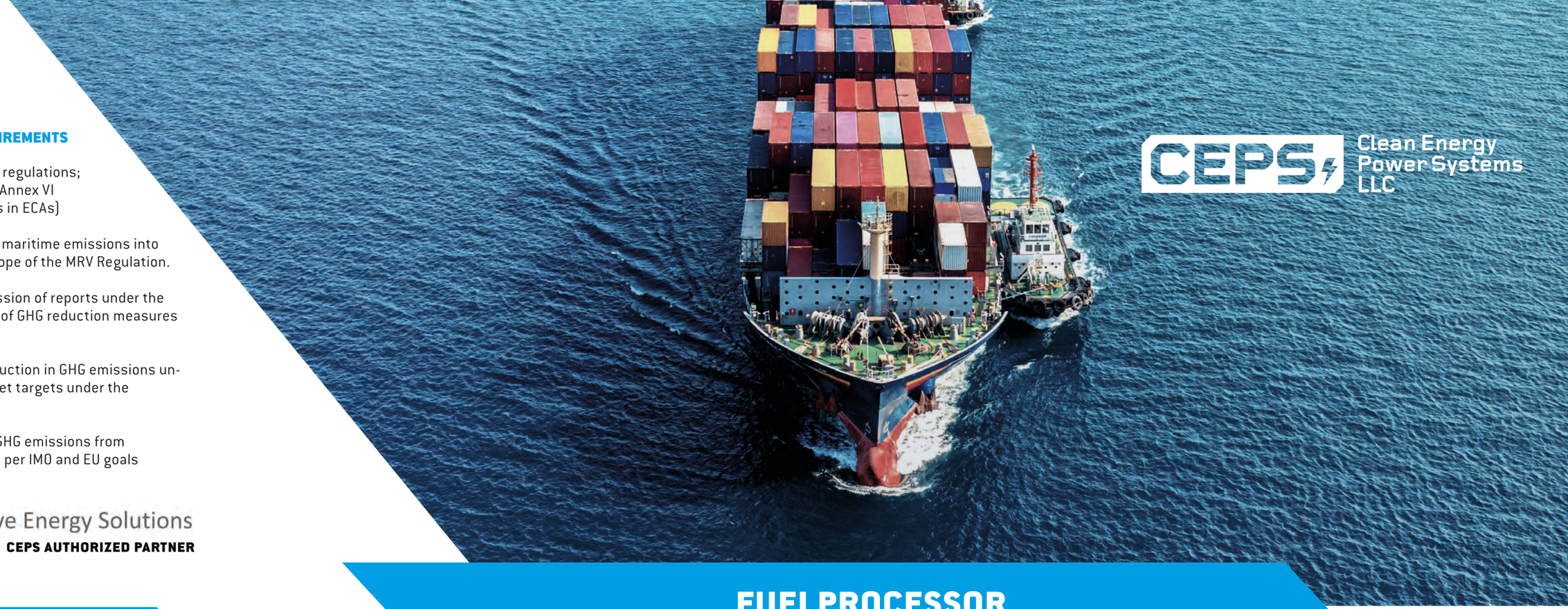

Clean Energy Power Systems LLC

### TIMELINE OF KEY REQUIREMENTS

**2023**: IMO's EEXI and CII regulations; enforcement of MARPOL Annex VI amendments (NOX limits in ECAs)

**2024:** Full integration of maritime emissions into the EU ETS; expanded scope of the MRV Regulation.

**2025**: Mandatory submission of reports under the EU ETS; further adoption of GHG reduction measures by the IMO.

**2030:** Achieve a 20% reduction in GHG emissions under the IMO strategy; meet targets under the EU's Fit for 55.

**2050:** Achieve net-zero GHG emissions from international shipping as per IMO and EU goals

Alternative Energy Solutions
AES by DTS **CEPS AUTHORIZED PARTNER**

# FUELPROCESSOR

**NOVEL REALTIME IN-LINE FUEL EMULSION SYSTEM (WFE / WID)**

**#FIT FOR 55**
**#EU GREEN DEAL**

## PROVEN BENEFITS

### 1 — REDUCED FUEL CONSUMPTION (SFOC-ISO 3046-1)

UP TO **11,3%** UNIVERSITY OF ROSTOCK (FVTR)
(non-optimized, MAK 6M20 fullscale)

