2022. Despite the drop due to the COVID-19 pandemic being less than expected in most global markets, supply chain issues and legislative headwinds have been causing headaches for OEMs and suppliers. The overall outlook for 2022 is a very modest increase in global production to 3.5 million units, up from 3.4 million in 2020 and 3.45 million in 2021.

On the back of stimulus, scrappage and emissions pre-buy programmes, the

Aftershocks of the COVID-19 pandemic remain, leaving commercial vehicle industry to focus on achieving reduced emissions targets. **By Alex Woodrow**

China market started 2021 on a high note. This, in advance of July's China 6 emissions legislation. Some provinces allowed China 5 to continue through September, but nationwide volumes have collapsed over the past quarter. Data for September showed an improvement in volumes, but the seasonally-adjusted selling rate remains much lower than in 2020, dragging down global Heavy Truck >16 tonnes volumes.

has remained quiet. Larger fleets have anecdotally been reducing overall fleet sizes, suggesting new sales of BS-6 lower-emission vehicles will only recover slowly, possibly taking until 2028 to reach 2018 levels.

North American volumes rebounded well from COVID. The expected downturn was considerably smaller than forecast early on in the pandemic, but numbers were still 20% down. That said, OEMs are at capacity, restrained by material shortages and logistics issues. Total production is forecast to reach 475,000 units in 2022, just short of the 2018 peak of 480,000 units.

In Europe, which has a higher export market share than North America, volumes have rebounded in 2021 where they are up over 10% on 2020. Demand may see growth of over 10% into

ABOUT THE AUTHOR

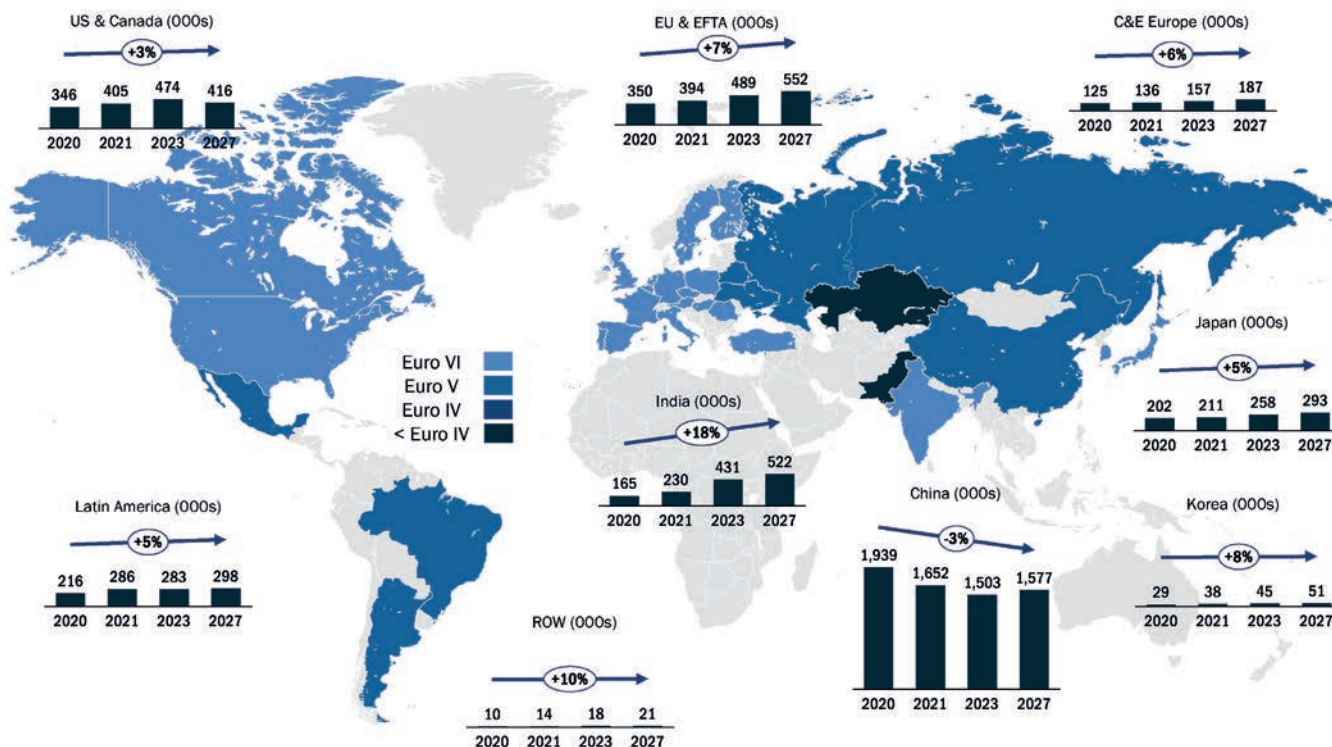


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GLOBAL VOLUME OUTLOOK

The India market continued to track lower at the start of 2021, but it is expected to recover to more than 300,000 units in 2022. That is still a long way short of the 544,000 units moved in 2018. With COVID rates still high and a lack of financial support for individual owner operators, this backbone of Indian sales

