

HARVESTING ENERGY WHILE SAILING

ARE DIESEL GENERATORS OBSOLETE?

STI Conference - A Coruña - Nov 2024



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Naval Architect
Thomas@dykstra-na.nl

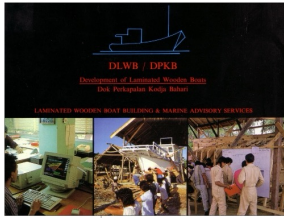


DYKSTRA

NAVAL ARCHITECTS

50 Years design innovation

Development of laminated wooden boats



Schooner Athena



Dynarig yacht Maltese Falcon



STV Shabab Oman



The Team



Founded in 1969
by
Gerard Dijkstra

OSTAR on sy Bestevoer



Laminated wooden boat building



Schooner ADIX



Schooner Windrose



Ketch Hetairas



Dynarig yacht Black Pearl



1970

1975

1980

1985

1990

1995

2000

2005

2010

2015

2020

Thys Nikkels becomes CEO

Mark Leslie-Miller becomes a Partner



OSTAR on sy Second Life



Spice race on sy Flying Wilma



J class Yacht Endeavour



Clipper Stad Amsterdam



J Class yacht Hanuman



The Polar explorer Nanuq



Whitbread round the world race on sy Flyer



Schooner Adela



Greenpeace's Rainbow Warrior 3



J Class yacht Rainbow



Schooner Sea Eagle II

Disciplines

Naval architecture

Hull lines optimization

Towing tank testing

In house CFD

Appendage positioning

Sail plan optimization

Wind tunnel testing

In house CFD

Sail handling design/arrangement

Load case definitions

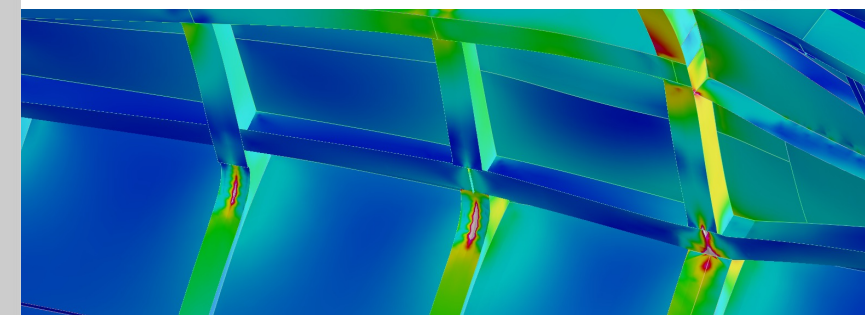
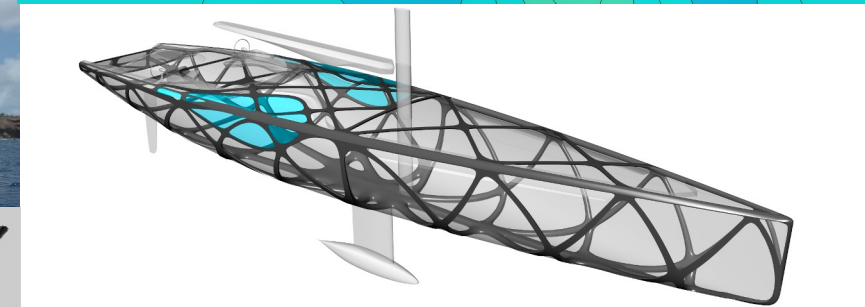
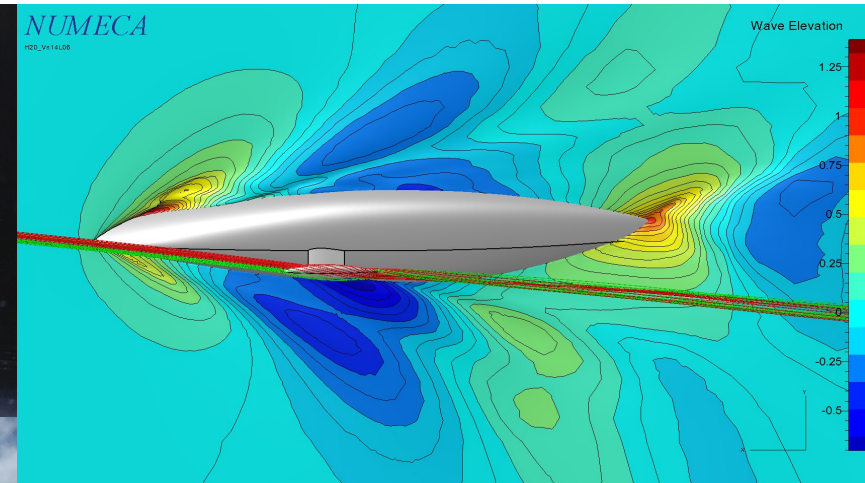
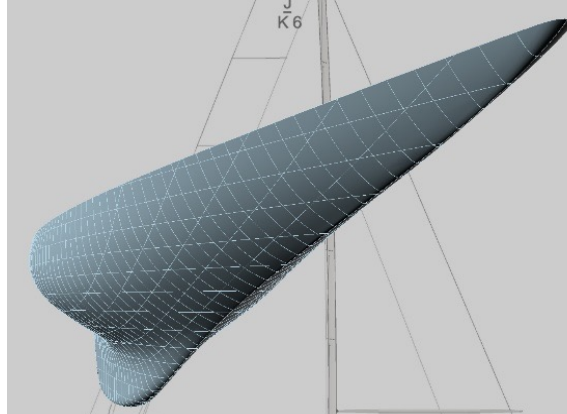
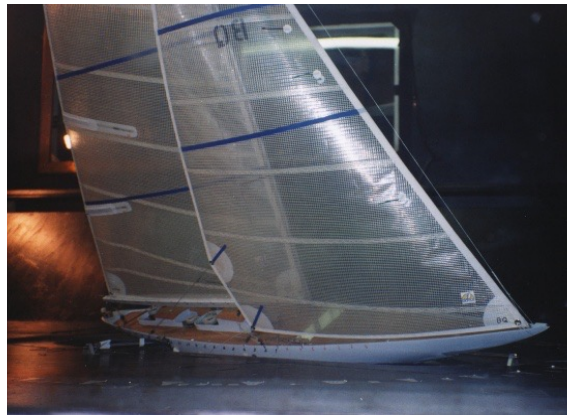
Deck lay-out

Structural design

In house FEM

General arrangement

Exterior design & styling



DISCIPLINES

DYKSTRA
NAVAL ARCHITECTS

Designs

Cruising yachts

J class yachts

Big Class Yachts

Square rigged ships

Miscellaneous

Bestevaer series

Bestevaer II

Eagle 44

Vaan catamarans



Designs

Cruising yachts

J class yachts

Big Class Yachts

Square rigged ships

Miscellaneous

Endeavour

Velsheda

Shamrock V

Ranger

Hanuman

Rainbow

Yankee



Designs

Cruising yachts

J class yachts

Big Class Yachts

Square rigged ships

Miscellaneous

Action	Hetairos
Adix	Kamaxitha
Adela	Koru
Aurelius	Maltese Falcon
Athena	Meteor
Apsara	MS Vorontsov
Aquarius	Perseverance
Borkumriff IV	Pumula
Black Pearl	Sea Eagle
Nyima	Windrose
Gweilo	Zenith



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Designs

Cruising yachts

J class yachts

Big Class Yachts

Square rigged ships

Miscellaneous

Stad Amsterdam

Cisne Branco

Shabab Oman II

Polang 8

Young Endeavour II



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Cruising yachts

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Rainbow Warrior III

NanuQ

Yacht Support Cat

ICE Kite

75m Greenpeace

WASP (Ecoliner)



