

# Circadian Positioning Systems

Wearable sensors for sleep tracking and optimizing human performance, including safe operations.



## Problem

The demand for humans to perform critical work-related tasks at adverse circadian phases (i.e., biological night) while lacking adequate sleep has played a role in some of the world's most devastating disasters.

## Business Model

### *Target Customers*

The U.S. Navy is our customer. We are expanding to other DoD customers and private/commercial vessels.

### *Channels*

- Navy/DoD = program managers, SBIR/STTR, continued sole source awards/contracts.
- Private vessels = safety officers

### *Potential Revenue Streams*

- DoD = contracts;
- Private vessels = product sales; subscriptions;
- Partnerships = licensing.

## Ocean Impact

Fatigue has been a major contributing factor in numerous incidents and catastrophic wrecks on the ocean.

We have been helping develop a fatigue mitigation solution for the U.S. Navy related to the catastrophic wrecks experienced relatively recently (U.S.S. John McCain and Fitzgerald).

One well known example of a fatigue related accident at sea with devastating ocean impact was the Exxon Valdez. Preventing these wrecks is critical to ocean health

## Key Metrics

- Revenue/non-dilutive funding (contract number, contract size)
- Demos/Data (how many demos with successful data that can be leveraged in additional markets or with regulatory entities)
- Technology Roadmap progress/TRL

## Solution

Light is the most potent stimulus to the circadian system. We have developed a data-backed, patented, fully-integrated circadian-targeted lighting system that mitigates fatigue and enhances alertness and performance.

## Solution Roadmap

*TRL Level - 7*

### *Immediate Next Steps in Development*

- We completed an at-sea demo with a commercial vessel recently
- Executing on our at-sea commercial demo and commercial fishing demo

### *Three Greatest Needs in Next 12 Months*

- Executing in the military environments;
- Executing on our cruise line demo and commercial fishing demo.
- Raising capital

## Industry Information

The market for sleep wellness solutions is exploding and projected to be in the Trillions by 2027 for segments we could serve.

We are currently pursuing the Navy/DoD and private vessel markets (\$40.02B by 2030, CAGR 7.74%), but additional markets include sports technology (\$21.9 B, CAGR 13.8% 2020-2027), wellness real estate (\$245 B, CAGR 13.7%), sleep aids (\$113 B, CAGR 5.6%), and wellness tourism (\$1.5 T, CAGR 6.6% (2022-2027).

\*CAGR 2020-2027 unless noted.

## Technology & IP

We have patented and patent-pending technology. We also have trade secrets and know-how.

The technology has been developed and tested by world-renowned sleep and circadian rhythms experts.

The firmware, hardware, and software has been developed by Silicon Valley veterans who previously worked at Square pre-post IPO, for example.

## Unique Value Proposition

Our solution was developed by sleep and circadian rhythm experts and Silicon Valley technology veterans.

Our solution is patented, data-backed and has been tested in laboratory and operational environments with and for the U.S. Navy (our customer), Marines, NASA, and other private vessels (e.g., super yachts).

We have received and successfully executed on a Phase I STTR from NSF. We are 11th hour racing official sleep partner.



## Key Metrics

- Environmental impact data: biodiversity increase (number of species), biomass generated, CO2 removed, and oxygen generated
- Environment health: acidity, chlorophyll, temperature, water transparency
- Number of infrastructures regenerated and turned into Hope Spots

## Solution Roadmap

*TRL Level - 9*

### *Immediate Next Steps in Development*

- Product optimization (efficiency and robustness-bullet proof) to maximize results
- Consolidate pilots in all core channels
- Visibility
- Start operating in the US

### *Three Greatest Needs in Next 12 Months*

1. Find financed pilots in US market
2. Hire Talent to boost growth
3. Fine tune digital reporting and AI monitoring systems to increase efficiency and robustness

## Problem

The ocean is losing biodiversity at a high speed, as human pressure grows, and it will only get worse. We need real solutions to restore marine life, offset our impact and make human activities ocean friendly.

## Solution

We provide solutions to offset environmental impact, restoring marine life in damaged areas with the latest regenerative technology, combined with AI monitoring and digitalised reporting to provide evidence of positive impact.

## Industry Information

It's a €3Bn market opportunity, considering infrastructures only. Offshore wind (€1,8 Bn) will be a key market as it is expected to grow significantly from 2027 on.