UP TO **13,3%** ICELANDIC MARINE COLLEGE
(on a fishing vessel )

### 2 — REDUCED EMISSIONS & AIR POLLUTION

UP TO **35%** HYDROCARBON (HC) EMISSIONS
(depending on engine load & water ratio)

UP TO **100%** FILTER SMOKE NUMBER (FSN) & PM & BC
(depending on engine load & water ratio)

UP TO **66%** NITROGEN OXIDE (NOx) EMISSIONS
(depending on engine load & water ratio)

UP TO **75%** CARBON MONOXIDE (CO) EMISSIONS
(depending on engine load & water ratio)

### 3 — REDUCED ENGINE WEAR & TEAR

CA. **50%** LESS WEAR & TEAR / MAINTENANCE
(cooler combustion + less soot & deposits & no hotspots)

CA. **50%** LESS LUBE OIL COSTS
(due to FSN / PM / soot reduction and much cleaner combustion )

### 4 — NO HARM TO THE OPERATING ENGINE

UNIVERSITY OF ROSTOCK (FVTR LAB & TESTBENCH)
No detrimental effects observed on engine or injectors

ICELAND SCHOOL OF MARINE ENGINEERING
on a fishing vessel

WWW.CLEANENERGY-POWERSYSTEMS.COM

The Clean Energy Power Systems LLC-FZ FuelProcessor is offering a cutting-edge realtime and inline **Water-in-Fuel (WFE) / Water-in-Diesel (WiD) emulsion system** to enhance fuel efficiency and drastically reduce emissions & air pollution in internal combustion engines overjumping several previous limitations & challenges of emulsion systems & emulsified fuels.

Our FuelProcessor is aiming to help industries looking to comply with stringent environmental regulations such as the **EU´s FuelEU Maritime and the Fit for 55** package, while achieving operational cost savings and reduced maintenance to accompany customers throughout the clean-fuel transition, helping them to save OPEX, enabling also the blending with alternative and biofuels in real-time.

### ADVANCED MICRO & NANO EMULSION SYSTEM:

The FuelProcessor creates a stable nano and micro-emulsion of water and fuel using a frequency-enhanced cavitation chamber. Unlike traditional systems, it does not require additives or surfactants, making it an eco-friendly and cost-effective solution.

### EASY RETROFIT INSTALLATION WITHOUT DRY-DOCK:

The FuelProcessor is designed to be easily installed into existing engine systems without any modifications. This retrofit solution works directly in the fuel supply line, providing immediate benefits in terms of emission reductions and fuel efficiency.

### FULL FALLBACK & REDUNDANCY:

Our system is equipped with a multi-level redundancy design, ensuring a seamless changeover to regular fuel supply if needed. This feature guarantees continuous engine operation, even in dynamic positioning (DP) modes, safeguarding vessel performance and operational availability.

*HELPING OPERATORS ON THEIR COMPLIANCE AND DECARBONISATION JOURNEY IN THE CLEAN FUEL TRANSITION*

**CLEAN ENERGY POWER SYSTEMS (CEPS) LLC-FZ**
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Alternative Energy Solutions
AES by DTS **CEPS AUTHORIZED PARTNER**

## POSITIVE EFFECTS OF THE FUELPROCESSOR:

Implementing the FuelProcessor not only enhances engine performance and reduces primary fuel consumption and the envrionmental impact, but also offers a range of additional operational expenditure (OPEX) savings through several key factors:

### FOR ENGINE & OPEX SAVINGS

**Extended Lube Oil Lifetime:**
Cleaner combustion with reduced FSN / soot and particulate matter (PM) leads to a longer lifespan for lube oil.