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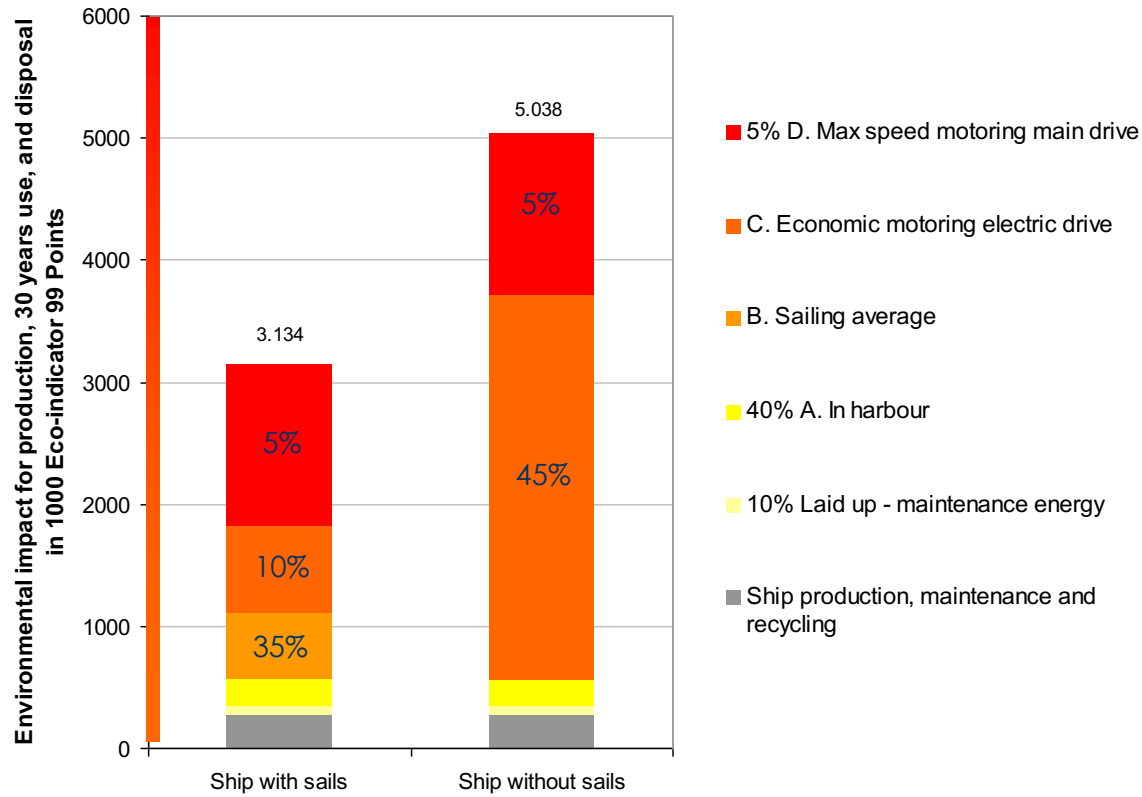




HARVESTING ENERGY WHILE SAILING

ARE DIESEL GENERATORS OBSOLETE?

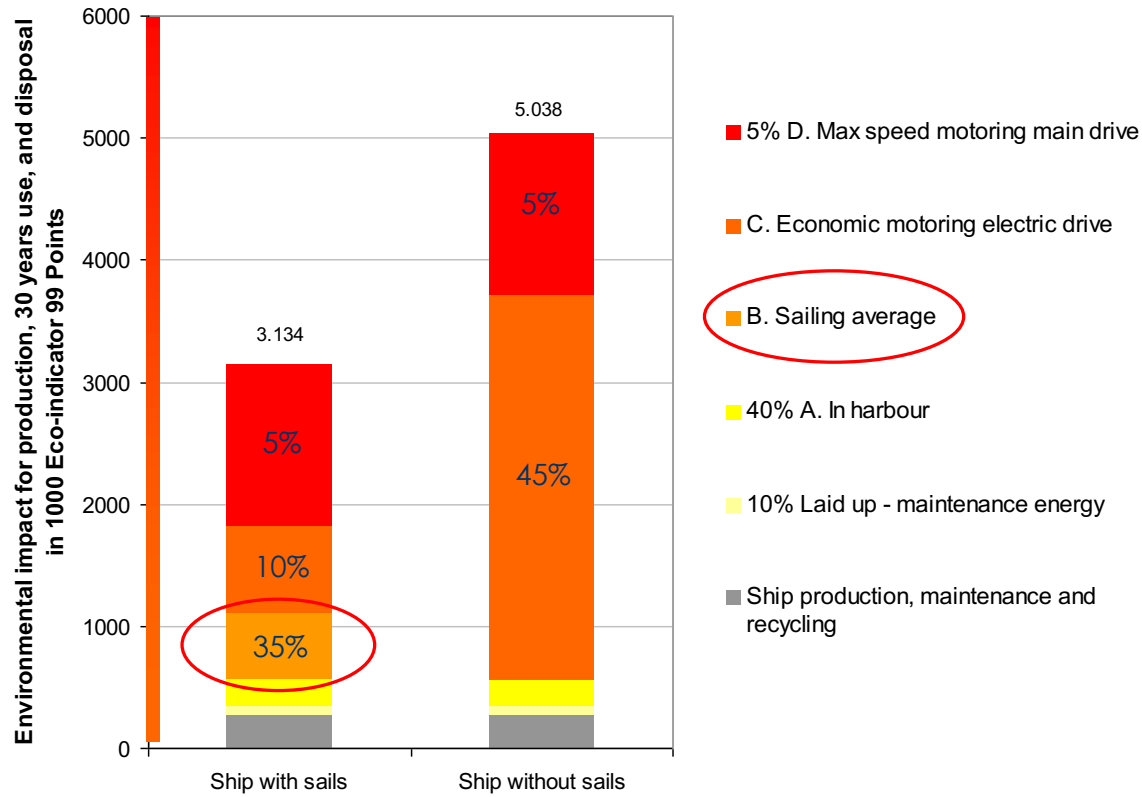
LIFE CYCLE ANALYSIS - Motor sailor vs Motor ship



Source: TNO Delft 2008

Why?

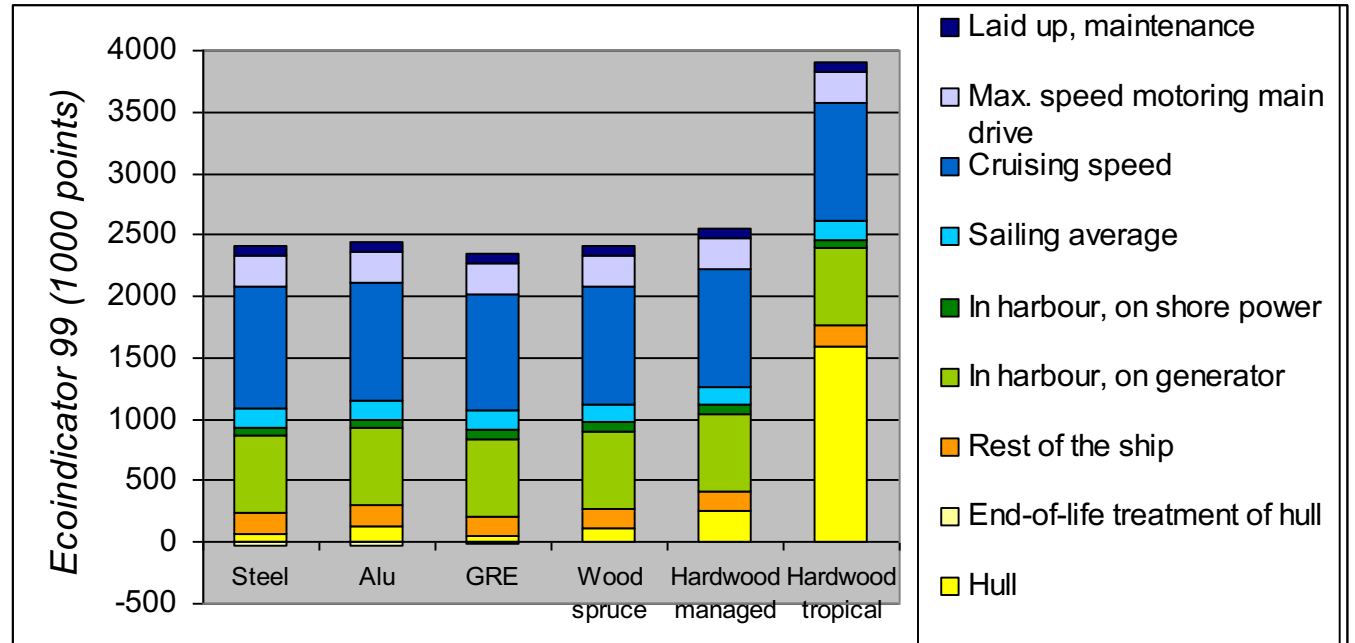
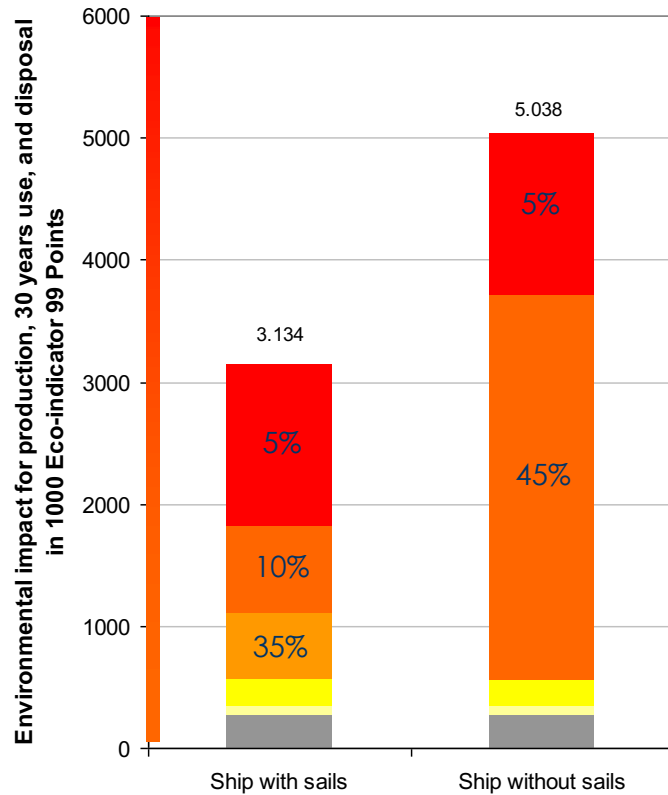
LIFE CYCLE ANALYSIS - Motor sailor vs Motor ship



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Why?

