DIESEL international

DIESEL SUPPLEMENT
3 March 2018
Vado e Torno Edizioni srl,
Via Brembo 27, 20139 Milan.
Phone: +39 02 55230950
Authorized by the tribunal of Milan
n. 786 of 17 december 1990
Managing director:
Maurizio Cervetto.
Print: Industrie Grafiche Rgm srl,
Rozzano (Mi), Italy.

9 LITERS GERMAN STYLE

DIESEL international

DIESEL SUPPLEMENT
3 March 2018

CONTENTS

OEM&ENGINES

DIESEL OF THE YEAR

4

DEUTZ TCD9.0

Eight years after the TCD2.9 Deutz wins the Diesel of the year for the second time. The award-winning engine is the TCD9.0, the first-born of the liaison with Liebherr, which deeply changes the 9-liter segment and shows a silhouette worthy of high fashion catwalks

DUBAI AND PARIS

MIDDLE EAST ELECTRICITY
ENERGISING THE INDUSTRY
6 – 8 MARCH 2018
DUBAI WORLD TRADE CENTRE, UAE

INTERMAT
PARIS
23 - 28 APRIL 2018
INTERNATIONAL EXHIBITION FOR CONSTRUCTION AND INFRASTRUCTURE

OUTSTANDING FIGURES

The TCD9.0 is the Diesel of the year 2018. The two winning cards of the ace of Cologne are competitive length and width compared to six cylinders, 1.1 liter cylinder engines and an unusual displacement for the 'German school' in a 'hot' range. Deutz is the most active manufacturer in 2017

It was 2010, as shown in the box coming from the May issue of that year, and Deutz was the winner. The Diesel of the year awarded the 2.9 liters, the "little" from Cologne. Since then, things have changed: the bottom of the range is represented by the odd 2.2-liter, also available in LPG version, like the 4-cylinder Doty 2010, and much has changed especially in the upper part of the Deutz engine range. The TCD9.0 introduced at Bauma China is the pioneer of the new family of in-line units that will join the V classics and will raise Deutz's quotations on heavy duty applications and machines needing power above 150 kilowatts. The TCD9.0 is the Diesel of the year 2018 and will receive the investiture in the usual earthmoving theater at the Intermat in Paris. From Bauma Munich, that hosted the award ceremony eight years ago, to the event in Paris, via Shanghai, Bauma China, where the TCD9.0 was introduced to the public.

For every application

Deutz's name crosses the three big coordinates of the industrial free market: earthmoving, agricultural and power generation. Since Volvo left its shares Deutz has been credited as the main European player of the free market and has interpreted this role with a dynamism that makes it the most dynamic engine manufacturer, both in terms of new products and strategy. The strong segmentation of the engine range, the gasification of the 3.6 liter along with Same Deutz-Fahr, the LPG on the 725 cc cylinder, the acquisition of Torqueedo to push on electrification are all factors that make Deutz the star of 2017.

Let's go into the details of TCD9.0. Why this engine?

The 9-liter displacement has always been marginal and substantially alien to the German engine philosophy, more inclined to unusual displacements like the 10.5 liters one. Among the protagonists of the transition to Tier 3 we find the Americans - Caterpillar, Cummins and John Deere, the Swedes, with the odd Scania and the 6 in line by Volvo, and Fpt Industrial (once Iveco Motors). Currently in this range we find the new D1556 by Man and its twin by Liebherr. Here comes another interesting page of this story. Ruling under 4 liters and struggling with other competitors in the range above this displacement, Deutz has found an agreement with Liebherr for a quartet that includes the 9, 12, 13.5 and 18 liters in the range from 200 to 620 kW.

Gebhard Schwarz, Managing Director of Liebherr-Component Technologies, stated «*thanks to its worldwide distribution network and its comprehensive service opportunities, Deutz can reach new potential users with the engines resulting from this collaboration*».

Mr Hiller says

Frank Hiller, President of Deutz, explains that «*The new engines that are the result of this cooperation are perfectly complementary to the current Deutz family, allowing us to expand the power range and possible applications. This way, customers will benefit from our integration and service skills*».

Besides that, this award is a sign of continuity with 2017, which marked the triumph of Liebherr's D9812. From a technical point of view, the winning card of the 9 liters by Deutz is the size of the only 4 cylinders in a range ruled by 6 cylinders and the 5 cylinders by Scania. This formula is a theme, but the TCD9.0 coordinates are particularly appealing even more looking at Stage V and downsizing to host hybrid modules.

Let's look at depth, which along with a structural sump fits the needs of open field tractors and construction machinery featuring short wheelbase and narrow wheel track. At 838 mm the TCD9.0 is positioned just about 14 percent behind the average of the 5 liters on the market (from Deutz itself to Isuzu, Jcb, Mtu and Agco Power), doing even better than Volvo. The length is one meter (1,015 mm); we compare it to the Tier 4 Final compliant engines in the 6.7 - 7 liter range. The TCD9.0 by Deutz is the narrowest engine block, delivering a power more than 25 percent above the average and more than 30 percent torque. The 9-liter delivers 300 kW at 1,900 rpm and 1,700 Nm at 1,200 rpm.

No EGR

In this case, Deutz didn't use exhaust gas recirculation, a solution that is affected by Liebherr phylosophy but could also be used on other small displacement units. EGR stays on the monoblock for unregulated countries, but relieves the end user from the burden of the after-treatment. **Fabio Butturi**

AND THE WINNER IS... DEUTZ

Brand Model	DEUTZ TCD9.0
I. D.	
B x S mm - S/B	135 x 157 - 1.16
N. cil. - dm³	4 - 8.98
Maximum power kW - rpm	300 - 1,900
Mep at max power bar	21.5
Piston speed m/s	9.9
Maximum torque Nm - rpm	1,700 - 1,200
Mep at max torque bar	24.2
% power at max torque (kW)	46.5
Torque at max power Nm	1,509
% power at max torque (kW)	71 (213)
Work range rpm	700
DETAILS	
Specific power kW/dm³	33.3
Specific torque Nm/dm³	188.5
Areal spec. power kW/dm²	52.36
RULES AND BALANCE	
Dry weight kg	750
L x W x H mm	1,015x838x1,116
Volume m³	0.95
Weight/power kg/kW	2.5
Weight/displacement kg/dm³	83.4
Power density kW/m³	315.8
Total density t/m³	0.79
Displacement/volume dm³/m³	9.46
SPECIFICATION	
Emission level	Stage V
Injection system	common rail
Techno	DOC, DPF, SCR
INDEX	
Torque	10,3
Performance	7,1
Stress	11,4
Lightness	11,5
Density	13,9
DIESEL INDEX	7,8

TCD2.9: Doty 2010

The Diesel of the year 2010 TCD 2.9 at Bauma Munich.

The TCD 2.9 is the Diesel of the Year 2010. The ceremony took place on 19 April at Deutz stand during the Bauma in Munich, where Gino Mario Biondi – in charge of Deutz AG product development received the prize. The four-cylinder by Deutz has won because it is characterized by innovative technical solutions and because it represents an important innovation for Deutz production. The TCD2.9 will be available in two different versions, aspirated and turbo. The first one delivers 36.9 kW at 3,000 rpm and a maximum torque of 147 Nm at 1,600 rpm. The top of the range is, instead, a supercharged model that delivers 55.9 kW at 5,500 rpm and a Mep of 9 bar. The engine is particularly compact and entrusts the injection to common rail. Emissions control relies on recirculation of exhaust gas, while particulate filter is not required.

THE WINNER IN A GLANCE

Model	DEUTZ TCD 2.9	
B x S mm - S/B	92 x 110 - 1.2	
N.cil.- dm³	4 - 2.9	
Max power kW/rpm	36.9 - 3,000	55.9 - 2,600
Mep bar	5.15	9
Specific power kW/dm³	12.6	19.12
Areal specific power kW/dm²	13.88	21.03
Piston speed m/s	11	9.53
Max torque Nm/rpm	147 - 1,600	252 - 1,600
Mep at max torque bar	6.45	11.06
Specific torque Nm/dm³	50.3	86.2
Torque at max power Nm	117	205
Torque rise %	25	23
% Power at max torque (kW)	66.8 (24.6)	75.6 (42.2)
Work range rpm	1,400	1,000
Emissions	Stage IIIB - Tier 4 interim	
Injection	Common rail	
Details	2V	2V turbo aftercooler
Techno	EGR	

YANMAR TN. AT THE TOP...

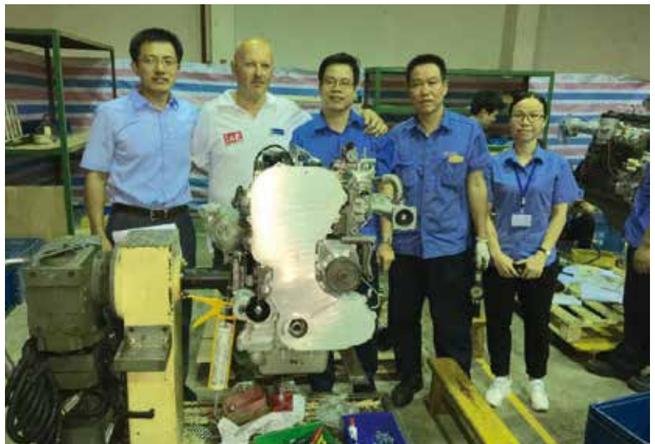
The echo of Yanmar's announcement sounded loud. **4TN 101** and **4TN 107** will be unveiled at Intermat. Thanks to these new entries Yanmar moves up the threshold: thanks to the first series, the 3.8 liters burst strongly into the top range of compact engines featuring power rates in line with 4 cylinders, 1 and 1.1 liters per cylinder, delivering from 56 to 129 kW. With the second product family the 4.6 liters will reach 155 kW and a torque curve up to 805 Nm. The Yanmar formula for Stage V homologation maintains EGR and double module for SCR and DPF. This is the answer to the cousins from Osaka, Kubota, which is gaining great success with its 3.8 liters and announced in Las Vegas the launch of the V5009 in 2020, a 5 liters delivering 155 kW.
The Japanese then leave the enclosure of medium and small sizes to expand their applications and look to excavators and wheel loaders more performing than those at home (sold by both Kubota and Yanmar) and open field tractors.
Yanmar is at MEE in Dubai after having redesigned the borders of its organization. Middle East and Africa are no longer controlled by Japan but by Yanmar Europe, under the guidance of Sidath Weerakoon and Emilio Tognetti.

4E-CONSULTING. PRODUCT ENGINEERING SPEAKS ITALIAN

A bridge to East

From Ferrara, a city to the eastern border of the motor valley and the Emilian mechatronic district, since 2010 4E Consulting designs from scratch engines for mobile applications, on and off road. Rooted in China and Iran, they have an hybrid on the launch pad

4-E Consulting and the Italian way to product engineering. Tier 4 Final e Stage V are the latest stages of a marathon that squeezed the diesel, scrupulously improving its combustion parameters. Engineering consulting companies often support engine manufacturers, being Ricardo, Avl and Fev the best known. In Italy there's one of that kind – at least looking at its mission - in Ferrara: 4EConsulting. A team of engineers that perfectly combines the 'glocal' model: roots in the Emilian motor valley, eyes on the world chessboard and in particular on the Far East. 4e-Consulting started a couple of research projects together with the University of Modena and Reggio, in particular the 'Up-to-date' re-edition of a two-stroke fast diesel introduced at Sae. **Iae (Intercontinental automotive engineering)** is a 4E-Consulting joint venture in China, in Nanchang (Jiangxi), and is its bridgehead in that area. More logistics and commercial bases of 4E-Consulting can be found in India and Iran. And it is right from Persia that interestig news are xpected under the bonnets of heavy maachines with a 6 cylinders in line, 2-liter cylinder, currently in an advanced stage. Among the pillars of the success of 4E, flexibility, no process downtimes and team building, which led to the development of four engines from scratch, from 1.1 to 3 liters, and several other projects in the homestretch. We asked Paolo Patrocini, who has founded 4E in 2010, a brief summary.



Let's make a high-sounding name: Yuchai.
After the development of a 4 cylinders light duty truck euro VI, Yuchai asked us new orders, we are performing a series of test cycles on their large displacement diesel engines (6M series) focusiong on friction optimization. In order to carry these tests we prepared a large special friction test bench in our facilities where we are currently testing engines and components in team with Chinese engineers.

Hybrid: any ideas?
By summer we will have the first prototype of off-highway vehicle with parallel hybrid powertrain. ***I can say that the engine will*** *be our Xinchai (3 or 4 cylinders Stage IV) and the hybrid system is developed in house with made in Italy components. I want to clarify that this is not a formal exercise at all, because the end customer has an ambitious market plan for this application in Stage V without SCR, and production suppliers sourcing is currently under development.*

What do you see in the next future?
Along with hybrid technology, undoubtedly our "tech ace", we are currently developing at least three projects regarding Stage V diesel for off highway, a Euro VI on highway a 2.5 for light duty truck and a 11 liters for truck.

Ps: on 6th January, after this interview, the Chinese announced the 4Y30, a 3 liters engine delivering 120 kW and 500 Nm that is at the top of its range. A Chinese four cylinders made in Ferrara. **FB**

DOOSAN G-DRIVE

After the premiere in Dubai, just a year ago, the time has come for the official debut in construction sites for Doosan engines. In fact, the **DP126LA** and the **DP126LB**, deriving from the 11.1-liter, six-cylinder for cogeneration with electronic regulator, are currently into production. Both are intended for 50 Hz and 60 Hz markets and are fully switchable. Power rates are between 320 and 355 kVA depending on use (prime power or stand-by) and 365 and 405 kVA.

PERKINS 4006-E23TRS4

Steady evolution

This is the characteristic of the 4000 series, shown at Key Energy in Rimini in a new power level. The six cylinders version belongs to a power range between 300 an 400 electric kilowatt, the oil consumption is 0.1 g/kWhr. The cooling system requires 3-Way-Valve Operation

Perkins updates the 4000 gas series introducing the 22.9 liters, 423 kW hexacylinder manufactured in Stafford (Uk). We met Paolo Pedrotti and Thomas Stuber, Application engineer and Sales manager gas engines of Bu Power.

How would you describe the 4006 in a nutshell?
Perkins 4000 Series gas engines cover the range from 322 to 1042 kWm or approx. 300 to 1000 kWe, depending on generator efficiency. The new 4006-E23TRS3 and TRS4 cover 300 and 400 kWe. These engines have been designed specifically for cogeneration applications with a class leading mechanical efficiency of up to 42.5% and a 2-stage charge cooler. It is based on the very successful TESI and current TRS technology which has been around for more than 20 years now. Electronically controlled ignition system with single cylinder ignition coils. The cooling system requires 3-Way-Valve operation.

Other structural improvements?
The latest generation turbochargers bypass system, graphite piston jackets, improved flow geometry of the exhaust manifold to improve mechanical efficiency, two-stage cooling for maximum heat recovery and better design of spark plugs and wiring.

Are manifold and electronics the same as the other units of 4000 series?
The exhaust manifold features a 'splitted' design that improves gas flow. Electronics includes a Lecm Woodward full authority management system managing all engine related processes, e.g. speed and AFR control, ignition, misfire detection and knock protection.

Filtration and cooling solutions?
The updated Powercore filter and two-stage cooling for improved thermal efficiency.

Power density?
Engines still show a relatively moderate mep, up to 14.8 bar, while getting excellent results in terms of performance. Low mep guarantees great margins. We also expect excellent maintenance intervals.

What about oil consumption?
This motor has shown during tests low oil consumption, at the top of its range, about 0.1 g/kWhr (27% improvement in oil consumption compared to current engine).

Possible applications in smart grids and data centers?
Regarding the first one, it depends on economic parameters such as fuel price, taxes and expected operating hours, but we are witnessing many projects based on gas, for example in the UK under the UK Capacity Mechanism. Speaking of data centers, however, they are generally not supported by gas engines, even if there are some trigeneration projects with absorption chillers in order to reduce environmental impact. These engines are often used also for back-up purposes. DF

ROTAIR AND KOHLER

Under the attack of Chinese engines, often sold at bargain prices on the shelves of DIY supermarkets just like mowers, motocompressors find a new life in professional applications, where quality engines hold the line. An example is the supply of Kohler **KDI2504-TCR** for the D300T4F and the **KDI1908T-CR** for the Ds185T4F, also by Rotair.
Non-trivial application, that of air compressors, which has evolved towards features that require endothermic performance and reliability. For example, the progressive acceleration compared to the air demand, the Intelligent System, which activates preheating of the thermal engine without overloading it, the centralized control panel for easier monitoring and resistance to temperature variations.