GEOGRAPHIC SCOPE (PRODUCTION 6T+)



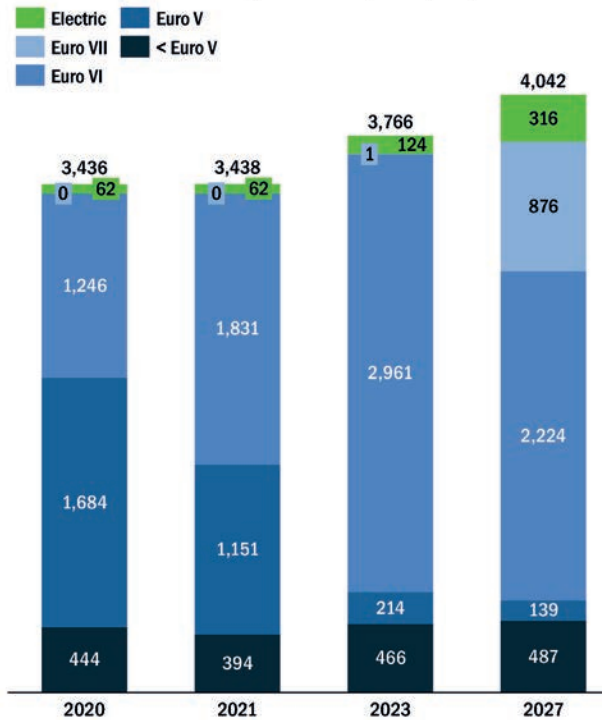
2022, subject to the following caveats.

Semiconductor shortages are the main concern for many OEMs and Tier 1 companies in the short-term forecast. Shortages are expected to continue until well into 2023 when new chip fabrication capacity comes online. The impact has been to limit availability in what has been a fairly buoyant market. However, semiconductor shortages are not the only bottleneck, with other materials also in limited supply and subject to significant cost increases. Shipping prices and capacity are also at critical levels.

Whilst trying to minimise the impact of supply constraints and COVID, the trend towards full electrification has continued apace. This time last year, KGP identified 750 electric and hybrid models already on the market or close to market launch. This year, more than 1100 are in the November Truck and Bus Electrification update.

We can expect new policies supporting electrification and zero-emission vehicles from the COP26 climate conference. Alignment of global net zero policies may also drive further decarbonisation. Many major markets are looking to decarbonise new commercial vehicles by 2040, with the aim of reaching net zero by 2050. But it remains to be seen whether investment

CV PRODUCTION BY EMISSIONS COMPLIANCE (000s)



KGP LMC Global Commercial Vehicle Powertrain Forecast GCVPTF Quarter 3 2021

in energy generation, distribution and charging infrastructure keeps pace with those new fleets.

It will be critical to incentivise smaller fleets worldwide, with larger, dedicated for-hire fleets being in the minority. Owner operators will be more reliant on public infrastructure and support for investment in new trucks and buses. In Europe, infrastructure investment will continue as zero-emissions vehicles are incentivised through EU policies supporting renewable fuels, including green hydrogen, but the longer-term view

in other regions looks more uncertain.

While it's difficult to predict new legislation, there is likely to be tighter noxious emissions regulations in North America and Europe by 2030, alongside the stringent greenhouse gas reduction targets. The Cleaner Trucks Initiative from the EPA has morphed into the Cleaner Truck ACT under the new administration. The rulemaking for that legislation has been postponed from July 2021 to the end of 2022, but with the same effective date of 2027.

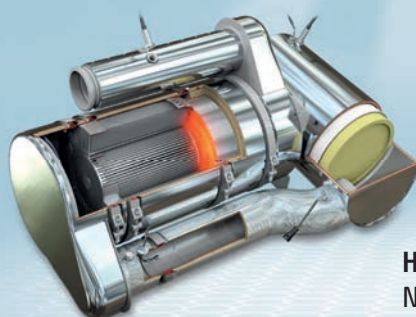
The other area that could see significant development from 2022 onwards is the hydrogen ICE. Although not strictly zero emissions, the very low NOx and PM emissions may see the engines qualify as such under current EU legislation.

