



Hybrid Hype

&

The Realities of Building Green

Joe Hudspeth

Vice President of Business Development
All American Marine, Inc.

Defining Moment



- We need change
 - Past the pinnacle of diesel engine innovation
 - Foreign dependence
- Hybrid Hype and Greenwashing
 - 10 Knots or less (low horsepower or low RPM)
 - Complex & Expensive (being green takes green)
 - Cinderella Principle: individual fit
- Makes more than a “Marketable” Difference
 - Success is demonstrated through repetition

Driving Regulations



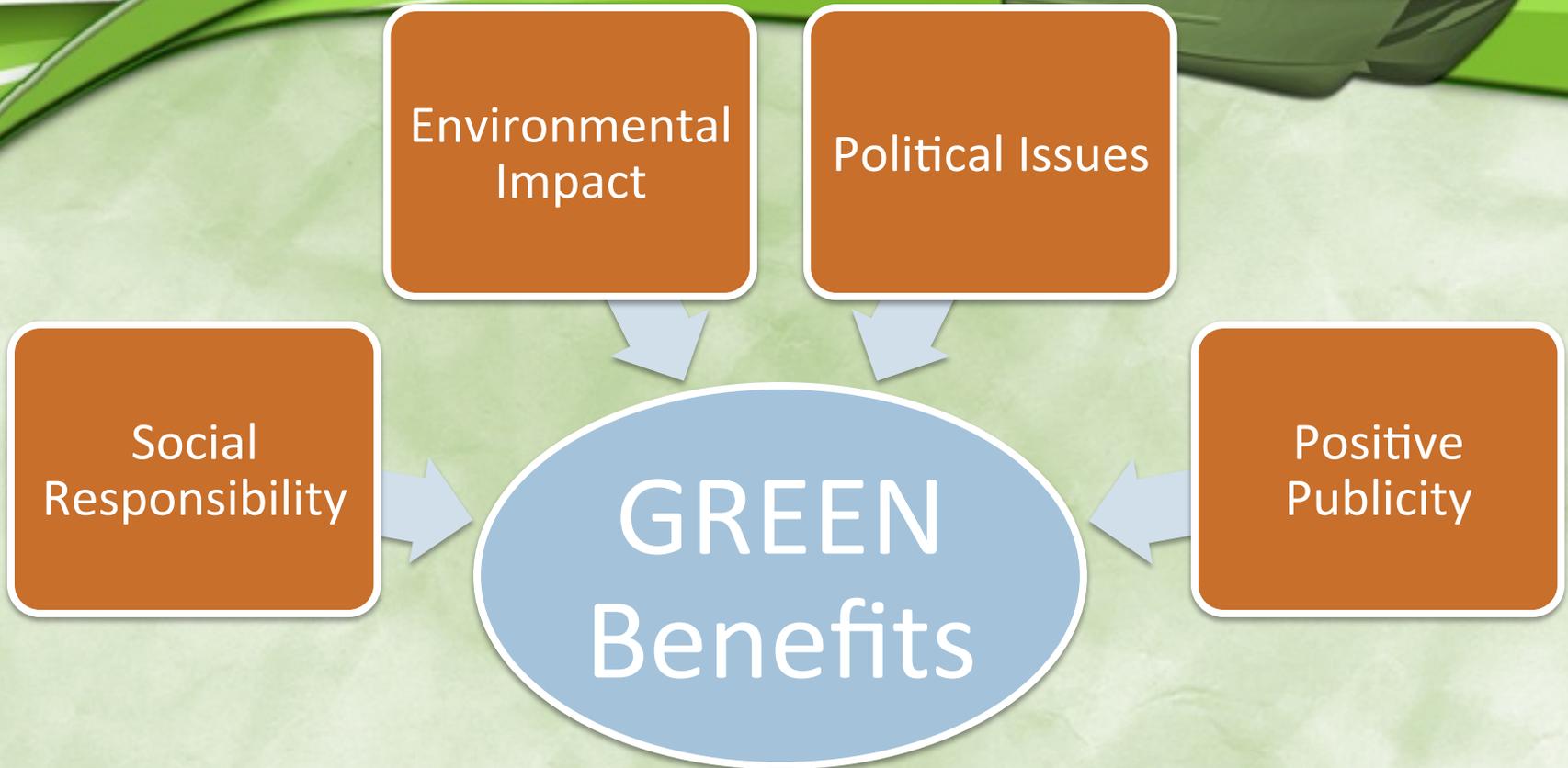
Innovation



Practical and Feasible

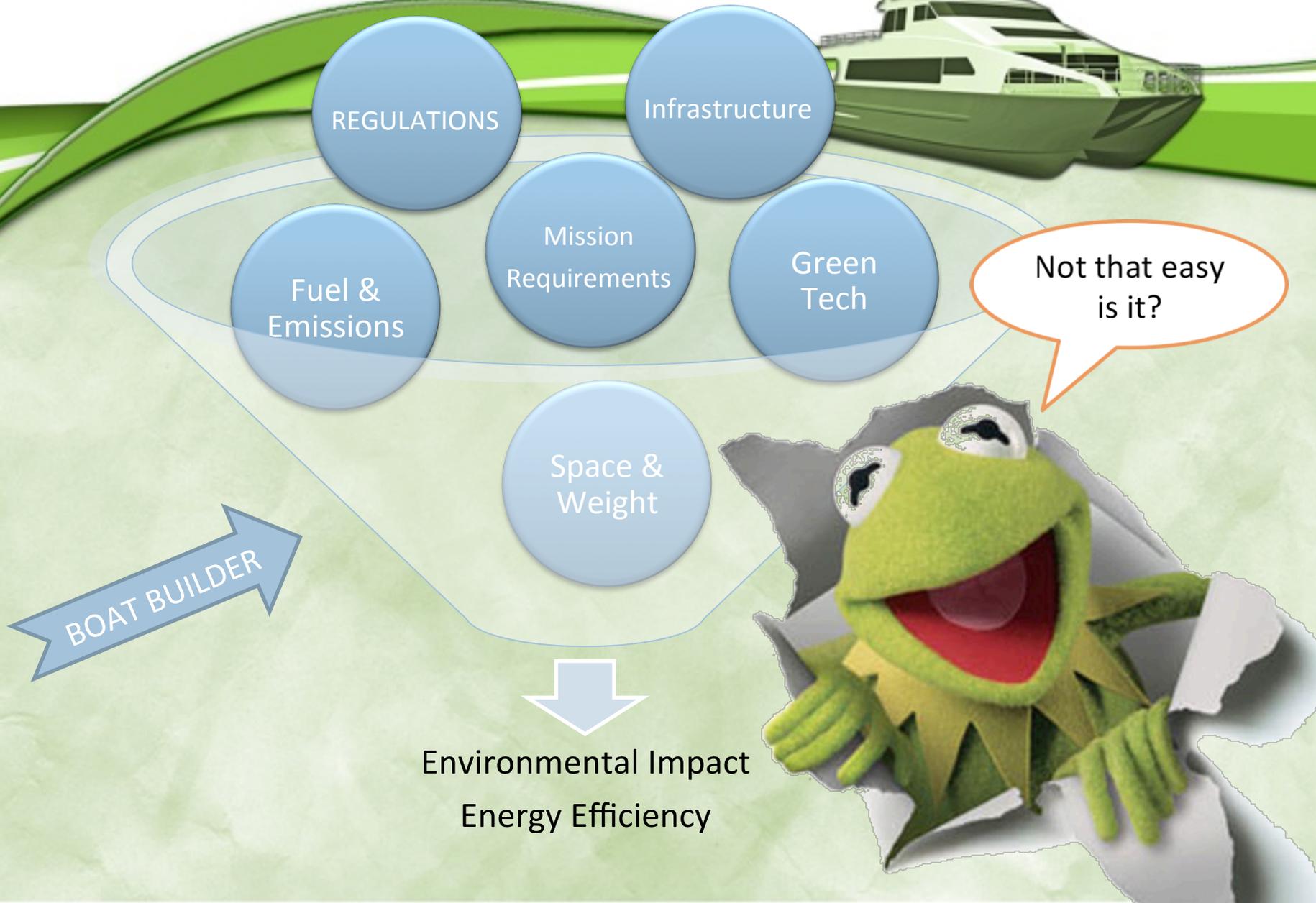
Ignorance

Why is Green Important?



~~(BOTTOM LINE)~~

Being Green



Green Research Vessels



- Regulations & Safety
 - USCG Subchapter T (recommended, not required)
 - Not encompassing of Hybrid Technology
 - Case by case
 - Lithium Ion Batteries
 - LNG
 - Hydrogen

Green Research Vessels



- Research Mission - critical
 - Hybrid Technology must be complementary
 - Solve one problem, create another
 - Speed
 - Range
 - Deck Gear / Systems

Green Research Vessels



- **Reminder: These are BOATS!**
 - **Subject to laws of physics**
 - Weight
 - Balance
 - Footprint
- **Infrastructure Requirements**
 - **Homeport vs. Away or At Sea**
 - Electrical: shore power connection
 - Fuel: LNG, Hydrogen

Green Research Vessels



- Environmental Impact
 - Set a Specific Goal - Arguable
 - Emissions
 - Fuel Burn
 - Fuel Type
 - Too Many Trade-offs & Variables
- Available Green/Hybrid Technology



What is Possible?

