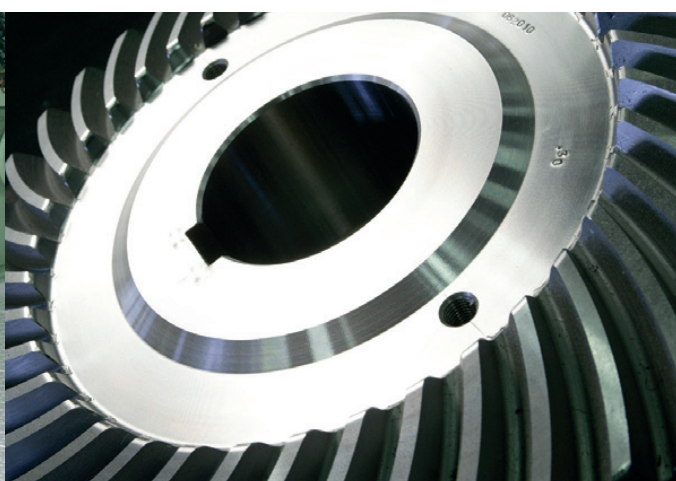
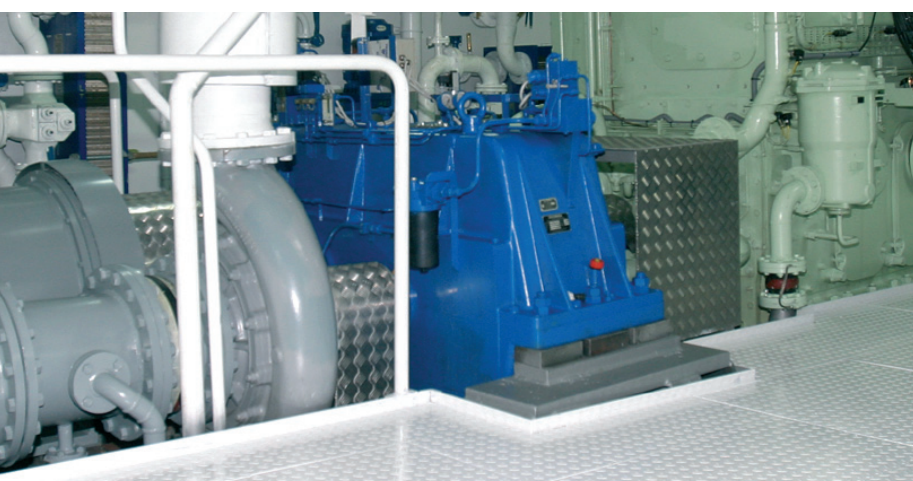


**Norgear Hybrid Propulsion gears
for Tugs & Workboats**

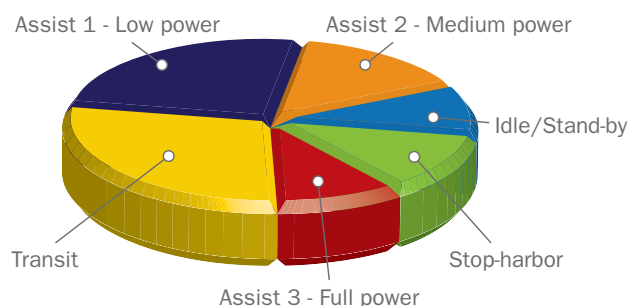


Norgear Hybrid gears

Operating modes for hybrid drive concepts

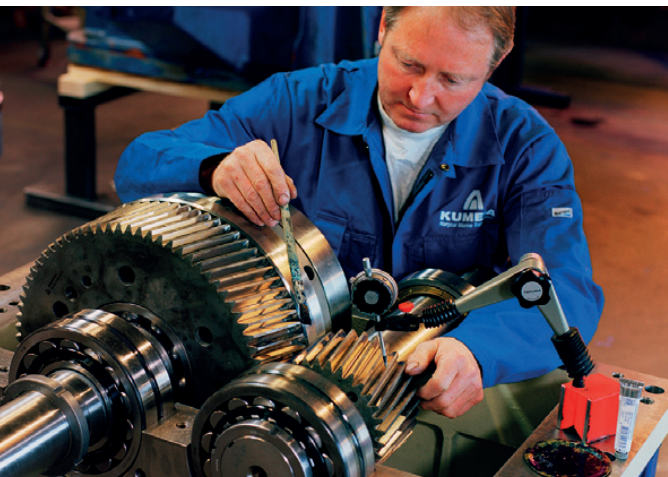
The operating modes for the tug or the workboat decide the fuel and emission reductions which can be expected. A harbor tug is used for a large variety of tasks with various speeds and bollard pull. Depending on the vessels operating pattern considerable fuel savings can be achieved. In some cases fuel savings up to a level of 40-50 % can be obtained with hybrid drives.

The classic operating modes for a harbor tugs are; stop-harbor, idle/standby, transit, with loads from low, medium and up to full load. A study of operations over time will indicate the vessels operating profile.



