LOW CARBON BUSINESS ACTION CANADA

Funded by the European Union

Low Carbon Business Action in Canada

CHALLENGE PITCH SESSION #4b: Regional Transport Decarbonization (VEC Translink)

March 1, 2022

HT MATERIALS SCIENCE

SMARTER HEAT TRANSFER FLUIDS™

MAXWELL™

LC2BA LOW CARBON BUSINESS ACTION CANADA

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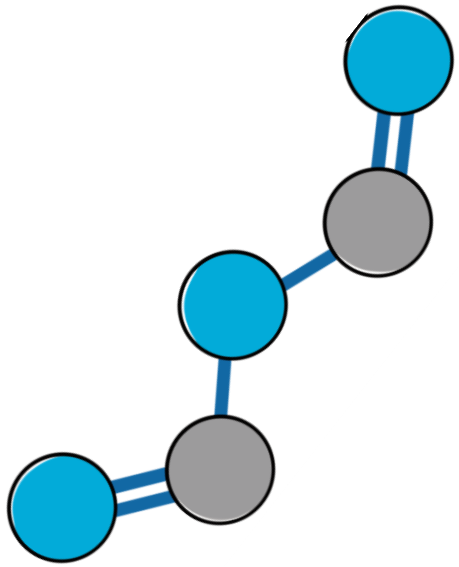
- Challenge Pitch Presentation
- February 2022

• CORE TECHOLOGY / INNOVATION: MAXWELL™



Aluminium Oxide (Al_2O_3) molecule

- Patented, innovative, heat transfer fluid additive
- Engineered suspension of sub-micron aluminum oxide particles
- Works in any closed-loop water or water/glycol-based system
- Suitable for cooling, heating and process applications
- Comprises only 2% of total system fluid volume
- Up to 15% reduction in energy consumption by the system
- No need to shut system down, no special retrofit required
- Typical installation in less than 8 hours
- Delivers immediate results
- Non-corrosive and non-toxic
- Useful life of 10+ years
- Maxwell™ is priced by the volume of fluid in the existing system

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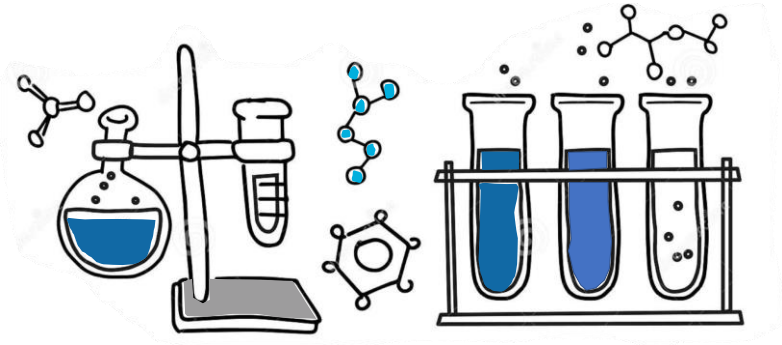
ABOUT HT MATERIALS SCIENCE

- HT Materials Science (HTMS), the developer and manufacturer of Maxwell™, is a privately-owned Irish company founded in 2018 with subsidiaries in Italy and the US
- There are currently 20 employees, the majority of whom are senior researchers and engineers, with extensive academic and commercial experience in nanofluids and mechanical systems
- R&D and production facilities are in Lecce, Italy, with corporate offices in New York and Dublin
- HTMS was granted 2 patents for Maxwell™ characterization / formulation of the submicron particles and fluid, and for the Maxwell™ production process; 3 additional patents are pending



R&D facility for nanofluids is based in Lecce (Italy)

Industry Partners and related installations to date include:

REGENERON (USA:2019-2021)

Johnson & Johnson (USA:2021)

aramco (KSA:2021)

SRG GLOBAL (USA:2021)

UNIVERSITÀ DEL SALENTO (IT:2019-2021)

SYSTEM GROUP (IT:2021)

SWIRE PACIFIC (HK:2022)

