



Oil & Gas

COMBINING YOUR ENERGY
WITH OURS



A Rolls-Royce
solution



- Partnering with comprehensive expertise
- Onshore and offshore installations competence
- Applications overview

Solutions overview

mtu battery energy storage systems (BESS)

Fully unfold your E-frac potential

High performance independence
All-in-one well servicing

Offshore generator sets
Redundant controllers

Engineering sustainability and responsibility	32 – 33
Emission reduction solutions	34 – 35
Series emissions certifications	36 – 37
Being mindfull of power (ESG)	38 – 39

Digital service solutions 40 – 43

Complete lifecycle service solutions / preventive maintenance	44 – 45
ValueCare agreements / Remanufactured products	46 – 47
Certifications	48 – 49

50 - 51

- 1 Argentina | 1100 kW / 1475 bhp**
Rapid deployment and movement of three electric drilling packages with **mtu** 12V 4000 engines between drilling sites.
- 2 South America | 1100 kW / 1475 bhp**
Drilling packages with **mtu** 12V 4000 engines reliably power rigs at altitudes of up to 15,748 ft. (4,800 m).
- 3 North America | 2237 kW / 2999 bhp**
mtu provided a digitally connected fleet of six Series 16V 4000 T95 gensets for higher fracking efficiency.
- 4 Norway | 2800 kW / 3755bhp**
The Johan Sverdrup field will account for around one third of all oil production in Norway and deliver very valuable barrels with record low emissions.
mtu provided nine **mtu** 20V 4000 P83 engines - four for emergency and five as fire pump drivers with each 2800 kW/3755bhp power output to ensure safe and reliable operation.



PIONEERING THE POWER THAT MATTERS.

01

Rolls-Royce provides world-class power solutions and complete life-cycle support under our product and solution brand **mtu**. Through digitalization and electrification, we strive to develop drive and power generation solutions that are even cleaner and smarter and thus provide answers to the challenges posed by the rapidly growing societal demands for energy and mobility. We deliver and service comprehensive, powerful and reliable systems, based on both gas and diesel engines, as well as electrified hybrid systems. These clean and technologically-advanced solutions serve our customers in the marine and infrastructure sectors worldwide.

A solution provider

Our systems power the largest yachts, the strongest tugboats, and the biggest land vehicles and provide energy for the world's most important mission-critical applications. Through advanced solutions such as microgrids, we integrate renewable energies and manage the power needs of our customers.

Our customized service offerings help you maximize uptime and performance and are supported by our digital solutions, which enable remote monitoring, predictive maintenance, and a range of other benefits that keep your systems running at their best.

For over 110 years, we have provided innovative power solutions for our customers – meeting even the most demanding drive requirements. Our products and services span a wide range of applications and power needs, with standard and customized options.

An expert in technology

As part of Rolls-Royce, we have long been known for cutting-edge innovation and technological leadership in product development. That same spirit of innovation inspires our sustainability efforts. Our focus is on developing and implementing system solutions that both

maximize efficiency and reduce emissions – which in turn work to reduce our impact on the environment.

A passionate and reliable partner

We at Rolls-Royce spend every day working together with our customers to deliver engines, systems, and complete life cycle solutions that best fit your needs. We understand that each application is different and has its own specific demands. Our engineers embrace the challenge of finding the perfect solution for your unique power requirements. Every step of the way – from project planning, through design, delivery, and commissioning to the lifetime care of your equipment – we are dedicated to helping you get the most from your **mtu** investment.

Partnership with Mercedes-Benz

mtu Series 1000, 1100, 1300, and 1500 engines are based on Mercedes-Benz models customized for off-highway use. These engines range from 115–480 kW and have been specially designed for agriculture and forestry applications and further developed to meet EU Stage V regulations.



over
70 YEARS

POWERING THROUGH
ENGINEERING LEADERSHIP
AND INNOVATION.

1 Resourceful

We are highly skilled at devising quick, intelligent ways to fulfil customers' needs.

2 Responsible

We develop innovative technologies that also meet the highest emissions standards.

3 Reliable

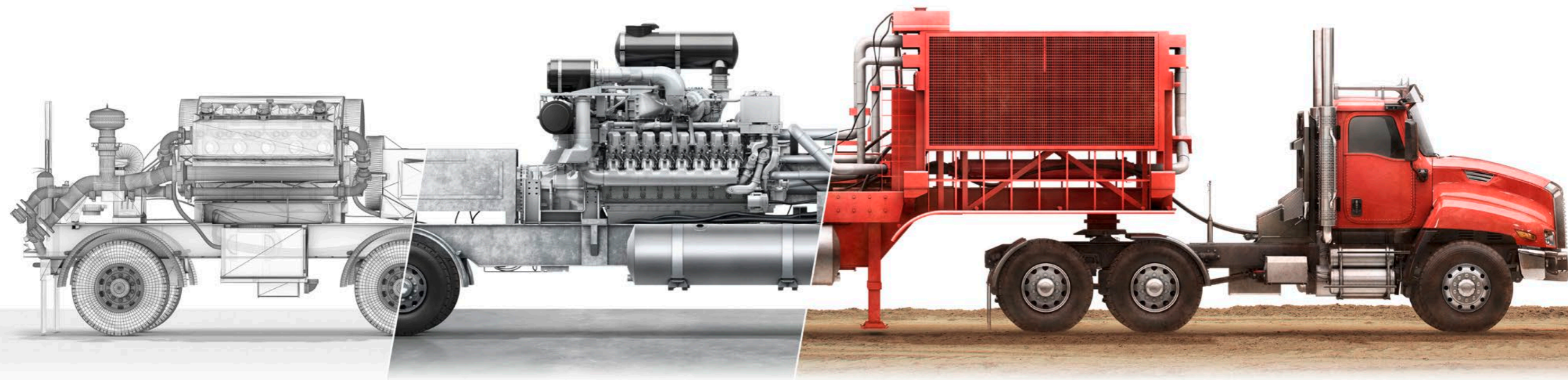
We can be counted on to find the perfect solution for any requirement at every step.

Lifecycle solutions provider

PARTNERING WITH COMPREHENSIVE EXPERTISE.

Unlike many other suppliers of power generation technologies for the onshore and offshore oil and gas industry, we specialize in delivering end-to-end solutions designed to optimize performance over the entire course of their lifetime. Our portfolio comes full circle with a range of reman and repowering solutions.

Our commitment aims to optimally support clients with first-rate solutions for their applications – continually, from day one and at every phase. From planning and design to development and commissioning, uptime maximization, digital field support, tailored services and more, we are sure to have an appropriate solution.



PLANNING AND DESIGN

- Expert consultation on available technologies options
- Feasibility and installation studies
- Technical specifications documentation
- 3D CAD models

DEVELOPMENT AND COMMISSIONING

- Tailored and modular drive solutions – diesel, electric or hybrid
- Alignment throughout design and prototyping
- FAT performance tests
- Emissions reduction tests
- Installation support
- Static and dynamic commissioning of the traction system

PRODUCT AND SECOND LIFE

- Tailored ValueCare Agreements (e.g. for parts availability, guaranteed uptime)
- Global support through our Customer Assistance Center
- Re-power solutions to improve fuel savings, emissions reductions, availability and more
- Engine overhaul for increased performance
- Reman services for parts and entire drive solutions
- Connectivity and digital solutions

Onshore installations

ENGAGING THE OPPORTUNITY.

Onshore oil and gas enterprises have faced various challenges within recent years, even prior to the COVID-19 pandemic. In response, many are now looking to engage the opportunity by optimizing the performance and efficiency of their operations. That has been a specialty of **mtu** for over 70 years – for all types of oil and gas drilling applications all over the world.



Offshore installations

MAXIMIZING HIGH SEA SAFETY.

In order to meet the growing global demands of offshore oil and gas drilling operations, equipment engineered to meet the unique requirements of high sea installations plays a crucial role – particularly, regarding safety. We have a broad range of compact, lightweight, highly reliable and customizable power generation solutions designed for just that – maximum safety.



Applications overview

ONSHORE.

Faced with sharply lower prices as well as ever increasing cost-cutting and environmental pressures, oil and gas companies look for ways to optimize the efficiency and sustainability of their operations. We specialize in gas and diesel power generation solutions that do both – deliver superb performance with high efficiency and greatly reduced carbon emissions. When combined with our energy storage systems (ESS), they set new sustainability benchmarks, significantly lowering operating costs in the process.

All of our solutions are designed for optimal integration and performance, thereby prolonging preventive maintenance and overhaul intervals. Drawing on years of industry experience and insight, they keep your drilling operation running productively and profitably.

Our onshore solutions

- Diesel engines, drive systems and gensets for emergency, essential, auxiliary and main power
- Fire pump drives for mechanical, hydraulic and electric installations
- Drives for mud and cement pumps, nitrogen units and crane vessels
- Well servicing power packs
- Hydraulic power packs
- Preparation of hardware documentation
- Preparation of software documentation

Fracking fleets

- Complete power generation solutions
 - 97% power transmission efficiency
 - Increased output with more low-end torque and improved acceleration
 - Tier 4 emissions standards compliance without aftertreatment

Safe power generation

- All of our solutions are tested and certified to meet the highest hazardous area requirements
- They feature numerous safety functions (e.g. redundant controllers according to NFPA 20) to ensure uninterrupted operation in the event of an emergency

Onshore drilling sites

- Drilling power solutions
- Mechanical drives
- Hybrid electrical genset and energy storage solutions

Mobile workover rigs

- High-performance engines ideally suited for well servicing
 - Extremely durable and reliable
 - Increased peak torque and efficiency
- Turbocharging technologies and electronics

OFFSHORE.

The development of oil and natural gas resources as well as the generation of wind energy at harsh, remote locations with extreme climates requires dedicated offshore power generation solutions of the highest efficiency, durability, reliability and safety. It also calls for eco-friendly technologies that offer utmost protection for these vulnerable environments. Our offshore solutions have proven to excel in both categories.

Decades of offshore experience have gone into the development of our solutions. All of the components are fully integrated, thoroughly tested and supported to ensure optimal operation while prolonging preventive maintenance and overhaul intervals.

Our offshore solutions

- Diesel engines, systems and gensets for emergency, essential, auxiliary and main power
- Fire pump drives for mechanical, hydraulic and electric installations
- Drives for mud and cement pumps, nitrogen units and crane vessels
- Well servicing power packs
- Hydraulic power packs

Together with our product we also offer customized offshore documentation according to project specific requirements.

Multi-purpose platform supply vessels

- Diesel-electric propulsion systems
- Onboard power generation solutions

03

Floating production storage and offloading (FPSO) vessels

- Gensets for emergency, essential and auxiliary power
- Fire pump drives: mechanical, hydraulic or electric

Semi-submersible rigs, fixed and jack-up platforms

- Gensets for emergency, essential, auxiliary and main power
- Fire pump drives: mechanical, hydraulic or electric
- Drives for mud and cement pumps, well-servicing operations, nitrogen units

Substation platforms for offshore wind parks

- Auxiliary power for wind farm construction and operational phases (e.g. cooling and control systems, fire water pumps)
- Back-up power solutions



Scan the QR code for more information on IMO Tier III solutions in marine applications.



Onshore & offshore engine, system and genset solutions

ADDRESSING DISRUPTION WITH INNOVATION.

04

A growing global population with steadily increasing energy demands, falling prices, ever more stringent environmental regulations, heightened sustainability expectations from various stakeholders and a gradual transition to other energy sources – the oil and gas industry faces multiple challenges causing major disruption.



Continuing to operate profitably requires innovation that is equally disruptive. The solutions of our extensive onshore and offshore engine, system and genset portfolio provide just that – with significantly increased fuel efficiency and operations reliability, greatly reduced carbon emissions and more.

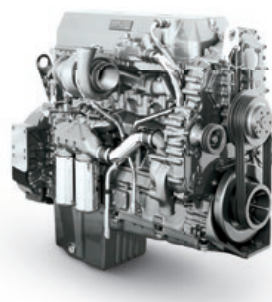
Onshore & offshore engine, system and genset solutions

ONSHORE.

Drilling and well servicing applications at onshore and offshore sites are immensely diverse. Their individual power needs are equally diverse. With our extremely broad-based portfolio of engine, system and genset solutions, we can provide a perfect fit.