The Voyage of Eco-Pioneers

Foss Hybrid

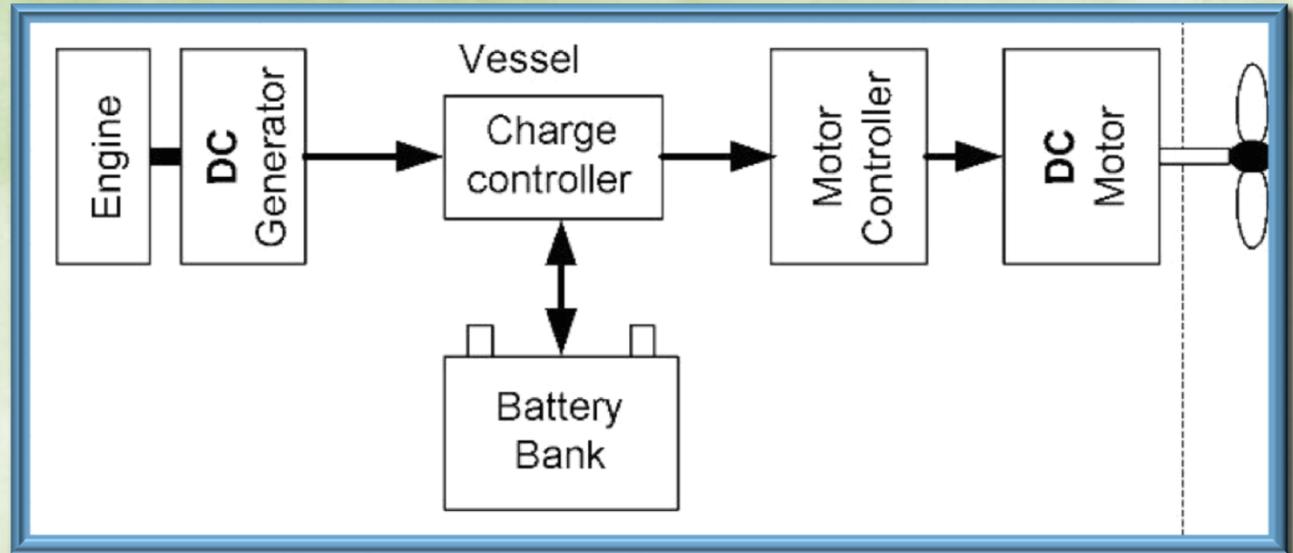
- Diesel Electric



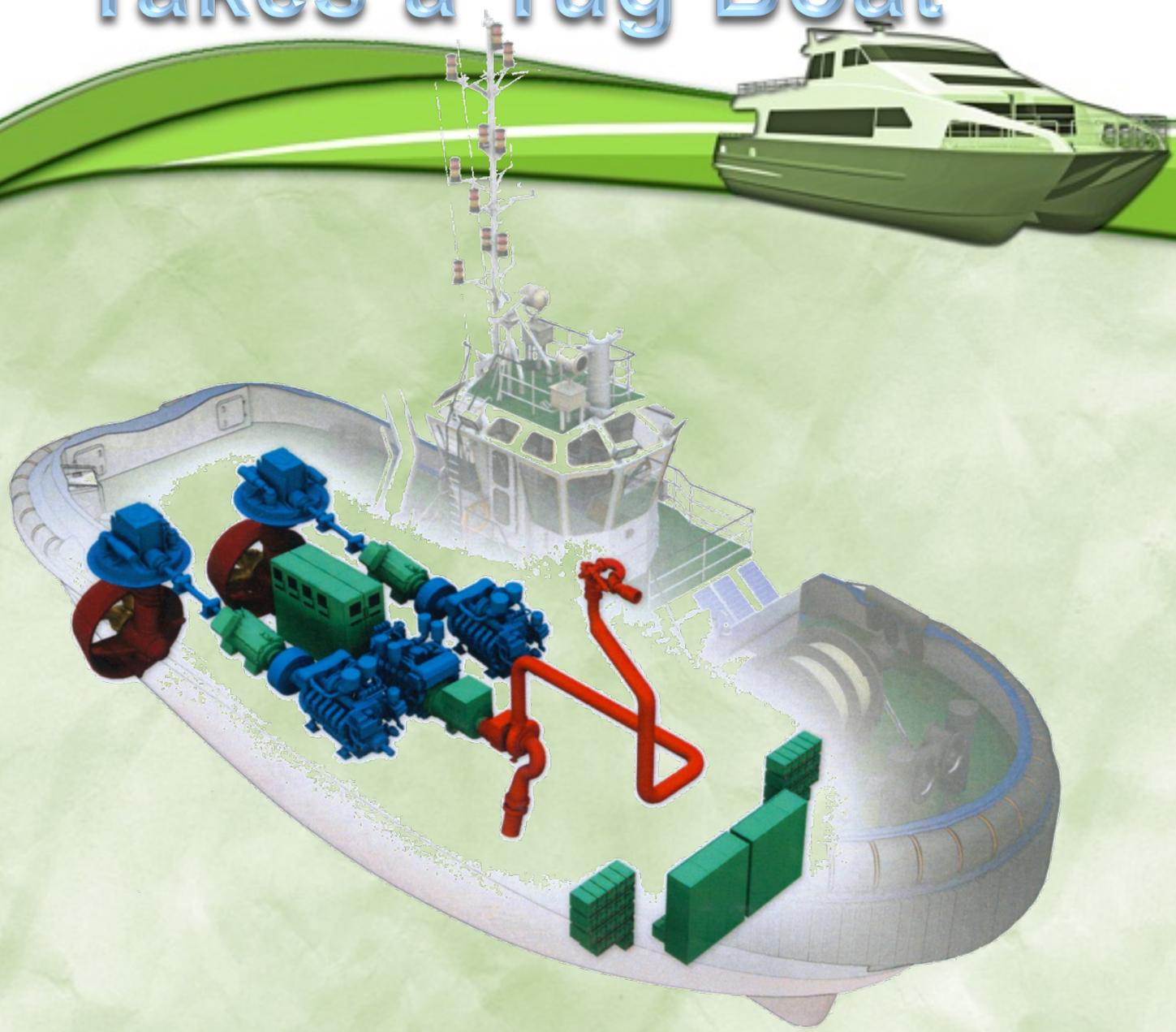
Diesel Electric



- Size and Weight
- Availability of Motors
- Battery Requirements: quantity, charge rate, voltage
- Speed



Takes a Tug Boat



Port of Los Angeles



**FOR
SALE**

- Heck with Hybrid

LNG: HARVEY ENERGY



LNG – What Gives?

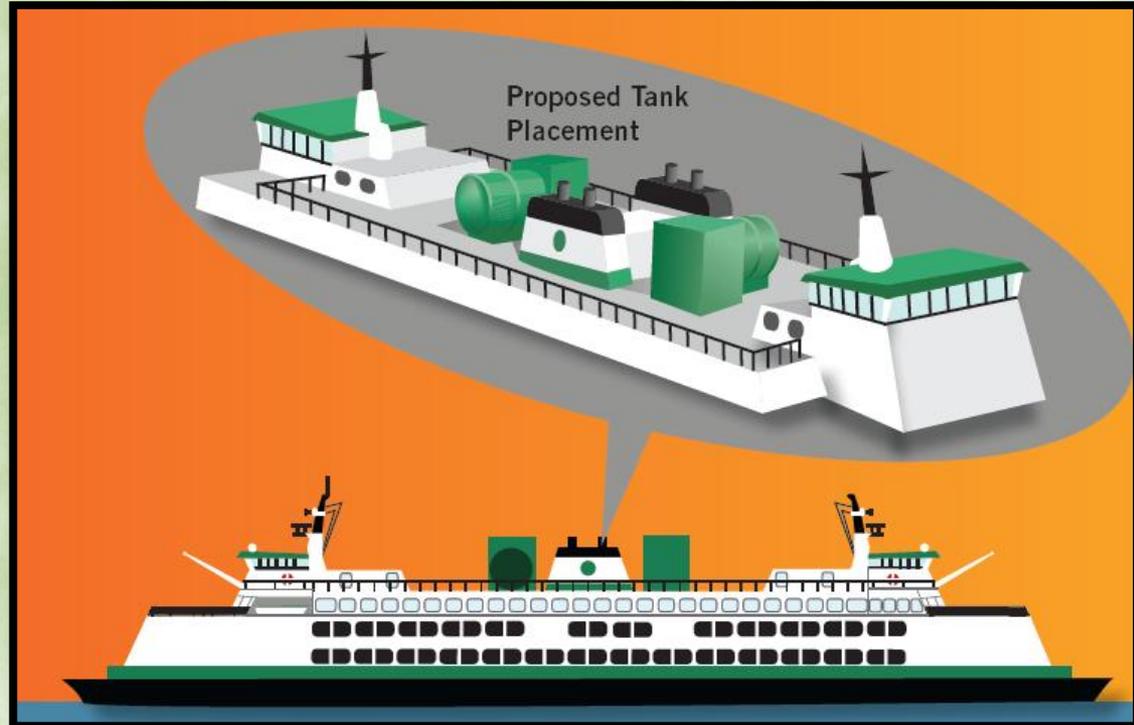


- Suitable Candidates:
 - Short Sea / Shipping Vessels
 - Tugs
 - Frequent refueling
- Nothing but reluctance
- Policy is being developed
 - LGC NCOE