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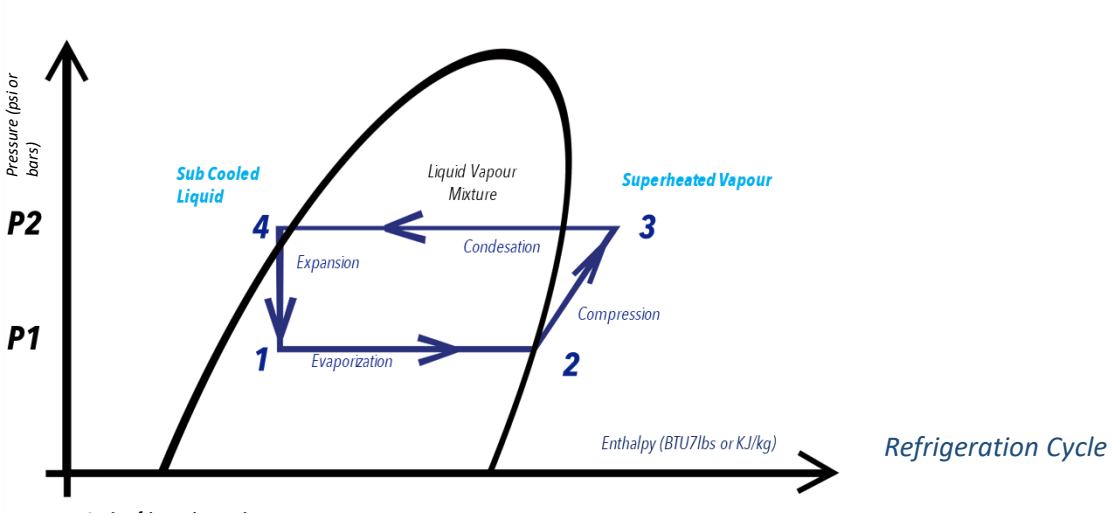
HOW MAXWELL™ WORKS IN COOLING & HEATING SYSTEMS

- Maxwell™ increases thermal energy transfer by 15% or more in the fluid and heat exchangers within the system
- This includes the evaporator and condenser cycles within Chillers and Heat Pumps (1-2, 3-4 in diagram below) and any cooling, heating or energy recovery coils throughout the system

- The increased thermal energy transfer in a Chiller or Heat Pump reduces the work of the compressors (2-3 in diagram below), improving efficiency and reducing energy costs by up to 15%

- Further reductions in energy consumption, maintenance costs and capital expenditures are achieved through lower flow rates and pumping power, less wear & tear on equipment and extended equipment lifecycles



Refrigeration Cycle

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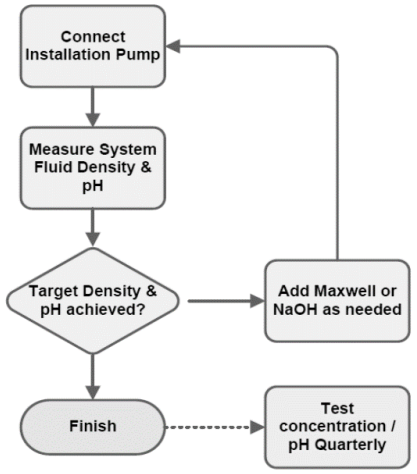
• MAXWELL™ PILOT SITE INSTALLATION PROCESS

- Mutually select a suitable test site installation, generally a single chiller / heat pump system with water or water/glycol fluid in a closed loop



Maxwell Installation Process

- Preparation includes
  - ✓ site visit by HTMS engineers
  - ✓ review of system schematics, equipment specs, current operation
  - ✓ determination of system fluid volume & composition, Maxwell™ required
  - ✓ design and installation of a Measurement & Verification System
- Remote monitoring by HTMS engineers of current electrical and thermal energy values of system and equipment during the baseline period (30+ days) to create a performance model for the base fluid
- On-site installation of Maxwell™ by HTMS engineers in one day (see diagram at left).
- Continued monitoring of system performance for evaluation period (30+ days)
- Preparation of detailed performance report using the International Measurement & Verification Protocol (IPMVP) to account for and normalize any variations in operating conditions (ambient temperatures, building loads) between periods
- Review and evaluation of performance report with VEC Translink

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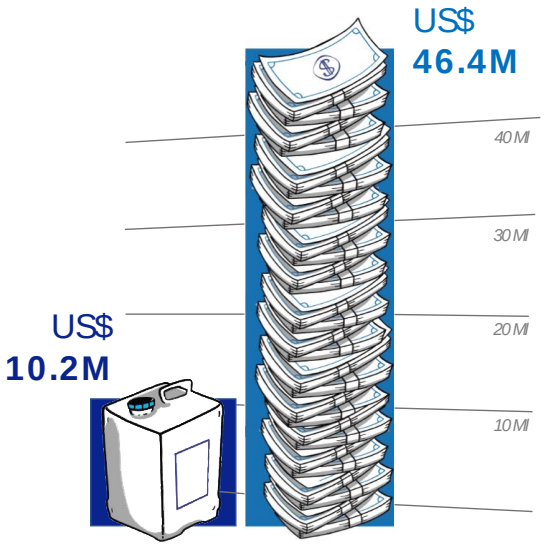
• ARAMCO HQ INSTALLATION, DHAHRAN, KSA