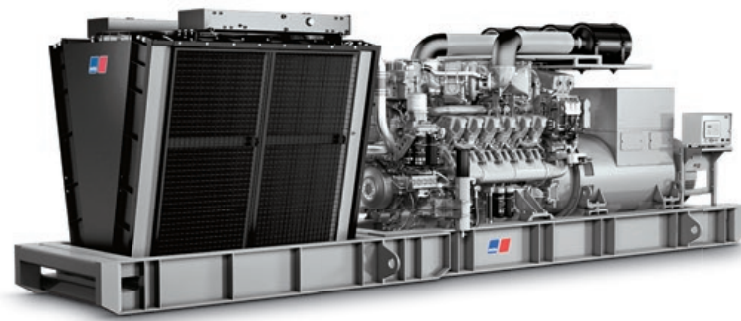
Series 460
A true trooper in all conditions, delivering proven performance with an evolved design.
220–375 kW (295–503 bhp)



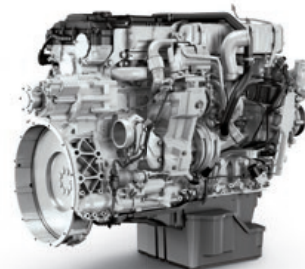
Series 60
A veritable workhorse, highly reliable for flawless heavy and medium duty operation.
242–496 kW (325–665 bhp)



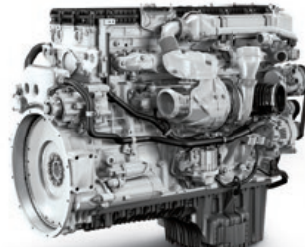
Series 900
Tireless performance, day in and day out, for heavy and medium duty tasks.
75–240 kW (101–322 bhp)



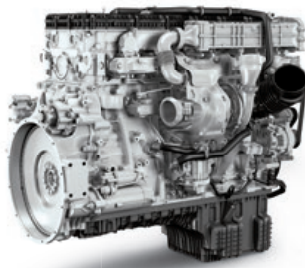
Electric DrillingPack Series 12V 4000 T95
Diesel engine, generator, radiator and other components – all in one exceptionally powerful, durable and efficient package.
1105–1420 kW (1482–1904 bhp)



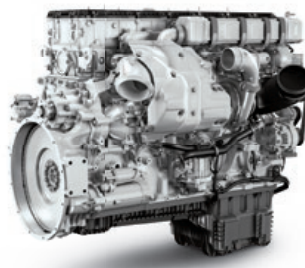
Series 6R 1000/OM 936*
The definition of dependability under the toughest circumstances.
100–280 kW (134–375 bhp)



Series 1100*
Increased rated load capacity with a never-say-quit attitude.
240–340 kW (322–456 bhp)



Series 1300*
Excellent reliability, emissions values and load performance all in one.
320–390 kW (429–523 bhp)

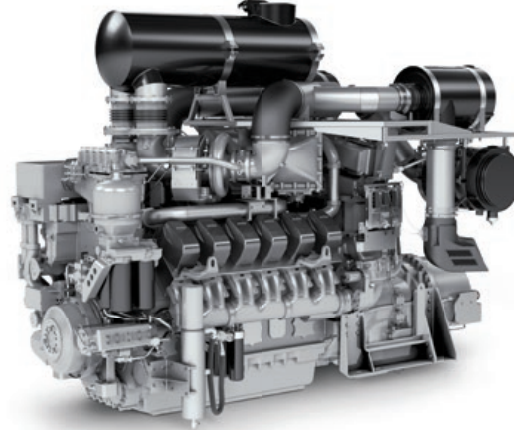


Series 1500*
Extremely clean, powerful and fuel-efficient output for maximum uptime.
380–480 kW (510–644 bhp)

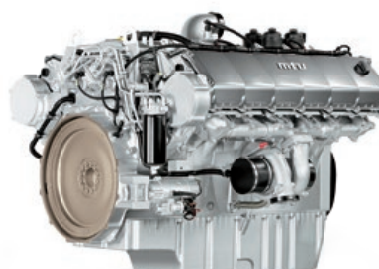
*Manufactured by



*Customized by



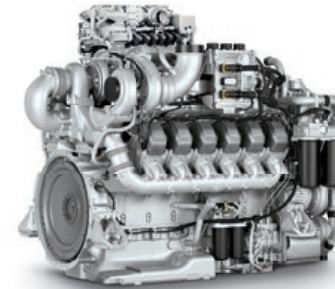
FracPack Series 12V 4000 T95
The power combo – compact, high-output engine and lightweight, high-efficiency transmission for superb performance at altitudes up to 13,000 ft (4,000 m).
1678–1939 kW (2250–2600 bhp)



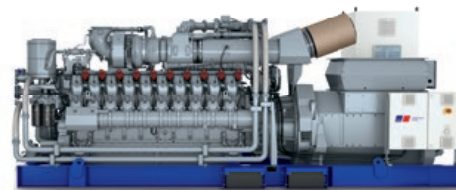
Series 1600
Solid performance paired with 3% lower fuel consumption than standards require.
407–608 kW (546–815 bhp)



Series 4000
A fuel consumption and emissions optimized overachiever for all occasions.
870–3010 kW (1167–4036 bhp)

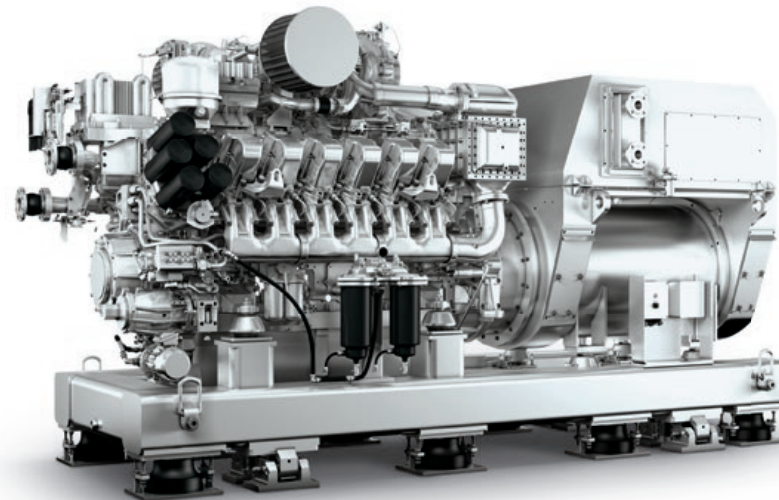


Series 2000
Durable, economical, reliable and powerful, even at high altitudes, for low life-cycle costs.
515–1163 kW (691–1560 bhp)

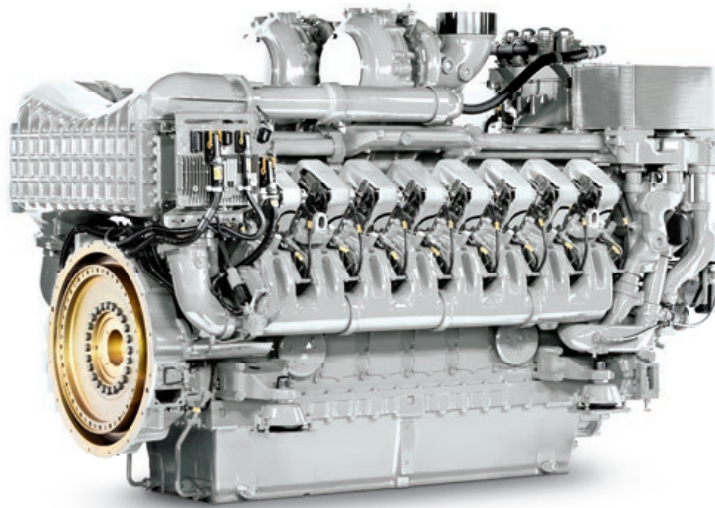


Series 20V 4000 L64 D2 system
A dependable and economical outperformer of a gas genset in a compact design (20 m² / 215 sq. ft.)
2016–2386 kW (2704–3200 bhp)

Exploiting oil and gas reserves at ever more remote offshore sites comes with many challenges. Conducting these operations with optimized efficiency, productivity and safety and with minimal impact to the environment calls for specialized equipment designed to meet the unique demands of fossil fuel operations on the high seas. Our offshore modular generator sets get the job done – safely, reliably and cleanly.



Modular generator sets
Exceptionally powerful, reliable, compact and safe gensets, customizable for the complete range of offshore power supply applications.



Series 4000 P diesel engines
Designed for highest mission-critical dependability and operational efficiency in the harshest environments.
1680–2800 kW (2253–3755 bhp)

mtu Hybrid Drilling solutions

UTILIZE MORE THAN 100% OF YOUR ASSETS – WITH ENERGYPACKS.

Low energy costs are indispensable for profitable drilling operations.

mtu battery energy storage systems (BESS) allow you to optimize load profiles, adding battery storage capacity to applications with limited grid access. Combined with up to three generator sets, even more than 100% asset utilization is possible.

Key benefits

**Lower CAPEX entrance costs**

Compared with a non-hybrid setup, **mtu** Hybrid E-frac solutions provide exceptional value over the long term, including with significantly lower CAPEX entrance costs.

**26% reduction in OPEX (based upon use case)**

Our advanced battery energy storage systems (BESS), **mtu** EnergyPacks, enable generators to run at optimal load profiles, reducing operating costs by up to 70%.

**Lowers CO₂ emissions**

In addition to greatly enhancing genset operating efficiency and fuel savings, **mtu** hybrid E-frac solutions also significantly reduce harmful CO₂ and other emissions.

**Reduces unplanned downtime**

mtu EnergyPacks continuously balance power generation asset load demands, thereby optimizing power supply availability and lowering the risk of unplanned downtime.

**Scalability**

Modular in their design, **mtu** Hybrid E-frac solutions enable flexible adjustment of power generation assets to accommodate for wide-ranging site setups and applications.

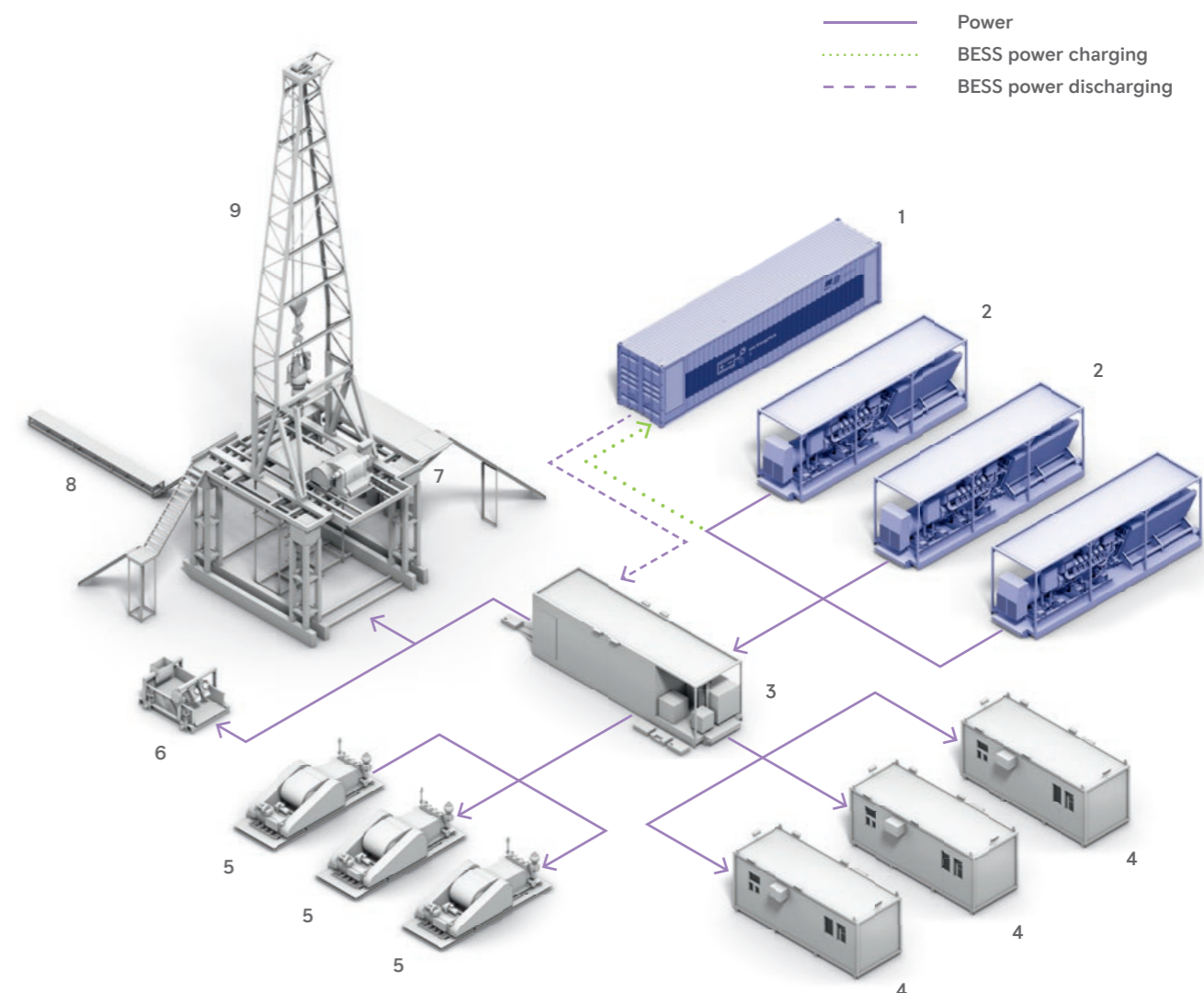
**Plug-and-play solution**

Featuring fully mobile, containerized and easy-to-install components, **mtu** Hybrid E-frac solutions are quickly deployed, delivering reliable power wherever it is needed.



