Concept Note

Project Title: Marine EEV-OCE-OCC
Target Call: Clean Industrial Deal / Horizon Europe partner concept note
Lead Organisation: TPG Cleantech (Canada)

Project Summary

Marine EEV-OCE-OCC is a transition-oriented clean propulsion concept for maritime applications, with extension potential to heavy land mobility. The project combines three integrated elements: **EEV** (Engineered Energy Vehicle) dual-source energy architecture, **OCE** (Opposed Cylinder Engine) as a continuous-efficiency prime mover, and **OCC** (Oxidized Carbon Capture) as an onboard carbon-management pathway. The objective is to create a practical decarbonisation route that reduces propulsion oversizing, improves operational efficiency, and provides a controlled pathway for exhaust carbon handling during real-world marine duty cycles. The concept separates continuous base-load propulsion from transient peak demand through ECU-orchestrated dual-source operation, rather than forcing one oversized power source to cover all operating conditions.

Challenge

Marine decarbonisation remains constrained by three structural problems:

1. conventional propulsion systems are typically sized for peaks rather than sweet-spot operation;
2. full-zero-emission transitions are often blocked by infrastructure, cost, and operational risk;
3. carbon management is usually treated as an external afterthought rather than an integrated onboard system.

This creates a gap for an intermediate but scalable pathway: one that is more realistic than immediate fleet-wide full replacement, yet more ambitious than incremental efficiency upgrades.

Proposed Solution

The proposed architecture uses the **EEV dual-source principle**, in which a continuous-efficiency source provides the propulsive sweet spot while a secondary storage/electric pathway manages peak loads, maneuvering, harbor operation, and regenerative logic under ECU coordination. In the marine configuration, the concept combines OCE mechanical force output, a generator subsystem, a secondary electric propeller, and onboard control modes including mechanical cruise, hybrid assist, harbor mode, and

hotel-load support. This architecture is intended to reduce drivetrain oversizing and improve flexibility across variable duty cycles.

The **OCE** element introduces a mechanically simplified prime mover based on guided force conversion rather than conventional crankshaft-dominated architecture. Within the current concept package, OCE is positioned as the steady continuous-efficiency source suitable for generator modules, compact power units, and auxiliary marine propulsion.

The **OCC** element adds onboard carbon handling through two regulated pathways depending on platform type: cartridge-based solid carbonate logistics and seawater mixing pool residue handling for marine contexts. In the current doctrine diagram, exhaust can be directed either to CaO cartridge handling or to seawater mixing with bottom-residue handling under regulated treatment logic.

Innovation Value

The novelty of Marine EEV-OCE-OCC lies not in a single component alone, but in the **system-level integration** of propulsion sweet-spot operation, buffered peak support, and embedded carbon handling in one marine-ready framework. This makes the concept particularly relevant for vessels that need a pragmatic decarbonisation step without surrendering operational flexibility.

Key innovation dimensions include:

- dual-source propulsion logic instead of single-source oversizing;
- continuous-efficiency prime mover plus electric assist;
- integrated onboard carbon-management pathway;
- scalable application from marine to selected land-mobility sectors;
- compatibility with phased deployment and future cleaner fuels.

Proposed Consortium Roles

We are currently seeking EU partners for the following areas:

- thermo-fluid modelling and CFD;
- marine propulsion integration and control;
- OCC chemistry, residue handling, and environmental validation;
- ship systems engineering and demonstrator design;
- emissions assessment, LCA, techno-economics, and regulatory pathway;
- port, vessel, or industrial end-user demonstration environment.

Expected Outcome

The project aims to deliver a validated engineering pathway for a cleaner marine propulsion system that is more deployable than immediate full replacement and more integrated than conventional retrofit-only solutions. The expected outcome is a consortium-ready demonstrator concept with clear technical work packages covering modelling, subsystem validation, marine integration, carbon-handling logic, and commercialization pathway.

Partnership Invitation

We welcome discussions with research, engineering, shipbuilding, validation, and industrial partners interested in joining the consortium for proposal preparation and technical co-development.