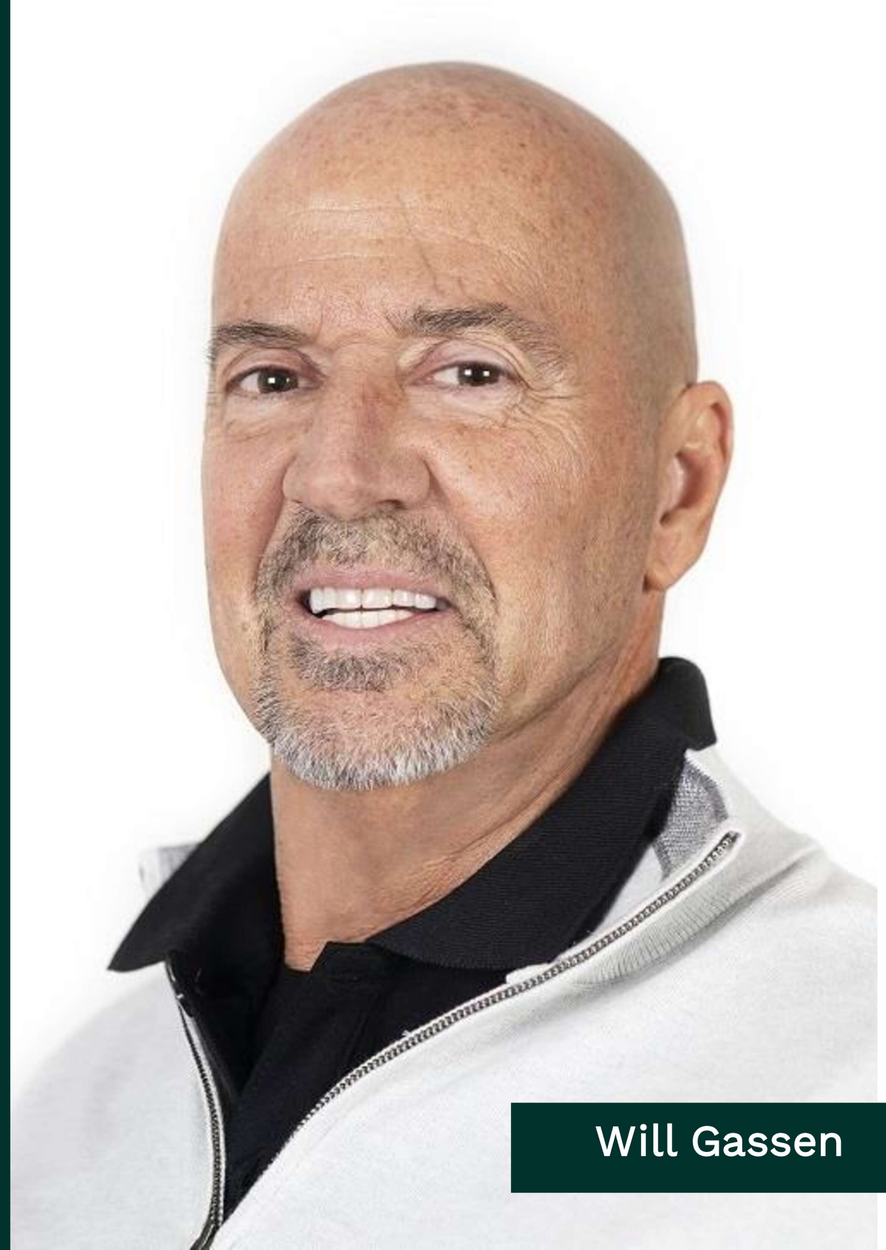
Zeroc Energy Inc.

Building a Green-Hydrogen Maritime Ecosystem
Zeroc is engineering a production and distribution infrastructure as the backbone of the zero-carbon maritime industry.
Our Green H^2 initiatives facilitate the delivery and assure a zero GHG emission fuel life cycle.

Green H^2 - H^2 Powered Yachts – H^2 Powered Cruise & Cargo Ships - H^2 Distribution Infrastructure

www.Zerocenergy.com



Will Gassen

Team

Mr. Gassen holds an MBA from Tulane University, a Six Sigma Black Belt certification from the Cockrell School of Engineering at the University of Texas as well as continuing post graduate studies at both Harvard and Yale Universities. Will Gassen is a published author and university lecturer. He has been admitted to numerous state and federal jurisdictions as an expert in intelligence gathering and its critical analysis.

For over two decades, Mr. Gassen has provided market analysis and asset valuation to global financial institutions and has assisted in portfolio restructuring of marine assets. By assembling a significant vessel data library, Mr. Gassen has been able to track strategic global inventories to enhance the relevance of his analysis.

Through more than 700 motor vessel transactions as both a buyer and a seller, Mr. Gassen has perfected the process architecture to reduce the execution cycle and operations cost of holding and owning motor vessels. Mr. Gassen enjoys unique, direct, and ongoing dialogue with institutional fleet owners and principal decision makers within the global yacht market. The result is the development of an incredibly broad set of proprietary relationships that empower his acquisition search, negotiation, management, and sale process. This access spans the global business and yachting community.