Scan the QR code
for more information about
mtu Hybrid Drilling solutions

05



- 1 Battery energy storage system (BESS), e.g. **mtu** EnergyPack QL or QM
- 2 Generator sets
- 3 Switch gear / powerhouse
- 4 Accommodations
- 5 Mud pumps
- 6 Hydraulics for additional components or accessories (e.g. shale shaker)
- 7 Draw works
- 8 Pipe handling equipment
- 9 Top drive

Hybrid E-frac solutions

FULLY UNFOLD YOUR E-FRAC POTENTIAL.

Sharp price declines, high operational costs, Environmental, Social and Governance (ESG) targets – today’s shale operations face many challenges. As a result, they are increasingly adopting E-frac systems to replace diesel engine/mechanical transmission setups. Advanced approaches like hybrid E-frac solutions combine gas gensets with a battery energy storage system (BESS) – allowing you to fully unfold your E-frac potential.

Whether as an alternative for a turbine E-frac or as a replacement for a diesel or dual-fuel fleet, hybrid E-frac solutions offer numerous advantages.

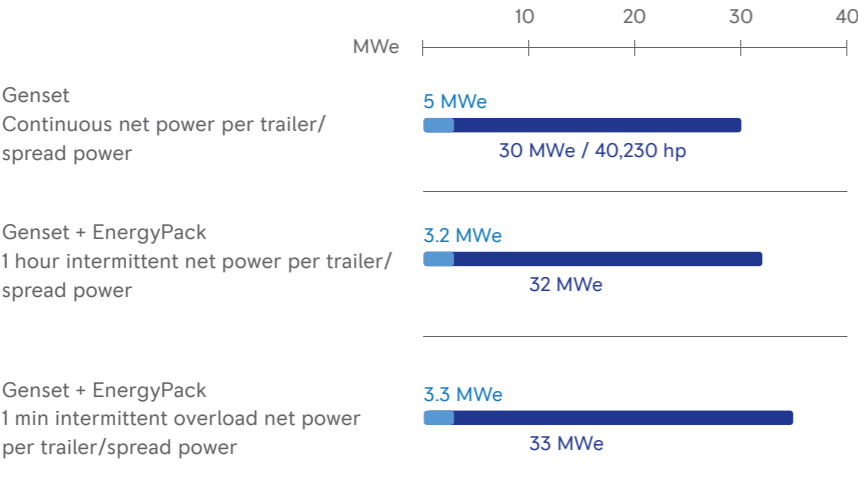
- Superior fuel consumption
- Highly efficient operation with variable loads
- Cleaner emissions
- Low maintenance
- Easy workforce cross-training
- Lower TCO

Configuration 1

Alternative for a turbine E-frac

This hybrid E-frac configuration integrates twelve gas gensets, two each to a container providing 5.2 MWe of combined power, with an *mtu* EnergyPack delivering 2 MWh. As a full-site, one-to-many aggregated power solution, it offers maximum power generation redeployment flexibility. Simply stated, configuration 1 is a cost-effective alternative for a conventional turbine E-frac setup.

Total available power per fleet



Components

- A** Two power gensets packaged in one container, 5.2 MWe combined
- B** *mtu* EnergyPack QL 2 MWh
- C** *mtu* microgrid controller
- D** Trailer with variable frequency drive (VFD) and frac pump

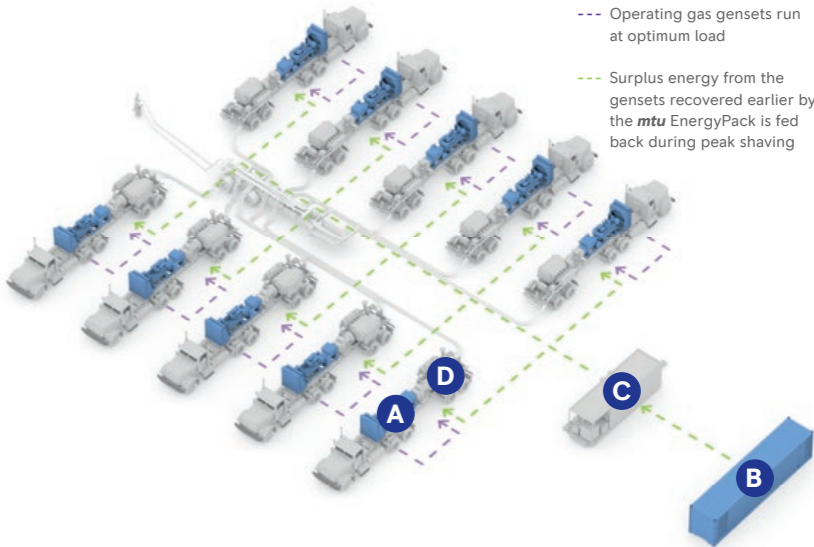
mtu EnergyPack QL 2 MW provides:

- Spinning reserves
 - Blackstart capacity
 - Grid stabilization
 - Peak shaving functions
- If power loss occurs, the EnergyPacks are able to provide power to flush well (2 MW over 1 hr.)

Configuration 2

Diesel or dual-fuel fleet replacement

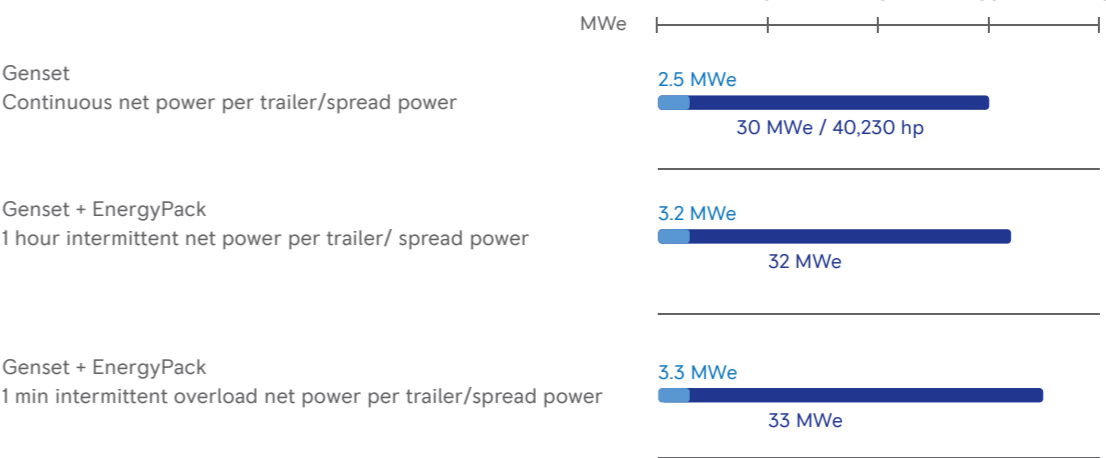
With this hybrid E-frac configuration, ten 2.5 MWe gas gensets, each mounted on a trailer, are combined with an *mtu* EnergyPack QL 2 MWh. An excellent full-site solution for replacing diesel or dual-fuel fleets, particularly as a high pressure-side power phase-in, this setup provides maximum trailer redeployment flexibility.



Components

- A** *mtu* 20V 4000 gas genset w/2.5 MWe active
- B** *mtu* EnergyPack QL 2 MWh
- C** *mtu* microgrid controller
- D** Trailer with variable frequency drive (VFD) and frac pump

Total available power per fleet



Hybrid E-frac solutions

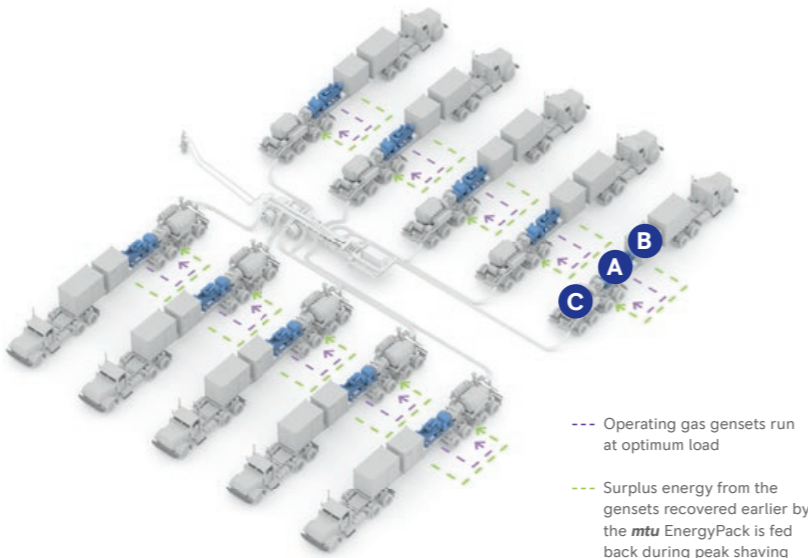
Configuration 3

Diesel or dual-fuel fleet replacement

Even greater mobility and faster on-site equipment redeployment capability is provided by this configuration, which integrates a gas genset, radiator, Battery energy storage system (BESS), controls, an inverter, variable frequency drive (VFD) and frac pump – all on one trailer. This hybrid E-frac solution is ideally suited for the seamless, step-by-step optimization of conventional spreads using diesel or dual fuel fleets.

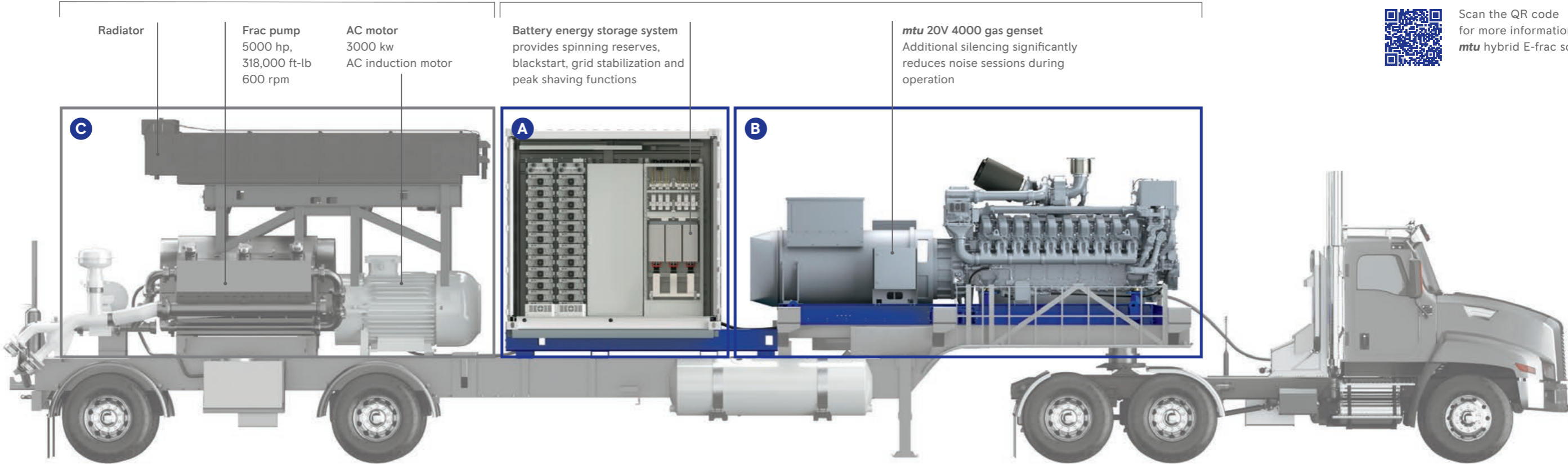
Components

- A **mtu** 20V 4000 gas genset & radiator
- B BESS, controls & inverter
- C Trailer with variable frequency drive (VFD) and frac pump



