HYDROWAVE

FUEL FOR THE FUTURE

Industrialization of wave power by
hybrids and multi-purpose-solutions

Geir Arne Solheim,
CEO HydroWave AS

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I don’t want to make a product.
I want to make a difference!

- Geir Arne Solheim, inventor

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European technology consortium

European A-team research consortium to optimize efficiency on the H-WEC-based wave power technology with start late 2017.

Partners:

EDP Labelec (PT)

Wave Energy Center (PT)

Kymaner (PT)

Instituto Superior Técnico (PT)

Ghent University (BE)

Aalborg University (Denmark)

SINTEF / Marintek (NO)

Stadyard (NO)

Havkraft (NO)

Global Maritime Consultants (NO)

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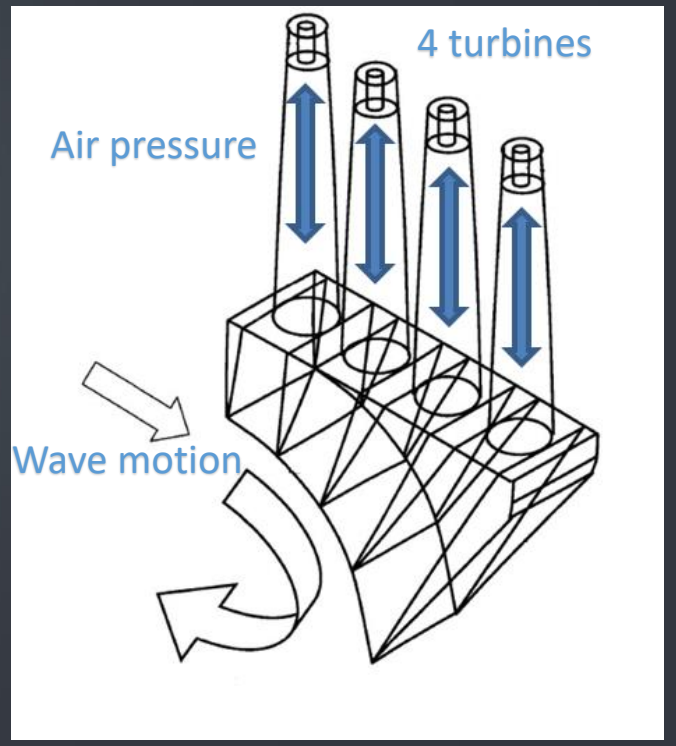
Havkraft Wave energy converter (HWEC-01 Series)

Converter info - main areas of impact:

- Installed effect – 200kW (4x50kW) per unit HWEC-01 series
- 02 series with a goal to reach 350kW
- 10x3 meters from above, 7 meters deep
- Oscillating water column technology – water to air pressure energy produced with an wells turbine and top mounted generator
- Produced in steel / aluminum (HWEC-01 series)
- 4 x 55kW Generators
- 4 x Wells Turbine
- Tested over 2000 hours with no failure
- Zero components in direct contact with water, **only 4 movable parts**
- Modular, and can be implemented in any floating device that is stationary
- Cheap and mass production ready components
- Can be built in various materials if needed
- Will be competitive with wind power within few years of development



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Retrofitted fishing vessel - MS Havkraft

First and only full scale prototype (0,32 MW) in real sea environment in the world to both survive hurricanes and producing electricity offshore from 2 kW/m.

In 2015, H-WEC prototype had an endurance test, running continuously for over **2000 hours** producing electricity in the harsh and open sea environment at Stad in Sogn og Fjordane, Norway, without any stops, through storms and high waters.