Tarek Ragheb

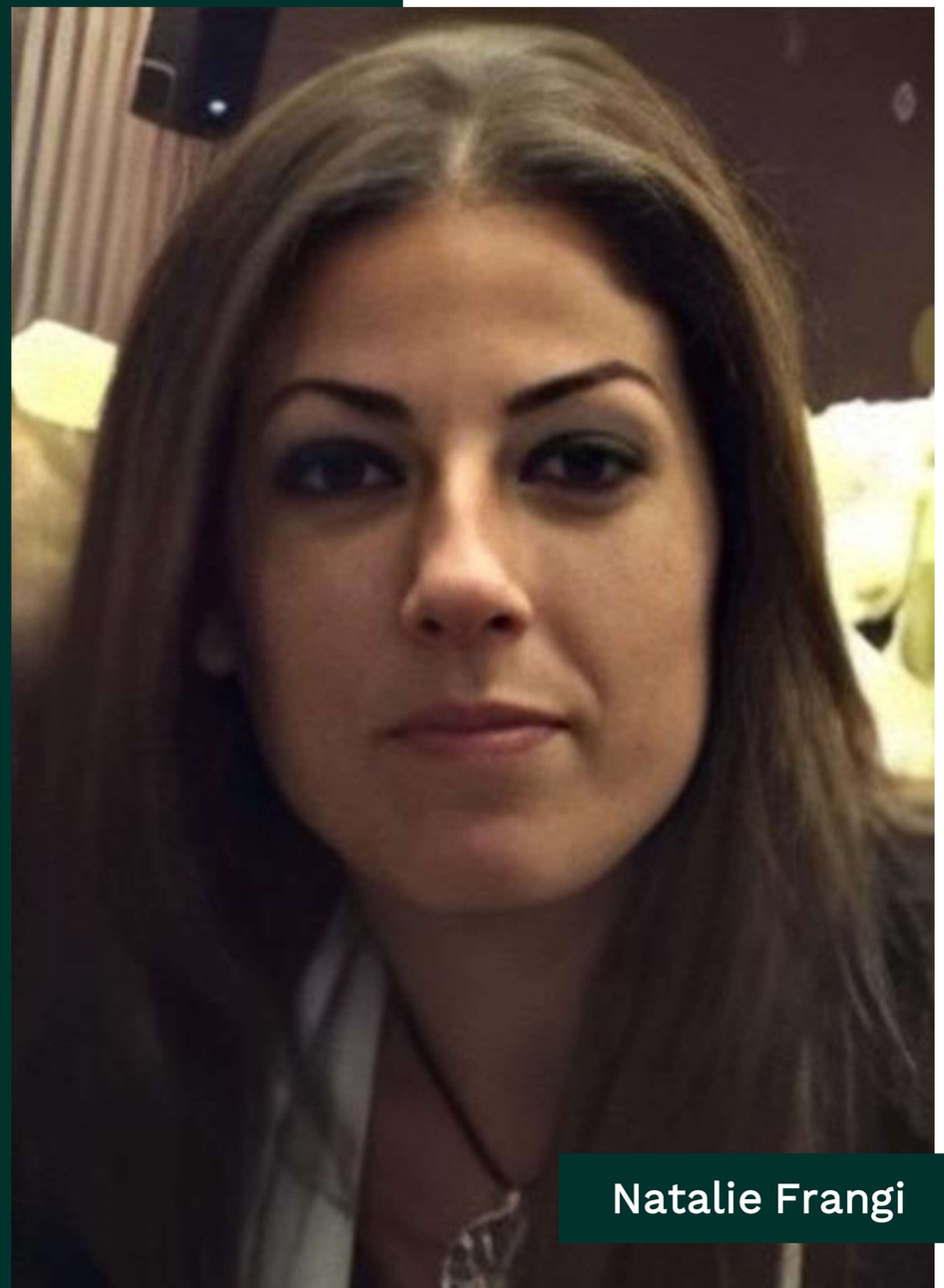
Team con’t

Mr. Ragheb has had a career in the private sector serving in leadership positions in major U.S. Aerospace and Defense companies and has held the position of Vice President for General Electric Aerospace and Military Engines Operations in North Africa and the Middle East.

Born in Egypt, Ragheb later immigrated with his family to the United States in the late 60s, where he would pursue his education and join the U.S Air Force and U.S State Department. Tarek served in the State Department as a Political Military Attaché at the U.S Embassy in Riyadh, Saudi Arabia.

After his government service, Tarek joined GE Aerospace as Vice President Middle East in 1988, and subsequently President of Martin Marietta Middle East, and finally Gulfstream Aerospace in 1994 beginning a 20-year career in business aviation, which he ended as Senior Vice President of Europe, Middle East, and Africa.

Tarek Ragheb is the Founding Chairman of the African Business Aviation Association (AfBAA), and served as Non-Executive Director of Investments for Camper & Nicholsons Marina Investments Ltd. Tarek founded De Birs Yachts, a leading design and manufacturing shipyard, ITS information services and finally Al Hora Group operating several duty free shopping zones in 3 international airports in the Arab Republic of Egypt.



Natalie Frangi

Team con’t

Natalie is a Computational Chemist & Researcher with emphasis in perovskites solar cells.

Ms. Frangi has been published in multiple industry journals, and her work is often cited and credited.

She has been lauded for her work in the synthesis of organic and coordination compounds with applications in dye-sensitized and perovskite solar cells (official workplace: NCSR Demokritos).