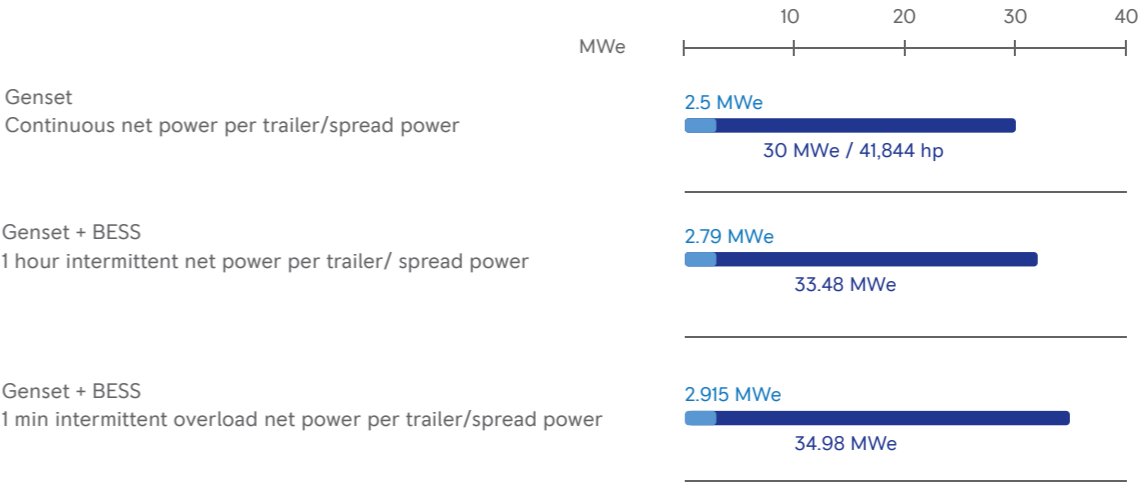
Variable frequency drive (VFD) and system control

mtu scope of supply



Scan the QR code
for more information about
mtu hybrid E-frac solutions

Total available power per fleet



Power storage solutions

ENERGYPACKS – FLEXIBLE POWER RELIABILITY.

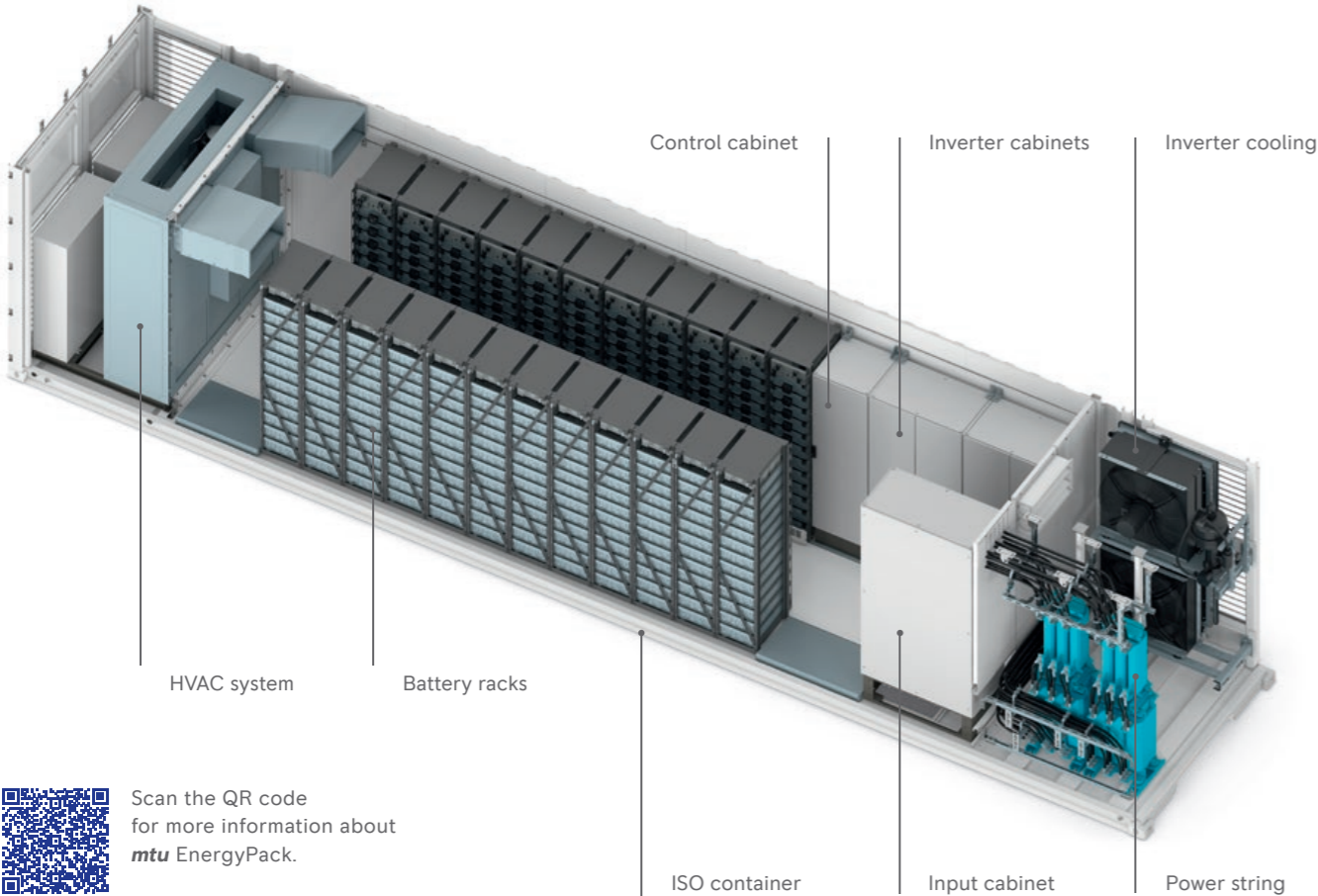
06

Oil and gas operations require lots of power. **mtu** EnergyPack offer a highly flexible, reliable and safe solution for providing it. Capable of storing electricity from diverse sources (power grid or gensets) and delivering it when and where it is needed, they are perfect for wide-ranging drilling and well-servicing operations.

Offering storage capacities of up to 2200 kWh at different power loads over a range from 60 to 2000 kVA/kWe, **mtu** EnergyPacks are easily scaled for virtually any requirement – for example, to compensate for weak grid connections or power supply fluctuations.

Key benefits

- High power density through extremely compact design. Ideal for projects with limited space
- Integration with existing power solutions for easy capacity expansion
- Plug-and-play ready and highly mobile to reduce setup times and costs
- Scalable to size for individual power storage requirements (from 400 kW to 2.0 MW)
- Ultra-fast power supply, frequency response (with up to 1.5 ms on inductive loads) and backup applications
- Multi-level safety features ensure reliable operation of batteries, fire alarm, extinguishing and other systems
- An onboard data logger for access to digital service solutions such as remote monitoring, rapid and reliable support as well as forthcoming offerings such as predictive failure prevention and operational optimization.



Scan the QR code for more information about **mtu** EnergyPack.



THE FULL POWER RANGE.

Our EnergyPacks are available in three sizes (QS, QM and QL), covering the full power storage range for virtually any requirement.



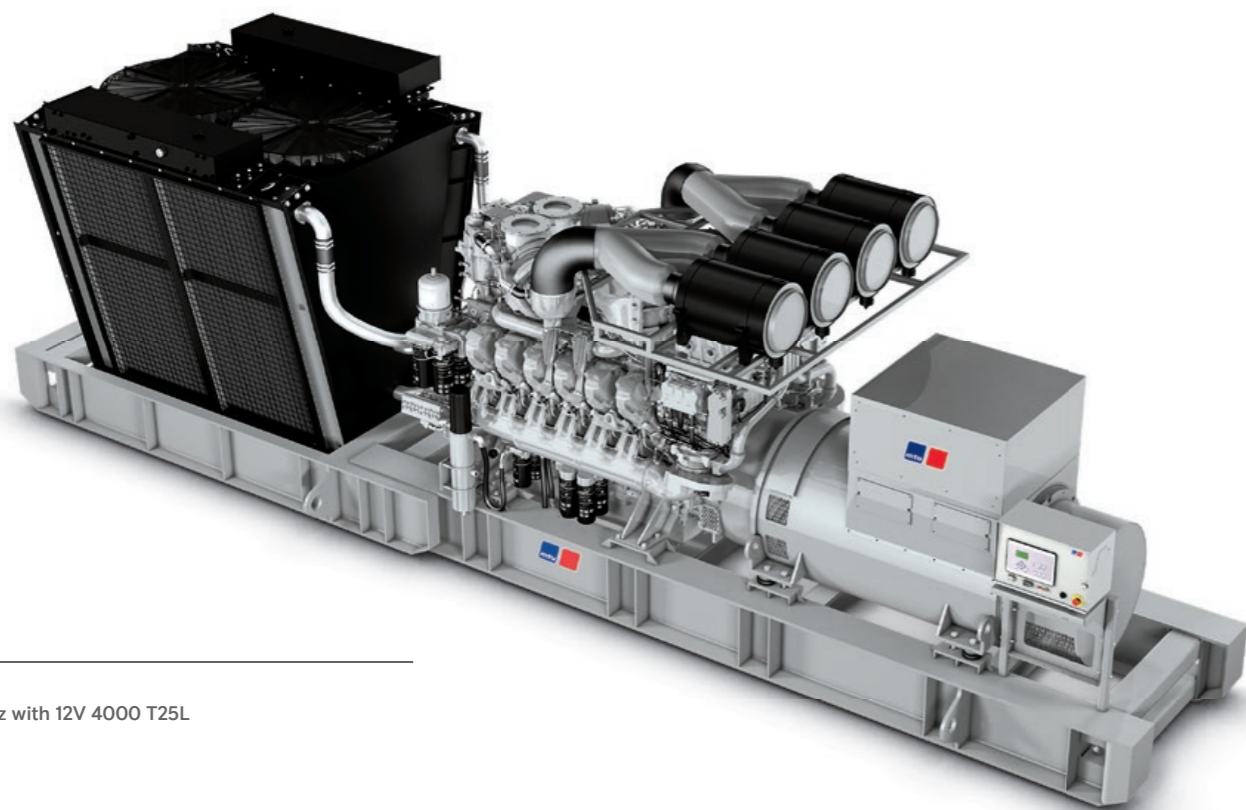
Systems solutions onshore

HIGH PERFORMANCE INDEPENDENCE.

Electric DrillingPack – the complete power package

Powered by a Series 4000 engine, the **mtu** Electric DrillingPack (EDP) delivers high performance, efficiency and reliability in one self-contained package that seamlessly integrates diesel engine, generator, radiator and other components. The EDP combines industry-leading common rail injection technology with outstanding fuel economy.

Given its enormous output, the base frame of the EDP is subjected to extensive FEA stress testing for maximum durability. Components such as the tow bars and fuel system are engineered with advanced technologies that also support easy serviceability.



EDP 60Hz with 12V 4000 T25L

ALL-IN-ONE WELL SERVICING.

FracPack – low weight and high performance

A complete solution designed specifically for the high demands and rugged conditions of well servicing tasks – that also characterizes the **mtu** FracPack. In its case, the powerful Series 4000 engine is combined with a lightweight transmission.

With a power output of up to 2600 bhp, the engine provides more low-end torque for excellent acceleration. In combination with the maximum input torque of 7,744 lb-ft (10,500 Nm) provided by the transmission, it delivers outstanding frac pump performance. Also noteworthy: Thanks to its sophisticated combustion concept, the Series 4000 T95 is the only frac engine to meet Tier 4 standards without aftertreatment.

