



ESCO POWER

guides you into the Hybrid Era!



Parallel Hybrid Solutions

Esco Power's Parallel Hybrid Solution gives your driveline
the exceptional advantages of both power sources:
Diesel and Electric

Parallel Hybrid Transmission - PHT

There are various reasons to look for an alternative to the conventional Diesel driveline and some may include:

- lowering fuel consumption
- meeting stricter pollution or noise regulations
- extending Diesel engine service life
- increasing efficiency of the entire drive line

No matter the reasons,

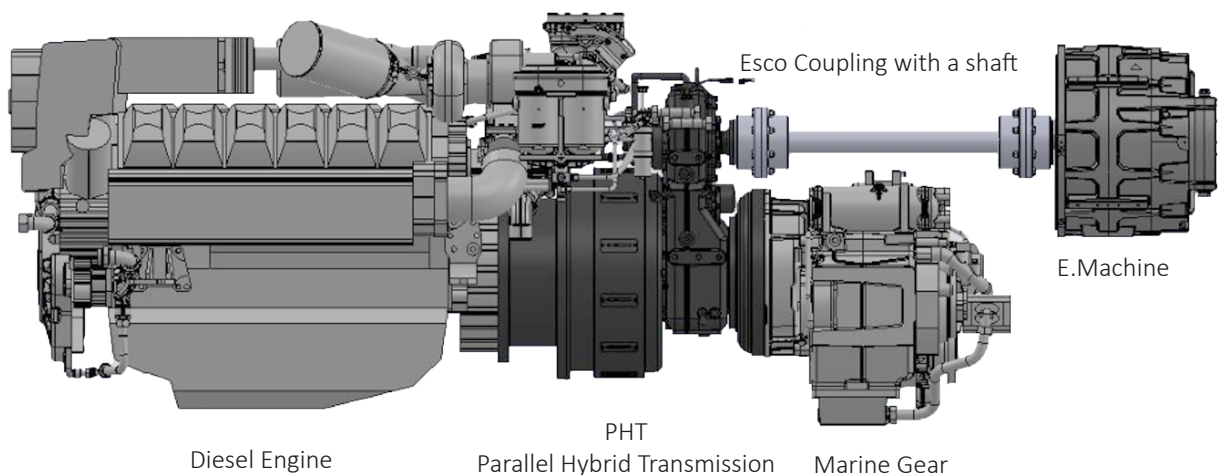
ESCO POWER has a Parallel Hybrid Solution for you!

ESCO POWER offers:

- A unique Parallel Hybrid Transmission PHT, ideal for a refit and a new build of hybrid installations
- A complete Hybrid Electric System Package HESP, with fantastic features such as Automatic Mode is standard
- Properly sized and perfectly matched to both PHT and HESP, LiFePO4 safe battery system
- A perfect cooperation with the local integrators and shipyards, often supported by enthusiastic local partners
- Technical Support at every stage of the project: selection and recommendation of the individual components, overseeing installation and commissioning. Preparation of project specific documents: specifications, single line diagrams, installation overview diagrams, cables overview, installation plans, installation and maintenance manuals.
- Commissioning of the hybrid installation to make your hybrid project a great success

Our challenge is to meet all your needs by offering you the best parallel hybrid solution, so you never want anything else!