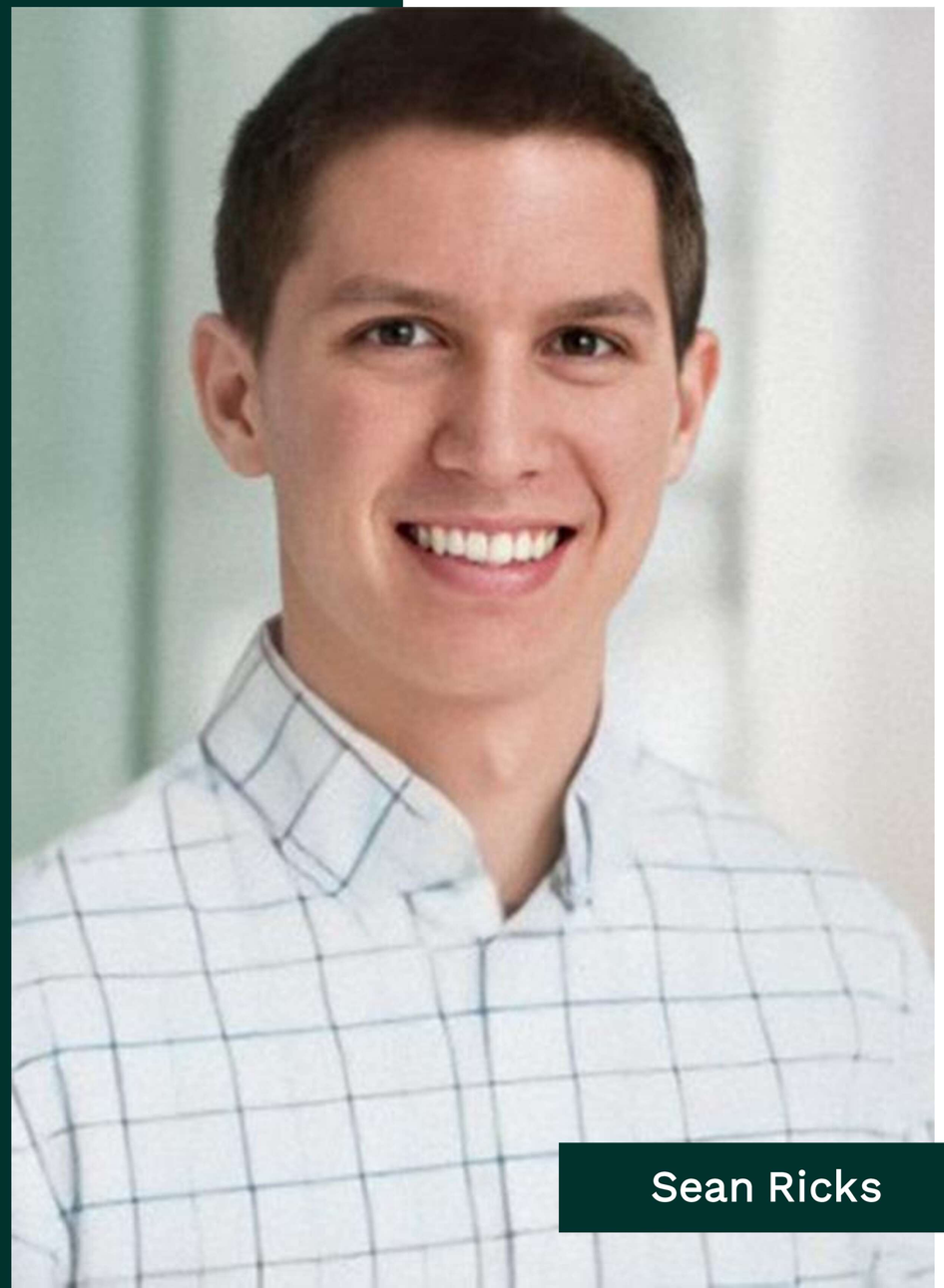
Natalie is Ph.D. Candidate
M.Sc. in Chemistry - University of Houston
B.Sc. in Chemistry - University of Houston

Patrick McCarthy

Team con’t

Patrick is a startup operator and investor with a background in corporate finance and M&A investment banking. At SpokenLayer he grew the company from $60K ARR to over $4M ARR, building the sales and operations teams from scratch, while also managing a network of over 250 contractors. During that time he negotiated deals with some of the largest publishers and media organizations in the world including Spotify, Pandora, and Apple. Patrick invests in early stage startups and also consults actively with founders in NYC and the Bay Area.

Patrick has a Bachelor's Degree in Finance from Fordham University.



Sean Ricks

Team con’t

Sean is a mechanical engineer with diverse experience in human-centered product design and development, machine learning, and systems engineering. Sean has been published in numerous International Design & Engineering Journals, as well as MIT Press Journals. Sean received his Bachelor of Science in Mechanical Engineering (Magna Cum Laude) from Brigham Young University, and his Master of Science in Mechanical Engineering from the Massachusetts Institute of Technology.

Sean's master's work at MIT was funded by the Tata Center for Technology and Design where he contributed to research that addresses socio-technological issues in India. Sean conducted a case study on the Tata Swach water purifier, a product created to alleviate the clean water crisis that affects the country.

The Challenge we address:
The environmental impact of global shipping...

Container Ships

Produce more greenhouse gas emissions than some small countries. It has been estimated that just one of these container ships, the length of around six football pitches, can produce the same amount of pollution as 50 million cars. The emissions from 15 of these mega-ships match those from all the cars in the world. And if the shipping industry were a country, it would be ranked between Germany and Japan as the sixth-largest contributor to CO2 emissions.