FracPack benefits

- 97% transmission efficiency (with Series 4000 T95)
- Lightweight design
- Maximum frac pump utilization
- Lower lifecycle costs¹
- Exceptional durability and reliability
- Long component life

1 Series 4000 frac engine

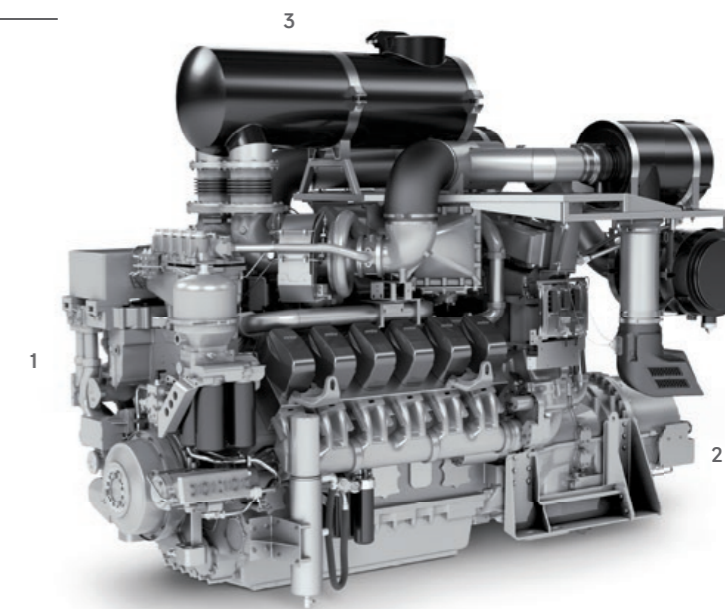
- EPA Tier 4 final certified (Series 4000 T95)
- No additives needed for aftertreatment emissions control
- Power output: 2250-2600 bhp (1678-1939 kW)
- Full performance up to 13,000 ft (4,000 m²)
- Easy integration with other frac equipment
- Optimized power-to-weight ratio
- Also available with Tier 2 compliant engine

2 ZF transmission

- Wide range of gears (speeds)
- High input torque
- Durable, lightweight design

3 Optional equipment (back pack)

- Additional frame
- Muffler
- Intake tubes
- Air filters



Scan the QR code for more information about the **mtu** FracPack.

¹ Compared to Tier 2 engines

² Dependent on air intake temperature; subject to confirmation

Systems solutions offshore

OFFSHORE
GENERATOR SETS

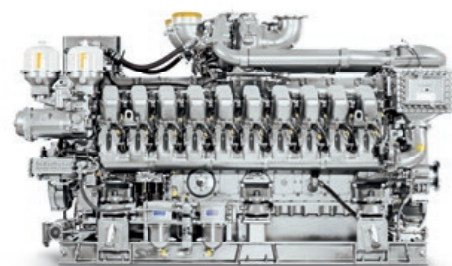
Exploration and production of offshore oil and gas reserves is extremely demanding on the equipment. Our wide range of customized, compact and lightweight diesel engines, systems and gensets is well equipped to keep you operating safely and profitably.

We specialize in complete, integrated and thoroughly tested power generation solutions from a single source. Everything we develop is designed to ensure optimal long-term performance, thereby prolonging preventive maintenance and overhaul intervals.

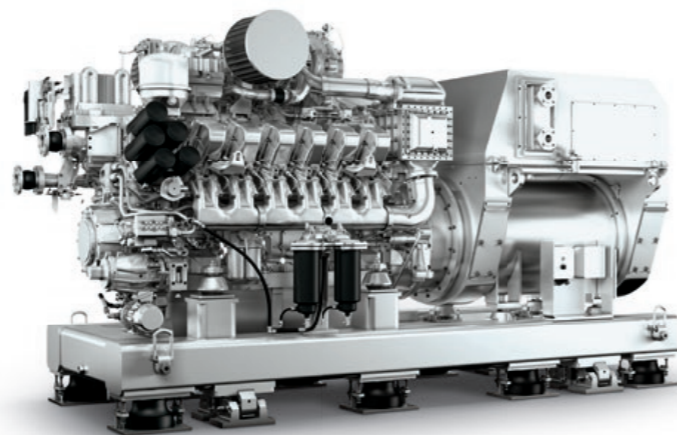
Our offshore offering

- Generator sets for emergency, essential, auxiliary and main power
- Fire pump drives for mechanical, hydraulic and electric installations
- Mud pump drives
- Well-servicing power packs
- Nitrogen units
- Cranes
- Cement pumps
- Hydraulic power packs

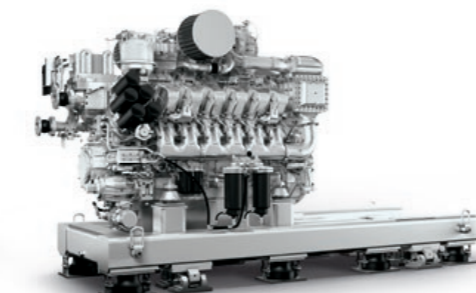
Together with our product we also offer customized offshore documentation according to project specific requirements.



Engine Plus system



Modularized generator set



Modularized generator drive

07

Redundant controllers for fire pump drive systems

INCREASED AVAILABILITY
THROUGH REDUNDANCY.

As called for by the NFPA-20 standard, fire pump drive systems must be equipped with redundant controllers to prevent water jet interruptions in the event of an emergency. A second controller must also be installed as a backup should the first controller fail.

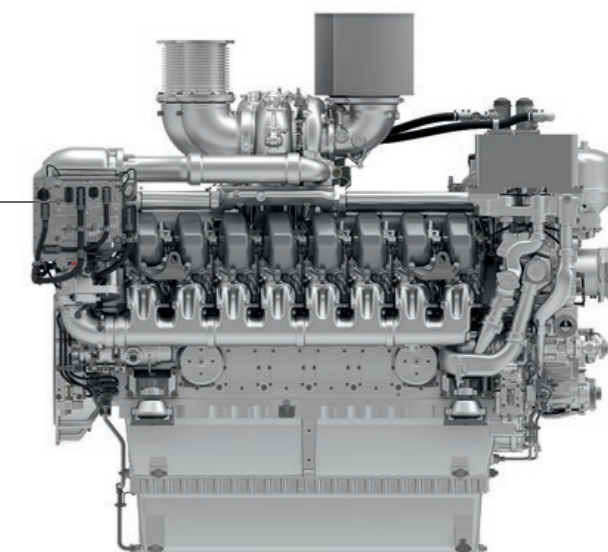
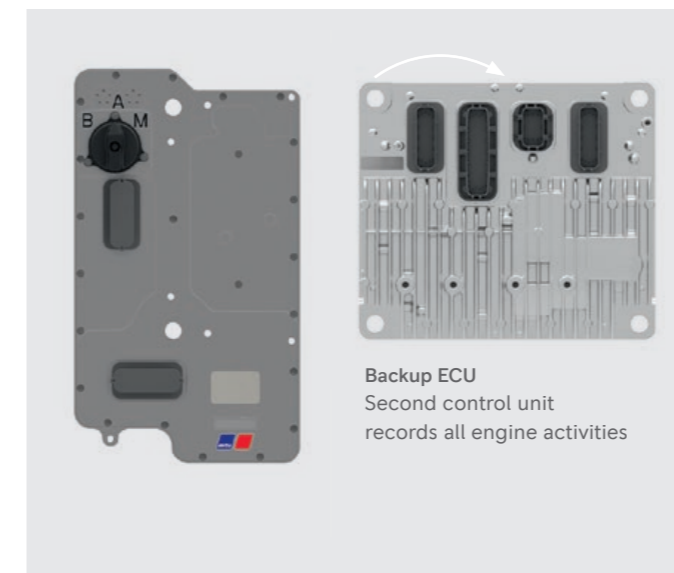
Our redundant controllers are the first to feature common rail injection, which helps to increase the availability of the entire drive system – whether direct, hydraulic or diesel-electric. The second ECU7 control unit, used as a backup, redundantly records all engine data. Forming the centerpiece between the two controllers is the SBX1 switch box. Manual switching is also possible to ensure the greatest possible system redundancy. The active controller is optically displayed via LED. Connection plugs are designed for extremely simple wiring.

Key benefits

- Fulfills NFPA20 (2010) norms for Series 4000 P-engines
- Common rail injection for increased drive system availability
- Simple plug-and-play retrofitting
- All components designed for seamless interoperability

Backup ECU

Second control unit records all engine activities



Scan the QR code
for more information
about the backup ECU

Environmental, social and corporate governance (ESG)

ENGINEERING SUSTAINABILITY AND RESPONSIBILITY.

Oil and gas is changing – rapidly so and in many ways. This is particularly visible in the industry's prioritization of environmental, social and governance (ESG) issues and programs within recent years.

As an engineering company, we specialize in designing, developing and manufacturing complex technologies of the highest quality. Our mission is also deeply rooted in a tireless commitment to advancing the good of the environment, humankind and the planet as a whole — in short: to engineering sustainability and social responsibility.

08

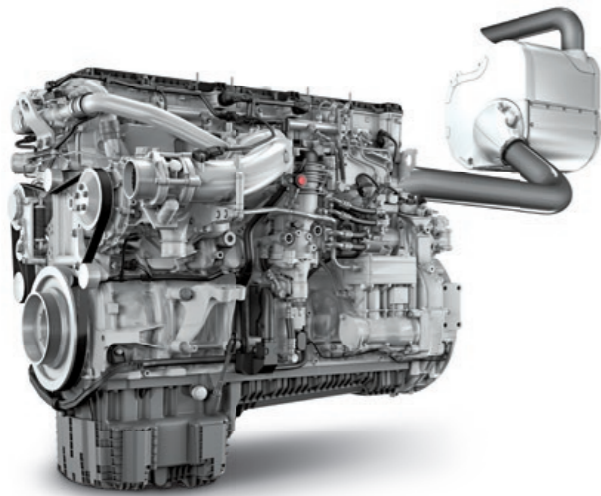


Emission reduction solutions

SMALL FOOTPRINT. BIG OUTPUT.

Advanced greenhouse gas regulations worldwide for oil and gas applications like the EU Stage IV and EPA Tier 4 final call for significant reductions in emissions. We have a comprehensive portfolio of highly effective emissions reduction solutions.

By focusing on fuel injection, turbocharging, cooled exhaust gas recirculation, electronic engine controls for optimizing processes and prevention of soot formation, our advanced engine and drive system technologies exceed legislative requirements.

**Aftertreatment solutions below 560 kW****Fuel injection**

Optimized fuel combustion in the cylinder is achieved by combining an electronically controlled common rail fuel injection system with turbochargers.

All-in-one exhaust gas aftertreatment

A single box with selective catalytic reduction (SCR), diesel particulate filter (DPF) and integrated dosing unit decreases harmful greenhouse gases and optimizes fuel consumption to meet EU Stage V emission limits.

Internal emissions reductions

The internal emissions technology alone can significantly reduce nitrogen oxide amounts to improve overall system fuel and urea consumption.

Turbocharging

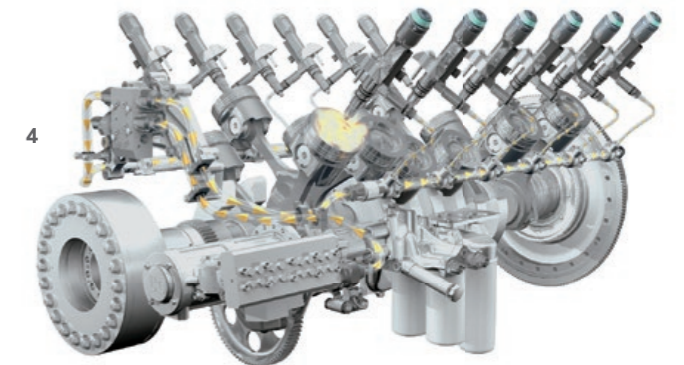
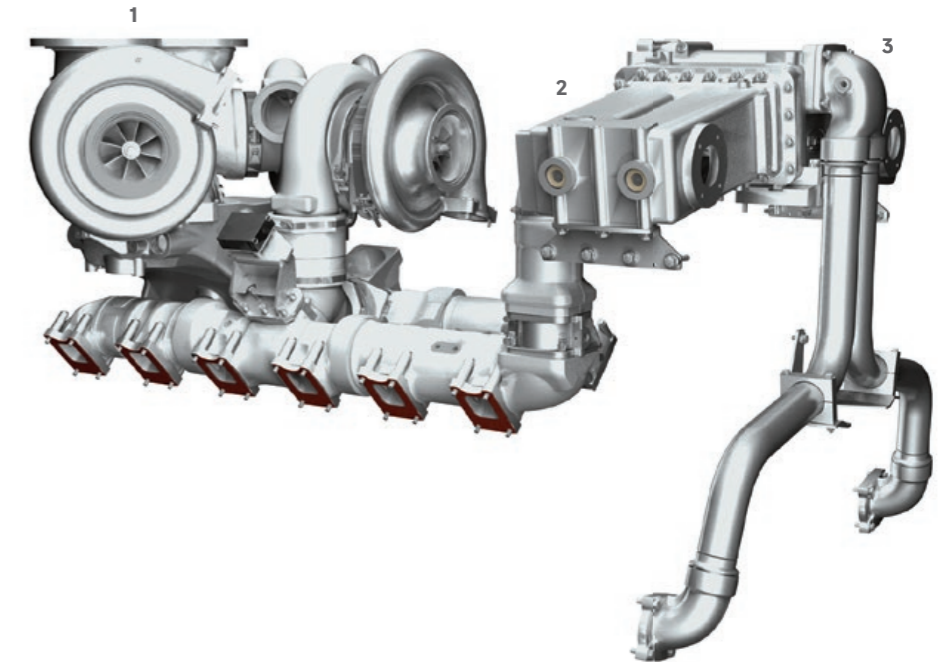
Single-stage turbochargers compress the air so that more oxygen flows into the combustion chamber, thereby burning more fuel and increasing engine power output. Two-stage turbochargers ensure low fuel consumption across a wide speed range, exceptionally high torque at low speeds and clean combustion.