ECOMOTIVE SOLUTIONS. GREENDUSTRIAL AND BIO-LNG

Fertile Land

It is that of Bio-LNG obtained through nano-liquefaction. At Ecomotive Solutions they call themselves 'tailors' and developed low-gas gasified solutions. Greendustrial consists of two Isuzu, Nef 6.7 and Cursor 13, which can be fueled with any type of gas

Specialized in solutions for heavy automotive, trucks in particular, such as the Dual-fuel diesel-methane, Ecomotive Solutions has reconciled the reasons for biomethane and those of liquefied natural gas for industrial applications. The compromise is Greendustrial.
Greendustrial is made up of four units, two Isuzu and two Fpt Industrial, and is set to use any type of fuel, thanks to very low compression ratios. The phylosophy of Ecomotive Solutions is summarized in those words of Roberto Roasio, Business Development Manager: «*Our tailor-made approach allows us to convert the dual fuel engine to the required fuel, chosing the best compression ratio*». The components are standard apart from pistons, valves and valve seats, which are derived from industrial automotive, including Bosch coils and mixture control valves in order to facilitate access to aftermarket parts. The SynSpark16 control unit drives units up to 16 cylinders, with phased ignition, for any kind of gas, also synthetic ones, at any lambda ratio. The engine is disassembled, its components working without lubrication are recalibrated and integrated with the ignition controls. «*Our typical customer wants to be autonomous. He buys a cheap engine, then adapt it freely. We provide our maintenance table, then the customer becomes autonomous*».
The immediate horizon is stationary, also including applications such as compressors for trucks designed together with Zanotti. The two Isuzu engines deliver 11 kW at 1,500rpm, 63 Nm and a 11.5: 1 compression ratio (1.1 liters) or 22 kW and 137 Nm (2.2 liters, obtained from 4 Le2, with report of 9.3: 1. The triangulation with Bimotor and Fpt led to convert the Nef 6.7 liters, 143 kW and 916 Nm, always in stand-by for gas (calibrations are also available for lpg and syngas), 8: 5 ratio, and the Cursor 13, 307 kW, 1,901 Nm, 9.6: 1 ratio.
Entering the world of gas engines also aims to improve the lng distribution network.
The company developed together with Gi&E from Porto Recanati (in the Middle of Italy, close to Adriatic shore) a 2-tonne bio-lng pilot plant. The commercial product will provide a capacity between 2 and 5 tons, requiring 0.8 kW per kilo of methane.

Jean Debout


GEMS is the Wärtsilä partner for hybridization.

Wärtsilä. Hybrid together with GEMS

YES WE STORE

Greensmith Energy Management Systems is the Wärtsilä American partner and conceived a Battery management system for hybrid applications to coordinate batteries and diesel engines or other energy sources. Advanced algorithms maximize battery performance

Storage is the new prime mover?

More than one hundred years after its birth, diesel engine is still the most widespread prime mover.
Sturdy, reliable, extraordinarily efficient, nevertheless diesel engine is heavily under attack because of its emissions: soot, particulate matter and NOx.
In the previous years the solutions was one: more and more technology.
Today this approach has been substituted by an holistic one, a 360-degree rethinking of the concept of energy production.
In search of more clean sources of energy, diesel word leader Wärtsilä at first diversified approaching photovoltaic technology.
Now, aware of the absolute impossibility to replace completely traditional prime mover in the next few years, addresses without hesitation storage world to reduce environmental impact of energy production.
This is the hybridization of diesel engine also for stationary purposes.

From diesel to gas?

Hybridization which aims at emphasize diesel efficiency using it always at full load and replacing it with batteries in all low efficiency – high emission situations.
And next step will be the hybridization of gas engines.
In fact, stored energy allows you to use IEC engine according to the maximum efficiency curves, to improve response and replacing it in low load situation.
To reach this goal is very important a perfect coordination between IEC and batteries and a minute by minute control over batteries behavior.
To accelerate the development of storage solutions, Wartsila has closed the acquisition of Greensmith Energy Management Systems Inc. (GEMS), a market leader in grid-scale energy storage software and integrated solutions.
Over one-third of all energy storage capacity installed in the U.S. is running on the GEMS platform and in the last few months GEMS has delivered umpteenth energy storage plant, power 1 MW, at the service of a local microgrid and is ready to start the production of a 125 kW storage system integrated with smaller installations.
At the hearth of every storage system we find batteries and Battery Management System or BMS. As for the batteries technology, Wärtsilä and GEMS declare themselves explicitly agnostic. They aren't batteries producer (but they don't exclude some acquisitions in this sector as well) and prefer to choose on the market whenever an ideally suited battery for each use.
Proof of that is that, to date, GEMS has chosen 14 kind of batteries, including multiple lithium-ion chemistries, as well as ViZn Energy's zinc redox flow batteries, and 10 different kind of inverters. On the contrary, Wartsila - GEMS are very proud of their leadership as BMS producer. A leadership which includes hardware and, above all, software with specific management algorithms.
BMS performs two functions.
The first one is to ensure a perfect coordination between batteries and diesel engines or other energy sources. To guarantee a constant supply of energy and to recharge batteries as soon as possible or when necessary.
The second one is important almost as the first one and aims at monitoring working conditions of the batteries themselves, at checking continuously their state of charge, their condition and the inevitable progressive deterioration and warning in case of anomalies.
Furthermore, advanced algorithms maximize battery performance and longevity contributing to maximizing return on investment.
A first use of storage consists in supporting endothermic engines in diesel or gas IEC power plants. Batteries ensure a reserve of power in case of default of one or more engines (thus avoiding micro-interruptions), it allows to turn engines off at night or when load is under optimum level and it improves the response to transients (either by providing missing energy or by absorbing it if excess), a fundamental characteristic when power plant isn't connected to main grid.
Good news also for endothermic engine performance: batteries allow to operate in optimal conditions, especially in transients and during load fluctuations. Maintenance costs also fall due to the lower number of operating hours. Similar arguments apply, even more so, when we are in the presence of non-programmable renewables (wind or photovoltaic).

Don't waste energy

In this case, the fact of being able to accumulate excess energy in moments characterized by excess of production with respect to demand is proving an indispensable factor for the economic sustainability in grid parity of these sources.
The goal of self-sustainability, even economic, is now close: the State of Hawaii has set itself the goal of achieving 100% renewable energy by 2045 by integrating solar, wind and electrochemical storage.
The storage systems can be placed stand alone or combined with thermoelectric power plants even in traditional distribution networks: the advent of non-programmable renewable, in fact, has reversed all the cards and grows the need for stabilization of frequency and voltage or load leveling services.
In these uses, the presence of storage systems allows the network operator to offer highest quality services at competitive prices.

Farewell to heavy fuel oil!

After many years of disinterest, legislators around are focusing their attention also on the ships and their pollution.
The reason is simple: with the HFO with 35,000 ppm sulfur percentages that were utilized until just a few years ago, almost 9% of all SO2 emissions globally were attributable to this fuel.
And so gaseous fuels are becoming more and more protagonists but also energy storage is cutting out his space.
A few rows of batteries housed in a container on the deck and the usage profile of ship engines can improve dramatically.
Wärtsilä confirm its leadership in naval engines and doesn't miss a direct commitment also in the energy storage sector.
Batteries ensure many advantages.
For example, it's possible to operate in closed water silently and with zero emissions (Green Mode), to increase temporarily power of propeller axis or to stabilize engine rotation regime by absorbing load transients (with efficiency benefits too).
It is possible also to operate in electric mode during manoeuvers, improving precision thanks to the quick response of electric motors when they are powered by batteries and thus avoiding to run the engines at low load for long periods.
Essential as ever, BMS monitors health and battery level and, if necessary, turn on the engines if their charge falls below a preset level.
Thanks to batteries, it's possible to operate also when engine is still cold and it's necessary less time for heating up, maintenance intervals of the endothermic engines are lengthened, consumption decreases by an average of 10-20 percent while 30 percent emissions reduction can be achieved.
And for new installations, is expected a reduction in the size or number of engines, with a further overall improvement in global performance.

Installed batteries could rise 17 times compared to the current situation.

Focus on storage

MORE SINERGY THAN COMPETITION

All industry surveys agree on a bright future for storage systems, in particular lithium-ion batteries, driven by discontinuous renewables and e-mobility. Falling prices, skyrocketing market - tens of millions pieces/year - good technological developments. And yet the situation is far from plain sailing...

The costs of stationary batteries are set to fall by 66 percent compared to current values by 2030, according to a study by IRENA, the prestigious International Renewable Energy Agency based in Abu Dhabi, United Arab Emirates.
Thanks to this, installed batteries could rise 17 times compared to the current situation. The same study notes that a doubling of the generation capacity from discontinuous renewable sources (solar and wind) can multiply the installed storage capacity by three. A drastic change in the current mix is also expected. To date, 96 percent of the stationary storage capacity in the world is represented by hydroelectric pumping basins. Alternative solutions such as lithium-ion batteries and flow batteries represent for now a very limited niche. It is precisely these technologies that should have their way paved by the expected reduction in costs, both as a result of technology leaps and economies of scale.
Along with the growth in demand for stationary storage systems, there is a growing demand in the automotive sector, where production costs are already lower and the dynamics of lower average prices are faster. Curiously, at least in the IRENA survey, in this stationary-mobility dichotomy the "synergy" effect should prevail on the "competition" effect. That is, they should help each other rather than bumping heads. For example, in Germany small-scale Li-ion batteries benefited from a 60 percent cut in less than three years (from fourth quarter 2014 to second quarter 2017).
The link tightens further thinking about the opportunity to use the same electric cars, when they are not moving, as real stationary storage points, able to provide part of the accumulated energy. Potentially, hundreds of thousands or million points connected to the electric grid and able to absorb or sell indifferently electricity depending on the request. No science fiction, this technology already has a name (vehicle-to-grid) and some positive experimentation. Actually, the regulatory part seems to be behind research and applications. The IRENA study also "certifies" a technological development and not just a reduction in costs. Also in 2030, lithium-ion batteries should be able to increase their lifecycle by 50 percent, while the number of full cycles could even grow by 90 percent.
Coming back to mobility applications, the market is moving at such speed that neither the most optimistic insiders would have expected a few years ago. In November last year, the Future of Energy Summit held in Shanghai set a new goal: "Electric cars will become competitive, compared to cars powered by engines fueled by traditional fuels, by 2026". At that date the price of lithium-ion battery will drop to only $ 100/kWh. To make this data more valuable, it should be noted that in 2010 the reference price was $ 1,000/kWh (ten times as much!) and that in 2017 that price dropped to 206 dollars/kWh.

Bloomberg said...

Month after month the main research and consulting companies are publishing more and more optimistic forecast. Bloomberg New Energy Finance ensures, for example, that 54 percent of vehicles sold in 2040 will be electric powered. KPMG interviewed 1,000 automotive executives around the world: the majority agreed that the Paris COP21 accelerated the change, and 30 percent of global production of the automotive sector could be electric in 2023.
On the other hand, China – whose presence on foreign market is weak, at least at the moment - has recently set a "mandatory target" for 2019: at least 10 percent of total car sales (therefore presumably also of production) must be an "EV" model. In a country capable to absorb over 21 million cars/year (it was 6 million in 2008), this means a seven digits number. PwC, in turn, has "responded" with a research (Five trends transforming the automotive industry) that drastically cuts the timing of this revolution: by 2030, 55 percent of the new vehicles will be electric! We are talking about tens, even hundreds of millions of batteries that will have to be installed not only on cars but also buses in the coming years. You can't underestimate public transport ... According to the International Organization for Public Transport (UITP) half of the urban bus market in Europe will be made of electric models by 2030.
On the other side of the world, Chinese seem to have targeted even more ambitious goals, since in China there were 169,500 electric buses in 2017 compared to 3,500 in operation in the rest of the world. The English consultant company IDTechEx raised the bar even further and estimated that in China, over the next 15 years, one trillion dollars could be invested to boost the country's electric fleet. It is no coincidence that major car manufacturers are trying to sign supply contracts with battery manufacturers on a very long basis (ten years) to avoid the risk of short supplies. The link between stationary and automotive could also become even closer. The objective (of the research) is giving a second life to batteries installed on a car whose performances tend to decline significantly after about 8/9 years. The idea is, in fact, to reuse them in wind or photovoltaic generation plants, therefore non-programmable renewables, extending their lifecycle by 20 years.

Is it all right?

Falling prices, skyrocketing market, positive synergies between mobility and stationary ... All right, then? Not exactly. The experts of geopolitics point out a detail that is anything but negligible. What are the batteries now prevalent on the market (and certainly still in use in ten years) made of? Graphite, nickel, aluminum, copper, lithium, cobalt and manganese. In particular, lithium is an essential element of modern batteries, so much so that it is also used in their name. Only three countries - Chile, Argentina and Bolivia - provide 75 percent of world production. It is even worse with cobalt, given that the Democratic Republic of the Congo currently covers 65 percent of the world demand. You do not need a strategist to understand that we are facing a concentration of resources higher than the one we had to deal with in oil and gas sector, that influenced the entire planet for decades (at least until the discover of unconventional reserves...). **Davide Canevari**

IRENA outlines the worldwide energy market macrotrends.

Renewables

SOLD OUT FOR THE NEXT 35 YEARS

The estimates in the long and very long run are always subject to approximations. The more we go far in the future, the more we're prone to "imagination" rather than scientific accuracy. This is why the most serious market experts always speak of scenarios and not forecasts. Based on this approach, the Global Landscape of Renewable Energy Finance 2018 published by IRENA tells us that "the energy transformation required under the Paris Agreements will require total investments in renewable sources equal to 25 thousand billion dollars by 2050". The figure is staggering and gives the potential of a market that, if we look closely, is based and will be based on two technological trends: wind and solar energy.

25 thousand billion dollars. According to IRENA this is the hyperbolic figure that can be spent worldwide by 2050. Solar and wind power will rule the market, as is happening today. China and India will promote the major part of the investments. Biomasses seem in stand-by

Even looking at the current situation, and therefore at consolidated figures, renewable sources seem destined to success more than ever. The total investments, again based on the IRENA assessments, reached a peak of 330 billion dollars in 2015 and then fell quite sharply to 263 billion in 2016. This drop does not worry the insiders and is due to a tangible cost reduction more than volumes. From 2010 to 2016, in fact, the costs of onshore wind dropped by 23 percent, while those of photovoltaics - in the same period - by 73 percent.
As already mentioned, the market is shared by two pro-

tagonists. Investments in solar power (photovoltaics, concentration, thermal) together with wind power (on land or offshore) reached a 93 percent share in 2016 (compared to 82 percent in 2013) out of the total resources allocated to renewables.
Biomasses still seem in standby. In 2016 they were worth 5 billion dollars in investments (less than 2 percent of the total value of renewables), in sharp decline compared to 9 billion in 2014. Geothermal stand on a consolidated average 2 billion dollars/year, while biofuels have dropped to 250 million in 2016 compared to 1.7 billion as the average annual value in 2013-2015. However this should be only a temporary stop, considering also the ambitious projects to apply biofuels to civil aviation.

Finally hydropower

Finally, hydropower: this is the area that perhaps more than all can be affected on an annual basis by some major project. Europe and North America seem willing to accept only minihydro; but the rest of the world does not seem so sensitive to the possible impacts of a new dam of gigantic proportions.
The results of the analysis by areas are not surprising. The East Asia-Pacific region has seen its leadership grow significantly in recent times, from $ 64 billion invested in 2013 to 114 in 2015 (88 in 2016). Recently, China declared to have achieved "full electrification of its entire territory", while India should be close to 90 percent. India itself intends to cover 25% of its internal demand for primary energy through renewable sources by 2030. Compared to other areas of the world, the Indian version of energy mix is deeply different, showing an overwhelming prevalence of biofuels (62 percent share) on solar (16 percent) and wind (14 percent).
In the rest of Asia, spending went from $ 32 billion (2013) to 37 (2014) and then dropped in 2016. After the Fukushima accident, Japan has adopted rather generous incentive policies for solar energy, which were immediately reflected in terms of investment.

Minus 20 in 1 year

Even Western Europe flexed its muscles, reaching 73 billion dollars in 2015 before falling back to 53 in 2016: the increasing interest in offshore wind was not enough to compensate for the strong reduction of incentives to photovoltaics. North America reached its peak in 2015, with 52 billion dollars, mainly thanks to solar and wind. Latin America is still struggling to emerge, with 9 billion "spent" in renewables in 2016 compared to 17 billion in 2015.

And the 2017?

And what about 2017? Bloomberg New Energy Finance analysts speak of a good year, with 333.5 billion dollars investments. The data is not directly comparable with that of IRENA (Bloomberg also takes into account efficiency and does not include large hydroelectric power). However, a trend value of 3 percent year is estimated, which should indicate with some confidence the recovery of a positive trend. Needless to emphasize the absolute dominating position of China with 132.6 billion dollars, followed by Europe (57.4 billion) and the USA (56.9 billion).

