



Advanced Permanent Magnet Machine (APMM) for SeaGreen^{*} Marine PTO / PTI Applications

As liquid natural gas (LNG) carriers look to gain fuel efficiency and flexibility, GE Power Conversion's innovative SeaGreen Power Take Off (PTO)/Power Take In (PTI) hybrid-electric ship technology helps to increase reliability, efficiency and reduce operating costs, fuel consumption and greenhouse gas emissions. By combining GE's PTO/PTI technology with the Advanced Permanent Magnet Machine (APMM) shaft generator, ship owners can benefit from the latest in compact, reliable electrification technology to help meet environmental regulations across their fleets and meet environmental standards.

Benefits to shipowners:

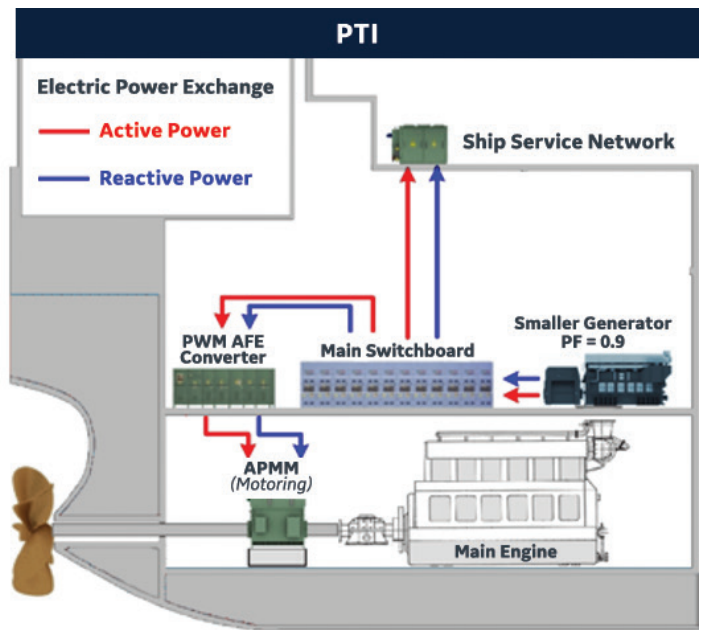
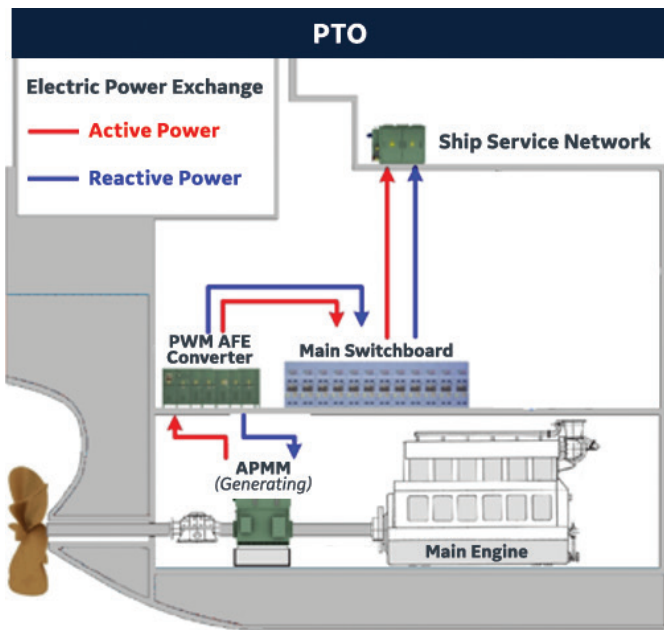
- Increased fuel efficiency
- Reduced emissions to help meet environmental regulations and stakeholder expectations
- Unrestricted operation in main engine operating speed range
- Reduced maintenance costs vs. diesel / four-stroke genset
- Decreased noise levels associated with onboard power generation from auxiliary engines
- Increased reliability helping propulsion engine to operate efficiently
- PTI ready



Building a world that works

gepowerconversion.com

GE's **SeaGreen** PTO/PTI shaft generator-motor system features the following operating modes:



Power Take Off

APMM works as a generator (electric power generation mode)

This operational mode focuses on energy-efficient electric power production. In PTO mode, the main engine serves as the power plant for the entire ship. The APMM works as a generator and provides power to the ship's main network. Depending on the electrical load, during PTO operation GE's SeaGreen can therefore reduce or even eliminate the running hours of separate auxiliary generators, and improve energy and fuel efficiency.

Power Take In

APMM works as a motor (booster mode)

PTI is an economical solution to provide the main engine with temporary extra power. This additional electric power is provided by the APMM running in electric motor mode, reducing fuel consumption, or increasing the speed of the vessel. The PTI system helps to enable main engine optimization and can provide extra torque on the shaft for icebreaking vessels.

Power Take Home

APMM works as a secondary propulsion system (emergency mode)

The APMM also can be used in Power Take Home (PTH) mode as a second propulsion system, independent from the main engine, when the main engine is switched off. This propulsion operation enables ships to safely leave or return to port with lower emissions that are compliant with harbor regulations.

Advanced Permanent Magnet Machine

The APMM can offer enhanced efficiency, in conjunction with improved power density, compared to more conventional machine topologies. This means higher efficiency for less volume for a given power.

Better Power Density

The coolant's thermal capacity and its close proximity to the heat source combine to create a highly efficient cooling system that delivers enhanced heat extraction for operations at high current levels and reduced volume.

Greater Availability

Simplified rotor construction reduces system complexity, resulting in lower maintenance needs.

Greater Resilience

Robust rotor construction uses embedded magnet topology.

Improved Reliability

Fewer components are needed on the machine and on the system. For instance, no separate excitation system is needed.

* Trademark of General Electric Company.