Example of Hybrid Installation with Esco Power Parallel Hybrid Transmission



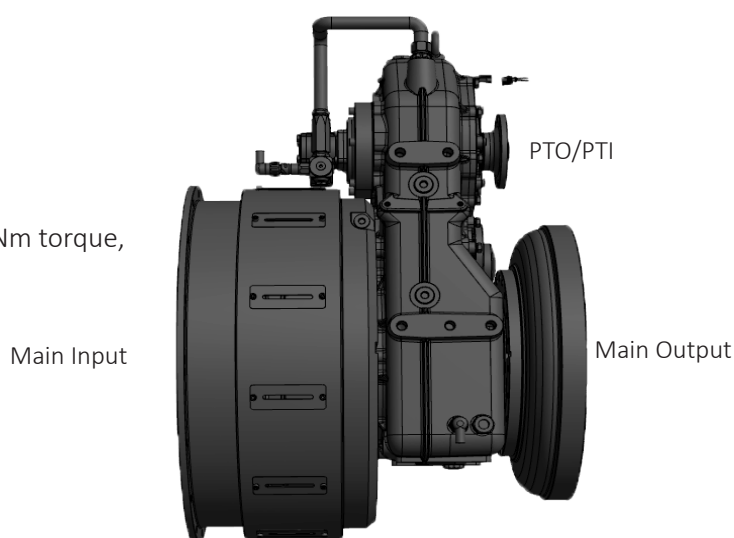
Parallel Hybrid Transmission - PHT

The heart of the Parallel Hybrid Solution is its Parallel Hybrid Transmission. The PHT unit is designed to allow any vessel or any industrial machine to run on two power sources connected in parallel.

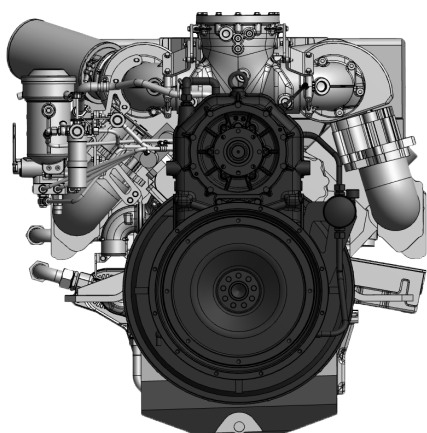
The PHT can be easily installed between the diesel engine and the marine (or industrial) gearbox, via SAE connections, or as a free-standing unit to be connected to the diesel engine through a high elastic coupling.

The PHT has a built-in, robust electromagnetic clutch for disconnecting the diesel engine from the main driveline.

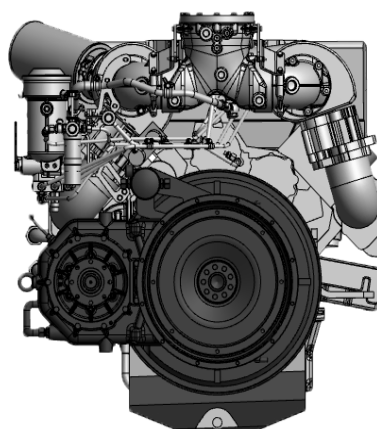
The PHT standard models suit engines up to 7000 Nm torque, about 147kW/200HP- 1655kW/2250HP.



The PHT unit can be installed vertically, horizontally or angularly.



Example of Vertical installation



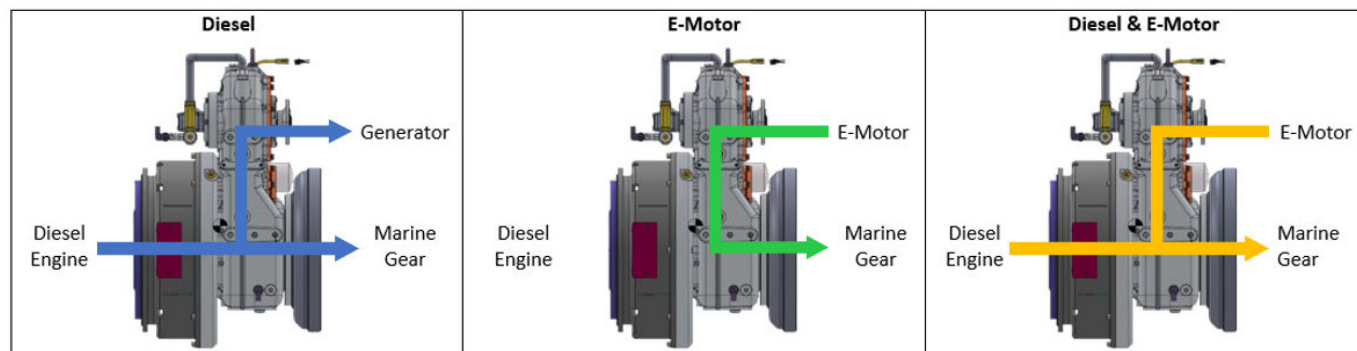
Example of Horizontal installation

Lloyd's Register and Bureau Veritas (BV) type approvals available.