Davide Canevari

Lights still out

...for more than a billion people.
More or less consciously distracted by the issues of decarbonisation and efficiency, which directly and primarily concern a segment of the world-wide planisphere - that of the most developed economies - we risk forgetting an even more substantial slice of the planet that still needs to move his first step from a strictly energetic point of view.
The United Nations Agenda 2030 reminds us that 40 percent of the world's population continues (surely not by choice) to cook, heat, light up their homes, work and even get treated just as they did before the discoveries of Edison and Tesla!
In nine-digit numbers, there are 2.8 billion people on Earth who still use biomass for cooking and heating, using traditional methods. And traditional does not always mean beautiful, given that the same Agenda 2030 estimates 2.8 million/year deaths due to harmful fumes in domestic environments coming from inefficient biomass combustion.
As for electricity, over a billion people (to be precise: 1.1 billion) in 2017 does not have access to electricity. In 2030 this number is expected to fall to 674 million (according to AIE estimates) without however decreasing to zero...
All this leads to a simple consideration. At least for the next 20-25 years, the foreseeable growth in demand will require to put into operation a huge generation capacity, which can not be entirely provided by renewable sources. On the other hand, in advanced economies, the phase out from coal or nuclear power may in turn require a significant replacement power (in this case, renewable or gas).

CAT, GLF and Maersk. The harbor technological excellence goes ashore in Italy

YELLOW 'SUBMARINE'

Maersk and GFL are main actors, Caterpillar and Mantovanibenne played a crucial role with their experience in excavation vehicles, systems and tools. Synergy and versatility are two of the most important guidelines in the conversion of Vado Ligure harbor in an European excellence. Gian Luca Paolinelli, GLF Fleet Manager, explained to us the genesis of a big project

It's not a Beatles quote, yellow is the Caterpillar flag color and yellow is the 'heart' of the Vado Ligure platform, a C18 Acert, under the Cat 390DL excavator excavator bonnet. Maersk planned to create an automatized hub where to establish a new headquarter in the Mediterranean Sea. The whole operational platform surface will be of 211,000 square meters.
Why to invest to in the Northern-West coast of Italy? We asked it to Gian Luca Paolinelli, GLF Fleet Manager.

Good morning, Mr Paolinelli. This project meets some big technological actors for a big challenge. Why Cat?

«Exactly. Together with Caterpillar» Paolinelli says *«we decided to opt for the 390DL that's the biggest, but still transportable and multipurpose, of their excavators, and therefore for the C18 Acert engine».*

C18 Acert is a 6-cylinders diesel engine with a displacement of 18.1 liters (around 3 liters of cylinder displacement: BxS 145 x 183 mm), 16.5:1 compression ratio, counterclockwise direction of rotation (from flywheel end), and it's equipped with a turbocharger aftercooled. It covers a power range between 258 and 470 kilowats, and the maximum power level is set from 1,800 rpm up to 2,100 rpm. In terms of emissions, it's Tier3 and Stage IIIA compliant.

Can you give to us more details about the excavator?

«390DL was the best option in fundamental terms of both versatility and speed of execution, also in reason of the possibility to attach different tools on the arm's extremity (e.g. demolition hammer, ripper, bucket or shears)» Paolinelli says. *«The original arm has been completely redesigned to operate on the sea floor, and only the boom has been kept. Other customizations were required on hydraulic systems to balance the arm's breakout force and the stability of the platform, anchored through poles. These features are the emblem of customization and versatility, because operating on land the 390DL can use all its breakout force, which is mechanically reduced on the pontoon».*

Vado Ligure looks like a strategical investment to relaunch the Mediterranean area.

«Together with the highly technological Harbor of Rotterdam, Northern Europe has always been more competitive in terms of turnover. Liguria is the natural connection with Swiss and Southern Europe, but Vado Ligure was not the only option. The main alternative was the harbor of Genova» Paolinelli says. *«Though, the main obstacle here was the low capacity of the storage facilities of the harbor, in terms of number of containers. Another plus of Vado Ligure compared to Genova concerns the depth of the sea in the harbor area, which in Vado increases quickly up to approximatively 30 meters, enough to meet the requirements of modern cargo ships in terms of draft».*

And finally, you choose Vado Ligure...

«In partnership with Savona's harbor authorities, Maersk decided to invest to Vado Ligure in reason of its advantageous conditions» Paolinelli states. *«The project did not involve building only the platform, but also those infrastructures which have been strategically thought in order to link the harbor and Via Aurelia, the main highway-connected arterial road. Due to the big quay on the back of the platform, which is planned to have a movement capacity of 720,000 TEU per year, it will be possible to directly move on wheels the whole containers, or to sort the wares before shipping them to their different destinations. The real problem today is not to have the ships approaching the docks, but all that follows the operation of unloading the wares».*

Which are most critical technical challenges of underwater operations?

«The aim of the project is to build a multipurpose platform that can provide all the services implied in the operations of unloading and shipping wares and containers arrived on cargo ships. Before putting up the platform, a customized structure was needed. It is a pontoon, with anchorage poles, on which an excavator has been secured through turnbuckles. The vehicle's main purpose is to remove the remnants of the precedent structures that hinder the construction of the new platform. Beyond the excavator customization challenges, another obstacle was underwater operations. The solutions that have been found are an example of efficiency. It has been managed to remotely control the hydraulic shears mounted on the excavator, through a GPS system. Even more, a camera based monitoring system was added to support the operations of cutting the iron basements of the old constructions, together with the intervention of divers, when truly needed. This synergy allowed to drastically reduce human intervention and the risks involved in diving in such contexts».

Machinery, tools and customizations?

Talking about the strictly mechanical side of the project» now Paolinelli takes stock of cooperation with Caterpillar *«Some years passed since we started relying on our current partners and in Caterpillar we found a 360 degrees coverage for our interests».* Talking about the CAT 390DL and its customization *«the reason of this choice depends on the GLF's will to endow itself with an adaptable vehicle. This was made from scratch because there was no real reference from previous projects. Though, the idea came to his mind studying backhoe dredgers» Paolinelli says.*

«Talking about the tools mounted on the extremity of the excavator's arm» Paolinelli states *«Mantovanibenne was the best choice that the market could offer, and thanks to the results of the project it could be just the beginning of a fruitful partnership. Challenging the tools, especially the hydraulic shears, for the first time in a marine context was achieved with success».*

Guglielmo Papagni

Stationary players

Three Caterpillar engines more are employed in another area which is a pond used for the construction of reinforced concrete pontoons. The mode of operation of this structure is complex, since after building the blocks it sinks and carries them, while floating, to their final position, where they will become breakwater structures and docks. Such mechanical system, which can operate in pseudo-offshore conditions, needs a lot of power, which is fully provided by two C19 (mainly used in parallel) and one auxiliary C6.6 engines, whose combined work ensures full autonomy without renouncing to versatility. The last one is a 6 cylinders diesel engine, with 1.1 liters cylinder displacement and a compression ratio of 16.2:1, with a power range from 89 to 470 kW (the revolutions range is between 2,200 and 2,500). It's Tier 3 and Stage IIIA regulations compliant.

Left to right, a pciture of C18 ACERt and some pictures from Vado Ligure harbour. Protagonist is 390DL excavator.

THE TOP OF NG RANGE HAS COME

Fpt structures its gas range like no other, raising the high-range flag on 13 liters. 388 kW and 2,000 Nm are a guarantee for truck drivers. There's not only LNG, however, compressed gas and biomethane open interesting scenarios also in off-road market. Stoichiometric combustion, knocking control, simplified architecture. And much more

The NG (Natural Gas) suffix applied of Cursor 13 testifies the leap haead of CNH Industrial in promoting liquefied natural gas as vector of the transition to emancipation from diesel. A 13 liters which follows the performance footsteps of the diesel 11 liters completing an engine platform that starting from 3 liters F1C includes the 5.9 liters Nef N60 and the 8.7 liters Cursor 9. Here we have three technological pillars: stoichiometric combustion, Multipoint injection and three-way catalyst. The main path of this transition is simplification in terms of redundancy of storage tanks, lay-out, lower loads on electronic control unit. No more complications related to chemical treatment of nitrogen oxides. The stoichiometric ratio is heading towards homogenization of the comburent during the combustion phase, an obsession that led diesel engineers to injection pressures up to 2,500 bar and daring reinterpretations of piston, combustion chamber and piston ceiling. Coming to particulate, gas provides a clean combustion. The blower relies on a water cooled waste gate valve. Another Fpt's research theme along with the control of stoichiometric ratio is that of knocking control to improve specific curves, fuel compatibility and protect the three-way catalyst from misfiring.

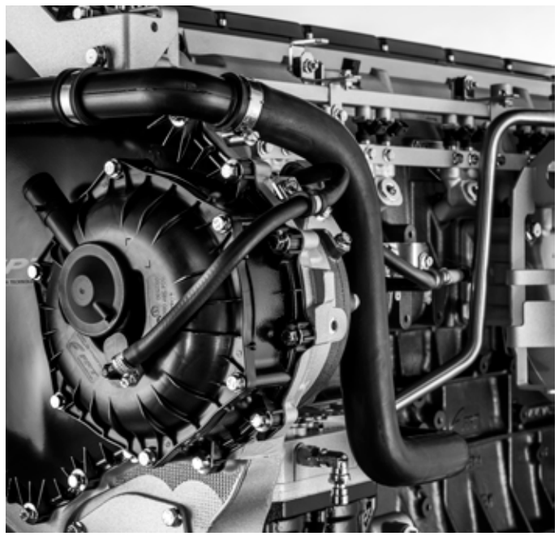
Made for gas...

The 13 liters is equipped to face the challenges of stress, gas specific flame point and thermal stress, detecting the malfunctions in ignition ('Misfire'), also from structural and materials choice point of view, first of all working on injectors and supply line updated to the comburent 'high-rate' flow, on ultra-high-performance cast iron (Nickel-Resist) exhausts, and using compact graphite (Cgi - Compacted graphite iron) for cylinder heads. Let's get into the kind of details that end users appreciate most: performance and life cycle. Thanks to its 388 kW @1,900 rpm the Cursor 13 Natural takes the lead of the three "road giants" intended for long distance transport together with Volvo, followed by Scania at 410 HP/301 kW. A torque rate of 2.000 Nm available from 1,100 rpm easily climbs the mountain passes. In terms of Tco the 13 liters features 90 thousand kilometers maintenance interval and a 'life expectancy'that hits one million kilometers. The expected range is 1,500 kilometres, thanks to energy density and cryogenic tanks. The fuel distribution network is being upgraded, waiting to solve the issues related to storage and regasification (the closer hub remains that of Marseilles).

Silence, please!

Another trick up the sleeve of natural gas in low noise due to acoustic excursion and 'roughness' of detonation in Otto cycle compared to Diesel cycle. The 12:1 compression ratio means lower yield but helps perceived noise containment that does not exceed 71 dB at full load according to Fpt. The 13 liters does not mean only liquefied natural gas. We find of course also compressed natural gas and biomethane, opening the narration of a Copernican revolution in agricultural traction in the main frame of circular economy and auto-production which deserves a separate chapter.

Fabio Butturi



Brand - Model	Fpt Industrial Cursor 13 NG
I.D.	
B x S mm - S/B	135x150 - 1,11
N.cil.- dm³	6 - 12,88
Max. Power kW/rpm	338/1.900
Mpe at max. power bar	16,9
Piston speed m/s	9,5
Max. Torque Nm/rpm	2.000/1.100
Mpe at max torque bar	19,92
Torque rise	0,18
Torque at max. power Nm	1.698
NELLO SPECIFICO	
Specific power kW/dm³	26,25
Specific torque Nm/dm³	155,3
METRO E BILANCIA	
Dry weight kg	1.240
L * W * H mm	1.610*1.027*1.178
Volume m³	1.948
Mass/power kg/kW	3,67
Weight/displacement kg/dm³	96
Power density kW/m³	173,5
COME E QUANTO	
Emission level	Euro VI C
Compression Ratio:1	12
Injection	Multipoint
Techno	3-way catalyst

Cursor 13 is ready to embrace Natural gas applications. The first is the truck one.

Gastone and Waste Heat Recovery

«Gastone (Gladstone Gander) is not a comic book, it's a European project to which Fpt Industrial took part from 2013 to 2017 along with other partners". This is the debut of Stefano Golini, our guide to the Tech Cube, the parallelepiped that introduced us to three-dimensional holograms and the backstage of the gas platform by Fpt in the CNH Village. *«The purpose of this project is studying how to recover energy from the engine».* We are inside the Waste Heat Recovery program, based on the Rankine cycle, which in the initial phase has shown to contribute to fuel savings up to 3 percent. *"What kind of energy? Kinetics and thermal. Talking about thermal energy, relying on gas engine has been a natural choice because stoichiometric combustion is 100 °C - 150 °C higher than that of diesel».* And the recovery of kinetic energy? *«The Belt-driven Smart Generator replaces the alternator and is driven by the engine control unit. It works in both ways, like an alternator (it takes torque from the engine and sends energy to the battery) and also like an engine (it takes energy from the batteries and provides torque to the engine through the belt). In the second case the engine load is partially relieved».* What are the operating conditions that qualify it "smart"? *«As an engine, it works during the starting phases, does not operate under a fixed temperature of the cooling water, because reducing torque means reducing fuel and increasing heating time, then friction, then consumption. When the engine reaches the working temperature the Bsg is inactive under a fixed torque value because it could lead to anomalies in the combustion. Let's move on to the exhaust line and talk about thermal energy. Here we meet the three-way catalyst, that shows at its end a peak temperature of 750 °C. A thermoelectric generator helps us to use this energy. The generator is based on the Seebek effect, the hot part is that in contact with exhaust gas, the cold one is outside the cylinder where the cooling water of the engine circulates. Gases are hot enough to sustain a turbocompound. A turbine linked to another generator, non static as the previous one, it's an alternator that provides additional energy sent to the storage system. The surplus energy feeds the Bsg when it operates as an engine and to separate some components (oil pumps, water pump, climatization compressor) from the engine».* In a nutshell: one belt less means mechanical power returned to the engine, which in turn will reduce fuel demand.

The speakers of the talk show on natural gas technologies: from left, Giancarlo Dellora, Fpt Research & Technology manager; Annemarie Timmermans, Lng Project Manager at Vos Logistics; Andrea Gerini, Secretary of Ngva Europe (Natural & Bio Gas Vehicle Association); Mauro Nicoletti, manager of Schmack Biogas.

Annalisa Stupenengo, Brand President of Fpt Industrial.

Hatz's 3H50T and downsizing in MH

RIGHT SIZE?

On January 18th Hatz has officially released its Stage V 3H50T version. The 1.5-liter engine is a compact 3-cylinders with a cylinder displacement of 500 CCs, the same of the 4H50T and it has allegedly been designed in prevision of the application of the upcoming European Stage V emissions standards

Engines designed to respect the new standard, especially those with more than 19 kilowatts, are basically more complex and more expensive than older ones, and furthermore they need supplementary components to clean exhaust gases. Moreover, engines that work with more than 19 kilowatts of power need to have a diesel particulate filter (DPF) which properly regenerates only from permanent exhaust gas temperatures of 250 degrees, that are rarely reached by machines, such as lifting platforms and forklifts trucks, that mainly operate for short-lasting cycles.

Cutting DPF

This implies that, given the averagely high costs of the DPF, it can't work well and requires frequent maintenance interventions in reason of its low working temperatures.

Hatz 1.5-liter engine was unveiled at Bauma 2016. The idea behind the 3H50T is that typical industrial purposes machines like forklift trucks, which usually run with up to 37 kilowatts engines, can reach their tasks well enough also with less powerful engines, ideally under 19 kilowatts of power. Instead of just leaving manufacturers to deal with old engines and with the need to adapt them to respect the new regulations, the company's purpose is to offer a series of downsized products to meet the Stage V requirements, whose beginning of application is scheduled on January 2019, and that could mean a loss in terms of investments for many machines manufacturers.

Hatz declares that through the rightsizing principle (instead of a more generical downsizing one), and thanks to the application of cutting-edge technologies, their 3H50T engine can satisfy the requirements of the machines involved, in terms of efficiency, needing less power and therefore without having to resort to the DPF. To support their assertion about rightsizing, they consider the case of a forklift truck weighting 2,600 kilograms, hypothetically provided with a 23.6 kilowatts engine. Due to this last feature, from January 2019 the machine would not respect the new standard unless it would be equipped with a DPF. Then, considered that the machine could reach a maximum speed of 20 kilometers per hour with a gradient of 6.5%, by reducing this one to 5.2%, the required power would decrease from 23 to 18.4 kilowatts. Since in most of cases forklift trucks work on almost flat and level surfaces, the variations of the gradient that could occur would not influence the operations that much. This, believes the company, means that making an engine that works with less than 19 kilowatts is a reasonable choice.

The 3H50T is a water-cooled, 3-cylinder diesel engine, with 1.5 liters of displacement. This last feature, together with the turbocharger technology and the Bosch common rail system (off-highway variant), are said to make possible to operate at low engine speed, which should also guarantee a reduction of noise emission by around two thirds.

Hatz asserts that the 3H50T has a maximum output of 130 Newton meters, obtainable at only 1300 rpm. Full power of 18.4 kilowatts is also said to be reached and maintained from 1350 rpm (the range is 1350-2600 rpm).