EMISSION FLEX PACKAGE.

Governmental regulations for oil and gas equipment vary greatly from country to country. Emissions standards in some markets are highly regulated, less so in others. Our Emission Flex Package software lets you quickly and flexibly deactivate engine exhaust gas aftertreatment and selective catalytic reduction (SCR) systems, thereby eliminating the need for time-consuming hardware modifications.

Example: Series 4000 emission reduction





- 1 Two-stage turbocharging control**
Assures low fuel consumption across a wide speed range, exceptionally high torque at low speeds, and clean combustion
- 2 Exhaust gas recirculation (EGR) coolers**
These coolers lower the combustion temperature and, subsequently, in-engine nitrogen oxide generation
- 3 EGR valve**
This valve regulates recirculated exhaust gas quantities, thereby optimizing the EGR rate for all operating modes
- 4 Common rail fuel injection**
It optimizes the combustion process to lower pollutant levels as well as fuel consumption





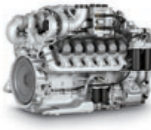

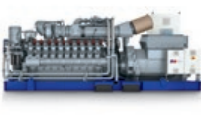
**No aftertreatment above 560 kW (750 bhp)**

All of our engines above 560 kW (750 bhp) do not require any exhaust aftertreatment. Combining advanced exhaust gas recirculation (EGR) solutions with key technologies, they achieve optimal performance and efficiency while meeting the most stringent emission regulations.

Emission reduction solutions

SERIES EMISSIONS
CERTIFICATIONS

Emissions qualifications	Series 900	Series 460	Series 60	Series 1000/ OM 934/936
				
EU Nonroad Stage IIIA Comp (97/68/EC)	■	■	■	
EU Nonroad Stage IIIA (97/68/EC)				
EU Nonroad Stage IIIB Comp (97/68/EC)	■	■		
EU Nonroad Stage IV Comp (97/68/EC)				■
EU Nonroad Stage V (2016/1638) + EPA Nonroad T4				■
China Onroad Stage V (GB17691-2005)		■		
China NRMM Stage III (GB20981-2014)	■	■	■	
MoEF India / CPCB Stage II				
TA-Luft optimized (diesel)				
Fuel consumption optimized				
UN ECE R96 Emission Flex Package EFP				■
NEA Singapore for ORDE				
EPA Nonroad T2 Comp (40CFR89)			■	
EPA Nonroad T3 Comp (40CFR89)	■	■	■	
EPA Nonroad T4i Comp (40CFR1039)	■	■		
EPA Nonroad T4 (40CFR1039)				■
O&G gas certification requirements				

Series 1100/ OM 470	Series 1300/ OM 471	Series 1500/ OM 473	Series 1600	Series 2000	Series 4000	20V 4000 L64
						
			■			
■	■	■				
■	■	■				
				■		
					■	
			■			
			■	■	■	
■	■	■				
			■		■	
			■	■	■	
				■	■	
■	■	■			■	
						■

Environmental, social and corporate governance (ESG)

BEING MINDFUL
OF POWER.

Power is our business, especially big power. With big power comes big responsibility. Environmental, social and governance (ESG) factors are core to our corporate values and always top of mind in everything that we do.

Environment

Operating an environmentally, socially and ethically sustainable business begins by understanding the impact it has on the world around us. Our commitment extends far beyond maximizing fuel efficiency, reducing carbon emissions and exhaust after-treatment. Through certification to ISO 14001, our environmental performance in the development, production, sales and service of engines, drive, monitoring and control systems as well as decentralized energy systems is well documented. Taking into account diverse perspectives – from stakeholders, customers, investors, regulators, community groups and society at large – also has a high priority in our efforts to make a positive contribution to the communities within which we operate.

Social

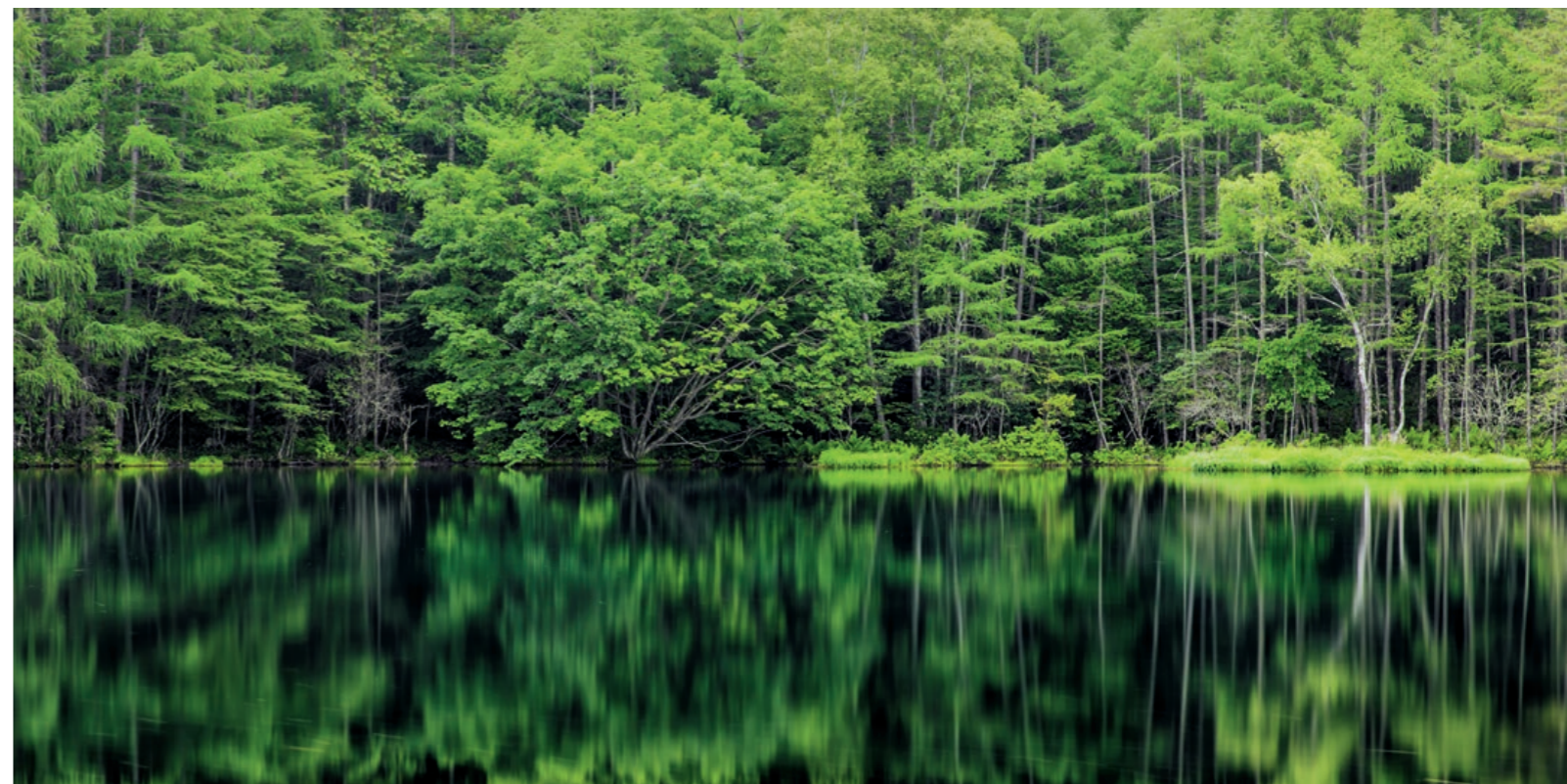
The safety and wellbeing of our employees at the workplace is central to all of our operations. Our Zero Harm programme defines 10 Life-saving rules and serves as a guide for employees to develop a proactive mindset and spirit when it comes to safety in their daily work. Measures also include initiatives and trainings aimed at preserving employees' emotional wellbeing and effectively managing stress. Our company-wide occupational health and safety management systems are certified to the international standard BS OHSAS 18001. These are regularly reviewed through audits. We have also put robust processes in place designed to protect our partners, contractors and the public as a whole against health and safety risks.

Diversity

As an international enterprise with operations in many countries around the world, we proactively promote diversity and inclusion as a critical factor to our success. This commitment is evident in our ongoing efforts to create a working environment where everyone feels respected and empowered, just as it is in our equal opportunity employment practices. We evaluate qualified applicants without regard to race, color, religion, sex, sexual orientation, gender identity and expression national origin, disability, veteran status or any other protected characteristic. After all, the diversity of our teams is not only good for business, it is also good for us. Balancing our individual uniqueness simply makes us better.

Governance

We have a Global Code of Conduct that applies to all employees and sets out the principles that underpin our values and the way we do business. Together with initiatives such as our TRUST (think, read, understand, speak and take action) model and our ethics and compliance improvement programme, it offers guidance on how to apply these principles. We encourage employees and stakeholders not to hesitate in raising ethical questions or concerns and we have implemented various confidential channels that they can use. This service is also available for third parties such as customers, suppliers and members of the community. Long-term relationships are key for our business. For them to be successful, they must be built on trust.



Digital solutions supporting your business

DELIVERING ACTIONABLE INSIGHTS THROUGH DIGITAL SOLUTIONS

We offer you the best possible equipment service by incorporating digitalization in a holistic service approach. This helps improve our service and helps you operate your equipment more effectively.

Our digital platform **mtu** Go! offers you the opportunity to analyze system data quickly, determine important action steps, and plan them optimally, either independently or together with our service department. Ensure that your business runs smoothly with **mtu** Go! digital service solutions.

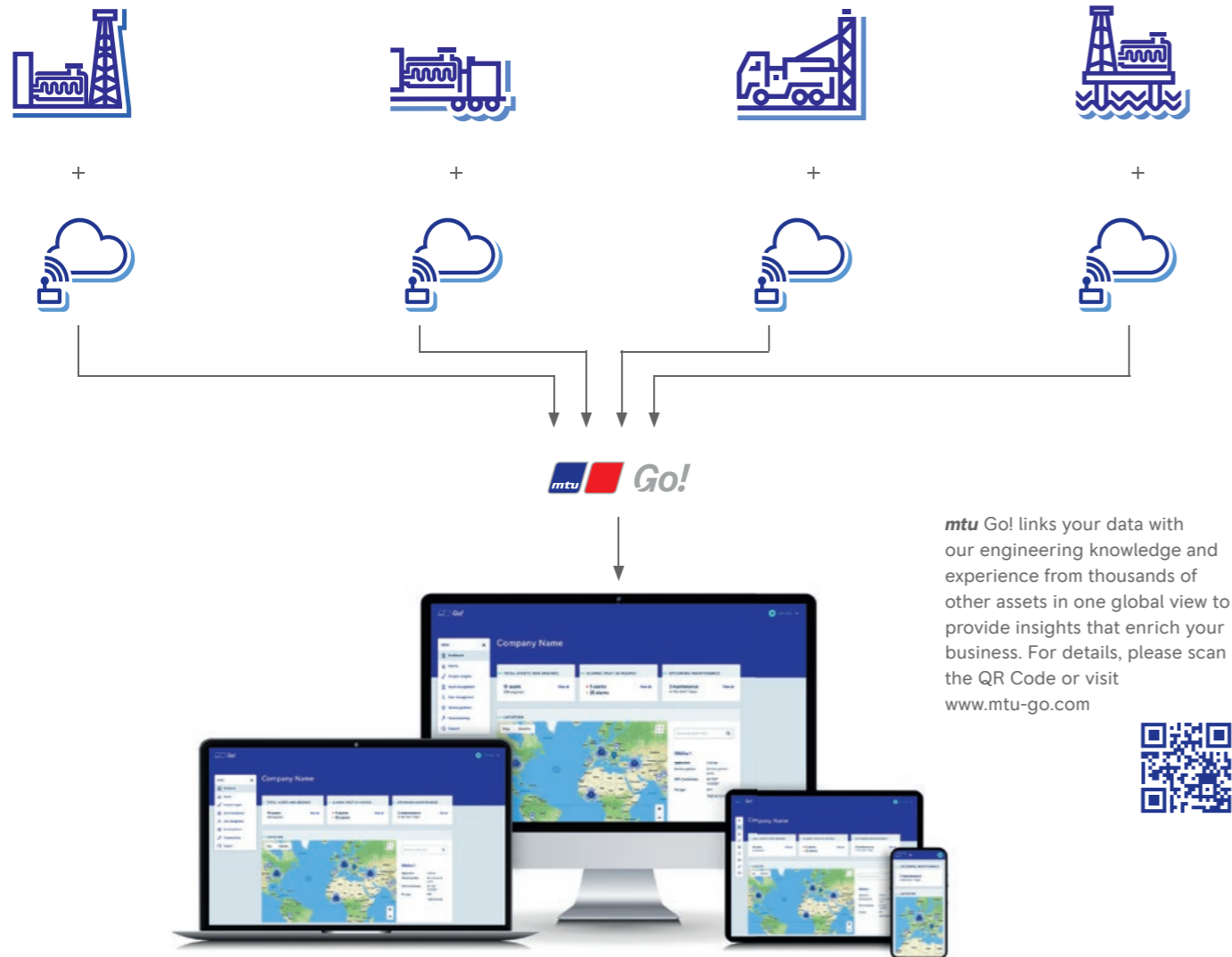
09



Digital Oil & Gas solutions

HOW DIGITAL SOLUTIONS OPTIMIZE
YOUR OIL & GAS BUSINESS.