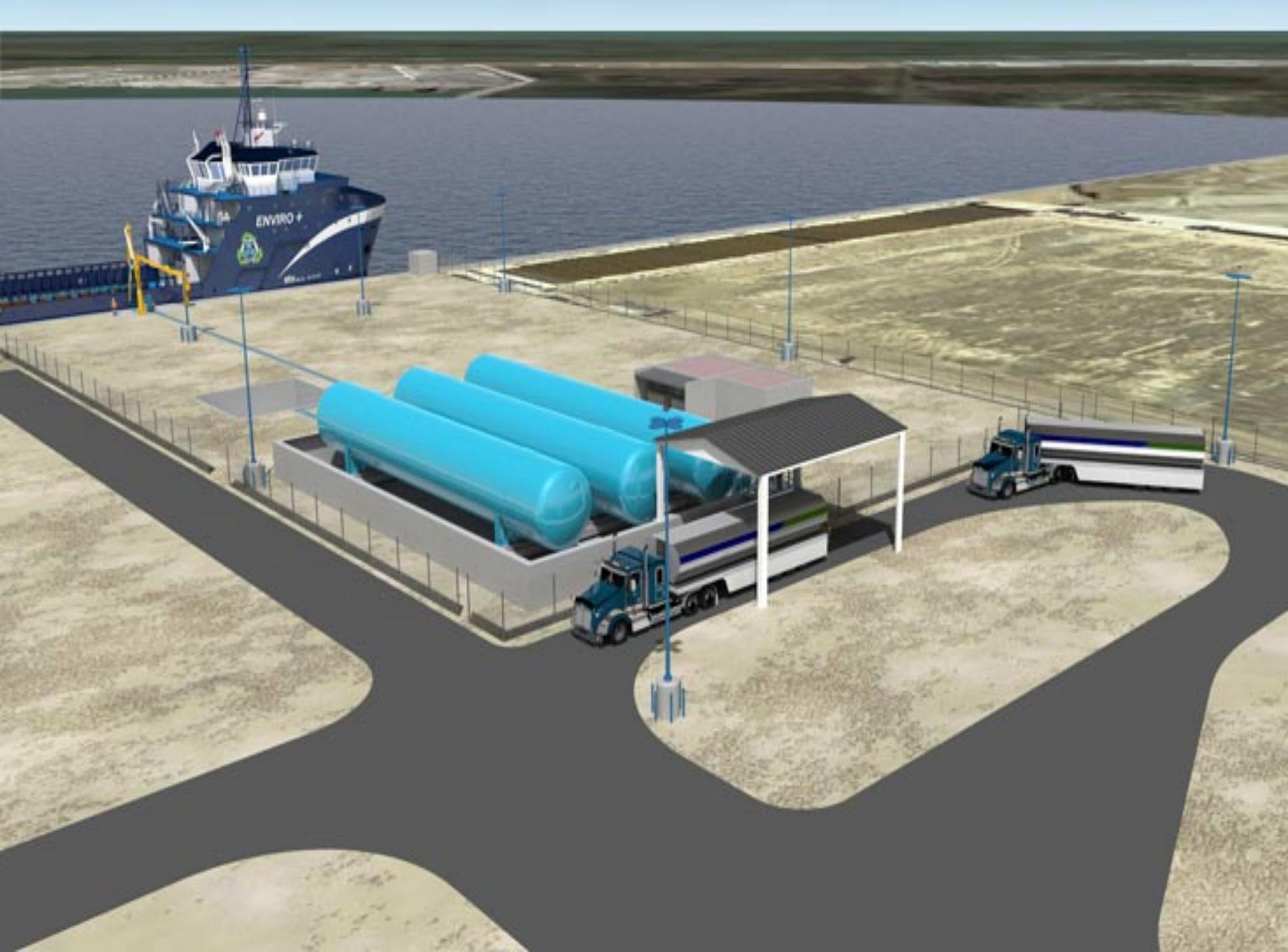
LNG – Passenger Vessel Application



- Tank Size
- Tank Location
- Bunkering
- WSF – 4 years+
 - RFP



- Research Vessels – Working Deck Issues



Hornblower Hybrid

- Hydrogen Fuel Cell



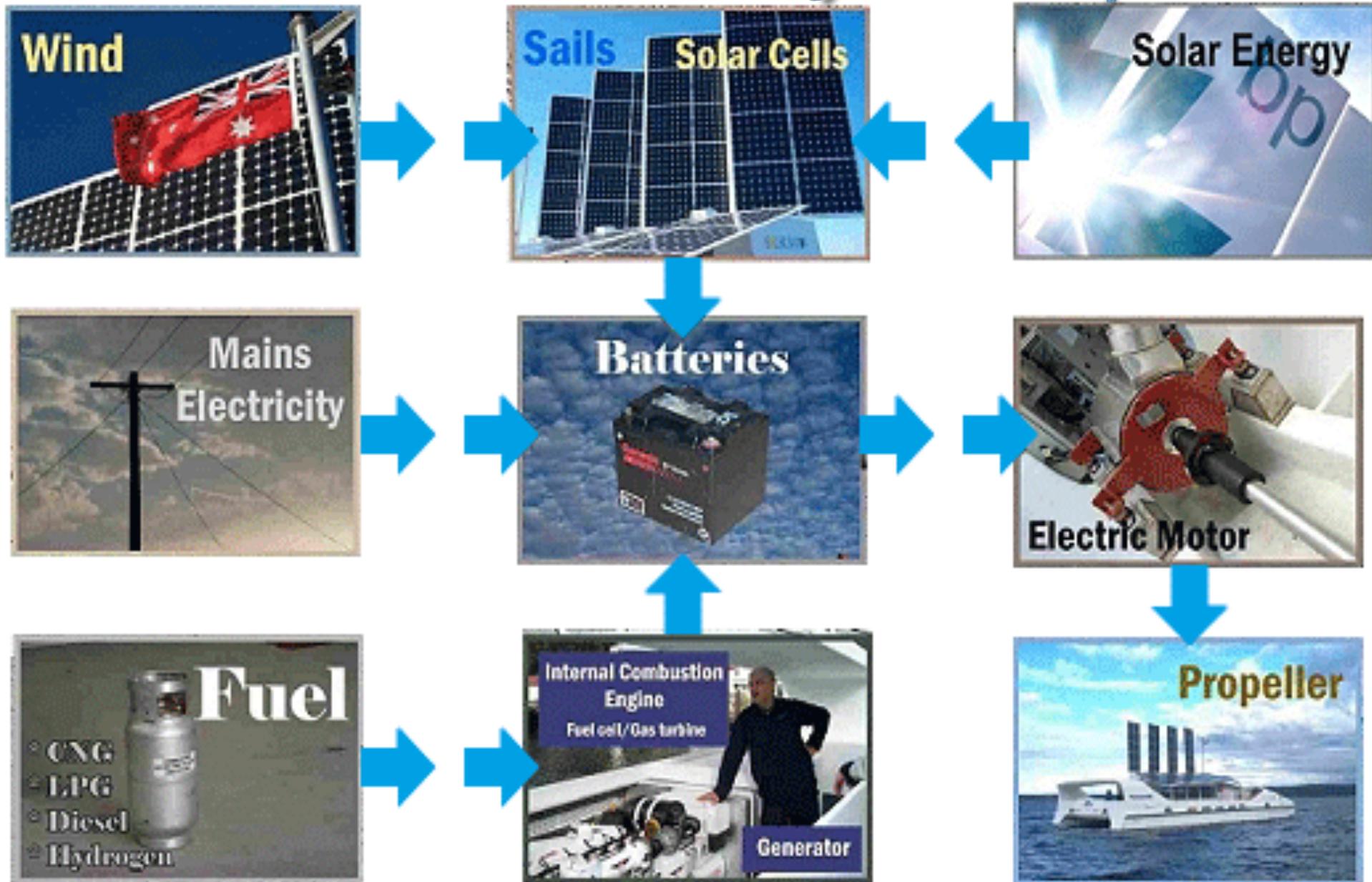


Solar Sailor

- Solar & Wind



Hybrid Propulsion



