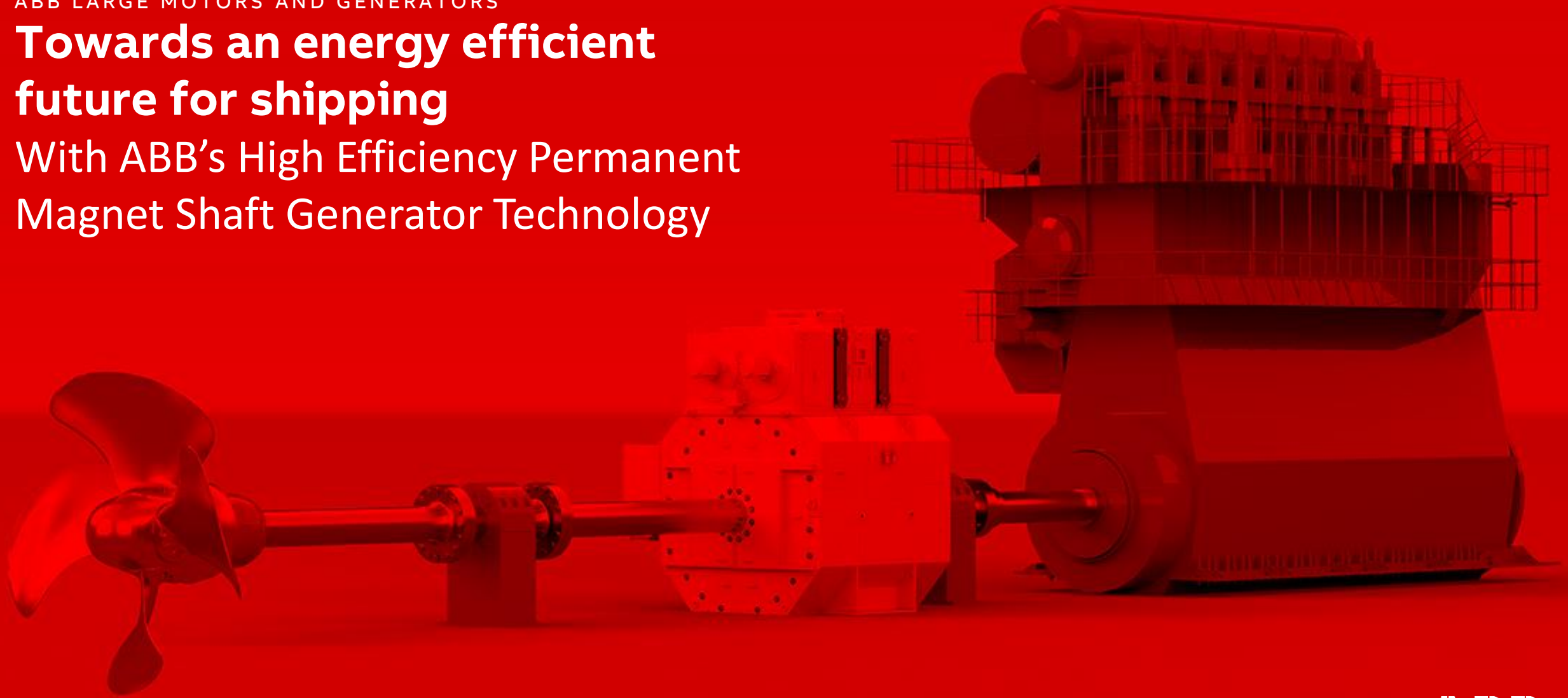

ABB LARGE MOTORS AND GENERATORS

Towards an energy efficient future for shipping

With ABB's High Efficiency Permanent Magnet Shaft Generator Technology



Towards an energy efficient future for shipping

High efficiency permanent magnet shaft generator technology



Reduce emissions



Higher efficiency

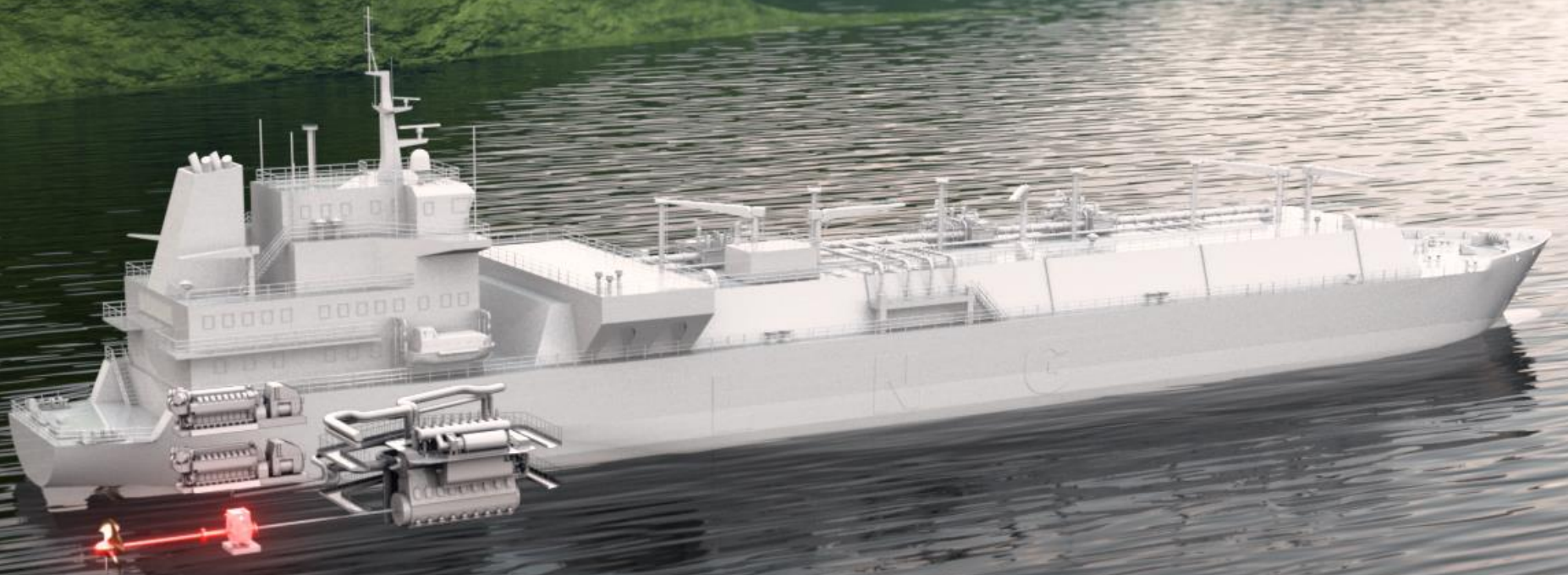


Better power/size and
power/weight ratio



Save energy

- Cut emissions
- Save fuel
- Reduce operating and maintenance costs



Global market and trends

Meeting emissions reduction targets

...By 2050



Shipping trades



GHG emission

x3

**Strong industry response
to climate change**



CO₂ emission reduction

To meet EEDI and EEXI set by IMO
also helps raise a vessel's CII rating

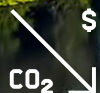
- EEDI (Energy Efficiency Design Index)
- EEXI (Energy Efficiency Existing Ship Index)
- IMO (International Maritime Organization)
- CII (Carbon Intensity Indicator)

A reduction of
emissions and
a higher efficiency
solution is needed

To respond to the market needs

The next level efficiency and emissions reduction solution

With ABB Permanent magnet in-line shaft generators, you can



Reduce CO₂ emissions

Helps towards meeting the CO₂ reduction targets set for the shipping industry by 2030 according to the IMO regulations (EEDI /EEXI/CII)



Run the machine with proven higher efficiency

Rely on the enhanced efficiency, performance and reliability of the machine



Save fuel costs by 3-4%

Converter control optimized design and lessened need for aux. generators enables better efficiency than other synchronous machines



Reduce the installation footprint by 20%

Innovative design with the lightweight and compact size reduces the installation footprint

Key facts and figures

ABB Permanent Magnet Shaft Generators

Proven facts
about **ABB large
permanent magnet
machines**

1200+

ABB MW class
permanent magnet
machines installed
around the globe



4000+

Accumulated years of
successful operation by
ABB large (over 200kNm
torque) permanent
magnet machines