Parallel Hybrid Transmission - PHT

PHT Working Principle

The PHT unit is designed to connect two power sources: Diesel engine and E-motor into one parallel hybrid drive line. The PHT Electro-magnetic clutch works independently from any other part of the transmission, allowing for engagement and disengagement of the diesel engine from the main driveline.



When PHT clutch is coupled, the power of the diesel engine will be transmitted directly to the marine gear and the driveline will operate as in a conventional diesel installation.

The electric machine (motor/generator) is connected to the secondary input/output of the PHT, located above the main output, by a use of a flexible or elastic coupling.

The PTO/PTI output benefits from the integrated ratio (1.27–1.47–1.70) making all E-power provided by the electric motor more effective than any other solution available, which is not obtainable for a similar parallel solution without implemented ratio.

When the electric machine operates as a generator, the speed of the diesel engine at the PTO output is increased by selected ratio. The higher speed at the PTO allows to choose a smaller in size electric machine. When the electric machine operates in function of E-motor, the speed of the electric motor is reduced at the main output shaft by the chosen ratio.

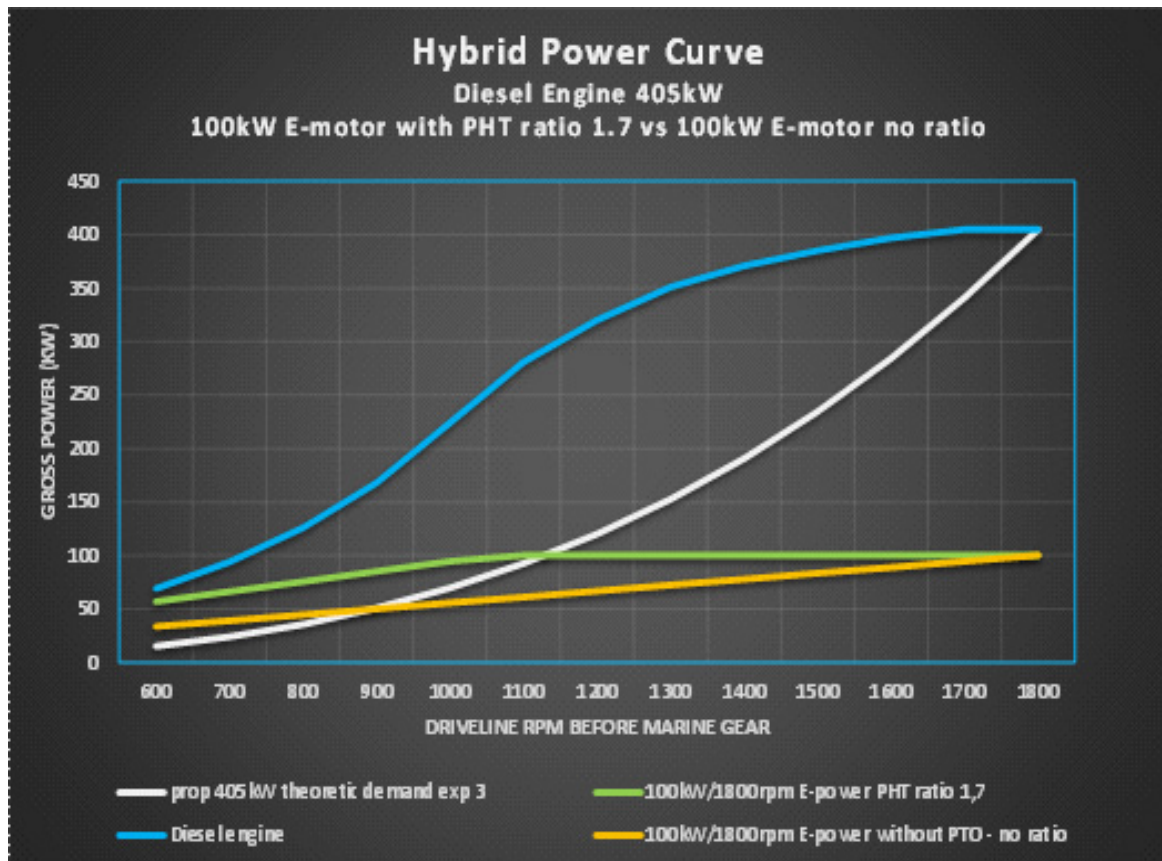
Standard PHT Models

	PHT 300A	PHT 420A	PHT 700A	PHT 700B	PHT 900A
Electromagnetic clutch	24 VDC	24 VDC	24 VDC	24 VDC	110VDC
Max main input torque	1500 Nm	2100 Nm	3100 Nm	5200 Nm	7000 Nm
Max PTO/PTI torque	1500 Nm				
Ratio to PTO/PTI	1.27- 1.47- 1.70				
Main Input	SAE 2 & 11.5" SAE 3 & 11.5" SAE 4 & 10" High Elastic 11.5"	SAE 1 & 14"	SAE 1 & 14" High Elastic 14"	SAE 1 & 14" SAE 0 & 18" High Elastic 14" High Elastic 18"	SAE 1 & 14" SAE 0 & 18" SAE 00 & 21"
Main Output	SAE 3 & 11.5" SAE 1 & 14" Flange	SAE 3 & 11.5" SAE 1 & 14" Flange	SAE 1 & 14" Flange	SAE 1 & 14" FW 18" Flange	SAE 1 & 14" FW 18" Flange