Cruise Ships

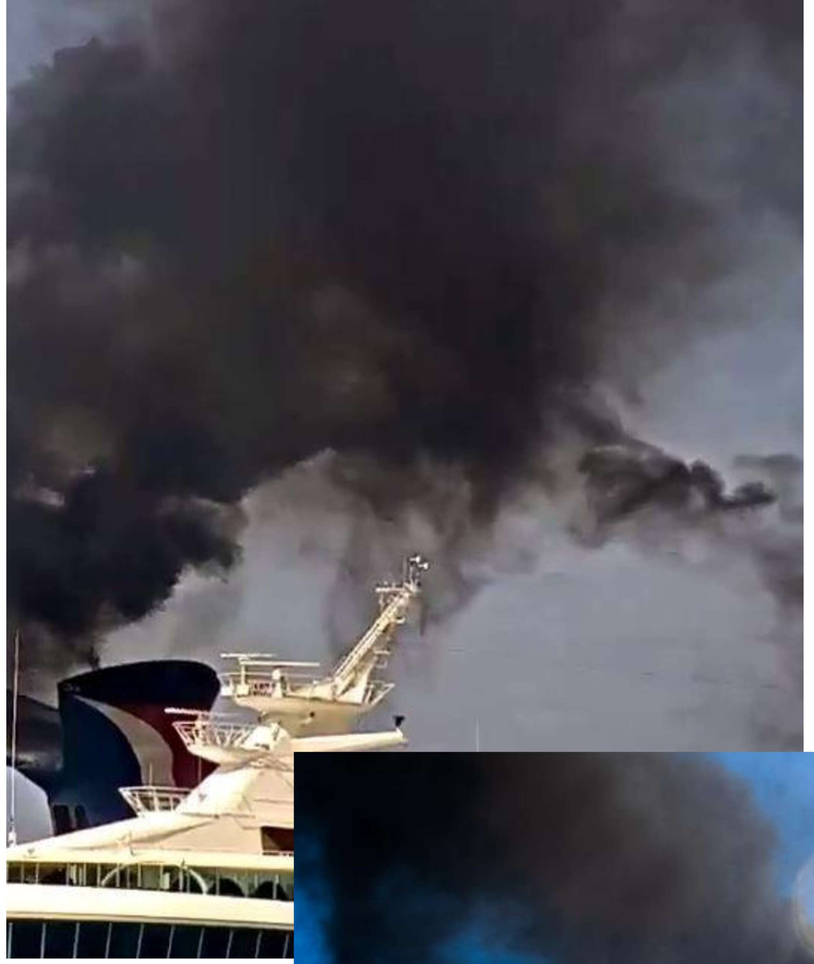
Carnival Corporation, the world's largest luxury cruise operator, emitted nearly 10 times more sulfur oxide (SOX) around European coasts than did all 309 million European cars in 2019. Royal Caribbean, the world's second largest, is 4X worse than the European car fleet.
The International Maritime Organization mandates that GHG emissions from shipping must be reduced 40% by 2030, pursuing efforts towards 90% by 2050, and many shipping executives and other industry stakeholders are facing uncertainty over how they will achieve this. The IMO ambitions will likely call for widespread uptake of zero-carbon fuels, in addition to other energy saving measures.

How does ZEROC address this environmental challenge?

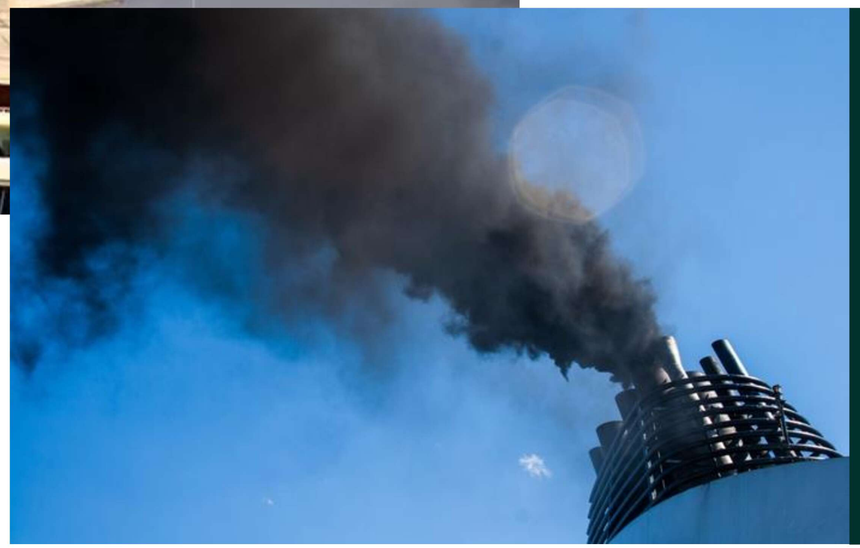
Through the design and construction of green-hydrogen powered superyachts. These instruments of environmental sustainability are an immediate opportunity to affect the 'paradigm shift' that Britain’s Prince Charles called for at the World Economic Forum in Davos.

The zero-carbon, zero-emission energy that green hydrogen offers is a vital component in this global realignment.

Net Zero ≠ Zero
&
Hybrid ≠ Carbon Neutral



A green hydrogen-powered yacht is the change needed for the industry to meet environmental sustainability goals and to create an opportunity to affect the 'paradigm shift'. Currently, liquified natural gas, or LNG, is being considered as an alternative 'clean' fuel for the yacht industry. In 2016, new environmental regulations were enacted in the USA to force boats over 24m and exceeding **500 tons** to cut back on their sulfur and nitrogen oxide emissions by **nearly 80%.**



However, while LNG is cleaner than diesel fuel, it is still not the most environmentally friendly option. ***It is still carbon, which means it is still pollution***. Green hydrogen-powered yachts offer zero-carbon, zero-emission energy, making it the best choice moving forward. As a transportation fuel, it has the capacity for localized production and is produced using renewable sources like solar power, wind, hydroelectric and geothermal energy.

(solution con’t)

Space & Handling LOHC

Hydrogen has, to this point, presented a challenge in handling, transport, and storage. The needed low temperature or high pressure, as well as space required for sufficient fuel stores has been marginally prohibitive.