Oil rigs will also be a key segment in the mid term (12.000 to be dismantled, with amazing negative impact- we can avoid that).

Commercial ports are also important, particularly because our technology can provide offsetting solution to the port community (shipping, cruising). Marinas are a big segment, but too fragmented.

## Business Model

### *Target Customers*

- Core: marine infrastructures (offshore wind and oil, ports)
- Secondary: all marine businesses needing to offset

### *Channels*

- Core: B2B, targeting ocean infrastructures operators and related businesses
- Next: B2B2C through NFT trading

### *Potential Revenue Streams*

- IaaS (monthly fee per unit, based on services received)
- Full sale + monitoring fee

## Technology & IP

- 2 IP in process
- 2 Industrial designs confirmed
- Several brands registered to provide consistency to our marketing efforts

## Ocean Impact

- Restoring Biodiversity - up to +300% increase in number of species per installation
- Increase ocean's CO2 removal capacity
- Generate oxygen
- Increase biomass

## Unique Value Proposition

High speed and efficient marine restoration technology, specifically designed for marine structures, becoming an impact Offsetting solution.

Complemented with our digital monitoring and reporting services, we provide evidence of the positive impact, thus generating tangible socio-economic benefits to our customers (offsetting, cost saving, ESG/compliance, social engagement).



# Fleet Robotics

Automated robot swarm to clean,  
inspect and collect condition of hull data.

## Problem

There is currently no easy and precise way to visualize the condition of ship hulls around the world in near real time. This is a critical aspect of anticipating and mitigating excess emissions due to hull fouling.

## Business Model

### *Target Customers*

We are looking for owners and builders of both commercial ships and large recreational vessels.

### *Channels*

We will sell directly to owners for our initial on-ship systems. As we expand, we will sell portable solutions for smaller vessels through equipment distributors.

### *Potential Revenue Streams*

Robots-as-a-service subscription.

## Ocean Impact

Recent IMO data shows that ships, on average, can save up to 22% excess fuel emissions with better hull cleaning routines. However, this data is only from estimates.

We will make it easier to precisely track carbon emissions avoided due to hull fouling and make it easier for ports to more closely monitor invasive species threats.

## Key Metrics

- 3%: target fuel savings averaged across vessel types.

## Solution

We offer a wireless, automated robot swarm that is rugged and easy to use. We can scale across a wide range of vessel sizes, from commercial to recreational. Our system is being designed to handle a wide range of inspection and routine maintenance tasks.

## Solution Roadmap

*TRL Level - 5*

### *Immediate Next Steps in Development*

- Finalize a working MVP that will be ready for on-ship testing in Q1 of 2024.

### *Three Greatest Needs in Next 12 Months*

1. Further customer discovery with industry stakeholders
2. Facilities to accelerate testing
3. Connections with personnel to further understand day-to-day operations

## Industry Information

Our aim is to create a new market within the \$2T maritime shipping industry. Shipping accounts for 2-3% of global emissions and ship owners have shown an increasing willingness to reduce this consumption.

Furthermore, having access to frequently updated data on the condition of ship hulls would streamline processes for many ocean stakeholders, including ports, insurers, charterers, and coating companies.

## Technology & IP

We have IP that covers the novel platform that serves as the basis for our robots, along with protection on it's method of cleaning and adhering to the ship.

We also have IP that covers the inspection methods.

## Unique Value Proposition

We have developed way to autonomously traverse vertical surfaces in difficult environmental conditions.



### Key Metrics

Nakai can directly eliminate thousands of tons of CO2e emissions per vessel per year by reducing vessels' surface resistance and added drag through proactive hull cleaning.

A potential customer with a fleet of tankers estimates savings to at least 10m/t per tanker per day, which translates into a minimum of 150 million tons of GHG savings in 2030.

### Solution Roadmap

*TRL Level - 6*

#### *Immediate Next Steps in Development*

- Commercial delivery of 2 robots in 2023.
- Fuel savings report (sister-vessel comp) publication in Q1 24.
- Reaching a final product and mass-production metrics - by Q3 24

#### *Three Greatest Needs in Next 12 Months*

1. Cash flow for HW sourcing.
2. Deep analysis and insights from system detachments.
3. No-reference sensor-based navigation in harsh environments

### Problem

The rapid accumulation of biofilm on ship hulls creates increased drag which results in billions of fuel wasted each year. Other providers can only provide manual and reactive services, limited to designated cleaning areas.

