# Tidal Stream Energy in Britain and the Solent

By

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https://perpetuustidal.com/

# Presentation Intentions

- **Strategic Backdrop**

(Global Energy and Climate crisis)

- **Tidal Stream Energy**

(Renewable Energy Contribution)

- **Perpetuus Tidal Energy Centre**

(Project Detail and Potential)

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# Strategic Backdrop Climate Change

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- Main climate change driver is greenhouse gases exacerbated by human activity.
- Oceans (70%) of globe will continue to absorb gases.
- But - Natural Land (30%) (Plants and Soils) is decreasing - through over utilization by and increasing population, all aspiring to industrial growth and mature economy benefits
- Causing industrial erosion of natural habitat, droughts, fires and competition for natural resources and in extremis - national wars.
- This is giving rise to global warming bringing extreme weather, rising sea levels, droughts, famine, and fires exacerbating the reduction in plant and animal species, rising Ocean levels, less wind strength and drought).

# Strategic Backdrop – Energy Crisis

- War induced energy shortages, rising energy prices and the reinstatement of fossil fuel energy.

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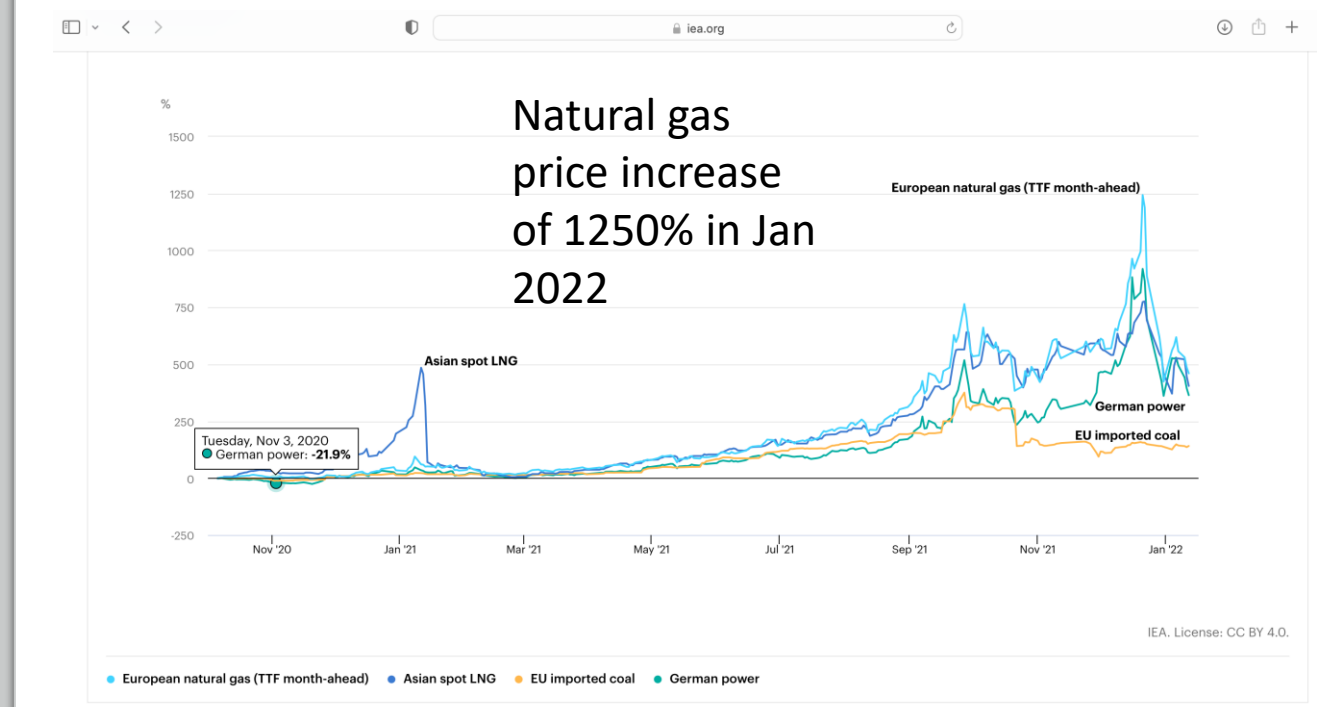