Sky Sails

- Kite Assist





Omega-sails.com



LE CLUB DE GUADELOUPE



LE CLUB DE GUADELOUPE



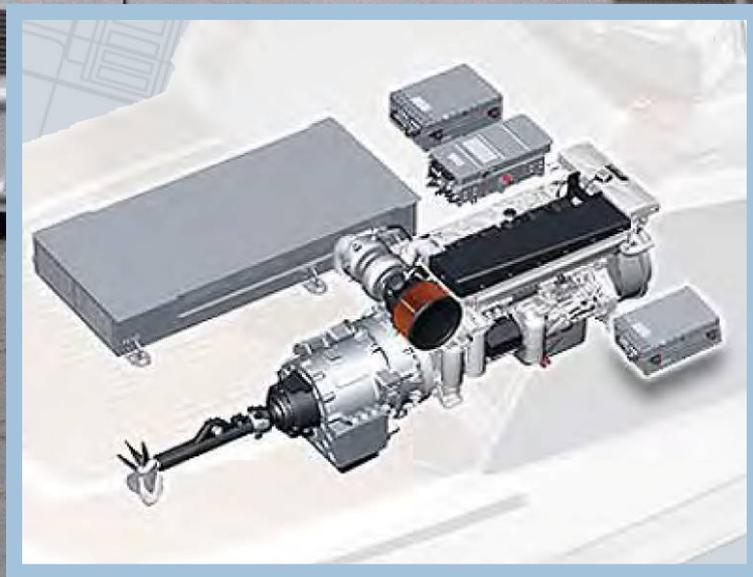
LE CLUB DE GUADELOUPE



LE CLUB DE GUADELOUPE

Spirit of the Sound

- Hybrid - Generator

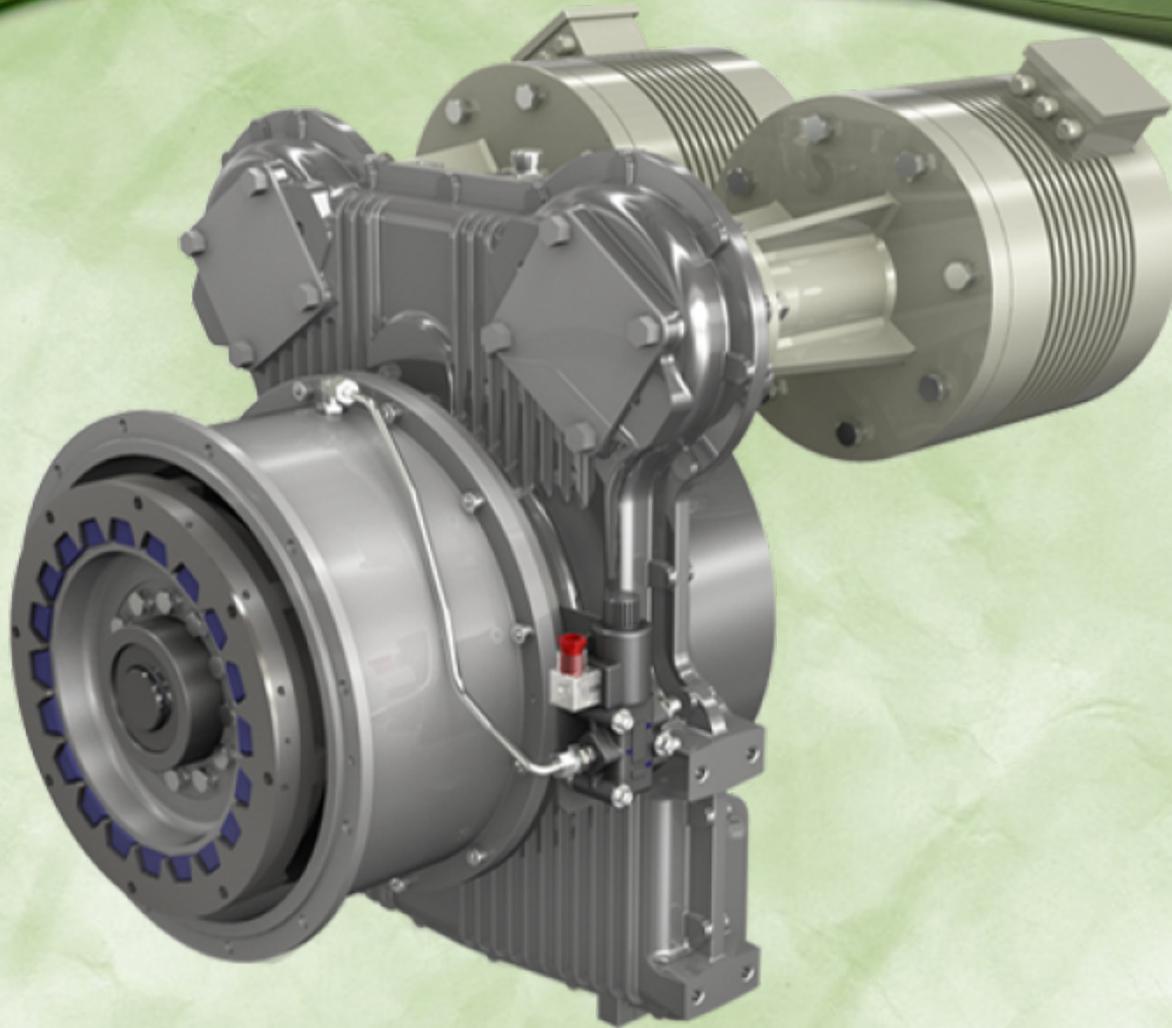




What is Realistic?

Many Shades of Green

