ECONOWIND

SNN
SAMENWERKINGSVERBAND NOORD-NEDERLAND
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BY CONOSHIP INTERNATIONAL

ECONOWIND

Wind Assisted Ship propulsion

IR. GUUS VAN DER BLES

LET US CATCH YOUR WIND : ECONOWIND-UNIT

BY CONOSHIP INTERNATIONAL

AIMING FOR EMISSION-FREE SHIPPING 2050

Goals:

- Emission-free in 2050 ?
- 40% CO2 reduction in 2030 ?
-IMO sulpher-cap in 2020 !

Reality:

10.000 typical short sea ships today

5 – 10t fuel / day

Wind readily available

=> **Hybrid systems including Wind**

CONOSHIP DESIGN & ECONOWIND-UNITS

eConowind BV:

- Founded 2016 by Conoship & HCP
- Developing eConowind-units

eConowind goals:

- Realizing massive Wind Assisted Ship Propulsion
- Be leading in wind propulsion

Reality:

- First sea trials nov 2018
- Production start Q2-2019

Introduction Conoship Design

Conoship BV, Groningen, Netherlands

- Ship Design office started 1952
- > 2000 vessels built of our design
- **Focus R&D**: eCONOmy & eCOlogy
  - Reduction of fuel & emissions
  - Wind Assisted Ship Propulsion
  - Propulsion on LNG / Hydrogen

  ⇒**'eCONOlogical'** innovations

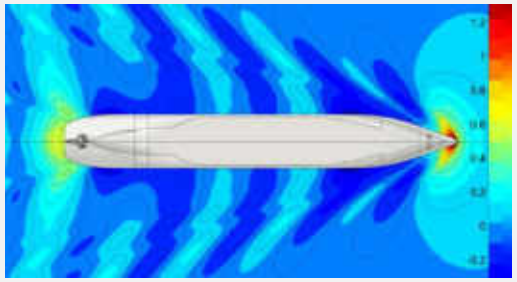
  Conoship initiated eConowind-unit

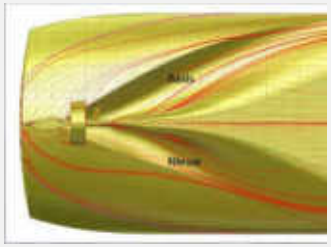
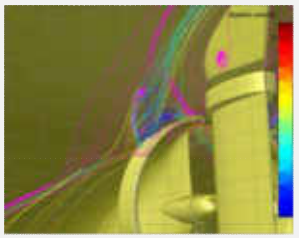
CONOSHIP: SUSTAINABLE ADAPTIVE SHIP DESIGN

Design Rationale Conoship:

Adapt towards emission free shipping !

1. Slender hull => lowest resistance
2. Optimize largest possible propulsor
3. Apply largest possible auxiliary Wind Propulsors that do not impede ship operations
4. Consider future retrofits in ship design : diesel -> syn-fuels -> methanol / LNG -> H2




FOCUS: WIND ASSISTED CARGOVESSELS

Minimum speed required 10 – 11 kn

Combi diesel engine + Wind propulsion

=> motorsailing + into apparent wind

Considerations:

- Stability constraints
- Cargo handling**:** loading & unloading
- no extra crew-handling required
- minimize drag in storm & head wind
- scalable design

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MODULAR WIND ASSISTED SHIP PROPULSION