Reducing emissions

The company said that the H-series engines have been thought to pursue low emissions levels which, without exhaust gas aftertreatment, are said to be radically reduced. Talking for example about particulate mass emissions, they're supposed to barely reach a tenth of the limit value, that for EU Stage V standard is 0.4 grams per kilowatt hour, without other exhaust emission aftertreatment like exhaust gas recirculation, or diesel oxidation catalyst (it is also said to meet EPA Tier 4 final emissions stage). Hatz says this won't compromise high torque capability. You can figure out an opinion by consulting the comparison on the following pages.

The engine has a maintenance cycle standard interval of 500 hours. It will be produced in two different versions, a Fan-to-Flywheel one and an alternative OPU (Open Power Unit). The first one is a little shorter and lighter than the second (577 x 650 x 602mm respectively in length, width and height and 132 kilograms for the Fan-to-Flywheel, and 577 x 650 x 662mm and 147 kilograms for the OPU variant), which is a plug and play solution adaptable to different kind of machines such as lifting platforms, hydraulic systems, drilling machines. Alternatively,

it can also be used with stationary applications like pumps and alternators. All the electronics, as well as the radiator, the hoses and the cabling have an integrated design.

Paul Scott

Left to right, two pictures of the 3H50T, one of thes bench test and a couple of potential applcations of the ultra-small compact engines.

Bernd Krüper is the CEO

Bernd Krüper is the new CEO of the 135-year-old German manufacturing company Hatz. The plan is to expand the range of the company's business out of German borders. Choosing Krüper means relying on the long term and proved experience that he acquired playing different leading roles in Mtu group and in Rolls-Royce Power Systems.

Hatz family will keep the leadership, but Wolfram Hatz expressed his enthusiasm about the recent agreement achieved with Krüper and about the improvements that the company will benefit from. Current positive economic circumstances have let Hatz believe that the market of precision metal components is going to face a 20 percent increase in the next years.

At the same time, the company is investing growing resources to team up with Bavarian universities in targeting big data and industry 4.0 as the next big step of expansion.

Comparison 3 cylinders above 19 kW between 1.1 and 1.6 liters

SMALLER IS BIGGER

Hatz made the challenge. Who's able to take it up? Kubota and Yanmar, of course, thanks to their strong Japanese roots in compact engines, Kohler and Perkins in Europe. Turbo and common rail is the German solution. The common mechanical philosophy is to semplify the technological approach

Two outdoor applications. Bottom, left to right, Hatz, Kholer, Kubota, Perkins, Yanmar.

Downsizing, the main road in the generation for Tlc, light towers and stand-by, in hybrid groups configuration for mobile applications and universal strategy to meet the prescriptions of Stage V. Who's standing beside Hatz close to 19 kW? The names are the best known in Europe and Japan in the range under 56 kW: Kubota and Yanmar from Osaka (once there was another Japanese, Mitsubishi), Perkins from the United Kingdom (once also Lister Petter...), Kohler answers from Italy (once also Vm Motori would have done it). The Japanese historically rule and "own" this range, having a strong primogeniture in compact construction machines (such as skidsteer loaders and mini-excavators), strong in the professional gardening, pioneers of the most advanced pre-chamber forms such as Kubota's E-Tvcs and of the use of gas recirculation on compact engines such as Yanmar Tnv series. Perkins inherited the agricultural vocation on motorhoes and tractors, in competition with Vm and Lombardini, showing a very strong segmentation both in terms of displacements and power levels. Finally, it is Kohler's turn. Among the OEMs of genset and small road contruction machines there was a fear that the Focs, legacy of the Lombardini era, would have been swept away by the Stage V.

Let's go to Stage V

We have instead learned at the Agritechnica in Hannover that they will find new blood from 2019 with the promotion to Stage V of the Focs 502, 1003 and 1604. The odd of Reggio Emilia was so far available in 27.6 and 29 kW ratings at 3,000 rpm and was appropriately lowered at 18.4 kW looking at Stage V without any torque loss and set at 100 Nm compared to 106.5 and 104 Nm of 27.6 and 29 kW.

As can be seen at first glance, the power threshold is immediately close to 19 kW (18.4-18.5 kW) and, at the same time, there is an evident range of torque and specific values mainly based on displacement. Torque awards Hatz with 130 Nm, practically unreachable. Figures change when calculations are based on the displacement ratio. A few cubic centimeters may have a significant influence. For example, Perkins loses 30/40 percent compared to the larger engines in this range (having its peak at 1.6 liter with Kohler, ignoring the half liter cylinder, four cylinders engines such as the H series by Hatz).

Torque and common rail

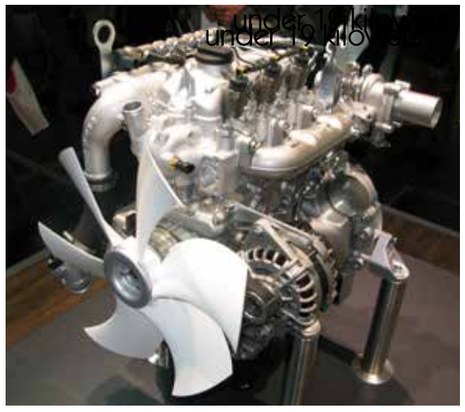
This is the cause of the gap in the torque curve in conjunction with the exuberance of Ruhstorf, which leaves behind the competitors by using the four-cylinder turbo charger and 1800 bar Bosch common rail, the only evidence of electronics in a landscape still dominated by mechanical injection and the formula of natural aspiration. Perkins, for example, recovers ground when it comes to power, both in specific and areal curves, that is related to the bore, reaching the first position. No supercharging, cooling and recirculation systems make Kubota and Perkins significantly lighter than the other three competitors.

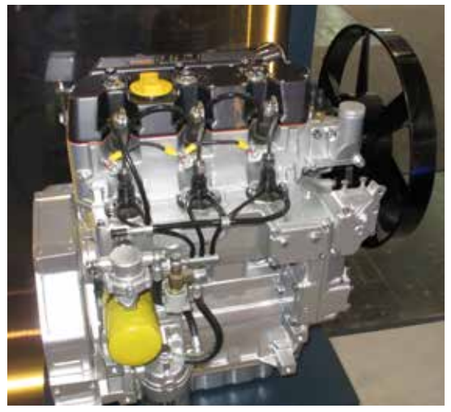
Weight-power ratio

The weight-power ratio awards the British, who win the Lightness Index. Hatz took the first step towards the implementation of electronics in low entry engines to provide sufficient torque to meet the needs of the 19 - 36 kW range with unregulated engines without using after-treatment systems. We await the development of a power range that, more than others, is exposed to the risk of an early extinction due to electrification, especially for indoor applications. ■

3 CYLINDERS BETWEEN 1.1 AND 1.6 LITERS

Brand Model	HATZ 3H50T	KOHLER KDW 1603	KUBOTA D1305	PERKINS 403F-11	YANMAR 3TNV80FT
I. D.					
B x S mm - S/B	84 x 88 - 1,05	88 x 90 - 1,03	78 x 88 - 1,13	77 x 81 - 1,05	80 x 84 - 1,05
N. cil. - dm³	3 - 1,46	3 - 1,64	3 - 1,26	3 - 1,13	3 - 1,26
Maximum power kW - rpm	18,4 - 1.350	18,4 - 3.000	**18,5** - 2.600	18,4 - 2.200	18,4 - 2.600
Mep at max power bar	11,4	**4,6**	6,9	9	6,8
Piston speed m/s	**4**	9	7,6	5,9	7,3
Maximum torque Nm - rpm	**130** - 1.300	100 - 1.600	80 - 1.600	64,6 - 1.600	85 - 1.800
Mep at max torque bar	11,4	7,8	8,1	**7,3**	8,6
Torque rise %	**60,7**	44,4	33,2	25,1	36,2
Torque at max power Nm	**127**	59	69	78	69
% power at max torque (kW)	96,2 (**18**)	91,10 (17)	72,50 (13)	58,90 (11)	87,10 (16)
DETAILS					
Specific power kW/dm³	12,5	11,1	14,6	**16,2**	14,5
Specific torque Nm/dm³	**88,8**	60,6	63,4	57	67
Areal spec. power kW/dm²	11,08	10,11	12,94	**13,14**	12,19
RULES AND BALANCE					
Dry weight kg	132	156	95	87	121
L x W x H mm	577x650x604	633x573x468	503x374x590	491x400x576	545x450x652
Volume m³	0,23	0,17	**0,11**	**0,11**	0,16
Weight/power kg/kW	7,2	8,5	5,1	**4,7**	6,6
Weight/displacement kg/dm³	90,2	94,6	**75,3**	76,9	95,5
Power density kW/m³	80	108,2	**168,2**	167,3	115
Total density t/m³	0,57	0,9	0,86	0,79	0,76
Displacement/volume dm³/m³	6,36	9,7	**11,46**	10,29	7,92
SPECIFICATION					
Injection system	common rail	Mech.	Mech.	Mech.	Mech.
Techno	Turbo	Natural	Natural	Natural	Turbo
INDEX					
Torque	11,3	10,5	10,4	7,2	9,5
Performance	3,5	3,1	3,1	2,8	3,1
Stress	6,3	5,6	5,2	4,4	5,3
Lightness	9,5	11,1	8,7	9	10,5
Density	20,7	20	31,7	28,7	22,9
DIESEL INDEX	**6**	5,3	5,8	5,5	5,5



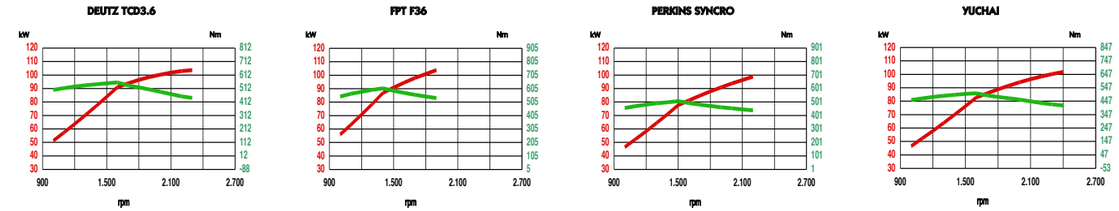


3.6 liters comparison. Among the compact industrial engines range

THE MOST SUCCESFUL DISPLACEMENT

Fpt Industrial unveiled at Agritechnica Hannover the identity of F34's big brother. Thanks to its three millimeters bore the 3.6 by Fpt is ready to face Perkins' Syncro and Deutz's TCD. It's a crowded arena, therefore, especially if we look at 3 to 3.8 liters range. Yuchai also quietly came in at 3.6, following the "best" Chinese tradition

3.6 is the figure that is breaking the table of compact engine. It's a peculiar fate for one of the most favorite displacements that involves almost all manufacturers, except for those aiming at large sizes (Mtu, Man, Scania, Volvo) and those who are extremely serious about compactness like Hatz, who found the winning formula in the 1.5 and 2 liter versions of the H series. Stage V broke into the 3 to 4-liter range thanks to the Syncro family, which two years laid the foundations of Perkins' comeback to agriculture. The 904J allows Perkins to leave behind the bond with **Fpt Industrial** and manufacture entirely in house the disputed 3.4 in 2019. But what exactly does Fpt do? The brand introduced at Agritechnica the increased bore version of 3.4 cylinder. Featuring the same ratio of the F34, the result is a 3.6 liters made in Turin that reached at once the threshold of this specific displacement, 105 kW, thus joining **Deutz** (and Kohler, which reaches the same value thanks to its 3.4 liters as is shown in the table of 3.3 - 3.8 liters range).




Left to right, FPT Indsutrial and Deutz.

THE FABULOUS FOUR

Brand	CUMMINS	DEUTZ	DOOSAN INFRACORE	FPT INDUSTRIAL	FPT INDUSTRIAL	KOHLER
Model	F3.8	TCD3.6 L4 HP	D34	F36	F34	KDI 3404 T CR
						
I.D.						
B x S mm - S/B	102 x 115 - 1.13	98 x 120 - 1.22	98 x 113 - 1.15	102 x 110 - 1.08	99 x 110 - 1.11	94 x 116 - 1.23
N. cylinder- dm³	4 - 3.75	4 - 3.62	4 - 3.40	4 - 3.59	4 - 3.38	4 - 3.22
Max power kW - rpm	**116** - 2,600	105 - 2,300	82 - 2,400	105 - 1,900	92 - 1,900	105 - 2,600
Mep at max power bar	14.5	15.4	12.3	18.8	17.5	15.4
Piston speed m/s	10	9.2	9	**7**	7	10.1
Max Torque Nm - rpm	600 - 1,200	550 - ,.600	430.2 - 1,400	600 - 1,400	500 - 1,500	**647** - 1,400
Mep at max torque bar	20.5	19.5	16.2	21.4	18.9	25.8
Torque rise %	41.7	42.3	42.3	47.1	44.4	**51.5**
Torque at max power Nm	431	441	323	**529**	461	382
% Power at max torque (kW)	65 (75)	87.80 (92)	77 (63)	83.80 (88)	85.40 (79)	90.40 (**95**)
DETAILS						
Specific power kW/ dm³	30.9	29	24.1	29.2	27.1	**32.6**
Specific torque Nm/dm³	159.6	151.8	126.2	166.9	147.6	**200.9**
Areal specific power kW/dm²	35.47	34.77	27.15	32.11	29.87	**37.77**
METRO E BILANCIA						
Dry weight kg	280	350	265	320	360	394
L x W x H mm	818x728x786	900x592x1.036	701x580x769	714x601x852	678x586x896	718x580x816
Volume m³	0.47	0.55	0.31	0.37	0.36	0.34
Weight/power kg/kW	**2.4**	3.3	3.2	3	3.9	3.8
Weight/displacement kg/ dm³	**74.5**	96.7	77.7	89	106.3	122.4
Power density kW/m³	246.8	190.9	264.5	283.8	255.6	308.8
Total density t/m³	0.60	0.64	0.85	0.86	1	1.16
Displacement/volume dm³/m³	8	6.58	11	9.72	9.41	9.47
INDEX						
TORQUE	**16.5**	9.6	12.2	7.7	6.5	15.1
PERFORMANCE	6.1	5.8	5	6	5.4	7
STRESS	10.2	9.6	8.4	9.5	8.6	12
LIGHTNESS	9	11.1	9.2	10.2	12.2	14.2
DENSITY	20.1	16.2	23.7	26.1	23.7	**33.4**
DIESEL	**8**	7.2	7.2	7.2	6.6	7.8

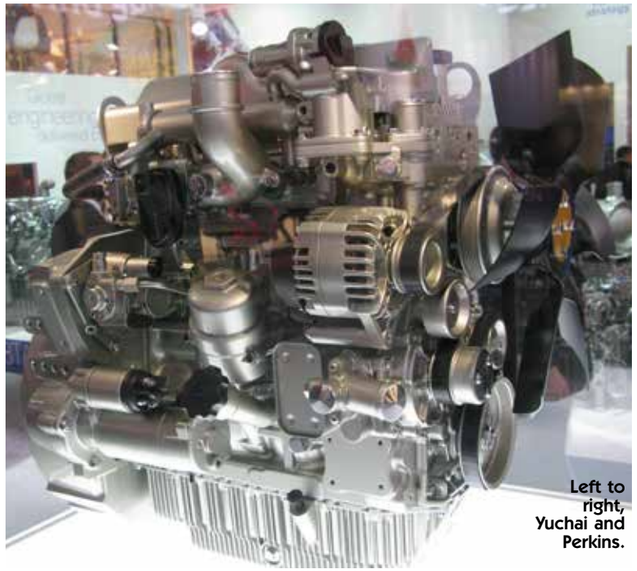
Brand	KUBOTA	MITSUBISHI	PERKINS	SAME	YUCHAI
Model	V3800 Tief4Hb	D04EG	904J-E36TA	KE 4	YCDK04140-T400
					
I.D.					
B x S mm - S/B	100 x 120 - 1.20	94 x 120 - 1.28	98 x 120 - 1.22	103 x 115 - 1.12	98 x 120 - 1.22
N. cylinder- dm³	4 - 3.77	4 - 3.33	4 - 3.62	4 - 3.85	4 - 3.62
Max power kW - rpm	95 - 2,400	74 - 2,000	100 - 2,200	100 - 2,000	103 - 2,400
Mep at max power bar	**12.9**	13.6	15.4	15.9	14.5
Piston speed m/s	10.4	8	8.8	7.7	9.6
Max Torque Nm - rpm	440 - 1,800	375 - 1,500	500 - 1,500	540 - 1,600	500 - 1,600
Mep at max torque bar	**15**	14.4	17.7	18	17.7
Torque rise %	34	36.4	40	44	38.6
Torque at max power Nm	314	353	431	480	412
% Power at max torque (kW)	87.4 (82)	79.70 (59)	78.60 (79)	90.50 (91)	81.40 (84)
DETAILS					
Specific power kW/ dm³	25.1	22.2	27.6	25.9	28.4
Specific torque Nm/dm³	116.7	112.5	138	140.2	138
Areal specific power kW/dm²	30.25	26.62	33.11	30.03	34.11
METRO E BILANCIA					
Dry weight kg	405	360	275	540	280
L x W x H mm	931x638x1.226	715x625x750	667x569x776	751x611x679	790x590x790
Volume m³	0.73	0.34	**0.29**	0.31	0.37
Weight/power kg/kW	4.3	4.9	2.8	5.4	2.7
Weight/displacement kg/ dm³	107.4	108.1	75.9	140.3	77.3
Power density kW/m³	130.1	217.7	**344.8**	322.6	278.4
Total density t/m³	0.5	1.06	0.95	1.74	0.76
Displacement/volume dm³/m³	5.1	9.80	**12.åß49**	12.42	9.79
INDEX					
TORQUE	13.8	7	9.4	6.5	10.4
PERFORMANCE	4.92	4.6	5.4	5.3	5.5
STRESS	**8.2**	7.5	8.8	8.6	9.1
LIGHTNESS	12.8	13.1	9.1	16.5	9.1
DENSITY	9.6	19.3	28.1	26.7	22.1
DIESEL	6.8	6.1	7.3	6.1	7.4

3.6 is a 'nice' figure

At Agritechnica the excitement of 3.6 displacement was not limited to the most famous names of the western engine pantheon. **Yuchai** played a poker of aces (in terms of number of cylinders) st the Raywin booth, featuring a 3.6 displacement that perfectly recalls the equivalent Deutz and Perkins. Cologne is not new to partnerships and joint ventures in Asia, even if this is not the case. The authorship of Ycdk04140-T400 (Chinese naming isn't usualy originaly) is Yuchai, which has another German-speaking joint venture with Mtu for the 4000 series. Result are in any case reassuring: 103 kW and 500 Nm. Curves are obviously equal, Deutz and Fpt are even, even if the new model from Turin shows a significantly lower ratio affecting also the piston speed, the lowest ever, and the stress index, which is very similar to Tcd3.6. Torque curve rewards the F36, which leaves behind the competitors thanks to its 600 Nm at 1,400 rpm and a strong mep both at maximum power and torque.