Hybrid Drive: Gear Box Driven



Source: Transfluid

Reintjes Hybrid Gear Box



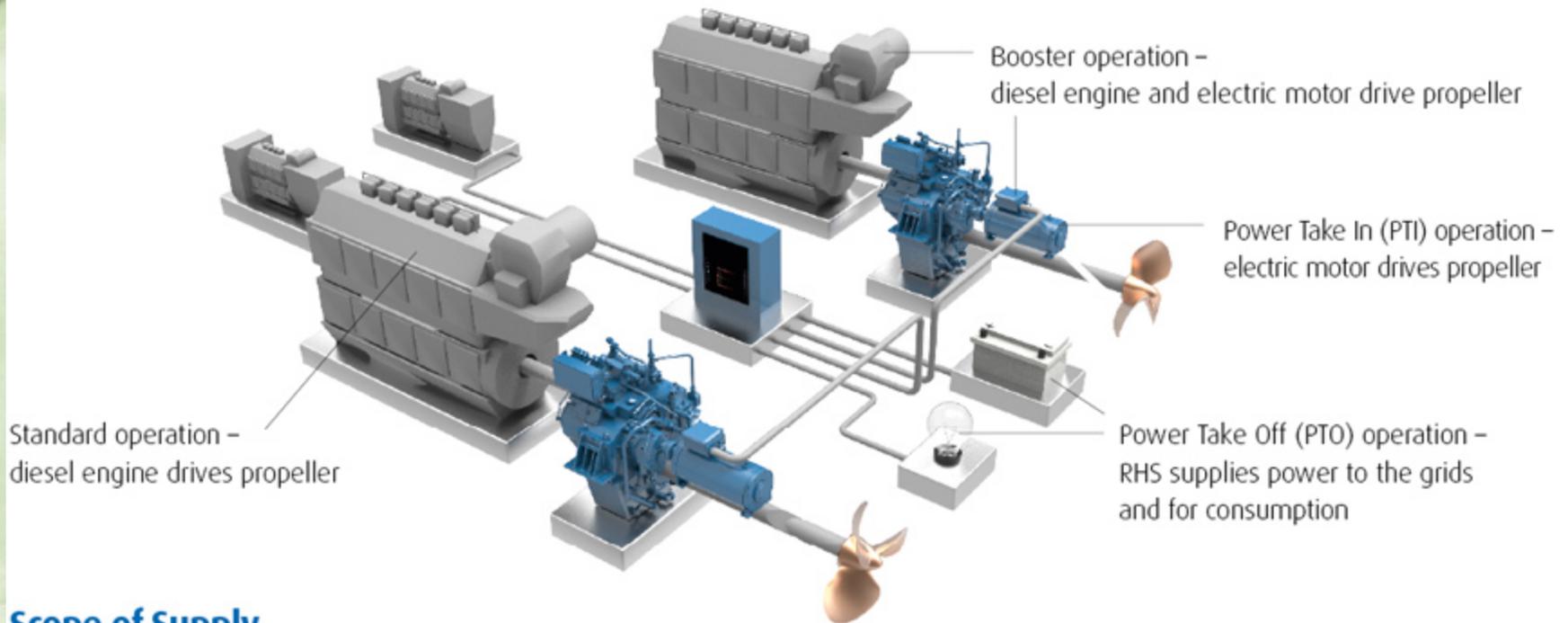
kW	300	400	500	600	700	800	900	1000	1100	1200
BHP	402	536	670	804	938	1072	1206	1340	1474	1608
	WAF-RHS 344 - 374					C				C Continuous Duty
		WAF-RHS 444 - 474					C			
			WAF-RHS 543 - 573							C