**Extended Component Lifespan:**
The FuelProcessor´a s ability to produce cleaner & cooler combustion leads to less soot and particulate matter (PM), which reduces wear and tear on key engine components, and heat-bearing parts.

**Reduced Maintenance Costs:**
With fewer deposits and cleaner & cooler combustion, there is reduced wear & tear and spare part replacements, resulting in cost savings over time, including lower maintenace on the TurboChargers & longer Injector lifetimes.

**Longer Time Between Overhauls (TBO):**
The cleaner operation extends the intervals between necessary engine overhauls, improving operational uptime and reducing downtime costs.

**Improved Fuel Flexibility:**
Our system enhances fuel flexibility without the need for engine modifications, making it an ideal solution for operators facing variable fuel qualities or water contamination issues. The FuelProcessor mitigates these challenges, protecting engine performance and ensuring operational reliability.

### FOR COMBUSTION & OPEX SAVINGS

**Micro-Explosion Phenomenon:**
The fine emulsification of water within the fuel leads to micro-explosions during combustion, which improves fuel atomization and mixing with air, resulting in more complete and efficient combustion.

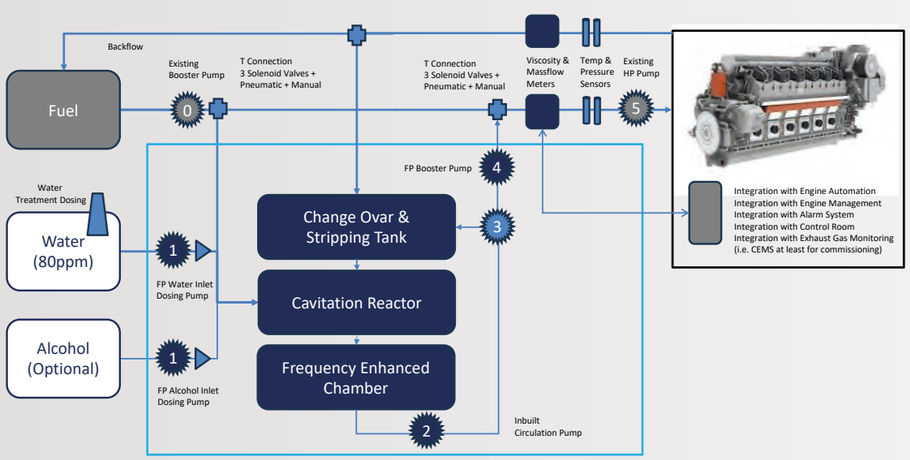
**Lower Emissions & Air Pollution:**
The improved combustion process significantly reduces emissions of NOx, CO, CO2, soot, and black carbon, helping to meet stringent environmental regulations.

**Increased Combustion Efficiency:**
The more thorough and complete combustion process results in higher energy efficiency, reducing specific fuel oil consumption (SFOC) and lowering overall fuel costs.

**Reduced Exhaust Temperatures:**
The presence of water in the fuel helps to lower localized hot spots in the combustion chamber, leading to reduced exhaust gas temperatures comverting more energy in heat instead of work.

**Emission Savings:**
The FuelProcessor contributes to overall emission reductions, helping operators meet stringent environmental regulations, save emission taxes and provides flexibility for fuel, while reducing the environmental impact to align with sustainable practices.

