

Permanent Magnet Propulsion

Integrated permanent magnet motor technology for CPP applications

MORE EFFICIENT

SAVES FUEL

REDUCES EMISSIONS



**“ FUEL SAVINGS AND
REDUCED EMISSIONS
TO AIR ”**

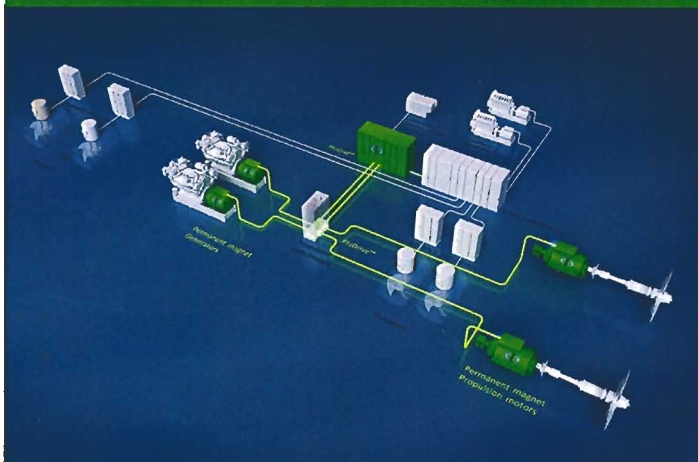
OVERVIEW

The key features of permanent magnet technology are efficiency and power density. By utilizing these advantages we gain reduced loss and increased simplicity in the propulsion system. In comparison with conventional diesel-electric propulsion systems, the permanent magnet propulsion system can reduce the fuel consumption substantially depending on vessel type and power configuration.

Scana offers a range of propulsion configurations with Permanent Magnet technology.

The combination of a CP propeller, permanent magnet motor, PhiDrive™ and a variable speed diesel engine offers a compact propulsion system with high efficiency and reduced emissions.

Complex configurations available with Permanent Magnet Propulsion



Permanent Magnet Motors

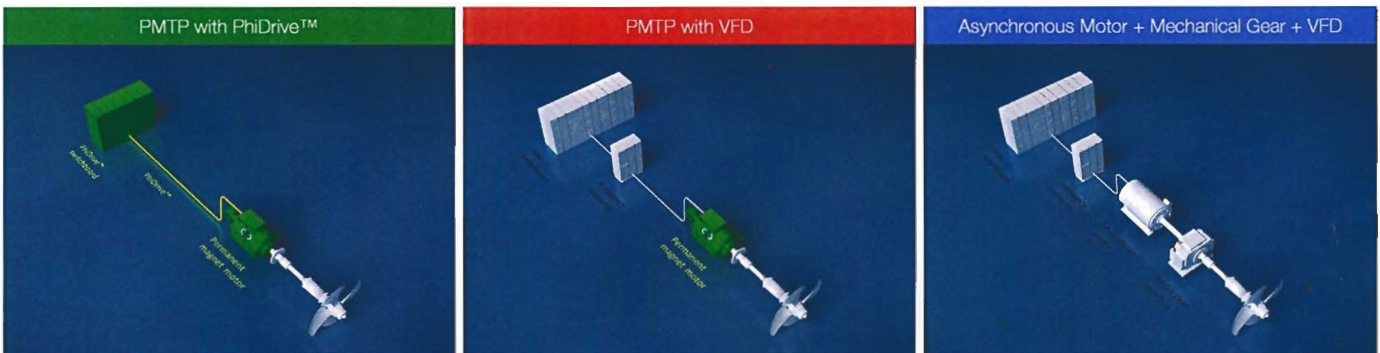
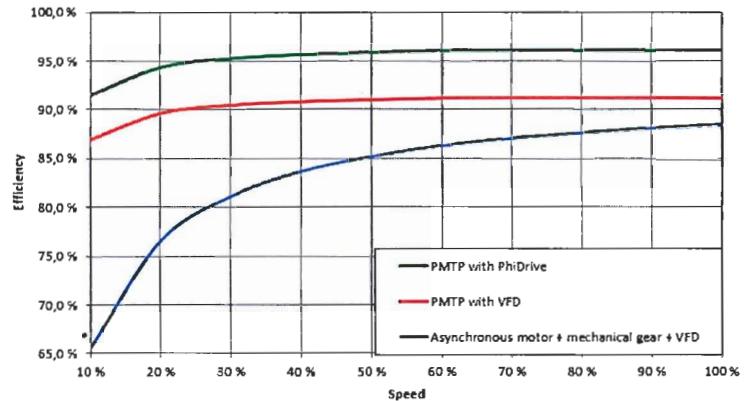
Primary benefits of permanent magnet technology

Permanent magnet technology is a well-proven and highly reliable technology widely used in industry automation processes, aerospace, hybrid vehicles, and offshore turbines.