Total Cost of Implementation vs Cumulative Energy Savings over a 10 yr. period

- Building 1900 is a multi-story 12,000 square-foot building where cooling is provided by two 60-ton air-cooled chillers. Local electricity costs are US$ 0.08 per kWh. The system runs 24/7, 365 days per year
- The improvement in energy efficiency of the chillers operating on the existing water at first, followed by operation with Maxwell™, was 16.9% with an overall system energy savings of ~15%
- Based on these results, Aramco engineers conducted a company-wide evaluation of the cost / benefit for implementing Maxwell™ in all non-industrial closed-loop chiller systems (63,000 tons)
- With a cost to install Maxwell™ of US$10.2M and annual energy savings of US$4.64M, the Payback Period is 2.2 years, and annual ROI 46% over 10 years
- Furthermore, annual CO_2 Savings are estimated at 25,000 tons
- Maxwell™ has now been included in the Aramco Board of Engineers Portal, "Proven Technology Database" and the Corporate Knowledge Portal and is being presented to the largest real estate departments in Aramco for roll-out in the buildings under their custody

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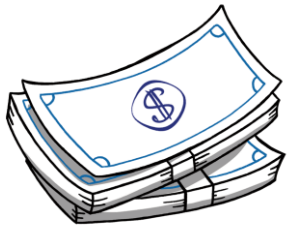
• J&J MENTOR INSTALLATION, IRVING, TX



46% IRR

2,000 tons CO_2 emissions reduced

- Maxwell™ installation at one 60,000 sq ft production building in Irving, Texas (two 210-ton parallel air-cooled chillers). Local electricity rates are very low, at $0.06 kWh
- Payback period of 3 years on installation cost of ~$46,000 for a 1,650-gallon system. Annual Maxwell™ maintenance estimate ~$5,000
- IRR of 46% per annum over 17 years. This project demonstrates an increase in chiller efficiency and extended system benefits from Maxwell™
- The Mentor building represents just 0.4% of J&J's global manufacturing footprint

- Estimated electricity reduction of 4.6 million kWh and a reduction in CO_2 emissions of 2,000 tons, due to:
  - ✓ Increased efficiency of chillers allowing one chiller to be taken off-line and used as back-up during a substantial part of the year
  - ✓ Reduced system flow rates resulting in lower pumping power
  - ✓ Reduced maintenance expenses and longer equipment life, extending capex for chiller replacement by 5 years

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• BROADER ENVIRONMENTAL IMPACT

Maxwell™ is a unique product* that will enhance the **sustainability** of new buildings by impacting the design & build process:

- ✓ Reducing the size of mechanical (HVAC) equipment
- ✓ Less energy required to manufacture and ship equipment
- ✓ Reducing the footprint of machine rooms and plants
- ✓ Reducing required electricity and natural gas supplies and the supporting infrastructure
- ✓ This, in turn, also reduces GHG emission at its source – the power plant
- ✓ Extending equipment lifecycles due to less wear & tear

Environmental, social and economic issues are at the core of our daily actions

(*) HTMS is not aware of any other nanofluid additives in the market that are non-toxic and applicable to heating, cooling and process applications using water or water with glycol as a circulating fluid.

• PROJECT IMPLEMENTATION TEAM | 1

Prof. Arturo de Risi
Chief Technology Officer

- 30+ years of experience in the energy sector, including authoring 11 patents
- Professor of Engineering for Innovation at the University of Salento. Chairman of Distretto Tecnologico Nazionale sull'Energia and committee member of the Italian National Energy Cluster

Rudy Holesek
Head of Product Applications

- Founder and CEO of Apollo, leading HVAC supplier in New York, designed, built and serviced 20M sq. ft of commercial and industrial buildings
- Former Chairman of USGBC-LI, an HIA-LI Board Member and Vice President of BOMA-LI

Edward Yusko
Head of Sales

- 30+ years of experience in technical sales including the commercial and industrial HVAC industry with Honeywell and Control Tech.
- BSc Engineering & Computer Science, Cornell University and SUNY Albany