200+

ABB permanent
magnet machines
delivered for marine
applications



30+ years

Of ABB permanent
magnet technology



Patents

Technology leadership
in permanent magnet
portfolio with tens of
patents



Global network

ABB Service facilities
worldwide



24/7

ABB service and
support/ hotline



Industry leading technology with superior efficiency

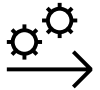
ABB Permanent Magnet Shaft Generators

ABB Permanent Magnet Shaft Generators **enhance the efficiency, performance and reliability** of vessels



Higher efficiency

Due to negligible magnetization losses, efficiency will remain high also in low speed and partial load operation



Straightforward, robust construction

30 years of experience in magnetic circuit know-how to maximize the efficiency and reliability of the magnet



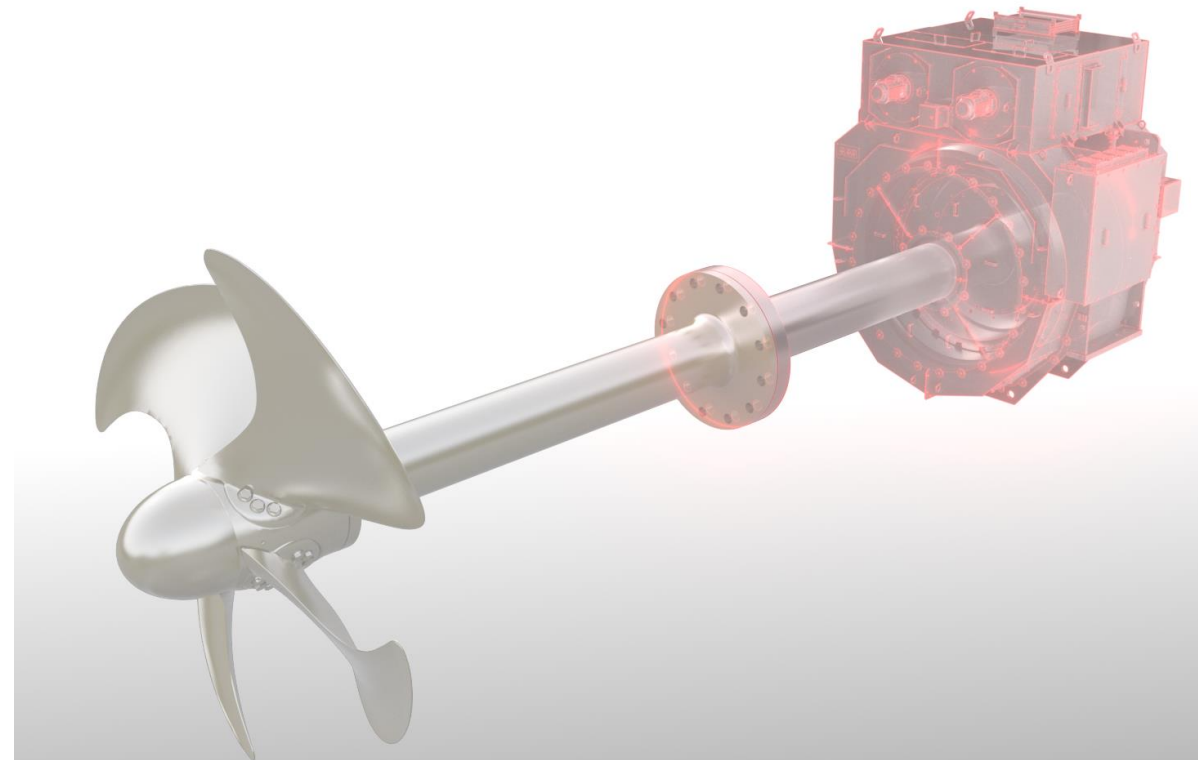
Extensive patents

Patented permanent magnet module and fixing method provides low magnet and rotor weight and enables the compact design



Short-circuit withstand

Magnet modules can withstand a direct short circuit at the rated temperature and maintains excellent reliability



Reduce emissions and save fuel costs at the same time

ABB Permanent Magnet Shaft Generators

ABB Permanent Magnet Shaft Generators' innovative design can **reduce emissions and cut fuel costs**



Utilizing the efficient main engine

Shaft generator reduces the vessel's overall fuel consumption and enables an effective use of the main engine's power reserve



Partial load efficiency

Designed for negligible magnetization losses, the efficiency remains high even when running at low speeds and partial load