SNN

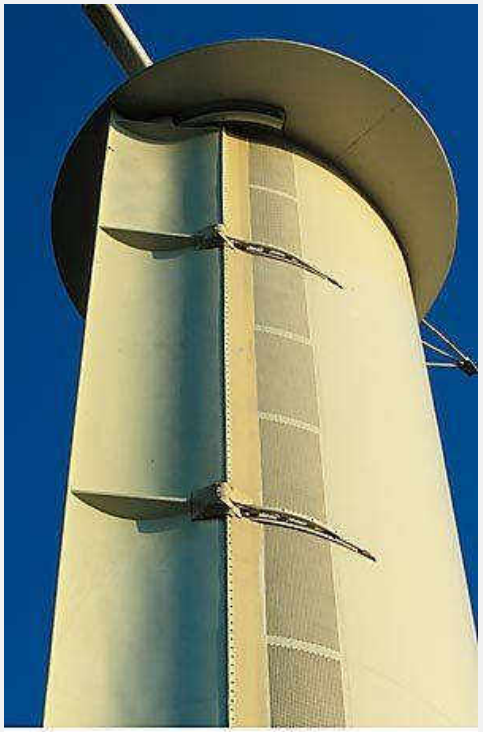
BASIC PRINCIPLE: COUSTEAU TURBOSAIL

Jacques Cousteau developed & patented the TurboSail ~1985

- vertical "cylinder-with-egg-shaped-cross-section"
- suction of boundary layer, ventilator inside

Promising on cargo vessels:

- Compact, static, no crew handling : '**VentiFoil**'



ECONOWIND

2016 founded:

THE IDEA:

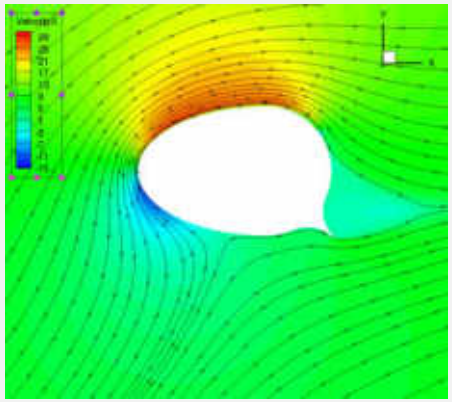
Concept:

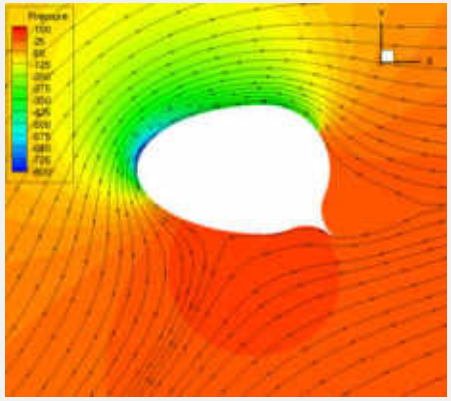
Foldable system of VentiFoils:

- in sea container
- Integrated in new-build ships

2017: TESTING 5,5 M FOLDABLE VENTIFOIL 1:2

'VENTIFOIL' CFD ANALYSIS TU DELFT STUDENT - MARIN





Variation wind-angles & suction coeff.