As doubts continue in the short term over battery electric for long haul applications and with questions over the potential of fuel cells, hydrogen ICE is seen as a potential stepping stone. But the tech could be reliant on green hydrogen production, which is still in its infancy and considered by many commentators as unsuitable for transportation due to its poor well-to-wheel energy efficiency. **dpi** 47>

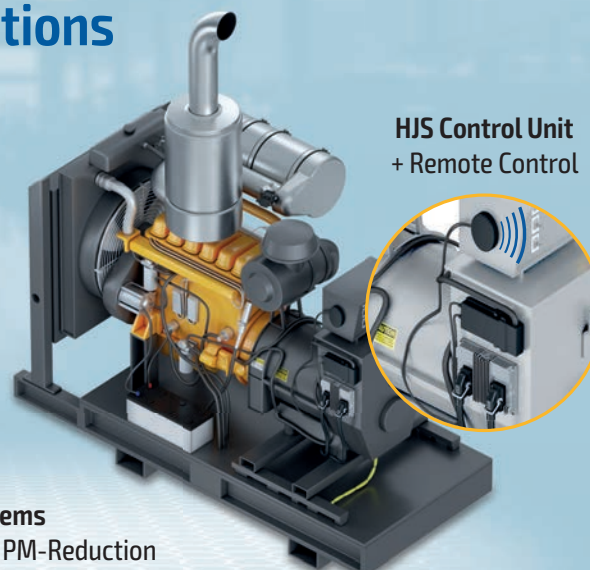
This update from KGP was written by Alex Woodrow, Managing Director of KGP, supported by CV Senior Consultant, Paris Kiernan, and with thanks to LMC Automotive and ACT Research.

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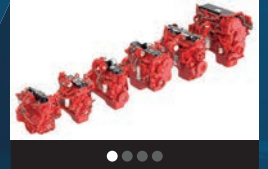
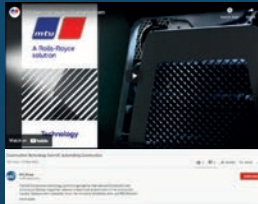


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Rebounds aplenty across sub-750 kVA markets

The sub-750 kVA generator market was hard hit by the COVID-19 crisis in 2020, with a decline of -18% (vs.2019). But the recovery that began in Q4 2020 has carried on into 2021 (+ 18% in 2021) and the market has rebounded to where they are close to pre-crisis levels, specifically for small generators (< 75 kVA). In 2022, growth is still expected (at least in the first part of the year), thanks to the construction sector and also those geographic regions which were exposed to the pandemic at a later date.

However, this market turnaround must take into account the sharp rise in production costs and supply constraints. The market is strongly impacted by price increases (alternators, enclosures, transport), even if it seems ready to absorb these increases in the face of a products shortfall and strong customer demand. The market will therefore grow much more significantly in value in 2022 (+ 13%) than in units (+ 3%).

The gap between supply and demand is now so large that the supply chain is under pressure. New issues continue to emerge, mainly in the supply of components to generator assembly lines. The lack of stock at many manufacturers and dealers creates a scarcity effect that puts pressure on assembly lines and significantly lengthens lead times.

OUTLOOK BY APPLICATION

On a global scale, the main market drivers

for sub-750 kVA generator sets are the industrial and construction sectors, the telecoms market, agriculture, rental groups and residential groups. Here are their trends for 2022.

MOBILE AND RENTAL: The market weathered the crisis better than expected, thanks to the new COVID testing and vaccination centres. This off-set the sharp drop in demand from events. In addition, 2021 saw the construction sector take off very strongly, and rental companies have massively reinvested in new fleets. The market is expected to stabilise in 2022.

INDUSTRY AND CONSTRUCTION: The construction sector is boosted by the various stimulus plans in different countries and should continue to grow in 2022. However, it will be necessary to monitor the price of construction materials and also the Chinese real estate market, which represents a threat to this growth.

TELECOMS: This sector was the least affected by the crisis, driven by investments in 5G particularly in the United States and China. This segment should continue to benefit from investments in new technologies in 2022, reinforced by an ever-increasing need to secure cell towers.

FORECAST BY REGION

CHINA: The market is split between an ever-dynamic telecom sector (5G), a sustained construction market, and recent power cuts boosting the market for generators. On the other hand, there is the possibility of a bursting real estate bubble and problems

on assembly lines linked to the electricity shortage. The market is expected to grow by 5% in volume in 2022.