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• PROJECT IMPLEMENTATION TEAM | 2

Jim McEnteggart, P.E.
Product Applications

- 30 years of experience in facilities operations and engineering as an owner and consultant. Licensed Professional Engineer in N.Y. State
- BEng from SUNY Maritime College, a Master of Marine Engineering from the US Merchant Marine Academy and MBA from Marist College

Claudio Grisoni
Product & Solutions Implementation

- 25 years developing control systems for the energy and telecom sectors including British Petroleum, Raytheon and Telecom Italia
- MSE in Engineering from Stanford University and MAE in Aerospace Engineering from the University of Rome

Marco Potenza
Product Installation & Validation

- 15+ years experience modelling, designing and developing control systems for industrial companies such as Bosch AG, Volkswagen AG, Fiat and Whirlpool
- MSE in Materials Engineering and a PhD in Energy Systems and Environment from the Universita degli Studi di Lecce

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For more information, visit our website
www.HTMaterialsScience.com

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MaritimeAPI

Carbon Footprint Reporting and Offsetting

March, 2022

Solution

A digital **decarbonization** solutions for ships where users can control their **carbon footprint** by**:**

Monitoring Carbons

with ESG reporting

Offsetting Carbons

with carbon credit market measures

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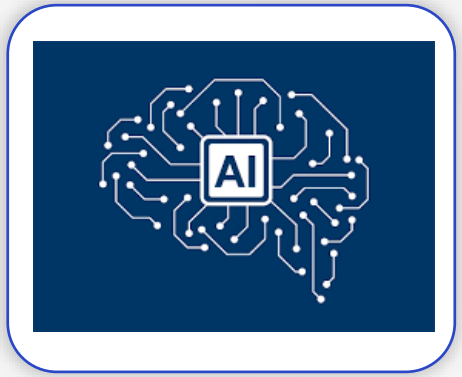
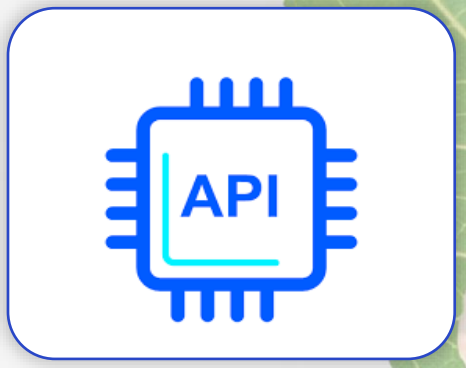
Core Technology/Innovation