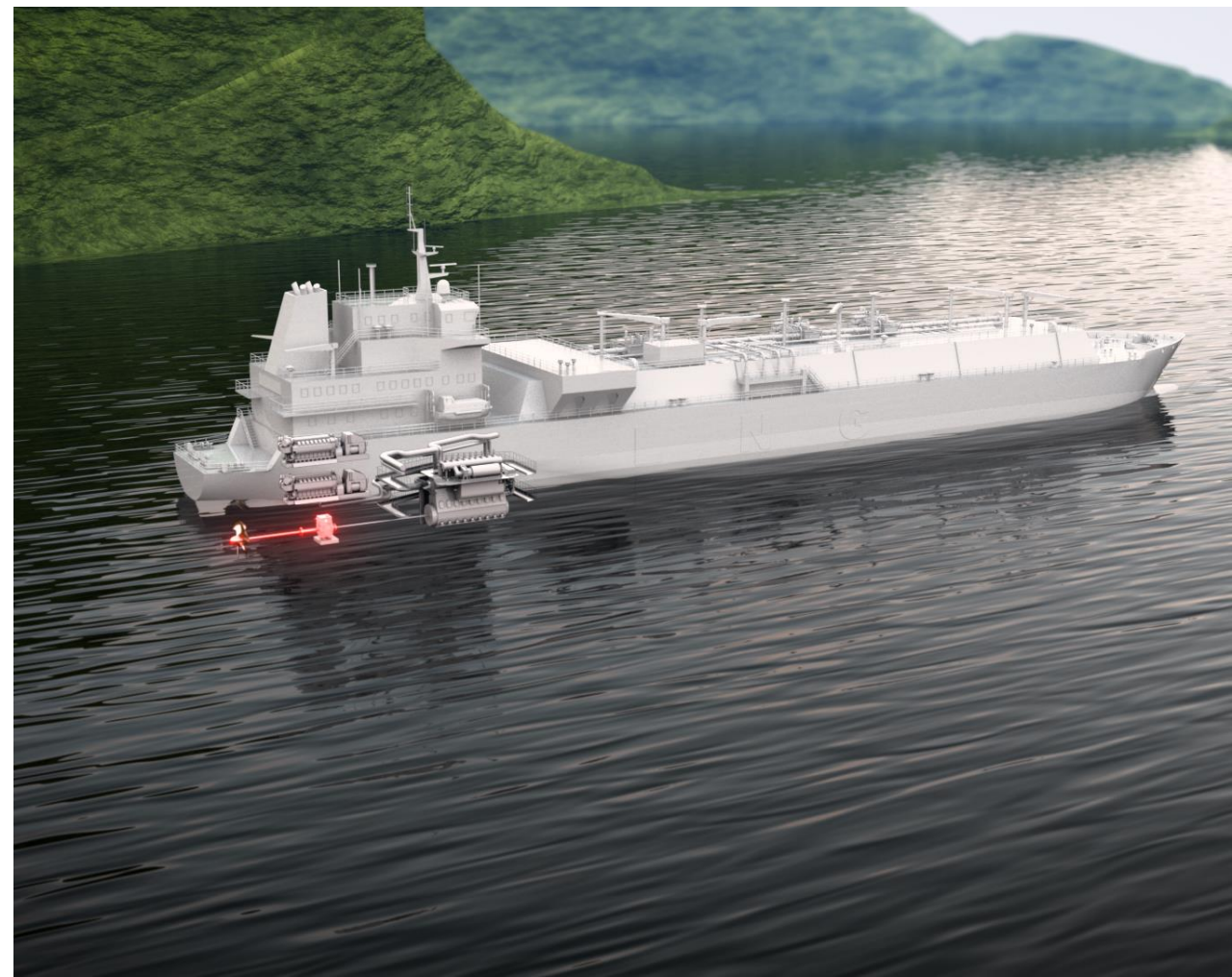
Save costs with less need for aux generators

Saving on CAPEX (capital expenditure) and OPEX (operating expenditure) with less auxiliary need of generators



Downsizing the main engine

Enables a smaller-sized main engine as the Power Take In capability provides additional power to the propellers



Compact, light and easy to install

ABB Permanent Magnet Shaft Generators

ABB Permanent Magnet Shaft Generators **reduces the installation footprint** of a generator by around 20%



Up to 30% lighter

Thanks to their high efficiency, ABB PM shaft generators have up to 30% lighter weight and 20% smaller size than equivalent generators