Zeroc is implementing a LOHC process solution. Liquid Organic Hydrogen Carriers (LOHC) is a technology that allows storing hydrogen in a safe and dense manner by reversible chemical conversion or catalytic hydrogenation.

A strategic advantage is achieved as H^2 can be stored safely at ambient conditions. Neither high pressure nor low temperatures are needed. Thus, heavy vessels for pressurized hydrogen are avoided. Zeroc’s LOHC systems reduce the required space and operational footprint by 80%. These boundary conditions make the LOHC technology advantageous for yachting and maritime applications.

The LOHC storage, release, and conversion unit for the operation of a yacht is based on the technical performance requirements of an emission-free yacht. The most important units of the system are the tanks, the reactor, the hydrogen purification, and the fuel cell.

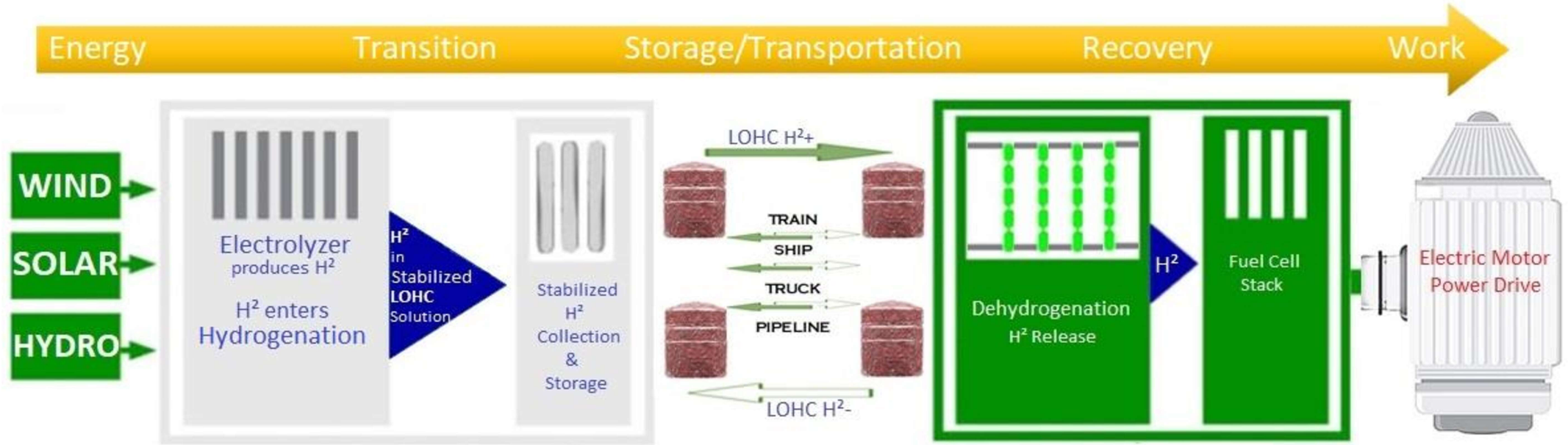
LOHC Value Chain Process

LOHC technology is based on an organic oil-like substance that binds hydrogen chemically. As various substances are suitable; Zeroc Energy uses dibenzyl toluene (H0-DBT) and its hydrogenated form perhydro dibenzyl toluene (H18-DBT), whose physicochemical properties are remarkably similar to diesel. The chemical storage of hydrogen in LOHC makes storage possible under ambient pressure (p = 1 bar) and at a normal temperature (T = 20 °C). Hydrogen in LOHC is not volatile and, will not self-discharge. The LOHC can be charged and discharged with hydrogen as often as needed.

Hydrogenation of the LOHC

The system functions in two independent processes; charging (hydrogenation) and discharging (dehydrogenation) the LOHC.

The chemical process for storing hydrogen in the LOHC is performed under pressure. This allows an electrolyzer to deliver the hydrogen directly, thereby eliminating additional energy-intensive compression. The chemical reaction in which the hydrogen is bound in the LOHC takes place in a hydrogenation unit with a bed of porous noble metal catalysts and metered LOHC. This exothermic reaction heat releases heat, which is further utilized in downstream processes. Finally, the hydrogen-charged LOHC+ (perhydro-dibenzyltoluene) is pumped into the storage tank.



Dehydrogenation of the LOHC

The hydrogen in the charged LOHC+ is recovered at a temperature of 250 to 300 degrees Celsius. This endothermic reaction requires heat, which is provided within the reaction process. The release process takes place in a dehydrogenation unit with a catalyst. Here, the chemical bond between the energy source and the hydrogen is once again released. The hydrogen is removed from the reactor as a gas and converted directly into electricity in a fuel cell. The discharged LOHC- (dibenzyltoluene) is stored in a tank until it is needed again. The LOHC cycle is closed.

Yachts Lead the Sea Sector

Change must propagate from the yacht industry. The economic demand curve dictates that the cost of radical innovation can only be absorbed by the inherent premium of luxury yachting. History suggests that where a strong enough driver exists, shipping can make radical changes. Sometimes it is hard to visualize these changes. In the case of hydrogen, the driver for change is not performance or cost-benefit, but purely environmental. The most significant opportunity here is for the superyacht industry to lead innovation upstream into the commercial world to include cruise, cargo, and more.

The most significant barrier to the realization of a full hydrogen superyacht is not the onboard technology, it already exists, but rather the practical availability of green hydrogen within a global distribution network.

It is practical that a robust maritime Green H^2 supply chain can be built and operational within a two yacht-build lifespan, or about six to eight years. Land-based solar and wind plants producing Green H^2 as terminals to feed Bunker Ships and Barges, Bunker Ships themselves as solar plants producing and distributing H^2. Strategically positioned humanmade islands and offshore platforms supporting solar, wind, and wave energy transformation into H^2 production and distribution.