Windspeeds: Bft 3 / 5 / 7

= 6 m/s /10 m/s / 14 m/s

=> Lift- & Drag coefficients => thrust & drift/heeling forces

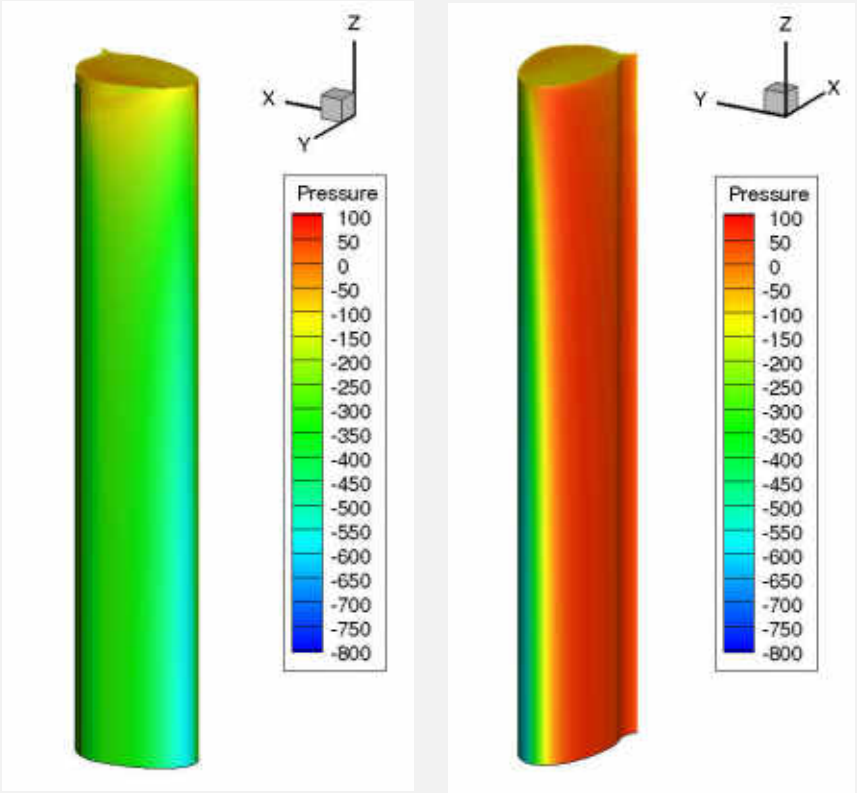
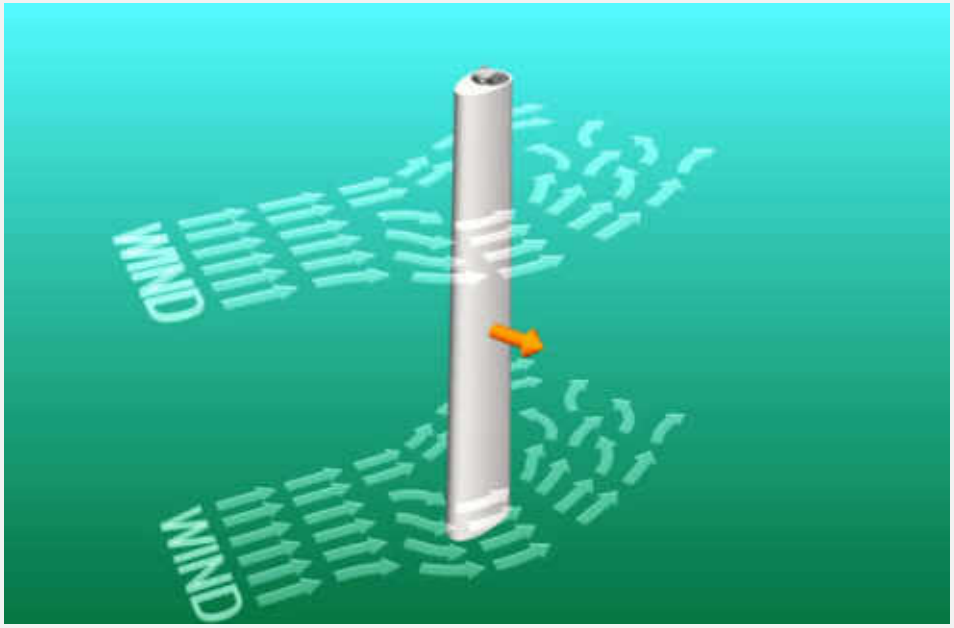
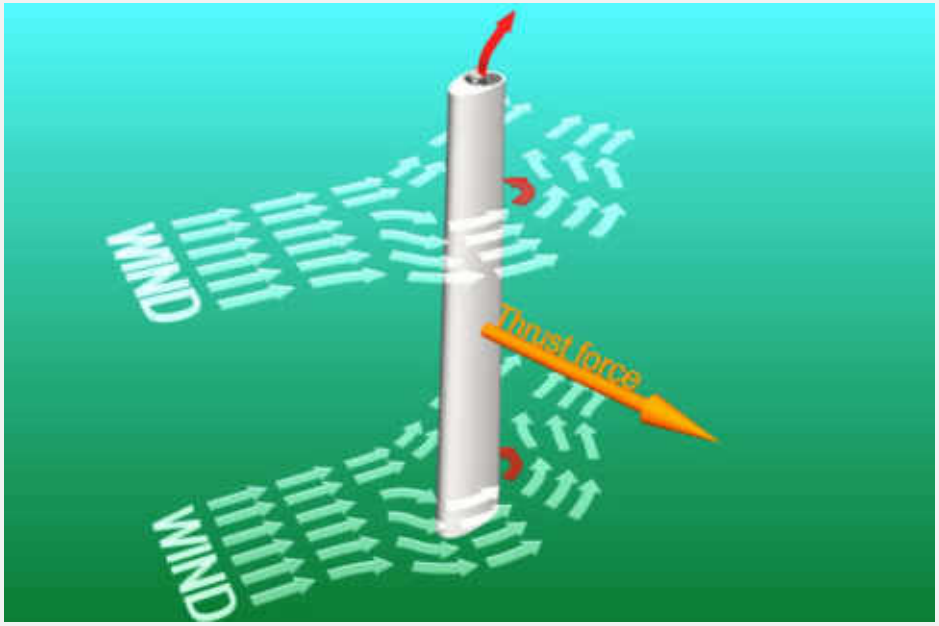


