# Ethanol as a Marine Fuel: Engines Are Ready

WHITE PAPER BY MARINE ETHANOL PLATFORM


## Summary

Ethanol is emerging as a viable, scalable, and immediately deployable marine fuel option. Recent developments across the maritime sector confirm that the use of ethanol in ship engines presents no fundamental technical barriers. Engine manufacturers have demonstrated that existing technologies—particularly those developed for methanol—can be applied to ethanol with minimal modification.

Extensive testing by leading engine developers shows that ethanol combustion characteristics are comparable to methanol, with stable operation across load ranges and no adverse technical effects. Critically, these results demonstrate that ethanol can be introduced into the marine fuel mix without requiring a new generation of engine technology.

The primary barriers to ethanol uptake in shipping are therefore not technical, but regulatory and market-based. As the International Maritime Organization (IMO) advances its decarbonisation framework, ethanol should be recognised as a ready and practical solution capable of contributing to near-term emissions reductions.


## Ethanol as a Marine Fuel

### A Scalable and Available Fuel Option

Ethanol is a widely produced liquid fuel with an established global supply chain. Its production spans multiple regions and feedstocks, with corn and sugarcane being dominant, while waste-based ethanol is also significant.

More than 100 million tonnes of ethanol are produced each year, and tens of millions of tonnes are transported by sea, making it the largest low-carbon fuel currently used in transport. This existing scale provides a strong foundation for maritime adoption.

The United States is the world's largest ethanol producer, followed by Brazil and Europe. Ethanol is available in all major port regions worldwide.

As a liquid fuel, ethanol is compatible with existing fuel logistics infrastructure, including storage, handling, and transport systems. This eliminates the need for entirely new supply chains and facilitates its integration into existing maritime fuel systems.

## Role in Maritime Decarbonisation

An IMO effort, such as the Net-Zero Framework, would require fuels that are affordable, widely available, scalable to large volumes, and capable of delivering substantial greenhouse gas reductions. For any non-fossil marine fuel to be viable, it must meet all four of these criteria.

Affordability is essential in a sector where margins are tight and fuel represents a significant share of operating costs. Availability requires not only sufficient production, but also the development of bunkering infrastructure across major global ports. Scalability means the ability to supply fuel in volumes of millions of tonnes annually. Finally, low carbon performance means significantly lower lifecycle emissions than fossil fuels. Most ethanol produced in the U.S., Brazil, the EU, Canada, and India achieves 50% or more GHG savings compared to bunker fuels (VLSFO, MGO), with some pathways exceeding 100%.

Ethanol meets each of these requirements. It is already produced at scale, supported by global supply chains, compatible with existing fuel logistics, and capable of delivering meaningful emissions reductions. Importantly, when accounting for both fuel costs and compliance with an IMO emerging decarbonisation framework, ethanol is among the lowest-cost low-carbon fuels available at scale in port regions worldwide. As such, ethanol stands out as a practical, cost-effective, and immediately deployable solution aligned with the IMO's decarbonisation objectives.

## Regulatory Status, Safety and Handling

Ethanol is already recognised within the IMO emerging framework, although not yet fully codified. The IMO issued interim guidelines for methyl/ethyl alcohol fuels in 2020, and a revision of these guidelines is currently underway. In parallel, ISO standardisation efforts aim to establish dedicated fuel specifications, including for ethanol.

Ethanol shares many physical and combustion characteristics with methanol, a fuel already being deployed in shipping, reinforcing its suitability as a marine fuel. Unlike methanol, ethanol is non-toxic and does not require additional safety measures beyond those applied to conventional marine fuels.

Crucially, handling ethanol does not require specialised crew training. Its safety and handling characteristics are similar to traditional bunker fuels.

## Engine Readiness: OEM Perspectives

### No Technical Barrier

Market interest in ethanol as a marine fuel has grown significantly over the past five years, with strong demand emerging from bulk carriers, tankers, and container vessels. OEMs highlight the strategic value of multi-fuel engines capable of operating on ethanol, methanol, and conventional fuels.

The most critical conclusion from recent industry developments is clear:

> **Ethanol can be used in existing marine engine platforms with minimal modification.**

This conclusion is supported by multiple OEMs and validated through full-scale engine testing.

### Real-Time Testing at Sea

Maersk has been actively testing ethanol as a marine fuel on its dual fuel vessel Laura Mærsk, progressively increasing blend levels to validate technical feasibility. The initial trial, conducted in late 2025, used a 10% ethanol blend (E10) and confirmed that ethanol can be safely integrated into marine fuel systems without impacting engine performance, efficiency, or safety. Building on these results, Maersk progressed to more ambitious tests, including a 50% ethanol blend (E50), to further assess performance at higher substitution rates. Results suggest that increasing ethanol content remains technically viable, reinforcing compatibility with methanol-based engine systems. The company has also indicated plans to move toward 100% ethanol operation, highlighting confidence that pure ethanol use is achievable with limited adaptation.

## Leading OEM Developments

The following sections draw on developments from the two leading marine engine designers, Everllence and WinGD, which together account for approximately 99% of engines installed on large ocean-going vessels.