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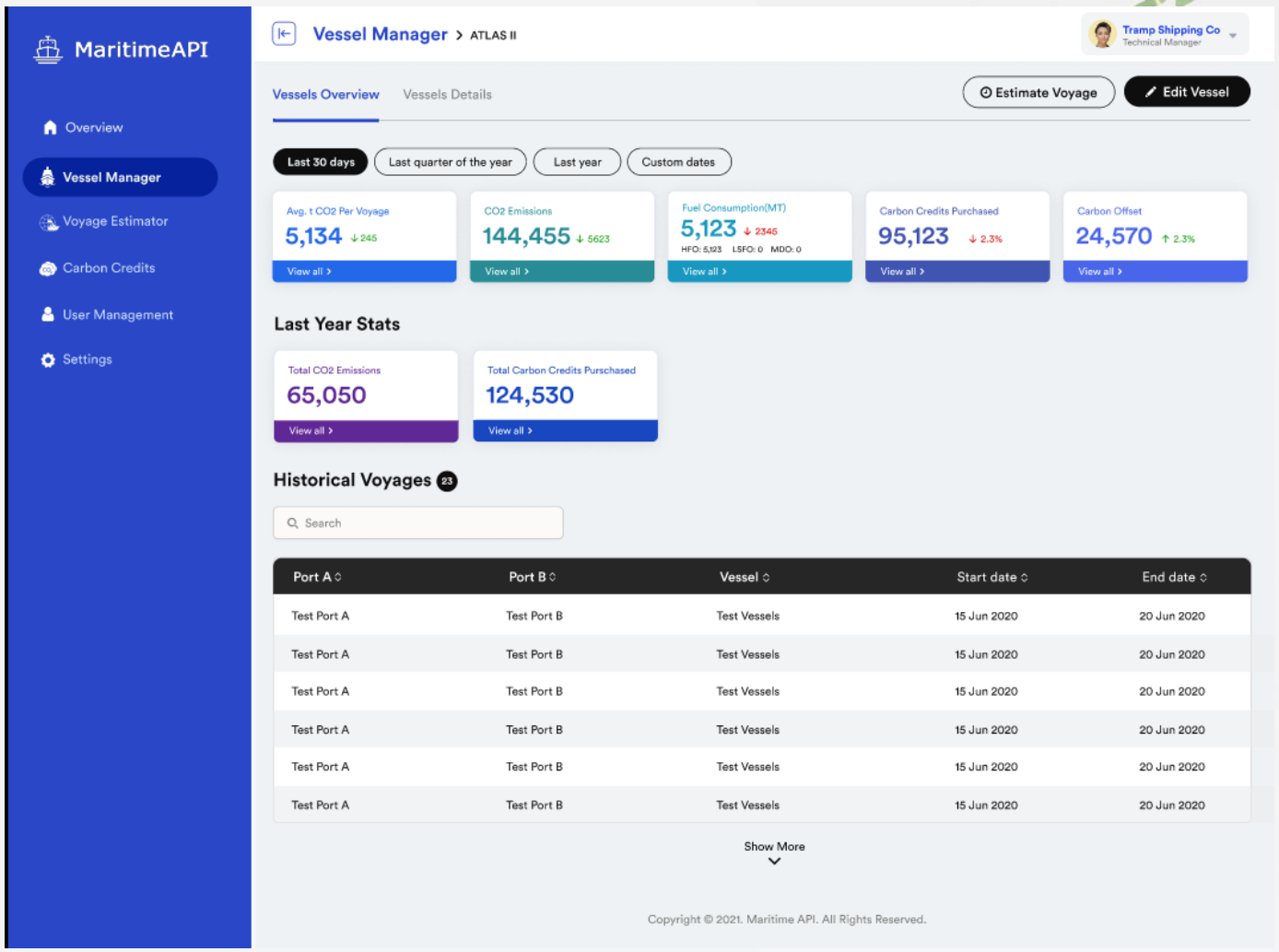
Core Technology/Innovation



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Buyer Challenge Fit

- Monitoring using IOT - AIS (Automatic Identification System) / real time location data
- CO2 emission accurate calculation methodology using AI/ML and International Maritime Organization formulas
- Offsetting emission by removing it from the atmosphere using voluntary based measures
- ESG reporting for the public authority and its assets (ferries)

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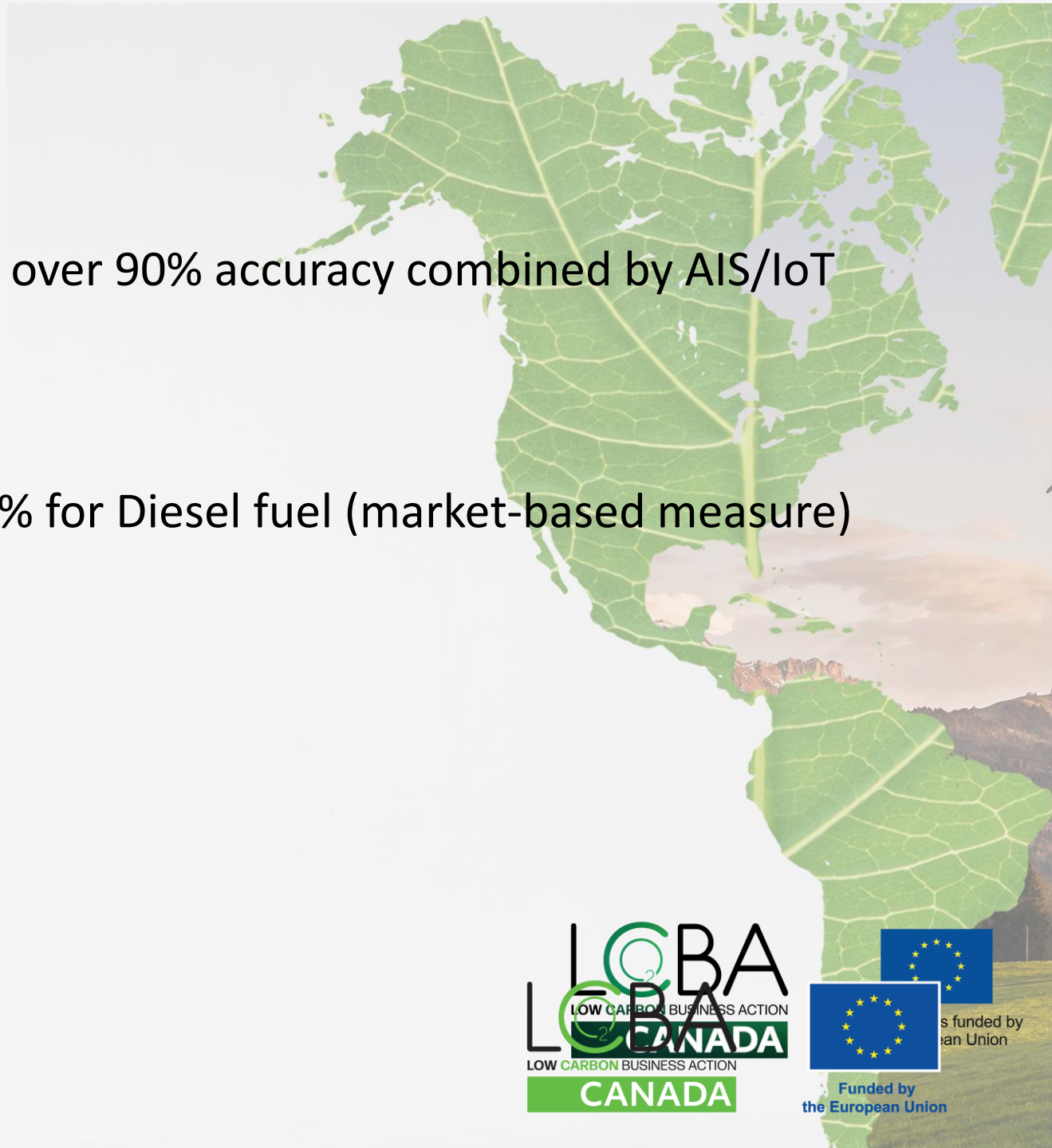
Environmental Impact