Figure: TUD Graduation Anton Kisjes

VENTIFOIL & BOUNDERY LAYER SUCTION => THRUST

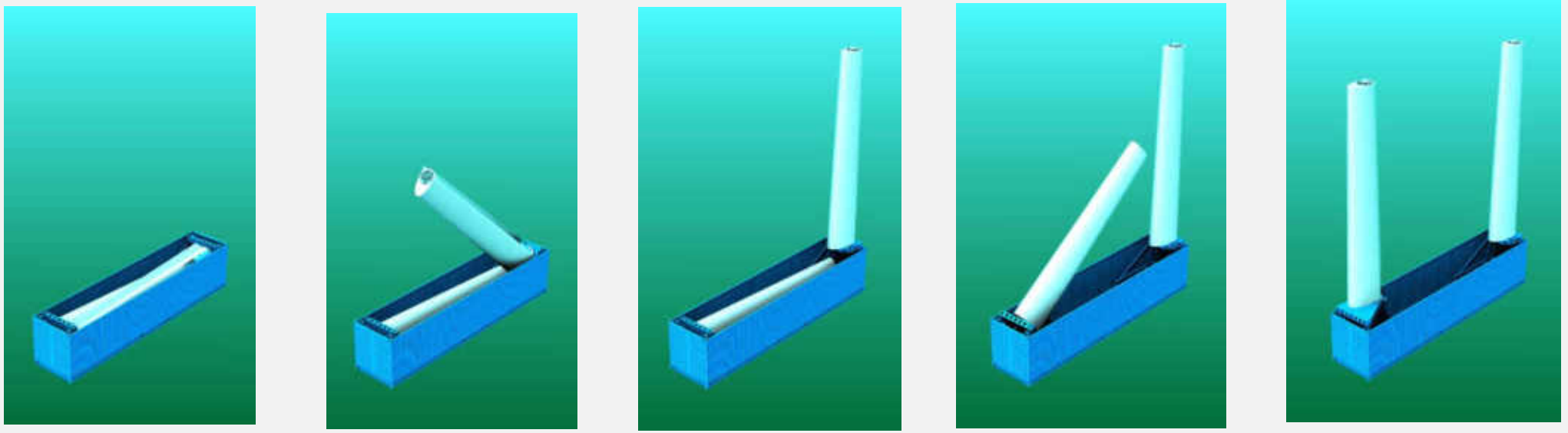


Without Ventilator: no boundery layer suction => small thrust force



With Ventilator working: optimal boundery layer suction => large thrust force

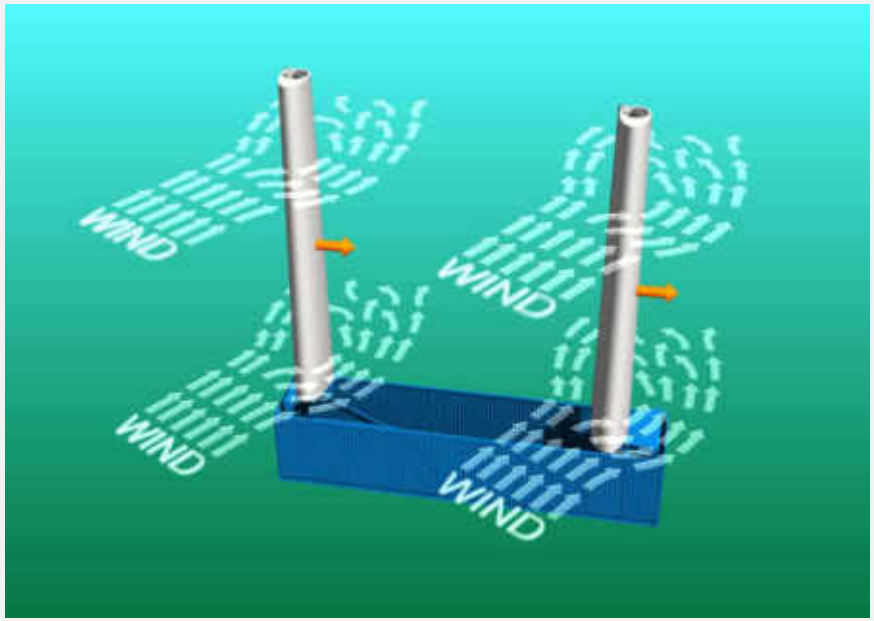