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Different wave energy-technologies compared

Technology	Scalability on system <5 MW	Without movable parts in contact with sea	Real sea tests in environment <50 kW/m	Hybrid compatible	Floating compatible	Modul based/system flexible	Subsea-free in operation	Score
Oscillating Water Column	YES	YES	YES	YES	YES	YES	YES	7 of 7
Overtopping/Terminator Device	YES	YES	NO	YES	YES	NO	YES	5 of 7
Rotating Mass	NO	YES	NO	NO	YES	NO	YES	3 of 7
Point absorber	NO	NO	NO	NO	YES	YES	NO	2 of 7
Attentuator	NO	NO	NO	NO	YES	NO	YES	2 of 7
Bulge Wave	NO	NO	NO	NO	YES	NO	YES	2 of 7
Oscillating Wave Surge Converter	NO	NO	NO	NO	YES	NO	NO	1 of 7
Submerged Pressure Differential	NO	NO	NO	NO	NO	NO	NO	0 of 7

Different OWC-technologies

Technology	Scalability on system <5 MW	Without movable parts in contact with sea	Real sea tests in environment <50 kW/m	Hybrid compatible	Floating compatible	Modul based/system flexible	Subsea-free in operation	Score
Havkraft Wave Energy Converter	YES	YES	YES	YES	YES	YES	YES	7 of 7
OceanLinx	NO	YES	NO	YES	YES		YES	4 of 7
Pico Plant	YES	YES	NO	YES	NO	NO	YES	4 of 7
LIMPET	YES	YES	NO	YES	NO	NO	YES	4 of 7

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THE CONSEPTS

Since We have an modular and flexible systems, the H-WEC can be implemented into various installations today.

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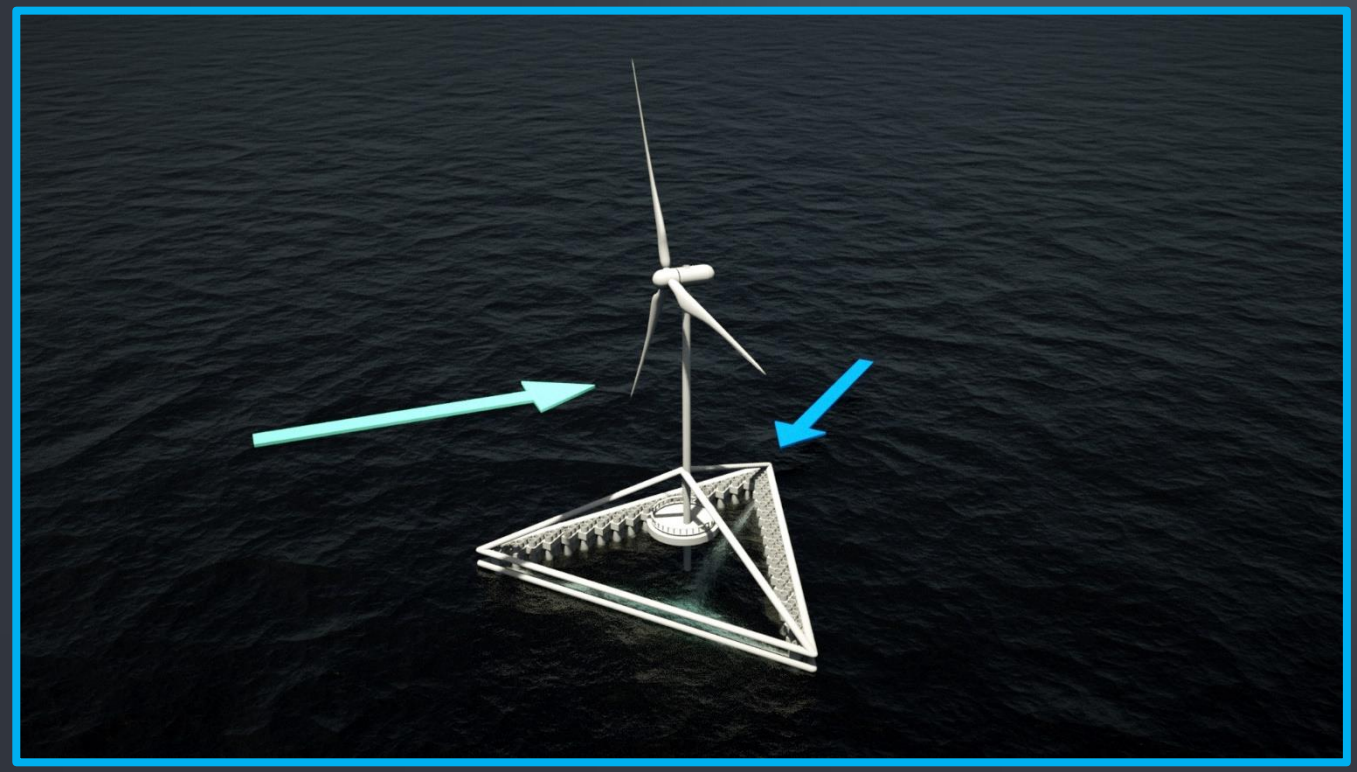
POWERPEAK™ – hybrid synergy technology (integrated with wind mill)