Source: Reintjes

Reintjes Hybrid Gear Box



The Hybrid System offers various Application Possibilities



Scope of Supply

- REINTJES gearbox with combined electric motor/generator and frequency converter
- Compatible with various electric grids and configurable for different applications
- Worldwide Service

Source: Reintjes

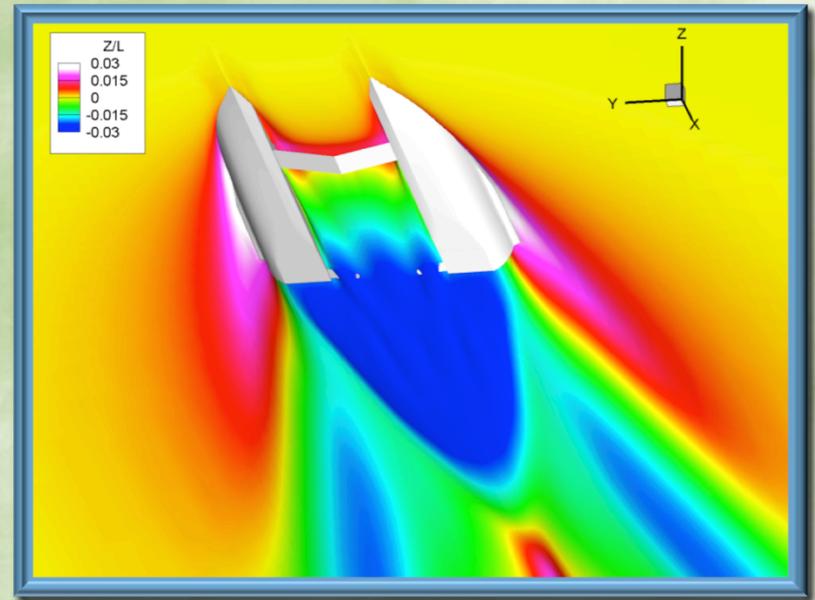
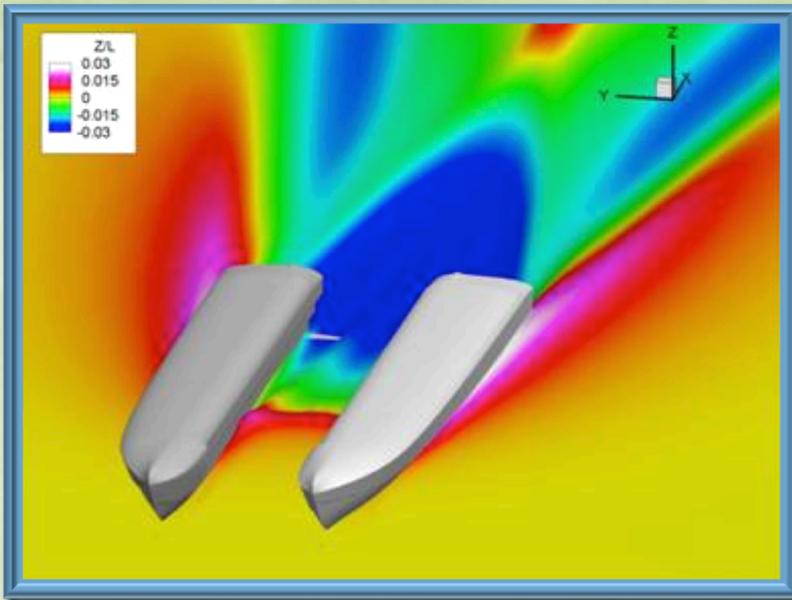
CorePlus



- Motor Generator
 - In Line
 - Decouples from Main Engine
 - Power Accelerator



CFD Analysis



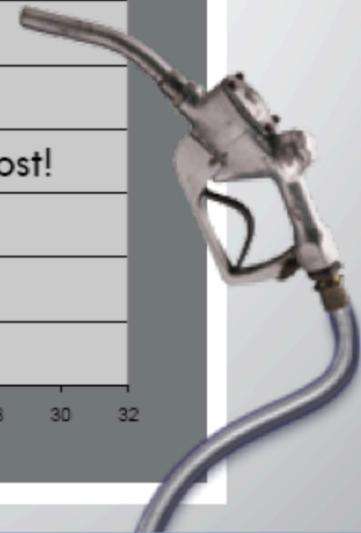
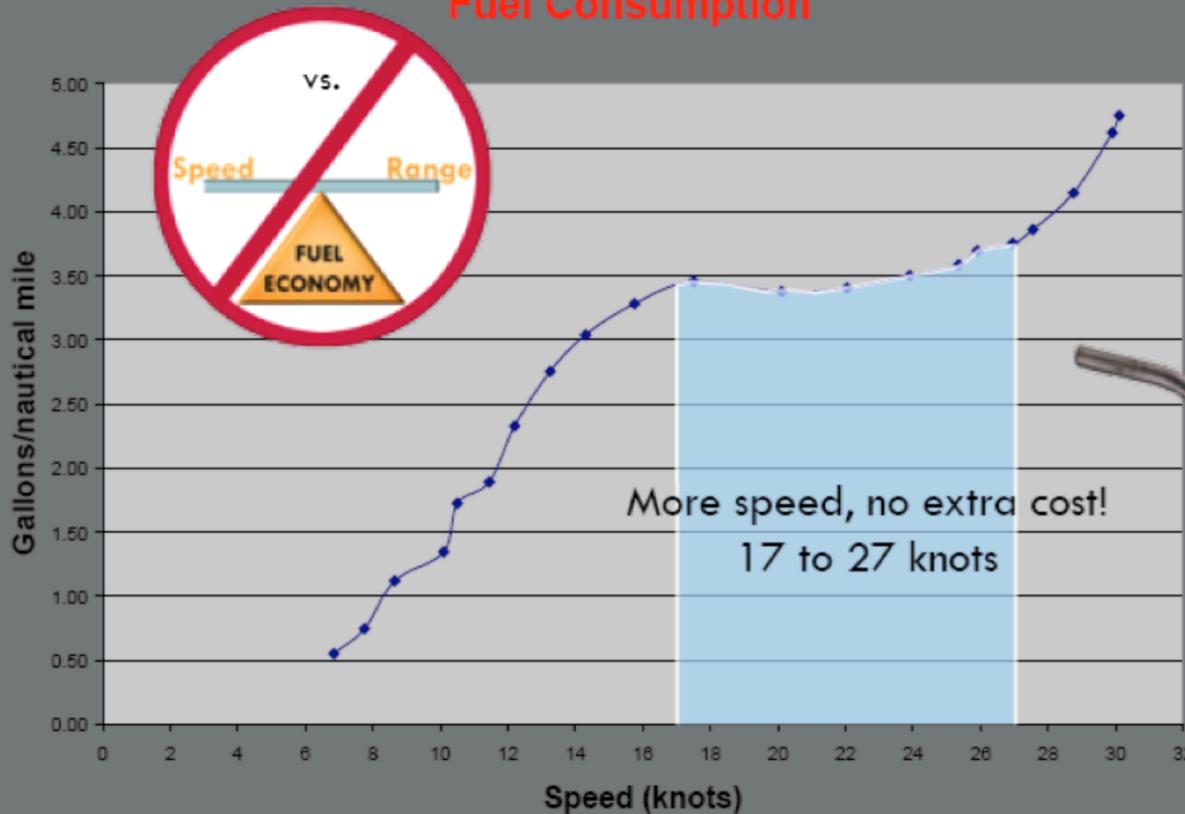
Hydrofoil-Assist Technology