In order to meet present and future environmental requirements the hybrid propulsion system offers the following benefits

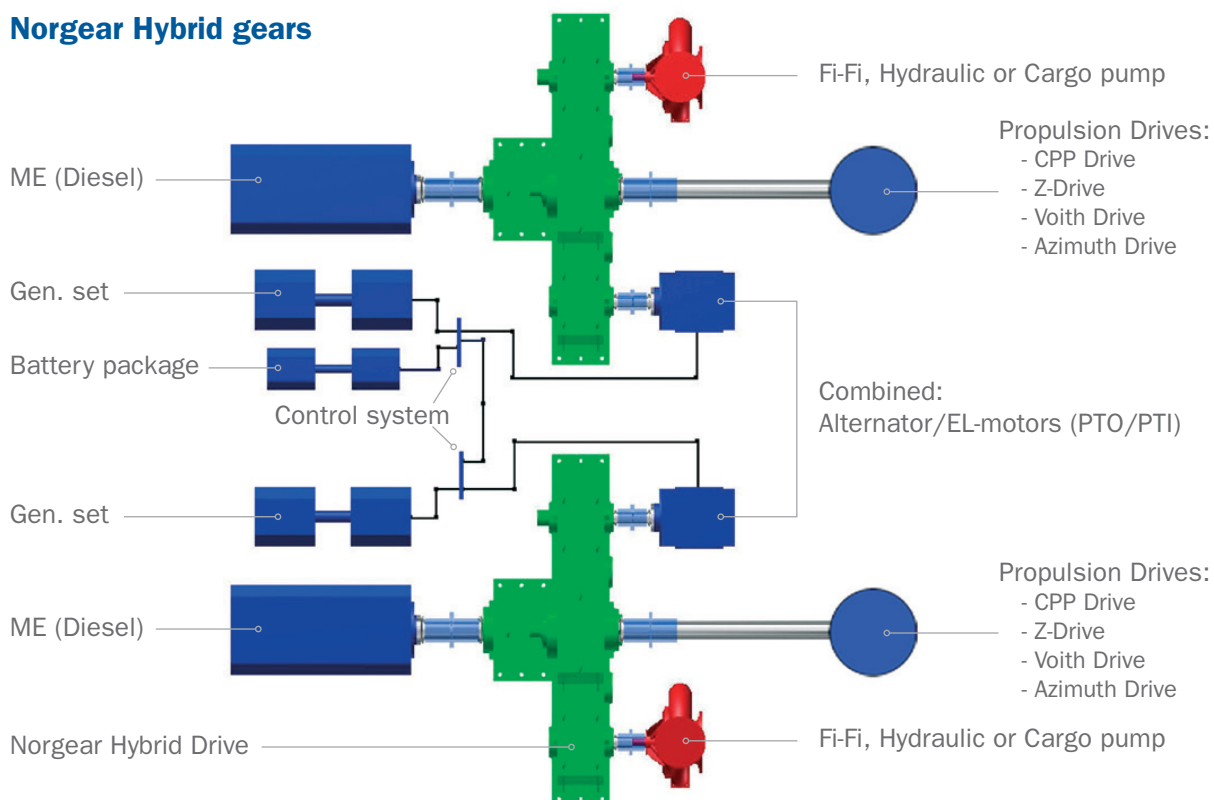
- Reduction of fuel consumption and emissions (CO₂, SO_x and NO_x).
- Downsizing of main engines with electrical boost for max bollard pull.
- Reduction of noise level in most operating modes.
- Improved redundancy.
- Reduced main engine operational hours and reduced service costs.
- Modular system with integrated auxiliary drives for Fi-Fi, Hydraulic and Cargo pumps.
- Satisfies ECA requirements allowing versatile operation in more geographical areas.
- Improves present and future design factors (IMO/EU).
- Meets main contractors and operators demand for "green profiles".
- Access to Official financing and TAX refund (NO_x) now available in some markets.
- Improved competitive power through innovative technical solution.



Main operating modes for Norgear Hybrid systems

- Main engine (diesel) drive.
- Electric drive from generator sets and/or battery package.
- Power boost from main engine and electric drive for max power.
- Electrical power supply from generator sets or from main engines.
- Auxiliary drives from each main engine or from generator sets.

Norgear Hybrid gears



The Norgear Hybrid gears are available with and without auxiliary drives for Fi-Fi, Hydraulic and cargo pump drives. Built in multidisc hydraulic clutches with soft engagement are standard.



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Norgear Hybrid Propulsion gears for Tugs & Worksboats

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Kumera Corporation

Kumera Corporation is a worldwide manufacturer of industrial machinery and engineering services. The corporation consists of four major operating divisions:

Power Transmission Group provides a comprehensive range of industrial and marine gearboxes for all major process industries. Kumera has more than 50 years of experience as manufacturer of mechanical power transmissions. There are more than 200.000 Kumera gear units in operation world-wide.

Technology Division specializes in state-of-the-art engineering and heavy process equipment for metallurgical and environmental industries. Kumera has successfully performed several modernization projects for metals industry and is a leading manufacturer of industrial steam dryers for copper and nickel smelters and lignite.

Foundry Division with **Peiron Oy** as the leading company produces all types of steel and iron castings, forming a link in the vertical refining chain of Kumera Corporation.

Marine Division produces propulsion gearboxes and propellers including control systems for any seafaring vessels.

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