These facilities are less complex, far less expensive, quicker to build, and remarkably safer from a human and environmental perspective than fossil fuel exploration, production, and refining. Hydrogen production creates a massive potential to recalibrate global energy markets. It appeals to a vast segment of new and incumbent yacht-climate-leaders, with the opportunity to affect a positive change and invest in something disruptive.

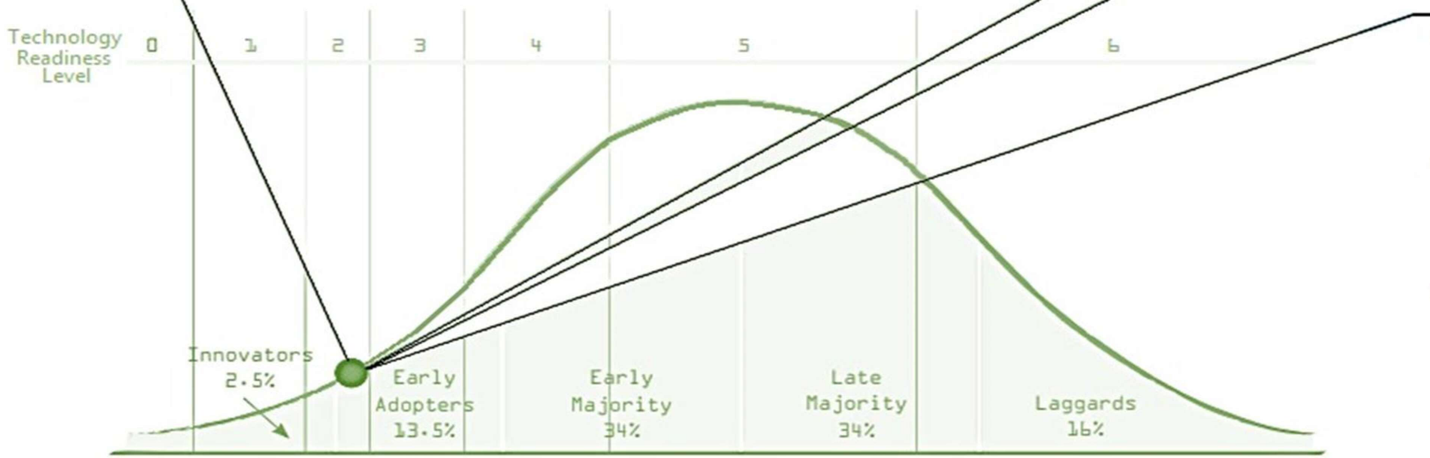
They stand in queue; superyachts to be built with a purpose to innovate and effect a positive change, to answer an economic argument and a duty to serve a logical environmental cause. They will be built by philanthropic thought leaders dedicated to making the world a better place. They will be legacy statements for generations to come. But let us not limit our vision to a small group of green yachts. Let us focus on transforming the entire green H^2 distribution and ecosystem.

Zero

There are vast assumptions surrounding future technologies and superyachts. However, it is not speculation that a zero carbon and zero emissions future is upon us. As international maritime regulations continue to move towards zero-carbon shipping within this century we are investing in research and development of engineering solutions to deliver this.

We have created a hydrogen fuel cell-based drive and power generating system for motor yachts. We implement LOHC technology to store the hydrogen, rather than the traditional high-pressure tank system. The system process is lean; LOHC w/positive H^2 storage - Dehydrogenation component - Fuel Cell - electric motor powering azipod.

We tend to associate creativity with the arts and to think of it as the expression of highly original ideas. In business, though, originality isn't the objective. To be creative in business, an idea must be useful and actionable. Often the most creative things in business put existing ideas together in new combinations. Business creativity and the ability to see new combinations depends on discovering answers outside an individual discipline.