PHT Ratio Advantage

The PHT PTO/PTI output benefits from the integrated ratio (1.27–1.47–1,70) making all E-power provided by the electric motor more effective than any other solution available. There is no other Parallel Hybrid Solution offering a ratio than Esco Power Parallel Hybrid Transission.

The PHT ratio makes the installed E-power completely available for the propulsion !



The above graph shows the availability of E-power for propulsion in two situations:

Hybrid Propulsion (Yellow Line): 405kW Diesel engine & 100kW E-motor with NO ratio advantage

Hybrid Propulsion (Green Line): 405kW Diesel engine & 100kW E-motor with the PHT ratio 1.70

In the situation when there is no ratio installed, the vessel can be propelled by E-motor only up to the speed of 900 rpm (before marine gear). At this max speed of 900 rpms the E-motor will provide only half of its nominal power, which will be 50kW in this example.

In the situation where the PHT is installed ratio 1.7, the same vessel can be propelled by E-motor up to the speed of 1130 rpm (before marine gear) and therefore can use all of the full nominal power of 100kW of the installed E-motor for a propulsion.

In addition, thanks to utilizing ratio, the E-machine benefits from a large safety margin making the electric propulsion a very reliable solution.

Hybrid Electric Solution Package - HESP

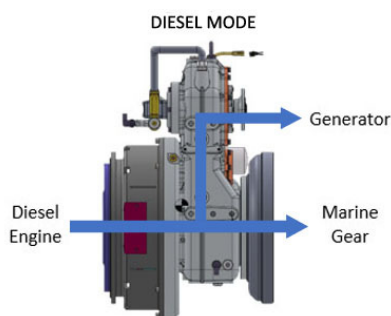
Hybrid Electric Solution Package HESP

In addition to the Parallel Hybrid Transmissions, ESCO POWER has developed a complete Hybrid Electric Solution Package HESP consisting of efficient electric motors, electronic control and command system, control levers, screens, and software to benefit from various operation propulsion modes: Diesel- Electric- Automatic and additional working modes as: generator- back up- cross-feed.