### Solution

Truly autonomous hassle-free robotic platform, made from a flexible, hydrodynamic and robust design, launches proactive hull cleaning sessions while in-transit, with no paint degradation and only 220V on-board as requirement

### Business Model

#### *Target Customers*

Robot-as-a-Service - vessel owners, operators, charterers (Global Operation Managers, Voyage Optimization de.)

#### *Channels*

Robot-as-a-Service->CAPEX (future) - shipyards, ports, antifouling and insurance companies

#### *Potential Revenue Streams*

RaaS direct sales and via channels (5-year booked-revenue conditional agreements starting with a downpayment)

### Ocean Impact

Direct reduction of CO2-eq. emissions - thousands of tons per vessel per year can be saved from the source!

Immediate protection and elimination of up to 85% in the transportation of aquatic invasive species on ship hulls.

Nakai creates "underwater transparency"; providing real-time data on structural damages, hydrocarbon pollutions, collision statistics, while collecting valuable underwater data across the major shipping lanes.

### Industry Information

The huge necessity for Nakai's solution was affirmed over and over again by industry leaders and regulation experts.

From our business model to the robot's cleaning tools and its independency, we are directly derived from information constantly generated from the industry, and such that will continue to determine our future portfolio and optimal support methodologies, remotely in most cases but also in frequently visited ports and vendors.

### Technology & IP

We believe in a rapid and agile field-based R&D execution of disruptive technologies, and after previously registering numerous patents in similar fields.

These days we have 3 claims in-process, two are for the in-transit attachment and one for navigation.

### Unique Value Proposition

1. Direct - 6 month ROI
2. Fully-autonomous hull cleaning system
3. Deploys itself both underway and where permitted
4. Does not harm the most common antifouling coatings
5. Tetherless with local energy and decision-making AI
6. Minimal requirement for deployment, no delay/class-change
7. Constant inspections and underwater data collection, enabling a true shift to preventive maintenance

# Clean Ocean Coatings

## Biocide and solvent free hard smooth antifouling coating, without microplastics.



### Key Metrics

- Imagine 2030 when we will coat 250 vessels and generate 70€ million in revenue.
- On the way we will save 853,000t of CO2 equivalents, 1.250t of microplastic and 440t of solvent.

### Solution Roadmap

TRL Level - 7

#### *Immediate Next Steps in Development*

- We adjusted the formulation for the spray application process and produce material for the upscaling test.
- In October we will measure friction in the flow channel.

#### *Three Greatest Needs in Next 12 Months*

- Successful spray tests;
- Running pilots which generate data and marketing material; and
- Secure seed funding next spring, to go to market

### Problem

Biofouling is the growth of algae and seashells on ships. This increases fuel consumption up to 40%.

More than 100,000t of toxic antifouling coatings are applied every year of which 50% end up in the ocean.

### Solution

We develop a biocide and solvent free hard antifouling coating which does not wash off.

Our magic is a uniquely smooth surface which saves fuel, is easy to clean and more durable than conventional coatings.

### Business Model

#### *Target Customers*

Our target customers are ship owners operating in the commercial shipping industry from ferries to big cargo.

#### *Channels*

The industry still works via direct sales, strong trust based networks and specific trade fairs.

#### *Potential Revenue Streams*

We sell the coating at a competitive price as well as development services to customize the product. We collaborate with smart cleaning solutions on a commission basis.

### Ocean Impact

- We save the ocean 1.250t of microplastic until 2030 alone.
- We stop the use of biocides.
- Our coating reduces microplastic and biocide contamination from antifouling coatings to zero.
- Since our hard coating is easy to clean, it is feasible to maintain a clean hull at all times and avoid the spread of invasive species protecting ecosystems around the globe.

### Industry Information

- The global marine coating market is in the size of 11Bn US\$. It is forecast to grow by 7 % CAGR to 15Bn US\$ in 2024.
- 80 % of the market is owned by five global players (International, CMP, PPG Paints, Jotun, Hempel).
- 90% still use conventional so-called self-eroding coatings which contain biocides and wash off into the ocean. The others rather use no antifouling than any alternatives which lag behind in durability and practicability.