Oil & Gas has great demands on engines and drive systems. Ensuring the equipment is constantly available for optimal use, means making the right maintenance decisions. Our digital solutions enable you to keep track of operating hours, system alarms and maintenance schedules so you can plan service intervals more effectively.



Delivering actionable insights through digital solutions

**Connect all your equipment****Data collection from your fleet, asset, system and engine**

Connectivity is the basis for all the advantages of digitally supported service. Using our edge software connected to the control unit, you and your service network can monitor relevant deviations from the optimum condition remotely. We offer several ways of collecting data, including the creation of interfaces to already existing data sets. In doing so, we always adhere to the highest data privacy and security standards of our industry.

Access your data

- Remote monitoring, available for individual assets, as well as complete fleets worldwide
- Different device and software options ensure optimal connectivity
- Data privacy and security to the highest industry standards

**Monitor your fleet****Visualization of data for a quick and accurate overview of your fleet**

With the **mtu Go!** platform, predefined users, such as on-site technicians or managers, can view the system data and perform initial analyses by using diagnostic tools. By accessing the same information, your service network can provide fast support in handling alarms and planning necessary maintenance together with you. Open APIs allow you to interface directly to your existing dashboards or systems.

Keep track of your data

- All important data and alarms available at a glance for efficient fleet monitoring
- Intuitive and clear design for easy operation
- Visual comparison of data using the diagnostic tools for initial analyses

**Manage your fleet****Digital solutions for your detailed data analysis on necessary actions**

Supported by **mtu Go!** your Service Network is able to analyze all relevant data from your equipment and compare it with data sets from other systems. From this we together can proactively derive recommendations for action.

In future, the analysis can be enriched with additional external data sets, such as environmental influences or time schedules. Cross-linking data will create new opportunities for optimizing business processes.

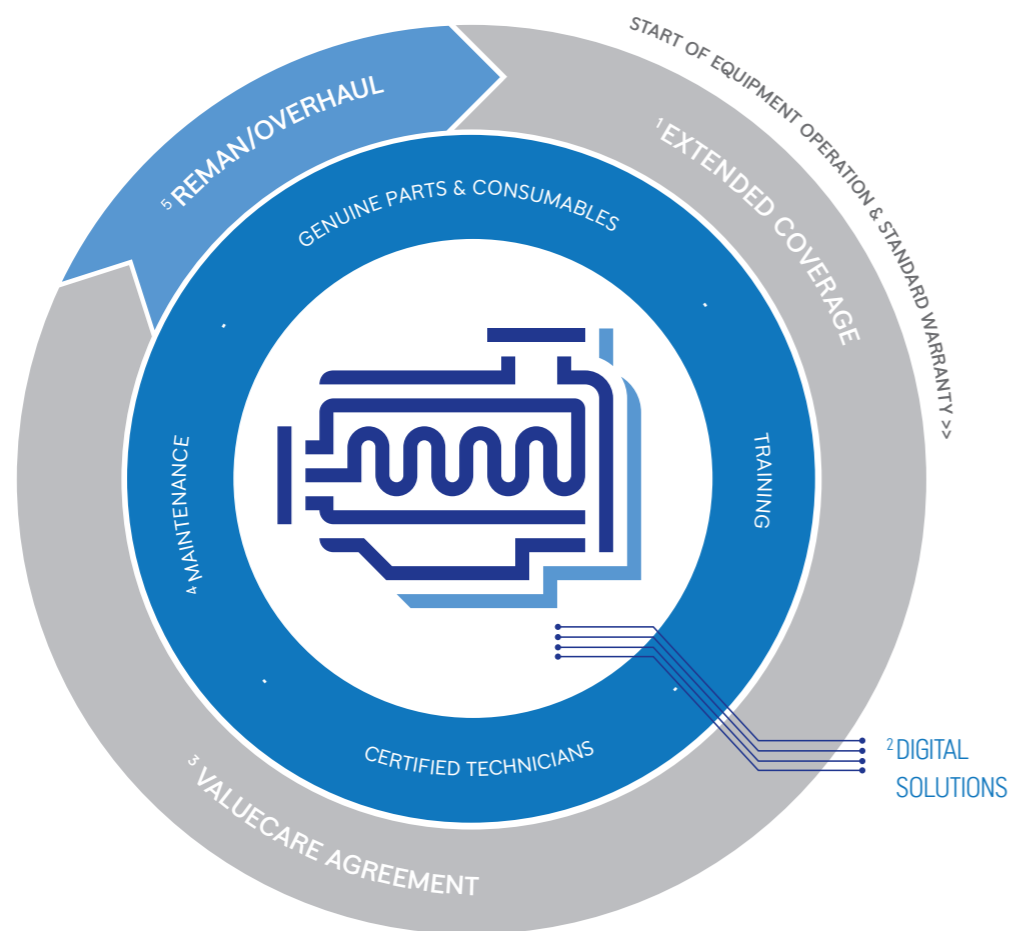
Learn from your data (under development)

- Algorithms for proactive early detection of deviations
- Troubleshooting based on large amounts of data with artificial intelligence
- Comparison with data outside own fleet leads for faster knowledge transfer and optimal service tool for initial analyses

How complete lifecycle solutions help

ENSURE A LONG, RELIABLE LIFE.

As your equipment ages, its needs – and yours – change. Our full portfolio of service solutions wrap around your investment, providing 360 degrees of customized support, for optimal value at every stage of life.



- 1 Avoid the unexpected with added protection beyond the standard warranty.
- 2 Make better decisions faster with digitally-enhanced tools.
- 3 Maximize availability and optimize lifecycle costs with a ValueCare Agreement.
- 4 Improve system performance and extend equipment life with on-demand support.
- 5 Keep a good thing going with factory reman/overhaul solutions.

10

Why preventive maintenance is essential

DON'T LET THE UNKNOWN
LEAVE YOU UNPREPARED.

With large investments, lifecycle costs can be significant. It's often the unforeseen costs lurking below the surface – things like fuel consumption, unplanned downtime and repairs – that have the greatest potential to impact your business. That's why it pays to invest in our superior power systems and plan ahead with preventive maintenance. There's no better way to optimize fuel economy, maximize uptime and avoid the unexpected.

Optimize fuel economy.

Fuel consumption accounts for up to 90 percent of total lifecycle costs depending on the application – by far one of the most significant costs associated with your equipment. Well-maintained engines deliver industry-leading fuel efficiency, helping you keep fuel costs down over the long term.

Maximize uptime.

Preventive maintenance services can be planned around your schedule, so your equipment is available when you need it most.

Avoid the unexpected.

Planned maintenance helps solve problems before they start, helping you avoid unexpected downtime and resolve problems early before they escalate.

Work with one source.

We keep maintenance simple, safe and efficient. Our factory-approved methods and expert technicians ensure everything is done correctly according to our proprietary preventive maintenance schedules, optimizing the availability of your equipment, reducing lifecycle costs and helping you avoid unforeseen problems.

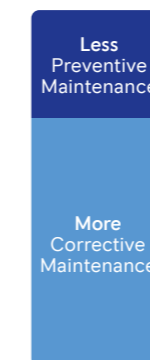
The Importance of Preventive Maintenance

When preventive maintenance is a high priority.

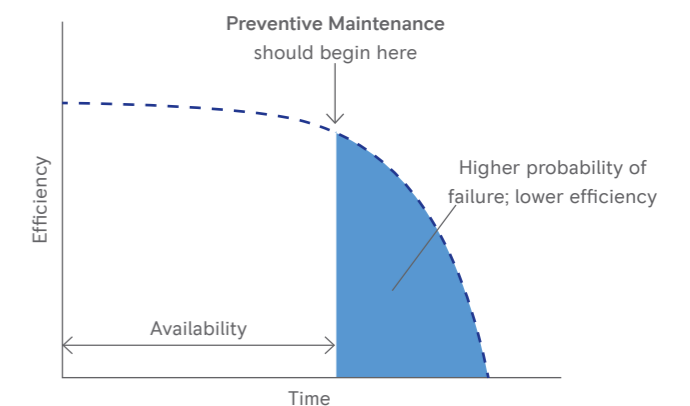


1. Scheduled stops
2. Improved performance
3. Better control over operation

When preventive maintenance is a low priority.



1. Nonscheduled stops
2. Inability to plan
3. Lower performance



We focus on preventive maintenance to reduce the downtime and added costs of corrective maintenance.

Delaying maintenance increases unexpected failures and decreases performance and fuel economy.

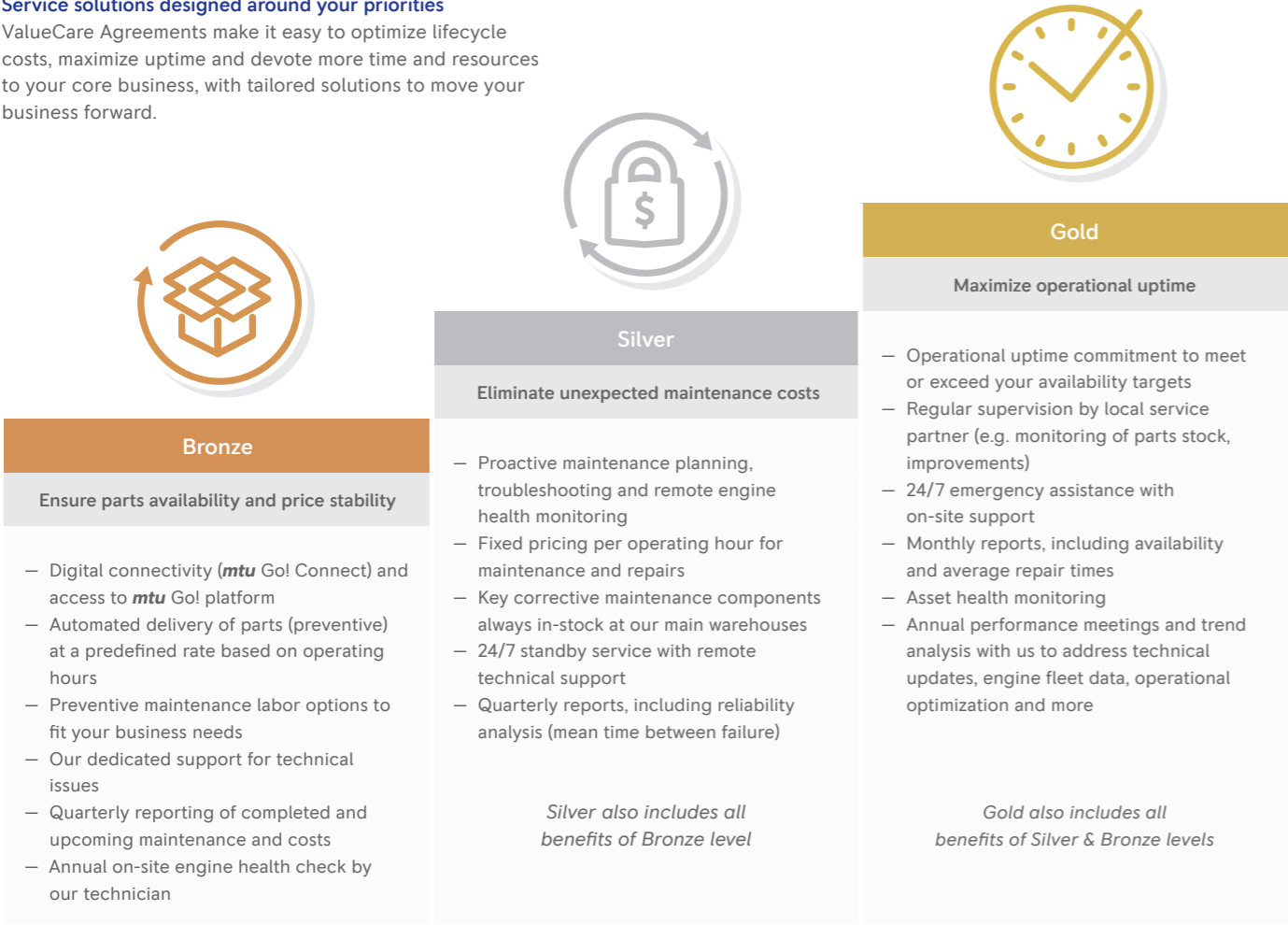
ValueCare agreements

FOCUS ON YOUR OPERATIONS.
LEAVE THE REST TO US.