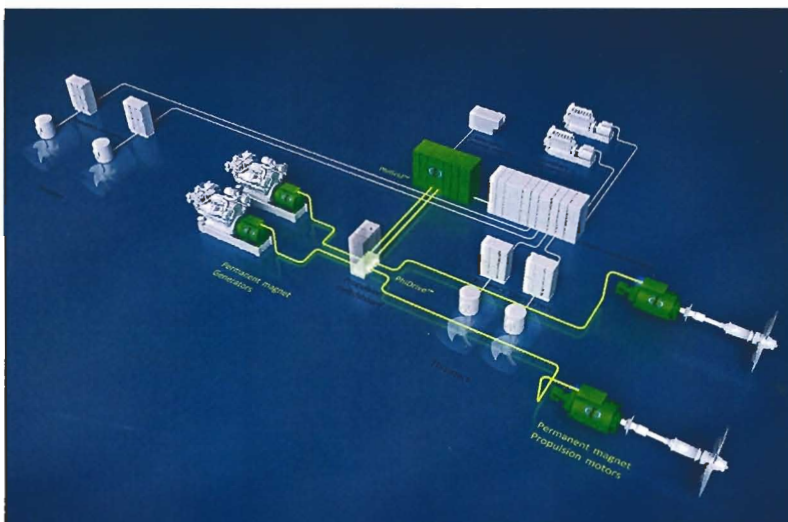
Major features of the permanent magnet motor (PM motor) is the efficiency, unique power density, and its simple construction.

The PM motor has an overall better efficiency curve than a system with an asynchronous electrical motor. In low power modes PM motor can be up to 50% more efficient than asynchronous motors.

PM SOLUTION EFFICIENCY VS MECHANICAL SOLUTION



PERMANENT MAGNET PROPULSION CONFIGURATIONS



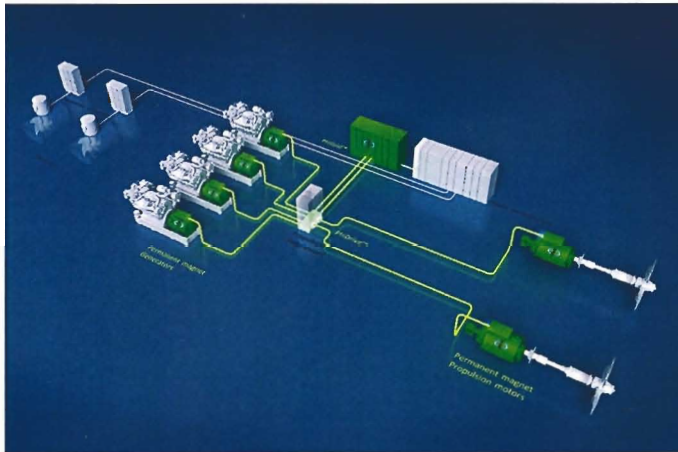
The basic configuration is an electrically operated controllable pitch (CP) propulsion system without a reduction gear.

This configuration offers the following benefits:

- A lighter and more compact propulsion system without the transmission losses caused by a reduction gear
- Built-in pitch and thrust mechanism for CPP applications
- High-power density
- Substantial increase in overall system efficiency

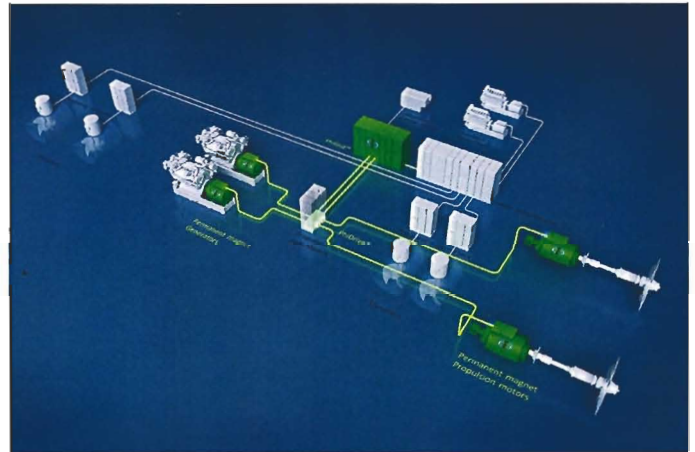
The PhiDrive™ philosophy is based on the direct coupling of a permanent magnet motor and a permanent magnet generator through an electric shaft without a reduction gear or frequency converter.

This is the most efficient method to transmit electrical power.



The PhiDrive™ configuration is basically a PM generator directly coupled to a PM motor running the CP propeller. The PM motor will follow the RPM of the generator with a ratio corresponding to the difference in the number of poles within the PM machines.

The PhiGrid™ configuration can be referred to as a PTO/PTI possibility for the PhiDrive™ system, where the PhiGrid™ distributes power to the main switchboard for other consumers of the ship.



In configurations with a high number of consumers other than main propulsion, the highest efficiency is obtained by splitting the auxiliaries between the PhiDrive™/PhiGrid™ and the main switchboard.

**DIRECTLY CONNECTED PM MOTORS + VARIABLE RPM DIESEL ENGINES =
SAVE FUEL + REDUCE NO_x EMISSIONS + SAVE LIFE CYCLE COSTS**

AN ENVIRONMENTALLY FRIENDLY AND COST-SAVING SYSTEM

By combining PhiDrive™ and a diesel engine running at a variable speed, the efficiency of the system can be further enhanced. A diesel engine running at a variable speed will, due to its flexibility in operation, save a substantial amount of fuel compared to an engine running at a constant speed.

The variable speed diesel engine will also be able to reach a higher exhaust temperature, providing significant reductions in NO_x emissions. This results in a solution which saves both the environment and fuel costs. In addition, the life cycle cost of a variable speed engine is notably lower than an engine with a fixed rpm.

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