Specific curves

These figures also affect specific curves: Fpt wins the first place although being very close to Deutz (the gap is two decimal), but showing a larger difference in specific torque - 10 percent more than the Deutz and 17 compared to the two other competitors. As dimensions and weight come into play Perkins takes the lead. The word 'density' is an English monologue.
Perkins wins thanks to its light weight and dimensions,



Left to right, Yuchai and Perkins.

an expertise that Peterborough gained during the transition from IIIB to Stage IV, which has seen the English engine increasing its size due to an after-treatment module unsuitable for the tight space under the bonnets. The installation of the DPF on the uprights of the cabin being discarded (a solution that Oem nipped in the bud), Perkins is now able to provide a balanced and compact unit.

About mep

Chinese show the lowest mep: considering the positive figures, this is an implicit encouragement to squeeze more kW looking at Stage V, on which Yulin's R & D is working probably in tune with the colleagues from Frankfurt, where the European headquarters are located. At the moment, the devices used for emission control are doc and dpf with scr, excluding recirculation. **Cummins** wins the extended comparison thanks to the 116 kW of the F38 (the identification code of the Quantum series has been removed) - which inevitably shows a high rotation speed - and 600 Nm just like Fpt. The Diesel index is American. **Kohler** climbs to 105 thanks to its 3.4 liters that wins the second place for power density and the best torque reserve.

Italian-American ace

The true Italian-American ace is however the maximum torque value: competitors will hardly equal 647 Nm at 1,400 rpm. Faithful to Eastern tradition, even **Kubota** does not show high mep thus gaining the opportunity to improve calibrations. In any case, the power increase up to 95 kW of the versatile 3.8 from Osaka featuring egr, doc, dpf and scr is for real. Also the only 3.3 liters speaks Japanese thanks to **Mitsubishi**, which shows low rpm values stopping at 74 kW. Mitsubishi left the limelight of major European fairs. Its strategies for Stage V are unknown. **Doosan Infracore** pushed the power curve up to 82 kW. New strategies are coming for **Same**, which for the time being features the 3.8 Farmotion, which reaches 100 kW and 500 Nme monopolizing SDF tractors together with Deutz. Fpt also deploys the younger brother F34, delivering 92 kW and very competitive dimensions.

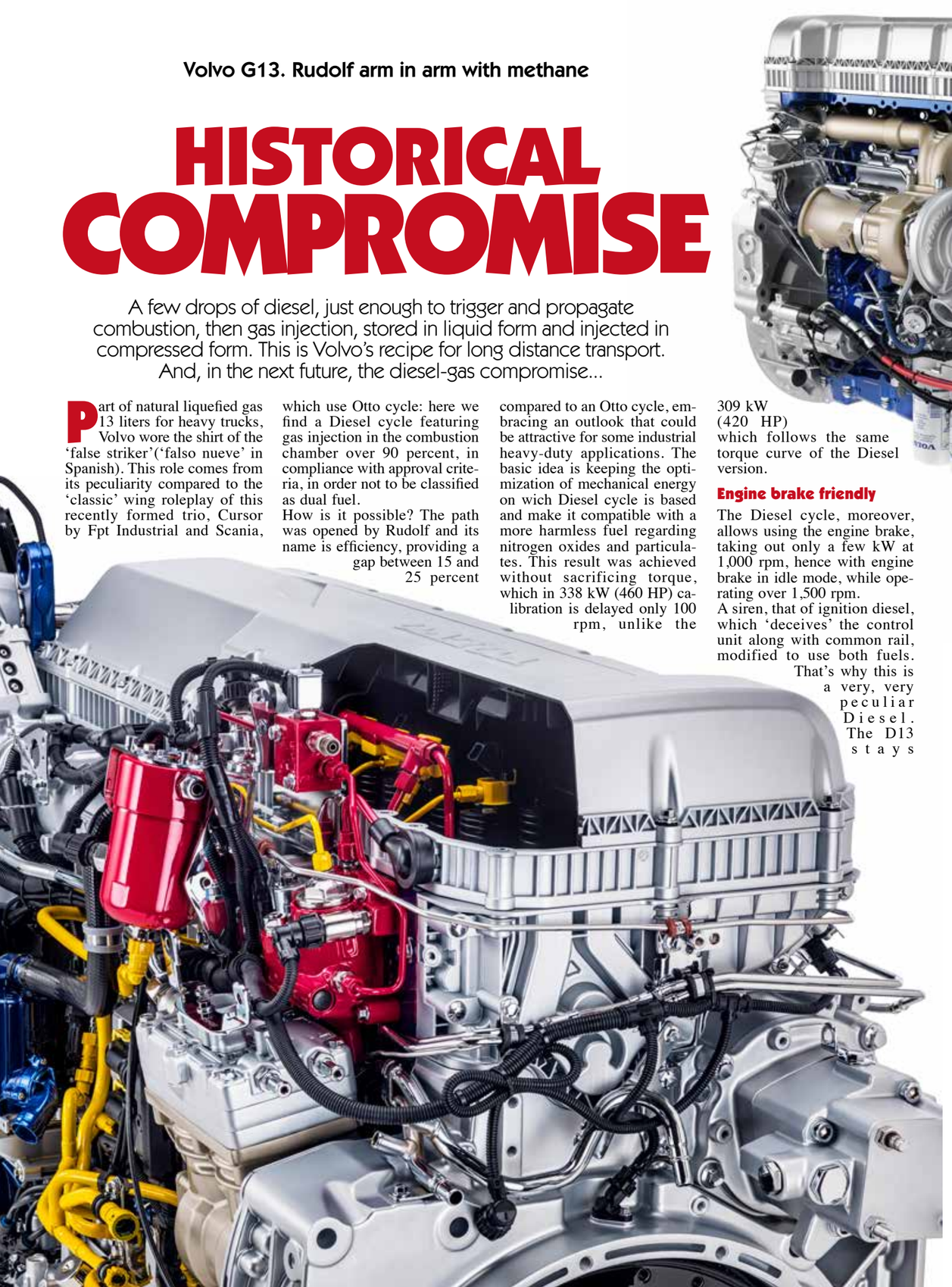
3 are 4. Vm and Yanmar

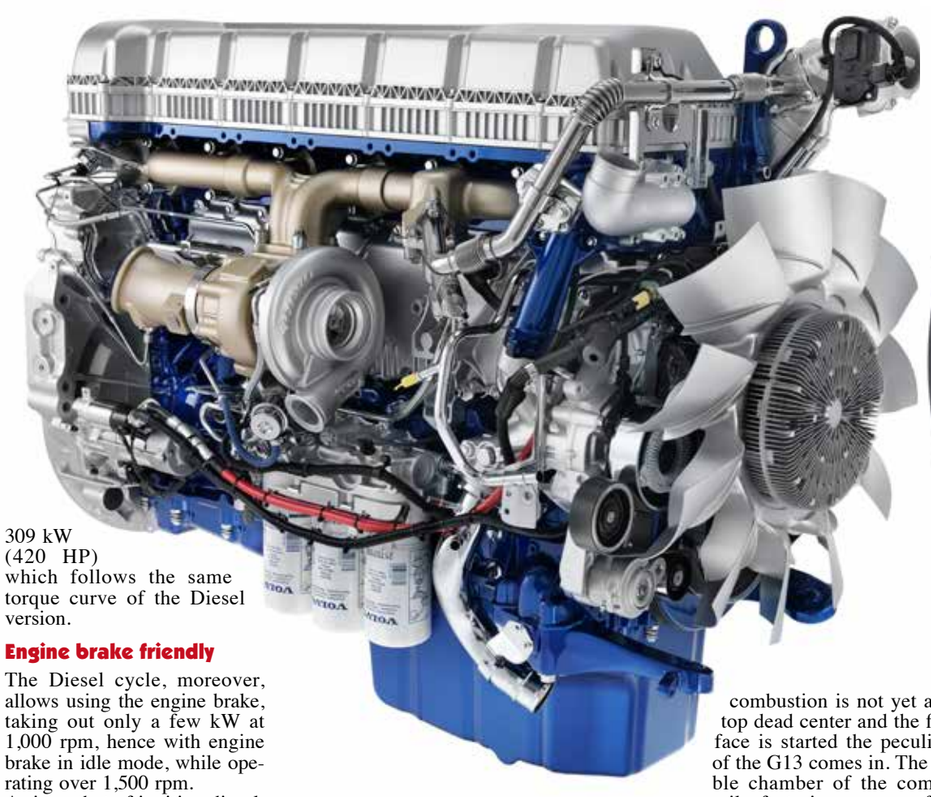
Paired in the wider comparison from 3 to 4 liters, last in alphabetical order, having in common the bore size, 94 mm, the 3 liters by Vm and Yanmar deliver respectively 85 and 88.4 kW (2,300 rpm for Vm, 2,500 for Yanmar). Both deliver 420 Nm torque. Also specific curves are almost always in the best three. Stresses are higher on the Japanese, which will live (presumably a long life, given the credentials which earned him the Diesel Index in the last 3 to 3.8 liters comparison) even in stage V, while the fate of Vm seems sealed, at least under the FCA brand. ■

Volvo G13. Rudolf arm in arm with methane

HISTORICAL COMPROMISE

A few drops of diesel, just enough to trigger and propagate combustion, then gas injection, stored in liquid form and injected in compressed form. This is Volvo's recipe for long distance transport. And, in the next future, the diesel-gas compromise...





The both sides of the G13. On the bottom a LNG tank detail.

Part of natural liquefied gas 13 liters for heavy trucks, Volvo wore the shirt of the 'false striker'('falso nueve' in Spanish). This role comes from its peculiarity compared to the 'classic' wing roleplay of this recently formed trio, Cursor by Fpt Industrial and Scania, which use Otto cycle: here we find a Diesel cycle featuring gas injection in the combustion chamber over 90 percent, in compliance with approval criteria, in order not to be classified as dual fuel.

How is it possible? The path was opened by Rudolf and its name is efficiency, providing a gap between 15 and 25 percent compared to an Otto cycle, embracing an outlook that could be attractive for some industrial heavy-duty applications. The basic idea is keeping the optimization of mechanical energy on wich Diesel cycle is based and make it compatible with a more harmless fuel regarding nitrogen oxides and particulates. This result was achieved without sacrificing torque, which in 338 kW (460 HP) calibration is delayed only 100 rpm, unlike the 309 kW (420 HP) which follows the same torque curve of the Diesel version.

Engine brake friendly

The Diesel cycle, moreover, allows using the engine brake, taking out only a few kW at 1,000 rpm, hence with engine brake in idle mode, while operating over 1,500 rpm.

A siren, that of ignition diesel, which 'deceives' the control unit along with common rail, modified to use both fuels. That's why this is a very, very peculiar Diesel. The D13 stays faithful to its nature, the monobloc is the same of the historic 6-cylinders 'Full diesel', some changes on the cylinder head have been made to adapt to the specific common rail and injection pump. First of all, the common rail delivers a kind of "pilot" injection, and when the combustion is not yet at the top dead center and the flame face is started the peculiarity of the G13 comes in. The double chamber of the common rail - featuring a non-perfectly circular section inject methane in gaseous state that is then in the appropriate pressure and temperature conditions to ignite. That's because the tanksare cryogenic, the store fuel is liquefied natural gas, but the nebulization in the combustion chamber takes place when the gas is compressed again.

The injector features a concentric and coaxial body and the pressure is driven by a pump immersed in the LNG tank.

Into the system

It aspires the liquid fraction bringing it to the upper section, where engine cooling water is flowing inside a serpentine acting as an heat exchanger and heating the line of liquid methane in order to convert it to the gaseous state.

A five-liter module acts as storage unit sending compressed methane to the engine at 300 bar. This accumulator is called Igm, and we could call it an "automatic translator" which links diesel and gas in order to balance the delivering of the two fuels. To allow this transformation Volvo "think tank" used a PTO which drives the hydraulic circuit.

As we said, the system only works if the Diesel conditioning module correctly calibrates the amount of diesel. In case of overflow Dcm controls the return to the tank. In the same way, to avoid non-combusted methane dispersion, slip methane risk must be avoided. The Return to tank excludes any possibility of unburned gas dispersion: the excess methane is cooled through a nozzle and returns to the tank in liquid state.

Losses allowed

Maximum loss of methane allowed during the operating cycle is 0.5 g/kWh. Volvo chart draws a value of 0.30 g/kWh in the harshest condition of use. Taking into account the rarefaction of liquefied natural gas distribution network, the G13 has an ace up his sleeve to manage emergencies. Once the gas is finished there's still a small reserve of diesel fuel which is not used for power but, as we know, as a "primer" of the flame face, capable to provide 50 HP (36.7 kW) at 20 km/h. ■

Gas 13 liters. A trio opened

A NEW CYCLE

It could affect also competitors. Fpt Industrial-Iveco, Scania and Volvo compete in the field of gas-injection six cylinders 13-liters caught on the road to Liquefied Natural Gas for long distance transport. Which direction will this technology take?

Call it Rudolf, though its second name could also be Nikolaus. Two out of three of the 13 liters converted to gas, all coming from diesel, took out common rail and used the injection ramp with multipoint timing and stoichiometric lambda ratio, passing under the flags of Nikolaus August Otto. The third one remains faithful to common rail, but overturning its inner section to allow gas flow. That's a mix of Otto cycle and Diesel cycle for long haulage and, as we suppose, for some heavy duty applications in earthmoving and large harvesting machines.

Pure LNG on the blood

Two brands - Fpt - Iveco and Scania chose to remove components during the transition to multipoint injection and stoichiometric combustion. The third one (heretic or conservative?) it's Volvo, which keeps a modified common rail to meet the needs of double injection and exploits the intuition of Rudolf (the spontaneous propagation of the flame face) to reconcile diesel efficiency and the benefits of gas. Fpt and Volvo deliver 338 kW and Scania 310 kW, but all engines share the same torque peak at 2,000 Nm. Waiting for a check on dimensions a pause for reflections is needed about power density, but MEP rewards Scania while followed by Volvo.
Nominal power at the best point of specific consumption rewards the revolutionary-conservative choice made by Volvo as well as specific curves. Scania on the other hand is lighter by 100 kg. The award-winning couple Fpt - Iveco shows the best absolute values in Otto cycle. Waiting for this "virus" to spread to industrial applications, we use the words of Vado and Torno, one of the oldest European monthly trucks magazines (its roots date back to 1963) to tell the tale of LNG. Vado and Torno witnessed the raise of LNG, attended the introduction of Scania R410 LNG at Ecomondo in Rimini, and tested on the road the Iveco Np 460 LNG and the Volvo Fh460 LNG. What's the reason of focusing on 13 liters? This is the central range of the European long distance tractors (from 410 to 500 HP) market, a power range that is worth 50 percent of total sales. The current limit of LNG is the distribution network. The north-west quadrant is quite covered, the expansion in the North-East is underway, going down the Via Emilia we find gas stations in Piacenza, Fiorenzuola d'Arda (Pc), Parma, Reggio and Modena.

