

SHAPE UK SHOWCASE

Shipping, Hydrogen and Port Ecosystem, UK



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In partnership with:



Funded by:



WELCOME AND INTRODUCTION

9.30-10.00



Dr David Hutchinson

Reader in Environmental Innovation
University of Portsmouth



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AGENDA

Time	Session title
09.30-10.00	Welcome and introduction
	Portsmouth Port Masterplan
	A high-level introduction to the project, Portsmouth University
10.00-11.30	Project presentations
11.30-12.00	Q&A panel session
	Morning sessions wrap up and online close
12.00-13.00	Lunch – opportunity to view the electrolyser
13.00-13.30	Future opportunities
13.30-15.00	Next steps and future project
15.00-15.15	Chair closing remarks
15.15	Networking

In partnership with:



UNIVERSITY OF
PORTSMOUTH

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Innovate
UK



Department
for Transport



IOTICS



Engas Global
an electrolyser and H₂ compressor company

PORTSMOUTH PORT MASTERPLAN



Mike Sellers

Port Director

Portsmouth International Port



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MAKING SPACE FOR A SUSTAINABLE FUTURE

2022 — 2042

POSITIVITY ON THE HORIZON

Our 20-year Masterplan focuses on supporting the future
of UK trade and travel

Independent consultants provided detailed market analysis

Extensive stakeholder engagement

Incorporating Freeports status

KEY THEMES

ENVIRONMENT AND SUSTAINABILITY

SOCIETY AND ECONOMY

RESILIENCE AND SECURITY

INNOVATION AND TECHNOLOGY



RESILIENCE AND SECURITY

BEYOND THE PORT

12 — 24 MONTH PLAN

- State of the art pre-gate facilities at outside of the city, looking beyond traditional modal services
- Expansion of unaccompanied trailers and satellite storage
- Reducing congestion on the road network



INNOVATION AND TECHNOLOGY

NEXT LEVEL PORT TETRIS

2 — 4 YEAR PLAN

- Creating automated pre-gate facilities, 50% faster processing
- Upgrade check-in lanes using ANPR
- Improved site layout for efficient flow of freight
- Out bound automation
- Rudmore Square junction and roundabout upgrades to manage port traffic flow
- Additional parking facilities using the council's expanded park and ride

NEXT 5 YEARS

- Junction upgrades at Whale Island Way





ENVIRONMENT, SUSTAINABILITY
INNOVATION AND TECHNOLOGY

SUSTAINABLE WANDERLUST

12 MONTH PLAN

- Terminal extension to manage an increase in passengers and exclusive lounge facilities

NEXT 5 YEARS

- Berth upgrade so the port can cater for ships up to 300m
- Support an electric ferry service including terminal facilities
- Overhead walkway from terminal to ship
- Provide shore power for ships alongside
- Redevelopment of passenger boarding bridge

RESILIENCE AND SECURITY

STRENGTHENING PORTICO

5 YEAR PLAN

- Respond to future shift of containerisation
- Expand facilities on-site to cater for a range of cargo
- Support employment land developments in the city's Local Plan that make provision for commercial opportunities near to Portico
- An agile port able to support shortsea services

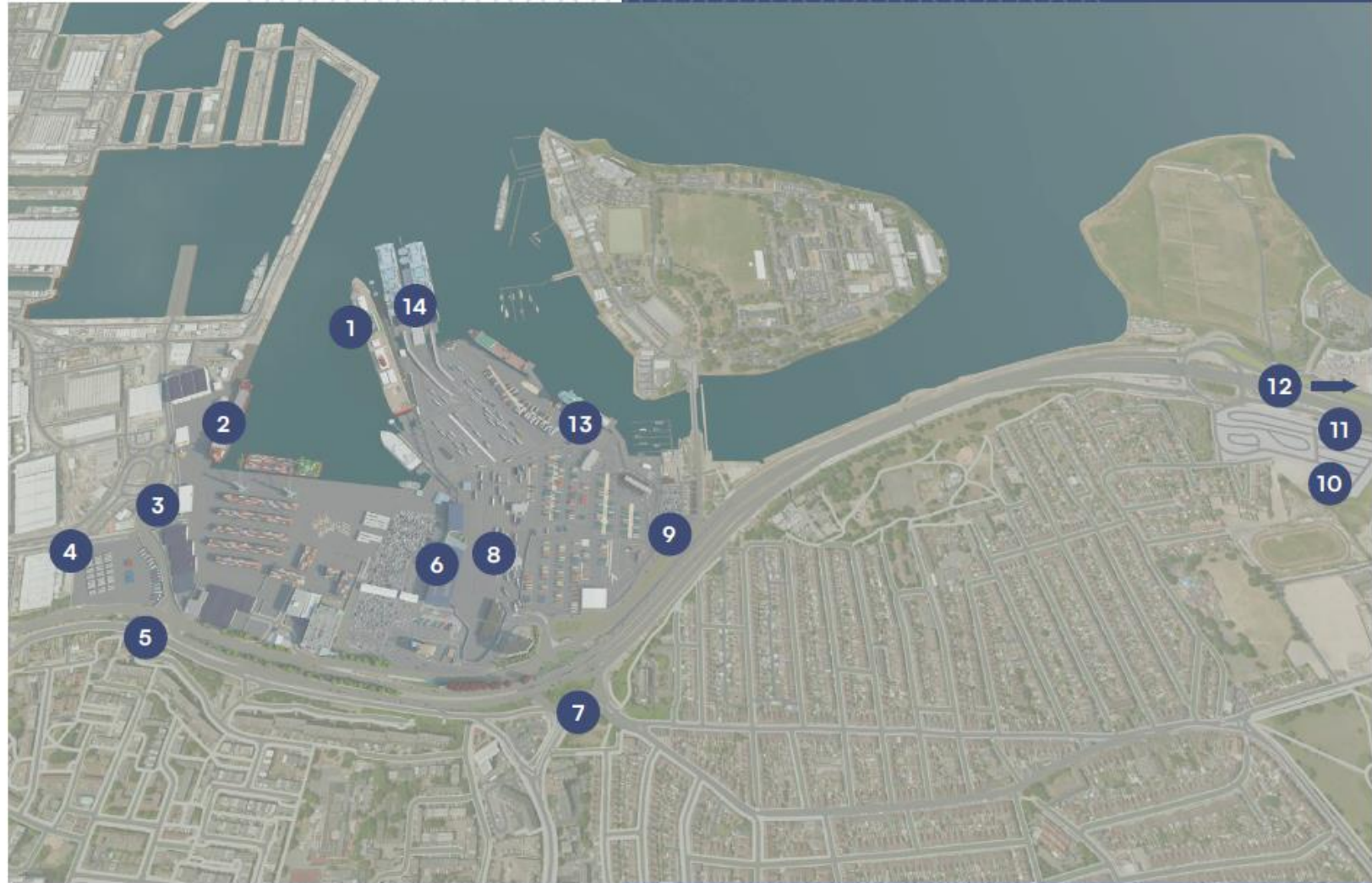
AFTER 5 YEARS

- Upgrade berths and water



PROJECT SUMMARY

1. Cruise berth 300m ships — shore power infrastructure ready
2. Lo-Lo terminal berth upgrades to AJQ and FHQ— deepened strengthening and realigned for flexibility — shore power infrastructure
3. Flexible Lo-Lo open storage upgrades — removal of cold stores
4. Portico terminal expansion — Expanded container consolidation warehouse
5. BCP ready and fully flexible
6. Terminal extension
7. Rudmore Square Junction and round-about upgrades
8. Upgraded smart ferry freight gates
9. Upgraded junction at Whale Island Way
10. Integrated park and ride facility for ferry and cruise services
11. Smart highways and driver notification systems
12. Satellite trailer parking and pre-gate facility
13. New electric ferry terminal and services
14. New passenger boarding bridge and shore power for ferries



PROJECT SUMMARY

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VALUABLE PORT

- Expansion investment over £90m
- Will return significant benefits locally and nationally

2022 >>>>>>>>>>>>	2032 >>>>>>>>>>>>	2042
£390M* <small>National Impact</small>	£739M <small>National Impact</small>	£801M <small>National Impact</small>
5,590 <small>Total Employment</small>	10,448 <small>Total Employment</small>	11,333 <small>Total Employment</small>
£189M <small>Local economic impact</small>	£357M <small>Local economic impact</small>	£387M <small>Local economic impact</small>
2410 <small>Local jobs</small>	4554 <small>Local jobs</small>	4940 <small>Local jobs</small>



FUTURE PORT LEADERS

- Members of diversity in maritime
- Encouraging the next generation towards a career at Portsmouth International Port
- Exciting times ahead
- Bold plans not platitudes



MAKING SPACE FOR A SUSTAINABLE, DIVERSE, FUTURE



A HIGH-LEVEL INTRODUCTION TO THE PROJECT, PORTSMOUTH UNIVERSITY



Dr David Hutchinson

Reader in Environmental Innovation
University of Portsmouth



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PROJECT PRESENTATIONS INTRODUCTION

10.00-11:20



Dr David Hutchinson

Reader in Environmental Innovation
University of Portsmouth



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PORT CHALLENGES

10.00-11.20



Jerry Clarke

Pilot/Senior Project Manager
Portsmouth International Port



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SALAMANCA

Portsmouth Commercial Docks

The Camber

The Age of Sail

This is a photograph of a port just before a very major change in what that little port was going to have to provide to keep operating

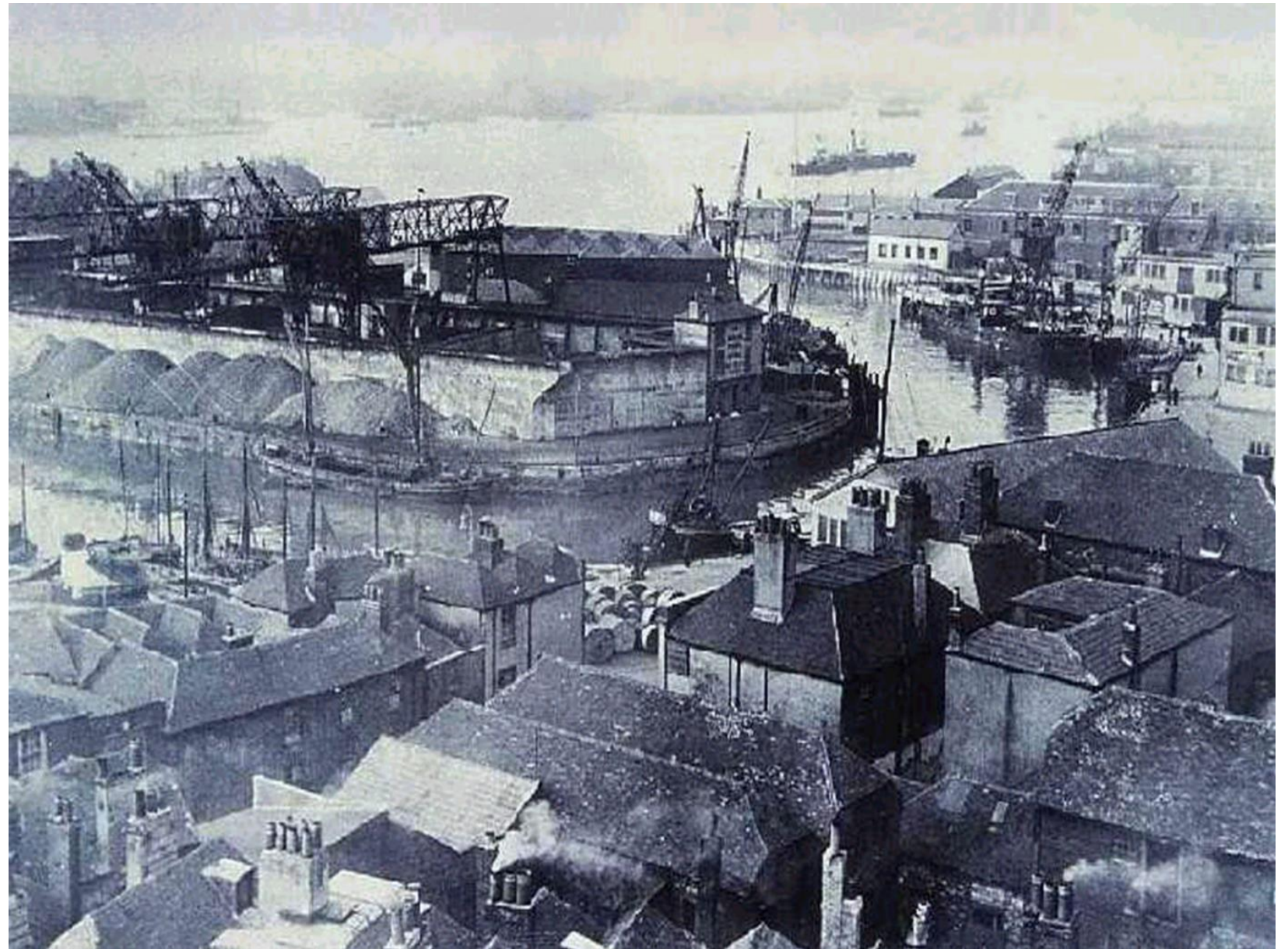


Portsmouth Commercial Docks

The Camber

Advent of the Steam Age

Coal – Same port,
servicing the Navy. The
port probably did not see
the change coming but the
sailmakers would have
moved out and the coal
merchants moved in



Portsmouth International Port

The Age of Information and of Change

5 Ro-Ro berths, 2 traditional berths. What's around the corner? We were all running forwards to unrestricted growth, we still can. If that growth can be made as Carbon and Air Pollution can be reduced sufficiently.



PORT AIR QUALITY STRATEGY

CARBON AUDIT 2018 & 2019

Production of carbon and Air Pollutants Port & Harbour Operations		Units	kgCO2 e	kgCO2	kgCH4	kg N2O
Totals 2018		Kgs	50,073,733	49,160,507	19,614	649,418
		Tonnes	50,074	49,161	20	649
Totals 2019		Kgs	60,391,962	59,520,937	21,041	803,536
		Tonnes	60,392	59,521	21	804

Annual Emissions Alongside Berth 2018/2019

26,000t/CO₂e

The biggest Winners for quickly decreasing not just the carbon we are pumping out but also improving Air Quality is the provision of shore power to all berths and the obligatory use of shore power where a ship is able to take it and ultimately the rejection of ships that cannot.

Biggest Winners for Carbon Reductions

LED Lighting – Over 60% carbon Saving

Shore Power – 90% carbon saving and significant Air Quality improvements.

Yes, but what does
it mean?

Net Carbon Neutral by
2030

Zero Emission Shipping by
2050

Intensity Based reduction in
Carbon Emissions

Measures

- 35Kw Hydrogen Electrolyser on port (CMDC)
- Digital Twin of the Port (CMDC)
- 300HP Hydrogen powered marine engine (CMDC)
- Shore Power Provision
 - Berth 1 – 1MW
 - Berth 2 - 10MW
 - Berth 3 – 5MW
 - Berth 4 – 5MW
 - Berth 5 – 4MW
 - North Quay – 1MW
 - 30MW needed by 2030



Power to ships from shore – Future ‘Cold Ironing’ – Shared load with Port Batteries

Ports	Effective time with shore connection	Energy to charge the battery	Power to charge the battery	Hotel load in port	Total power from shore connection
	min	kWh	kWe	kWe	kWe
Portsmouth	80	3 408	2 556	2 569	5 125
Ouistreham	80	3 408	2 556	2 569	5 125
Saint-Malo	125	3 408	1 636	2 569	4 205



Cruise Liners 2Kw to 2.5Kw per passenger berth

Dual ‘Bus’ bar allows shared load

DNO’s unable to supply what’s needed

Joining up the
doing.....
after the joined-up
thinking

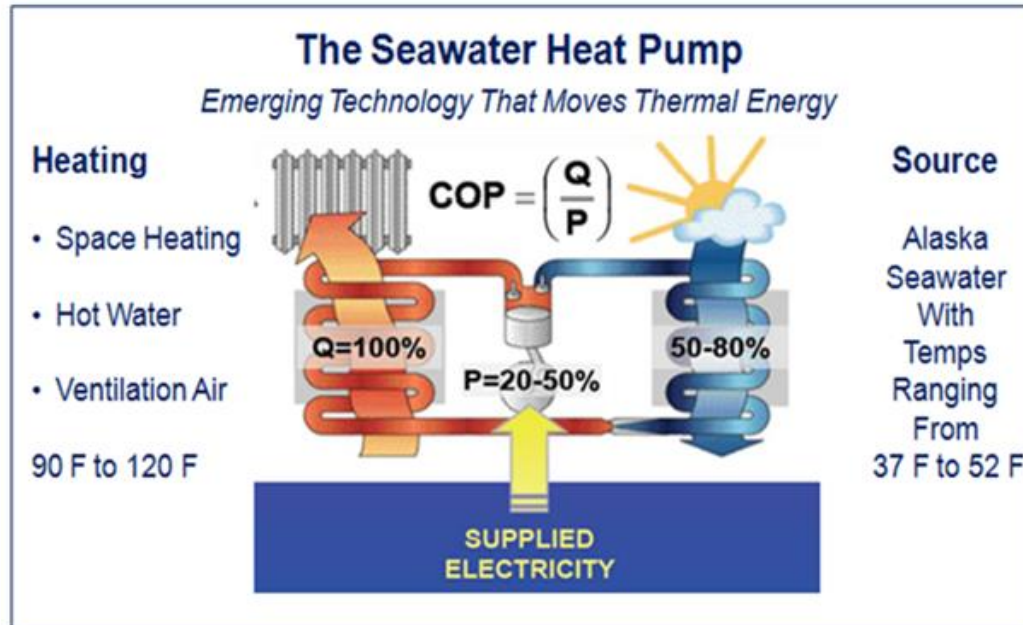


Measures

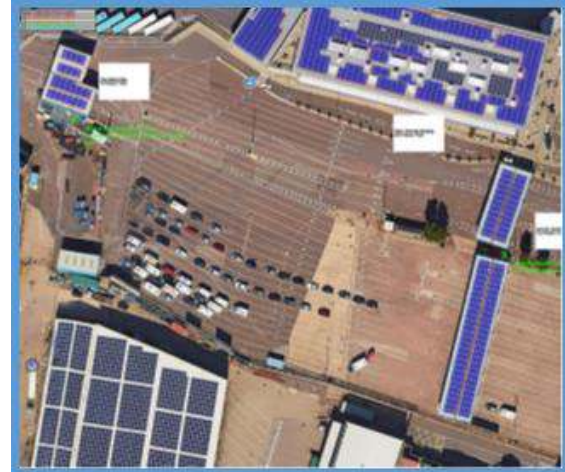
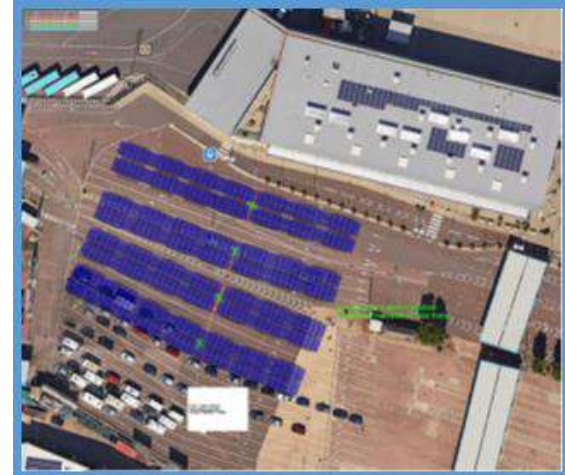
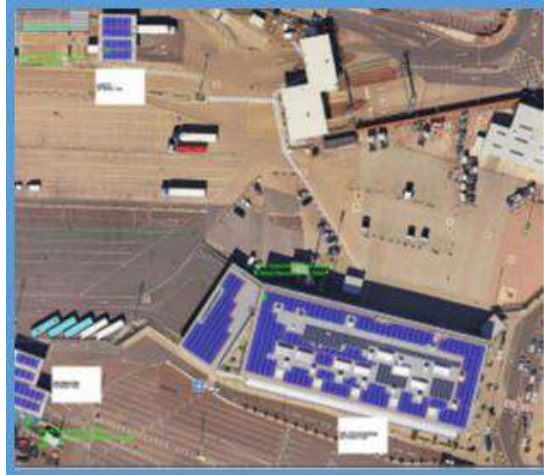
Measures

- New LNG Ferries starting in 2022 and 2023
- New Hybrid Ferries starting in 2024 & 2025
- All lighting now replaced with LED
- Sea Water Heat Transfer Pump
- Sea water flushing toilets
- Princess Royal Way (Trafalgar Gate Link Road)
- Shippers Cargo portal
- New sustainable linkspan at berth 4
- Terminal Solar Array
- PESO dual chemistry Energy Storage System
- Freight Management Software Upgrades
- Passenger Information Display Systems (PIDS)
- Electric Charging Points for EV
- Electric Port vehicles

An energy efficient terminal heated in the winter and cooled in the summer using a sea water heat transfer pump, sea water flushing toilets and wind cowls in place of air conditioning.

