
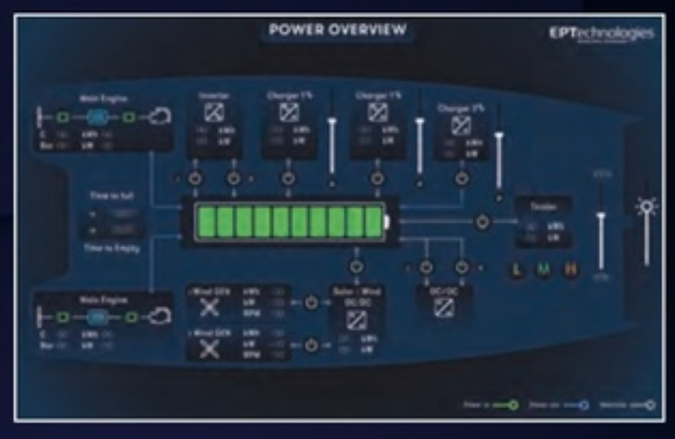





Electric outboard motor technology can optimize onboard propulsion and system design

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# Outboards and hybrid solutions

Danish propulsion specialist EPTechnologies is working on a range of high-power outboards from 70-300bhp. The 180bhp outboard is scheduled for release in Q2 2021, with the 300bhp expected in Q4 2021. These will be an addition to EPTechnologies' existing Z-Jet and shaft-drive drop-in units.

The units include all integrated systems. Users need only connect the battery cables, seawater inlet and outlet, signal cable and human-machine interface (HMI) to complete the setup, ensuring simple installation.

The outboard engines are designed to combine well with EPTechnologies' new super-light marine batteries, which currently achieve 5.2kg per kWh. The company has targeted 4.3kg per kWh by Q2 2022. The batteries come with IP67 rating, they are modular and feature 1.5C continuous discharge. For high-temperature regions such as the Middle East, the batteries can use optional modular water-cooling plates and an associated cooling system.

EPTechnologies understands the importance of lightweight systems, which is why the company's experts developed their own battery. All components are carefully balanced for light weight and endurance, including the e-motor and controller.

1. EPTechnologies' electric outboards are designed to work well with super-light marine batteries. Inset images show example screens from the company's smart HMI, designed to simplify system operation

Table 1 shows a weight comparison of a thermal/ICE setup and an electric system aboard a standard 28ft day cruiser. The difference is limited, but EPTechnologies remains focused on further optimization.

The setup might not offer a particularly large range and, obviously, is also dependent on hull performance.

With EPTechnologies' larger battery banks, for this type of boat it is possible to achieve up to two hours at 20kts, 1.5 hours at 25kts and 12 hours at 6kts, depending on the platform.

## Hybrid systems for larger vessels

EPTechnologies has partnered with Piening Propeller and ZF for PTI/PTO gears. Together, these companies are progressively producing hybrid systems for medium and larger sailboats, powerboats and ferries, and vessels up to superyacht size.

A hybrid propulsion system consists of much more than just the drive components – it relies on harmony between all components to achieve quiet and ecologically sustainable operation.

The system consists of a drivetrain with e-motors, variable-speed and efficient DC generators, high-voltage DC bow thrusters, HV DC hotel inverters, multi-voltage/

Hz shore power chargers, HV and LV battery banks (including DC-DC converters), solar panels and wind generators. EPTechnologies can supply these systems for larger vessels or passenger ferries, including the needed DNV GL certification. In some vessels, it makes sense to have the IC engine and the e-motor in-line on the same shaft, or to have a serial hybrid setup. The best solution is always determined on a case-by-case basis.

EPTechnologies has developed a smart HMI with an emphasis on simple design and ease of operation. Much of the operation is automated, and the screen displays pop-ups if needed.

## DC versus conventional AC

Many conventional vessel systems rely on alternating current. This AC must be consumed and, more importantly, be produced instantly as it cannot be stored. This results in oversized onboard generators and shore-power connections, as these must be sized for the maximum peak power needed. As a result, complicated power management switchboards, to regulate peak power, need to be in place. Should the grid be overloaded, and if the PMS doesn't shed the load quickly enough, this can result in blackouts.