13 LITERS TRUCKS AND LNG

Brand	FPT INDUSTRIAL	SCANIA	VOLVO
Model	**CURSOR 13 NG**	**OC13 101**	**G13 460**
B x S mm - S/B	135 x 150 - 1,11	130 x 160 - 1,23	131 x 158 - 1,21
N. cylinder - dm³	6 - 12,88	6 - 12,74	6 - 12,77
Max. Power kW - rpm	**338** - 1.900	302 - 1.900	**338** - 1.900
Mep bar	16,9	**15,3**	17
Piston speed m/s	**9,5**	10,1	10
Max Torque Nm - rpm	2.000 - 1.100	2.000 - 1.100	**2.300** - 1.100
Mep at max torque bar	**19,9**	20,1	23,1
Torque rise %	49,1	56,1	**58**
Torque at max. power Nm	**1.695**	1.519	**1.695**
% Power at max. torque (kW)	68,2 (231)	76,30 (230)	78,4 (**265**)
DETAILS			
Specific power kW/dm³	26,2	23,7	**26,4**
Specific torque Nm/dm³	155,2	156,8	**180**
Areal specific power kW/dm²	39,35	37,94	**41,78**
RULES AND BALANCE			
Dry weight kg	1.240	1.140	1.214
Weight/power kg/kW	3,7	3,8	**3,6**
Weight/displacement kg/dm³	96,3	**89,5**	95
Power density kW/m³	173,3	227,1	**229,9**
Total density t/m³	0,64	0,86	0,83
Displacement/volume litri/m³	6,61	**9,58**	8,69
COME E QUANTO			
Emissions	Euro 6	Euro 6	Euro 6
Injection	multipoint	multipoint	common rail
Techno	Lng, 3-way catalyst	Lng, 3-way catalyst, Egr	diesel-Lng,Scr
INDEX			
TORQUE	10,7	10,8	**11,6**
PERFORMANCE	6	6	7,5
STRESS	**9,8**	10,1	12,7
LIGHTNESS	13,2	11,5	12
DIESEL	7,1	7	**7,2**

13 LITERS TRUCKS AND DIESEL

Brand	IVECO	SCANIA	VOLVO
Model	**CURSOR 13-570**	**DC 13 125 490**	**D 13 K-540**
I.D.			
B x S mm - S/B	135 x 150 - 1,11	130 x 160 - 1,23	131 x 158 - 1,21
N. cylinder - dm³	6 - 12,88	6 - 12,74	6 - 12,77
Max. Power kW - rpm	**419** - 1.900	360 - 1.900	397 - 1.800
Mep bar	21	**18,2**	21,1
Piston speed m/s	**9,5**	10,1	**9,5**
Max Torque Nm - rpm	2.500 - 1.000	2.548 - 1.000	**2.600** - 1.000
Mep at max torque bar	**24,9**	25,6	26,1
Torque rise %	49,6	4,1	**55,5**
Torque at max. power Nm	**2.107**	1.813	**2.107**
% Power at max. torque (kW)	62,5 (262)	74,20 (267)	68,60 (**272**)
DETAILS			
Specific power kW/dm³	**32,5**	28,2	31
Specific torque Nmdm³	193,9	199,9	**203,4**
Areal specific power kW/dm²	48,78	45,23	**49,07**
RULES AND BALANCE			
Dry weight kg	1.230	1.200	1.134
L x W x H mm	1.513x998x1.123	1.392x877x1.093	1.285x1.100x1.301
Volume m³	1,70	**1,33**	1,84
Weight/power kg/kW	**2,9**	3,3	**2,9**
Weight/displacement kg/litri	95,5	94,2	**88,8**
Power densitykW/m³	246,5	**270,7**	215,8
Total density t/m³	0,72	0,90	0,62
Displacement/volume litri/m³	7,58	**9,58**	6,94
INDEX			
TORQUE	12,2	**24,8**	11,3
PERFORMANCE	7,1	10,3	7,3
STRESS	**11,5**	243,9	11,9
LIGHTNESS	13,2	1,2	11,7
DENSITY	**7,8**	3,1	7,3

After Bologna we have to get to Rimini, then Fano and Corridonia in the Marche region, and Silvi Marina. Once inaugurated the announced station in Brindisi the Adriatic ridge would be fully covered. At the moment, the "black hole" in the map of LNG stations is the Tyrrhenian coast.

Volvo fuel?

Let's start with the tests and the interpreter of the metamorphosis of diesel, Volvo. The brand who won the Sustainable truck of the year award of Vado and Torno kept all components in the transition to gas as shown by the I-Shift transmission, which handles its 12 speeds in sequence without the least indecision running constantly between 1,000 and 1,500 rpm (green zone), reaching 1,800 rpm only at lower gears. Once reached the cruising speed the engine runs at 1,100 rpm at 80 km/h, rising to 1,250 rpm at 90 km/h, showing a very similar behavior compared to the 460 diesel. Driving on the ups and downs of Swedish motorways, last generation I-See (with cloud-based maps)

G13 and FH truck by Volvo. Right, Scania LNG and the new 13-liter gas engine from Södertalje.

together with Acc (active cruise control) manage the whole transmission line switching to Ecoroll as soon as possible or shifting gears to always maintain the best torque (which starts at 1,000 rpm instead of 900 rpm of diesel). When slopes become demanding the Veb Plus switches from Auto position (engine brake driven by the brake pedal) to three different settigs. It's action is so effective that the driver can also stop the vehicle. The FH relies on a full emergency brake (as anticipated in the review of the G13); even if the driver does not react the emergency brake automatically stops the vehicle, acting together with frontal radar and camera controls. Another indispensable safety device is a right-side sensor able to detect cars or cyclists and trigger the alarms, plus a camera that activates along with the direction indicator.

FH Cabin

The FH cabin is perfectly identical to itself, except for the indication on the dashboard of the status of the three tanks (gas, diesel and AdBlue) and for the LNG logo on the doors. Even in gas version, and this is also true on the FM, all versions and options provided for diesel version are available, except for the short cab (Fm) and Dual Clutch gearbox. Iveco is the hare who led the big group. Industrial and Italian heritage, gas has found a home in Turin. After all, Fpt Industrial, formerly known as Iveco Motors, sold more than 30 thousand gas engines on the market in over twenty years. After the debut of the Stralis Np 400 in 2016, equipped with the 294 kW Cursor 9, it was the turn of the Stralis Np 460.

Pierre Lahutte said

Pierre Lahutte, president of the Iveco brand, stated: «*We started last year the revolution in the gas long distance trucks. Following that success, we launch today a whole range*». In order to "*complete the fuel transition*", as Lahutte says, Iveco therefore relies on the 13-liter Cursor gas version that reduces particulate emissions by 99 percent, NOx by 60 percent compared to Euro 6 and, in the case of biogas, up to 95% CO2. Plus, the Stralis Np is quiet - less than 71 decibels and falls within Piek standards (the homologation was requested and soon a key to stop rotation speed at 1,500 rpm and travel quietly will be implemented) and two cryogenic tanks of liquid methane provide a range of 1,600 kilometers thanks to a fuel consumption 15 percent lower than to diesel. The engine lowers Tco (Total cost ownership) up to 9 percent, compared to 7 percent reached by the 294 kW Cursor 9 (400 HP). Together with the Cursor 13 gas, the Stralis Np 460 also features the 12-speed Hi-Tronix gearbox (the latest evolution of the Zf Traxon), 10% faster than the Eurotronic, which supports Hi-Cruise predictive driving through Gps, in addition to Ecoroll, Hill-holder and many other features: the rocking function designed for poor grip conditions, the integrated hydraulic retarder (standard) and a new range of PTOs. Furthermore, the Hi-Tronix cuts the noise level by 6 decibels and extends maintenance intervals and durability up to 25 percent.

Hi-Way

Making the Stralis Np 460 a real flagship, the Hi-Way cabin and a strongly improved electronic equipment. On the center screen of the dashboard are all the information of the Driving style evaluation (Dve) that monitors and improves the driving style. Then there's the Ecoswitch speed and torque limiter, the Eco-fleet to optimize gearshifts, a function that is paired with the Ecomode (set through a dedicated key) and the driver's fatigue detector featuring sensors on the steering wheel and visual signals. This is followed by additional Tco2 Live Fuel consultancy services with Smart evaluation reports from Dve, Tco2 Advising to save fuel and Tco2 Driving economic driving courses.

Finally... The Griffin

Scania closes the review. Introduced in November at Ecomondo, it has not yet been shown on the road waiting for the ice to melt and the mists dissolve. We report the impressions from Rimini, after the Hollywood-style premiere with the management from Södertälje. According to them, sustainable transport is a key factor for success also from the point of view of profitability. The innovations introduced by the Griffin brand in the last eighteen months, from Next Gen to 8 V engines, the G-cab and the Xt Series for quarry and construction go unequivocally in this direction. The launch of the new 13-liter Euro 6 410 HP (with Egr and catalyst) fueled by liquid methane (LNG) further strengthens and establishes the goals on which focus every design effort. Just like on diesel, engine power and torque - which like the 9 liter, five cylinders, 206 and 250 kW (280 and 340 HP) meets the Piek noise standards delivering a noise level under 72 decibels - are managed by Opticruise, the automated gearbox conceived, developed and manufactured by Scania. A guarantee in terms of comfort, driveability and precision.

Up to 1100 kilometers

For its new liquid methane top of the range, Scania declares a driving range up to 1,100 kilometers in the case of a classic tractor - 40 ton semi-trailer combination, and a 1,600-kilometer peak for insulated vehicles.
In this case too, these are values that make it possible to best meet the needs of transport and distribution on a long-haul national scale.
Naturally, in line with the Swedish manufacturer philosophy and tradition, there is no compromise in terms of safety. A theme that designers and engineers of Södertälje have interpreted with the usual accuracy, for example by rotating backwards the tank valves.
A safety solution which reduces the risk of compromising the integrity and functionality of the valves in the event of a collision.

The European LNG infrastructure

The new infrastructure of LNG distribution network is emerging in Europe. It is still early to call it a structured network or an organic distribution structure along the main heavy traffic routes. Still, something solid and concrete is going on. The latest evaluation by the European Natural & Bio Gas Vehicle Association (NGVA) counted 114 operating LNG stations (end of December), compared to over 3,000 compressed natural gas distribution points. The heart of old Europe beats at the rhythm of LNG: Spain dominates the scene thanks to its thirty installations in operation. Great Britain, Holland and France follow with 20 points each, while NGVA counts ten filling stations in Italy and six others in Portugal. For now, the silence of the German colossus is loud: only two distribution points are available in Germany.
These surveys are certainly rounded down as admitted by NGVA itself, stating that the data are being updated and that the situation is evolving from week to week as confirmed by the Italian example. At the end of 2017 there were actually 15 LNG distribution points (5 more) for 400 LNG and 100 dual fuel vehicles (the "pure" option is clearly preferred compared to the hybrid option). Considering that the distribution of natural compressed gas is already rooted in our country - almost one thousand stations in operation - it is highly likely that even the liquefied version will significantly expand its current market share. Coming back to the continental situation, NGVA estimates that in 2030 400 thousand LNG-powered trucks will circulate on Europe's roads. Even considering this estimate as generous and reducing the size of the total fleet, it is clear that the distribution network will have to grow several times compared to the current situation in order to provide an adequate coverage.

JCB and the hybrid era genset

STANDING TOGETHER

JCB hybrid gensets are powered by Dieselmax, 4.4 liters cylinder displacement by JCB. They are available in three different sizes and they fit the same battery pack. Batteries deliver power up to 40 electrical kilowats and they run up to 20.5 hours. Battery Box is available for whole range

Intyelihybrid seen on the building sites. Below a picture of Dieselmax by an exhibition.

Internal combustion engines are becoming more and more hi tech to fulfill incoming emissions standards without compromising too much fuel consumption.
Turbocharger and intercooler system are not enough to accomplish the mission, motorists reckon on higher and higher injection pressure, catalysts of any kind, SCR or EGR to say a few: everything is okay if allows you to reach the goal: to reduce emission without penalizing efficiency.
But when this technology panoply is not enough, the solution could be an alliance between two old antagonists: internal combustion engine and electric motor.
That's way hybrid technology is becoming more and more common in every sector: cars, trucks, ships, trains.
No surprise, then, for an innovative proposal from JCB: an hybrid gen set.
To combine in a gen set a diesel engine with batteries may look like a provocation.
But we are speaking about Sir Bamford and JCB, the first to launch a farm tractor at 80 kph, but not without providing it with true suspension and brakes on both axles.

Innovation and design

In a few words: innovation is okay but only when it sounds such as design and engineering.
Normally, we have an hybrid solution when an ICE is combined with and electric engine which, in turn, is powered by a battery pack.
In a gen set it's different because in this case the aim of the ICE is not to move something but to produce electric energy as do the batteries.
But then, what are the batteries for?
Statistics can provide us with an answer: very often a gen set works at full power only for few hours a day. During the remaining hours the load is very low or even zero.
And as we know that a gen set runs at a constant 1.500 (or 1.800) rpm, partial load means poor efficiency. Specific consumption is almost constant down to 75% nominal power and loose up to 5 percentage points at 50%, a limit under which is better to turn off the engine.
It's the moment when batteries can take the load.
An engine that runs few hours at such low loads means also less oil consumption, less wear, less emission, less noise, less maintenance costs.
Inteli-Hybrid Generator, this is the name of JCB hybrid gen set, derives from QS gen set and is available in different emission level for European (STAGE IIIA) or for no European market.
The layout if the same as similar is the canopy: the biggest difference is the white and blue color instead of the classic yellow color and the battery compartment underneath.
The IEC is the classic JCB 4,4 liters four cylinder (bore and stroke 104 x133 mm), available in three power levels.

50 Hz

At 50 Hz the line up starts with the 66 Stage IIIA col GTC-1 S2 (65 kVA). Prime rating is at 50,4 kW continuous at variable load and can work without connection to the main grid. There is no limitation on the annual hours of operation and 10% over load power can be supplied for 1 hour to 12.
Stand by rating is at 56,8 kW and can withstand variable load, in the event of a utility power failure, but no overload is permitted.
60 Hz versions are, on average, 10% more powerful but less efficient, as fuel consumption increase by a substantial 25%.
Next steps are the G91QSi (diesel engine is the GTC-2 and the power is 91 kVa and 65,00 kW in Prime and 71,90 kW in Stand-by) and the 116Si – 115 kVA - (in this case the engine is aftercooled) and power is 84,00 kW in Prime and 92,80 kW in Stand-by.
Batteries are very traditional 24 x 2V Sealed Lead Acid Gel: bulky, heavy but very reliable. No problem for low or high temperature (operating temperature is -10 to+40 °C) and very few risks of fire or thermal runaway or things like that.
During periods of low load, JCB DSE 7410 PLC turn of the engine and power is supplied by batteries, much like an automotive Stop/Start system, increasing efficiency, reducing fuel consumption and cutting emissions.
Battery pack is the same for all the versions: nominal capacity is 40 kWh but with a 50% Depth of Discharge you can use only 20 kWh.
On average, that's enough for 20,5 hours at 1 kW load, 4 hours at 5 kW o about an hour at full load.
May look much less than rated power but, for example, 1 kW very often is enough to light up a construction site during the night leaving the diesel engine off.

15 years service life

Batteries have 15 years maximum service life at 25°C, which corresponds to about 1500 cycles at 50% DOD.
Battery management include inverter protection and overload, overheat, short circuit, low battery, excess battery voltage ripple control.
Battery monitoring functionalities allow to control and check voltage and % capacity available and time available at current discharge rate.
If battery level reaches 50%, diesel turn on (with the help of two independent 120 Ah lead batteries) and charge batteries to 80% in one hour and a half and to 100% in three hours and fifteen minutes.
Alternator is a 4 poles star winding connections HM250A2 made by JCB. Insulation class is H and enclosure is IP23.
Steady state regulation assures +/- 1.0% voltage tolerance.
There are two output types available, a seamlessly switched single-phase and a load-sensing three-phase output.
The seamlessly switched sockets are ideal for IT and fire and security systems that require constant power. In full eco mode the generator will sense when a load is applied to the three-phase outputs, starting the generator as required.
While the generator is operating on battery power, potentially through the night time period, there will be no noise emissions, and no carbon making it an ideal solution for urban and city sites.
Connectors are CEEFORM standard.
There is no need for installation: just place it on the construction site (pay attention: the gen set is 3 tons heavy box and dimension are 2,85x1,14x2,23 (LxWxH), fill the 285 liters tank and the gen set is ready to go.
JCB offers a product also for existing gen set.

B40 Battery box

It's the B40 battery box.
Blue and white (but you can require also traditional yellow) has a 40 kWh storage capacity (20 kWh at 50% DOD) and 7,3 kVA continuous output at 25°C and 20 kVA peak power (5 seconds).
It's compatible with all sizes and kinds of generator. It's fitted with two standard wires and it can be charged from a main source.

Alberto Scalchi

Left to right two pictures of the previous version and a couple images of the new ZH-210-6 hybrid excavator.