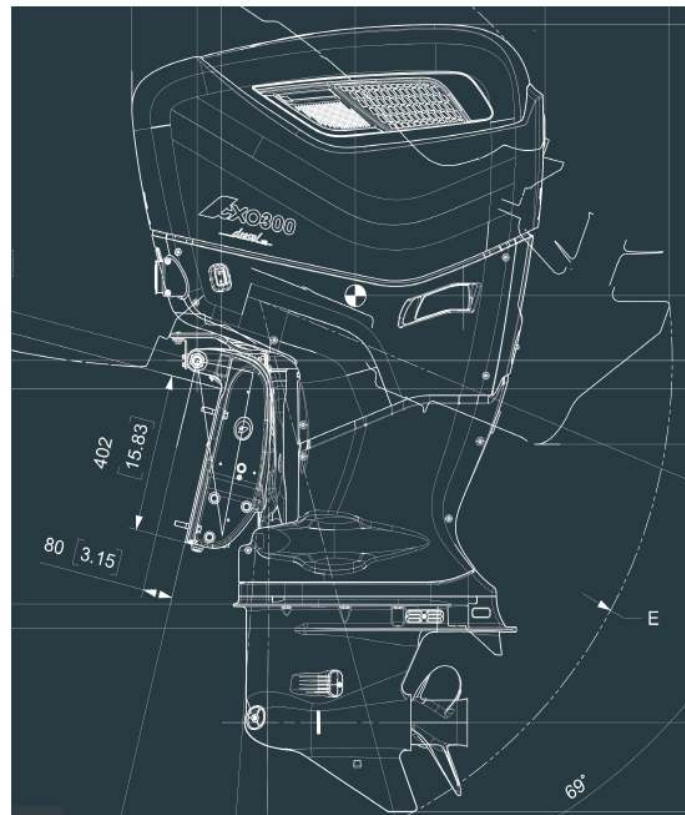


New Solar Array



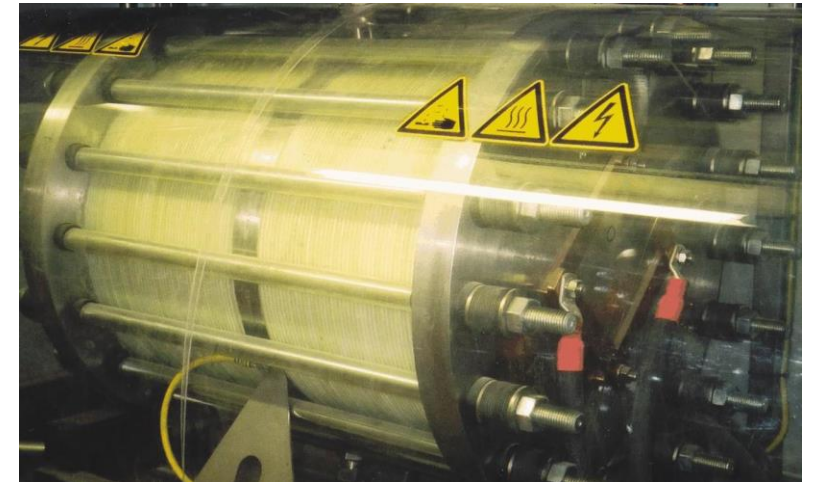
Clean Maritime Demonstration Call 2021

CXO300
Technical Specification



COX	TYPE	CXO300	DIESEL OUTBOARD ENGINE
	YEAR	2021	

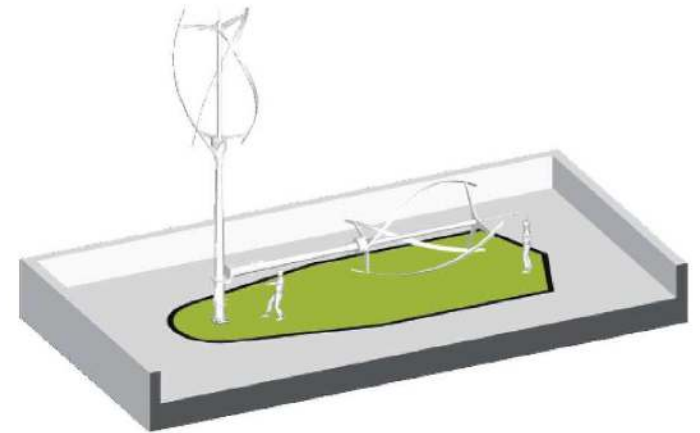
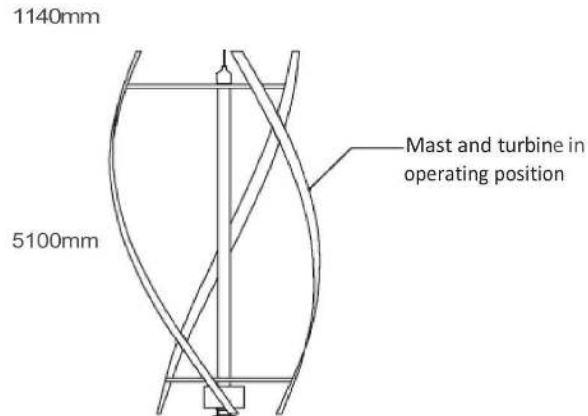
CXO300
coxmarine.com



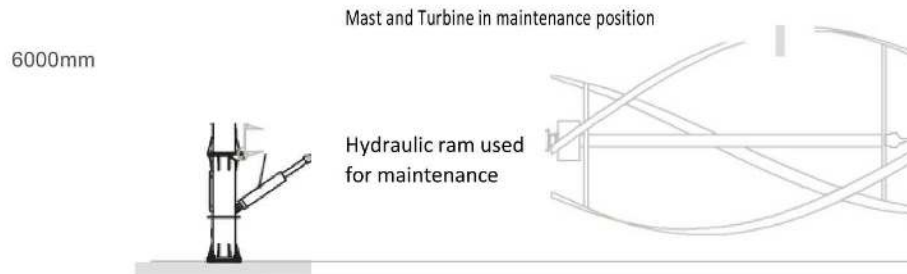
Increase Port Renewable Energy

Vertical Axis
Wind Turbines
Maximum
height is below
15m to avoid
planning
concerns.

WORKING AREAS



Highlighted area denotes working area for installation and maintenance – 6m mast however see table for required dimensions for other mast sizes



Mast Height	Dimension 'H'	Total Length
6m	5015mm	14185mm
15m	13885mm	23055mm
18m	16910mm	26080mm

ELEVATION @ 1:100 (A4)



Diesel Fuel Filtering provides massive reduction in Particulates



Particle Count (particles/mL) ISO 4406 & mod. ISO 11500	Result	Min	Max
ISO Cleanliness Code	20 / 19 / 19	/ /	/ /
> 4µm	9793		
> 6µm	4978		
> 10µm	3180		
> 14µm	2787		
> 21µm	2292		
> 38µm	28		
> 70µm	0		
> 100µm	0		

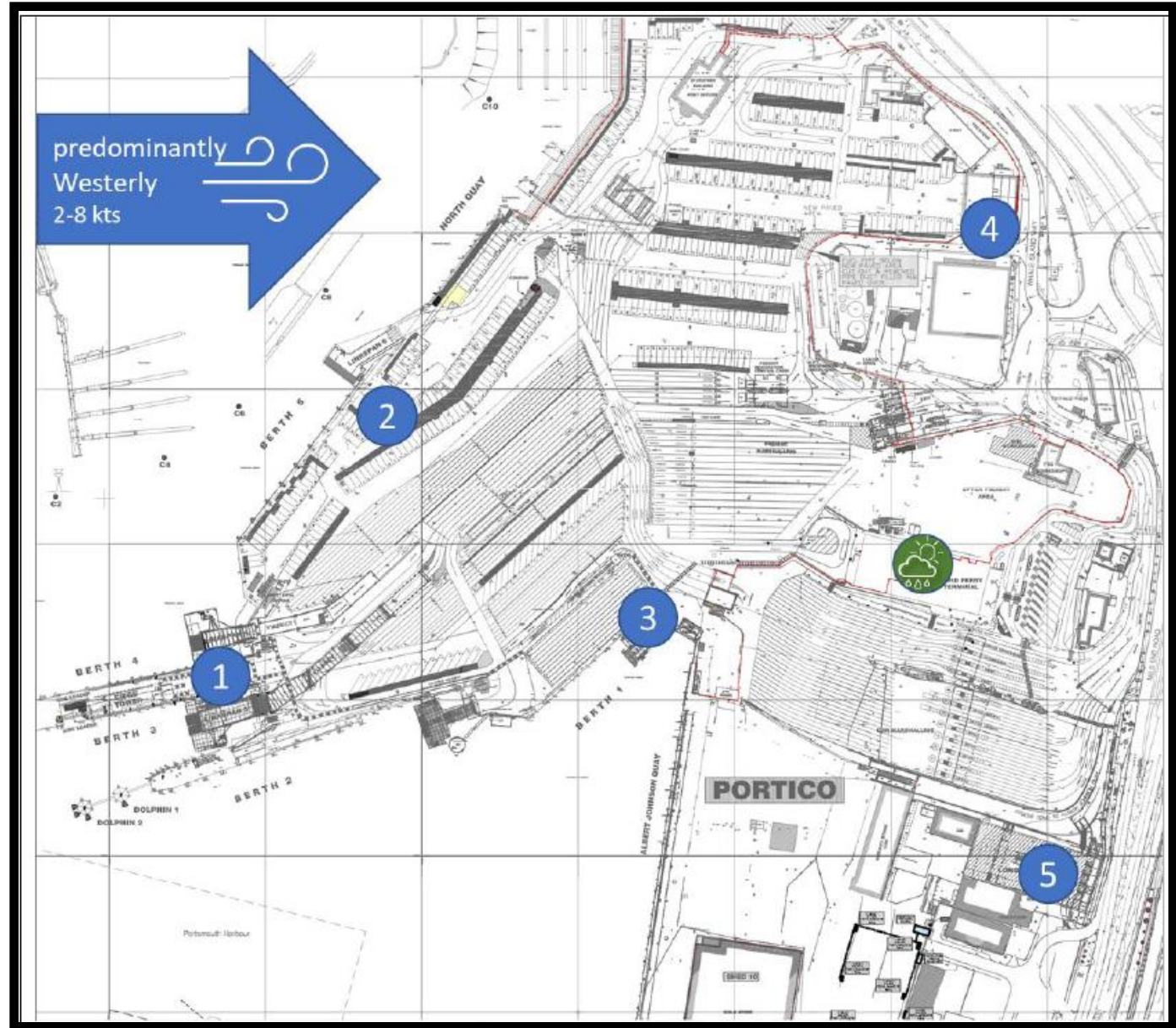
Particle Count (particles/mL) ISO 4406 & mod. ISO 11500	Result	Min	Max
ISO Cleanliness Code	16 / 14 / 11	/ /	/ /
> 4µm	544		
> 6µm	152		
> 10µm	34		
> 14µm	12		
> 21µm	5		
> 38µm	1		
> 70µm	0		
> 100µm	0		

GAS	NOX	NO	NO2	SO2	CO
% REDUCTION	44.6	45	72	40	26.66

Port Wide Air Quality Sensors

- 5 sensors around the port measuring, NO, CO₂, SO and PM's
- Uses LPWAN not 5G or Wi-Fi
- Local Technologist, full system including software and storage <€30K
- Annual cost is for replacement of sampling units only

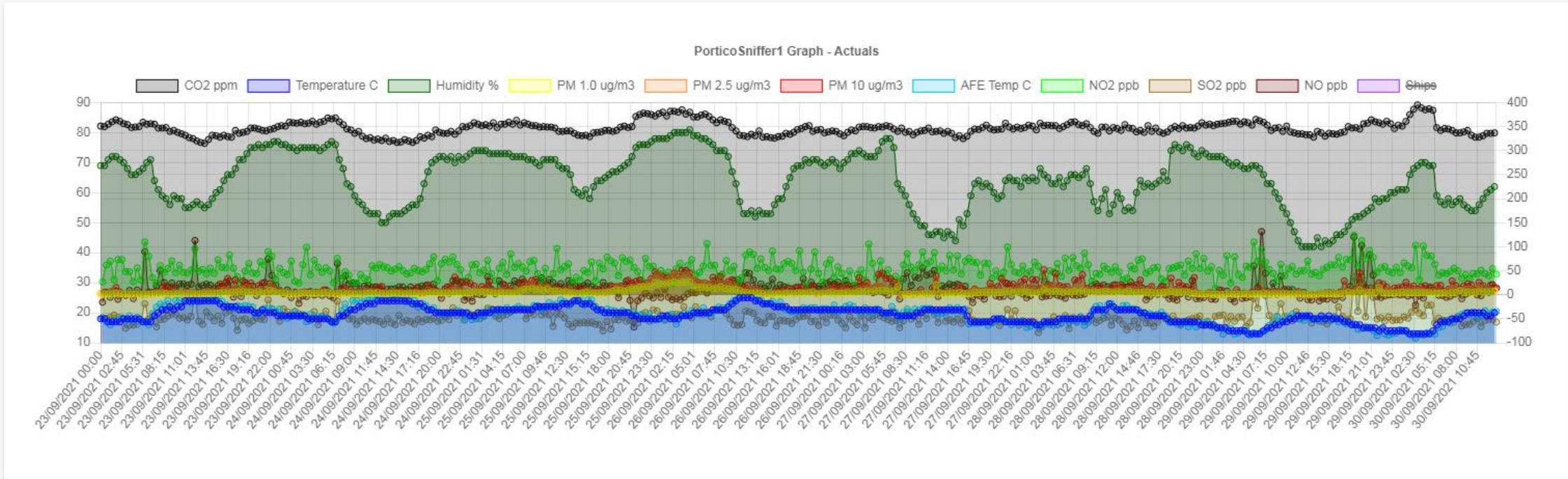




Air Quality

PorticoSniffer1 Graph for Device: 1D8BC5 FLC11 @MEGCP B:0097

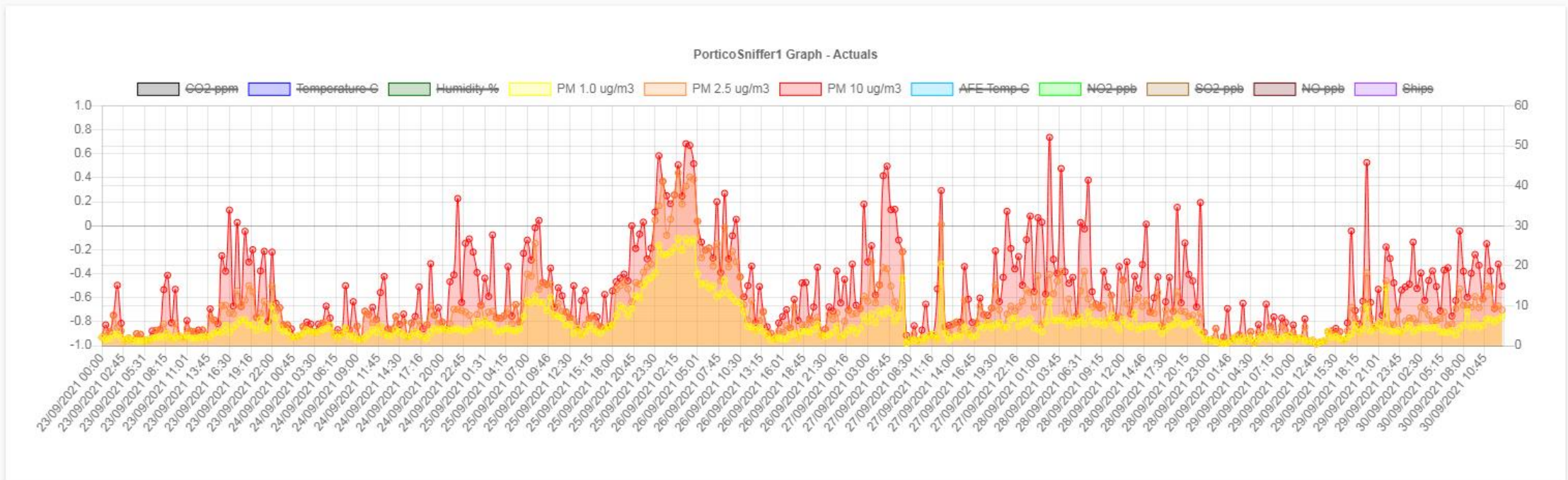
Between 23/09/2021 and 30/09/2021



Air Quality

PorticoSniffer1 Graph for Device: 1D8BC5 FLC11 @MEGCP B:0097

Between 23/09/2021 and 30/09/2021

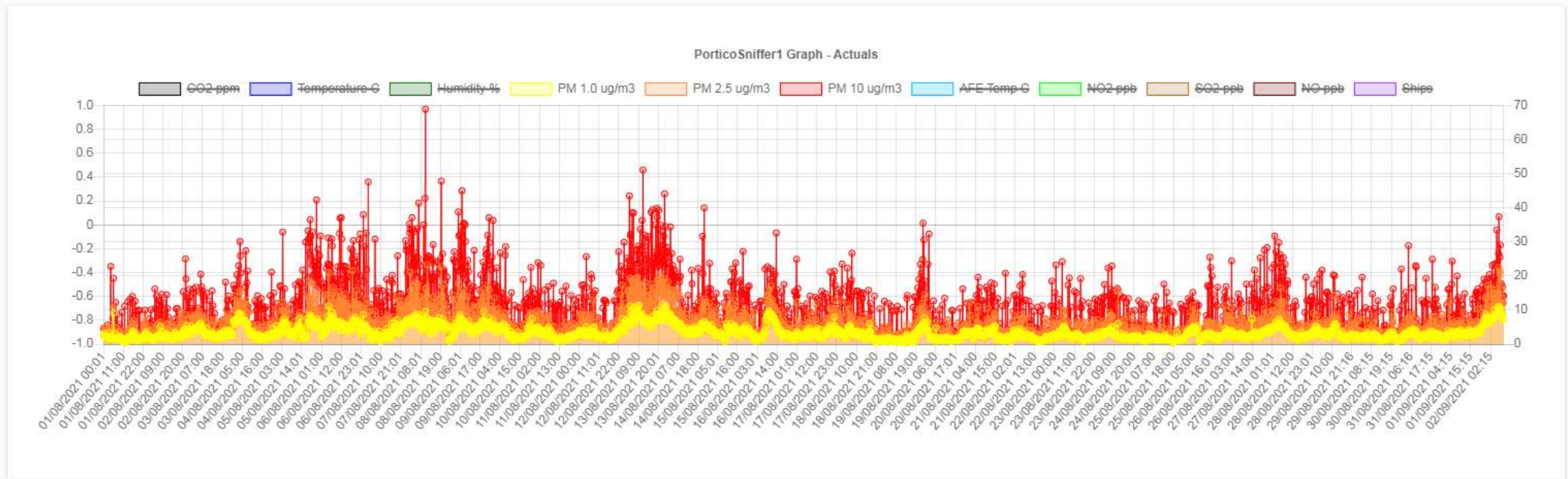


Air Quality

The Air Quality Standards Regulations 2010 require that concentrations of PM in the UK must not exceed:

- An annual average of $40 \mu\text{g}/\text{m}^3$ for PM10;
- A 24-hour average of $50 \mu\text{g}/\text{m}^3$ more than 35 times in a single year for PM10;
- An annual average of $25 \mu\text{g}/\text{m}^3$ for PM2.5.