- Accurate GHG monitoring based on ML over 90% accuracy combined by AIS/IoT data and fuel consumption metrics

- Anticipated GHG offsetting by 20% - 40% for Diesel fuel (market-based measure)



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Solution Economics

- Cost estimate to implement for the solution
  - CAPEX 23K on currently known requirements
  - OPEX:
    - 7K Euro for 4 vessels per year
    - Approx 32 Euro per CO2e MT for carbon offsetting (voluntary market measure)
- 30% more cost-effective for on ESG reporting competitive solutions

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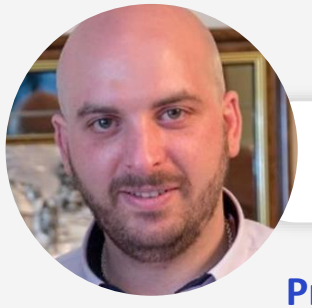
The Implementation Team



Gianis Priovolos

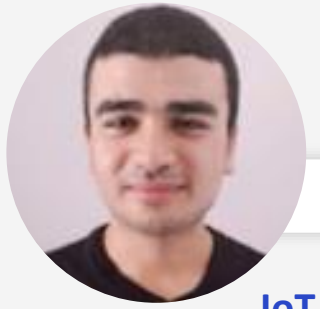
Product Manager

- 10+ years of maritime expertise, business and risk analysis, HSEQ and product management. Ex-deck Officer.
- Cardiff Business School graduate

Hiroko Sanuki

Project Manager

- 10+ years in IT related managerial positions (account, product, business development) for the digital media industries



Majdi Chebil

IoT System Engineer

Apurba Banerjee

Data Scientist

seametrix

Compensate

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Company Traction

Partnerships

seametrix

Compensate

vms sa
VIRTUAL MARITIME SERVICES

SEALOGS
PAPERLESS LOGBOOKS

Accelerator Networks

Greece

EUROBANK

egg
enter • grow • go

Greece and International

MIT Enterprise Forum Greece

Singapore

NUS National University of Singapore | NUS Enterprise

Competitions

Finalist – 2020
Winner AI Track

OCEAN OF OPPORTUNITIES CHALLENGE GRAND FINALE

Winner Smart Ship IOT - 2021

GALATEA
BLUE GROWTH ACCELERATOR

Finalist - 2021

GreenTech Challenge
by ESU NTUA

As featured on

Medium

STARTUPPER

Blue Invest Project Pipeline

LOBA

European Commission

This project is funded by the European Union

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Funded by the European Union

Key Contact Details

Contact: hello@maritimeapi.co

Website: