Wind: the clean and free energy source

a white paper on wind-assisted ship propulsion

ECONOWIND

Harvesting the wind

The Econowind VentiFoil, a foldable and autonomous unit for wind- assisted ship propulsion, offers the highest possible CO2 reduction per nautical mile using wind. Due to large savings on fuel, the yield is higher than the unit's lease costs. With 30.000 ships in operation worldwide a daily saving of between 10% and 20% on fuel and thus an average CO2 reduction of 760 tons per ship per year can be achieved. Making wind assisted ship propulsion a must have for every ship owner.

Frank Nieuwenhuis, CEO Econowind

ECONOWIND

A plug ‘n play solution towards a zero emission future

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Shipping and the energy transition

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1. Emissions

International shipping accounts for 2-3% of global carbon emissions. IMO's strategy on the reduction of Greenhouse Gas (GHG) emissions from ships requires that total annual GHG be reduced by at least 50% by 2050 compared to 2008.

How to reduce the CO2 per nautical mile?

Short Sea Shipping is responsible for more than 70% of sea transport in the the interconnected seas of Eastern Med, the Aegean, the Marmara Sea, the Black Sea and all the rivers that flow into the Black Sea.

The pressure to transition to low emission shipping is fierce, upcoming regulations impacting the emission per nautical mile (EEDI/EEXI and CII) are leading to investments in this decarbonization. Alternatives from fossil fuels are searched for. This transition will happen gradually, from a growing contribution of renewable energy within the energy mix consumed. In other words, the thirst for energy will be met by a growing degree of renewable production over the next 20-30 years. As such, renewable sources will continue to grow at a much faster pace albeit from a low base that we have today.

30,000

EXISTING SHIPS READY FOR WIND PROPULSION

There are currently 30,000 ships in operation worldwide that could be equipped with Wind Assisted Ship Propulsion (WASP).

Measures to reduce shipping emissions

Addressing Green House Gas Emissions are captured in the Ship Energy Effiency Management plan (SEEMP) whereby there are operational measures to be taken via the AER and EEOI.

Efficiency improvements by a management plan: SEEMP

Annual Efficiency Ratio (AER)

The AER is commonly used by the shipping industry as it serves the primary purpose of evaluating annual progress of a ship. It reflects the ratio between CO2 emissions and the maximum transport work, based on the cargo carrying capacity in DWT or GT, not the actual cargo carried. This indicator relies on a proxy for transport work, which does not differentiate between the different loading of a ship for each of its voyage.

Energy Efficiency Operational Indicator (EEOI)

The EEOI is defined, in its most simple form, as the ratio of mass of CO2 emitted per unit of transport work. As it varies according to the actual cargo carried, this indicator reflects the carbon intensity of the transport service rendered by each individual ship and its primarily used for voyage level monitoring of a ship as part of its SEEMP.

Impact Wind Assisted Ship Propulsion

In all of the above measures wind assist has a measurable effect. It only needs wind to lower all other power needs. Reaching with less emissions faster a nautical mile.

2. Regulations

To meet the agreed targets, the IMO has developed GHG emission standards. The Energy Efficiency Design Index (EEDI), aimed at introducing energy-efficient new ships, applies to new builds only. The Energy Efficiency Existing Ship Index (EEXI) has been introduced to address the technical efficiency of ships. The Carbon Intensity Indicator (CII) rating scheme addresses operational efficiency.

EEDI, emissions per nautical mile for new-builds

One is the Energy Efficiency Design Index (EEDI) for newbuilds, mandating up to large improvement in design performance depending on ship type. In combination with the upcoming EEDI Phase 3 and a possible Phase 4 later this decade, these measures will impact both newbuilds and existing ships (via EEXI) to ensure that international shipping will meet the 2030 ambition of 40% reduction in carbon intensity.

EEXI, emissions per nautical mile for existing ships

The application of the EEDI retroactively to all existing ships through the Energy Efficiency Design Index for Existing Ships (EEXI); and the Enhanced SEEMP, a strengthening of the SEEMP to include mandatory operational-efficiency improvement targets.

The EEXI will impose requirements equivalent to EEDI Phase 2 or 3 to all existing ships, regardless of year of build. This also includes ships built to EEDI Phase 0 and 1 requirement, which do not currently meet EEDI Phase 2 or 3 requirements. It is intended as a one-off certification, but with a future strengthening of the EEDI we may also see a second EEXI phase to ensure that existing ships are not subject to less strict requirements than newbuilds, which might otherwise discourage fleet renewal.

Carbon Intensity (CI)

Carbon intensity is a measure of how much CO2 is being produced per unit of electrical energy generated. The carbon intensity of a vessel depends on the fuel used in generating propulsion power and the efficiency per nautical mile (DWT).

Carbon Intensity Index (CII)

CII calculates the total Annual CO2 emissions per ton design capacity and per total miles of voyage travelled. Per ship type and an annual required Carbon Intensity reduction factor will be determined, which is similar like the EEDI 2008 base reference line. The main target of the operational short-term measures applied through the CII is to bring further a gradual 40% CO2 Reduction of emissions of the global active fleet from 2023 down marching to 2030.

Navigating in challenging times

The IMO & EU carbon emission guidelines discourage the use of existing carbon-intensive propulsion technologies. Regulations in the maritime domain are running ahead of the developments in propulsion technology adoption. There are a lot of options in the efficiency Library, but it's not a clear pathway when choosing innovative technologies.

There are divergent opinions between regulators, policymakers, shipowners and shipyards regarding which will be the future fuel. This Fuel challenge leads to delays in shipbuilding Shipyards in Europe expect an explosion in demand in about three years from now.

Be prepared

The improvement of the operational energy efficiency of existing ships will include both Technical and Operational measures. A goal-based energy efficiency measure utilizing an Energy Efficiency Existing Ship Index (EEXI) will be used, including a mandatory engine power limit (EPL) on all ships at a flat rate, in order to support the non-EEDI compliant ships, for example those delivered before 2014 for which the EEDI was not applicable by design.

All ship owners are to align whether their ships comply towards the coming EEXI. Having a low rated D or E rated ship this will lead to challenges on being chartered in, or be refinanced. When not fitting under the sustainability targets from shipping financiers.

How wind can help

By installing Wind Assisted Ship Propulsion high fuel savings are being accomplished resulting in an improved EEDI & EEXI. The IMO has defined MARINE ENVIRONMENT PROTECTION COMMITTEE (MEPC 77th) that wind power improves the EEDI and EEXI effect. As it will also lead to better improved vessel performance it is a logic choice for the future.

"Using less energy is the best and approved way to lower emissions per nautical mile."

Renewable Energy Strategy

A way to reduce emissions, and be an outperformer on emissions is to have as low as possible emissions per nautical mile.

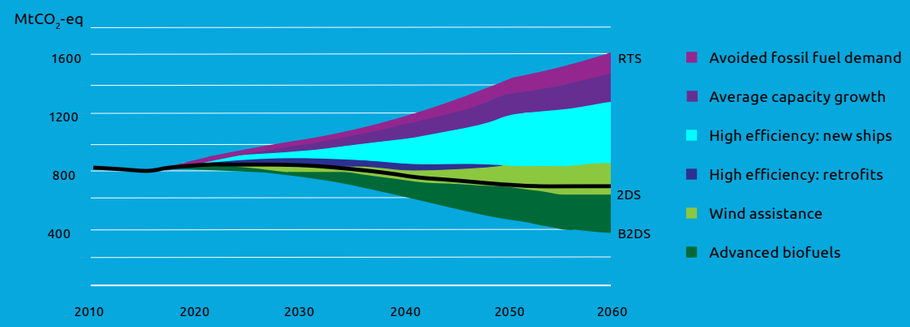
Though in all metrics wind propulsion is the route for renewable energy solution. Having the lowest costs propulsion driver, wind can be combined with any fuel source.

For shipping to be in line with reaching Paris Agreements, shipping needs to start decarbonising whilst the market is expected to grow at significant paste, being a challenge as shipping emissions are expected to grow by 50% to 100 % growth.

Wind assistance is needed as part of the future propulsion needs and will be accountable for over 200 $MtCO_2$-eq emission avoidances.

WTW GHG emissions reductions in international shipping in the B2DS relative to RTS

The largest share of GHG abatement in shipping results from operational and technological efficiency improvement combined with wind assistance in the B2DS.



Source: IEA (2017a). Mobility Model, March 2017 version, database and simulation model, www.iea.org/etp/etpmodel/transport

Whatever your decarbonisation strategy is, wind is the renewable energy source here to stay.

What can wind assisted ship propulsion do?

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1. VentiFoils by Econowind

Econowind offers and provides wind assisted propulsion to seagoing ships in the shape of VentiFoils. They can be containerized inside a 40ft container or fixed to a vessel so the size of the foils are not limited to container dimensions.

The VentiFoil is a wing shaped element using modern innovations in aerodynamics creating high propelling force relative to its size. Smart suction is integrated in the wing, resulting in double the force of the VentiFoil while reefing when needed.

Folding vs. non-folding

25% to 40% of ships have unfavourable wind conditions. So, by default, VentiFoils have a folding option. This way there is never a negative drag from the wings, which non-folding versions of wind assisted ship propulsion would experience.

One investment - immediate ROI

With fuel pricing ranging between 800$ to 1.300$ dollar per ton there is a clear payback of wind assist. When financed via the ships mortgage or via a “lease construction” there is an immediate ROI. The monthly savings of fuel and potential ETS costs are higher compared to financing costs.

When compared to future renewable fuels, wind is a no brainer business case. Equivalent Ton prices of up to 2.000 to 3.000 $ per ton are no exception and the payback is immediate.

Easy to replace on other vessel

Being flexible to install is key, with the case of the Frysian Sea from Boomsma a flat rack was developed whereby the installation is done in one day. Having flexibility to place on next ships gives shipowners the freedom to operate.

Improved EU-ETS

Fuel not used lead to emissions not polluted. With the main fuels having a fuel to CO2 ratio of around 3, each ton of fuel not emitted lead to 3 ton less emission. With average sailing emission avoidance of 10% and Higher this will have a significant effect on ETS savings.

Plug ‘n play - Easy Installation

Being installed in one or a couple of days there is a key integration efficiency need. This is done by a bridge control link and as such an easy installation on a ship. As the VentiFoils are considered lightweight in their design there are no large constructional changes needed for vessels.

Regulatory safe

IMO EEXI and EEDI approved there is a saving from day one. All vessels with wind installation have the capability to sail faster, due to less constraints in power limitation. This is all due to the added green power. Class adapts vessels and their green profile, ensuring a swift acceptance.

From idea to innovation

Econowind and Conoship International developed the Ventifoil as a swift deployed project. Taking the responsibility from idea of wind power to the execution.

up to 20%

SAVINGS OF FUEL USE

By installing Wind Assisted Ship Propulsion high fuel savings are being accomplished resulting in an improved EEXI

Case study Boomsma Shipping

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1. Boomsma Shipping

Founded in 1968 in the City of Sneek, The Netherlands, Boomsma Shipping is a family-run business providing a range of shipping services including multi-purpose vessels up to 8,500 DWT.

Why Wind Assisted Ship Propulsion?

Boomsma participated in the WASP project[1] due to the climate and regulatory challenges that lie ahead. After optimizing their vessels build and trim to reduce fuel use, the next logical step for them is wind assisted ship propulsion.

Some eight months after signing the contract, Boomsma Shipping has installed its first two VentiFoil wind-assisted propulsion units. The Dutch flagged MV Frisian Sea, a 6477dwt general cargo vessel has made its maiden voyage to Vasteras, Sweden with the VentiFoils in operation,

“We believe it is necessary and very important to meet sustainability challenges. We want to do our part to reduce our fuel consumption and CO2 emissions as soon as possible.”

Johan Boomsma, co-owner of Boomsma Shipping B.V.

[1] The WASP (Wind Assisted Ship Propulsion) project is funded by the Interreg North Sea Europe program, part of the European Regional Development Fund (ERDF) and brings together universities and wind-assist technology providers with ship owners to research, trial and validate the operational performance of a selection of wind propulsion solutions.

The retrofit of MV Frisian Sea with Econowind Flatrack system

The requirements as stated by Boomsma for MV Frisian Sea were a perfect fit for the Econowind flatrack system: no interference with cargo operations, removeable/replaceable and easy to use. The preparations for the installation required cable routing, hatch covers to be enforced and class approval.

Stamp of approval for EEXI reduction

Lloyds Register approved the EEXI Calculation and Technical file for MV Frisian Sea of Boomsma Shipping. This approval underlines that the vessels' EEXI is lowered by installing the Econowind VentiFoils.

Navigation and safety proof

The wind assisted units are installed on Port side on this vessel. Ensuring a safe navigation and to remain in 5degree sight angle.

Freedom of placement

Being installed on a flatrack the VentiFoils are moveable by the Hatch Crane system.

Operational safe

No manual interface to start sailing. At captains' choice and Econowind advisory it's time to 'go sailing'.

The best marketing material available: a pair of Econowind VentiFoils on deck!

The sea, the great unifier, is man’s only hope

Jacques - Yves Cousteau

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