LIFE CYCLE ANALYSIS - Motor sailor vs Motor ship

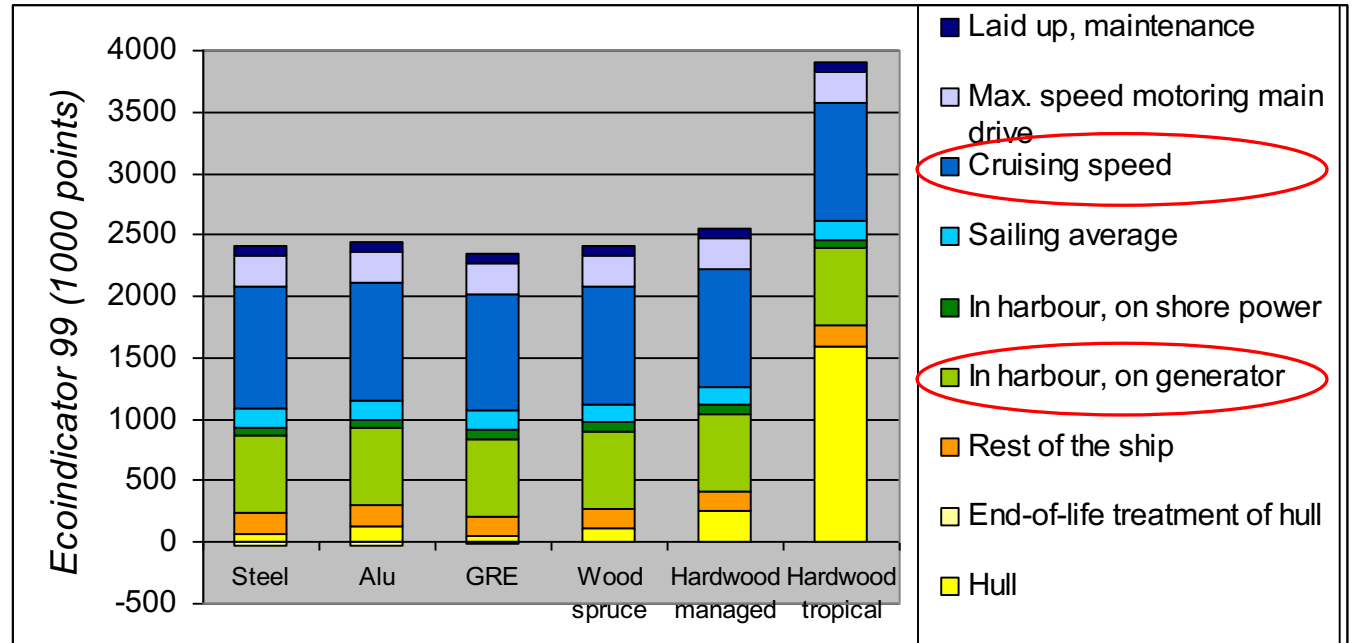
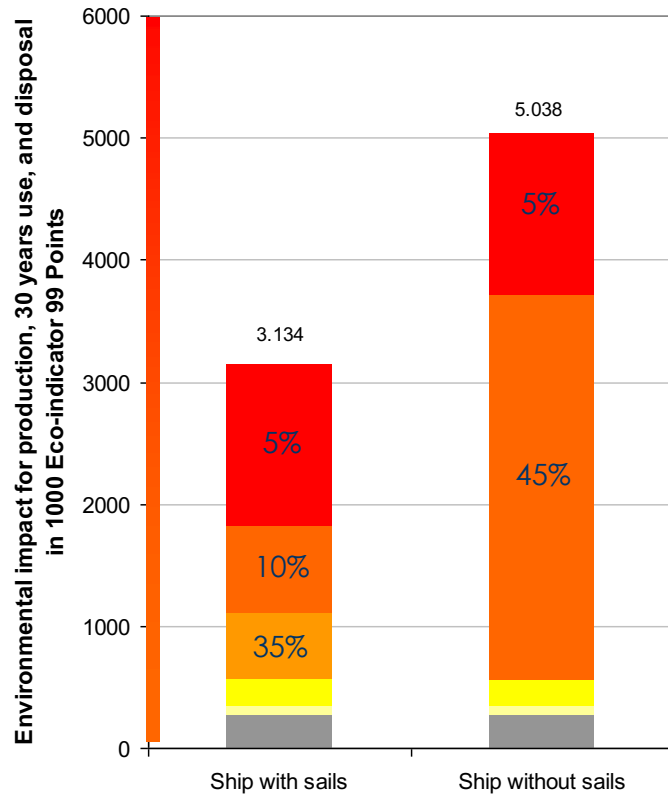


HULL MATERIALS - Steel / Aluminum / GRE / Spruce / Hardwood

Source: TNO Delft 2008

Why?

LIFE CYCLE ANALYSIS - Motor sailor vs Motor ship

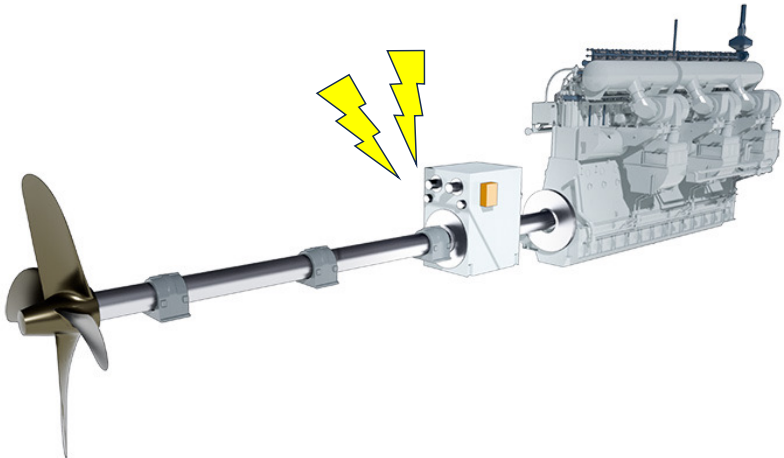
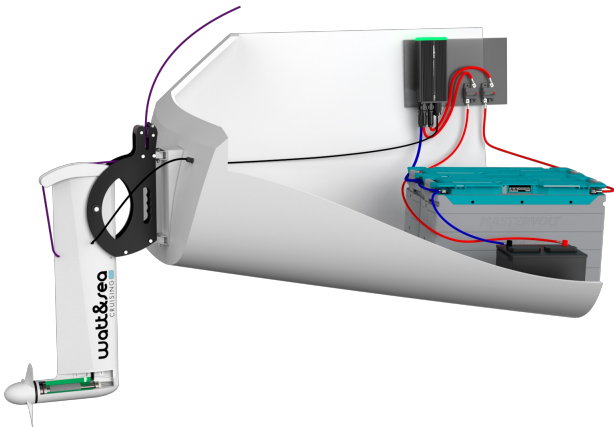


HULL MATERIALS - Steel / Aluminum / GRE / Spruce / Hardwood

Source: TNO Delft 2008

Why?

HYDRO GENERATION



What's available?

WIND GENERATION



What's available?