The HESP hardware comprises efficient electric motors, frequency inverters, control levers, screens and electronic control and command system.

All the HESP control features are displayed and can be operated via the touch screen.

HESP Propulsion Modes

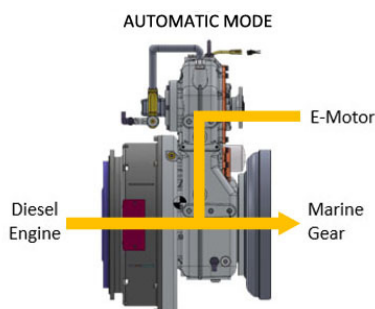
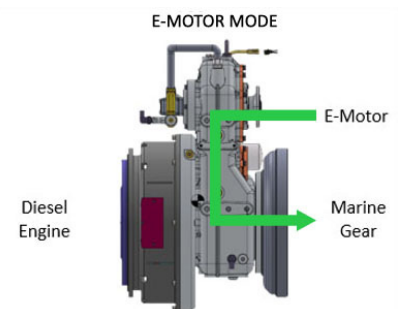


Diesel Mode

When the diesel engine is running, the clutch is engaged and drives directly the marine gear. Thanks to the PHT, the diesel engine can also power the generator. The electrical generator can generate or not, if not the axis will spin idle inside the generator. Due to the ratio (1.27, 1.47 or 1.7) inside the PHT, we increase the rpm of the diesel engine at the PTO/PTI which allows us to reduce the electrical motor size

E-Motor Mode

The PHT in electrical mode disconnects the diesel engine by disengaging the clutch, thus the diesel engine can be shut down or idling. The electric motor drives the marine gear or transmission directly through the PHT gears with a ratio (1.27, 1.47 or 1.7) which decreases the electric motor rpm and increases the torque. The electric motor takes his power from a generator set or from on-board batteries.



Automatic Mode

Starting in electric mode, with similar procedures, but lever position 0% ->40% for electric operation. (40% = max prop speed for electric power), automatically switching to diesel operation, after checking diesel needs and synchronising engine with E-motor, and with similar procedures as diesel mode with lever position 40%->100% for diesel operation.

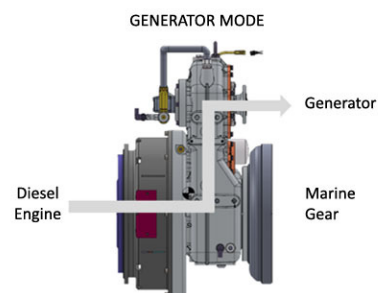


HESP Additional Working Modes

Generator Mode

When diesel engine is in operation, with the PHT clutched, generator can be activated. The mode can be used whenever in Diesel operation, even with the vessel at quay, anchored or loitering. In order to use the generator mode with the vessel parked, the marine gear needs to be overridden with a use of the power commander.

It will be possible to program specific automatic generating modes following the operator's requirements.