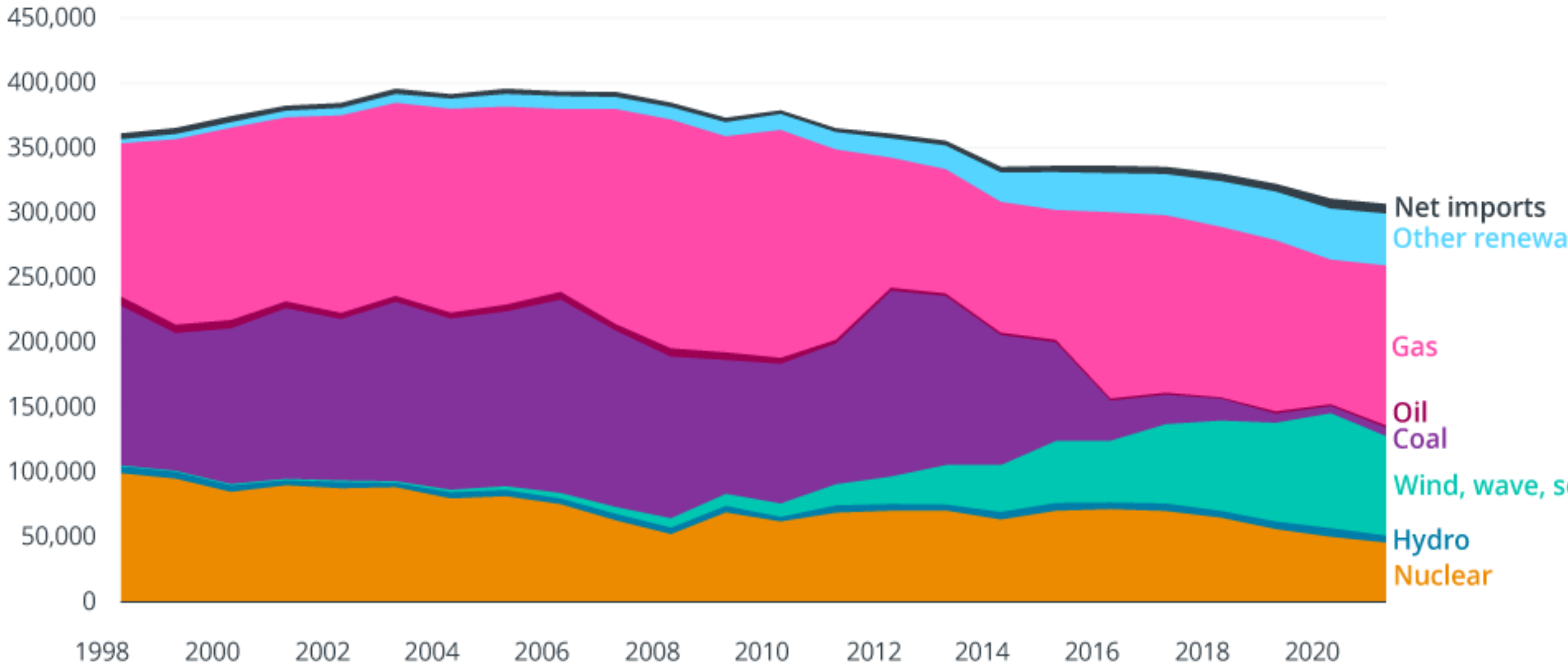
# Typical UK Generation day (November)


**Current Generation by Energy Type**

https://www.energydashboard.co.uk/live

**TIDAL STREAM ENERGY COULD IMPROVE THE RENEWABLE CAPABILITY & REDUCE THE FOSSIL FUELS**

# Electricity production in the UK by source (gigawatt hours), 1998–2021




Source: Institute for Government analysis of Department for Business, Energy and Industrial Strategy, Digest of UK Energy Statistics (DUKES) 2021, Chapter 5: Electricity, published 29 July 2021, Table 5.1.A. Notes: includes all generating companies.