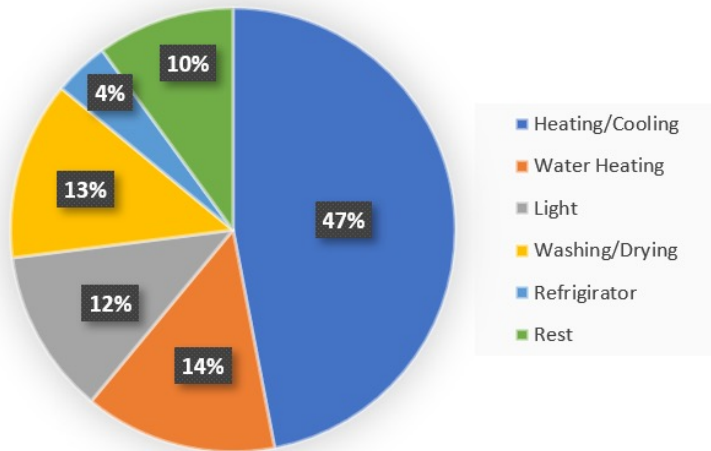
SOLAR POWER



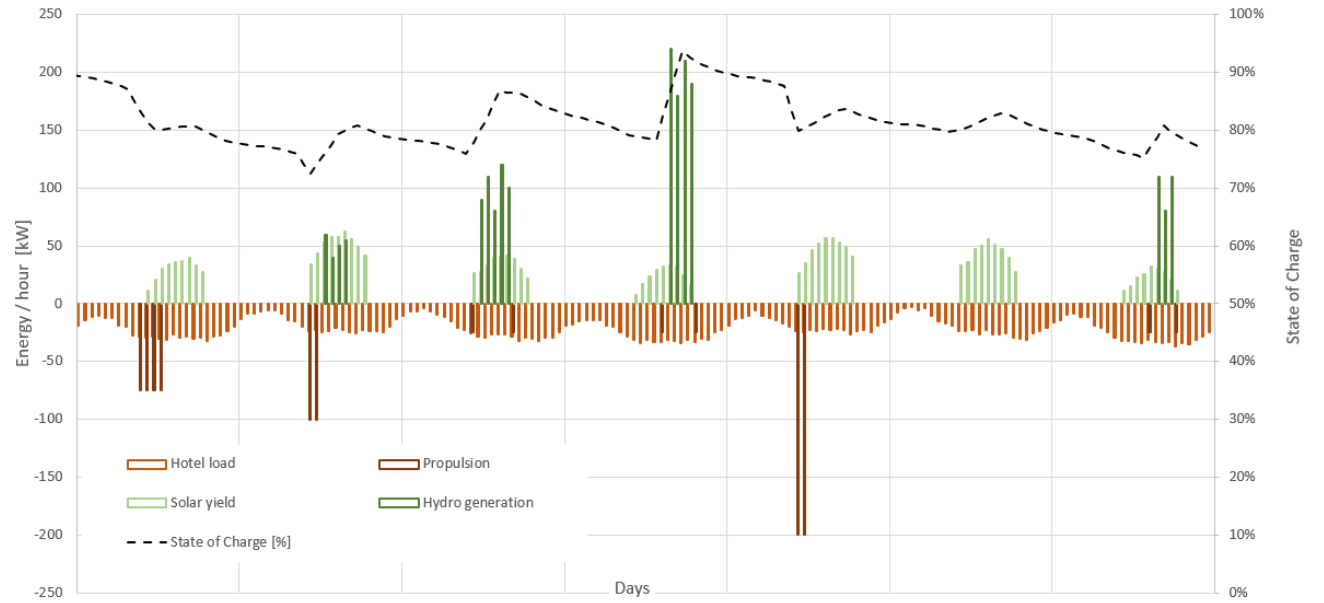
What's available?

ENERGY USE

Domestic Energy Use



ENERGY BALANCE



What's the need?



REDUCE DEMAND



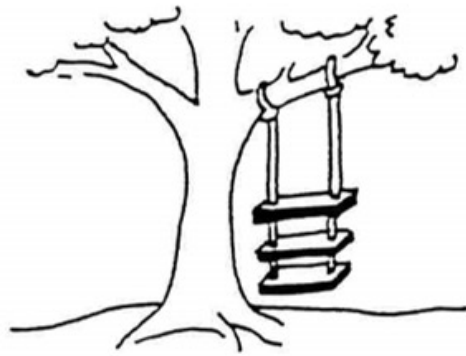
INCREASE RESOURCES

What's the need?

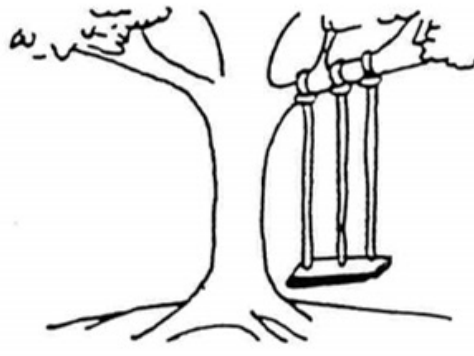


Perseverance
Black Pearl
J Class Rainbow

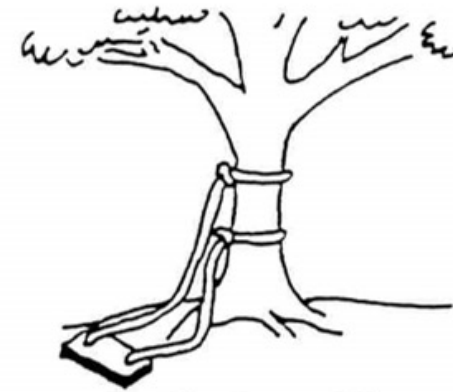
What's been done?



As proposed



As specified



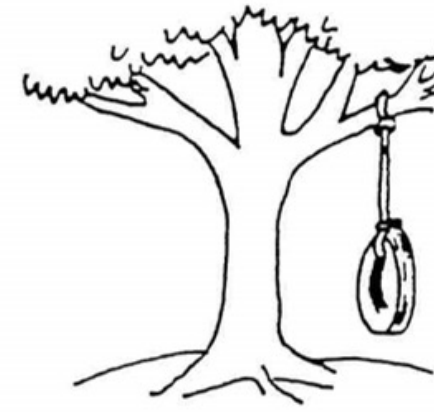
As designed



As produced



As installed



What the client needed

What can we do better?

{ Foundation° }

Shares ideas, designs, data and learnings so all may benefit as we search for solutions

www.foundationzero.org

PROJECT ZERO

Displacement	450 t	Sail area	upwind	2122 m ²	Battery package	5.0 MWh (eff 3.8MWh)
Length over all	69 m		running	3139 m ²	weight	35 t
Draft lifting keel	8.4 m	Electric propulsion		650 kW	eq MDO	900 ltrs