Hybrid systems with existing technology will increase power, lower cost and give additional value.

This is an tripod structure that can compete with high wind production.

Ideal for small industry areas, open waters with low wind potential and as an supplement to high wind.

Hybrid structures secures a synergy both in power production and in economical terms!

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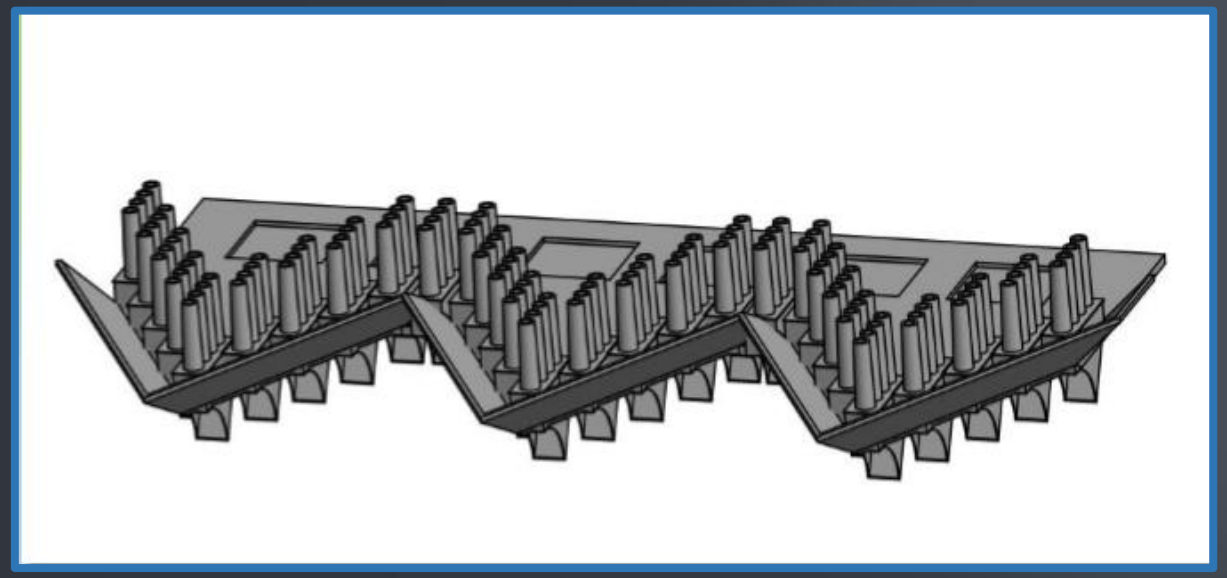
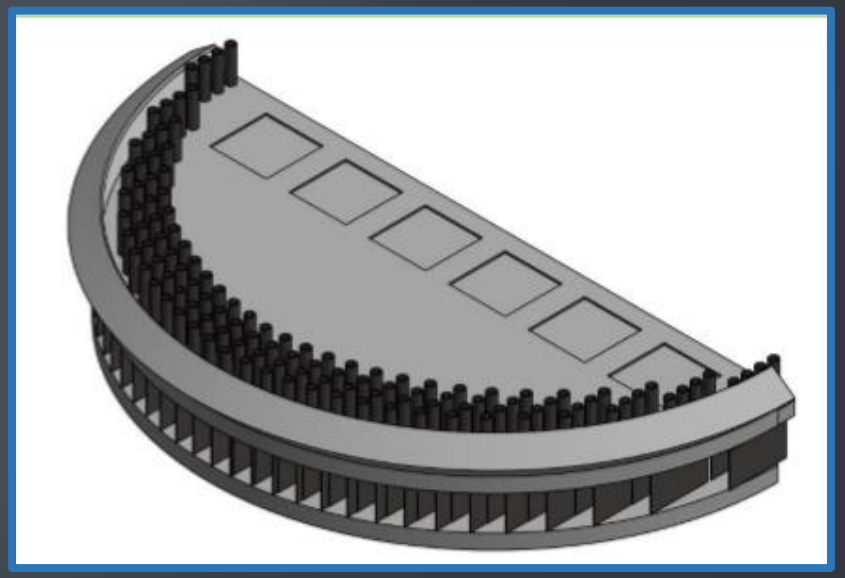
POWERPIER™ – multi purpose steel structure and concrete structure





