PORT ENERGY DECARBONISATION: BUT IT'S NOT JUST PORTS

How to choose your decarbonisation route

Presented at All-Energy 2023

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Shipping & Port Interfaces in the New Era

Our project aim is to aid the maritime industry in creating a coherent investment plan to tackle two megatrends of decarbonisation and autonomy for de-crewing of vessels

- Funded by MarRI-UK's Smart Maritime Land Operations programme
- Total budget - £1.65m with MarRI-UK support - £1.06m
- 1 Sept 2022 - 31 December 2023

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From the status-quo to the future

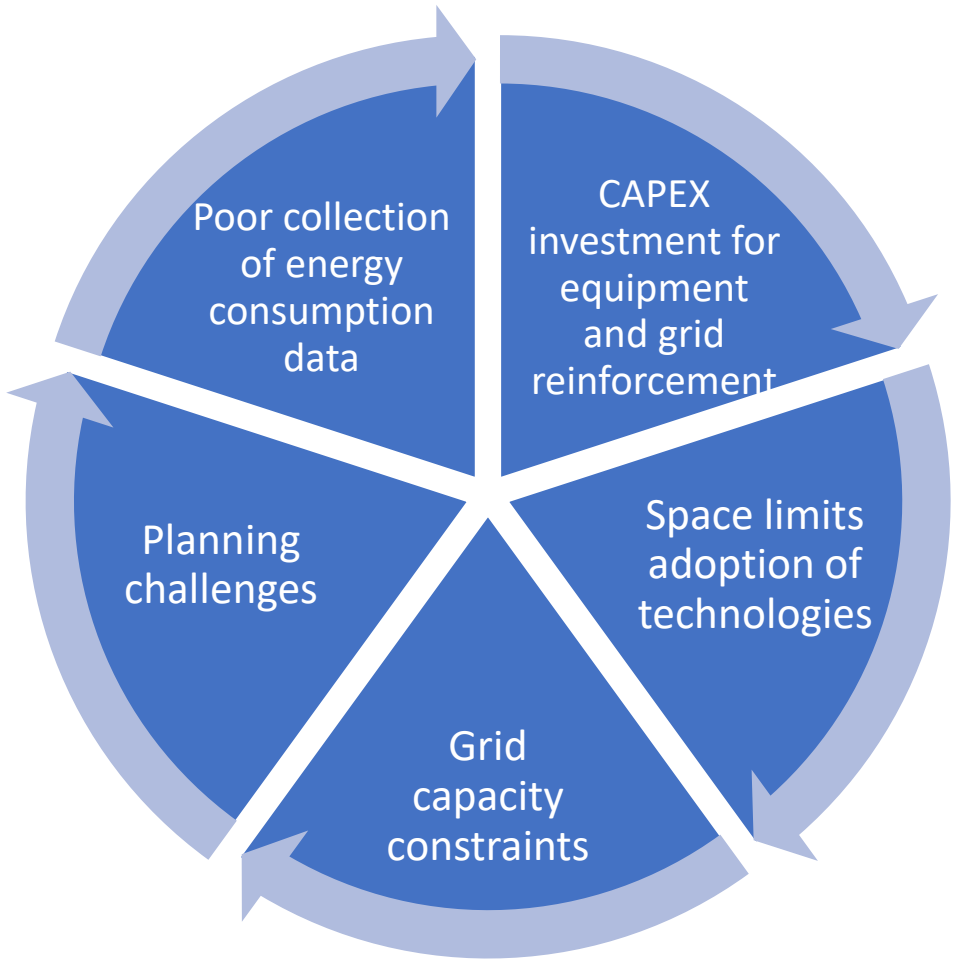
Ports:

- Most equipment is diesel run or hybrid
- Electrifying port activities (cranes FLT, HGV etc) is the first step in port decarbonisation.
- Solar PV uptake varies given CAPEX constraints
- Offshore wind uptake also seen where possible

Shipping:

- Fuel choices: Oil/ LNG/ Electricity/ Hydrogen / methanol/ ammonia
- Causes uncertainty in shipping – ***and in most other sectors.***

Industry Challenges



Study Approach

Ports engaged
ABP Portsmouth
London Gateway
Port of London Authority
Great Yarmouth
Peel Ports – Liverpool
Port of Aberdeen
Newhaven
Shoreham Port
Lerwick
Portsmouth