Project Zero

{ Foundation° }
foundationzero.org

DYKSTRA
NAVAL ARCHITECTS



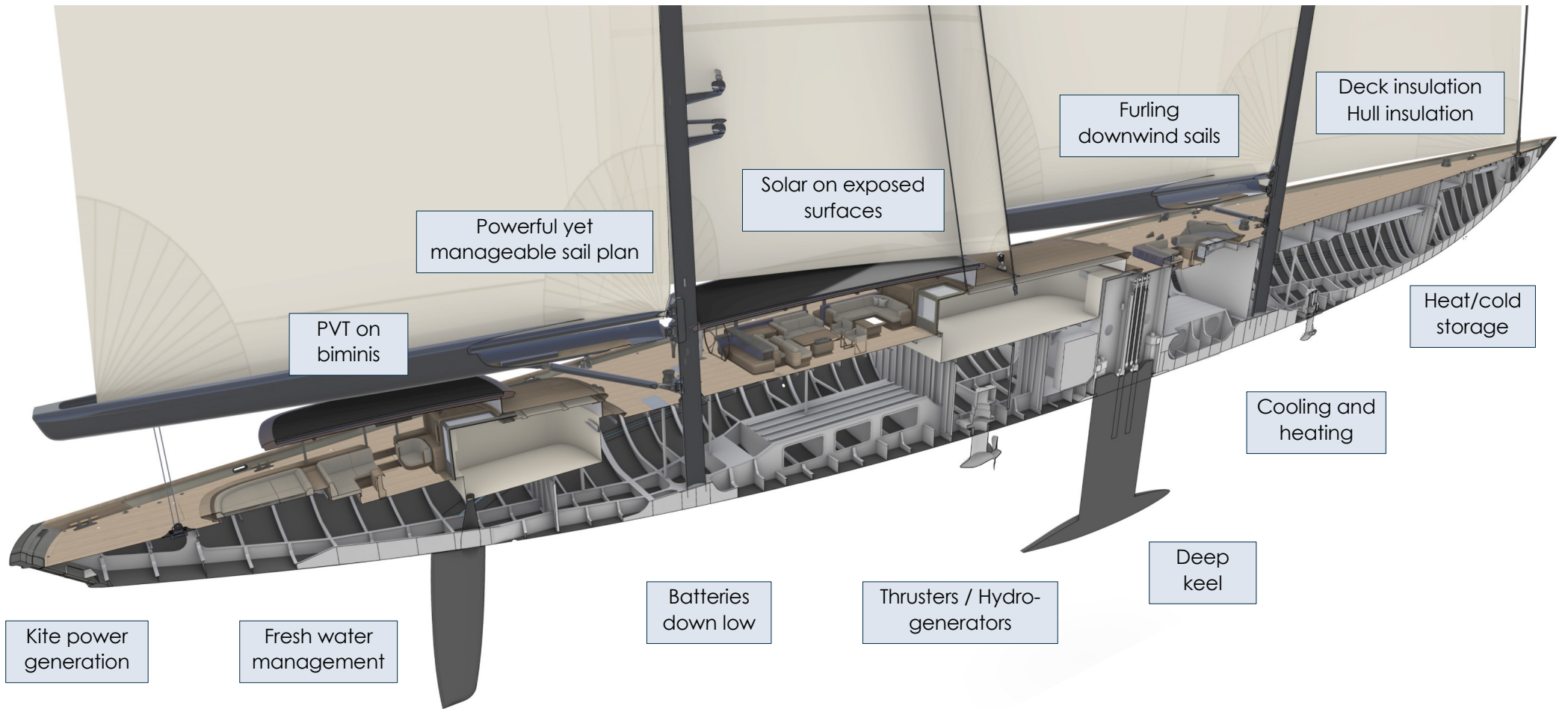
{ Foundation° }

Dykstra Naval Architects
Vripack Yacht Design
Vitters Shipyard

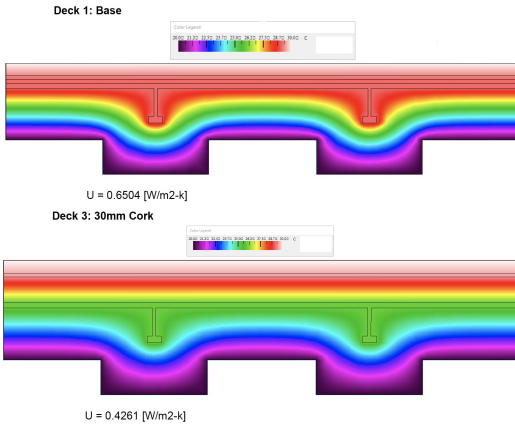
Project Zero

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foundationzero.org

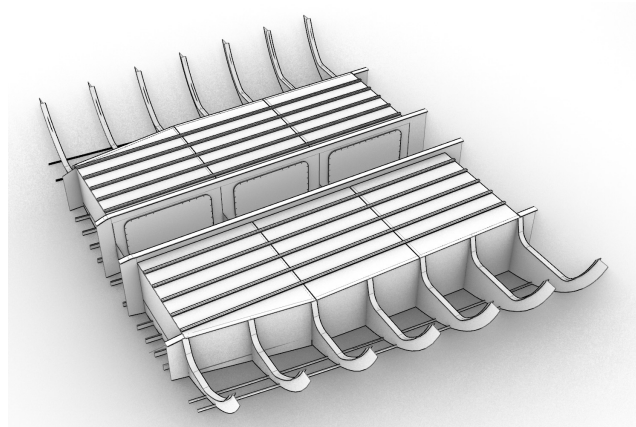
DYKSTRA
NAVAL ARCHITECTS



Deck insulation 30mm of cork



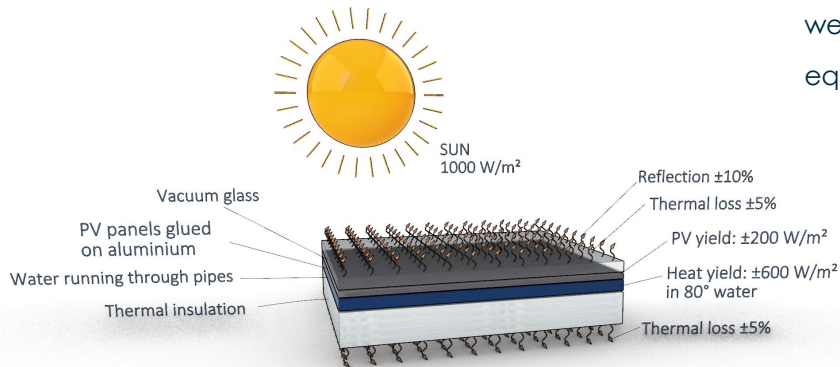
Battery bank (peak shaving)



Infrared reflective paint

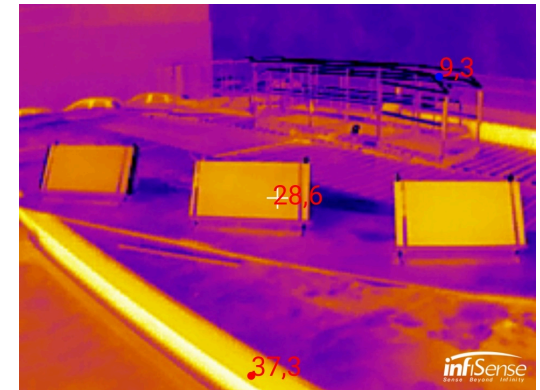


Photo Voltaic Thermal (PVT)



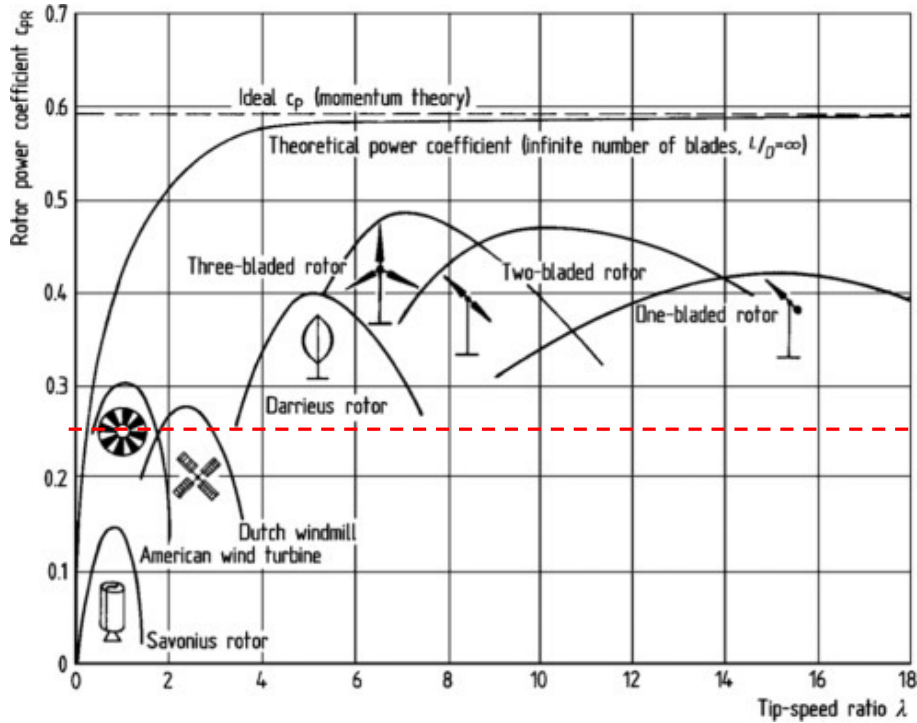
Battery capacity	5.0 MWh (eff 3.8MWh)
weight	35 t
equivalent MDO	900 ltrs

AVERAGE CONSUMPTION
DOWN TO 480 kWh / DAY



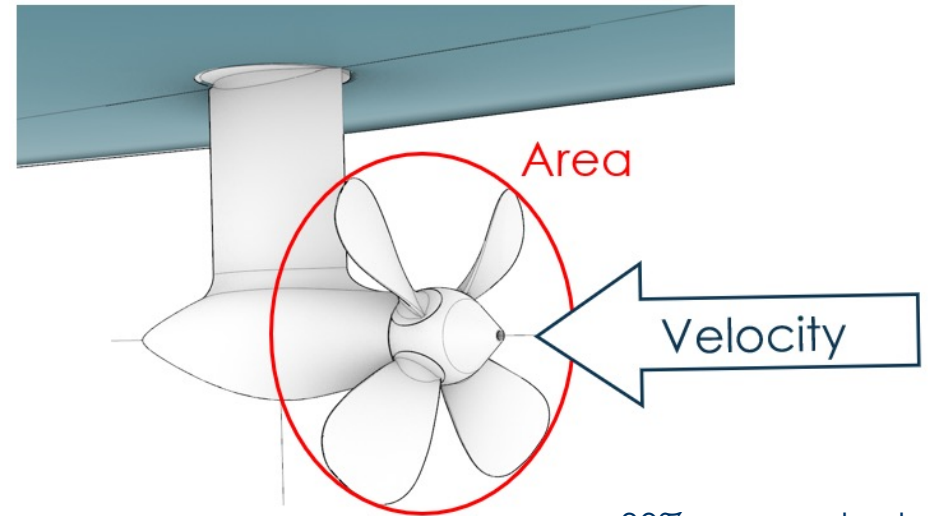
What's the use of it?