AUTONOMOUS FOLDABLE VENTIFOILS IN 40' CONTAINER



Check wind is OK => VentiFoils unfolding out of eConowind-unit automatically +

Turning to optimal wind angle , start ventilator + adjust to windspeed => THRUST !

2 VentiFoils in eConowind-unit => 2 x Thrust



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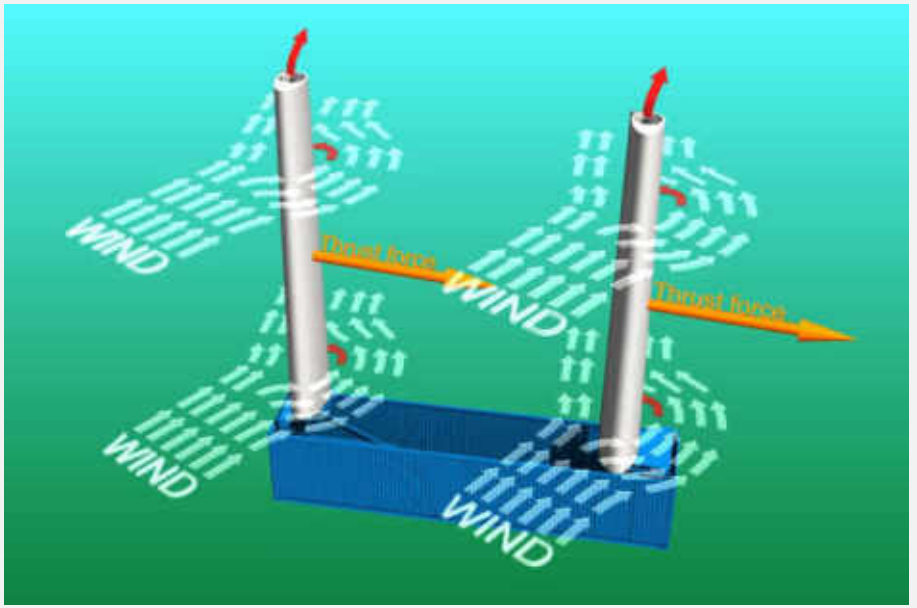