Technology Readiness Level vs Diffusion of Innovation

TECHNOLOGY READINESS LEVEL

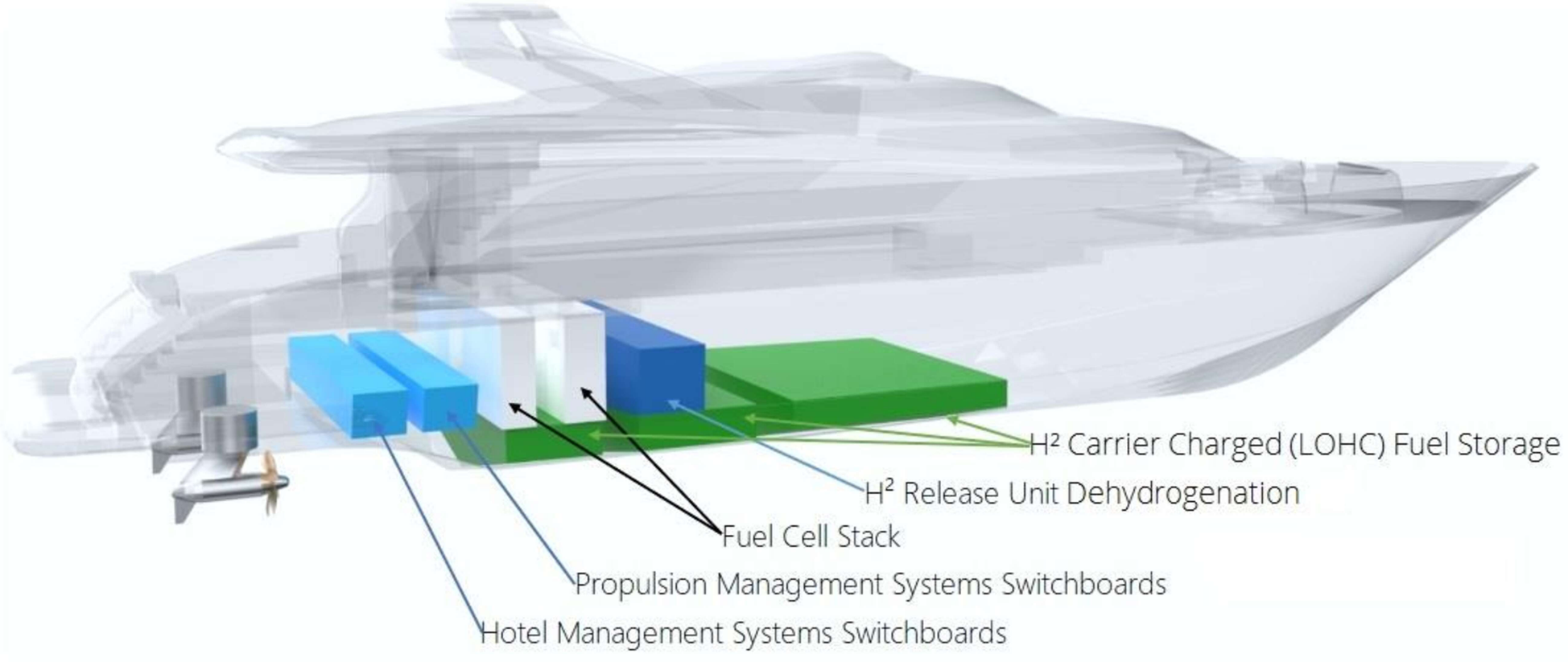
- **TRL 0 – Blue Sky Idea**
  Anecdotal concept with no analytical proof of feasibility.
- **TRL 1 – Paper Concept**
  Exists only in paper proposals or academic research, analytically proven.
- **TRL 2 – Industrial Development**
  Product is not being developed for a marine industry application however a test rig or prototype product exists to develop the technology to a real world application.
- **TRL 3 – Marine Product Development**
  Product is not offered for sale, however a test rig or prototype product/ installation exists.
- **TRL 4 – First User**
  At least 1 reference yacht, concept fully certified by authorities for marine use.
- **TRL 5 – Common Practice**
  Multiple reference yachts and vendors available.
- **TRL 6 – Obsolete**
  Obsolete by increased regulation or alternative technology.

Current Engagement (1)

Solar Facility Producing Green Hydrogen... Port of Civitavecchia (ROME)

Current Engagement (2)

In-Build: Currently in Construction... 34m(112ft) Hydrogen Powered Yacht

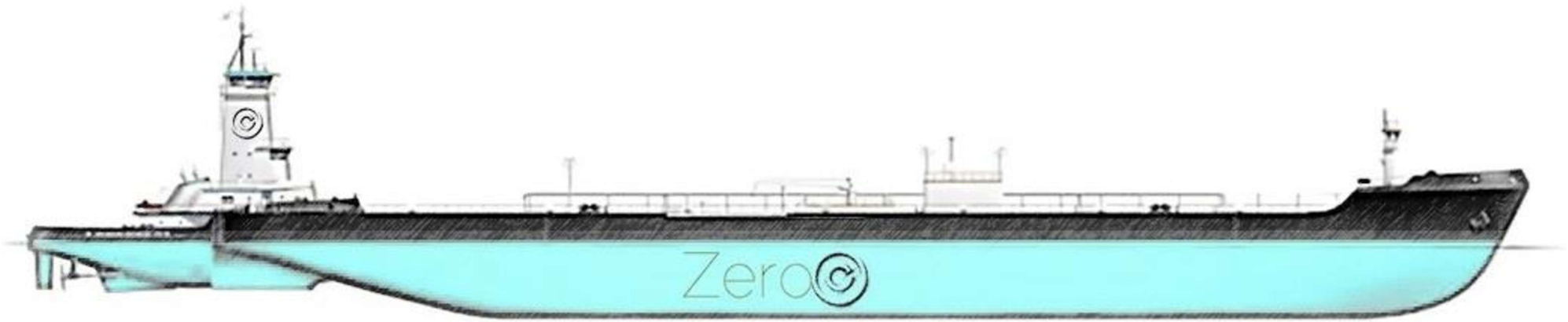


Current Engagement (3)

Technical management of the 145m Superyacht Project

Current Engagement (4)

Engineering H^2 Bunker ATB – Tug/Barge



Current Engagement (5)

Engineering H^2 Bunker Ships

Current Engagement (6)

Engineering Green H^2 Land Based Production

Current Engagement (7)

Engineering Green H^2 Sea Based Production

First Revenue

Traction

We have Letters of Intent for the purchase of twelve(12) H^2 powered yachts. The current unit in-build will be a prototype to measure efficiencies and specifications for the final construction parameters. Additionally, Zeroc is under contract for technical management of the hydrogen/fuel cell systems application for the 145m Superyacht ‘Project Alexander’.

Market

We will use the yacht market to drive this innovation up into the Cruise and Cargo/Container Commercial market.

As first mover, we have an advantage. However, once we build a distribution infrastructure, legacy maritime leaders will follow. We will compete, partner, or be bought out.