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# Tidal Stream Energy

## Strategic advantages

# Proven concept


- **Tidal sites generating** today Korea, Japan, Britain (3 sites), Canada, USA, France (3 sites) all using predominantly British technology tested at EMEC (PTEC partner)
- Tidal **turbine technology now proved** (SAE, Orbital, SME, Nova, Tocardo, QED, Verdant, Magallanes)
- Existing **offshore wind and marine supply chain** helps to reduce time to build and operate
- UK government has **reinstated ring fenced tidal revenue support** £20m (40MW) with minima (£211/MWh) – awarded at £178.54MWh (£242.8 at 2021 rates)

# Economic


- Huge global market – between 100 and 500 GW
- Britain  has trained maritime labour force
- Supply chain - UK Global lead in turbine manufacturing (SAE, Nova, Orbital, QED) and testing (EMEC) with 80 to 90% British content in current deployed turbines
- Could regenerate post-industrial coastal towns and shipbuilding
- OREC estimate – **GVA £1.4 billion and 4,000 jobs throughout UK by 2030** (arguably 1 DE job per MW *(Tidal Stream and Wave Energy Cost Reduction and Industrial Benefit, ORE Catapult, May 2018)*

# Global Potential (0.5TW)

(Delft university 2021)

Predicted Tidal global market in 2050 is £76 billion (Highlands and Islands Enterprise)

Predicted Green Hydrogen global market in 2050 is $700 billion (report by Arthur D Little)

# Environmental

- Climate change will drive increased emphasis on renewable energy to deliver Green Hydrogen fuel - including government legislation
- Tidal farm is 1/8th size of footprint of wind (density of water 800 > air) and at sea not on overused land
- UK turbines already produced 44 GWh to grid without harm to fish or mammals
- Could link different tidal regions to deliver continuous power (Base load)

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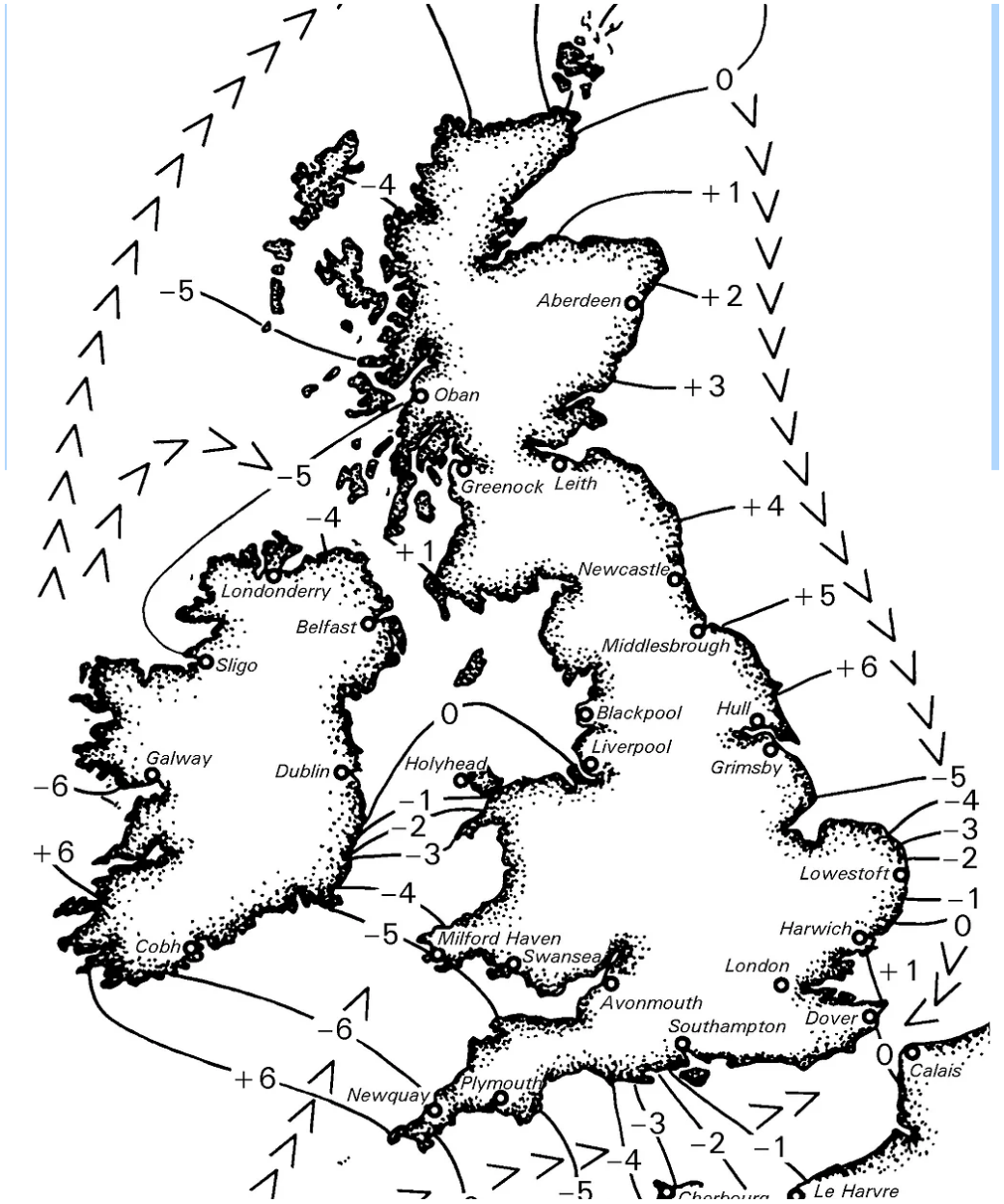
# Co Tidal chart for the UK