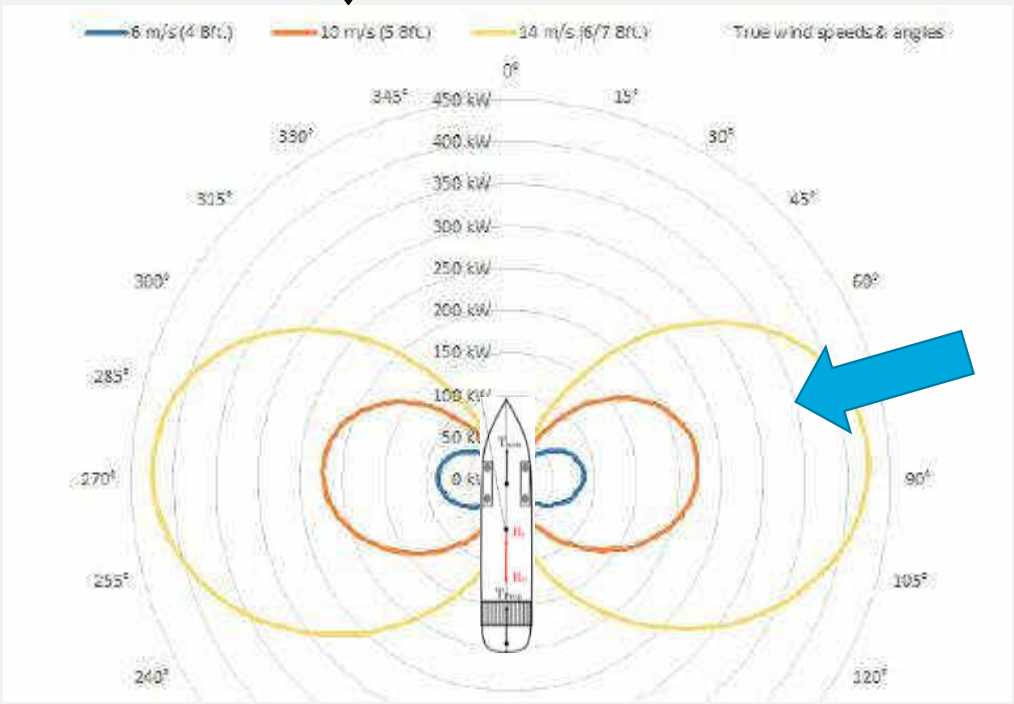
With Ventilator working: optimal boundery layer suction => large thrust force

EQUIVALENT THRUST SAILS <-> ECONOWIND-UNIT

eConowind unit with 2 VentiFoils:
Optimal thrust force in compact unit

For equivalent thrust force, a sail area of abt.
165 m2 should be applied !

Reduction of Fuel & CO2 <-> wind speed & direction



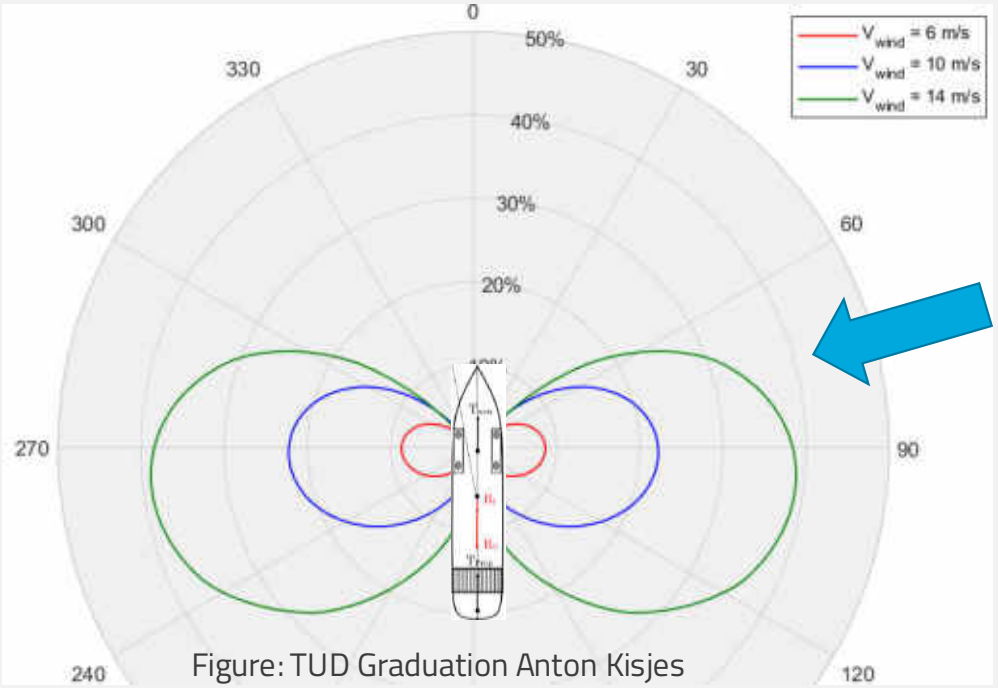


Figure: TUD Graduation Anton Kisjes

Savings at 3 Bft, 5 Bft & 6/7 Bft wind :