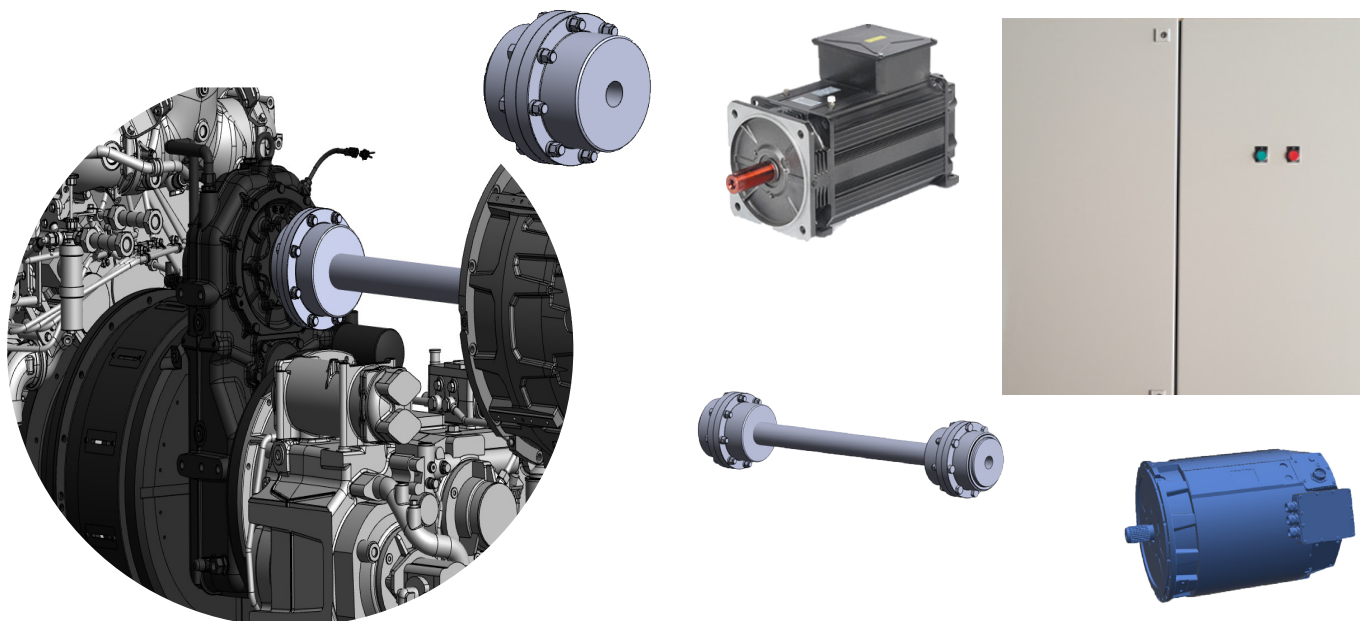
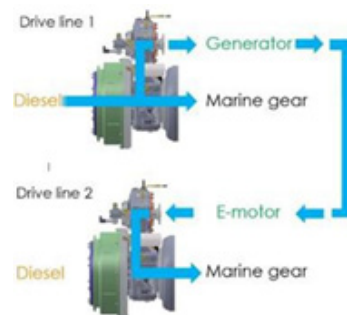


Back-Up Mode

In an emergency situation with hybrid propulsion not working, a secured Back-Up mode is available with a selection button in the control panel. The vessel will switch to standard diesel engine driven propulsion, with clutched PHT. Lever position 0% -> 100% for diesel operation (100% = full diesel engine power/diesel engine speed). No hybrid functions, as generator, available in this mode, as PLC & hybrid software are bypassed.

Single/Cross-Feed Mode

In a twin-engine installation, standard operations of both drivelines will be synchronized (=similar mode for both lines). Thru touch screens, split operations can be activated: running with one engine 'single' or in cross feed operation 'cross'. In cross feed mode the PHT will transfer energy from one driveline to another using one electromotor as a generator and another as a motor. This energy is passed from generator to motor over the frequency inverters and a battery management system.



ESCO POWER, part of the Belgian ESCO Group, Belgium based manufacturer of Parallel Hybrid Transmissions (PHT) and Hybrid Electric Solution Packages (HESP) designed for both marine and industrial heavy-duty use in applications where combining two sources of power, diesel and electric, in one drive system is beneficial.

After over 70 years experience in manufacturing of high torque couplings, distribution, and sales of marine and industrial drive components, ESCO POWER designed and implemented an innovative, unique solution where the emerging hybrid market will definitely benefit from:

Parallel Hybrid Solution!



Pictures Courtesy of GreenLine Yachts

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