SOUTH EAST ASIA: The market is still far from its pre-crisis levels, in part due to a tourist industry which is struggling to restart. 2022 is expected to see sustained growth (7% in volume), but even then the market will still be 4% below 2019 levels.

INDIA: After a return to strong growth in 2021, the market should continue to grow in 2022, but in a more measured way thanks to investments from companies and retail. The market is expected to grow by 5% in volume in 2022.

EUROPE: In Western Europe, after extremely strong growth in 2021, the market is expected to stabilize or even consolidate, at least in units. Likewise in Eastern Europe, the market is expected to remain stable after sustained growth in 2021.

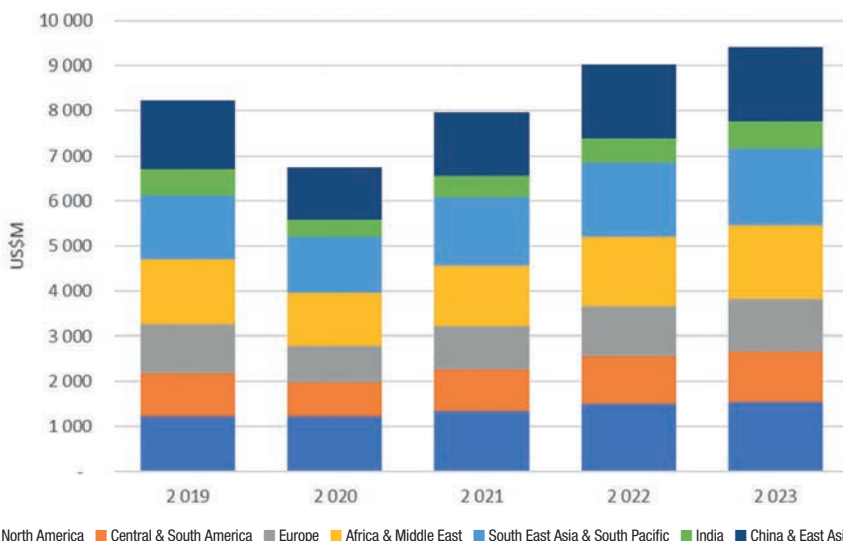
AFRICA AND MIDDLE EAST: These two markets, which have been severely affected by the crisis, are finding it harder to return to their pre-crisis levels. Issues relate to an often undiversified economy, the boom in renewable energies, the dependence on government investments (in the Middle East), and the high dependence on foreign investment and commodity income in Africa. The market is expected to grow by 2% in volume in 2022.

NORTH AMERICA: The market is in full euphoria for residential groups, even though they are now overwhelmingly gas. The telecom sector, mobile groups and construction are all drivers that will continue to grow the market in 2022.

SOUTH AMERICA: The region is one of those which will benefit from growth in 2022, particularly due to the economic dynamism of Brazil, supported by the construction sector and major infrastructures. The market is expected to grow 4% in volume in 2022.

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GLOBAL MARKET OF DIESEL GENERATORS (sub 750 kVA)



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The start of better things

Regional market is set to continue tracking upwards in 2022. By **Mauro Belo Schneider**

Brazil's construction machinery production has grown over 2021 in comparison to 2020, when the global pandemic hit the country and forced many companies to shut down. Data from the Brazilian Industry Association (ABIMAQ) show that 23,877 machines were produced between January and August of this year, an increase of 75.8% over the same period in 2020. International sales reached 6398 units (+70.1%).

The problem now facing machinery producers is a global rupture in the supply chain. According to Alexandre Bernardes, president of the Machinery Chamber at ABIMAQ, it has been difficult to buy raw materials and finished products, including resin, tyres and electronic components in South America. "Our global logistics turned upside down. Corporations have never faced such a challenge," he said in an exclusive interview with Diesel Progress International.

Weakening currencies have also created difficulties across South America. "There was an increase in price for the acquisition of raw material, like steel, and for transport in all modals," Bernardes said.

But the last 12 months will still be considered largely positive, primarily due to the numbers coming from activity in construction, rentals and agriculture. The expectations for 2022 are even better. "Many concessions and auctions made in the country over the last two years will start operation, which will boost the need for machines,"



explained Bernardes.

There's more to be optimistic about looking forward. COVID-19 infections in production plants have been controlled and measures adopted to reduce cases. This has helped production regain its momentum across the region.

TRUCKS AND BUSES

The truck market is currently hot, too. Roberto Leoncini, vice-president of Sales for Trucks and Buses at Mercedes-Benz do Brasil, said that vehicle manufacturers are struggling to meet demand. "There are already significant orders placed for 2022, which indicates the market will continue to be quite heated next year," he stated.