HYDRO GENERATION

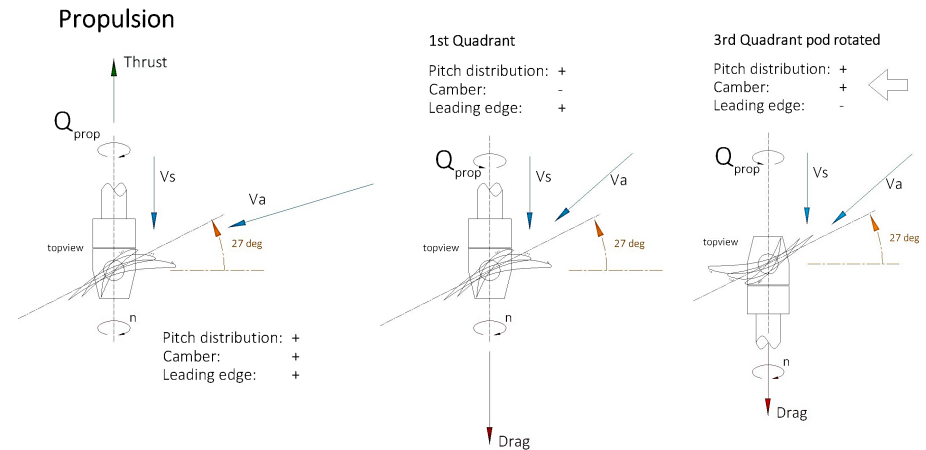


BETZ'S LAW

Indicated the max power that can be extracted from flowing medium by means of a rotor

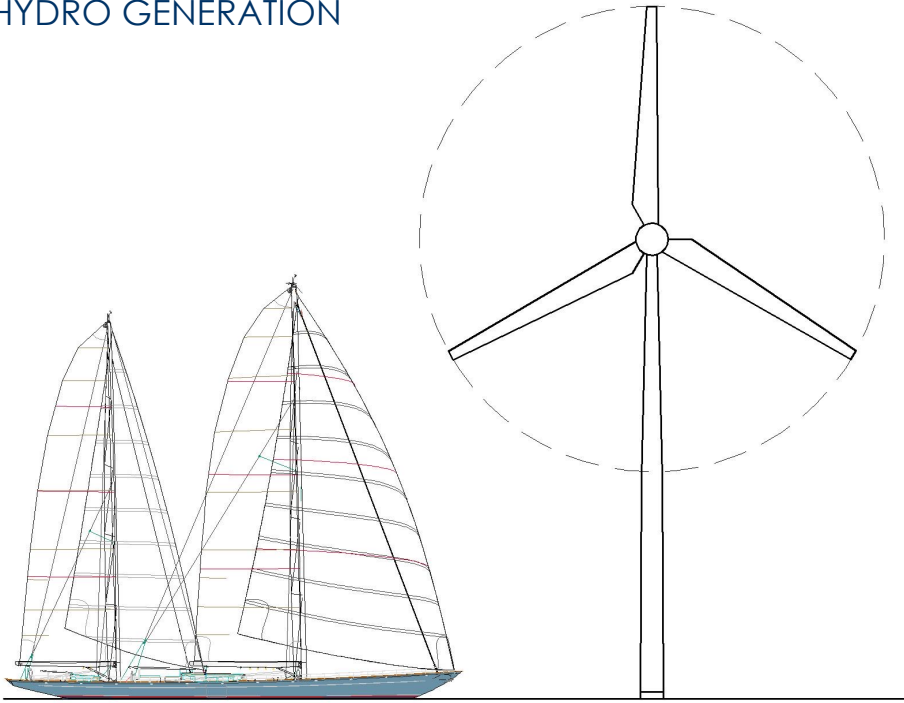


30% more output

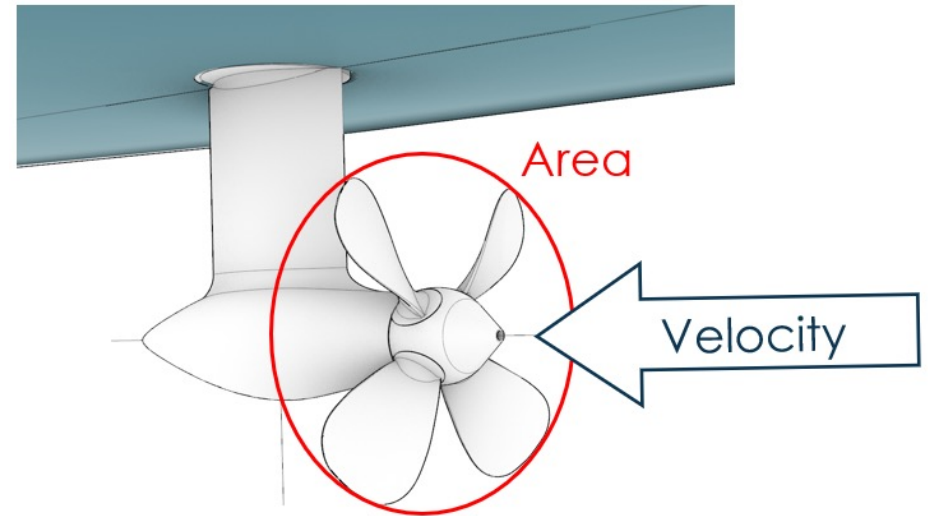


What's the use of it?

