

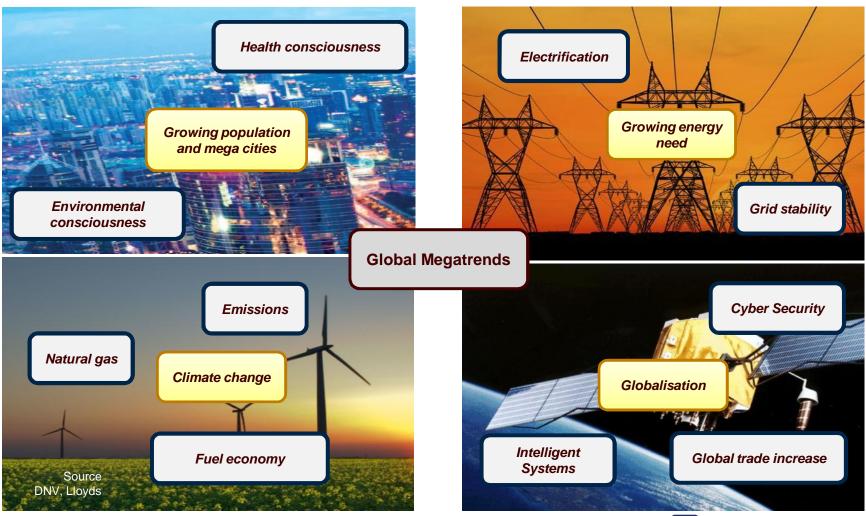
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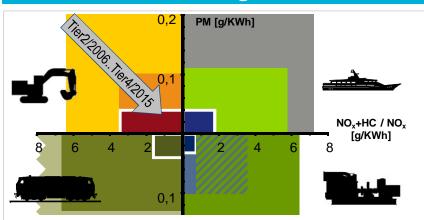
Megatrends





Challenges

Emission Legislation



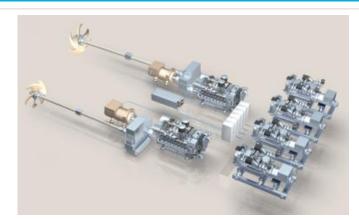
- Diverse emission legislation (application, region)
- Increasing share of exhaust aftertreatment solutions

Fuel Diversity

	Diesel	Gas, Bifuel	in product.
Powergen	X	X	in devel.
C&I	X	X	
Rail	X	X	
Marine	X	X	

- Gas engines also for mobile apllications
- New combustion systems and fuel supply

Increasing System Complexity



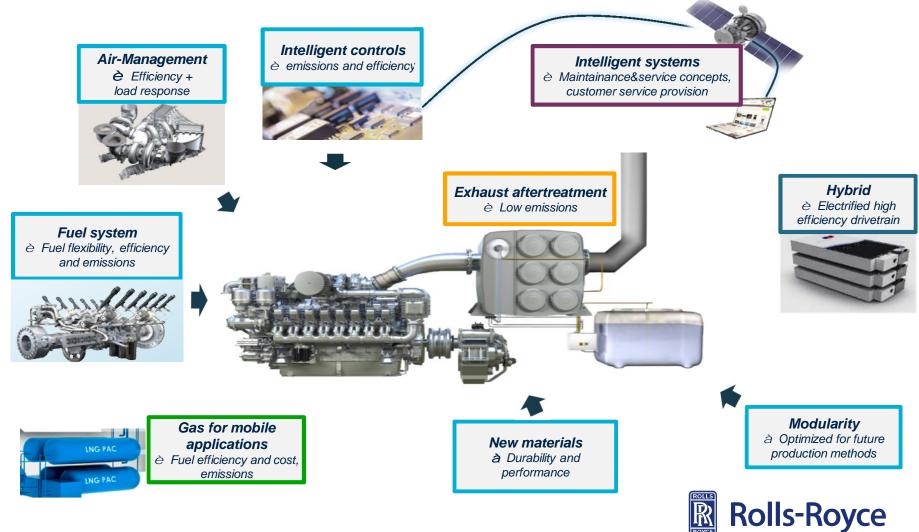
- Improved efficiency of electrified propulsion system
- System integration of electric modules

Intelligent Systems



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Green- & High-Tech Program Next generation of propulsion systems



Green- & High-Tech Programm

RRPS Green- & High-Tech Program | Stefan Mueller | Shanghai, December 2017

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Route to low-emission marine **Diesel** propulsion systems

So far 2017 2022 > 2025 State of the art **Marine Diesel engine System integration Fully integrated** "Green Diesel" with EAS intelligent system Diesel engine w. EAS Diesel engine Optimized, integrated Hybrid drivetrain Mechanical Mechan, Drivetrain **EAS** with high-efficiency- Next generation Diesel engine propulsion Diesel technology • Intelligent system Hybrid modules and fleet • Intelligent system management elements GHG=100% ■ NOx,PM=100% **Rolls-Royce**

Green- & High-Tech-Program

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Route to de-carbonized marine **Gas** propulsion systems

2017 2022 > 2025 So far State of the art First available marine **System integration Fully integrated** intelligent system gas engine Diesel engine Lean burn (I >1) gas Lean burn (I >1) gas Hybrid propulsion engine with EAS Mechanical engine w/o exhaust with optimized drivetrain gas aftertreatment Hybrid modules Low-GHG-engine Intelligent system (EAS) Intelligent system Mech. drivetrain elements and fleet management GHG = 100%