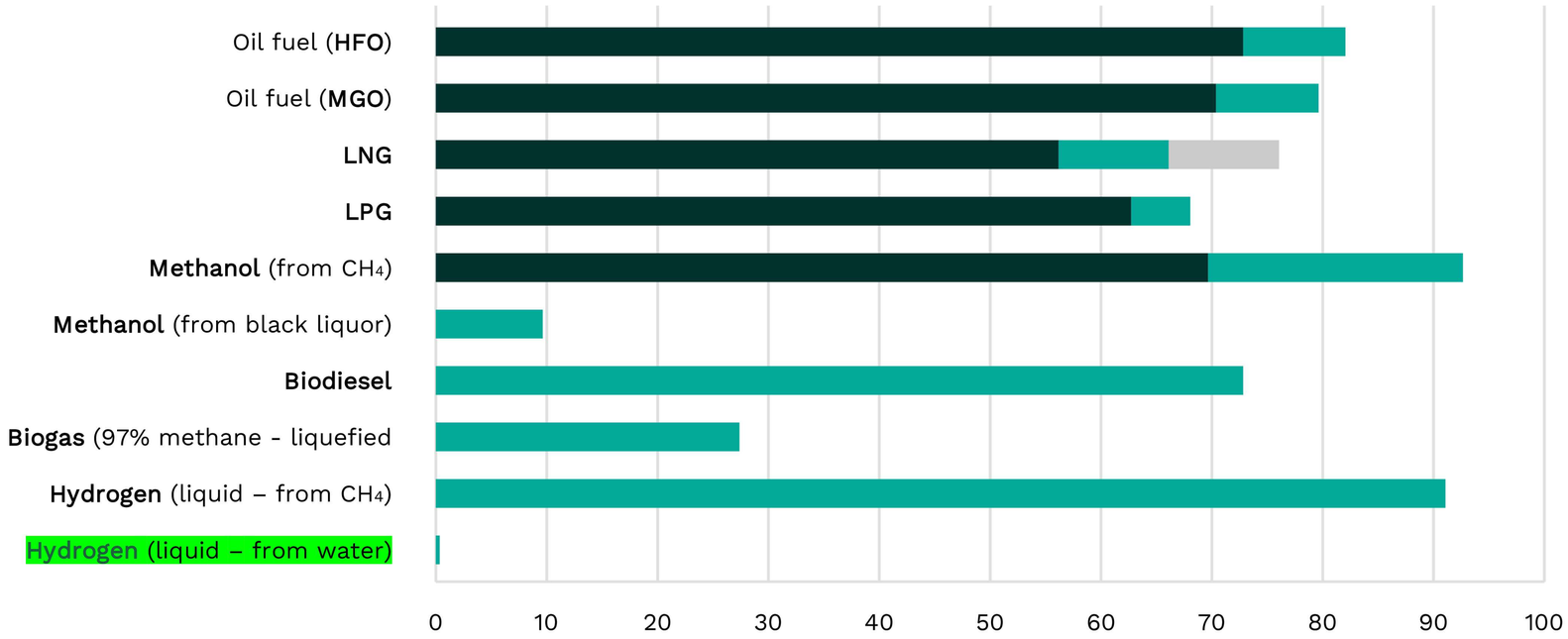
These are forward-looking projections that cannot be guaranteed

Competition

Green Hydrogen is the only Zero-Emission, Zero Carbon energy solution.

At this moment there are no full-hydrogen powered yachts or ships afloat. There are hybrid vessels that utilize H^2 for hotel accommodations at anchor or in port, but none that utilize H^2 for propulsion.

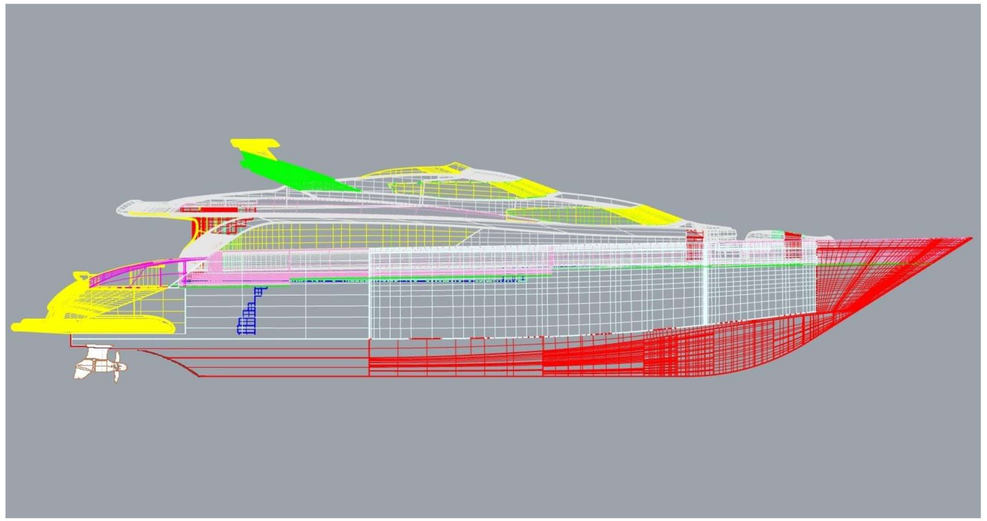
The German builder Nobiskrug had planned a H^2 vessel, but has not followed through, and plans are now on hold.



CO^2 Emissions of Alternative Fuels in Shipping

ZeroC

Business Model



-Revenue is expected as soon as we deliver Proof of Concept in Yacht One. At that time, we anticipate collecting deposits and draws for the construction of the yachts on order.

-Our contract with the owner of Project Alexander calls for payment of 1.5% of the ship's value upon completion and delivery of the yacht. While we do not have control of the progress of the build, we anticipate settlement in 36 to 42 months.

These are forward-looking projections that cannot be guaranteed

Contact

Zero

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