Hitachi ZH210-6

ENERGY SAVING

From supercaps to lithium batteries and dowsizing thermal engine from 122 kW to 73 kW. It's a brief summary of the hybrid track excavator ZH210-6, currently able to recover energy during the upper structure braking. Hitachi is well know for its hybrid machinery, together with Isuzu

Unveiled as a preview by Hitachi dealer in Belgium, Luyckx, at the Matexpo biennial international trade fair held 11-15 September, Hitachi new hybrid excavator ZH210-6 is, at the same time, an evolution and a revolution compared to the previous ZH210-5. Since his debut, Hitachi hybrid excavator was an absolute novelty for hybrid world because, unlike all other hybrids, savings were originated during normal load cycles and not as a result of the shutdown of the ICE during idling or low load periods. During working cycle, an excavator needs more power (and more fuel) not only when digging but also to rotate the upper structure.

Upper structure's momentum is very great: the counterweight itself of the ZH210 has a mass of 4,850 kg moving cabin, engine, boom and bucket, 400 liters fuel tank, 375 liters hydraulic system and tank oil and so on. Quickly rotating such a mass (nominal swing speed is 11.8 rpm) needs a very high torque to start (hydraulic motor has 68 kNm or 6,940 kgm swing torque) and stop the rotation.

The innovative idea is to use an electric motor-generator to generate electricity when it's necessary to stop the upper structure rotation and to assist hydraulic motor to swing it. The perfect match of hydraulic and electric motor maintains the same swing controllability as with traditional excavators: electric motor provides its best for small swing operations. Electric power generated during braking is now stored, and this is the difference compared to the previous ZH210-5, large-capacity lithium-ion battery developed by Hitachi Automotive Systems. This has significantly increased continuous output to the electric power assist motor, which means it is able to support the engine power considerably and for longer time. In fact, on previous ZH210-5 recovered energy was stored in a electric double-layer capacitor.

Capacitors

Capacitors are very interesting for their capability to withstand very high inrush current (just think that charge time is measured in seconds while in lithium batteries is measured in hours) and because they are not subject to overcharge, can discharge very quickly, have a very wide operative temperature range (-40 + 65 °C) and up to 1 million cycles life. On the other hand capacitors have a very low specific energy and, above all, are much more expensive than lithium batteries. Low specific energy means higher mass (and this could be not a problem considering that, anyhow, a counterweight has been added to the upper structure) but means also bigger dimension. And this is always a problem. Due to lithium batteries upgrades in the past few years, Hitachi left super capacitors on the ZH201-6 for lithium batteries. Apart from the advantages of higher energy density, lower cost and reduced volume, the use of lithium batteries allowed to change working profile: not only energy recovery during working cycle but a power contribution to diesel engine in every moment. This allowed to reduce diesel engine size from 122 kW to 73 kW, that's a proper power level in order to manage ordinary operation. Only when more power is needed, the management system starts the 44 kW electric motor to assist diesel engine. This solution has broadened the operative range in hybrid mode, previously limited to the assistance to the upper structure hydraulic motor. For this reason the new ZH201-6 is not only more efficient than the standard ZX210-6 (minimum 20% up to 31% fuel saving and reduced emission) but also than the previous ZH210-5 in both PWR and ECO mode (with savings up to 12%).

Power to recharge

During low load periods, excess diesel power is used to recharge batteries with the electric motor acting as a generator.

Thanks to batteries and electric motor, diesel engine is shut down during idling and stand by, further contributing to fuel and emission reduction.

To further reduce fuel consumption, all the hydraulic circuit has been re-designed. The hydraulic TRIAS-HX II system has been enhanced for the ZH210-6 to improve the efficiency of the hydraulic system and further reduce fuel consumption. The hydraulic electric swing has also been improved, with an electric motor torque maximum of 220Nm, compared with 160Nm on the ZH210-5.

ZH210-6 diesel engine doesn't use SCR to cut AdBlue and it's Stage IV compliant by including diesel oxidation catalyst and diesel particulate filter.

Alberto Scalchi

Hybrid wheel loader speaks Japanese only

Due to ZH 210-5 experience, since 2016 Hitachi sold 220 HYB - 5B wheel loader just for the Japanese market. Thanks to its 3.4 m3 standard bucket capacity and 18.18 tonns operating mass the machine provides an outstanding productivity with incredibly low emission and noise levels. Electric drives replace traditional transmission and energy recovery during deceleration recharge a capacitor while the lift boom system retains traditional hydraulic circuit. So, it's possible to adopt independent control that controls the vehicle speed with the accelerator pedal and the front work with the control lever respectively. Boom lifting and movements are completely separated and there is no need to use brakes anymore to control speed. The diesel engine is a 147 kW Isuzu 4HK1 at 2,100 rpm. Besides a 20% fuel consumption and emission reduction versus standard version, the 220 HYB-5B is classified in Japan Ultra low noise construction Machinery

BETWEEN EAST AND WEST

Fpt Industrial is the privileged partner, sharing the membership in the CNH Industrial family and promptly answering the need for constant dimensions. Isuzu, Kubota, Mitsubishi, Shibaura and Yanmar engines come from old and new cooperations with Japan

Case Construction Equipment boasts a complete and articulated lineup and an ancestral attraction for the New Continent, where it was established 176 years ago by Jerome Increase Case. After all, the brand in this sector is identified as a 'full liner'. Under the bonnets the Fpt hegemony is diluted by the large delegation from the Rising Sun - Isuzu, Kubota, Mitsubishi, Shibaura, Yanmar - inherited from the collaboration with Sumitomo and the Japanese paternity of compact machines.
We talked about it with **Egidio Galano**, Emea product manager, and **Antonio Strati**, product marketing manager.

How would you summarize the engine strategy of Case Construction Equipment?
Several technologies coexist under the same roof, following a couple of common directions, first of all the ostracism to particulate filter on Heavy Line machines. Following the alliance with a Japanese partner, we fit on excavators a 4 and a 6 cylinders by Isuzu, an exception on the heavy line that is generally faithful to Fpt Industrial which powers wheeled excavators, wheel loaders, graders, dozers and also compact loaders and backhoe loaders. The exclusion of dpf is the common denominator of the whole 'heavy' range, regardless of the engine brand. As for Fpt, we use the Nef 4 and 6 cylinder and the Cursor 9 on our two largest wheel loaders.
A specific sump has been developed for wheel loaders, having to cope with the inclination of the machine which often works on slopes and unstable ground. The engine is mounted above the axle together with this sump, which features an oil pump capable of transferring the oil from one side of the sump to the other based on the inclination of the machine.

And apart from Fpt?
We fit Isuzu on crawler excavators and midi, while the 3.2 liter, 36 and 50 kilowatts Shibaura is fitted on skid loaders low range. We find again Fpt on Ctl (Compact track loaders) with the F3.4. Mini machines boast a mix of Japanese mother-tongue engines, inherited from the industrial partnership: Mitsubishi, Yanmar and Kubota. Moreover Japan is renowned for engines between 1 and 2 liters. We established a long-standing partnership with Sumitomo for excavators above 7 tons, while on smaller machines we signed a more recent agreement with Hce (Hyundai construction equipment), in both cases a large part of the manufacturing takes place in San Mauro Torinese factory.

Which are your criteria when choosing engines?
We meet the different needs of heavy and light machines. We are forced to find a compromise on compact machines, for example on 47-48 kilowatt the compliance with Tier 4 requires dpf, unlike the range under 36 kW. The FPT F34 features a light egr and an exhaust gas recirculation rate under 10 percent, which avoids dpf and reduces the dimensions of the SCR. The particulate filter is fitted below 56 kW in two Yanmar engines used on larger machines.

What about gas and hybrid engines?
Due to applications and customer needs there is no demand for alternative fuels on earthmoving machines. The hybrid, from a decade ago, has been a protagonist of the experiments of some manufacturers, including Hitachi, Komatsu and Sumitomo itself. We're talking of market niches involving the hydraulic circuit and accumulators, without replacing the traditional engine. Rotation, inertia, boom lowering can alternate the hydraulic motor with an electric one in order to recover energy.

Stage V. What will you ask to engine manufacturers?
The main request is to meet dimensions and spaces and favor interchangeability. The Fpt Stage V formula does not include changes to dimensions and canning on installations. The technology changes within the scr module where the ScrOnFilter will be implemented, integrating the particulate treatment in the scr catalyst. There is no need to regenerate the filtering system, there is no filter maintenance, the 'regeneration free' Ats system is widely used, which avoids downtime and provides automatic filter cleaning. The effort was to avoid additional impacts on end user operations.

And what about the interaction between hydraulics and engine?
We are developing Stage V minimizing the impact on the vehicle, focusing on continuity. A development of electric applications could mainly involve mini-excavators, even if market and incentives trends does not seem going this way. A new technology - and this also applies to LPG and gas - involves development costs, and we must check if the customer is willing to pay for it. There is a problem regarding fuel storage for machines such as excavators, which sometimes work in environments that are difficult to access and move little, at least in certain life cycles.

A brief summary of Case Construction Equipment?
Case Construction Equipment is one of the founders of the backhoe loader concept, has historically built its success on skid loaders and has made the history of key products such as wheel loader. Its roots in the US have gradually expanded making Case Construction Equipment a global brand. Coming to excavators, machines having high technological content that are strategic on the market, we started a partnership at the beginning of the 90s with the recently renewed and strengthened Sumitomo, which planned to transfer part of its production to Europe, to San Mauro Torinese. In the past Case Construction Equipment has taken over the earthmoving division of Poclain. Another important chapter in our history is the relationship with Fiat. In 2004, Fiat Hitachi and Fiat Kobelco excavators were manufactured in San Mauro. We have a particular ability to handle different technologies. Customer service is located in Paris and on the other side of the Atlantic in Tomahawk, Wisconsin. Within the Cnh brand, Case Construction Equipment manufctures the entire range of compact and heavy machines, while in the Emea area New Holland Construction has an exclusive focus on the compact line, marketed with the yellow color through the agriculture dealer network.
Fabio Butturi

Case as seen by Case

Antonio Strati, Marketing Manager Emea, sums up the founding values of Case Construction Equipment. «Case Construction Equipment is a global company, present all over the world. The EMEA area requires a widespread network: here we have 128 dealers (84 in Nafta, 136 in Apac (Asia Pacific) which is highly competitive, 43 in South America.The sales at global level are strongly connoted in North America, we are historically strong also in South America, where we hold significant market shares. We have offices in Monthyon, a few kilometers from Paris Charles de Gaulle airport, where our entire range is available to our customers. A Poclain cave allows to excavate, move gravel, simulate a real work cycle. Coming to operators, they live in the cabin, and in this case more than in others comfort becomes essential. We have improved seat and ergonomics on medium - large wheel loaders, reduced cabin noise and vibrations, improved the steering joystick, renewed the display, improved visibility fitting a curved single - piece front glass, eliminating all joints».

Left to right, Soilmec headquarters, the SR-75, some Cat engines and a detail of a Volvo engine.

Soilmec with Cat, Cummins, Deutz and Volvo

FOUR-STRIKERS ATTACK

Soilmec division expanded its engine offer: Volvo Penta joined Caterpillar, Cummins and Deutz in Tier 4 Final. Monoblock transitivity from Tier 3 to 4 and service are the key features of its engine partners

Since 1969 Soilmec has been synonymous with drilling, a fame echoing from great deserts to large metropolitan worksites. Headquartered in Cesena, Italy, in the district of the Romagna Riviera, eight factories in Italy, United States, Brazil, China, Dubai and India, roots all over the world and a strong presence in North America, Emirates and Africa. In Europe UK is its main market, Mexico is growing in the Nafta area featuring over 50 units delivered in two years. The Trevi Group rely on a technological and productive division, Soilmec, and an operative division, Trevi itself, linked by a continuous exchange of synergies and strategic information. Engines are supplied by a historical trio, Cat, Cummins and Deutz, recently joined by Volvo. We entered "inside and behind the engine compartments" with the help of Federico Pagliacci, Soilmec Development Vice-President.

What are the criteria followed by Soilmec in choosing engine suppliers?

Our product range includes 45 models ranging from micropiles drilling machines from 3 to 40 tons to the core business, the piling rigs from 35 to 160 tons, from heavy duty cranes equipped for diaphragms and foundations to hydromills water machines. Our figures tell a story of a strong company and 7,500 machines manufactured since 1969. We will celebrate in February the 5,000th large diameter unit. The average annual production is around 250-300 units with a peak of 700 machines in 2007, after the Middle East market raise. The range of installed power goes from 70 to 700 kW provided by Cummins, Deutz and Cat units. Volvo has recently joined the lot. We had our first contacts with the Swedes at Bauma China, where we were highly impressed by the homologation of the same block in Tier 3 and Tier 4, a standardization which we see very favorably being Soilmec active in over 60 countries.

Which are the critical issues of the transition from Tier 3 - Tier 4 Interim to Tier 4 Final?

As I told before, Soilmec achieves considerable figures in our market that are however small for our suppliers, forcing us to be subjected to the regulatory steps. Based on our information Stage V should not have a critical impact in terms of size, contrary to what happened during the migration from Stage 3 to Stage 4.

What are the issues related to the migration to Tier 4 Final and the harshest work conditions?

We use Scr, while installing Dpf only on request. In the transition to present regulations we had to redesign our machines in some cases. With regard to the environmental impact, our machines may also work in the desert, enduring temperatures up to 50 °C, and Tier 3 makes engine's work easier. We established a very valuable collaboration with Porsche Consulting, resulting for example in 4 top-of-the-range models that use the same Soilmec-designed turret, changing front attachment and counterweights, allowing us to simplify engineering, production and stock codes.

What are the most popular displacement and power ranges?

The 13 liters fits our needs very well. The 'hot' ranges span from Cummins QSB 6.7 @164 kW to Cat C18 @470 kW.

How important is fuel economy?

More and more, considering that some machines may use up to 800-900 liters per day. The operator is used to an average speed of 1,800 rpm and could be not confortable with automatic shutdown functions. We are working instead on decreasing the engine rotation speed in order to reduce fuel consumption at low loads.

1,800 rpm means working as a stationary engine...

... and in intermittent work cycles. Just think that the average translation from one drilling point to another is about 10-20 meters and operations are repetitive, requiring different power rates and discretionary use. We evaluated hybrid solutions but our work cycles do not allow energy recovery as it happens on many earthmoving machines. We are talking about rotation movements that occur every 3 minutes at 90 degrees. An electric based solution may be more interesting in our area, even considering all negative implications related to construction sites. The first Soilmec electric machines date back to the 90s, the positioners used in the Aosta - Monte Bianco motorway tunnels and high speed railway from Florence to Bologna. Drilling operations were carried by two-booms electric machines featuring a pair of electric drives on each boom, while translation was assured by usual engines. The current trend is of cure heading towards electric applications.

Electric, then?

Trevi is currently working in Mosul, Iraq, where we use small electric driven drilling machines. These are entry level machines, delivering about 70 kW. We are developing a research project that involves power rates up to 200 kW. On urban sites we have to deal with noise limitations. New generation diesel engines involve larger cooling systems and consequently noisier fans.

Which acoustic treatments do you use?

We installed protective panels around the machine like in Copenhagen. Speaking of engineering, we are working on airflow. Usually radiators are positioned laterally and are very noisy; in some cases now we oriented them upwards in order to lower noise emission, in other cases using bigger fans at lower rotation speed. The biggest machine we manufacture - the 140-ton, 470 kW SR-125, is the best in class for noise emissions in its product range with a guarantee Sound Power level of only 109 decibels.

What about gas fuels?

Some prototypes of excavators are currently under development, but the implementation of these experiments on our machines is quite complex, just think about the refueling on construction sites. Even the simple management of oxyacetylene tanks for cutting is critical on site.

Oil & Gas?

Drillmec is the Trevi Group company that builds plants for applications in this area, where the electric technology has become very important. D.F.

An 'insider' point of view

Fabrizio Giorgini, Sourcing & Procurement Manager, completed the overview of what is going on in Soilmec "underground". He gave us two specific indications, loud and clear: the first one, "the right engine rating is our life insurance"; the second one, «the leap from Tier 3 to Tier 4 brought considerable service problems". "Tier 4 Final rewarded engine manufacturers based on market launch timing and flexibility, being a homogeneous service on a global scale and technical characteristics fit for market needs the winning factors. On larger sizes, such as the 27-liter, Caterpillar provides a complete package and multiple ratings depending on the work cycle; lately I noticed more attention on consumption levels. The technical department takes into account lower rotation speeds when the machine is in idle state. In this case the low idle system lowers rpm from 2,200/1,800 to about 700/800. Over the past 4 - 5 years, following Tier 4 Interim and Tier 4 Final certifications, on site servicing has sometimes proved to be out of date, relying on the parent company even for routine operations. Supplying and planning have also suffered: after decades of absolute immobility, stricter regulations had a major impact on the entire OEM organization, from technical office to warehouse. And it's not over...".

Katrina. The Apocalypse

August 2005, Katrina Hurricane flips New Orleans from its foundations. Just like Attila, its passage leaves behind a pile of rubble 1,836 victims and 108 billion dollars damages. The reconstruction have Soilmec among its protagonists. In that scenario, the 900 kW threshold was broken to consolidate 1.8 km of Mississippi embankments. Mixing systems worked with two drilling units mounted on the same machine using both conventional engines and an external control unit, thus summing 700 and 400 kW.