Hydrofoil-Assist Technology



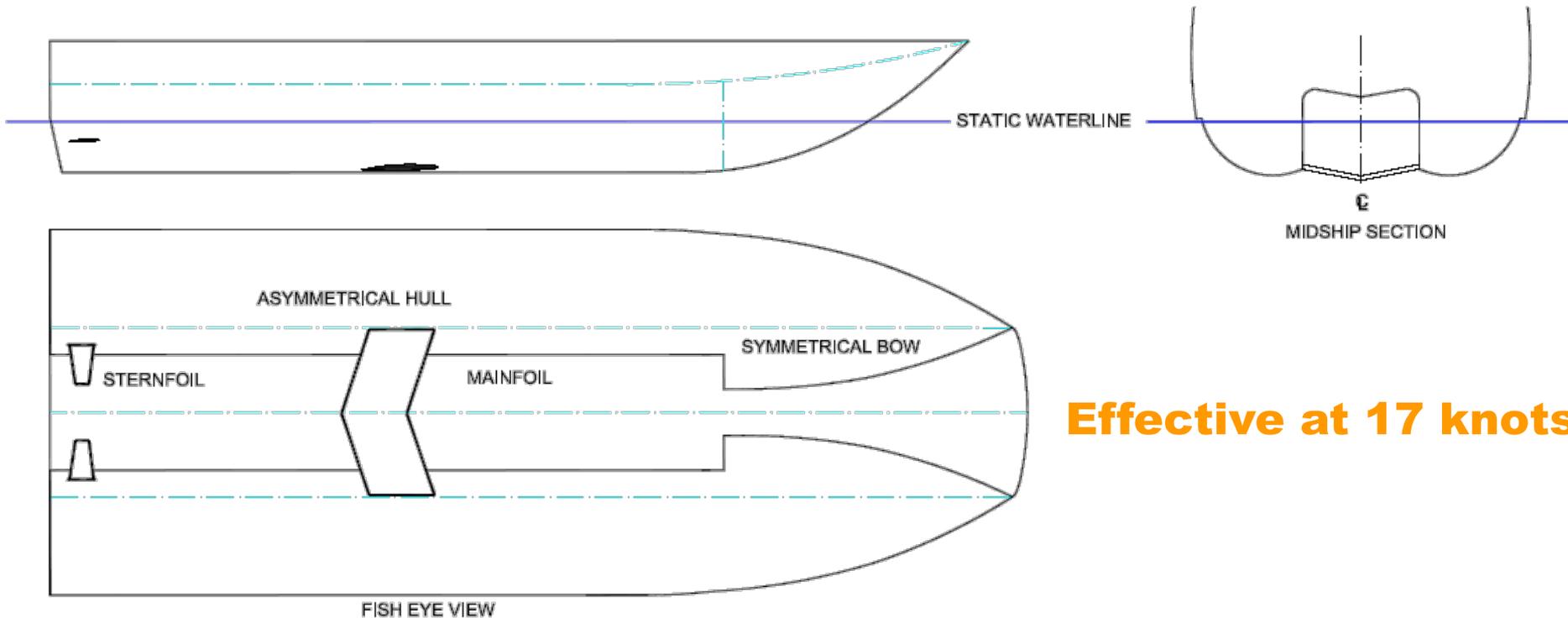
Fuel Consumption





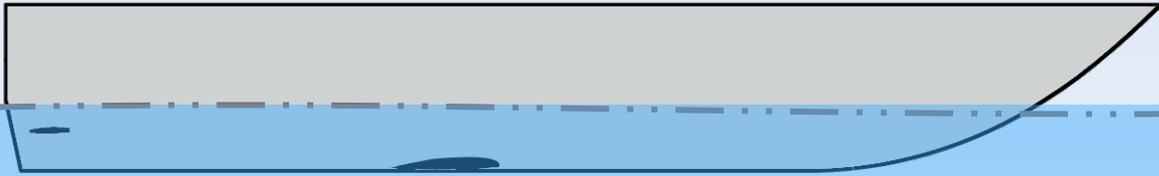
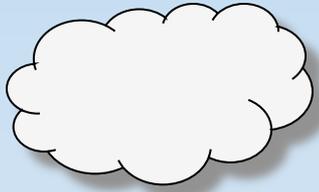
Teknicraft Hull Schematic drawing

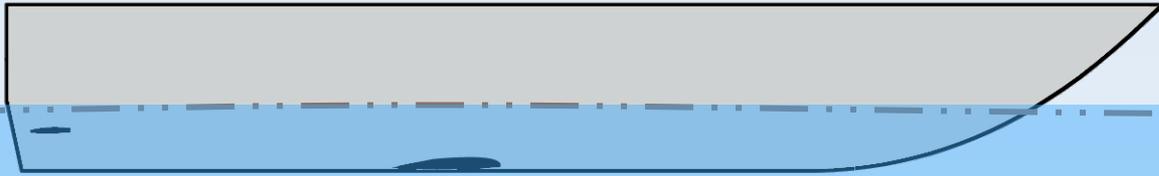
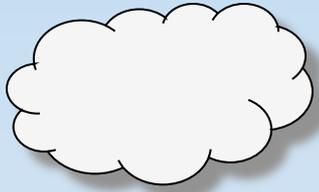
Teknicraft Design Ltd
PO Box 34-712
Birkenhead
Auckland
New Zealand
Tel: +64 9 482 3331
Fax: +64 9 482 3334
Email: info@teknicraft.com