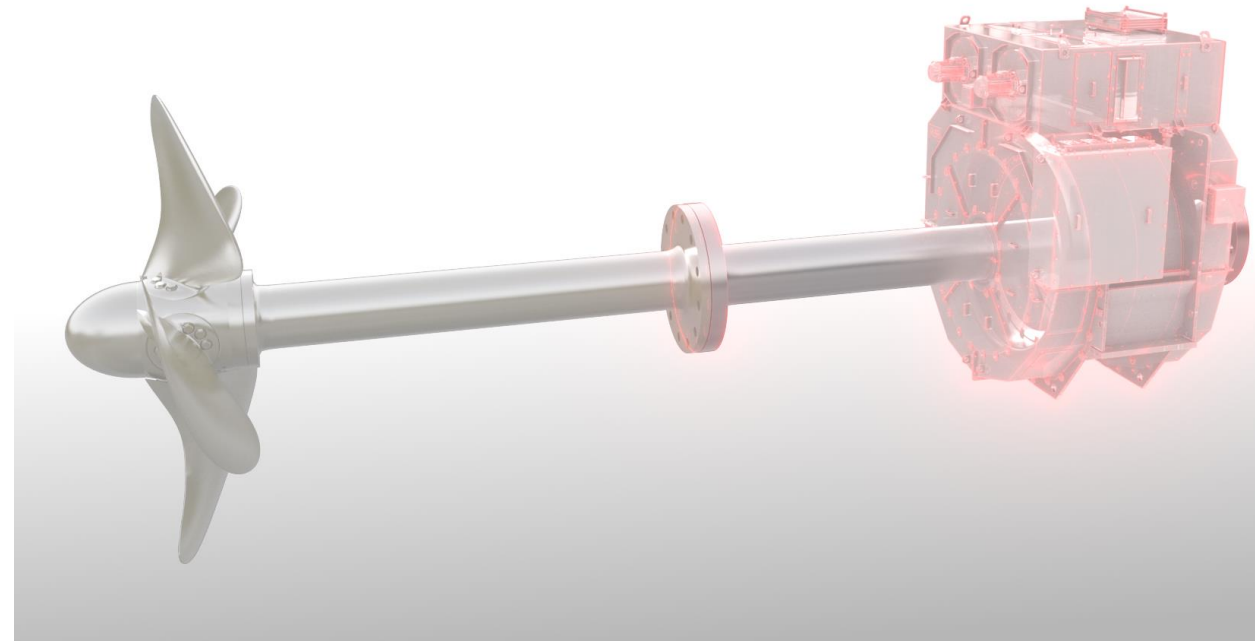
Short delivery lead times

30 - 50% shorter delivery lead times with the standardized product platforms compared to conventional engineered solutions



Easy installation procedure

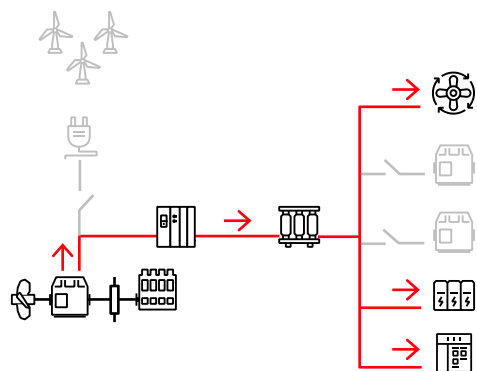
The innovative five-step assembly and installation procedure needs no special tools.



Operational flexibility, redundancy and safety

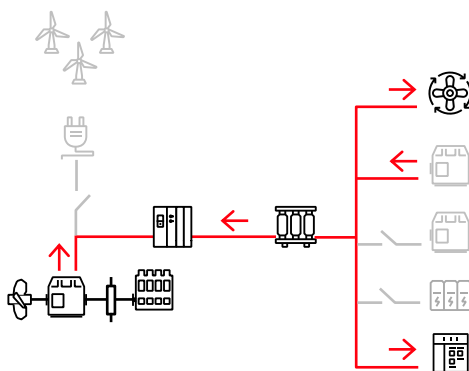
ABB Permanent Magnet Shaft Generators

ABB Permanent Magnet In-line Shaft Generators support your future-proof vessels for **new energy sources and propulsion systems**