Up to 400 kW propulsion power of engine with 2 eConowind units

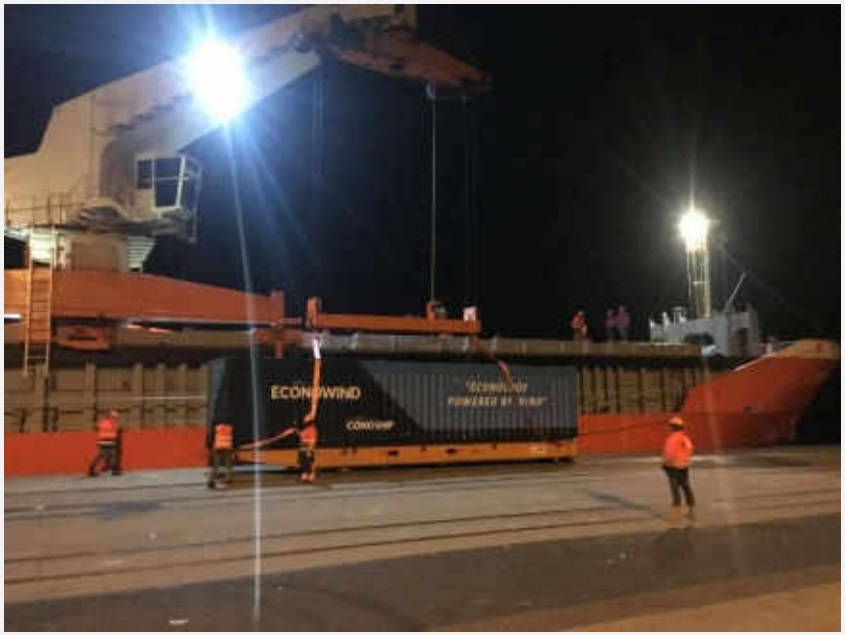
Reduction of fuel & emissions in % related to wind speed & direction: 10~15% average !

eConowind saving fuel & emissions

Vessel sailing economical speed
11 kn (=20 km/h) , propeller only
-Diesel engine abt. 1000 kW
-Abt. 4,8 ton gasoil/24 hours
-Abt. 15,3 ton CO2 / 24 hours

Vessel sailing economical speed
11 kn , propeller + 2x eConowind
Wind 5Bft favourable directions
-Diesel engine abt. 780 kW
-Abt. 3,7 ton gasoil/24 hours
-Abt. 12 ton CO2 / 24 hours
Over 20% reduction on emissions !!

Maiden voyage 19-11 until 2-12-2018



eConowind technology tested at sea: wind saves!

Maiden voyage nov 2018

Emden – Plymouth – Finland.

1st Fuel savings reported:

Up to 8% with 1 eConowind- unit in first technology tests at sea

Fuelcosts saving estimate:

€ 70,000 - € 120.000 / year

for 2 eConowind-units POP~4year

eConowind on fleet: wind saves the climate !