### Technology & IP

Ecoating is a combination of a nano-structured patented particle and a polymer matrix, so called Polyramik.

Combining the advantages of ceramics and polymers, the coating is sturdy yet flexible.

Patricia Griem developed the coating at Phi-Stone during three research projects together with Christian Albrechts University Kiel. We have an exclusive agreement to use the particle.

### Unique Value Proposition

Our magic is a uniquely smooth surface.

Due to the smooth surface we have less friction. First modelations indicate at least 6% fuel savings. No solvent – no micropores – no corroding surface for organisms.

Our coating does not only stand out in longevity and sustainability but also in ease of application. It is highly scalable and applicable with standard methods.



# Repela Tech

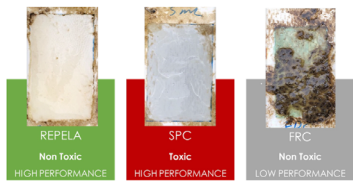
Non-toxic antifouling marine coating.

Detroit, MI, USA

[repela.co](http://repela.co)

[linkedin.com/company/repela-technology](https://www.linkedin.com/company/repela-technology)

3-Month Field Test Performance Comparison



6 Months



## Problem

Copper is the most common pollutant found at toxic levels in marinas; copper-based antifouling paints are the source of 98% of this pollution.

## Business Model

### *Target Customers*

Our beachhead market is recreational boating followed by scale-up into the large vessel segment.

### *Channels*

The Repela System will be sold through distributors to boatyard professionals and DIY boaters.

## Ocean Impact

Toxic copper/biocidal antifouling paints make up over 95% of the market and no effective eco-friendly alternatives exist.

But demand is growing from consumers and regulatory agencies for greener solutions, driven by the need to reduce marine biocide pollution and de-carbonize shipping.

The Repela System will be the first eco-friendly marine coating that is also high-performing.

## Key Metrics

Copper is toxic to marine life. Vessel hulls coated with copper-based antifouling paints leach copper at the rate of 2 lbs. per year. This amounts to 100 tons of copper polluting the Great Lakes and 480 tons polluting the coastal and inland waters of Florida. Replacing copper antifouling paints with the eco-friendly Repela System will immediately halt this pollution.

## Solution

The Repela System is the first non-copper, non-biocide marine antifouling coating that matches the performance of copper paints but without the toxic consequences.

### *Potential Revenue Streams*

We have a two-prong approach: 1) direct to market by selling to distributors; 2) white label/licensing to OEM.

## Solution Roadmap

*TRL Level - 6*

### *Immediate Next Steps in Development*

- Manufacturing processes are being validated in partnership with a contract manufacturer;
- 3rd-party validation of coating performance is underway by a major paint OEM.

### *Three Greatest Needs in Next 12 Months*

1. Pilot projects on test vessels to be conducted;
2. Distribution channel relationships need to be established;
3. Fundraising to support market entry.

## Industry Information

The global antifoulant market is \$1.3 billion in size. Copper antifoulants comprise 95% of this market. Foul-release coatings (FRC) are a non-biocidal alternative but only have 3% market share.

FRCs have many shortcomings and have not been able to match the antifouling performance of copper paints. Regulatory restrictions on copper and other biocidal paints are increasing.

It is estimated that their market share will diminish from today's 95% to 40% in the next 5 to 10 years.

## Technology & IP

The Repela System acts like a cloak of invisibility.

The innovation is based on a patent-pending hydrophilic polymer technology that prevents biofouling, not by killing, but by forming a protective barrier coat on the hull surface to make the hull "invisible" to fouling organisms.

US and PCT patent applications have been filed to protect the IP.

## Unique Value Proposition

The Repela System's value proposition is that it matches the performance of today's toxic biocide-based antifoulants, but without the harmful consequences to marine ecosystems.

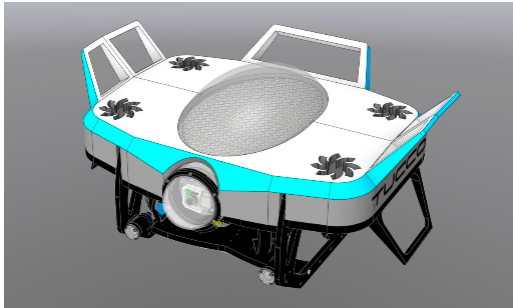
Also, by eschewing biocides we avoid the long and costly regulatory process of registering biocide-based products.