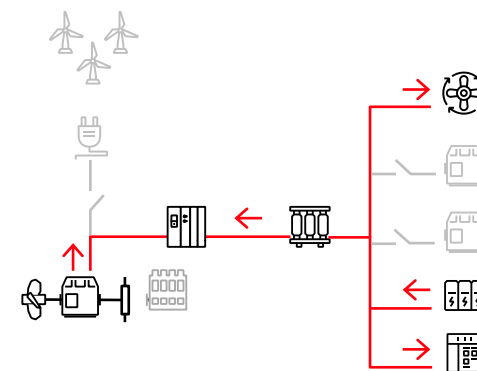
Power Take Off (PTO)

Supply the main power for the vessel's electrical network, optimizing the use of the large engine, while reducing the need to run auxiliary generators. Saving on fuel costs and lowering emissions



Power Take In (PTI)

The shaft generator acts as a motor, delivering a power boost to the main propulsion shaft to cover peak power or 'worst-case scenario' needs



Power Take Home (PTH)

For emergency or short-term use, PTH mode provides redundancy and safety for an unexpected situation

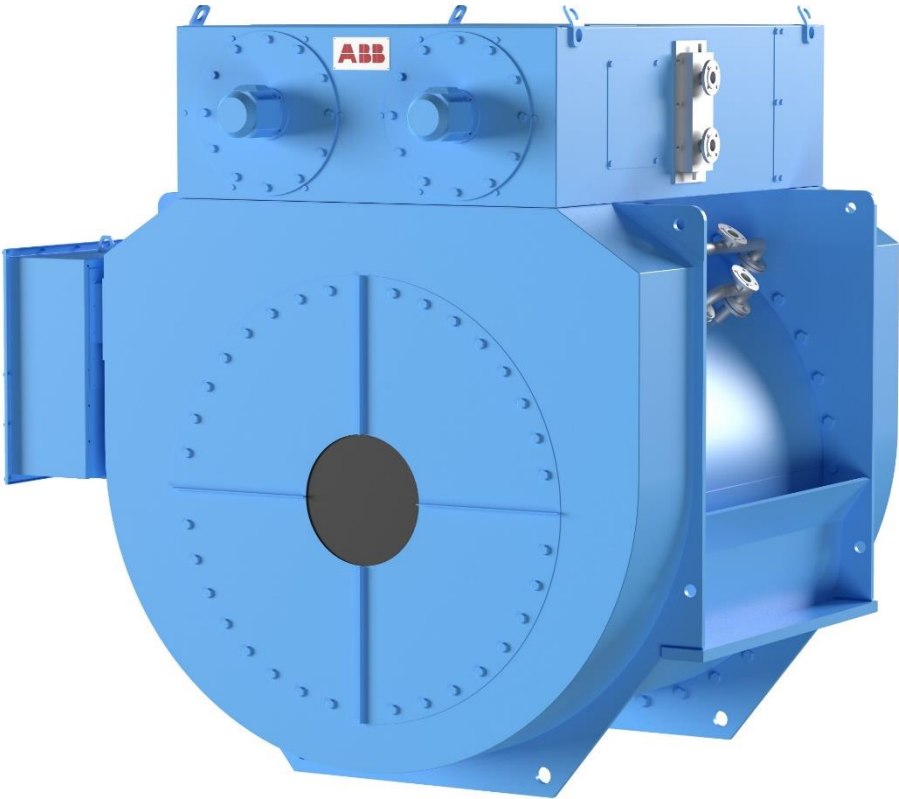


Product overview

ABB Permanent Magnet Shaft Generators

Variable speed shaft generator, AMZ

	Direct drive, slow speed
Typical power range	From 1 to 3.6 MW, up to 4 MW ¹
Torque range	up to 600 kNm
Typical speed range	Base speed 30 ... 80 rpm, up to 150 rpm
Voltage levels	Low or medium voltage
Type	Permanent magnet (PM)
Frame size	1400
Cooling	Water jacket and heat exchanger