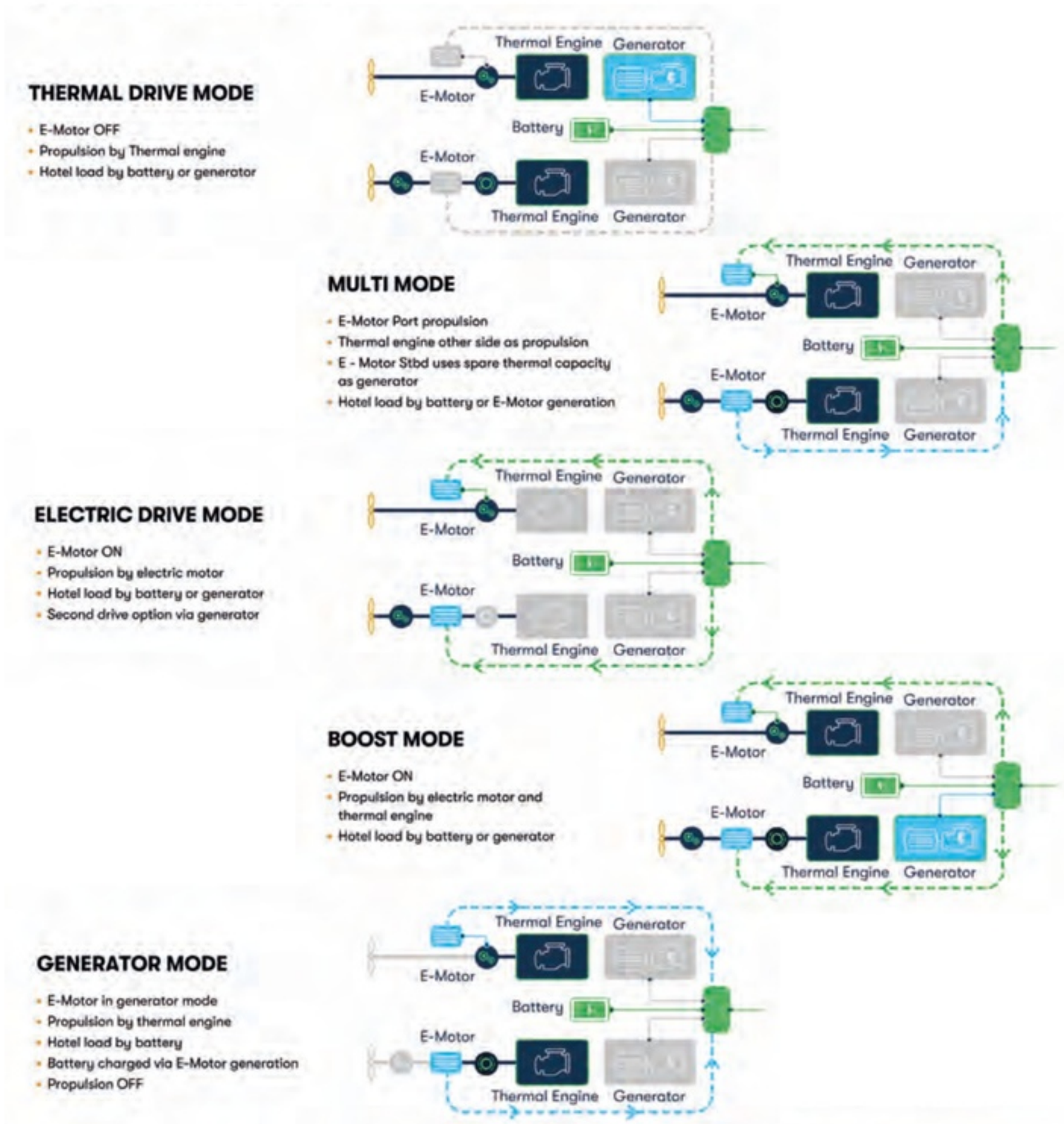
On a vessel where the big consumers (such as bow thrusters, hydraulic power packs and main engines) are supplied with direct current, this problem does not exist, as the batteries can easily compensate for any peak load.

EPTechnologies experts advise supplying the vessel's AC load mainly via inverters that are also fed from the HV DC link, which can virtually remove the issue. What now becomes key, however, is the energy management system (EMS). The batteries must simply be kept at a good charge level - much as is the case for a cell phone.

Customers should select the right available power source to charge the batteries, at intervals, or supply a basic float level of power via a variable DC generator. This approach has been used on board large vessels for many years now, and is proven. EPTechnologies is now bringing this practice to the small and medium ship market.

A selection of drive modes is available with ZF PTI/PTO gears. EPTechnologies has also developed a hybrid version for small gear options. With Piening Controllable Propeller (PCP) lines, the recuperation modes become even better while sailing. If recuperation is not needed, the PCP can be switched to feathering with the lowest resistance during sailing

These systems have an up-front cost, but are surprisingly cost-effective and offer customers fuel savings. Larger vessels have benefited from diesel and electric power for years, and now those advantages are being applied to medium and small vessels.

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2. A selection of drive modes are available to suit operation profile and type

| Outboard ICE | | Outboard electric | |
|---|---|---|---|
| Outboard 180bhp | **220kg** | Outboard electric | **120kg** |
| Empty fuel tank | **30kg** | Batteries 90kWh | **396kg** |
| Fuel | **150kg** | Charger | **12kg** |
| Accessories | **20kg** | Accessories | **10kg** |
| TOTAL | **420kg** | TOTAL | **538kg** |

Table 1: Comparison of a thermal and an electric setup on a standard 28ft day cruiser