Multi purpose products secures a competitive energy price and high return on investment! This concept is not just an functional method on shealding areas from the elements, it is an powerplant – making an large cost to an investment for the future.

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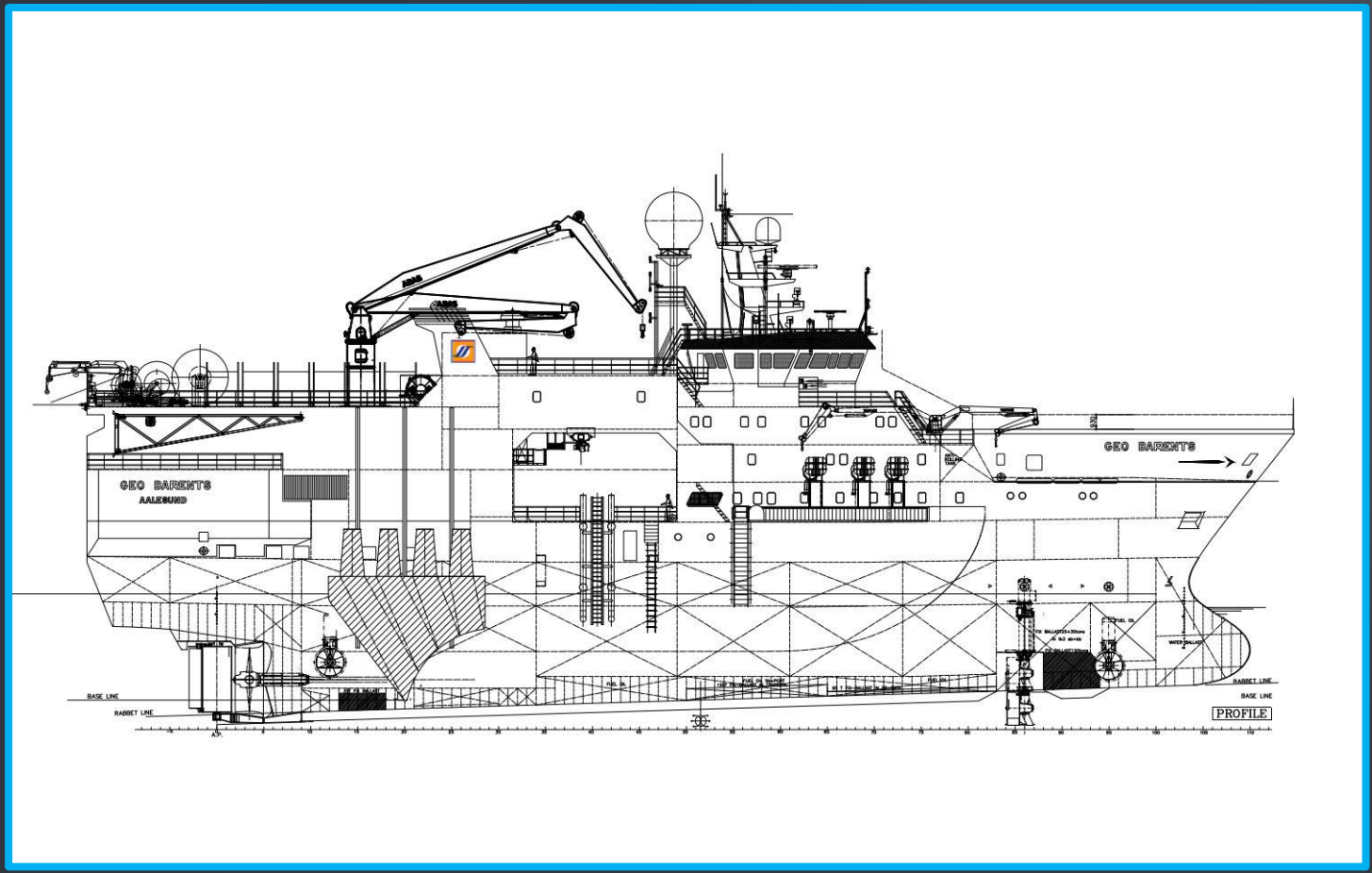
POWERSHIP™ - multi-purpose-solution by retrofit