Mercedes-Benz has created a committee to monitor the supply and production processes so as to minimise the difficulties of supplying the local and

Roberto Leoncini,
Mercedes-Benz do Brasil

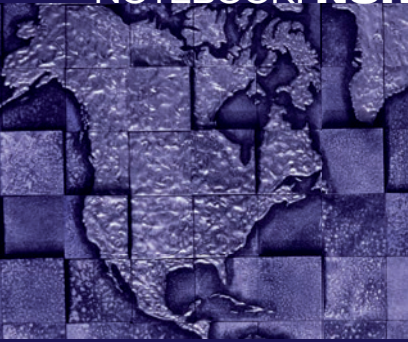
global logistics networks. The biggest challenges are related to the delivery of electronic components, such as semiconductors and chips, as well as some chemicals, metals and plastics.

Looking at the bus market, Mercedes-Benz is expecting a recovery on the back of a wider vaccination programme. "People will feel more confident going back to using public transport. Both in the urban and road segments, the most affected by COVID-19, the market should develop well, with companies able to recover financially. With more passengers on buses, this could lead to a new fleet renewal in 2022, cancelling out the low volumes of purchases in the previous two years," added Leoncini.

Despite the pandemic, the current investment cycle of Mercedes-Benz do Brasil has been maintained as planned, reaching R\$ 2.4 billion for the period 2018-'22.

"The company is the leader in sales of commercial vehicles in Brazil. In 2020, it achieved leadership in the truck segment for the fifth consecutive year. In the bus segment, we have held the top spot for 64 years," noted Leoni, saying that the booming markets for trucks now include agribusiness, e-commerce, civil construction and mining.

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Speedbumps on the road to recovery

Volvo Penta of the Americas enjoys strong market demand, while supply chain turbulence rocks the boat. By **Ronnie Wendt**

After navigating a world of masks, social distancing and government-enforced lockdowns, Volvo Penta of the Americas now finds itself in new territory featuring unprecedented demand and extraordinary supply chain challenges.

“Fueled by lifting restrictions, government incentives and other factors, nearly every sector we service within the North American market is experiencing growth,” says Martin Bjuve, president of Volvo Penta of the Americas. “As the recovery progresses, we’re seeing an uptick in order intake and deliveries across the board from segments such as materials handling, construction, power generation. But while market demand is pulling in one direction, a turbulent supply chain challenges the ability for OEMs to keep pace.”

North American companies – Volvo Penta included – are seeing unprecedented demand as the country emerges from

its pandemic cocoon. But Bjuve is asking how long will it last.

“Barring any major disruptions, the outlook is good through at least the next year,” says Bjuve. “There’s a lot of liquidity in the marketplace right now. Organizations want to invest and the government is injecting funds into the economy. These forces create revenue opportunities for those serving industrial segments. There is also strong optimism around the progression of the Infrastructure Bill and the opportunities it would present should it pass.”

Still, Bjuve warns the “constraints of a tremulous supply chain are being felt in every corner of the industry.” And, he adds, equipment manufacturers are stuck in the middle. “They have a strong order

book but are struggling to fulfill as their portfolio of suppliers tries to mitigate shortages in semiconductors and other resources.”

OEMs are also wrestling with higher costs and increasing inflation, but Bjuve stresses Volvo Penta remains in a strong position. “Being part of the larger Volvo Group puts Volvo Penta in a position to better support our customers,” he says. “We’re able to leverage the size and scope of the group, tapping into broader resources to source suppliers and support production.”

SUSTAINABLE SOLUTIONS

The Biden administration has focused on the effects of climate change and electromobility. As a result, expectations for reduced carbon footprints and more sustainable solutions now take center stage.

Bjuve says Volvo Penta is committed

to extending its footprint within the North American off-road and power generation segments with ever-more sustainable options. “We have proven, reliable Tier 4 Final and Stage 5 solutions that deliver a clear ROI.”

He says Volvo Penta also plans more investment in sustainable and connected solutions. Bjuve: “Leveraging the expertise and experience of the Volvo Group in emerging technologies, we see it as our responsibility to guide customers through the transformation into electromobility.”

Volvo Penta’s partnership with TICO provides a prime example. In March the companies announced plans to introduce an emission-free, electric terminal tractor. “TICO’s decision to partner with Volvo Penta was based on our ability to deliver proven electric driveline technology,” he says. “This end-to-end partnership approach will be the cornerstone of our expansion into electromobility within the US market.” **dpi**

Martin Bjuve,
Volvo Penta of
the Americas



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