# TUCCO - The Underwater Cleaning COmpany

Autonomous drone that navigates the submerged part of ships and irradiates hull.

London, UK  
[tucco-ltd.com](http://tucco-ltd.com)  
[linkedin.com/company/tucco-ltd](https://www.linkedin.com/company/tucco-ltd)



## Problem

Biofouling - a 400bln USD per year problem that has been affecting mariners since homo sapiens crafted the first canoe

## Business Model

### *Target Customers*

Shipowners; ship operators; yacht owners; marina & port operators; navies; research entities; shipyards

### *Channels*

Trade fairs, networking, referrals: the client pool is large, but the gatekeepers are relatively few

### *Potential Revenue Streams*

Mixed leasing model: we provide the drones on a yearly basic fee, plus a per-use

## Ocean Impact

Reducing biofouling to near-zero means:

- significant cutbacks in carbon emissions
- reduced use of polluting anti-fouling paints
- less discharge of residue
- significantly reduced bio-contamination risk;

all in a easy-to-use package with ZERO environmental impact.

## Key Metrics

A “Always clean” hull means significant savings in fuel and maintenance costs, potentially running into the millions/year for big commercial ships.

As for the environmental benefits, we can add to the very important savings in carbon footprint and the use of other pollutants, the difficult to calculate but enormously important reduction in biodiversity risk.

## Solution

A system of autonomous drone with an AI/machine learning navigational system that follows the contours of the hull irradiating it with UVC light and thus preventing the formation of biofouling

## Solution Roadmap

*TRL Level - 5*

### *Immediate Next Steps in Development*

- The next step is a working prototype to put together all the aspects that we already know work separately.

### *Three Greatest Needs in Next 12 Months*

1. Cash.
2. Scientific partners: to tune and validate the amount of irradiation necessary for a satisfactory result
3. Industrialisation partners.

## Industry Information

No one is like us as we switch focus from passive prevention / active remediation to active prevention, leading to a radically different operational scenario.

## Technology & IP

Almost all of the components of the system are either off-the-shelf or easily modified from such.

The system itself is patented in Italy and patent pending internationally.

## Unique Value Proposition

NOBODY else acts at our point of action: we prevent rather than cure the problem.

# AnchorGuardian by Swiss Ocean Tech

Solution with complete range of intelligent data throughout anchoring including anchor drag.



## Key Metrics

- Sales & Revenue according to financial plan.

## Problem

Despite advanced naval navigation equipment, it is still not possible today for the crew to know if, by how much and how fast, the anchor is dragging in real-time. There is no peace of mind when anchoring.

## Business Model

### *Target Customers*

Main entry point in the superyacht segment followed by merchant ship, fishing vessels and then leisure boat.

### *Channels*

Direct sales / Distribution partners / Online shop / Website / ENewsletter / Social Media / Media / Events

### *Potential Revenue Streams*

- One-Time sales
- Product options
- Service as annual fee for remote health checks/SW updates/ + features

## Ocean Impact

Dragging anchors pose a threat to fragile marine ecosystems. Bigger boats means heavier anchors&chains means bigger impact on seabed.

AnchorGuardian monitors the absolute movement and position of a ships anchor and supports the crew whilst laying and lifting the anchor with relevant intelligence and provides immediate, fail-safe alarms with sub-meter accuracy. Moving anchoring from reactive to proactive. Finalist for Ocean Awards 2022.

## Solution

AnchorGuardian is bringing safety to anchoring for sailor, ship and sea. It monitors the absolute movement and position of a ships anchor and supports the crew whilst laying and lifting the anchor with relevant intelligence.

## Solution Roadmap

*TRL Level - 7*

### *Immediate Next Steps in Development*

- Testing / Class society certification / Optimising AnchorGuardian for mass production / Supply Chain definition

### *Three Greatest Needs in Next 12 Months*

1. Financing for industrialization and go-to-market in 23/24 for the SY market
2. Sale of 100 units in 2024
3. Establishment of customer and distribution base

## Industry Information

Anchor dragging threatens the safety of a ship's crew and passengers and is the cause of significant environmental impact on the seafloor and marine life. A dragging anchor is the main cause for damage to subsea pipelines and cables.

Current anchor alarms include a high degree of uncertainty as they monitor the vessel, often raising false or too late alarms for the crew to avoid accidents.