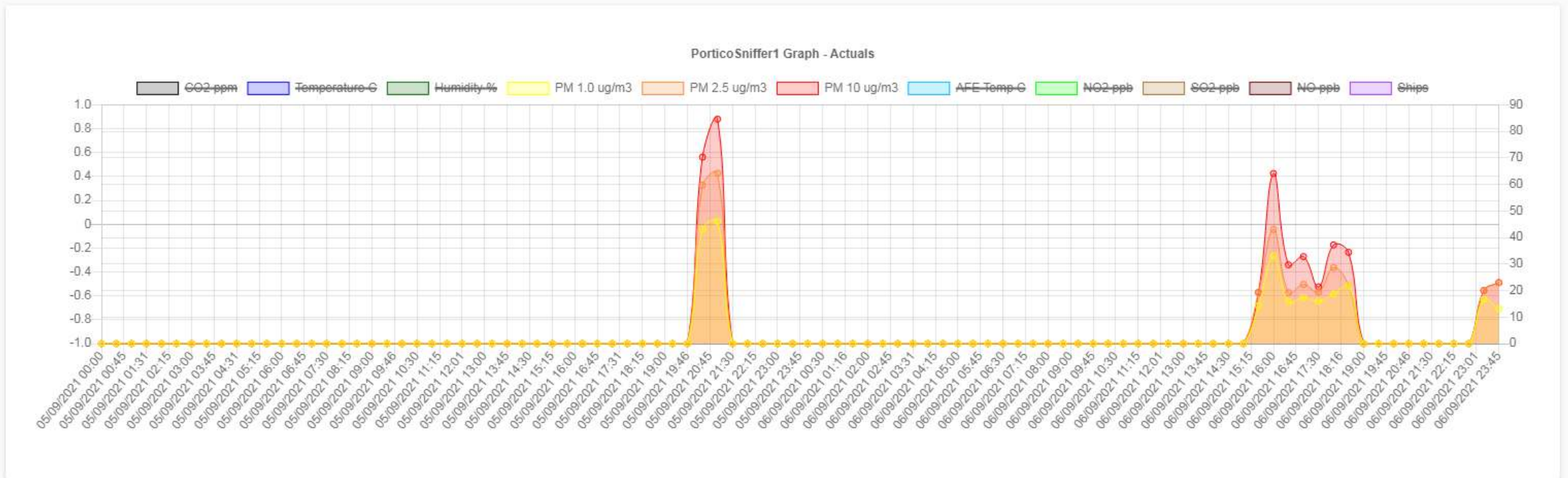
Between 01/08/2021 and 30/09/2021



Air Quality

PorticoSniffer1 Graph for Device: 18E141 FLC49 @Berth4 C:0098

Between 05/09/2021 and 06/09/2021



The readings above show 84.6 and 64.1 for PM10

December 2020

Before this date a port could carry on as usual, relying on local authorities to advise them when emissions start exceeding local or national maximum limits.

Since this date, since the first death in the UK ascribed even in part to poor Air Quality, the usual excuses no longer apply.

Not measuring because you do not want to know the answers is no longer a valid management strategy in the face of new corporate liabilities, most especially with fine particle emissions.

Search jobs

Sign in

Search

UK edition

The Guardian

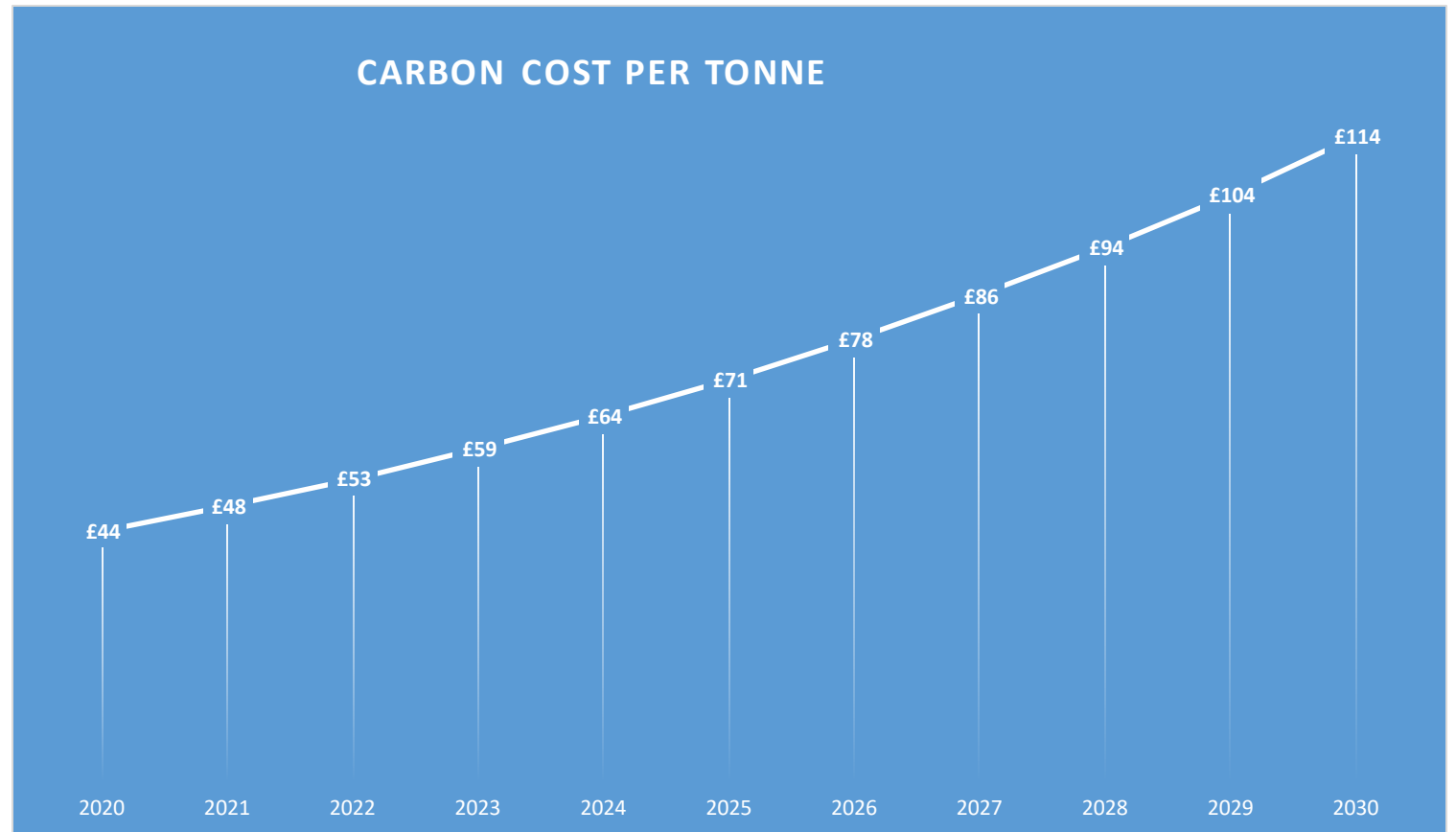
Air pollution a cause in girl's death, coroner rules in landmark case

Coroner says failure to reduce pollution levels to legal limits was factor in death of Ella Kissi-Debrah, who had severe asthma



▲ Ella Kissi-Debrah lived within 30 metres of London's South Circular road. Photograph: PA

A coroner has made legal history by ruling that air pollution was a cause of the death of a nine-year-old girl.

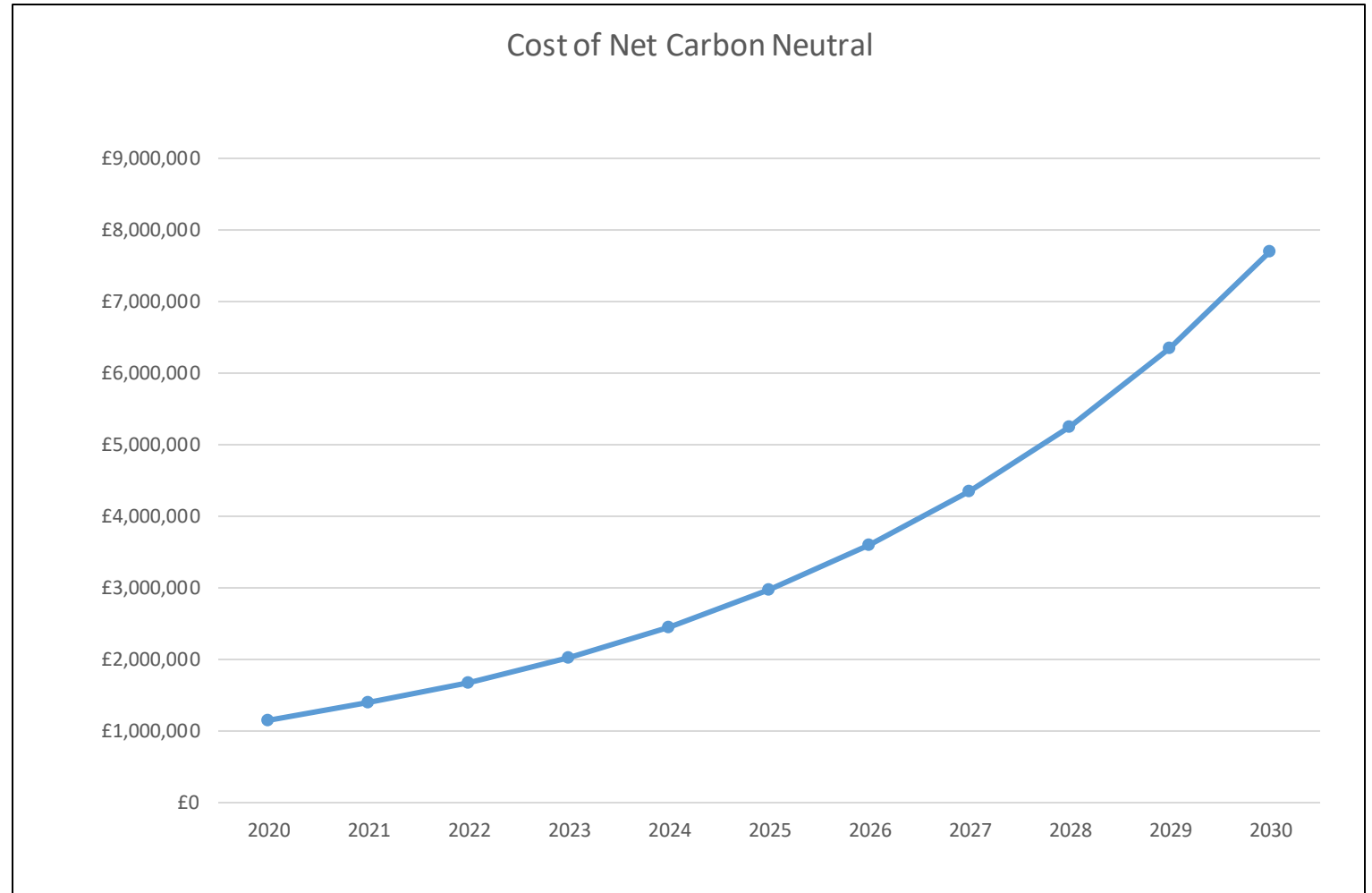


The first UK Carbon Trading scheme that was auctioned in May this year of 6 Million allowances sold at £43.99 Per tonne to just 4 buyers – This table shows a Conservative 10% p.a. rise.

Shore Power

Because if you want to be Net Carbon Neutral you are going to have to offset.

If we had to offset this year purchase costs would be in the region of £1M



Collaboration

You don't need to
go it alone.

The port has been fortunate in being at the Centre of a vibrant City with a newly invigorated University with an International standing. Current collaborations include:

- Portsmouth University (CMDIC)
- Brighton University (SHAPE CMDIC)
- The Connect Places Catapult
- The Energy Catapult
- B4T
- Knownow
- Iotics
- Lloyds Register
- Solent Southampton University (PECS)
- Bournemouth University (SPEED)
- Marine South East (PESO)
- InnovateUK

Moving Forward

1. Continuous Annual Carbon Audit
2. Continuous Air Quality Sensing
3. Continuous Grant Applications
4. Lobby for local off-setting
5. Co-ordinate Carbon credit management
6. Lobby to Push mitigation up the control hierarchy
7. Push PIP forward as a 'laboratory' port
8. Share Air Quality data using visualization
9. Increased co-operation with Universities and other (self-funded) research organisations
10. Turn around the way we look at doing business

HYDROGEN PRODUCTION WORKSTEAM

10.00-11.20



Dr Amit Roy

CEO

ENGAS Global Ltd



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Connected Places

An introduction to the technology deployed through the trial and key findings.



Dr Amit Roy

**Founder & CEO,
Engas Global Ltd**

Engas Global

an electrolyser and H₂ compressor company

Safety first

Which one is more energetic? 1 lt diesel vs 1 lt hydrogen at 350bar?

diesel has 10 times more energy than 1lt H₂ stored at 350bar.

Which one is more energetic? 1 lt diesel vs 1 lt LIQUID hydrogen?

diesel has 4 times more energy than 1lt liquid H₂.

My experience



Engas Global Ltd, Founder, CEO, **electrolyser, hydrogen compressor, hybrid power**, system integration.
Developed the UK's first wind-solar hydrogen field demonstration project at Loughborough in 2002 (PhD research).

Engas UK Ltd, Founder/CEO: **Biogas upgrading to bio-CNG** for EV charging & refuelling.

University of Portsmouth: Senior Lecturer, School of Energy and Electronic Engineering; Course Leader of an industry focussed BEng / MEng degree programmes on renewable energy engineering.

2017-ongoing: Member of UK working group OIML on Gas Metering for Product safety & standards, appointed by BEIS, the UK Govt.

2015-2017: Member of green hydrogen standards committee, appointed by the Department of Business, Energy & Industrial Strategy- BEIS- UK Govt.

AFC Energy Plc (2006-2009), Chief Scientist, Head of Fuel Cells Division, Business Development manager, I developed fuel cells stacks & systems (balance of plant).

Engas Global

an electrolyser and H₂ compressor company

We are an energy storage & system integration company, offering:

1. A lower cost, modular electrolyser for green hydrogen production to displace diesel for multi-modal application e.g., H₂ refuelling of boats and vehicles, & shore-power for charging of electric boats and EVs.

2. A hydrogen compressor for low-cost hydrogen storage.

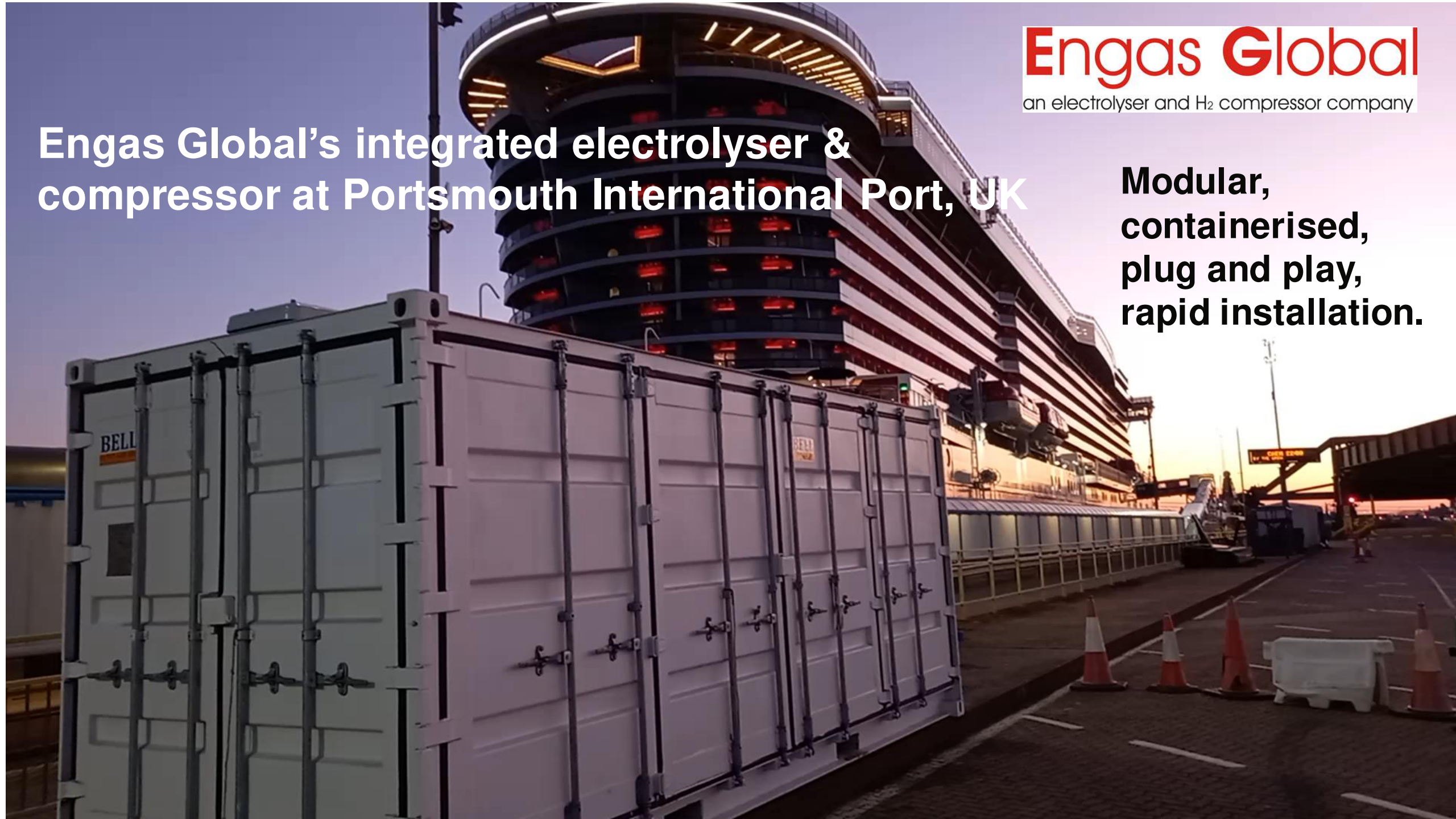
3. Consultancy services and feasibility studies to integrate hydrogen energy within an existing system including cost analysis, engineering specification & system engineering services.

4. Supporting PhD, at the School of Energy & Electronic, University of Portsmouth.

Topic: Hydrogen production using electrolysers powered by wind turbines and solar PV for grid balancing, refuelling of vehicles & injecting hydrogen to the gas-grid to decarbonise the heating sector.

Engas Global's integrated electrolyser & compressor at Portsmouth International Port, UK

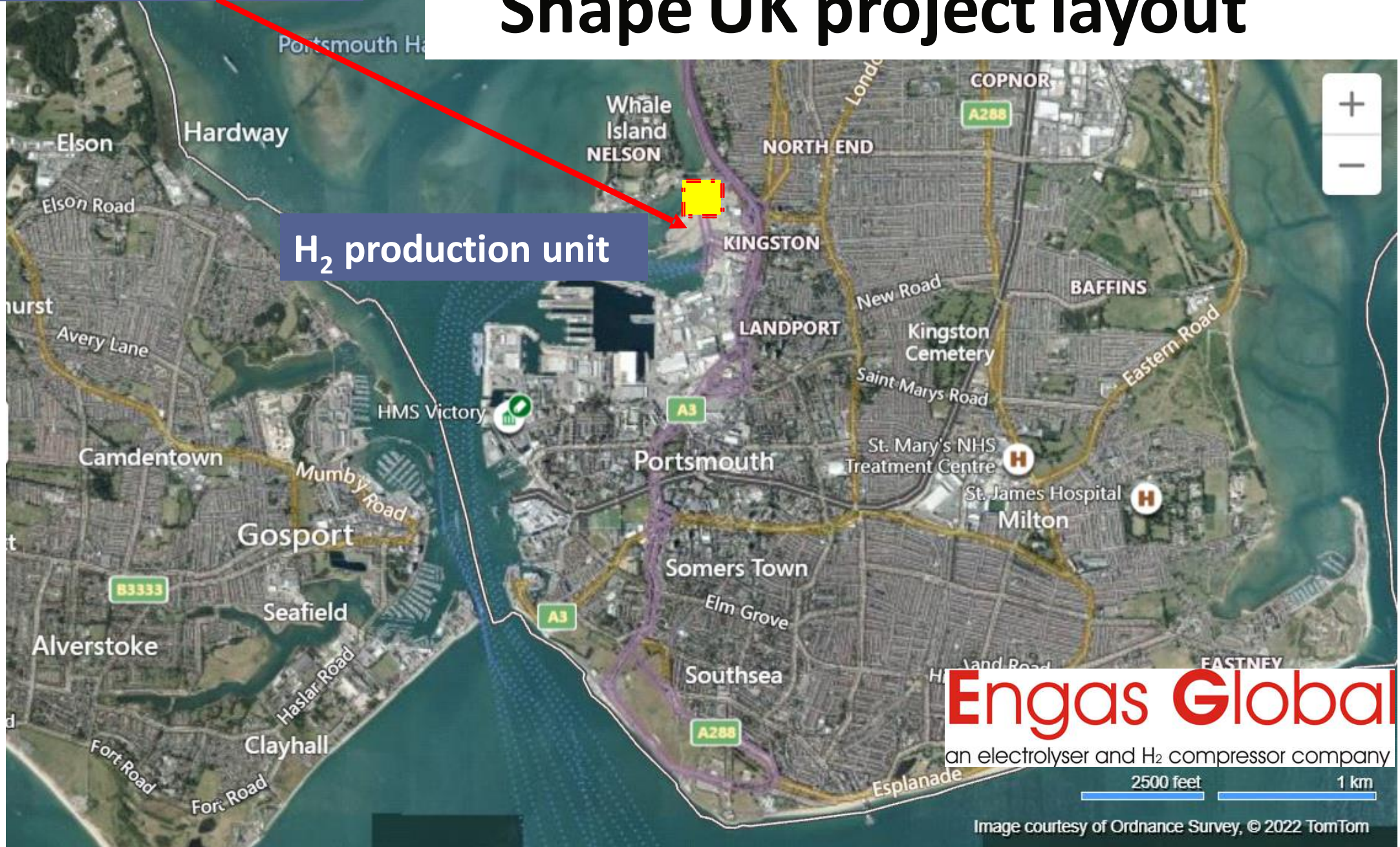
**Modular,
containerised,
plug and play,
rapid installation.**



Refuelling of H₂ boat

Shape UK project layout

H₂ production unit



Engas Global
an electrolyser and H₂ compressor company

Electrolyser & H₂ compressor at Portsmouth International Port, UK.

Engas Global

an electrolyser and H₂ compressor company

**35kW stack, 7-8Nm³/h, 25 bar,
4.2kWh/Nm³ (stack).
15kg H₂/day.
H₂ compressor: 150bar.**

References:
Vandenborre HS,
Hydropac, and various
component suppliers.



350bar Hydrogen refueller

Engas Global

an electrolyser and H₂ compressor company



Hydrogen & oxygen vents, ventilation and cooling system

Engas Global
an electrolyser and H₂ compressor company



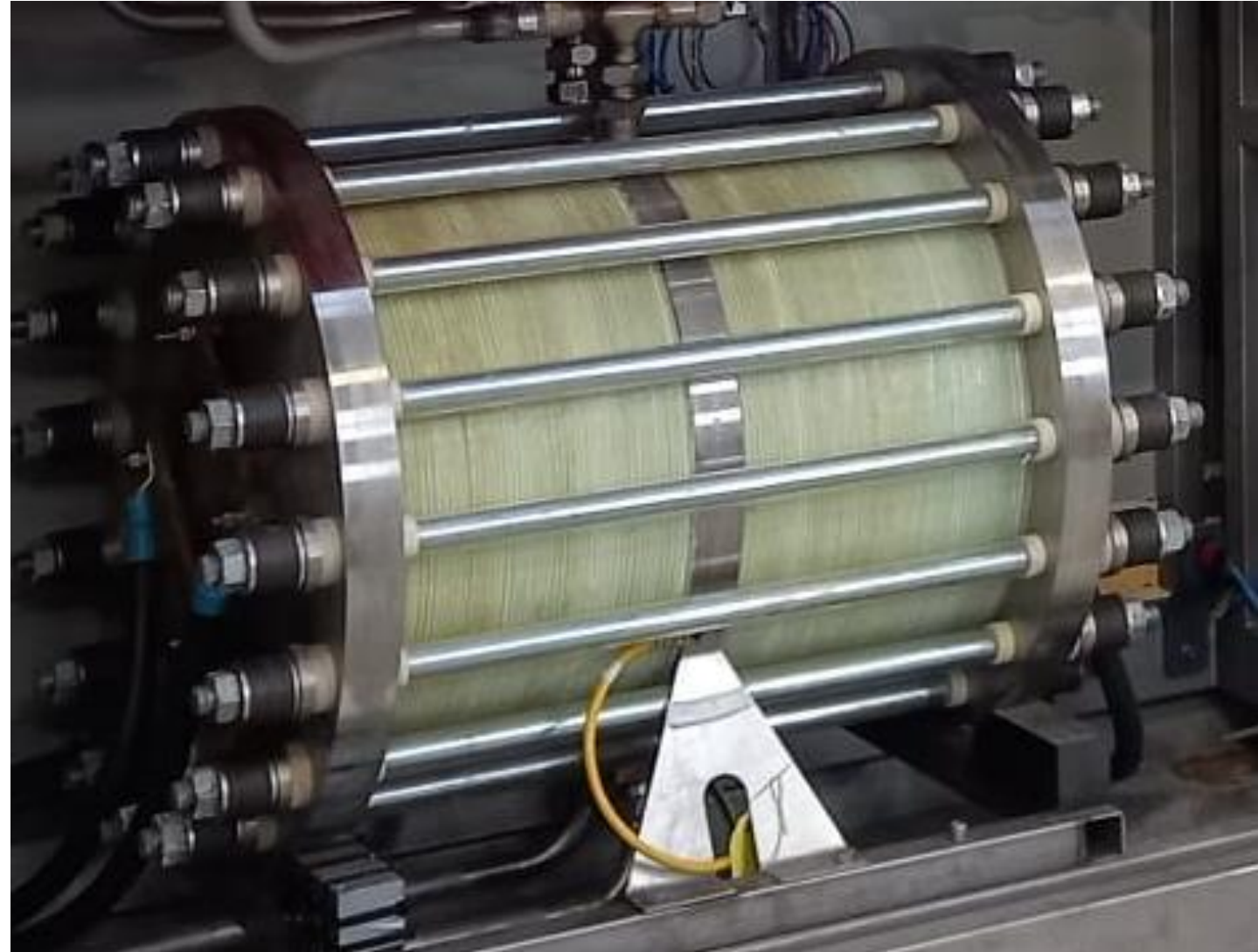
Electricity cost of hydrogen

It takes about 50kWh electricity, and 11.2 litre water to make 1kg H₂.

1kg hydrogen= 3.78lt diesel on energy content basis.

The electricity cost @ 1pence/kWh from solar PV= 50kWh *
1pence/kWh = £0.5/kg H₂.
(equivalent diesel price=£6/ gallon),

Also 7.8kg O₂ is produced as free by-product for every 1kg H₂.



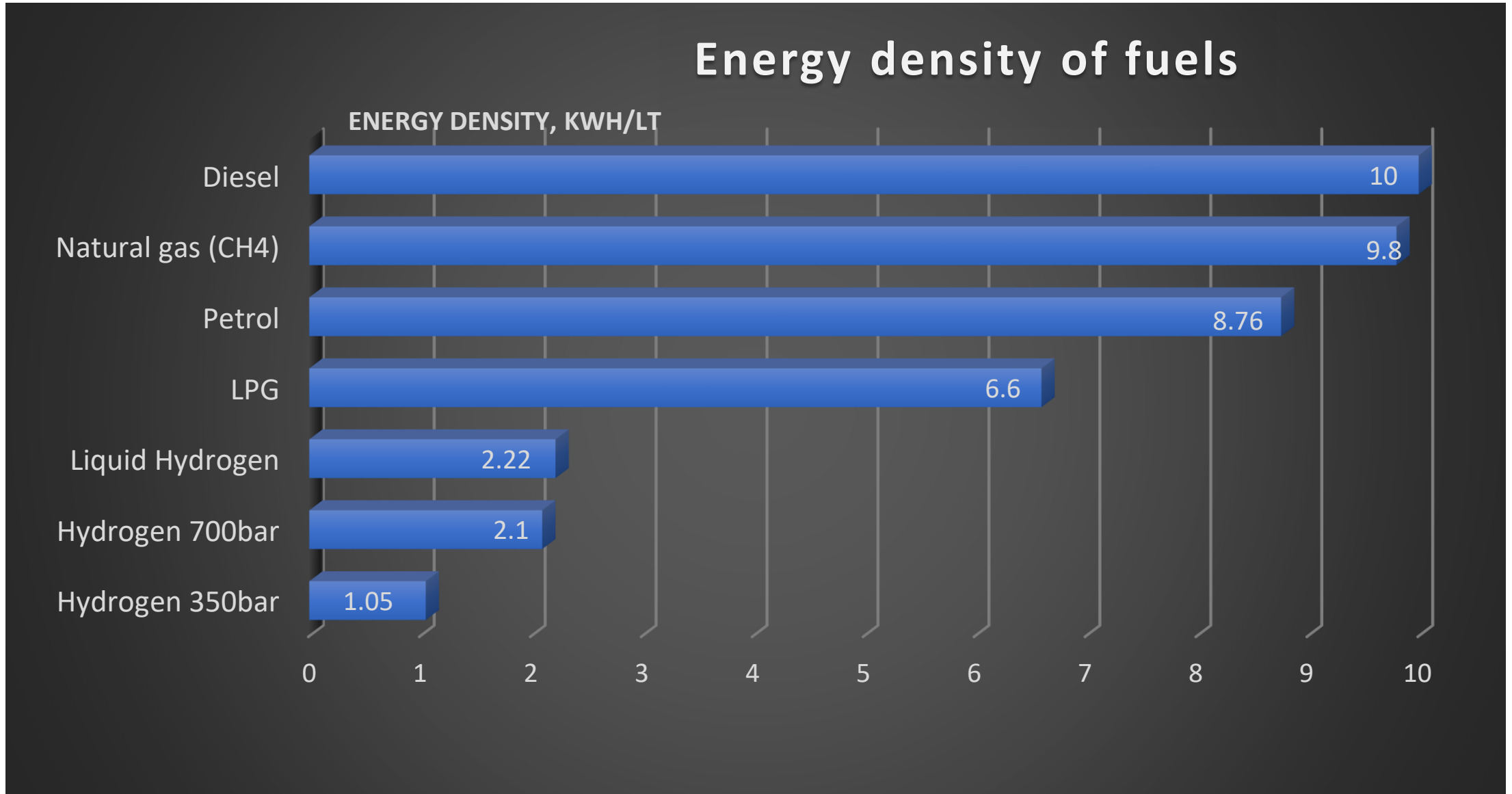
System integration & hybrid power for smarter-grid balancing

Engas Global
an electrolyser and H₂ compressor company



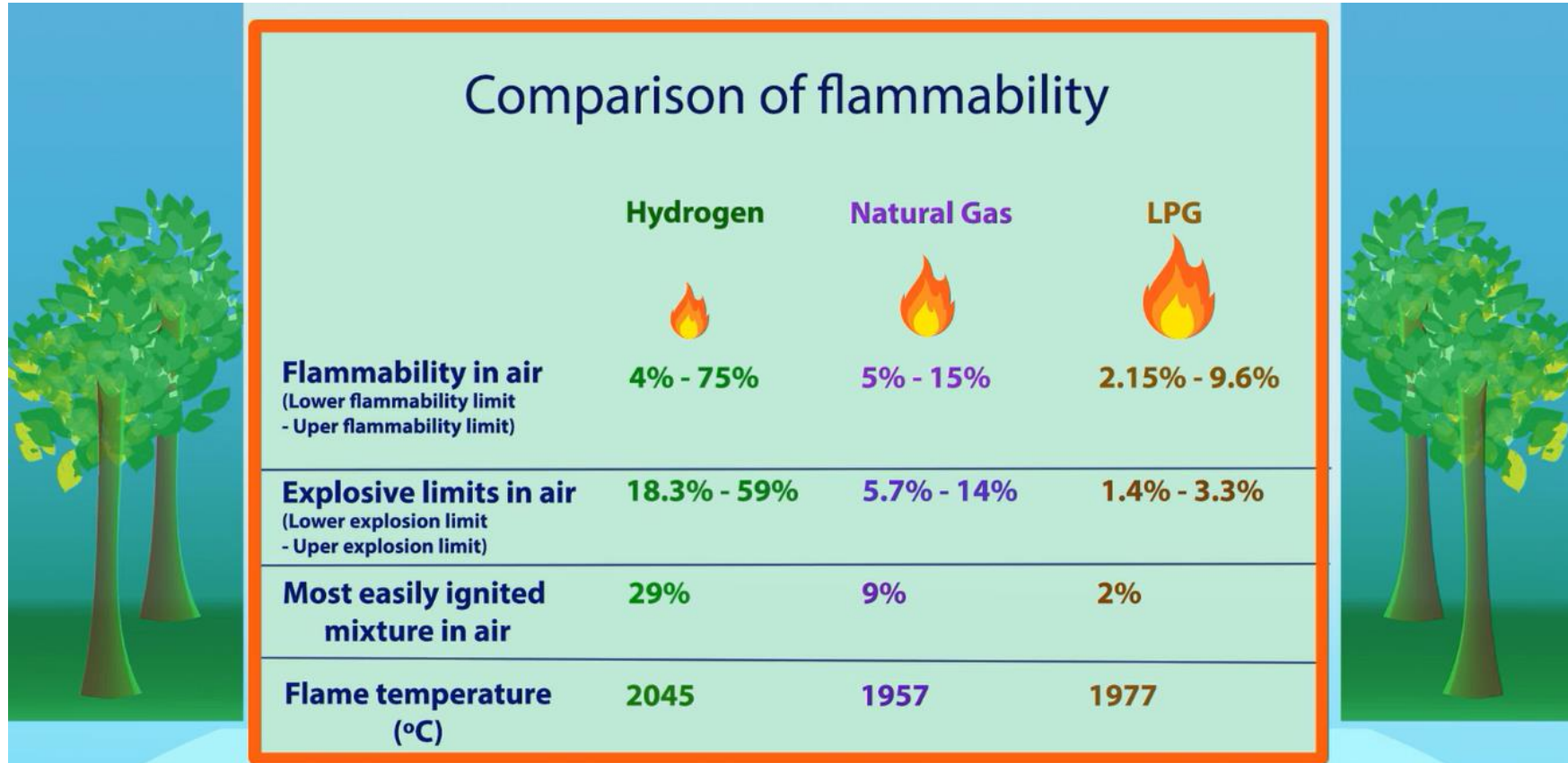
We provide system engineering solution, system modelling, scenario forecasting of energy systems, feasibility studies for scaling up or down.

Hydrogen safety



Hydrogen safety

In a ventilated space hydrogen will disperse 5 times faster than LPG (propane) due to the higher diffusion coefficient of hydrogen than LPG.



Source: <https://image.slidesharecdn.com/whyhydrogen-131024105342-phpapp02/95/why-hydrogen-5-638.jpg?cb=1382612096>

The flammability range for hydrogen is 4%-75% by volume in air but for natural gas, it is 5%-15% by volume in air, which means natural reaches its higher explosion limit well ahead of hydrogen gas. The LPG, Liquid Petroleum Gas such as propane, has the flammability range from 2.15% to 9.6%, which means a small leak of LPG reaches to its higher explosion limit rapidly; and LPG being heavier than air, settles at the bottom of the floor and does not get dispersed easily.

Contacts

Engas Global
an electrolyser and H₂ compressor company

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aroy@en-gas.com
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HYDROGEN VESSELS WORKSTREAM

10.00-11.20



Dr Penny Atkins
Principal Research,
Fellow Advanced
Engineering Centre
University of
Brighton



James Eatwell
Head of Research and
Development
Cox Powertrain Limited



This SHAPE work package aims to demonstrate a retrofit hydrogen dual fuel system for Cox's diesel outboard engine

Work package objectives

Demonstrate a retrofit solution for up to 50% hydrogen substitution

Develop a roadmap for future development

Cox CXO300 engine specification

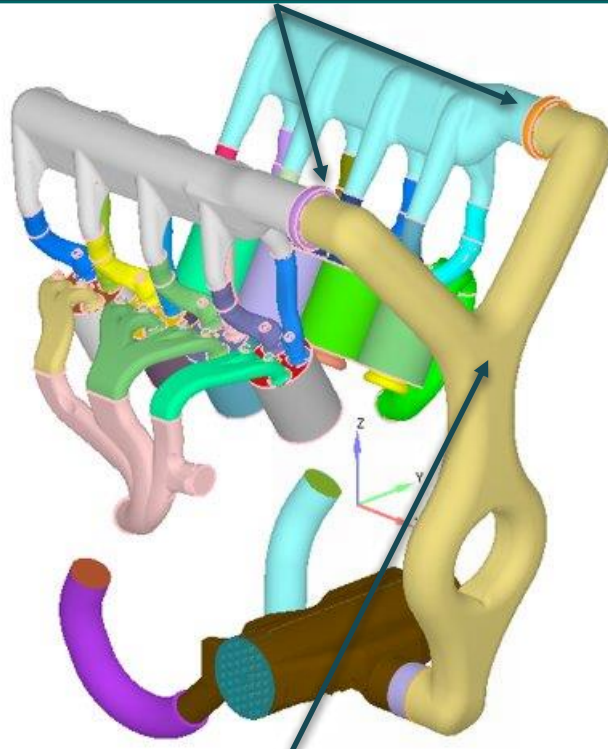
Power	220 kW (300hp)
Weight	393kg
Displacement	4.4L
Cylinders	V8
Aspiration	Twin turbochargers with electronic boost control Water-to-air charge cooling
Fuel system	Electronically controlled high pressure common rail fuel injection
Emissions compliance	IMO Tier 2, EPA Tier III, EU RCD



The team used simulation to understand hydrogen flows and combustion

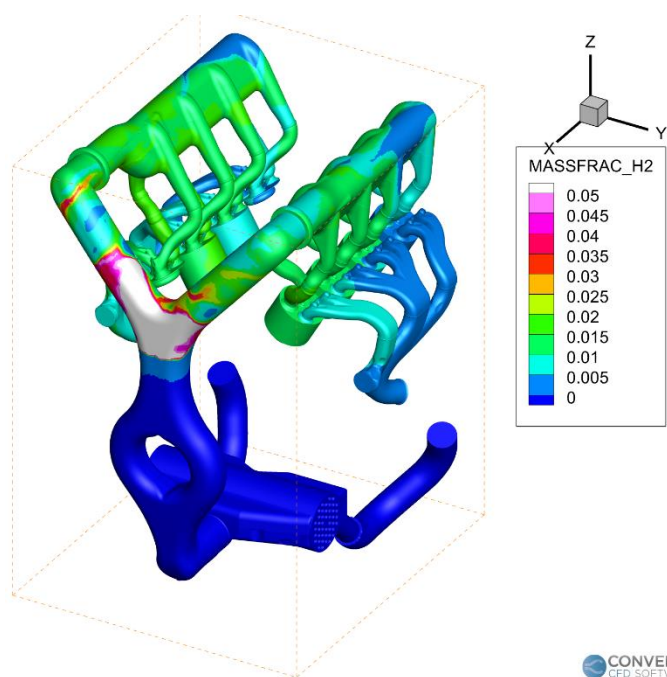
Example simulation results: Understanding the effect of injector location on hydrogen distribution

Two injectors

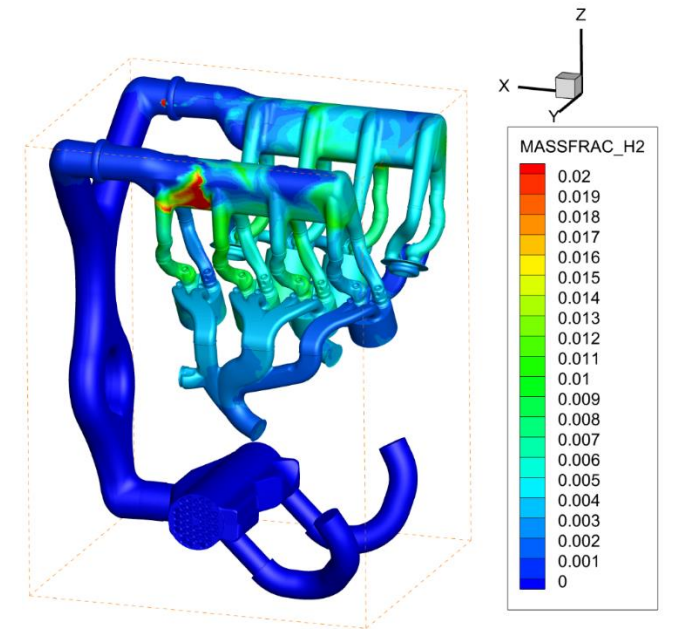


Single injector

Hydrogen mass fraction, 4000 rpm, 50% hydrogen substitution

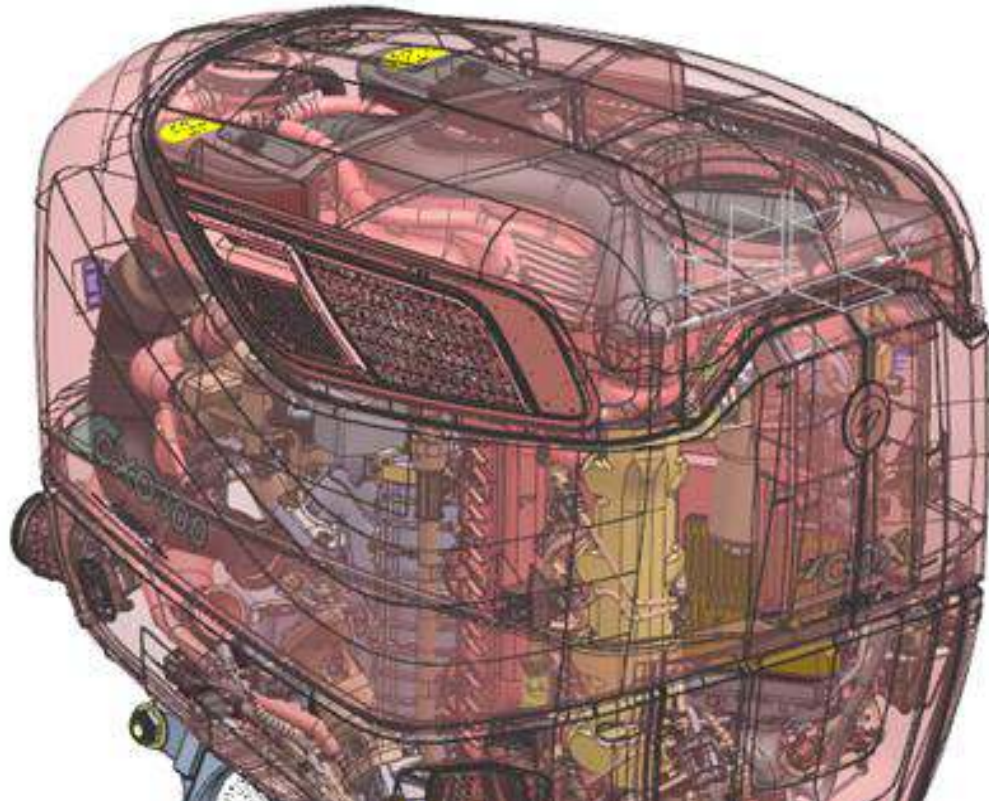


Single injector



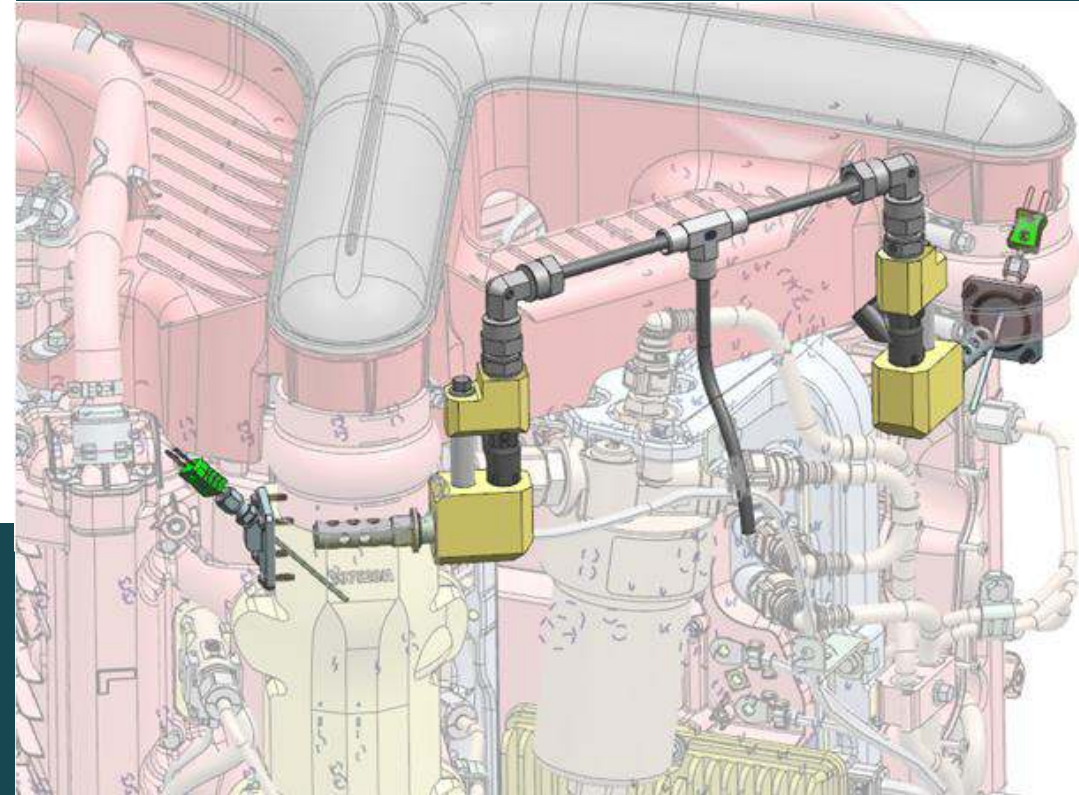
Two injectors

Minimal engine hardware changes were made for this retrofit solution, a bespoke control system was designed for the hydrogen system



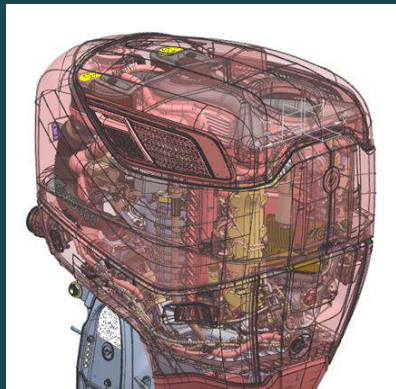
Bespoke hydrogen injection controller developed to minimise turnaround time with integrated control of a “fail-safe” on vessel hydrogen storage & delivery system

Inlet manifold based hydrogen delivery system developed to operate in parallel with existing diesel fuel injection hardware



The demonstration vessel has a range of new systems for hydrogen operation, and has been retrofitted by Subsea Craft

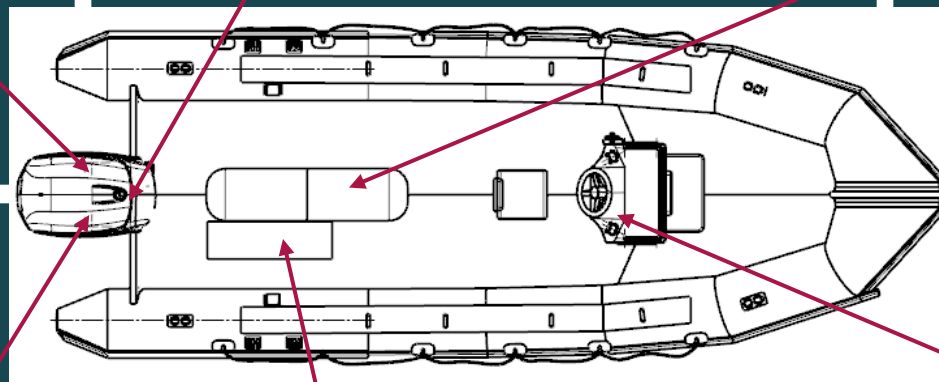
Engine modifications



Safety



Gas storage



Gas injection



Gas distribution



Control

The work completed in this project informs Cox's future fuel strategy and supports University of Brighton's research on clean propulsion

Next Steps

- Work with Portsmouth International Port to complete regulatory permissions for testing with Lloyds Register and Maritime Coastguard Agency
- Final installation and commissioning of the completed hydrogen propulsion system
- Comprehensive programme of on vessel testing to determine:
 - i. Hydrogen combustion performance of the prototype hardware
 - ii. Performance of the bespoke hydrogen control and delivery systems

Future Opportunities

- University of Brighton are planning journal and conference dissemination of this work and applications for further funding
- Data and learning gathered from this project will be used to inform Cox's ongoing R&D programme, particularly as regards to the future potential implementation of a hydrogen product



CLEAN PORT SYSTEMS

10.00-11.20

A digital twins ecosystem and novel technologies approach to surfacing data for analysis and insights



Sophie Peachey
Head of Customer
Success
IOTICS



Alex Barter
Managing Director
Barter for Things



SECURE SELECTIVE DATA SHARING

24 March 2022

Our Product

IOTICSPACE

“[IOTICSpace] facilitates cross-boundary data exchange between multiple parties”

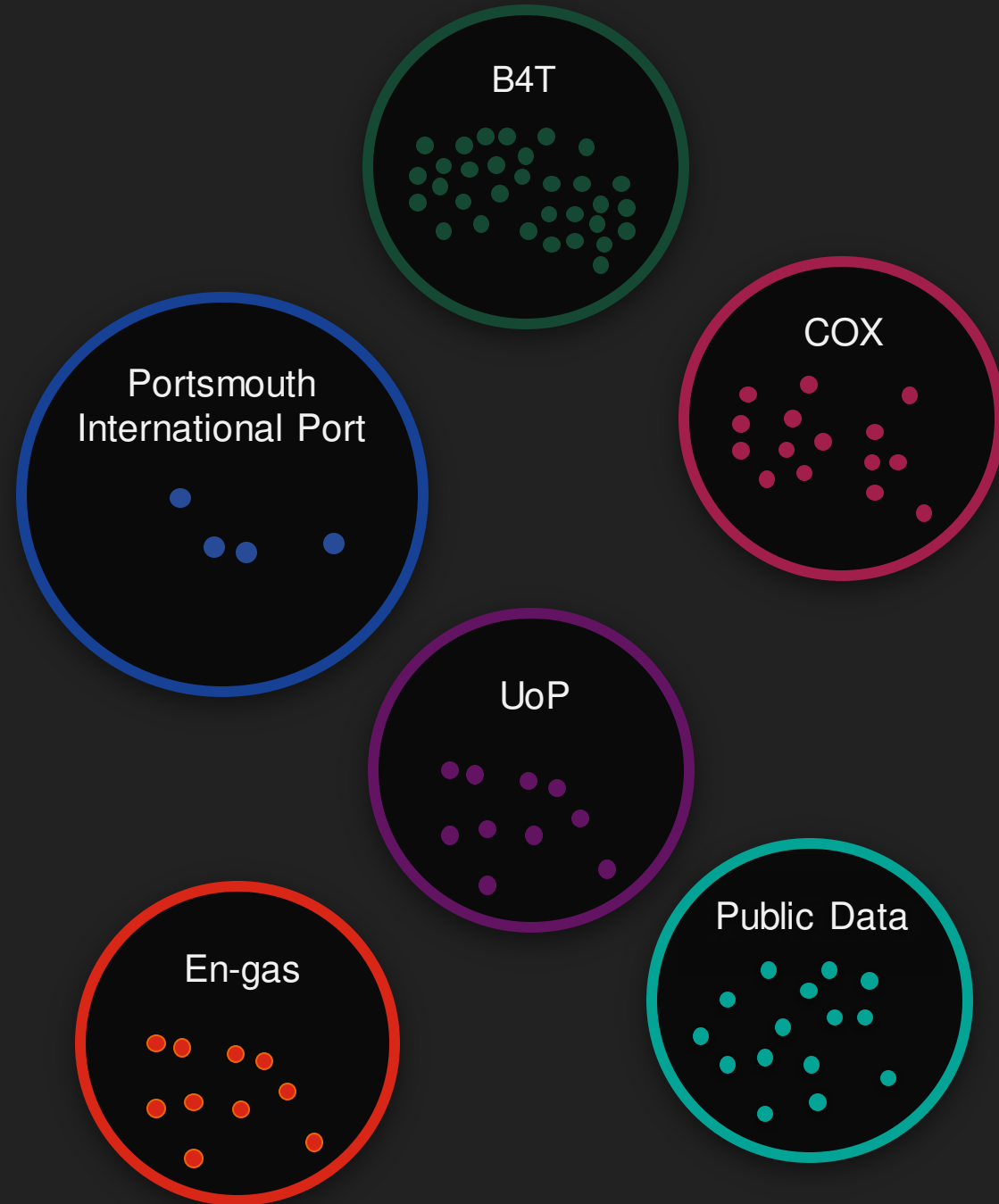
– Vikki Williams, Digital Lead Water, Arup



Approach

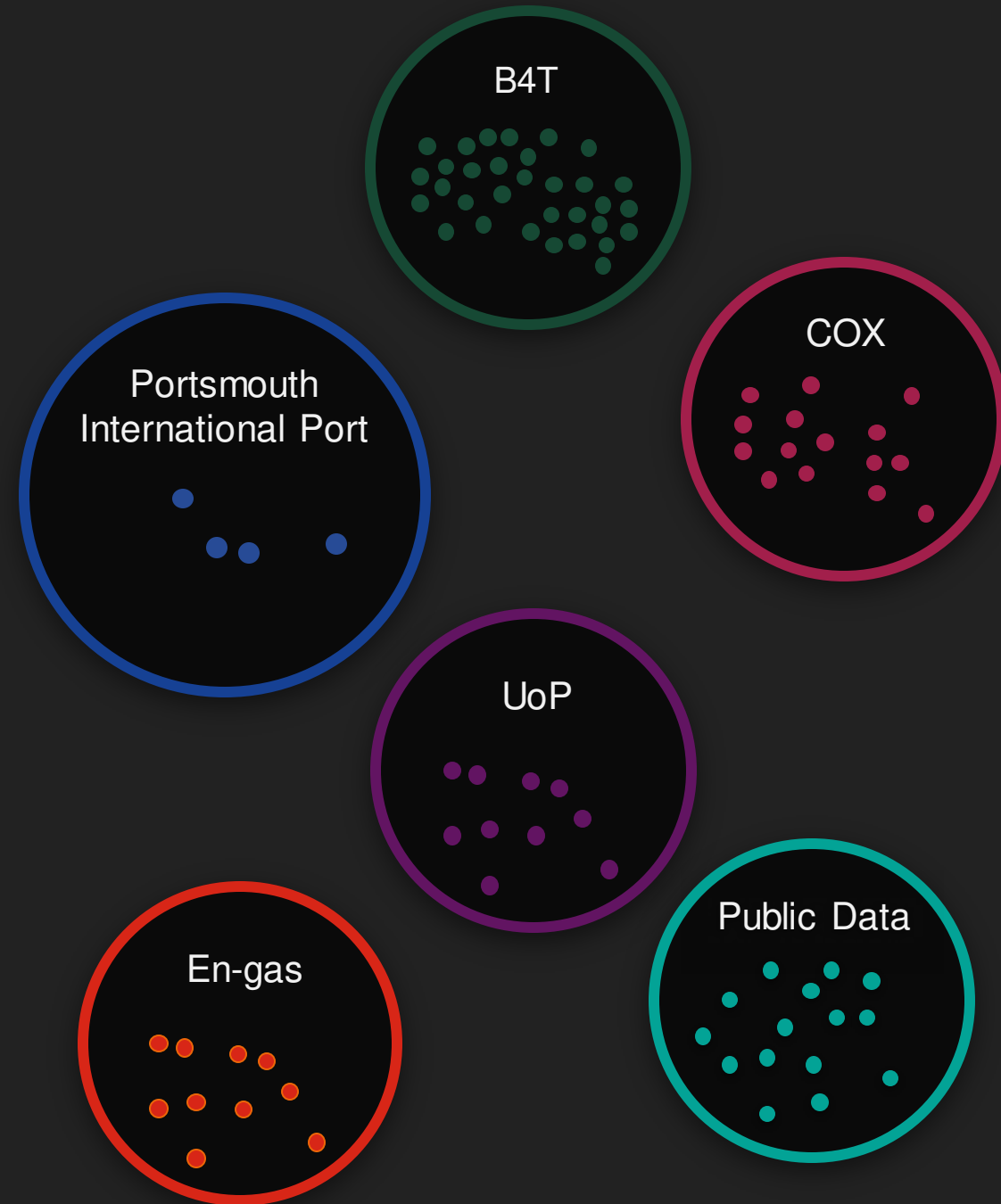
SURFACING DATA WITH A DIGITAL TWINS ECOSYSTEM

- Secure
- Flexible
- Extensible



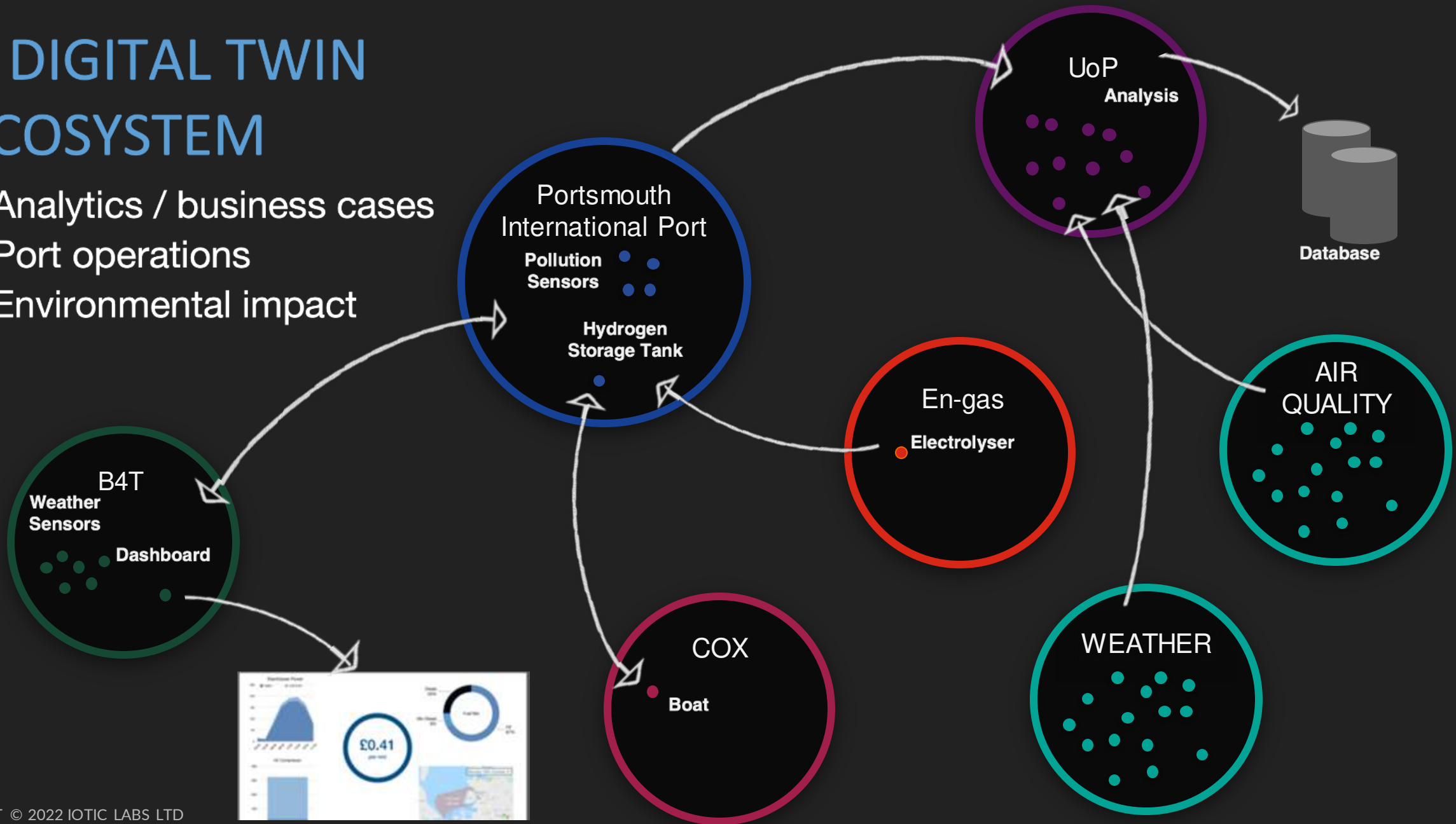
SURFACING DATA WITH A DIGITAL TWINS ECOSYSTEM

- Everything is a twin
- Driven by search
- Described by semantics
- Virtualised data interactions
- Data is Findable, Accessible, Interoperable, Reusable



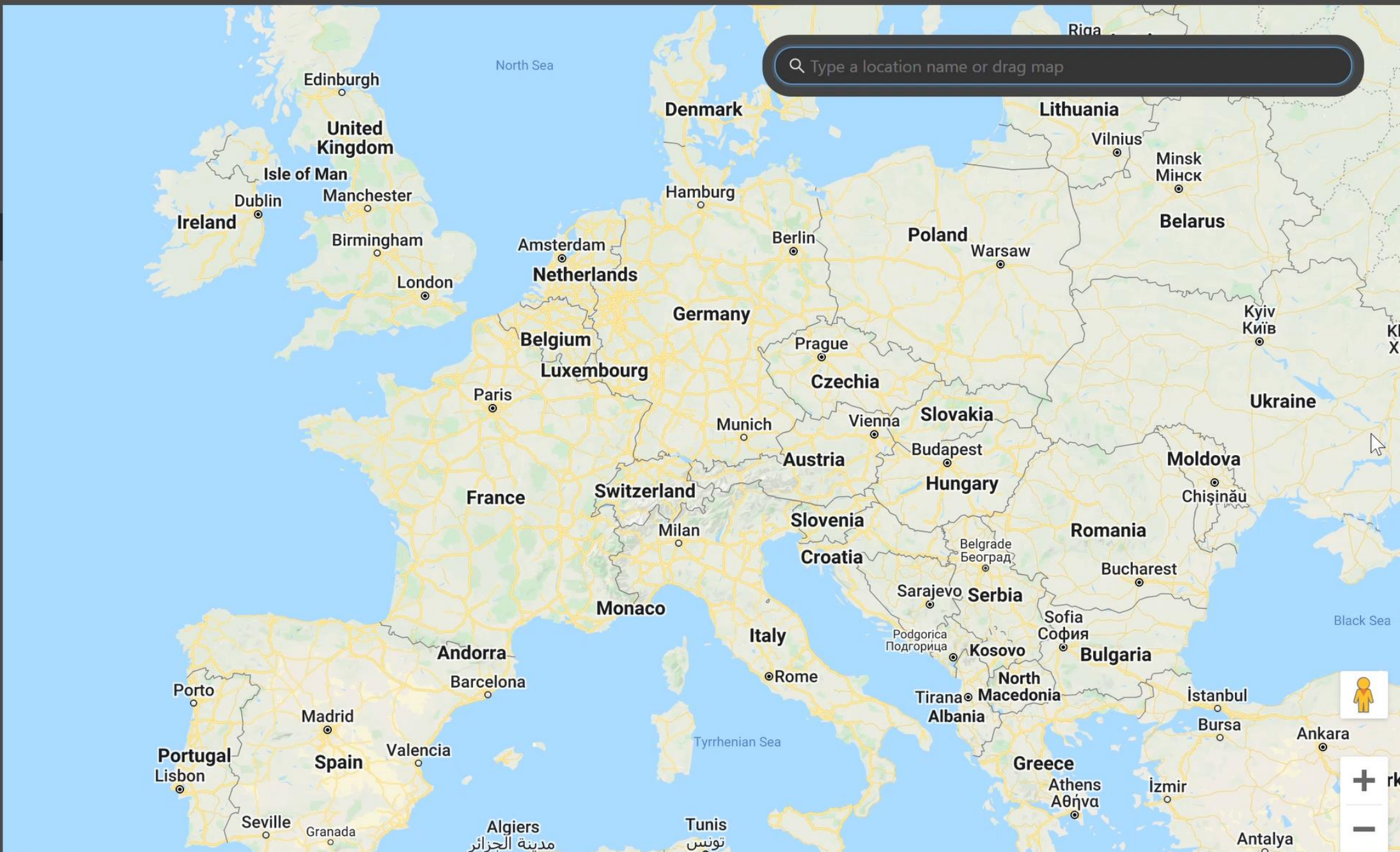
A DIGITAL TWIN ECOSYSTEM

- Analytics / business cases
- Port operations
- Environmental impact



Navigation Menu ☰

- 📍 Explorer
- 🎯 Models
- 🔗 Twins
- 🗃️ Data Interactions
- 🏠 Applications



SHAPE-UK / CLEAN MARITIME
THANK YOU FOR YOUR TIME



IB4T

The Value of Digital

SHAPE: Local H2



Today's Energy Price: **£0.15/kWh**

RELOAD DATA

Ships in port: 5

Name	Time Arrived	Length	Draught (M)
------	--------------	--------	-------------

Port Map



the artefact

SAFETY AND REGULATION WORKSTREAM

10.00-11.20



Charles Haskell

Programme Manager

Lloyd's Register Maritime
Decarbonisation Hub



CATAPULT
Connected Places

The logo consists of the letters 'L' and 'R' in a bold, white, sans-serif font. The letters are set against a background of a teal ocean with white foam from waves. The 'L' is on the left and the 'R' is on the right, both partially overlapping the white text box.

LR

**Shipping,
Hydrogen
And
Port
Ecosystems, UK**



Sustainability

IMO's 2013 definition, updated by UNCTAD 2019

“sustainability in maritime transport entails, among other features, the ability to provide transportation infrastructure and services that are:

Safe

Socially inclusive

Accessible

Reliable

Affordable

Fuel-efficient

Environmentally friendly

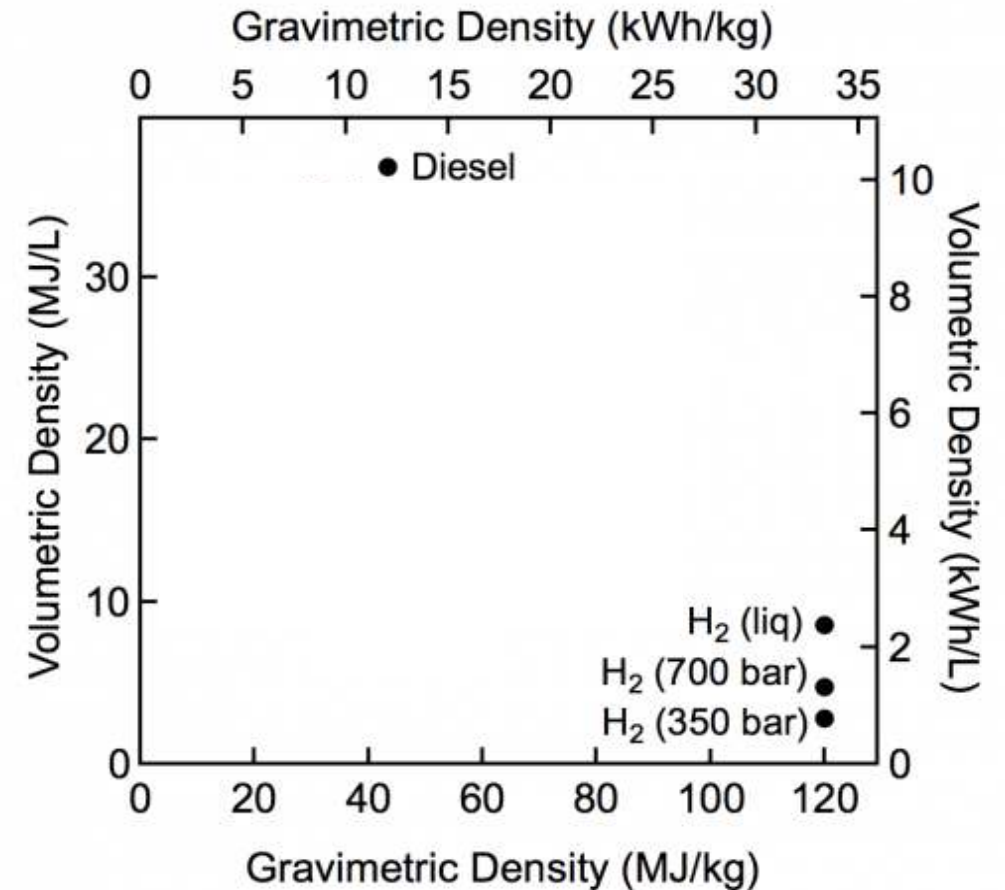
Low-carbon

Resilient to shocks and

disruptions

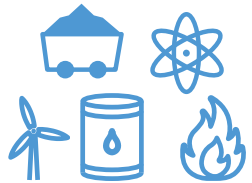
Key features of hydrogen

- High gravimetric energy density
- Low volumetric energy density
- Liquid cryogenic storage at -253 C, 1 bar
- Flammability, invisible, high temperature flame
- form explosive mixtures with air

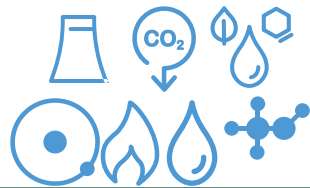


A transition involving a wider system

Putting shipping into the wider energy context as we transition to alternative energy sources and technologies



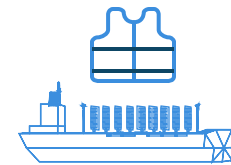
Resources



Production, conversion
and system integration



Bunkering and Ports
integration

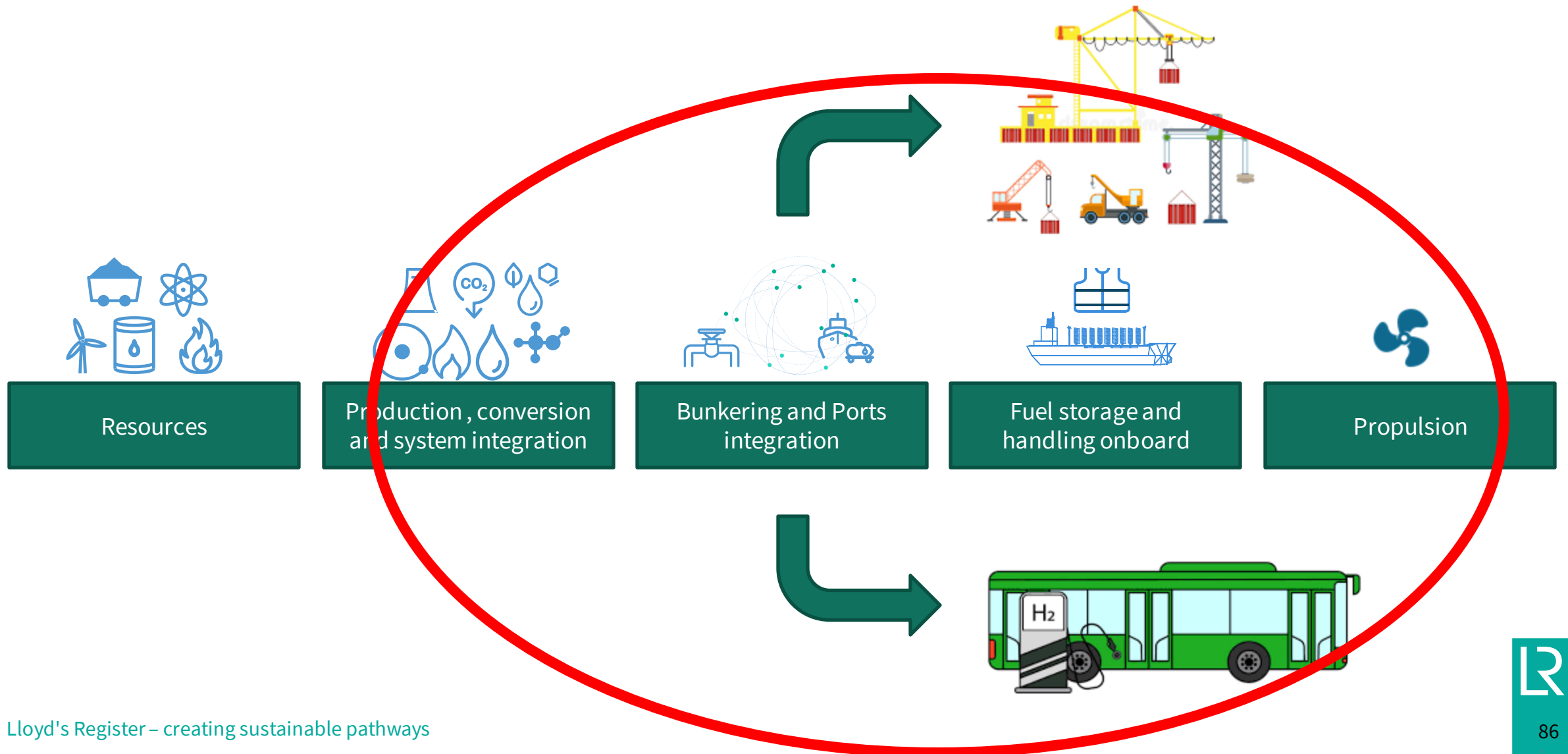


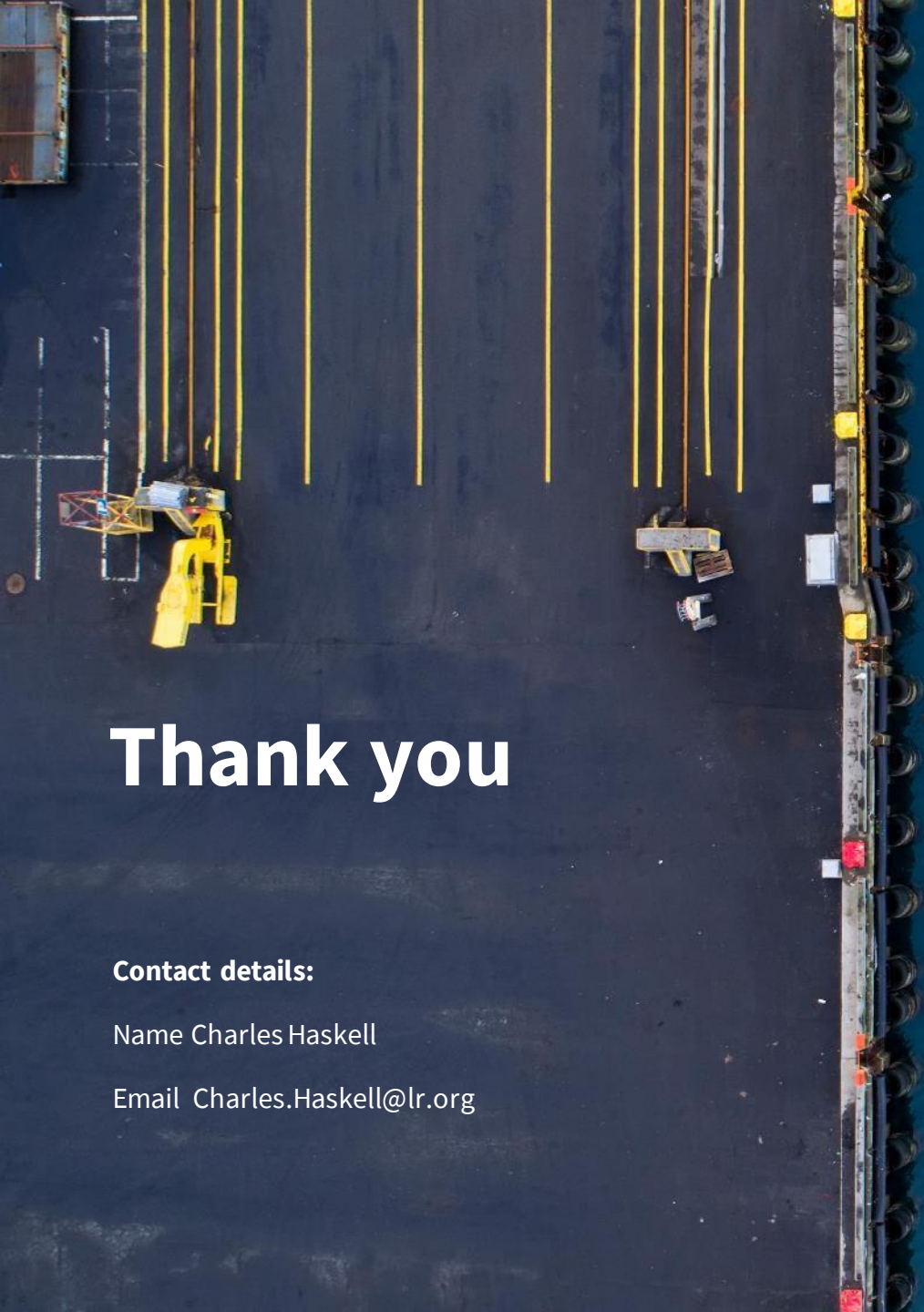
Fuel storage and
handling onboard



Propulsion

Shipping, Hydrogen And Port Ecosystems, UK





Thank you

Contact details:

Name Charles Haskell

Email Charles.Haskell@lr.org



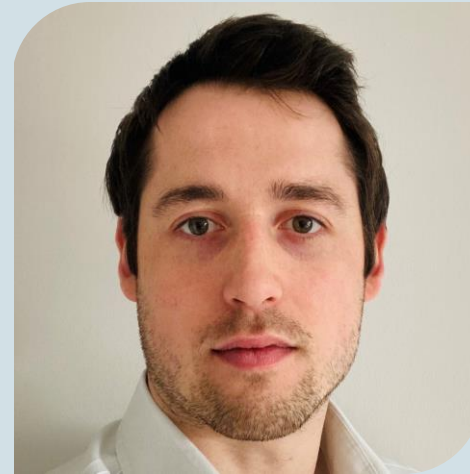
SCALE UP ROADMAP

10.00-11.20

How Hydrogen, Shore Power and Digital Twin can deliver benefits to the port and associated operation



Richard Holland
Principal Engineer
Connected Places
Catapult



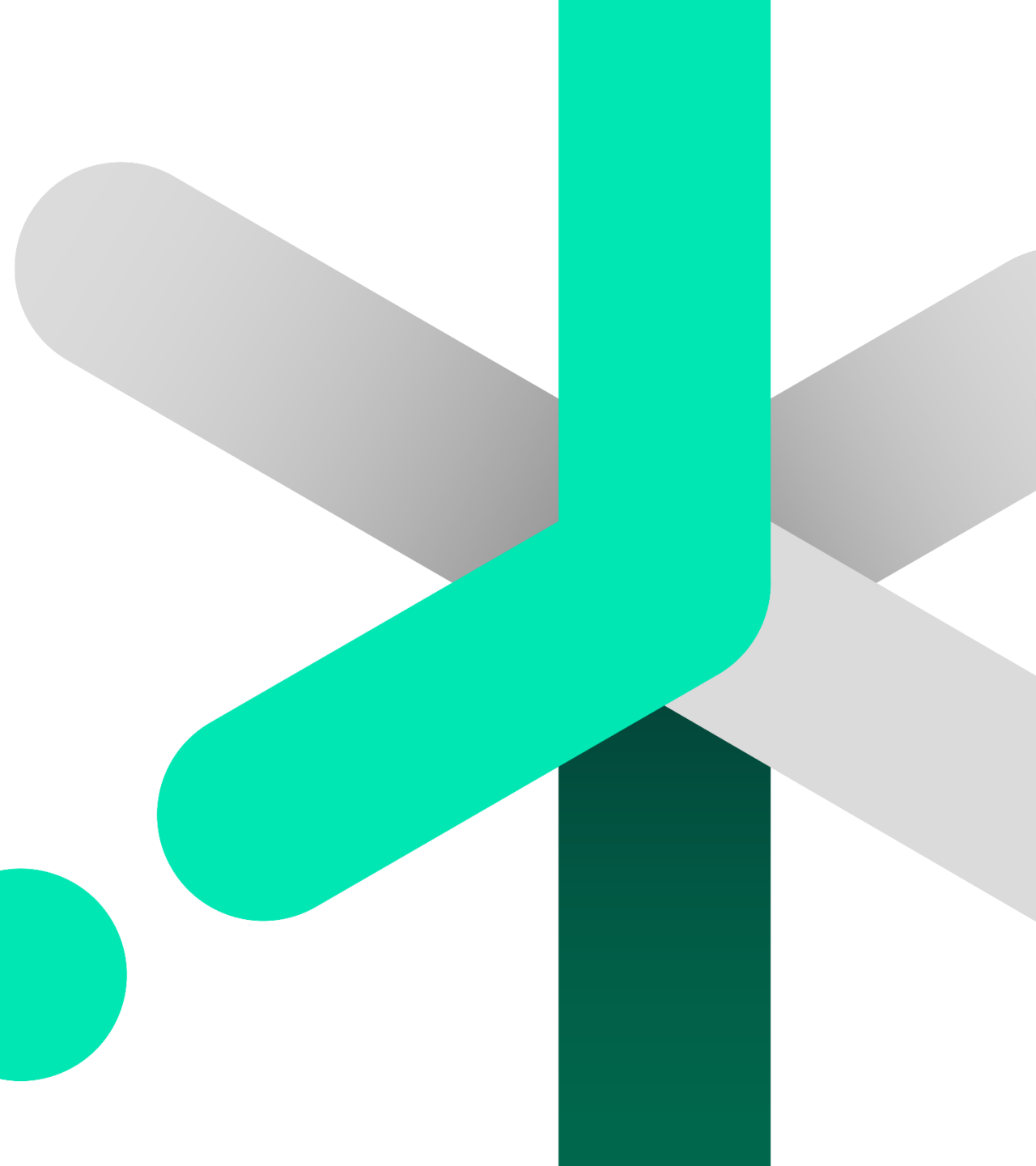
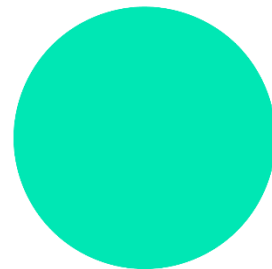
Christopher Brook
Senior Systems
Engineer
Connected Places
Catapult



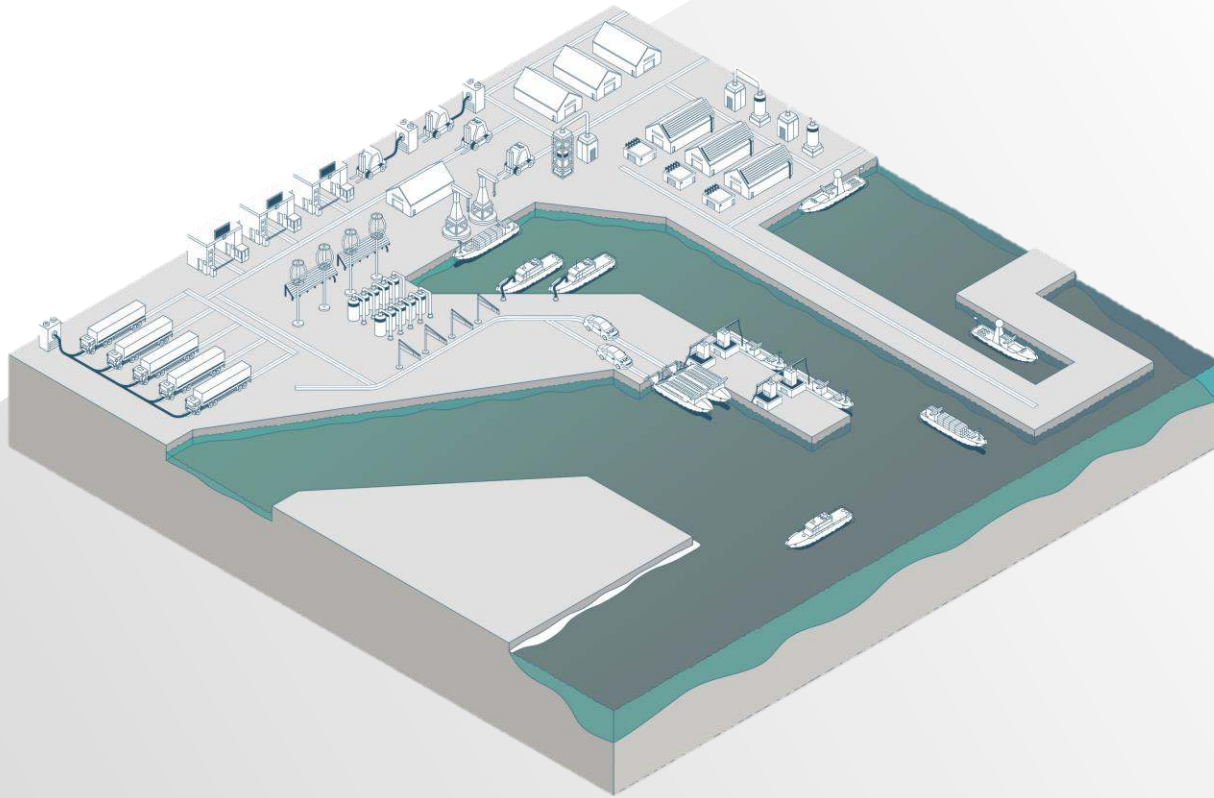
Wednesday, March 30, 2022

Scale up roadmap: how hydrogen, Shore Power and Digital Twin can deliver benefits to the Port and associated operations

Richard Holland & Chris Brook
New Mobility Technologies



Vision 2028



Aims

- Significantly increase Air Quality
- Net Carbon Neutral operations by 2030
- Doubling the economic value to the local area

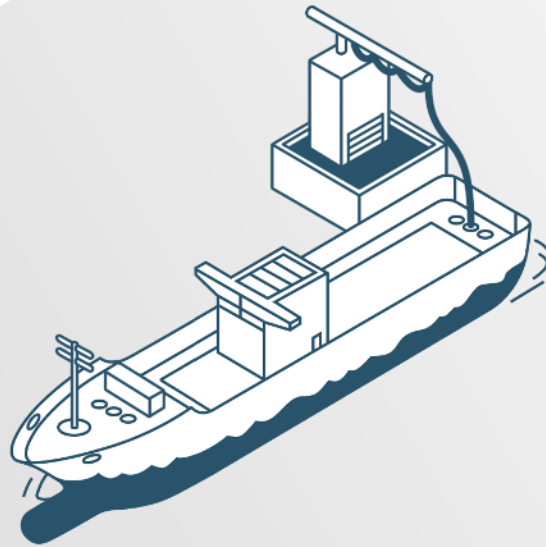
How

- Through a blended mix of Electrification, Digitisation and introducing new fuels such as Hydrogen
- Investing in future technology, new ways of operation and championing new partnerships across industry.

Results

- Reduced Emission increasing air quality
- Growth in the local and wider economy
- Social and other health benefits

Shore Power - enablers



Key partnerships

- Industry
- SMEs
- Academia

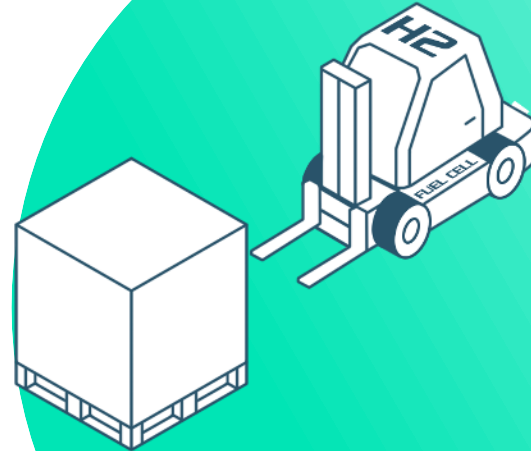
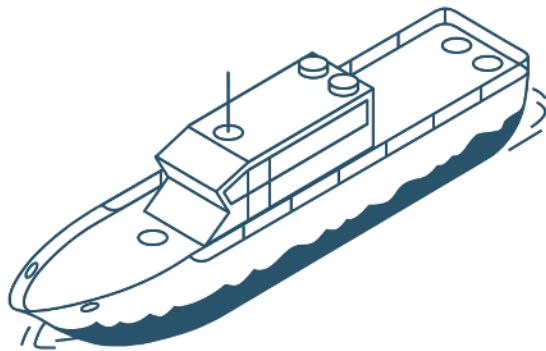
Funding

- Grants
- Collaborative R&D

Skills

- Knowledge sharing
- Cross-sector learning

Multi-mode Hydrogen-enablers



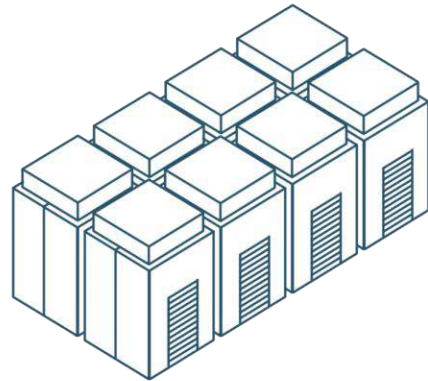
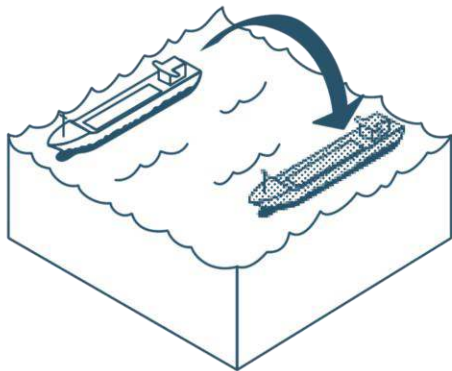
Key partnerships

- Industry
- Royal Navy
- SMEs
- Academia
- Regulators / MCA

Cross-sector collaborations

- Road freight
- Rail freight
- Zero emission flight

Digitisation - enablers



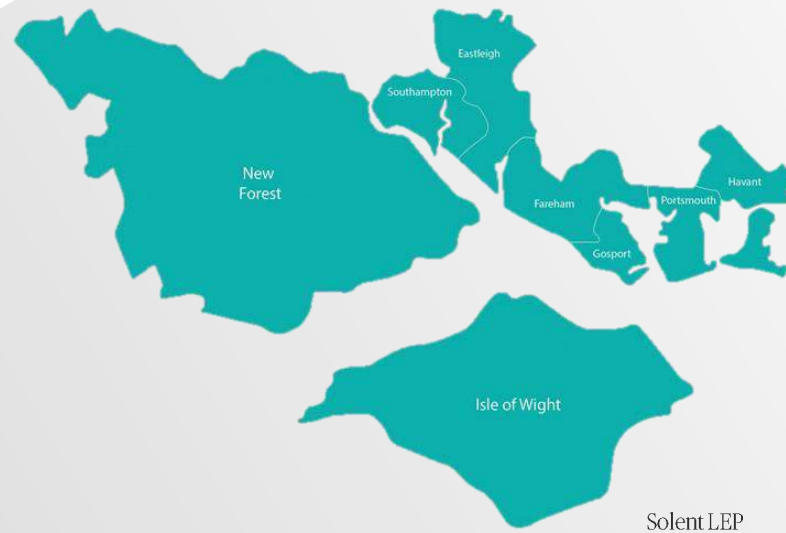
Key partnerships

- Industry
- Royal Navy
- SMEs
- academia

Data

- Availability
- “Living laboratories”
- Energy generation
- Microgrid optimisation

Solent Regional Benefits



Environmental

- Air, Water & Land Quality
- Biodiversity
- Noise reduction
- Historic environment maintenance

Economic

- Green Grant funding
- Reduction in potential carbon taxes
- Commercially attractive
- Industry growth opportunities

Social

- Public Health
- Worker Welfare
- Customer Experience

Benefits Local



Portsmouth International Port

Economic

- Port Customers & operators
- Growth - attractiveness
- Reduced operating costs (fuel/ maintenance)
- Funding opportunities

Environmental

- Air, Water & Land Quality
- Biodiversity
- Noise reduction
- Historic environment maintenance

Social

- Worker's wellbeing
- Public Health
- Customer attraction

Barriers

What's stopping this all from being done right now?
(Thought provoker for the creative session later!)

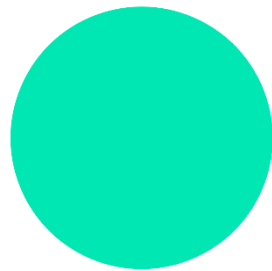


- Cost of hydrogen production and limited space for generation and storage
- Limited Hydrogen powered vehicles and lack of certification processes
- Immature “end-to-end” transport systems thinking and lack of standardisation
- Unwillingness for data sharing between stakeholders
- Limited investor confidence who are seeking proof of positive returns on investment and a strong business case

Thank you

richard.holland@cp.catapult.org.uk
christopher.brook@cp.catapult.org.uk

CATAPULT
Connected Places



Q&A PANEL SESSION

11.30-12.00

Chaired by: Tom White

Ecosystem Director Maritime and Ports
Connected Places Catapult

Jerry Clarke

Pilot/Senior Project Manager
Portsmouth International Port

Dr Amit Roy

CEO
ENGAS Global Ltd

Dr Penny Atkins

Principal Research, Fellow Advanced
Engineering Centre
University of Brighton

James Eatwell

Head of Research and Development
Cox Powertrain Limited

Sophie Peachey

Head of Customer Success
IOTICS

Alex Barter

Managing Director
Barter for Things

Charles Haskell

Programme Manager
Lloyd's Register Maritime
Decarbonisation Hub

Richard Holland

Principal Engineer
Connected Places Catapult

Christopher Brook

Senior Systems Engineer
Connected Places Catapult

MORNING SESSION WRAP UP AND ONLINE CLOSE



Dr David Hutchinson

Reader in Environmental Innovation
University of Portsmouth



CATAPULT
Connected Places

In partnership with:



knownow
INFORMATION LTD



Funded by:



THANK YOU FOR ATTENDING

In partnership with:



Funded by:



LUNCH

OPPORTUNITY TO VIEW THE ELECTROLYSER

INTRODUCTION



Tom White

Ecosystem Director Maritime and Ports
Connected Places Catapult



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Connected Places

FUTURE OPPORTUNITIES

Opportunities for the Solent, Portsmouth University

13.00-13.30



Sarah Duckering

Director of Research and
Innovation Services
University of Portsmouth



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Connected Places



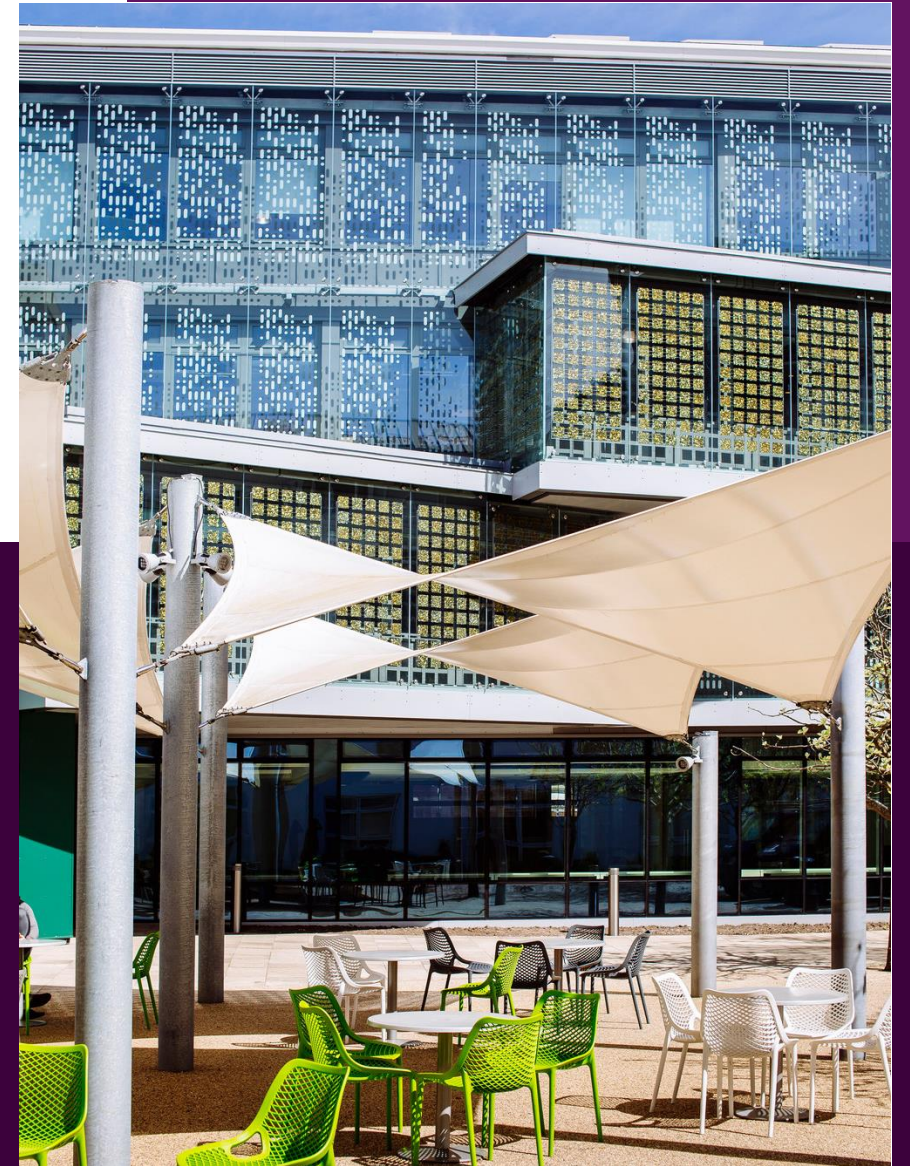
**UNIVERSITY OF
PORTSMOUTH**

Innovation in the Solent

ShapeUK Workshop 24th March

Sarah Duckering

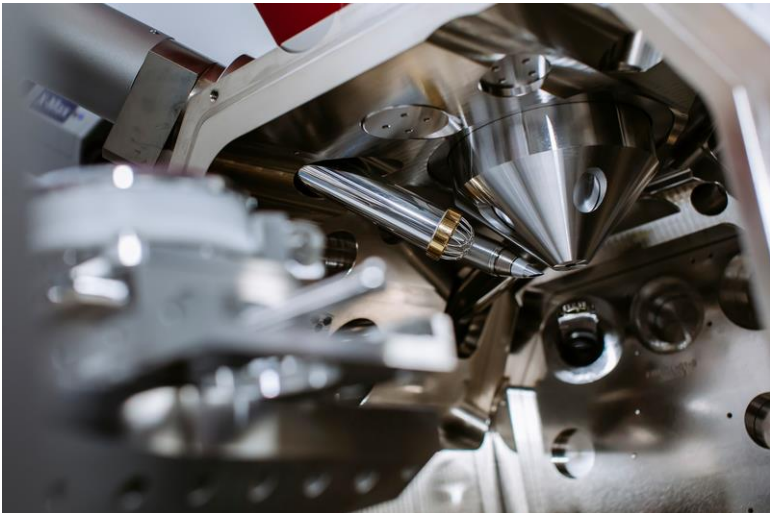
Director of Research and Innovation Services



An aerial photograph of Portsmouth, Hampshire, England. The image shows the city built on a peninsula, with the harbor in the foreground. The Spinnaker Tower is a prominent landmark in the center. The water is a deep blue-green, and the city buildings are a mix of red and white. In the background, there are green fields and a hazy horizon.

‘Hampshire is a county unparalleled in England, an economic powerhouse in its own right.

Innovation Assets



Centres of Research and Innovation



**National
Oceanography
Centre**



**UNIVERSITY OF
PORTSMOUTH**

SOLENT
UNIVERSITY

SOUTHAMPTON



**University of
Southampton**

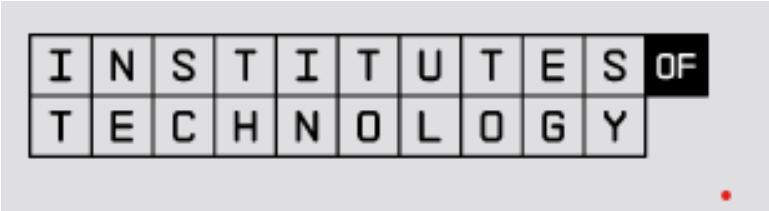
Innovation Spaces



Courtesy of BAE Systems Plc



Innovation People and Networks



Innovation Ecosystem

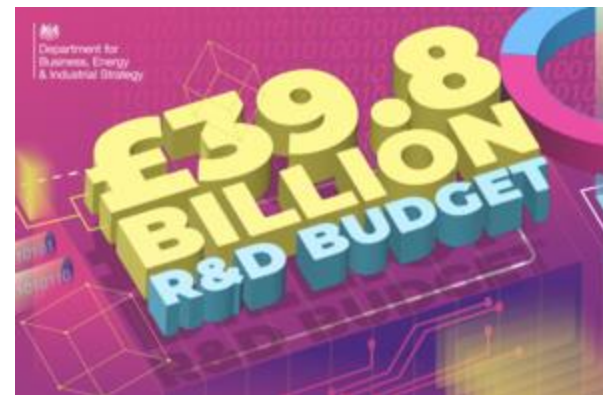
- Government co-operation
- Housing and Land Use policies
- Digital, Civic and Open Data platforms
- Larger firms and future growth sectors
- Enterprise-friendly pathways and regulation
- Proactive and risk taking knowledge anchors
- Skills and talent appeal
- Connectivity to markets
- Access to capital

Innovation Ecosystem Enablers

- Government co-operation
- Housing and Land Use policies
- Digital, Civic and Open Data platforms
- Larger firms and future growth sectors
- Enterprise-friendly pathways and regulation
- Proactive and risk taking knowledge anchors
- Skills and talent appeal
- Connectivity to markets
- Access to capital

Innovation Opportunities

- Solent Freeport
 - Freeports will
 - create hotbeds of innovation
 - Demonstrate a halo effect in the region
- Solent Maritime Innovation Gateway (Solent MIG)
- Government commitment
- *Can/will we respond?*





**UNIVERSITY OF
PORTSMOUTH**

Thank You



FUTURE OPPORTUNITIES

Role of Ports in Decarbonisation, Connected Places Catapult

13.00-13.30



Tom White

Ecosystem Director Maritime and Ports
Connected Places Catapult

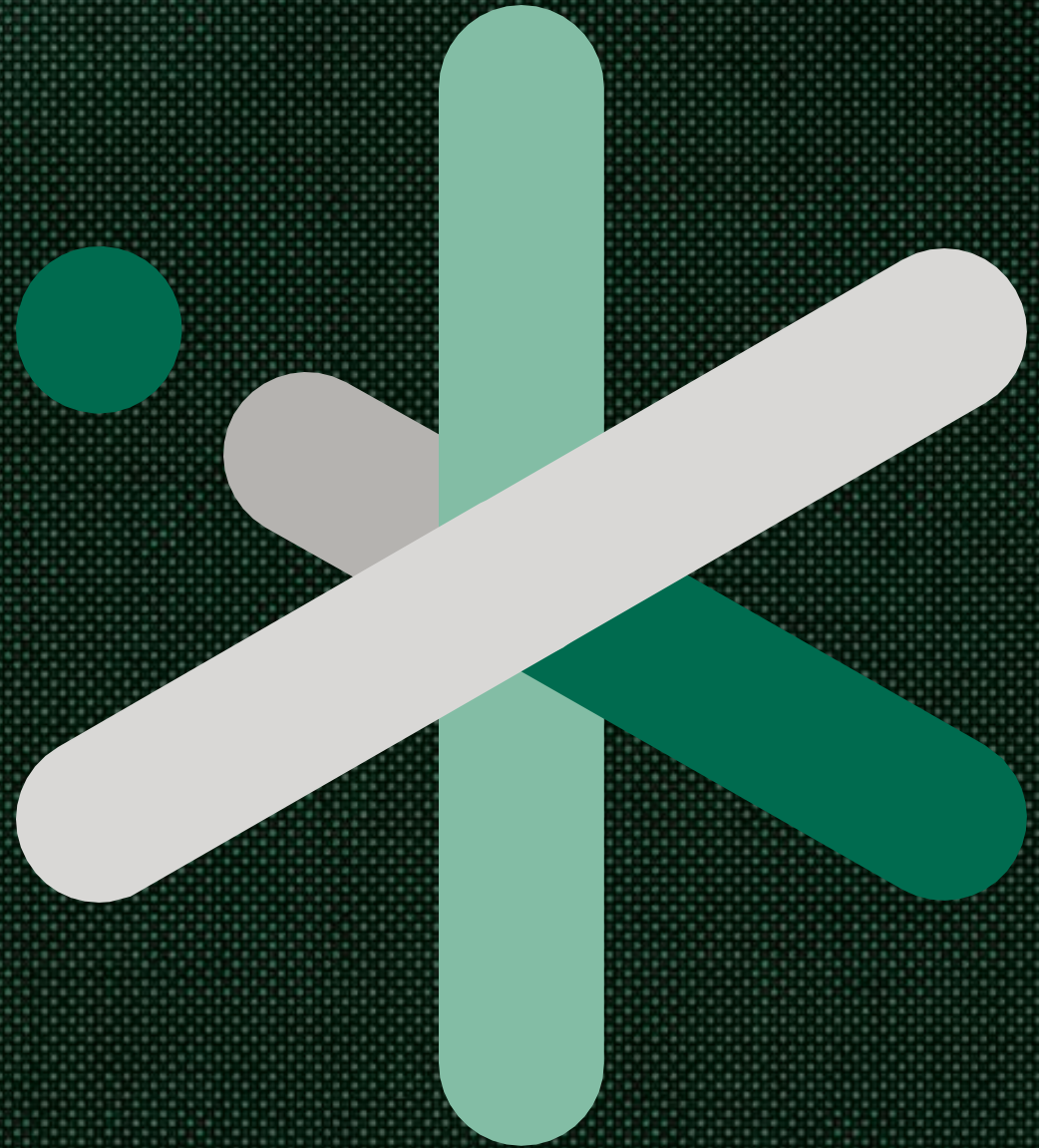


CATAPULT
Connected Places

Wednesday, March 30,
2022

Innovation in Maritime

Tom White
Ecosystem Director – Maritime and Ports



Cities, transport and place leadership



Maritime
& Ports



Airmobility
& Airports



Rail &
Stations



Integrated
Infrastructure



Place
Leadership



Homes
& Housing



Ecosystem
Incubation

Our Innovation imperatives



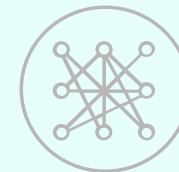
Climate action

Reduce emissions.
Build resilience.