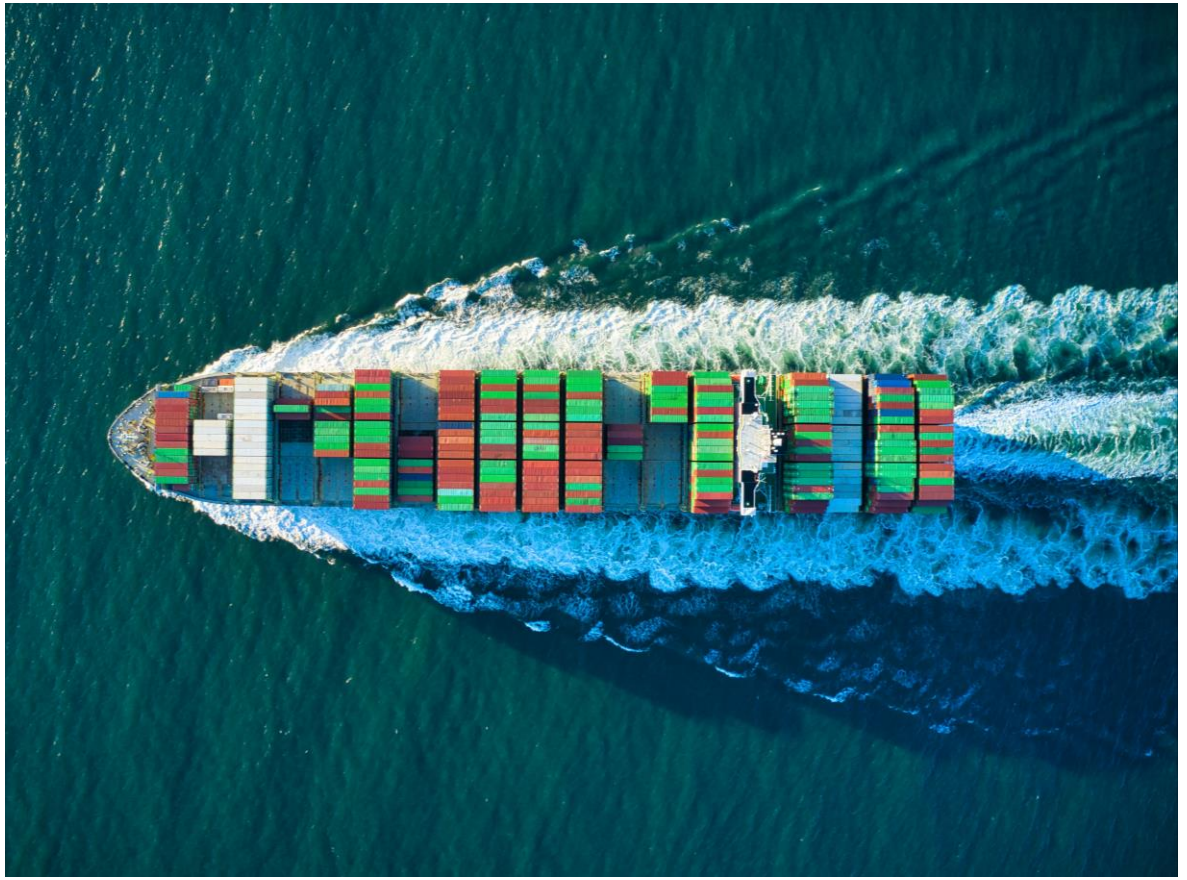
Interview **focus areas**:

We conducted **10 interviews**, 0.5-1 hr, with ports to determine:

1. Is there a need for a tool to support ports in their decarbonisation?
2. Understanding insights needed from a tool
3. Understanding the availability of energy related data across various ports
4. Validating various concepts already envisioned for the tool

Key Takeaways

- *Ports are focusing on decarbonising their landside operations whilst the seaside operations decide on fuels o*ptions
- Electrification and the fuels already available at scale e.g. HVO and LNG are being adopted
- It is seen necessary for vessel owners **and** operators to give confidence on fuel options to eliminate chicken and egg situation
- Government and investors will need to support the transition financially
- The regulatory framework in the UK requires reform to accelerate transition