AnchorGuardian monitors the anchor with submeter accuracy.

## Technology & IP

AnchorGuardian represents sophisticated engineering which can be used for any vessel.

For the first time, using sensor fusion and sophisticated algorithms, our technology can build a stable dataset of the anchor's relative and absolute position, providing reliable information over the entire anchoring procedure.

2 patents (with more coming) / 1 registered trademark

There are no direct competitors, we are creating a new market.

## Unique Value Proposition

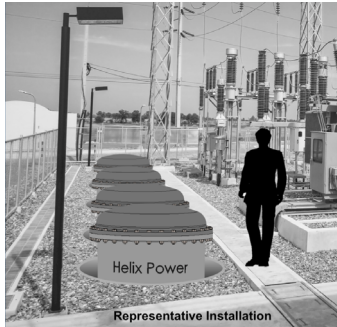
A good night's sleep is conditional on crew knowing that they are safely anchored.

No early warning system means a vessel can be in considerable trouble by the time a problem is identified resulting in not only damage to the boat and the seabed below, but also risk to people onboard.



# Helix Power

Kinetic batteries for seaports. Addresses surges by recovering energy and recycling.



## Problem

As seaports transition to fully electrified cranes and container handling equipment, power spikes created by regenerative braking and drops created by crane demand need to be balanced to a strained energy supply from the grid.

## Business Model

### *Target Customers*

Port Authorities operating seaports with >100k TEU annual throughput.

### *Channels*

Helix power works with Port auth., port infrastructure manufacturers, independent port planning advisors.

### *Potential Revenue Streams*

Port authorities and operators purchasing Helix Power hardware.

## Ocean Impact

Helix kinetic batteries enable faster and more cost effective adoption of port electrification and transition to emissions free operation.

Incorporating high power and short duration storage allows electrified crane and container equipment to operate more efficiently and with less peak power demand from the grid.

Electrified ports result in less noise, less pollution & GHG emissions, and lower potential for chemical fouling of surrounding waters.

## Key Metrics

- 1 megawatt of power
- 90/90 seconds charge/discharge cycle
- millisecond response time
- continuous operation capable
- 20 year operating life
- 64 square foot footprint

## Solution

Helix Power's unique high power kinetic battery system attenuates surges and sags by recovering regenerative braking energy and recycling it for surges in demand, creating more efficient operation and reduced peak demand.

## Solution Roadmap

*TRL Level - 6*

### *Immediate Next Steps in Development*

Complete assembly and testing of the first full-scale 1 megawatt kinetic battery system.

### *Three Greatest Needs in Next 12 Months*

1. Financing for the first full scale prototype
2. Establish an initial seaport demonstration site
3. Continued stakeholder buy-in for emissions free port operation

## Industry Information

Seaports are transitioning to fully electrified operations to reduce port emissions and enhance port operability and efficiency. This includes transitioning from fossil fueled cranes and container handling equipment to electric cranes.

Electrification can also extend to providing shore-to-ship power for shipboard refrigerated container operation and the potential for charging cargo ships with electric propulsion. The Inflation Reduction Act provides \$4B for US port electrification projects.

## Technology & IP

Helix Power has 4 issued design patents, covering the overall design architecture as well specific innovations in cooling and rotor design.

In addition, Helix Power has several proprietary design features that give our kinetic battery step change enhancements in performance and safety.

## Unique Value Proposition

Each 1 megawatt unit has a 20 year operating life, 1-3 year pay-back period, and annual energy savings of \$0.5M.

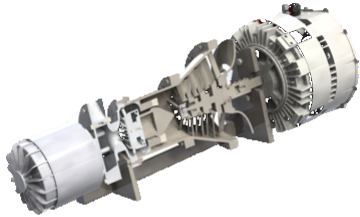
Additional savings include operational stability and efficiency of complimentary port infrastructure.



# Nobel Works

Supersonic combustion engines use fossil fuels more efficiently.

Tucson, AZ, USA  
[nobel-works.com](http://nobel-works.com)



## Problem

Our world runs off the combustion of fossil fuels, albeit at the expense of harmful emissions.

Global demand is growing faster than installed renewables, and fossil fuels meet most of that growing demand.

## Business Model

### *Target Customers*

Microgrid and decentralized heavy industries including ports

### *Channels*

Nobel is teaming with a microturbine leader to upgrade their systems for their existing customer base.