People's experience

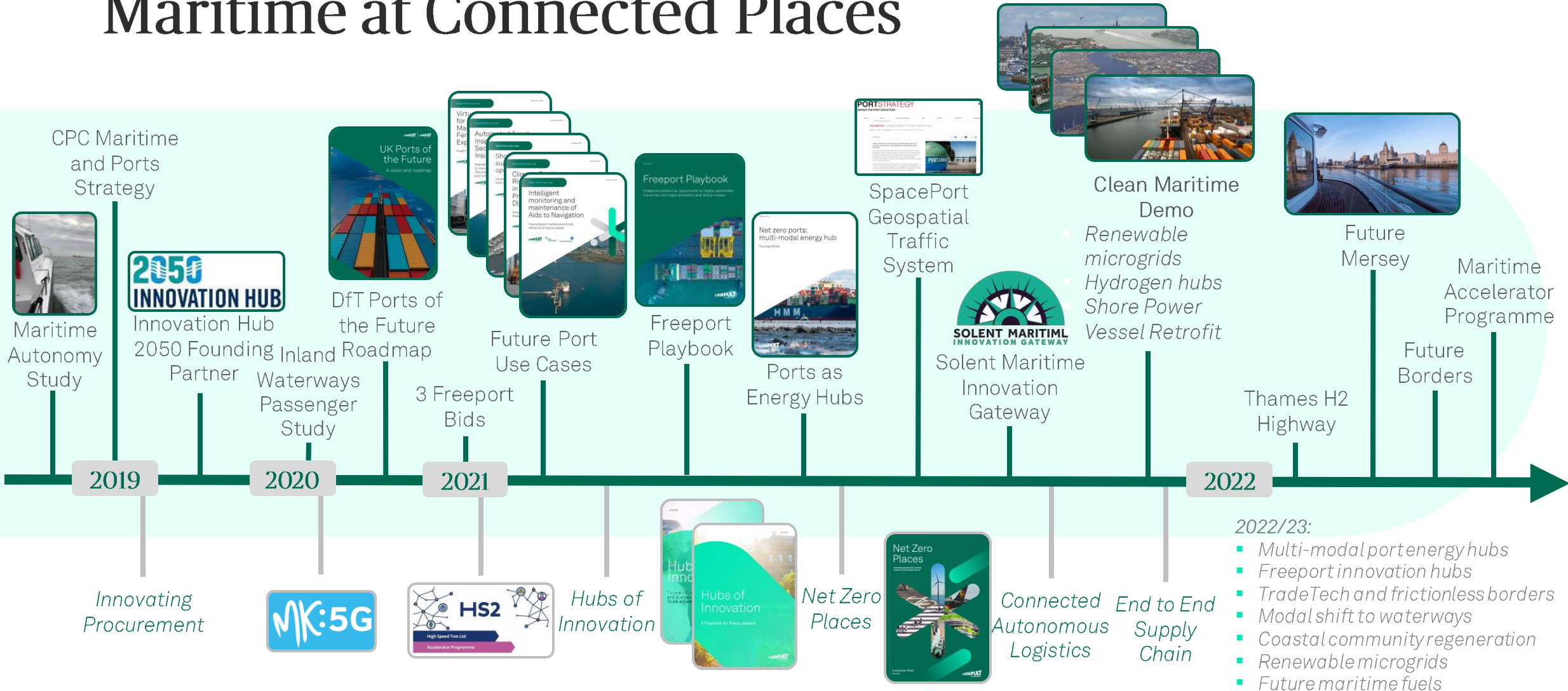
Design for the customer.
Address changing needs.



Connected intelligence

Connect data.
Make sense and take action.

Maritime at Connected Places



Offshore wind, tidal and wave generation

Autonomous and remotely controlled survey and port service vessels

Inland waterways connectivity and last mile logistics

Future fuel vessels

Green shore power connectivity

Autonomous cargo handling operations

Remote maintenance of critical port equipment

Zero emissions freight handling equipment and mobile plant

Multi-modal transport optimisation

Onsite green hydrogen generation and ammonia conversion

Predictive and resilient multi-modal fuel supply

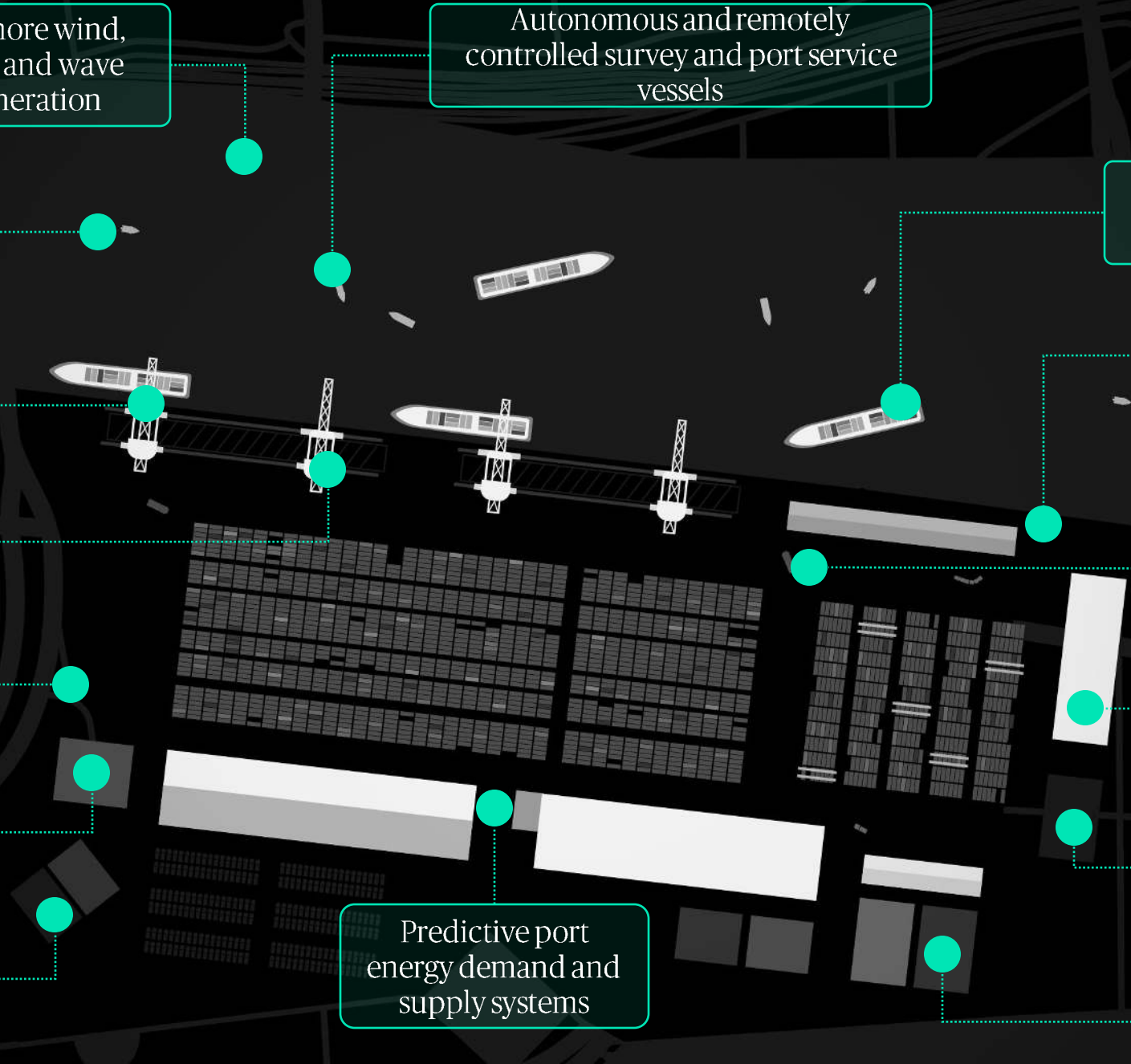
Onsite wind and solar generation

Multi-modal future fuels supply and distribution

Predictive port energy demand and supply systems

Smart energy efficient buildings

A System of Systems Innovation Hub



Why?



Regional
Economic
Growth



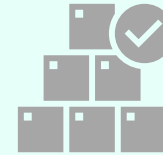
Grow SMEs and
commercialise
research



Accelerate Net
Zero Transition



Stimulate Cross-
Sector
Opportunities

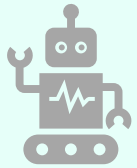


Supply chain
efficiency and
resiliency

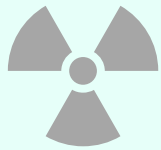


Grow global
market
presence

What slows us down?



Lack of confidence in new solutions



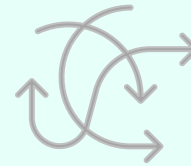
Risk appetite



Access to funding



Collaboration in risk or large scale challenges



Clarity of future state and route



Visibility of challenges to the market



Lost in translation

UK SHORE and CMDC 2

- Government launches new unit, UK SHORE, to tackle shipping emissions and advance the UK towards a sustainable shipping future
- £206 million new funding to accelerate research into and development of clean maritime technologies and create skilled jobs across the country
- Clean maritime competition given multi-year extension for UK organisations to accelerate zero emission shipping technologies

News story

DfT launches UK SHORE to take maritime 'back to the future' with green investment

Office dedicated to making maritime greener will pioneer new technology that could make journeys by sea as green as they were hundreds of years ago.

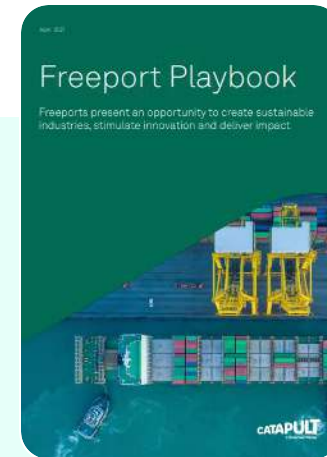
From: [Department for Transport](#), [Robert Courts MP](#), and [The Rt Hon Grant Shapps MP](#)

Published 10 March 2022



Freeports

- Stimulate significant economic, technological and social impact
- Attract investment through targeting a specialism/niche based on regional and nationally linked ecosystems
- Stimulating regional growth and development
- Wider systemic impacts through innovation across supply chains
- Support the transition to Net Zero
- Innovation Hub at their core to support the growth of key sectors and accelerating the commercialisation and exploitation of UK IP

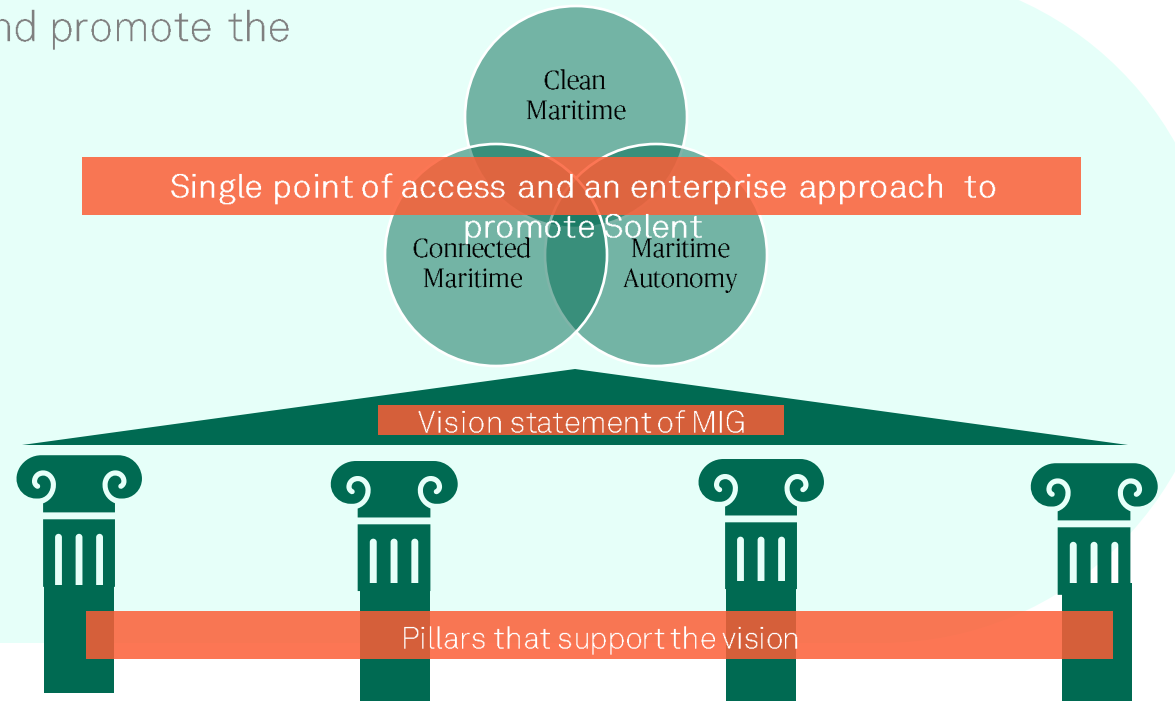


A screenshot of a news article from 'The News' website. The header includes the site name 'The News' and the tagline 'News you can trust since 1877'. A navigation bar lists various categories like 'Ukraine', 'Portsmouth FC', 'Sport', etc. A red banner for 'Ladbrokes' is visible. The article title is 'Plans for new Solent Freeport worth billions to Portsmouth to take a leap forward'. The text below the title states: 'COUNCILLORS in Portsmouth are set to approve the final business case for the Solent Freeport later this month ahead of its submission to the government – in a move civic chiefs hope could bring billions to the economy.'

Solent Maritime Innovation Gateway

Collaboration across multiple regional partners to strengthen and promote the Solent maritime innovation ecosystem:

- Stimulating investment
- Enabling and driving collaboration
- Opening new business opportunities
- Co-ordinating activity on shared imperatives
- Leveraging regional assets and initiatives
- Promoting the region internationally



CPC Maritime Innovation Flagship 2022



Accelerating the growth of SMEs in maritime



Increasing private investments in solutions



Innovation programme investment



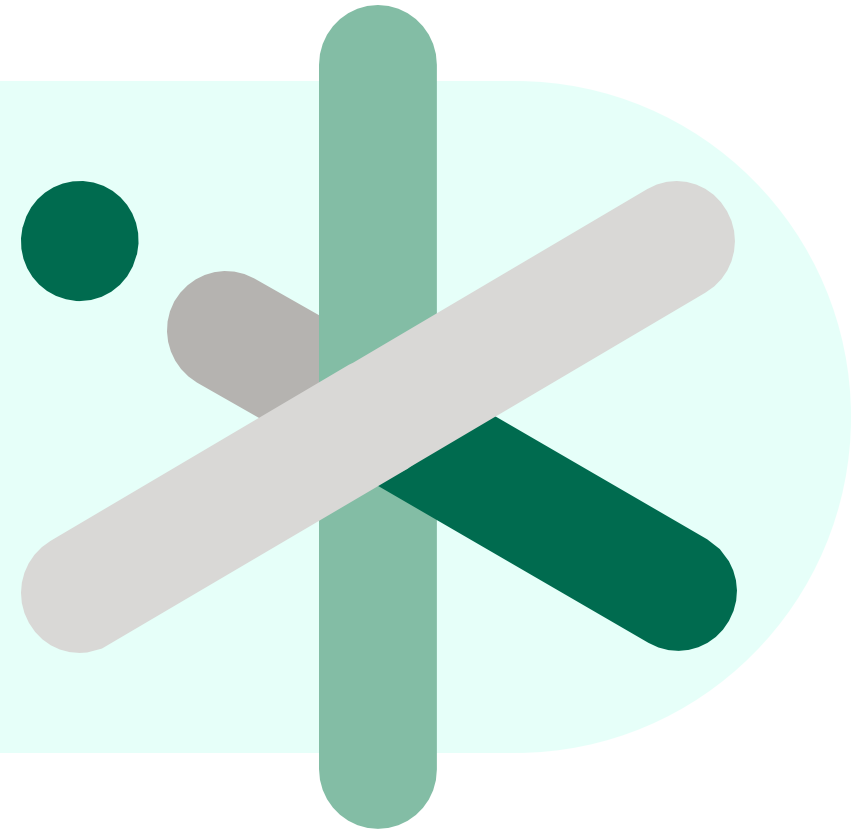
Building commercial confidence in future technologies



Regional engagement and support



Stimulating live demonstrators and trials



Get in touch: Thomas.White@cp.catapult.org.uk

Maritime and Ports

Tom White

Ecosystem Director

Maritime & Ports

Thomas.White@cp.catapult.org.uk

NEXT STEPS AND FUTURE PROJECTS

13.30-15.00



Tom White
Ecosystem
Director Maritime
and Ports
Connected Places
Catapult



Dr David Hutchinson
Reader in
Environmental
Innovation
University of
Portsmouth



Next Steps and Future Projects - activity

- 1.5 hours in total
 - ~ 65 minutes on tables
 - ~25 minutes facilitators feedback to the room
- Each table is assigned one of the 3 technologies
 - Hydrogen
 - Electrification / Shore power
 - Digitisation

(Consider both technology progression and the business case aspects)

- What should be done next to build on the Solent's strengths and the outputs of SHAPE UK?
 - How aware of SHAPE UK were attendees before today?
 - Would you engage with SHAPE UK going further?
- Who else needs to be involved?
- How will this benefit the port and the region?
- Market awareness and route to market (potential outside of reducing emissions)
- What is the wider impact?

CHAIR CLOSING REMARKS

15.00-15.15



Dr David Hutchinson

Reader in Environmental Innovation
University of Portsmouth



CATAPULT
Connected Places

In partnership with:



UNIVERSITY OF
PORTSMOUTH

Funded by:



Innovate
UK



Department
for Transport



IOTICS



Engas Global
an electrolyser and H₂ compressor company

THANK YOU FOR ATTENDING

In partnership with:



Funded by:



Innovate
UK



Department
for Transport



IOTICS



Engas Global
an electrolyser and H₂ compressor company

NETWORKING

SHAPE UK

Shipping, Hydrogen And Port Ecosystems, UK



UNIVERSITY OF
PORTSMOUTH



University of Brighton



Department
for Transport