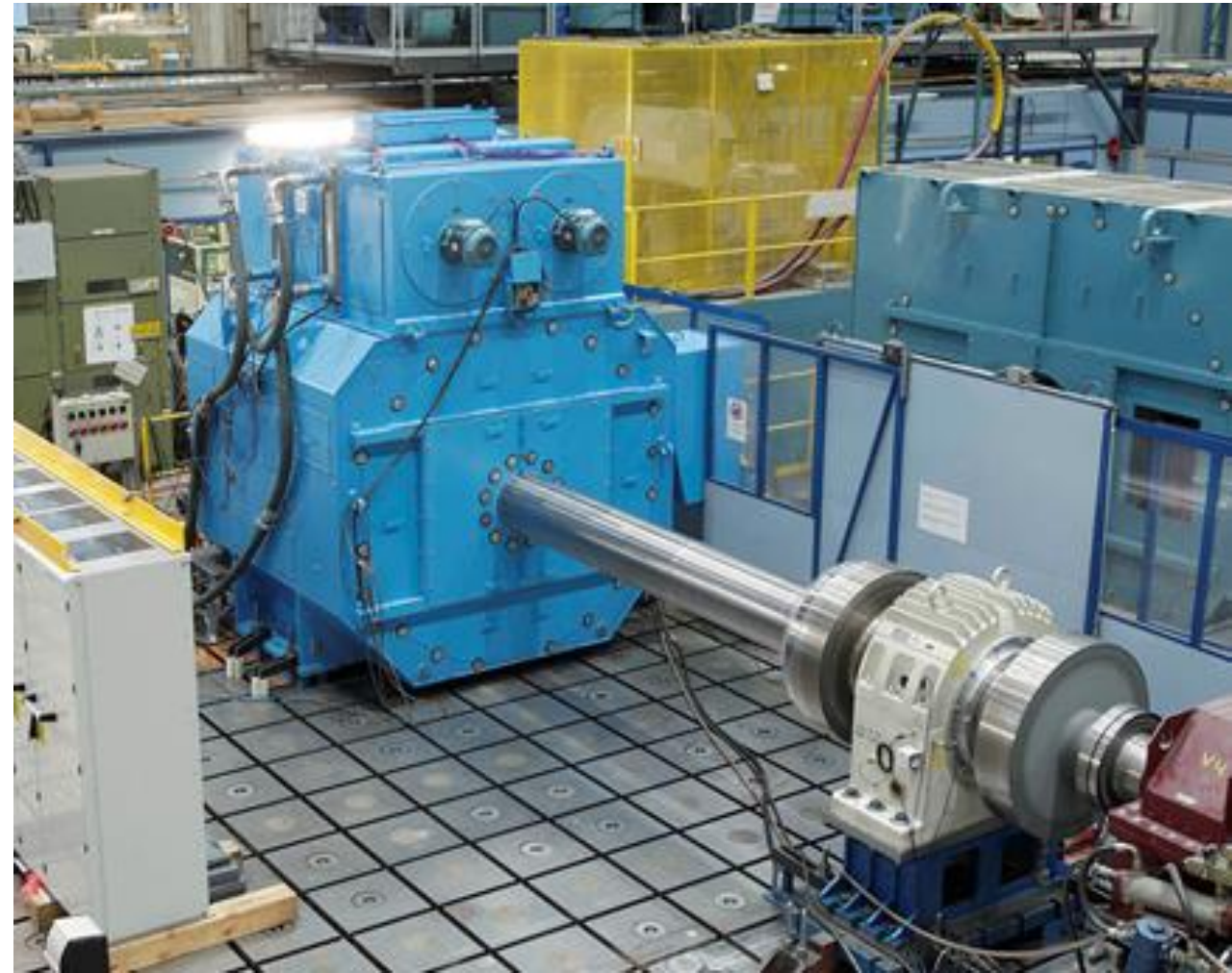
A fully optimized operation

ABB Permanent Magnet Shaft Generators and Drives package solution



ACS880

- **Rated power:** 1.5 to 6000 kW (cabinet drives), 1.5 to 3200 kW; parallel mounting up to 6000 kW (modules)
- **Voltage:** from 380 to 690 V
- **Enclosure:** IP22, IP42, IP54 (cabinet drives), IP00 (modules)
- **Robust design** fit to Marine environment
- **Versatile** with full functional **safety**
- Cabinets can be engineered to meet customer needs
- **High efficiency** and high-power quality



Variable speed operation boosts efficiency

ABB Permanent Magnet Generators and VSD

ABB Permanent Magnet Shaft Generators with VSD can **boost the energy efficiency** for vessels



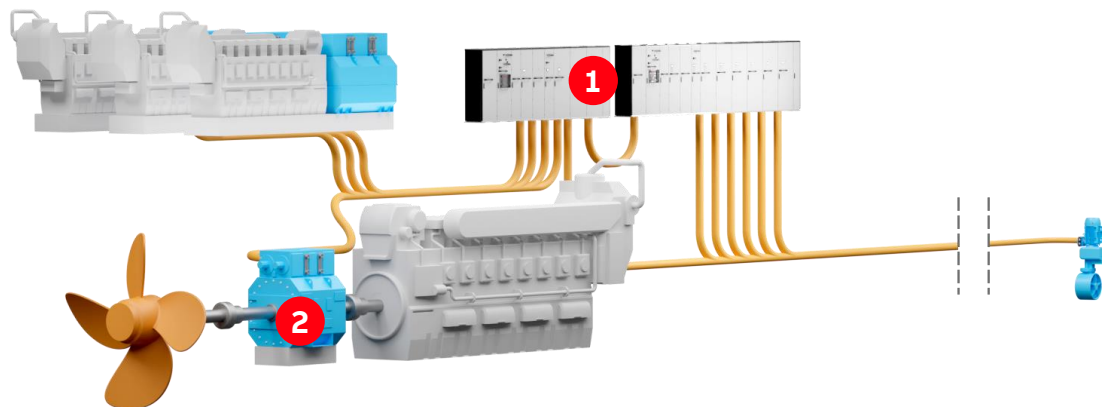
Up to 30% lighter

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Short delivery lead times

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1 Variable Speed Drives (VSD)

2 Permanent Magnet Shaft Generator

Global scale and coverage



Over **1,200** field service engineers



Services in more than **70** countries



130 years of manufacturing and servicing motors and generators



600 service partners



50 service workshops

40 years of manufacturing and servicing drives

We are a global player –
always close to our customers
and partners

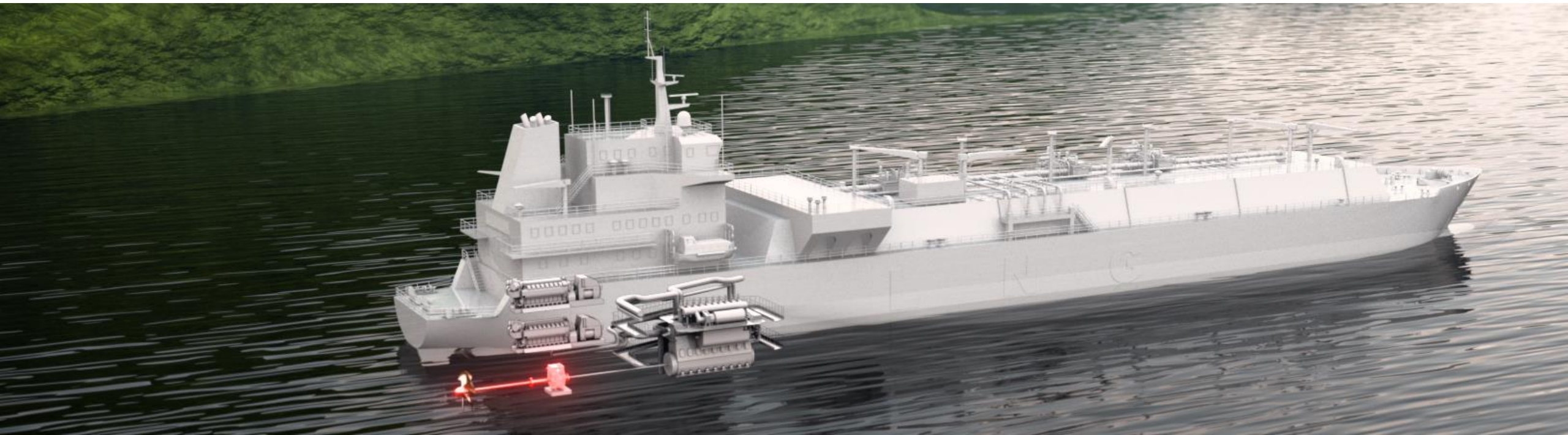


Towards an energy efficient future for shipping

High efficiency permanent magnet shaft generator technology



<https://new.abb.com/motors-generators>



ABB