

Greening The Shipping Industry With Help From Mother Nature



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The **Carbon-neutral** Future of the Shipping Industry

Introduced and coordinated by

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Scope of the proposal

We are proposing the decentralized production of **carbon-neutral** renewable drop-in fuel - VLSFO, ULSFO, and road diesel from purpose-grown and waste biomass around the world. First pilot installations planned in the Philippines and Mauritius for 4000t/a of VLSFO. Other potential in North Africa, India, Florida, and Louisiana.

The Problem for the shipping industry

The Low Sulfur Regulation MARPOL Annex VI by the International Maritime Organization (IMO) has come into force on 1 January 2020, requiring all shipping companies to **reduce their Sulfur emissions by 85%**.

Currently, there are three options to choose from, to comply with the Annex VI regulation. All do **nothing or very little** to reduce the carbon footprint (CO2 balance) of ships:

1. Buy more expensive, low Sulfur content compliant fossil VLSFO fuel.
2. Install EGCS (scrubbers) on their vessels, creating another waste stream.
3. Utilize alternative fuels, such as LNG, which are supposedly “clean” - but are not.

We will add a fourth option to this selection, more

ENVIRONMENTALLY FRIENDLY, CARBON-NEUTRAL and COST COMPETITIVE

From 2020 onwards the focus in shipping will shift towards **full climate action and cut carbon emissions by 50% in 2050 versus 2008**. This is extremely challenging as shipping lags other sectors in this goal-setting. And the opinion in the industry is that no realistic techniques are available yet to meet the IMO 2050 regulations.

We will show that the solution is already there and can be implemented even before 2030 with the least expenses and efforts –**CARBON NEUTRAL DROP-IN FUEL**, requiring no change in infrastructure, with the additional benefit of efficient biomass waste management (e.g. of sugar cane trash) and purpose-grown feedstock - a tremendous CSR opportunity in developing countries.

Producing Renewable Carbon-neutral VLSFO from Biomass

Our Catalytic Conversion Technology with low-temperature and pressure

The process of our partners can convert **in one simple stage in less than 5 minutes** biomass directly into a diesel oil that **fulfills and exceeds the standards of the IMO 2020 requirements**. The technology has been tested and vetted by the **RENEWABLE ENERGY AGENCY** of a large country with a pilot plant and led to a large-scale feasibility study with sawdust. The pilot program was conducted for half a year at total costs of US\$900,000 and demonstrated the technical and financial viability of the process. The next step is the implementation of a full-sized converter plant with feedstock supply and pre-processing, which is currently in the planning stage.

The test results of the pilot plant were excellent

Feedstock – mainly waste biomass

Most kinds of biomass waste can be converted. For example, bagasse and sugarcane trash, husk and shells of almonds and other nuts, canola and olive oil press cake, etc. The problem of supply security due to the seasonal fluctuation, a weather-related drop of harvest, storage problems we can buffer with **purpose-grown biomass**.

Upscaling for ship diesel – the answer to the biomass question, DAMO® Energy Grass

Building larger and more conversion plants is just a financial question. However, **where should the humongous amounts of biomass come from?** Of course, from organic waste in the first place. But we will need additional purpose-grown material WITHOUT re-igniting the discussion about land use and “plate or tank.” A large cruise ship consumes up to 250t/day. At a 25% conversion rate over 1000 tons of oven-dry biomass would be required.

The solution is DAMO® Energy Grass - up to 600 tons per hectare

This grass is a **super high yield, non-GMO, non-invasive hybrid species**. As a perennial grass, it grows back after being cut without replanting. Even on **poor soils and marginal non-agricultural land**, when well irrigated and fertilized, we can yield 200-300t/ha. The catalytic process converts the grass at a rate of about 25-30 % or about 35 tons of VLSFO per hectare of land. One day operation of a cruise ship with 250 tons of fuel consumption can be handled with 7.14 ha or 2286 ha for 320 operating days. Not even considering any biomass waste, we have in both countries, the Philippines and Mauritius already secured land for the production of **850,000 tons of VLSFO**. However, this grass can grow in any tropical and frost-free subtropical country of Asia, Africa, the Caribbean, and South America.

The Pivotal Question - Costs

The supply of biomass waste material is ample and cheap. In Florida and, Louisiana 1.5 million tons of sugarcane trash and half of the 900 million tons of agricultural waste in India are currently even burned off. Production Costs of the grass are also low, and as we use solar power for the operation of the plant, we are very confident to be able to offer the fuel at a **lower price than fossil VLSFO**.

The CSR Aspect

Besides the environmental aspect, fair treatment of the farmers in developing and threshold countries is of the highest importance for us. In the end, they are the backbone of a successful operation. We organize farmers in coops that hold shares in the special purpose corporations. This will channel a fair share of funds directly into the pockets of the poorest farmers without an intermediary to improve their livelihood and prevent business interruptions by strikes. **A win-win-win situation**. We are looking forward to working with you on this exciting opportunity.