### *Potential Revenue Streams*

- Microturbine sales to established OEMs
- Development contracts from aerospace and defense

## Ocean Impact

Adopting supersonic combustion turbines in ocean shipping could lead to transformative benefits.

Enhanced fuel efficiency reduces costs and emissions, aiding environmental goals.

Ports and adjacent heavy industries such as LNG facilities can benefit from hydrogen or hydrogen-blend powered efficient turbines to decarbonize their activities.

Overall, shipping and port operations will become more sustainable and efficient.

## Key Metrics

- Increase in total efficiency and reduction of CO2/NOX versus conventional combustion devices.
- Reliability and mean-time-to-failure metrics at or better than traditional microturbines.

## Solution

Nobel is developing supersonic combustion technology that increases fuel efficiency by up to 25% and works well with new green fuels.

This alternative results in more energy with less emissions.

## Technology & IP

Nobel has three provisional patents and a pipeline for further patents on key subsystem technologies.

Nobel's IP strategy is to lock down key "choke-point" subsystems pivotal to supersonic combustion system level performance.

## Solution Roadmap

*TRL Level - 4*

### *Immediate Next Steps in Development*

Integrating Nobel's demonstrated and proven supersonic combustor with turbines to efficiently extract power.

### *Three Greatest Needs in Next 12 Months*

1. Securing Seed Round lead investor
2. Identifying pilot project demonstration
3. Initial qualification of new microturbine design

## Industry Information

Planes, trains, automobiles, ships, rockets and most (83%) of energy comes from the combustion of fuels.

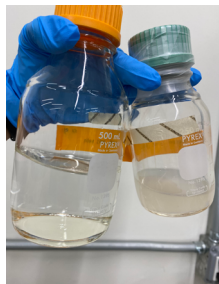
Energy and transportation alone account for over \$10T a year in global expenses, while also accounting for most of the CO2 emissions. This demand is growing 50% by 2050.

Renewables are not keeping pace, so most of this demand will be provided by yet more combustion. New combustion technologies and new fuels are necessary if we are to meet global demand and keep emissions to a minimum.

## Unique Value Proposition

Nobel is the only company dedicated exclusively to supersonic combustion technology, which can increase fuel efficiency by up to 25%.

Currently, this technology is being developed by aerospace and defense, which is where our founders have spent most of their careers. Nobel seeks to bring about the rapid adoption of this technology to energy and transportation where it will have the greatest global effect on fuel efficiency and clean emissions.



## Problem

The marine industry relies on bunker fuel which is extremely polluting and toxic, damaging to both the environment and human health. With decarbonization pressure, there is a need for an alternative fuel to offset emissions.

## Business Model

### *Target Customers*

We target fueling systems and bunkering companies (Shell, BP, etc.) to distribute our MeOH to end-users.

### *Channels*

Our target customers are the channels to distribute our MeOH to major shipping companies, like Maersk (B2B2B).

### *Potential Revenue Streams*

Sale of fuel. We plan to install, build, and operate close to point of delivery for price competitiveness.

## Ocean Impact

MeOH results in a massive reduction in GHG emissions from blue ocean vessels, and a very large reduction in the energy needed to produce renewable energy - a huge benefit to harbor operations.

Reduced risk of damage from spillage.

Eliminates the need for bunker oil preheating with diesel.

Drops the need for port side storage of bunker oil.

## Key Metrics

1. Carbon intensity: we use biomethane as input, and little energy to run our systems. Our carbon intensity ranges from -25 gCO<sub>2</sub>e/ MJ to -260 gCO<sub>2</sub>e/ MJ. We have potential for the lowest carbon intensity methanol on the market.
2. Energy efficiency of production process: we expect >75% vs <45% for others.

## Solution

CarbonBridge offers carbon-negative methanol produced from waste greenhouse gas in a microbial process.

In a low cost, low energy process, this methanol will replace the toxic, dirty bunker fuel used in the marine industry.