Linking Tidal farms in 2 to 3 hours apart could produce continuous power



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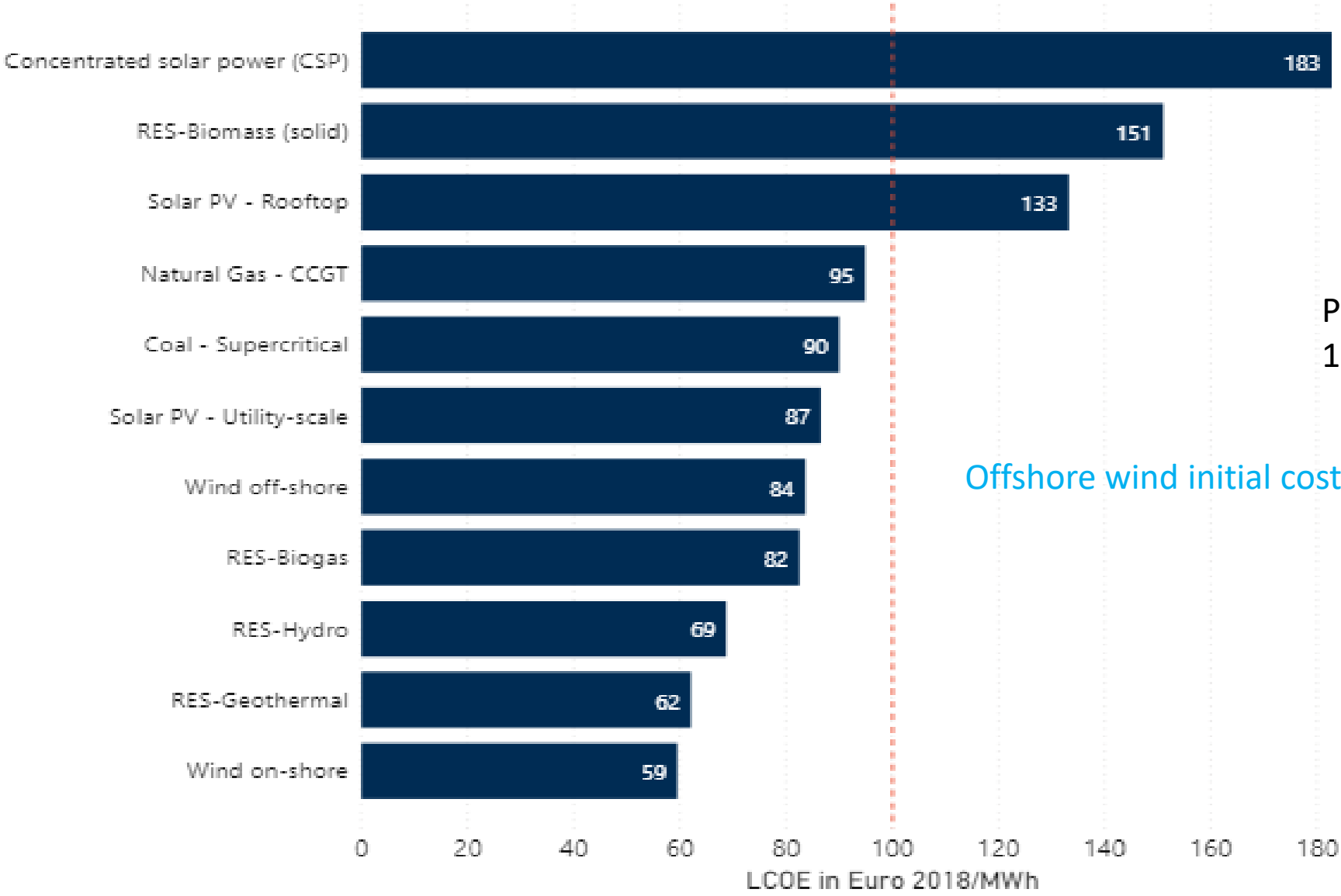
# Tidal Stream Energy