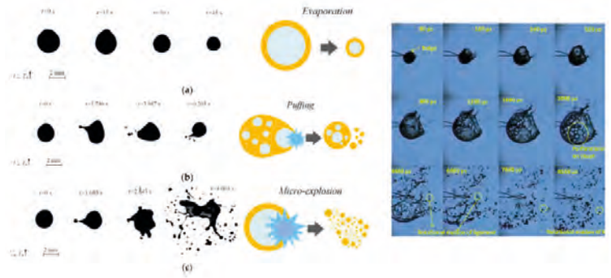
## FP SCHEMA




## MAIN EFFECTS TAKING PLACE:

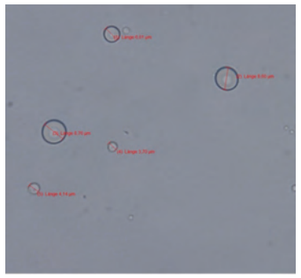
**Enhanced Atomization:**
The FuelProcessor's emulsion process leads to fine emulsion and improves the atomization & spray picture due to the change in viscosity & the microexplosion effect, improving the atomization and distribution of fuel in the combustion chamber.

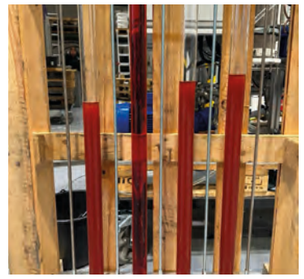
**Micro-Explosions:**
The rapid evaporation of water within the emulsified fuel causes micro-explosions, which break up fuel droplets further and promote more complete combustion.




**Emission Reduction:**
The more efficient & complete combustion process and lower combustion temperatures lead to a significant reduction in harmful emissions, including NOx, PM / BC, CO and CO2

**Efficiency Gains:**
The improved combustion conditions contribute to higher thermal efficiency, reducing the amount of fuel required to produce the same level of power, thus saving on operational costs.





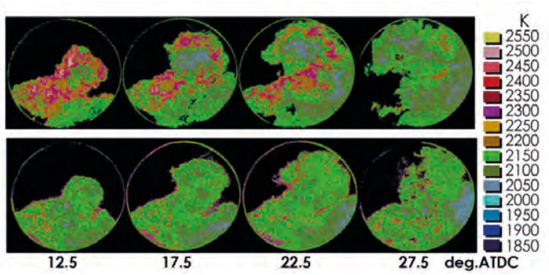
## OTHER CHARACTERISTICS

**Dual Fuel Capabilities:**
The FuelProcessor enables the use of alternative fuels like methanol, ethanol, biofuels, renewable clean diesels, etc. without the need for engine modifications, enhancing the engine>s adaptability to different fuel types.

**Works for 2 Stroke & 4 Stroke Engines + Boilers:**
The FuelProcessor is designed for versatility, making it compatible with both 2-stroke and 4-stroke engines with th same working principle and without the need to modify the engine.

**Scalable and Modular Design:**
The FuelProcessor is engineered for scalability and ease of installation, allowing it to meet the needs of various engine sizes and power outputs and assets to be installed in with low space requirements. Standard units are compact, with dimensions of 120 x 80 x 190 cm and weights ranging from 300 to 500 kg.

**EU ETS Savings:**
Significant savings can be realized under the EU Emissions Trading System (ETS) for CO2 and CO2e reductions, provi-




CLEANER & COOLER COMBUSTION WITH LESS HOTSPOTS & LOWER NOX - ABOVE EXAMPLE IS TAKEN A VISUAL STUDY ON COMBUSTION OF FUEL WATER EMULSION (TAJIMA ET AL, 2001).

STABLE & FINE EMULSION WITHOUT ADDITIVES, EMBEDDING WATER & OPTIONAL HHO & ALTERNATIVE FUELS INTO THE FUEL MATRIX

## EU & INTERNATIONAL (IMO) REGULATIONS ON ENERGY EFFICIENCY AND EMISSIONS REDUCTION

The IMO and the EU have established a robust framework of regulations aimed at reducing greenhouse gas (GHG) emissions, improving energy efficiency, and curbing air pollutants such as nitrogen oxides (Nox as precursor to N20) and black carbon (BC).

For maritime operators, understanding and adhering to these regulations is critical not only for legal compliance but also for contributing to global sustainability efforts, where our technoloigies support our esteemed customers in a viable way.