## Solution Roadmap

*TRL Level - 3*

### *Immediate Next Steps in Development*

- An integrated system
- bioreactor development

### *Three Greatest Needs in Next 12 Months*

- Offtake agreements
- Funding for patent filings
- Talent - wet-lab research intern, chemical engineer

## Industry Information

The shipping industry is broken broadly into near-shore and blue ocean. While near-shore operations may adopt battery tech, blue ocean vessels cannot. This leaves several thousand large vessels under pressure to decarbonize due to US/EU regulations. This transition towards an alternative fuel is already happening. Methanol is leading, due to its ease of storage, transport, and climate friendliness. Our methanol, as the lowest carbon-intensity methanol available on market, meets key customer needs based on interviews with major operators.

## Technology & IP

We are planning 4 patent streams for a highly defensible plan. This IP is centered on our:

1. Fully evolved microbe and optimized formulations
2. Scalable bioreactor
3. Filtration system
4. AI/ML control system for fully automated maintenance of bioreactor

We currently have a patent pending for filtration processes.

## Unique Value Proposition

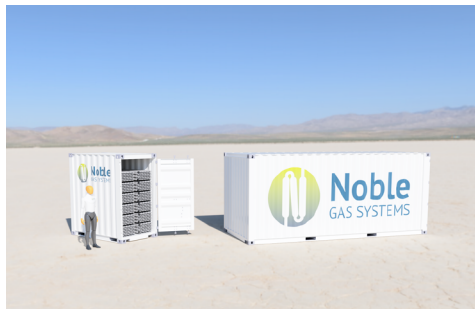
By using microbes to convert CH<sub>4</sub> and CO<sub>2</sub> into methanol, our max temperature and pressure drops to 70 C and 10 PSI (too low for a deflated football).

This entirely bypasses the current process at 1000C & 450PSI, and thus eliminates the related supply chain, capital costs, energy costs, operating footprint, and safety concerns.

No genetic engineering is used and therefore our microbes are not under stress, allowing scale up and long-term production.

# Noble Gas Systems

Recyclable, innovative, lighter  
hydrogen storage tanks with safety benefits.



## Problem

High-pressure gaseous hydrogen is difficult to store and transport, and existing solutions are heavy and cumbersome, make extensive use of unrecyclable carbon fiber, and cannot scale to support the maritime industry.

## Business Model

### *Target Customers*

Energy and gas producers who transport hydrogen from production sites to downstream applications.

### *Channels*

Energy and gas producers who transport hydrogen from production sites to downstream applications.

### *Potential Revenue Streams*

Noble Gas will produce and sell hydrogen storage systems.

## Ocean Impact

Noble Gas tanks have a compounding impact on the oceans:

- The modular tanks will enable rapid transition to ships powered by hydrogen.
- The more efficient storage will reduce the number of trips required to transport hydrogen or use hydrogen as an onboard fuel.
- Lowering the barriers for the transport and storage of hydrogen will support decarbonization in many industries.
- The increased material circularity improves resource utilization.

## Key Metrics

- Each kg of storage capacity will save over 6kg of carbon fiber production and waste - 3,000 kg saved per container.
- By 2030, Noble Gas tanks will be preventing over 8 million kg of carbon fiber production and waste per year.
- This will additionally save over 160 million kg of CO2 released into the atmosphere.

## Solution

Containerized hydrogen storage modules that can be retrofit and/or swapped between vessels and intermodal transport - providing instant scalability that doesn't have to wait for infrastructure to mature.

## Solution Roadmap

*TRL Level - 6*

### *Immediate Next Steps in Development*

- Pressure vessel development is already done, and we're delivering bulk storage prototypes by early in 2024. Also working with DNV to complete an Approval in Principle.

### *Three Greatest Needs in Next 12 Months*

1. Complete certification work
1. Begin production scale ramp-up
1. Hire additional staff

## Industry Information

Although hydrogen supply and demand are growing, adoption is severely limited by a storage and transport solution.

Between now and 2050, the growth in demand for hydrogen storage in the maritime industry will have a CAGR of 17.5%, and will be more than a \$2B market by 2030.

## Technology & IP

The core technology of Noble Gas relates to the design and manufacturing of a conformable pressure vessel with a plastic liner and a non-carbon fiber reinforcement layer.

Noble Gas has multiple granted patents related to the design and integration of storage systems using these vessels as well as solving some of the significant operational challenges.

Building experience and know-how every day. More patents are on the way.

## Unique Value Proposition

The safest and most efficient way for compressed hydrogen to be stored and transported onboard ships and throughout intermodal transport modes, enabling decarbonization - land, air, and sea.