HYDRO GENERATION



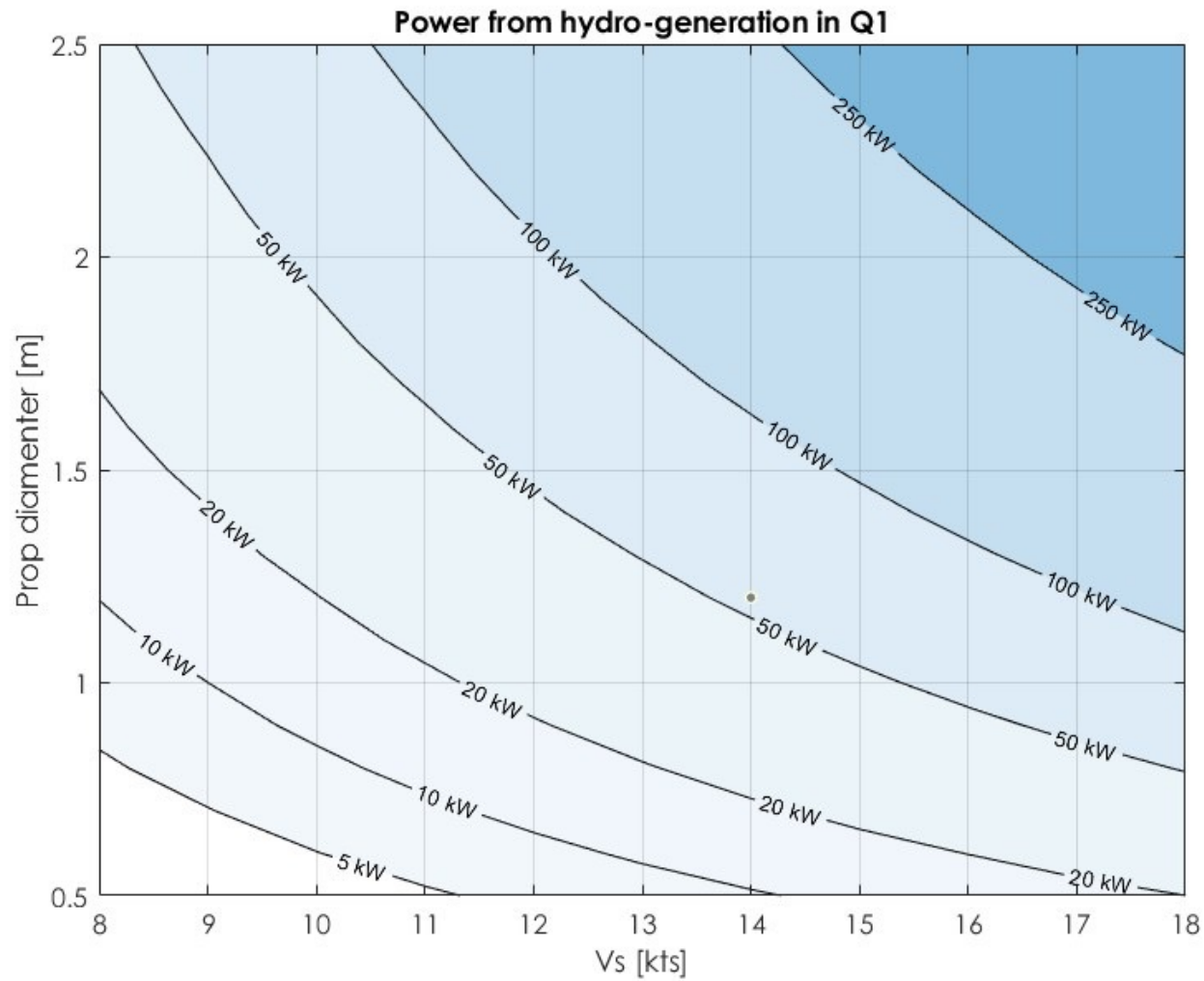
Same potential as a 1.5MW wind turbine



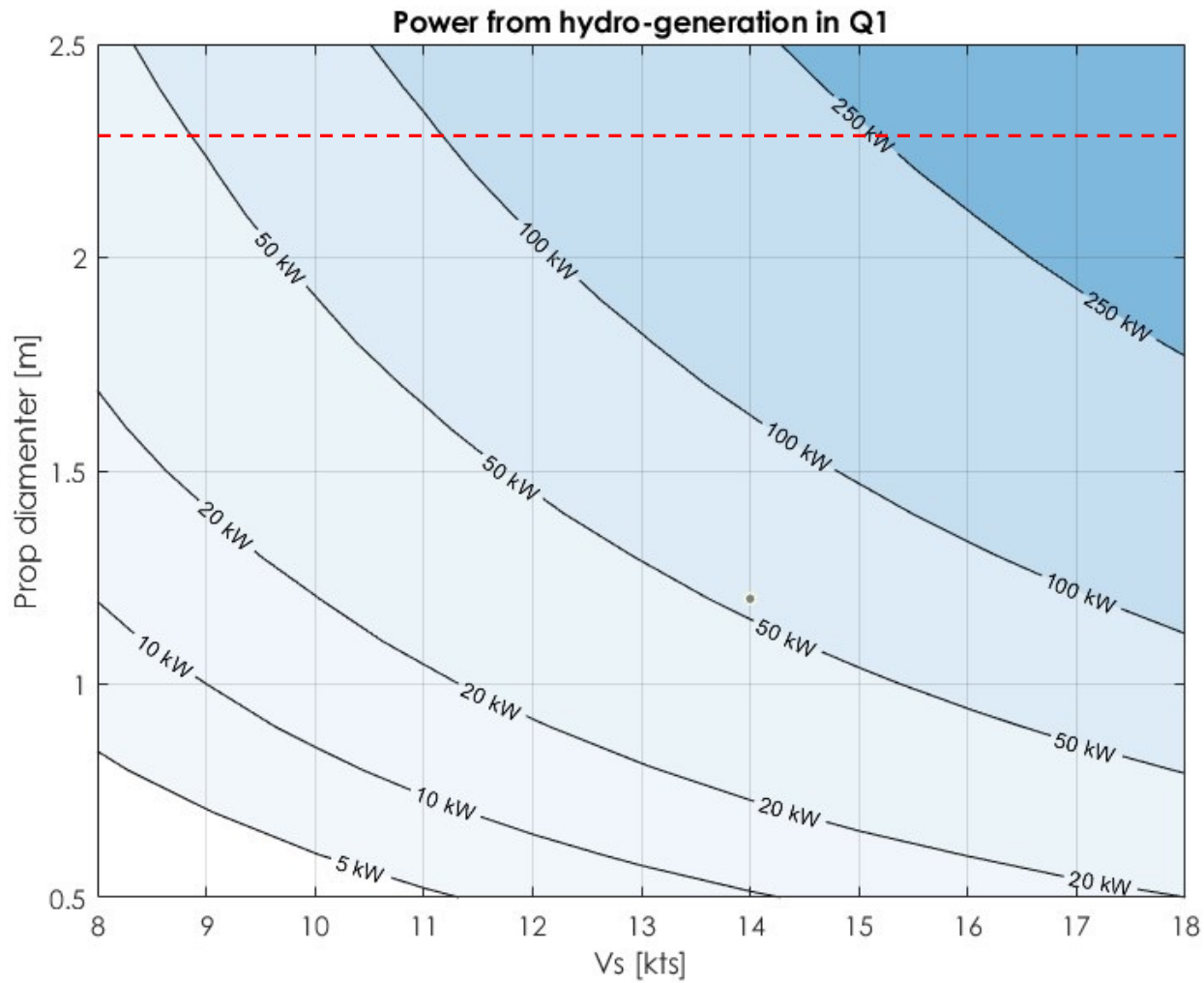
2x CPP Propellers Azimuth thrusters



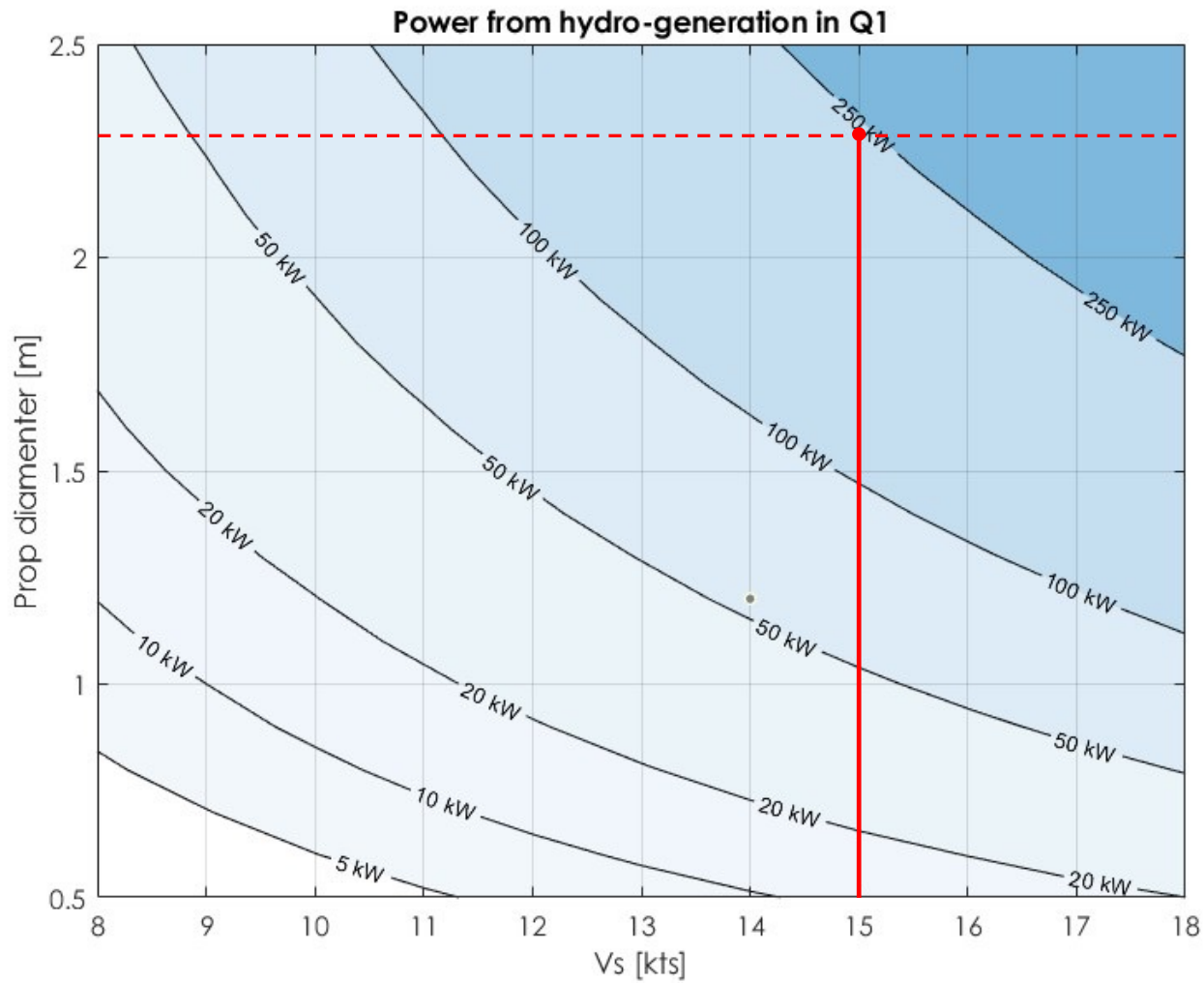
What's the use of it?