You’ve got a tough job. With us as your partner, you’ll get the power, performance and peace of mind to get it done right. Our digitally connected power systems, wrapped in ValueCare Agreements, make it easy to keep your business running smoothly and reduce total cost of ownership by maximizing uptime, optimizing lifecycle costs and helping you avoid equipment-related business disruptions through preventive maintenance.

Service solutions designed around your priorities

ValueCare Agreements make it easy to optimize lifecycle costs, maximize uptime and devote more time and resources to your core business, with tailored solutions to move your business forward.



Remanufactured products

EXCHANGE AND SAVE.

Factory remanufactured products deliver the same high standards of performance, service life and quality as new products, along with identical warranty coverage – at a fraction of the cost. And with design and model-related updates, they also feature similar technological advancements. Developed by R&D engineers, the remanufacturing process saves you time and money, while benefiting the environment through the reuse of materials. To help you work efficiently, a wide range of remanufactured parts, engines and systems are available worldwide.

Reduce lifecycle costs.

As you evaluate your long-term power needs, you must consider a variety of factors. Factory remanufactured products are a smart solution, helping you reduce the total lifecycle cost of your equipment.

Save time.

Factory remanufactured products put your equipment back to work faster than an overhaul, which reduces downtime, service time and indirect costs such as storage.

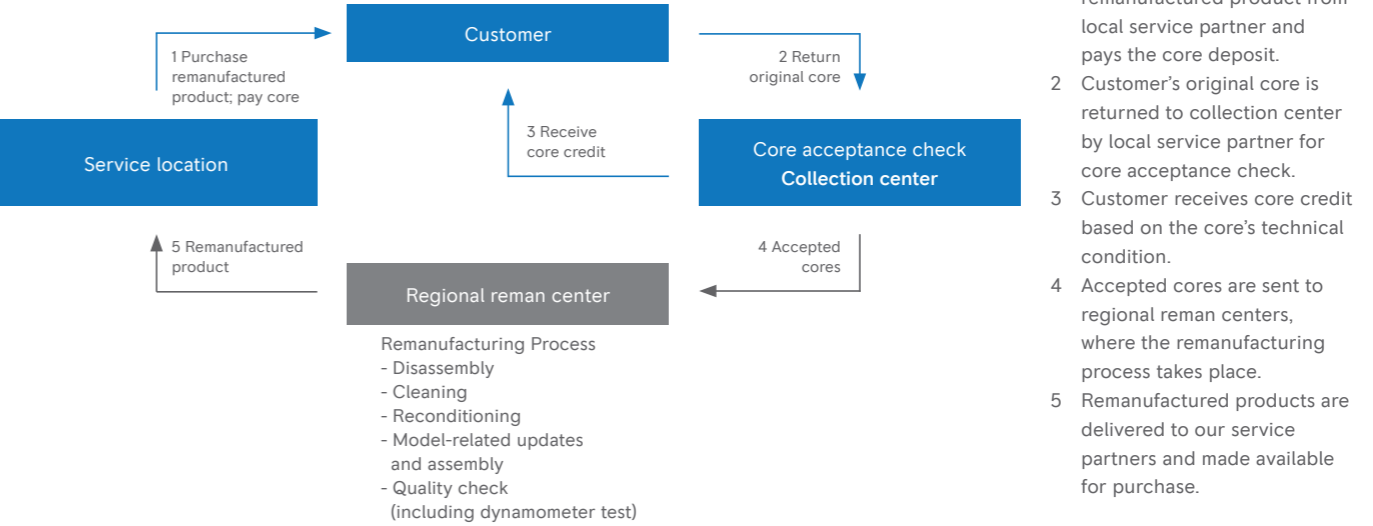
Our maintain standards.

All products are remanufactured to strict to our standards by certified technicians at our regional reman centers can remanufacture our parts, engines or systems to original factory specifications.

Protect the environment.

Since remanufacturing is an efficient use of resources and energy, factory remanufactured products benefit the environment as well.

Exchange process



Certified quality

FULFILLING DEMANDING REQUIREMENTS.

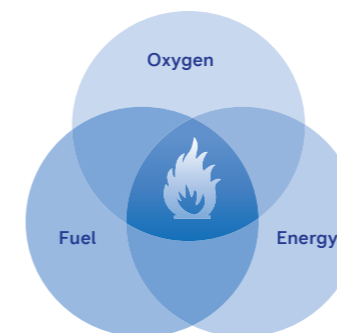
For decades, we have upheld the highest standards of engineering excellence, ensuring the quality of our products at every stage of their development. Through hard work and dedication, we have earned many quality certifications.

We meet the international requirements of ISO 9001:2008 and 14001:2009. Our engines and gensets are certified by all major classification societies such as Achilles, BS OHSAS 18001:2007, ABS, DNV, LRS, GL, BV, CCS and RS. Nevertheless, there is a lot more to quality than obtaining a certificate or meeting an inspection specification. For us, the true mark of

quality is reflected in customer satisfaction, confidence and loyalty. Our customers have high expectations for quality. This inspires us to set high standards for ourselves – to keep innovating, improving and succeeding. With reliable engines and systems trusted by customers all over the world, we will continue to power the oil and gas industry well into the future.

ATEX Zone 2 (IIB T3 Gc)

Critical safety factors



Modifications of P-engines for ATEX zone 2

The combination of three factors makes an explosion possible:

- Oxygen
- Fuel/flamable substance (gas, vapors, mist, or dust)
- Energy/ignition source (devices, electrical plants, sparks, hot surfaces)

The exclusion of one of these three factors means the elimination of the risk. In order to guarantee safety in potentially explosive environments, a modification of factor 3 – the engine – is the most efficient solution both technically and economically. **mtu** engines are designed to minimize or even prevent the risk of high surface temperatures and spark generation.

On request **mtu** P-engines fulfill the requirements of ATEX Zone 2: IIB T3 Gc according to directive 2014/34/EU. This means that they deliver an extremely high standard of safety in conjunction with superior cost efficiency.

Meaning of the ATEX marking.

- Zone 2:
An area in which an explosive mixture of gas is not likely to occur in normal operation and if it occurs it will exist only for a short time
- Explosion group IIB:
Explosive mixture of various types of gas, i.e. ethylene, whereas hydrogen and acetylene is excluded and air
- T3:
Surface temperature < 200°C equivalent to class I division 2 (North America)
- Gc:
Equipment protection level (according to Zone 2 for gas hazard, former marking: 3G)

For further detailed explanation please refer to the ATEX directive.

1



2



3



4



5



6



7



8



9



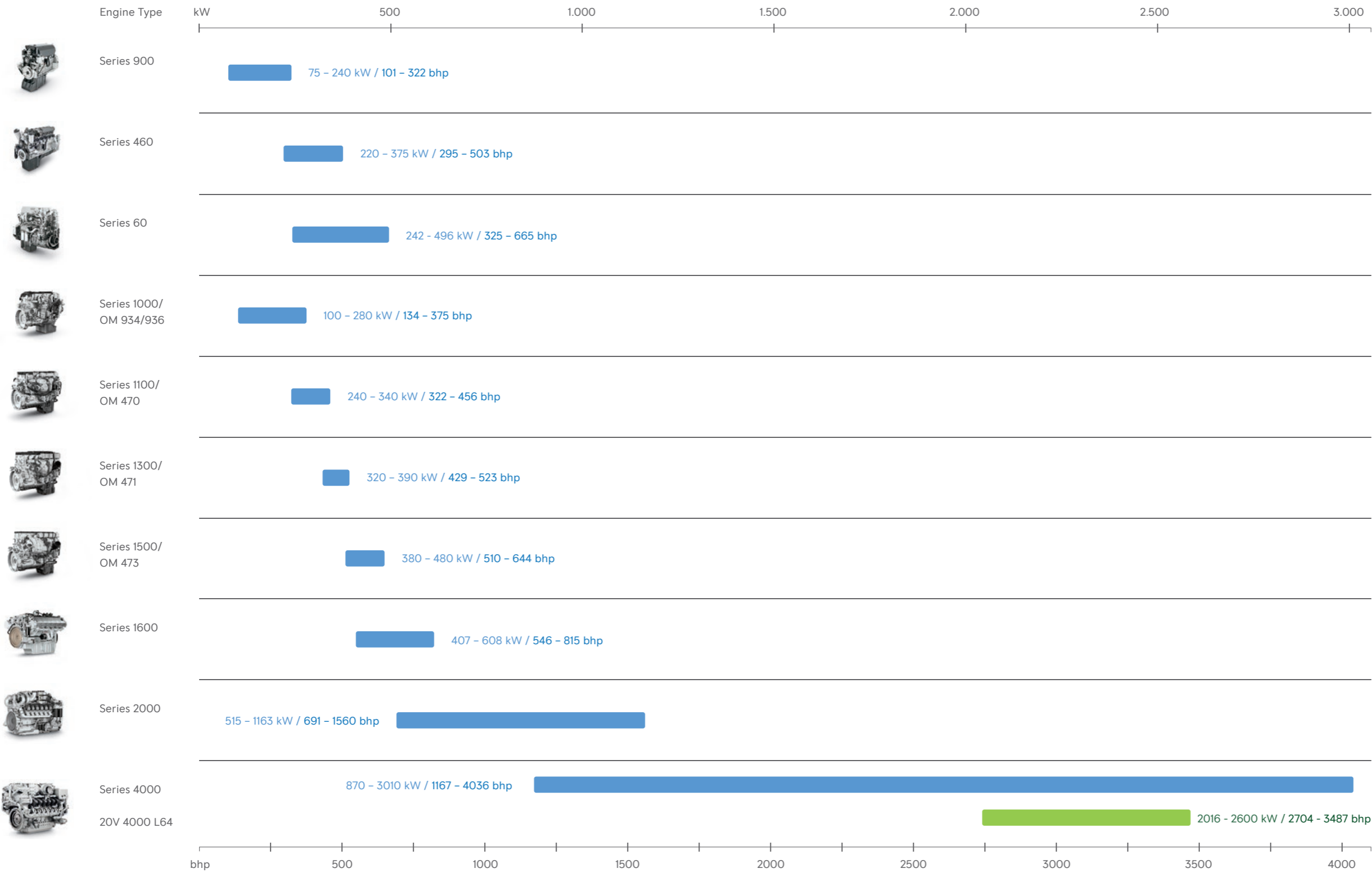
10



- 1 QMS ISO 9001:2015
- 2 ISO 14001:2015
- 3 OHSAS ISO 18001:2007
- 4 Achilles FPAL
- 5 Lloyd's register
- 6 Achilles JQS
- 7 ABS
- 8 Bureau Veritas
- 9 DNV-GL
- 10 Code 09010000

Diesel and gas engines

ALL ENGINES AT A GLANCE.



Our diesel engines portfolio covers the full power range from 75 – 3010 kW (101 – 4036 bhp) – while also fulfilling all emissions requirements. With their uncompromising operational availability, they set the benchmark for oil & gas applications performance. Combining exceptional efficiency with absolute reliability, they greatly contribute to the economic success of oil and gas operations.



Stay posted with more powerful information
and follow **mtusolutions** under:



Rolls-Royce Group
www.mtu-solutions.com

The Rolls-Royce name, Rolls-Royce badge and Rolls-Royce monogram logos are registered Trade Marks of Rolls-Royce plc