SC-135 Tiger: going under

In order to meet the need for increased diaphragm wall depth in the most challenging soil conditions, Soilmec has designed the "HDD" (Hose Drums Design) hydromill configuration featured on the new SC-135 Tiger, where hydraulic and mud winders are positioned on a base carrier, allowing high depth drilling performances. The new SC-135 Tiger is designed for an ideal job site suitability, allowing to work in a wide range of working radius and module rotations. The machine features several improvements, especially in terms of safety and oil contamination, which are the result of years of drilling experience. The SC-135 Tiger features some of the best solutions developed by Soilmec such as a special hydraulic system designed to avoid breakdowns due to bentonite contamination, easy and safe assembly, high productions delivered by the new Tier4f 950 HP diesel engine, hse drums and cathead layout optimized to work in several working radius and module orientations. Furthermore, this machine has been designed for a modular assembly, with a max transportation weight of 45 t (106,000 lb). The DMS (Drilling Mate System) provides real-time monitoring of all operating parameters and production process, including a dual-axis positioning sensor that controls the geometry of the panel with 2D and 3D graphics print out.

A ONE-STOP SHOP

Nidec's industrial platform has its roots in North-Eastern Italy, in the headquarters of Nidec Ansaldo sistemi industriali, very close to Trieste. The company is a candidate to become a competitor of ABB and Siemens along with Leroy Somer and Avtron. Cogeneration, microgrid and storage are on the horizon of the Japanese industrial division

Nidec Industrial Solutions is a leader in high-precision engines market, challenging ABB and Siemens on their very ground. As stated in the corporate presentation, Nidec focuses on "everything that rotates and moves". The most recent application of Nidec's industrial platform is co and tri-generation. We explored the topic of Nidec expansion in the industrial scenario with a parterre de roi (in alphabetical order): Massimo Baret, Federica Bianchettin, Kaila Haines, Tommaso Pedicchio, Alessandro Perich and Gianni Pizzati (*). Let's start from the beginning, as befits every reasonable story such as Nidec Asi industrial strategy, now and in the next future.

The history of Nidec Asi starts from Italy?

Nidec bought Ansaldo Sistemi Industriali in 2012, becoming Nidec Asi, the leader of the industrial platform that brings together Nidec Asi, Leroy Somer, Avtron and other units working in the industrial sector. The first step in the industrial market was done through Us Motors, a buy-out from Emerson, which features a range complementary to ours, focused on rotating machines, power electronics, automation systems. The last piece of this mosaic is cogeneration.

How does cogeneration take root at these latitudes?

When Finmeccanica included all the Ansaldo factories, now GE for turbines, Nidec-Asi for electric motors, AC Boilers for boilers, generation and cogeneration systems were single-branded as Ansaldo. Nidec-Asi is currently engaged in the coupling between internal combustion engines and electric motors for cogeneration and trigeneration in industrial applications. The potential of this market is testified by all market analysis, by European regulations and is reflected in the appreciation of all involved companies. The reason is simple: cogeneration provides 38/40 percent of primary energy savings.

Where does this industrial project start from?

We are accurately analyzing Germany's exit strategy from nuclear power, a policy of very flexible stations based on 10 Mw engines, in line as needed, city by city. Using a very popular slogan, it could be called "zero-kilometer energy production and utilization". This approach provides flexibility, network stability and opens up the storage market to Nidec. Even if we look at Europe we are unique thanks to our panel of application-customized machines. We have a hundred generators working, including oil & gas and on-board generation: we are partners of Fincantieri on cruise ships such as Costa, Carnival, Msc. The more complicated the application is, the more we feel comfortable... We are completing a contract that took us three years, the supply of 244 electric motors for a pipeline in the Russian Federation, in 97 pumping stations, mainly in Siberia. These machines are designed for critical areas, exposed to explosion danger and prohibitive temperatures - up to 60 degrees below zero. Those area are also exposed to high seismic risk.

Which applications do you support?

In the reference markets of the Monfalcone plant (in Italy, not far from the Slovenian border), oil & gas covered about 70%, upstream and downstream, from extraction to refining to compression. This means that the primary destination of our engines is the Opec area, Saudi Arabia, Qatar, Emirates, Iran, Libya, Egypt.

What can Leroy Somer provide to Nidec's product integration?

Surely a small size product, a market segment in which we are neither competitive nor operational today, the range between 500 kW and 2-3 MW. They have a history focused on small and medium-sized generators and process optimization, while for 30 years we were strongly focused on product engineering.

What about microgrid?

Future power grids will be based on a fishbone architecture, several microgrids connected to a minimal structure. To give you an example, batteries are massively entering the Californian market, where utilities turned towards a rewire strategy. We developed Artics smart energy to operate in two ways: both as single unit and connected to the national grid through the distribution network of the production plant. We installed our first microgrids in Chile, in Ollagüe, a mining village in the Andes, and in the Maldives, in a resort lacking an electric grid. Lately we've seen microgrid requests increasing. Maybe we were too early in 2009, at the same time we started the energy storage branch with 500 MWh installed.

What technology does Nidec offer for storage?

We are an Epc (Engineering, Procurement & Construction) in the energy market, providing project, engineering, inverter and power management through in-house solutions. The key is the development of the algorithm that supervises the batteries and the flow to the network based on our real-time automation platform, providing extremely fast response and allowing to improve the batteries life cycle up to 10%.

Is it possible to optimize the energy of marine turbines?

We developed a prototype project on 1 MW tidal turbines in France, installed on the seabed. The second generation is now ready; we are studying wear to increase the power rate. Diesel works as a back-up also in Ollagüe in case of an emergency. In Canada we are talking with customers who work in plastics extrusion. If the system stops even for 5 minutes they need time to re-set before starting the system again.

What are the prospects for cogeneration?

We are witnessing an increasing demand for biomass applications. We are working in tune with Exogen and Turbogen for supplying generators coupled to their machines.

In which areas of the world?

In Eastern Europe, in Turkey and South East Asia, which are very interested in biogas and we did not have a distribution infrastructure. Following the acquisition of Emerson we inherited a presence in this area that allows us to expand.
In conclusion I would like to summarize Nidec Asi. We are the parent company of Nidec Industrial solutions, the CEO is Giovanni Barra. Monfalcone is the only factory in the group that manufactures medium voltage generators. A sister company sells Us Motors brand, which is complementary to our offer. We bought LeRoy Somer and Kato Engineering (which stops at 25 MVA, while we reach 60) from Emerson. Our products are sold 80 percent abroad and we have no barrier limits. We are developing a joint technical-commercial strategy with Kato Engineering thanks to our strong complementarity in order to become a one-stop shop and compete as Siemens and Abb do.

Fabio Butturi

(*)
In alphabetical order: Massimo Baret, Manufacturing & Technologies Director Motors & Generators; Federica Bianchettin, Marketing & Communication Specialist – Sales & Marketing; Kaila Haines, Marketing & PR Director Marketing; Tommaso Pedicchio, Project Manager - Motors & Generators Service & Epc; Alessandro Perich, Engineering & Proposal Director Motors & Generators; Gianni Pizzati, Head of Cogeneration Team Service.

Italian core, Turkish incentives

After starting local production of its Radial Outflow Turbines in 2014 - which allowed many clients to benefit from increased feed-in-tariffs - today, thanks to an exclusive agreement signed with Nidec Asi, Exergy (the developer and manufacturer of Organic Rankine Cycle (ORC) systems with the pioneering Radial Outflow Turbine technology based in Milan) will be the first company in the market to supply its Turkish clients with locally manufactured generators. With this new opportunity, clients will benefit from a further 7 USD/MWh on top of the basic feed-in-tariff rate of 105 USD/MWh and to the 13 USD/MWh bonus already granted by Exergy to its clients with the local turbine and auxiliaries production. Exergy's partnership with Nidec dates back to 2013 supplying projects around the world with a total of 13 generators now generating 200 MW of green power. This strategic alliance for the production of generators in Turkey will made EXERGY the first company to offer this opportunity in the market. Turkish Government facilitates cogeneration with an even more advantageous tariff when there is a strong Turkish participation in the plant. Nidec Asi manufactures electric generators, with on-site assembly and testing.

Right to left, a geothermic plant and some views of Monfalcone factory.

Meritor. Axles and brakes

NOT ONLY FOR TRUCK

This is the indication we gathered at the press conference dedicated to the inauguration of the Vecto test bench at the European headquarters in Cameri. Meritor enjoys excellent health and could expand its range outside bus&truck applications

Meritor, trucks and bus are not enough anymore. Cameri, between Milan and Turin, hosts the European headquarters; the graphs drawn by the executives of the multinational from Troy, near Detroit, welcome us with one upward curve, that of turnover. From the farsighted result of 2.2 billion dollars in 2016 to 2.3 estimated for this year, the three-year target is +20 percent in 2019. It is therefore plausible to think that Meritor could target other areas outside of its core business - truck axles. Volvo is its number one client followed by Iveco, Renault and Daf (starting from 2018). Meritor also manufactures braking systems: drum brakes, an area in which the company is unrivalled, and disc brakes, where Meritor is second in Europe only to Knorr-Bremse. What applications could end up in its target? Relying on internal resources and future acquisitions Meritor could get ready to equip dumpers, big harvesting machines, excavators and dozers for heavy-duty applications, forestry and special applications. These kinematic chains differ from those mounted on long-distance trucks where Meritor could however transfer through the required customizations its mechanics, hydraulic and electronic skills providing a complete axle-brakes package. The investment to take over Transpower is for real. From its headquarters based in California Transpower manufactures electric motors mainly addressed to bus&trucks applications: trucks, school bus, waste collection trucks and terminal tractors. As school bus application mentioned about Transpower reminds us Meritor also means people transportation. We spoke about this subject with Marco Bassi, General Manager, sales, marketing & product strategy.

Some questions

Are Meritor products for bus & coach market derived from truck world?
We provide specific products for *bus & coach applications designed to reduce noises from axles and bevels through a process focused on the improvement of the gear teeth surface*.

Which is your best selling product?
Without a doubt it is the 17X used by two large companies who manufacture buses (Iveco and Volvo). In this case, besides a dedicated bevel, we developed a specific, more rigid axle box able to better insulate the noise coming from rotating components.

What can you tell us about the transition to electric?
The first hypothesis is to couple a conventional axle to an electric motor, a solution which still requires a particular and specific design of the axle. The second hypothesis takes into consideration a better integration of the electric motor inside the axle. The third solution is to leave the traditional axle characterized by the presence of the differential and have an electric motor directly mounted on the wheel hub.

R.S.

Vecto test bench

Meritor inaugurated last November 16 the test bench in its Cameri (Italy) factory. The test bench was required to comply with Vecto - Vehicle energy consumption calculation tool standard, an European certification mandatory from January 1, 2019 that will be adopted along with C02 emission limits from 2025. Vecto is a certification of the efficiency of a vehicle taking into consideration four different areas: tires, aerodynamics, engine and axles. The analysis of these items results in an environmental impact classification very similar to that of home appliances. Meritor test bench in Cameri - a unicum in Europe - is worth two million euros and is able to analyzes 160 matrix points and hundreds analysis points scanning the parameters collected at different speeds, loads and torque values.

www.dieselweb.eu

DIESEL

Engines and components for OEM
Culture, technology, purposes
And market of Diesel engines
Established in 1986

Editor in chief
Maurizio Cervetto

Managing editor
Fabio Butturi

Editorial staff
Stefano Agnellini, Ornella Cavalli, Cristina Scuteri, Roberto Sommariva

Contributors
Davide Canevari, Roberto Negri, Carlo Pifferi

Layout & graphics
Marco Zanusso (manager)

Printing
Industrie Grafiche RGM srl, Rozzano (Mi)

Offset
Fram, Milano

Milano City Court Authorization n. 860 – December 18th 1987 National Press Register n. 4596 – April 20th 1994 Poste Italiane Inc. – Mail subscription D.L. 353/2003 (mod. in L. 27/02/2004 n° 46) Art. 1, subsection 1, LO/MI

vte
VADO E TORNO EDIZIONI

MANAGEMENT ADMINISTRATION
via Brembo 27 - 20139 Milano.
Tel. 02/55230950 - Fax 02/55230949

Website
www.vadoetorno.com

Editorial coordination
Paolo Scarpat

ADVERTISING

Management
via Brembo 27
20139 Milano
tel. 02 55230950 - fax 02 55230949
e-mail: pubblicita@vadoetornoedizioni.it

Editorial management
Fabio Zammaretti

Sales agents
Roberto Menchinelli (Roma), Luca Pizzocri, Michele Schiattone, Emanuele Tramaglino

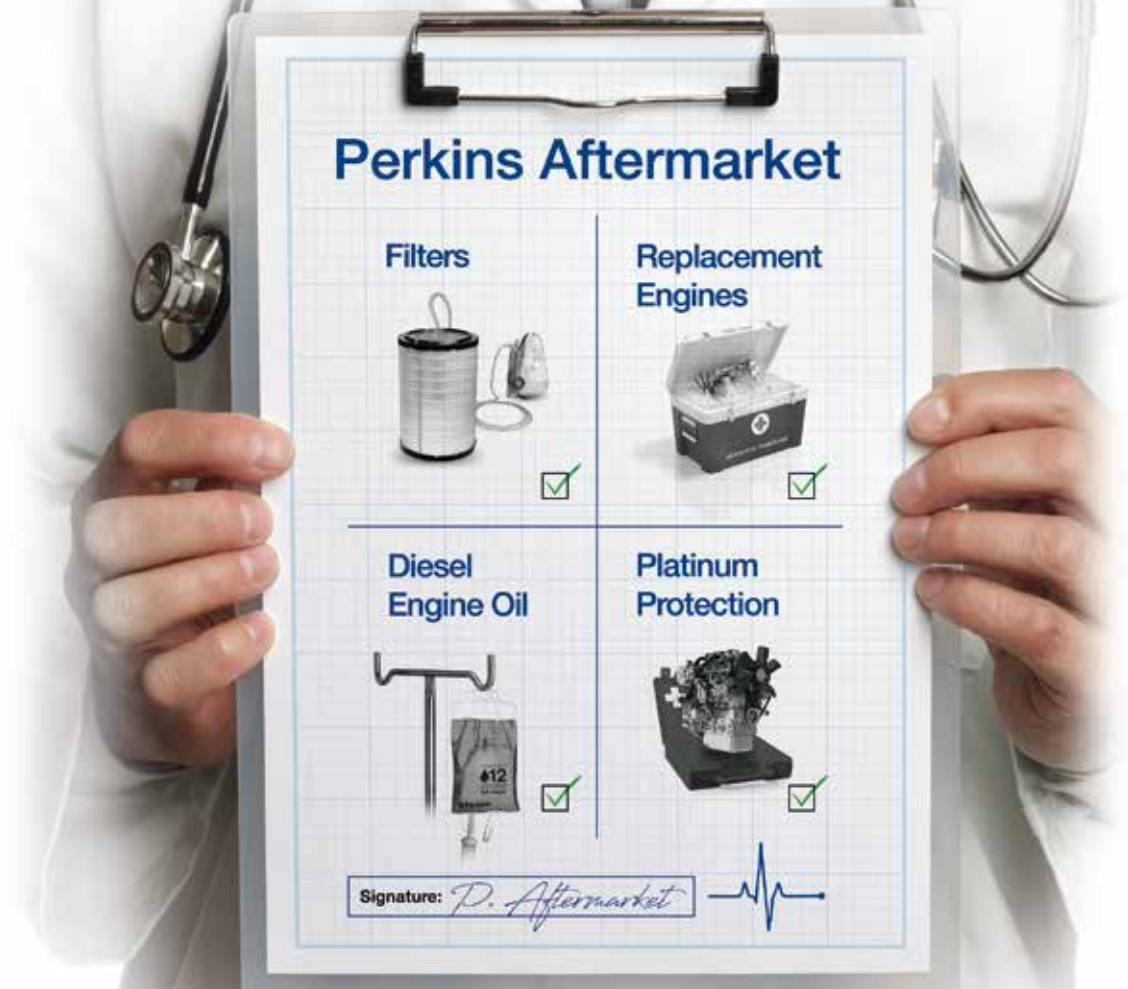
Annual subscription
Italy 35 euro, International 55 euro
Air Mail Annual subscription
65 euro
Back issues
7 euro

Payments
Current account 50292200
Vado e Torno Edizioni srl,
via Brembo 27, 20139 Milano.
e-mail: abbonamenti@vadoetorno.com

E-Mail
diesel@vadoetorno.com

Perkins Aftermarket

Keep it genuine keep it **healthy**



Perkins Aftermarket, engineered for life

We care about every aspect of your engine's health by providing extended warranties, diesel engine oil, training centres and experienced, qualified engineers who are local to you.

Find your local distributor at
www.perkins.com/distributor

Visit Perkins at MEE: **Booth S1C10**
www.perkins.com/MEE
#PerkinsMEE2018

Perkins®
THE HEART OF EVERY GREAT MACHINE