Effective at 17 knots

- **Displaces 1/3rd of the vessel's weight**
 - **Uses 1/3rd less horsepower**
 - **Burns 1/3rd less fuel**
- NOTE: This drawing shows the hull and hydrofoil conceptually
Both the hullshape and the foil arrangement
may change to suit a particular application





Unconventional Conventional Drive



Green Band-Aids



- Tier IV and SCR Systems
- Particulate Filters
- Noise Silencers
- Fuel Flow Meters
- Fuel Treatments

EPA Tier IV System



- Elements of a Tier IV System:
 - Engines
 - DEF / Urea Tanks
 - DEF / Urea Dosing System
 - SCR Catalyst
 - Compressor (maybe)
 - Heating Chamber (maybe)
 - Dry Exhaust

Low Emissions



- SCR Systems

- Pros

- Removing harmful emissions: NOx & SOx
 - By-products – water and ammonia

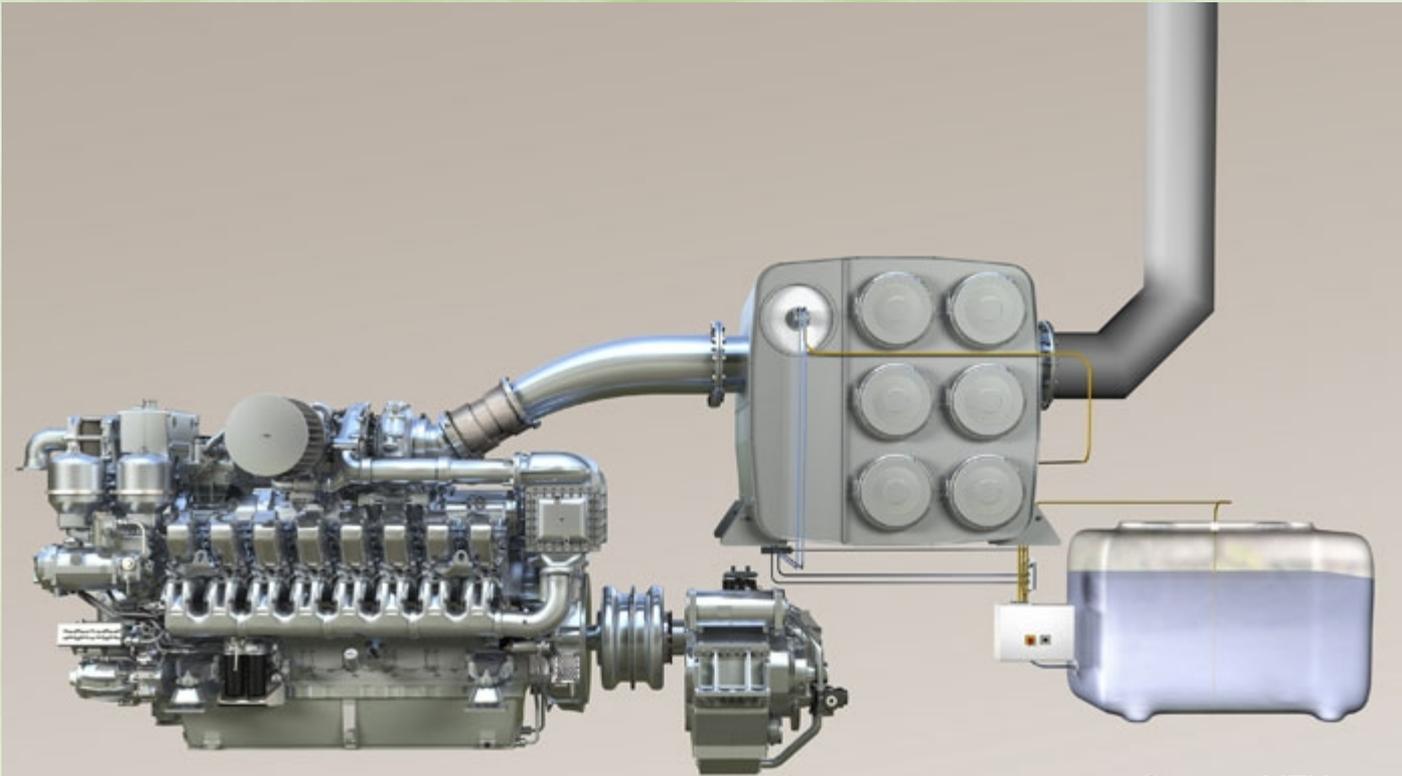
- Cons

- Marinization of industrial and highway technology
 - Build boat around system
 - Weight, Burn more fuel
 - Cost of Urea
 - Better off building lighter, smaller engines, burning less fuel emitting fewer emissions?





- Representative SCR System – MTU



Source: MTU

Low Emissions



- **After-Treatment Filters**

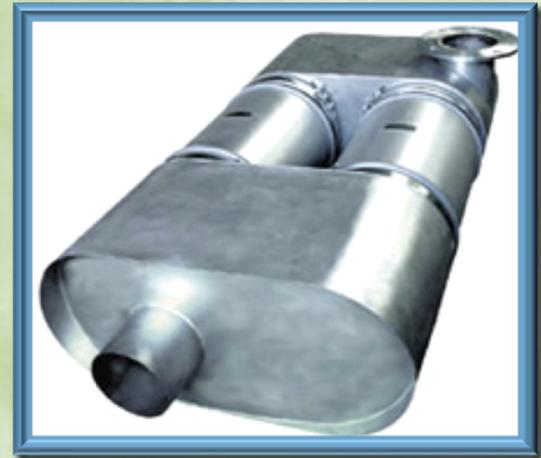
 - **Catalyzed Particulate Filter for Diesel Engines**

 - **Pros**

 - 99% of Carbon monoxide
 - 99% of Hydrocarbons
 - 85% Particulate Material
 - Provides additional sound attenuation

 - **Cons**

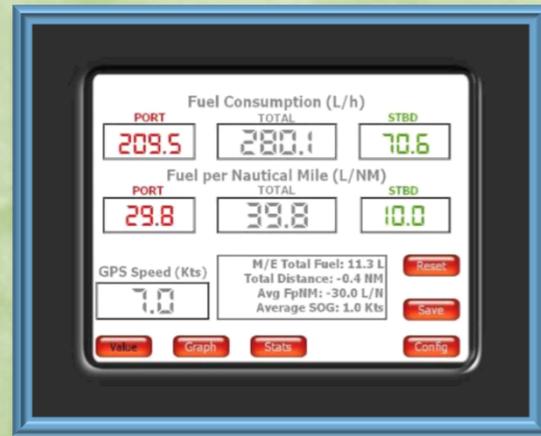
 - No provisions for NOx and SOx treatment
 - Back pressure



Fuel Systems



- Fuel Flow Meter
 - Flow Scan
 - Kral



- Fuel Treatment
 - Eco Emissions Platinum Catalyst



Joe Hudspeth

Jhudspeth@allamericanmarine.com

THANK YOU