## Everllence

In 2025, Everllence successfully operated the world's first ethanol-fuelled two-stroke engine using a commercial-scale ME-LGIM platform. The tests demonstrated:

- Stable operation across all load points
- No adverse combustion or technical effects
- No need for major hardware modifications
- Use of existing fuel injection systems

Notably, the tests required only minor adjustments (e.g. atomizer configuration and control parameters), with no fundamental engine redesign.

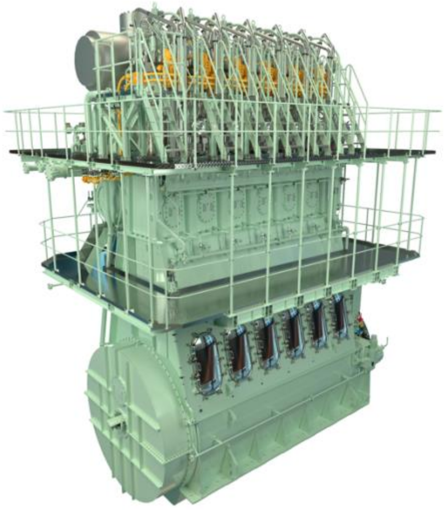
Key findings include:

- Ethanol burns as well as other alcohol fuels
- Existing ME-LGIM fuel systems can be used for ethanol injection

These results confirm that ethanol is not only technically feasible, but operationally robust.

Everllence is ready to support the application of ethanol as a marine fuel across its ME-LGIM engine portfolio, initially targeting G50ME-C10.7, G70ME-C10.7, G80ME-C10.5/7, and G95ME-C10.5/7 variants. Preliminary market introduction is expected by H1 2026, with further rollout dependent on demand.

In dual-fuel engines, the transition from methanol to ethanol requires only limited technical adjustments:

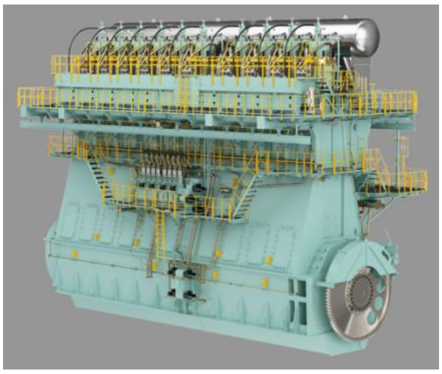


- Calibration of injection parameters
- Optimisation of atomiser design
- Verification of material compatibility and lubricity
- Update of engine's technical folder to include ethanol as a fuel

These are standard engineering refinements—not fundamental technological challenges.

### WinGD

WinGD has confirmed that ethanol-fuelled propulsion is moving from development to commercial reality. The company announced it will introduce the first ethanol-fuelled two-stroke marine engine in 2026, with deliveries for both newbuild and retrofit applications starting in 2027. The engine is based on WinGD's proven X-DF-M methanol platform and uses the same combustion concept and safety framework, demonstrating that ethanol does not require a fundamentally new engine architecture.



The development builds on more than a decade of research, including full-scale engine testing as early as 2018 and participation in major EU-funded programmes on alcohol fuels. WinGD has been investigating ethanol since 2014, and its early work directly contributed to the successful commercialisation of methanol engines, which now form the basis for ethanol deployment.

From a technical perspective, the transition to ethanol requires only limited and well-understood modifications, including adjustments to the control system and fuel injector nozzle to reflect ethanol's higher energy density. Importantly, the underlying diesel-cycle engine concept remains unchanged and is applicable across WinGD's full range of engine sizes, confirming scalability across vessel segments.

WinGD is already engaging with shipowners, fuel suppliers, and class societies on first commercial applications, highlighting that not only the technology but also the supporting ecosystem is advancing rapidly. The company emphasises that ethanol can deliver performance, efficiency, and reliability comparable to existing dual-fuel engines, while offering a competitively priced, lower-carbon fuel option in several markets

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## Conclusions and Policy Implications

Recent developments across leading engine manufacturers point to a clear conclusion: **ethanol can be used in existing marine engine platforms with minimal modification**.

Full-scale testing on commercial two-stroke engines has demonstrated stable operation, with combustion behaviour comparable to methanol and no adverse technical effects. In most cases, ethanol can be applied using existing engine concepts and fuel systems, requiring only minor adjustments such as control system calibration or fuel injection optimisation.

These developments build on more than a decade of research and the successful deployment of methanol engines, meaning ethanol benefits from mature and proven technology rather than requiring new solutions. The technology is applicable across engine sizes and vessel types, and supports both newbuild and retrofit applications.

**Ethanol is therefore a technically viable marine fuel that can be deployed using existing or near-commercial engine technologies. There are no fundamental engineering barriers preventing its use in shipping.**

> The central question for policymakers is no longer: "**Can ethanol be used in ships?**"
>
> But rather: "**What is needed to enable its uptake?**"

Ethanol represents a practical, scalable, and immediately available solution for maritime decarbonisation.

> **The engines are ready.**

The remaining challenge lies in aligning regulation, markets, and investment to enable its deployment at scale.

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