How:

Easy plug in solutions

Use the existing power line

Optimize vessel consumption in standby

Use low cost power applications and existing power management

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Green synergy at stanby – anchouring ”mothership”

Diesel generator

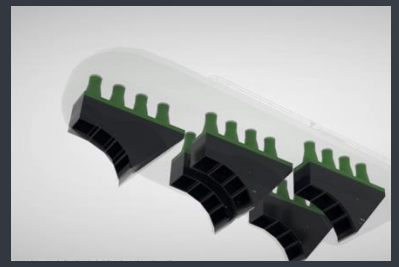
Diesel charge when energy level low. Can then operate optimal

Power distrobution

Consuption

Power storage

Battery pack charge and discharge by energy demand



Wave energy

Main energy supply 500 kWh optimal – First stage (2 converters)

Electric operational boats

Charge at mothership and windmill work location

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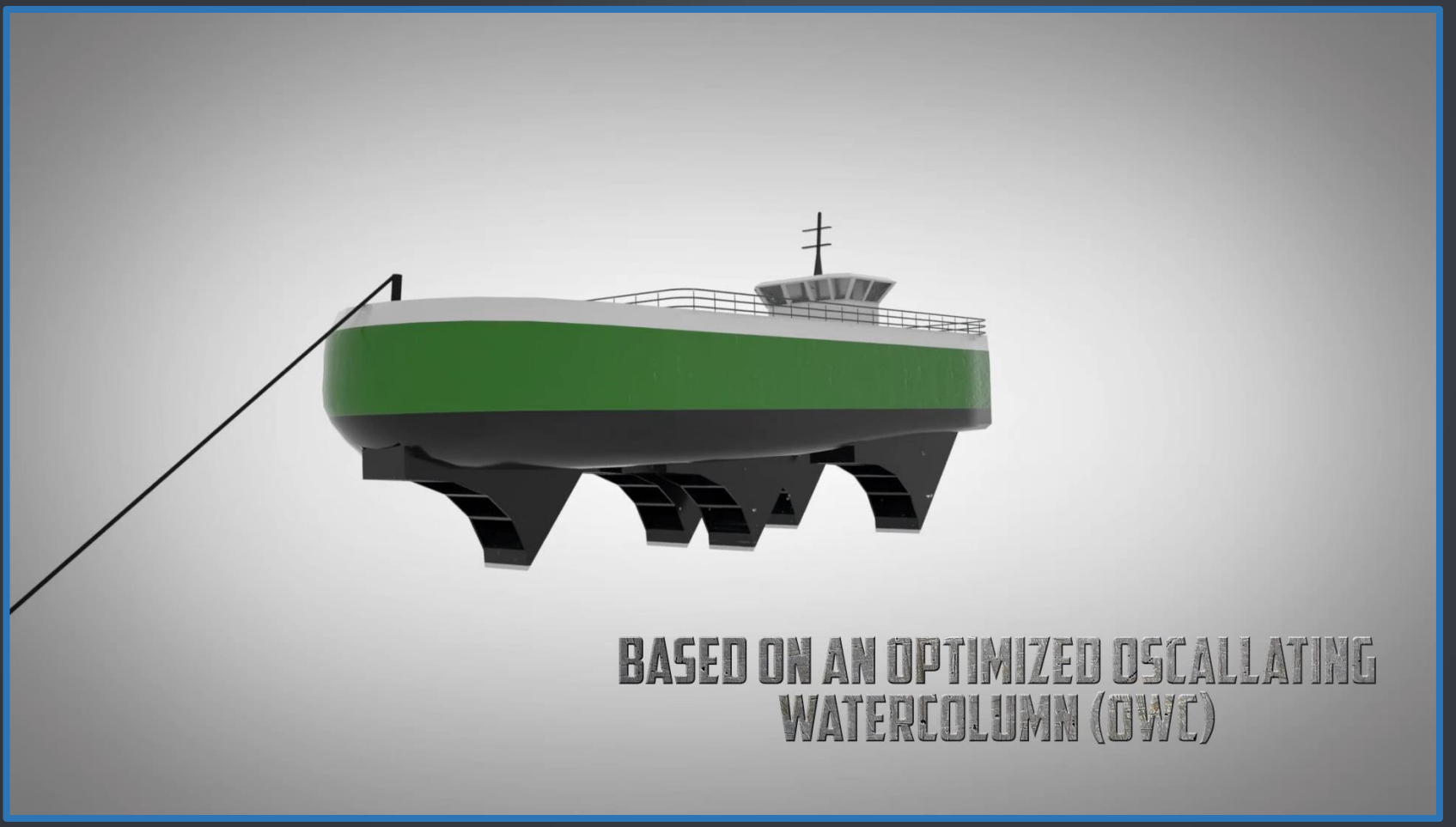

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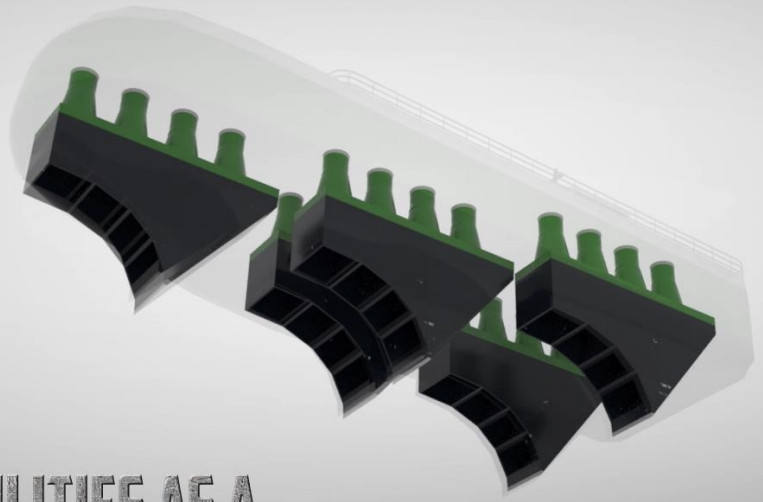

IN ADITION ABILITIES AS A POINT ABSORBER

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