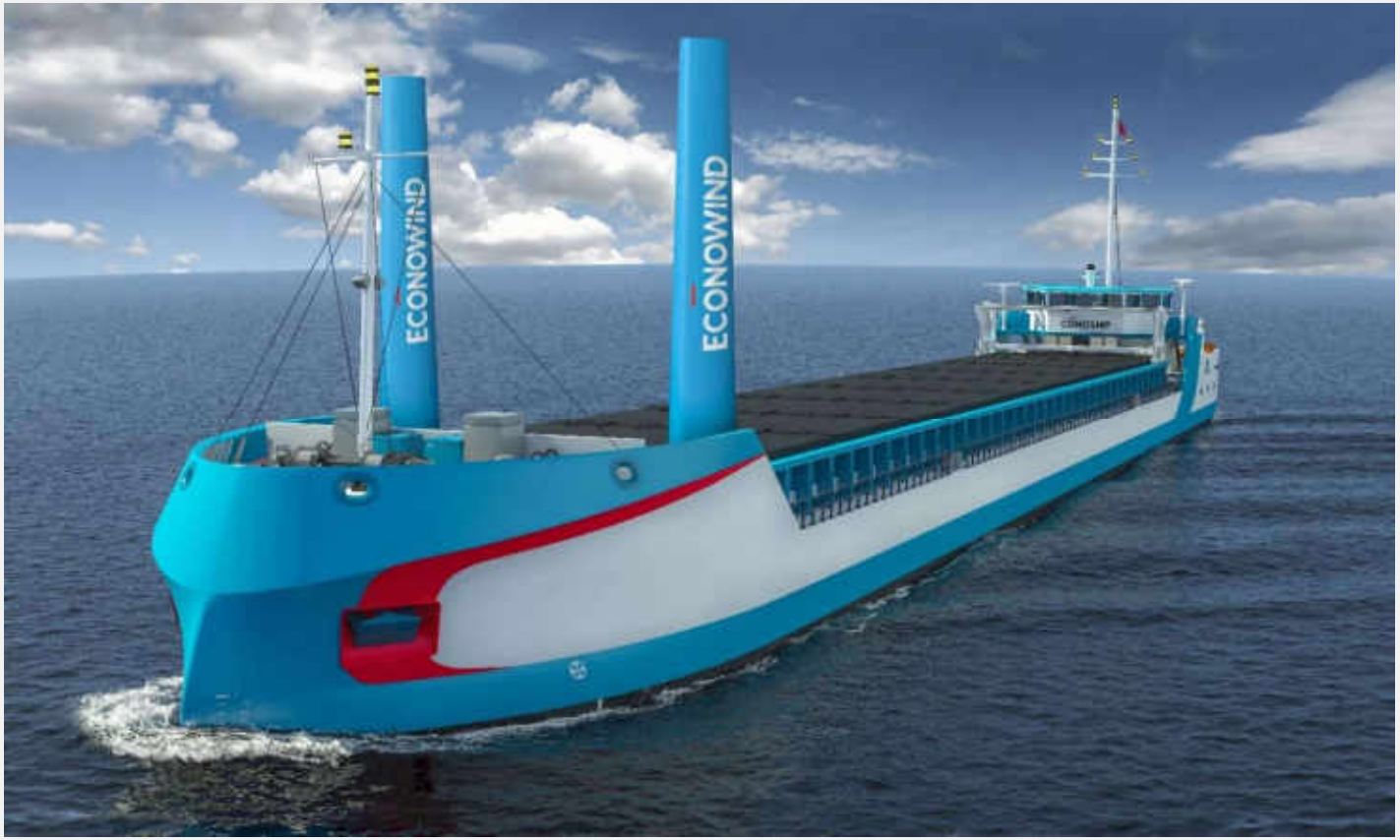
eConowind-unit based on 40 feet container:

Easy retrofitable on many short sea vessels (> 500)

Cargo handling: loading & unloading takes care:

Ports may support in due's & handling gear

FUTURE : ECONOWIND VENTIFOILS INTEGRATED IN SHIPDESIGN



FUTURE: ECONOWIND-VENTIFOILS ON LARGE VESSELS

eConowind- VentiFoil

Retrofit on **bulkers / tankers**

Integration in new designs

VentiFoil XL 30m to be developed

Folding sideways

Cargo handling: loading & unloading takes care

eConowind: Let wind support your emission targets!

eConowind-VentiFoils

Folding down in headwinds

Ample deck space available

Cargo handling:

Loading & unloading not impeded

Protective measures to be determined

eConowind: saving climate & air quality!

GOOD HEALTH:

~20% reduction on NOx & Sooth/PM

~No SOx by legislation

CLIMATE ACTION:

~20% reduction on CO2 emissions =>

~ 380 ton CO2/year/ ship

~ 200.000 ton/year for relevant short sea fleet (~500 ships)

BUSINESS CASE SHIPOWNER: INVESTING OR LEASING

Several shipowners interested in eConowind-units on their vessels :
PayBackPeriod 4 ~ 6 years
(on fuel only … &CO2 &NOx &image)

Production starting Q2 2019

Proposals for purchase/hire/lease

Let eConowind support your emission targets !

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Wind Assisted Ship propulsion

THANK YOU ! QUESTIONS?

BY CONOSHIP INTERNATIONAL