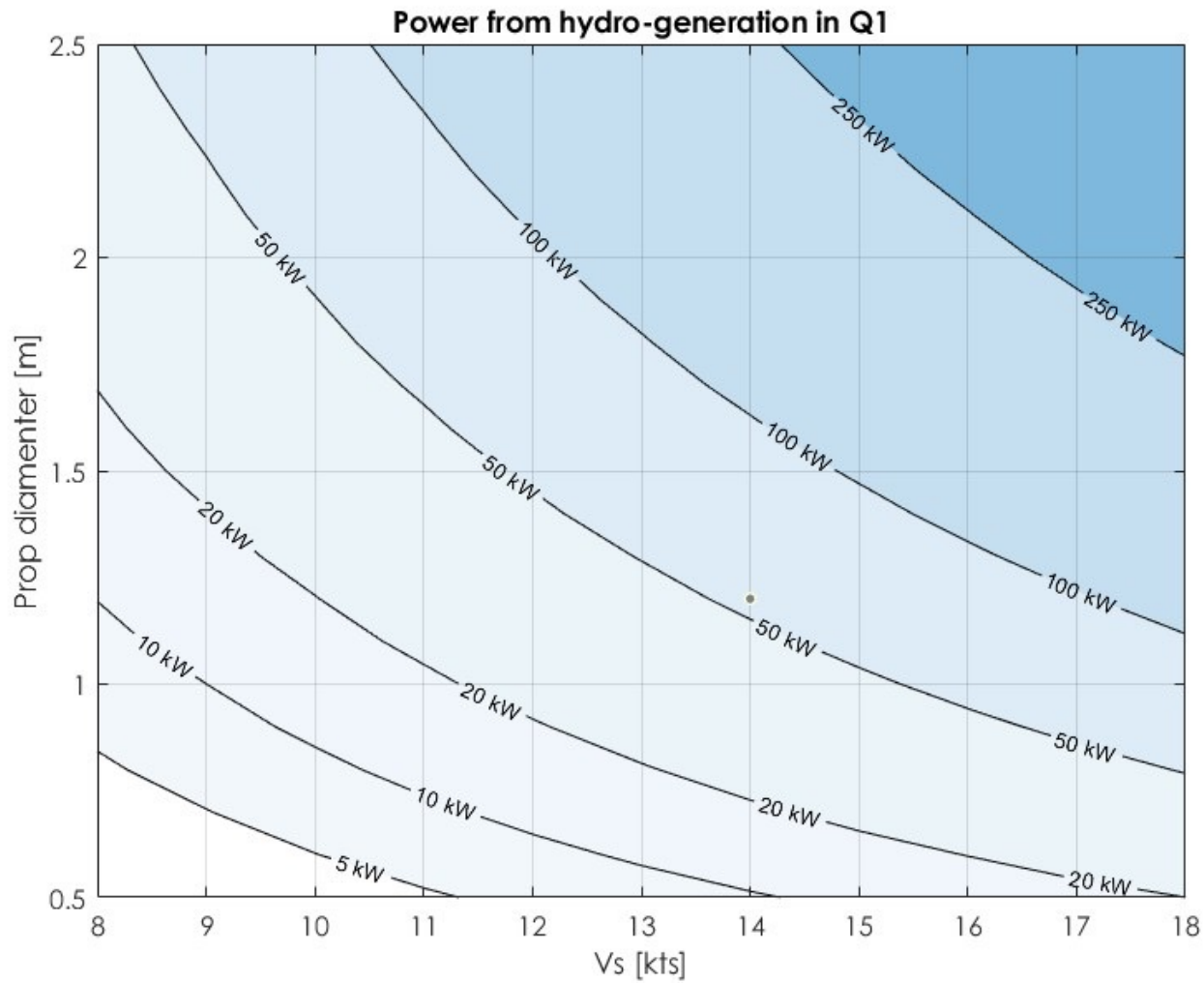
In practice



In practice

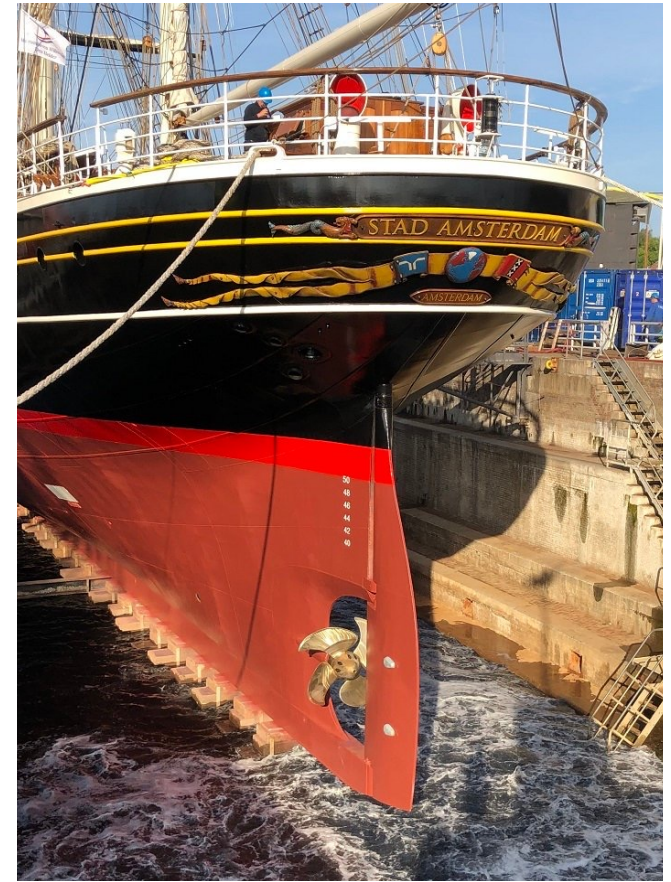
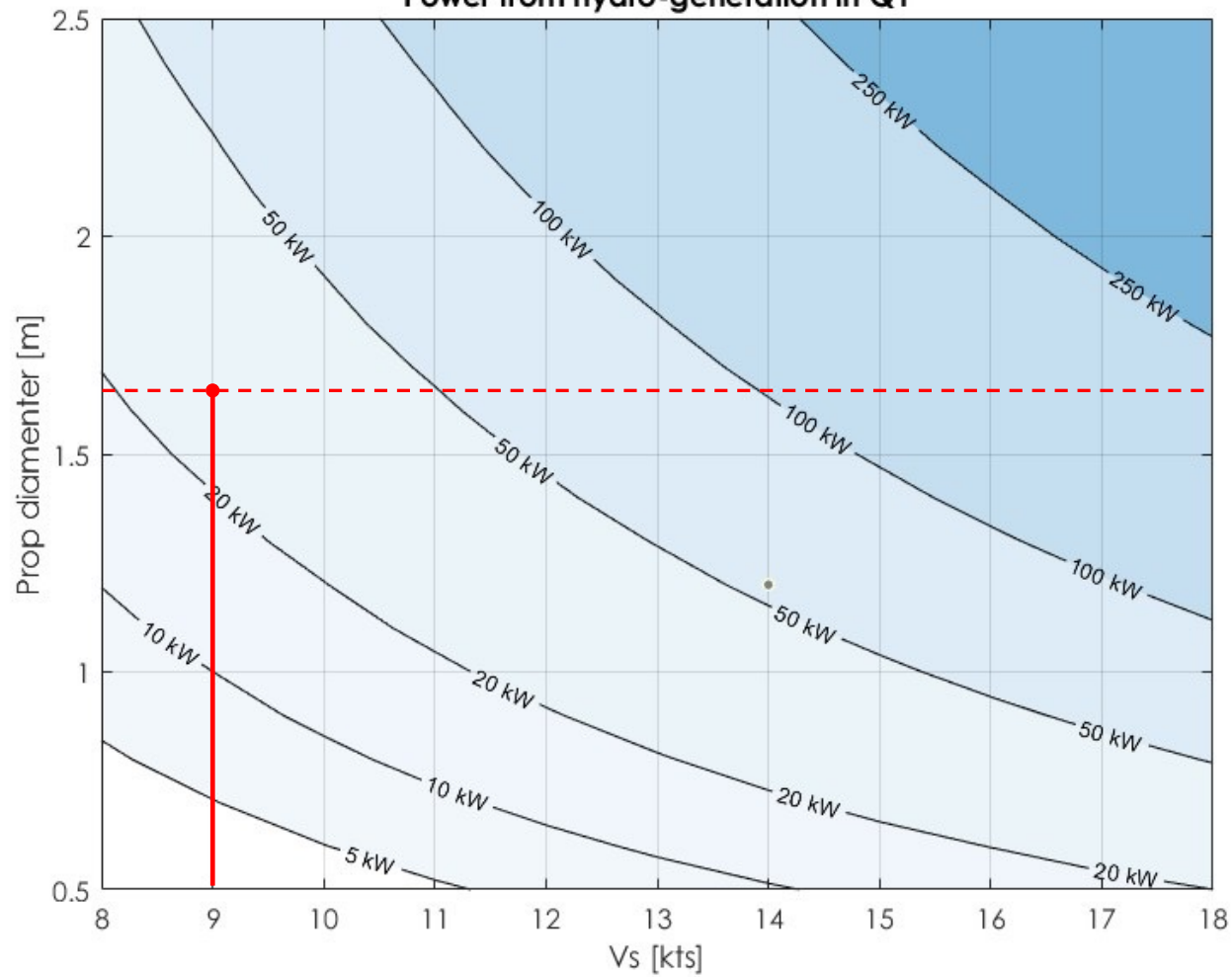


In practice



In practice

Power from hydro-generation in Q1



In practice



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