Roles

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- Port energy modelling
- Business interviews
- Scenarios

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- Business requirements
- Port energy storage model

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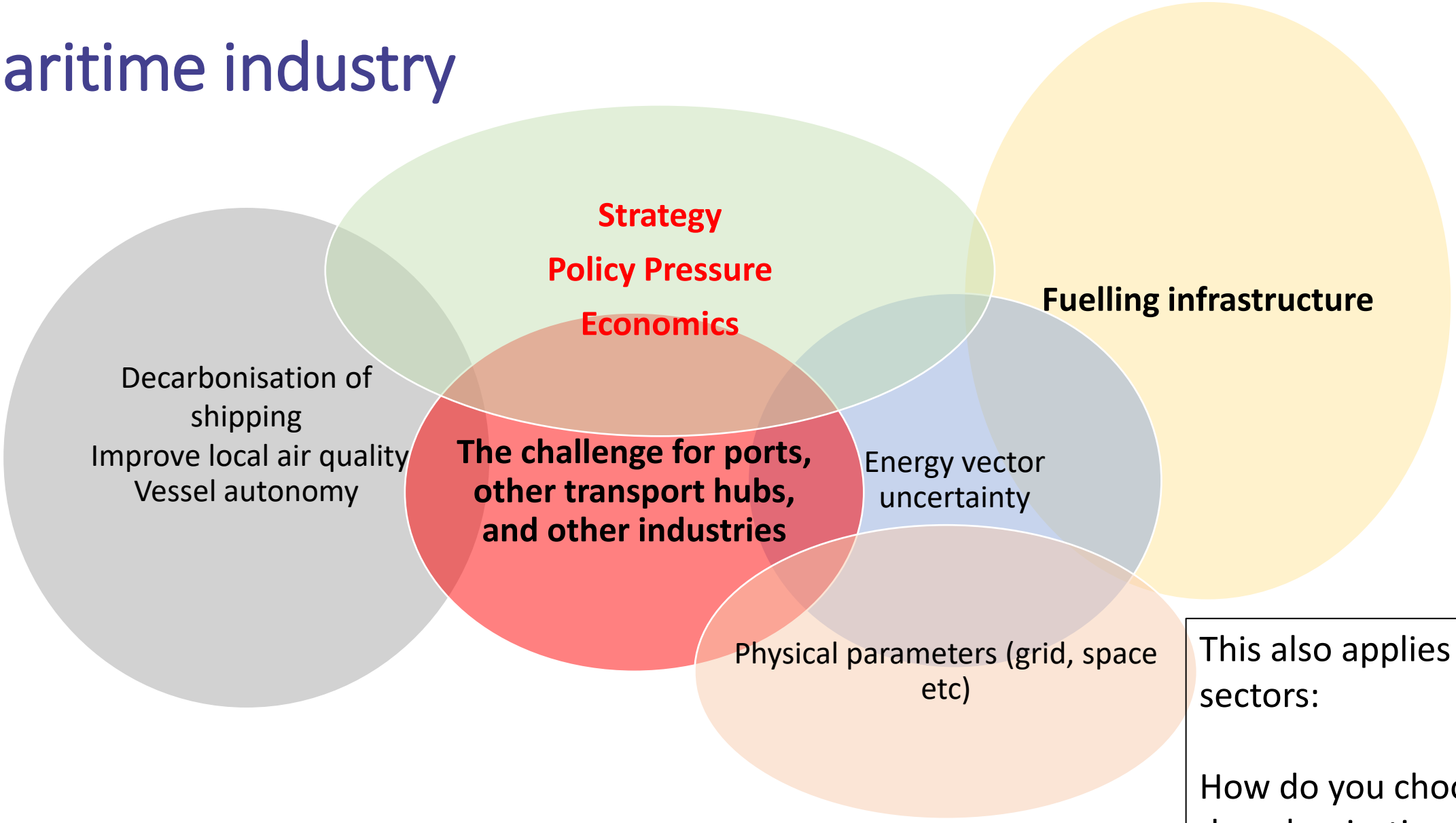
Maritime industry



This also applies to other sectors:

How do you choose the decarbonisation route?

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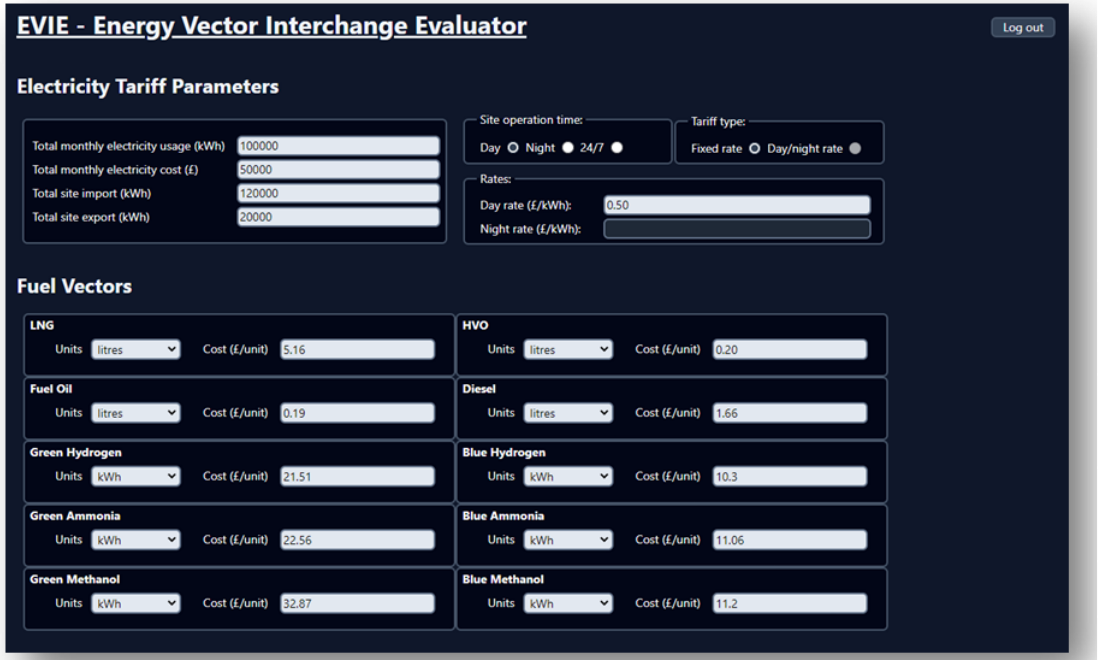
Looking forward

Change in fuel type involves:

- Change in infrastructure
- Alternatives
- Options
- Strategic choices – home fleet and visiting vessels
- Port infrastructure, vehicles and port operations
- Investment
- Estate availability
- Network connections
- Cost and security of supply of energy

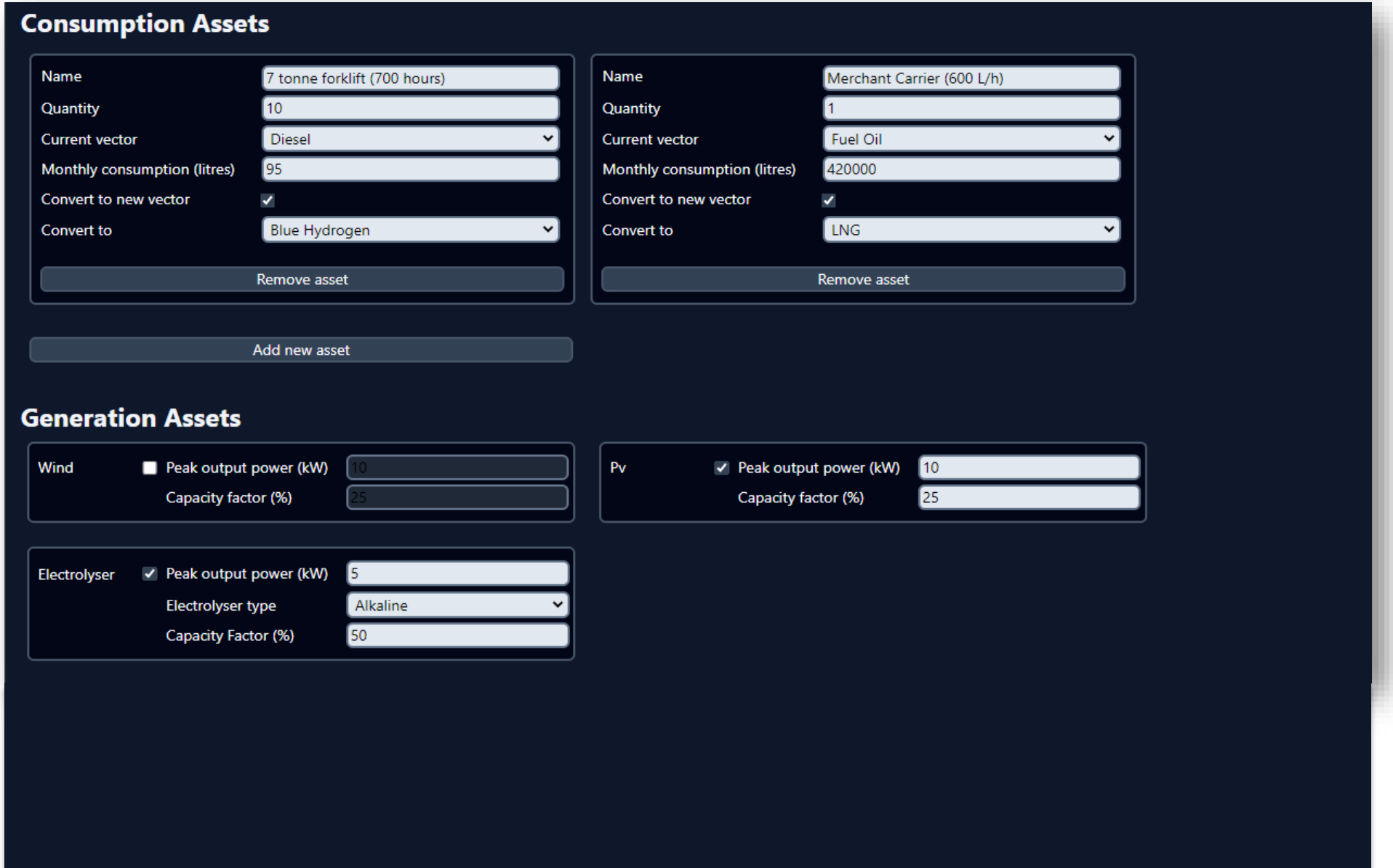
Configure energy vectors

Options



Energy vector	Volumetric energy density (LHV)	Carbon Intensity	Cost
Green hydrogen	1.1 kWh/L (500bar)2.3 kWh/L (liquid)	None	215.13£/MWh
Blue hydrogen			103£/MWh
Green ammonia	3.6 kWh/L	8.5 to 79.4gCO2eq/ MJ(depending on percentage of N2O)	225.59£/MWh
Blue ammonia			110.55£/MWh
Green methanol	4.3 kWh/L	69g CO2/MJ (combustion)	328.68£/MWh
Blue methanol			112 £/MWh with DAC79 £/MWh using industrial CO2
LNG	6.67 kWh/L24 MJ/L	75gCO2e/MJ	£52.16/MWh
HVO	9.56 kWh/L34.3 MJ/L		20 pence per litre
Fuel oil	10.89 kWh/L35.94 MJ/L	74g CO2/MJ2.29kgCO2/.L tailpipe emissions	23.90(low sulphur fuel oil at 8 $/GJ)18.77p a litre
Diesel	9.98 kWh/L39.21 MJ/L830kg/m3	79-150g CO2/MJ3.6kg CO2/L2.66kg/L CO2 tailpipe emissions	166.05p a litre
Network electricity			62.25(Average of 0.1, 0.05 $/kWh)

Port energy storage model



Energy vector implications

Ten forklift trucks on diesel
- 21,000 L
- 56 tonnes CO_2e
- £35,000 opex

Ten forklift trucks on batteries
- 9.5 MWh
- 34 tonnes CO_2e
- £33,000 opex

Ten forklift trucks on H_2
- 6.5 tonnes H_2
- 7 tonnes CO_2e
- £78,000 opex

Merchant carrier on HFO
- 150,000 L
- 450 tonnes CO2e
- £28,000 opex

Merchant carrier on batteries
- 750 MWh
- 270 tonnes CO_2e
- £112,000

Merchant carrier on LNG
- 130,000 L
- 300 tonnes CO_2e
- £67,000 opex

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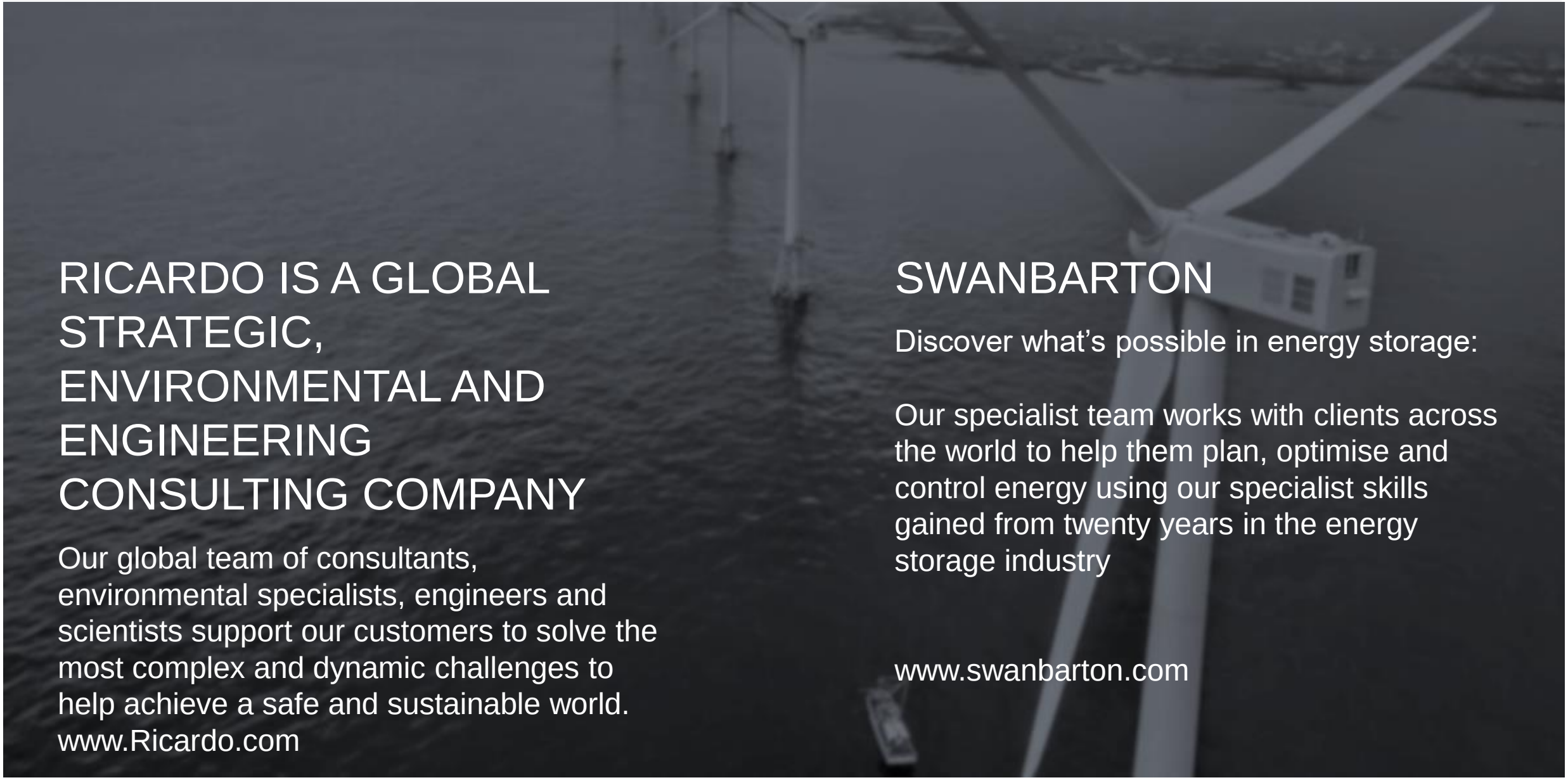

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How will you choose your decarbonisation route?

We can help. Come and talk to us:

Colin.McNaught@ricardo.com
Anthony.Price@swanbarton.com