## Strategic Concerns

## ‘Short term cost of Energy’

# Costs --Renewable energy in 2018.




Offshore wind initial cost £250MWh

# Tidal Costs

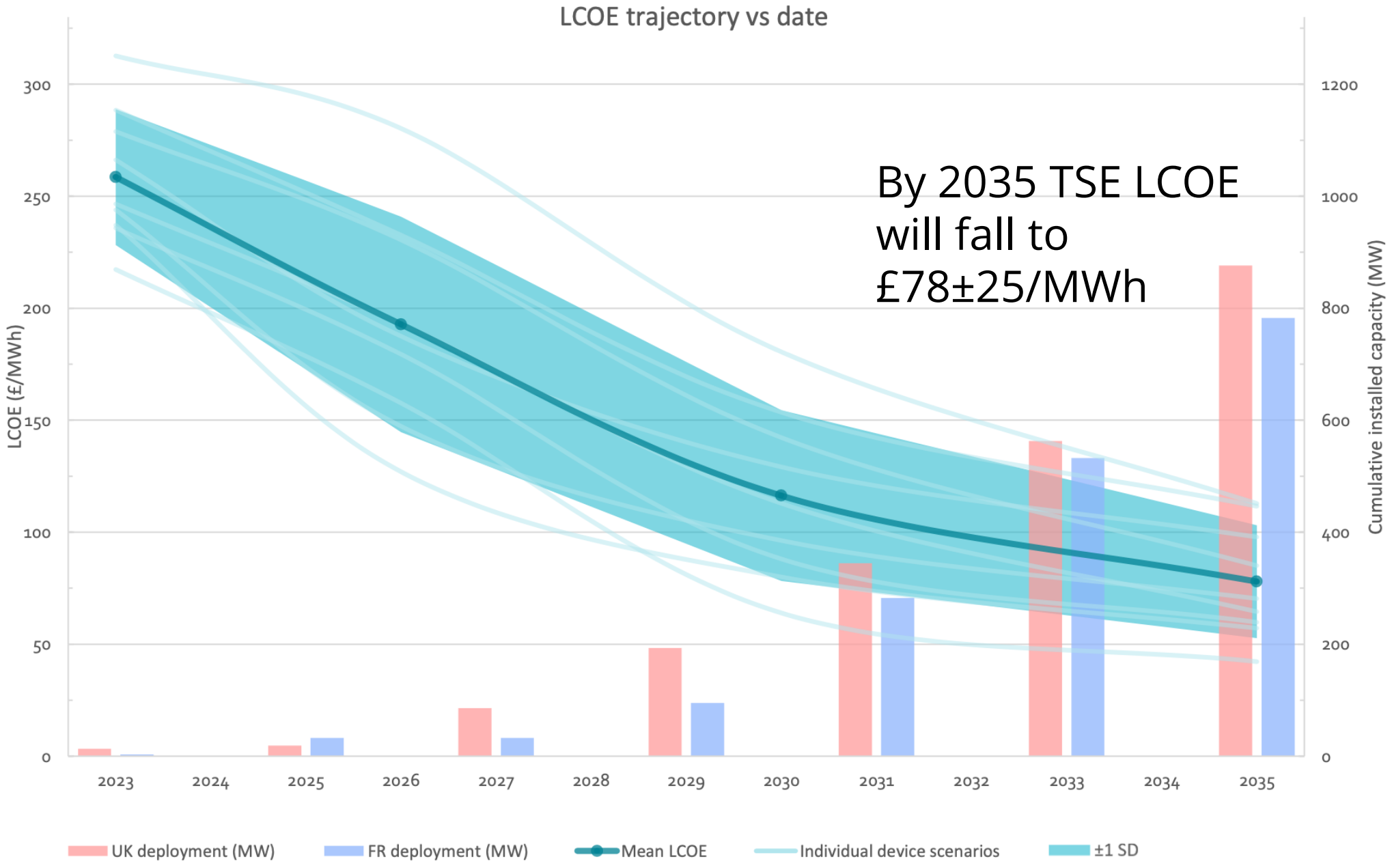
Initial cost of tidal (2018) £300 MWh

Today's strike price £178 MWh

Potential cost of tidal £116 (-38) MWh
1 GW deployed (2030)

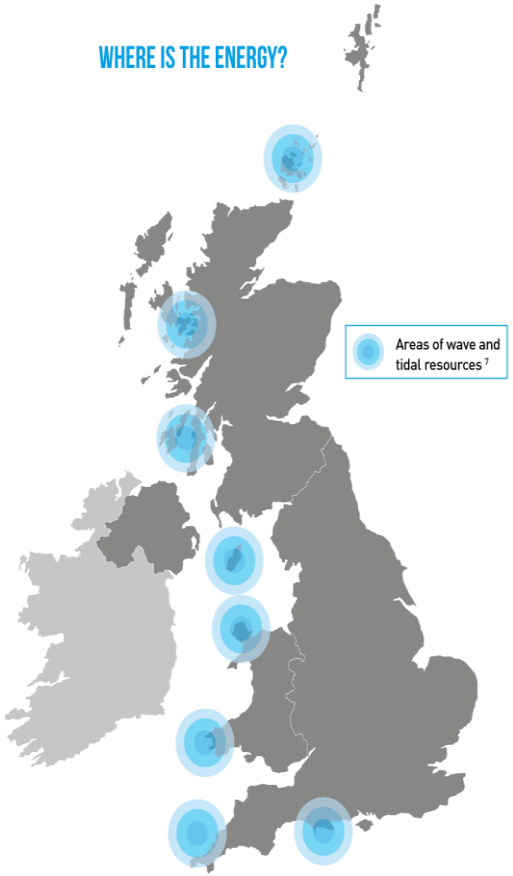
2035 cost of tidal £78 (25)MWh

**2042 cost of tidal £60MWh**
**2047 down to £50MWh**




**UK and French TSE market projection and associated LCOE trajectories for the three devices and nine cost scenarios examined.**

# ACHIEVEMENTS TO DATE AND POTENTIAL




**Significant achievements** to date

- 18 MW of grid-connected devices
- Exported 43.8 /GWh to the grid
- **124MW of sites preparing for AR5**
- **£500m UK investment by 2025**
- **1GW of sites under development**

Potential to provide 11% of UK electricity demand.
**100GW+ global export market**

**Tidal stream**

- Net GVA to the UK by 2030 of £1,400m
- 4000 high quality jobs by 2030, 14,500 by 2040.
- Deliver net £25b GVA by 2050

**Wave energy**

- Net cumulative GVA benefit to the UK by 2040 of £4,000m
- 8,100 high quality jobs by 2040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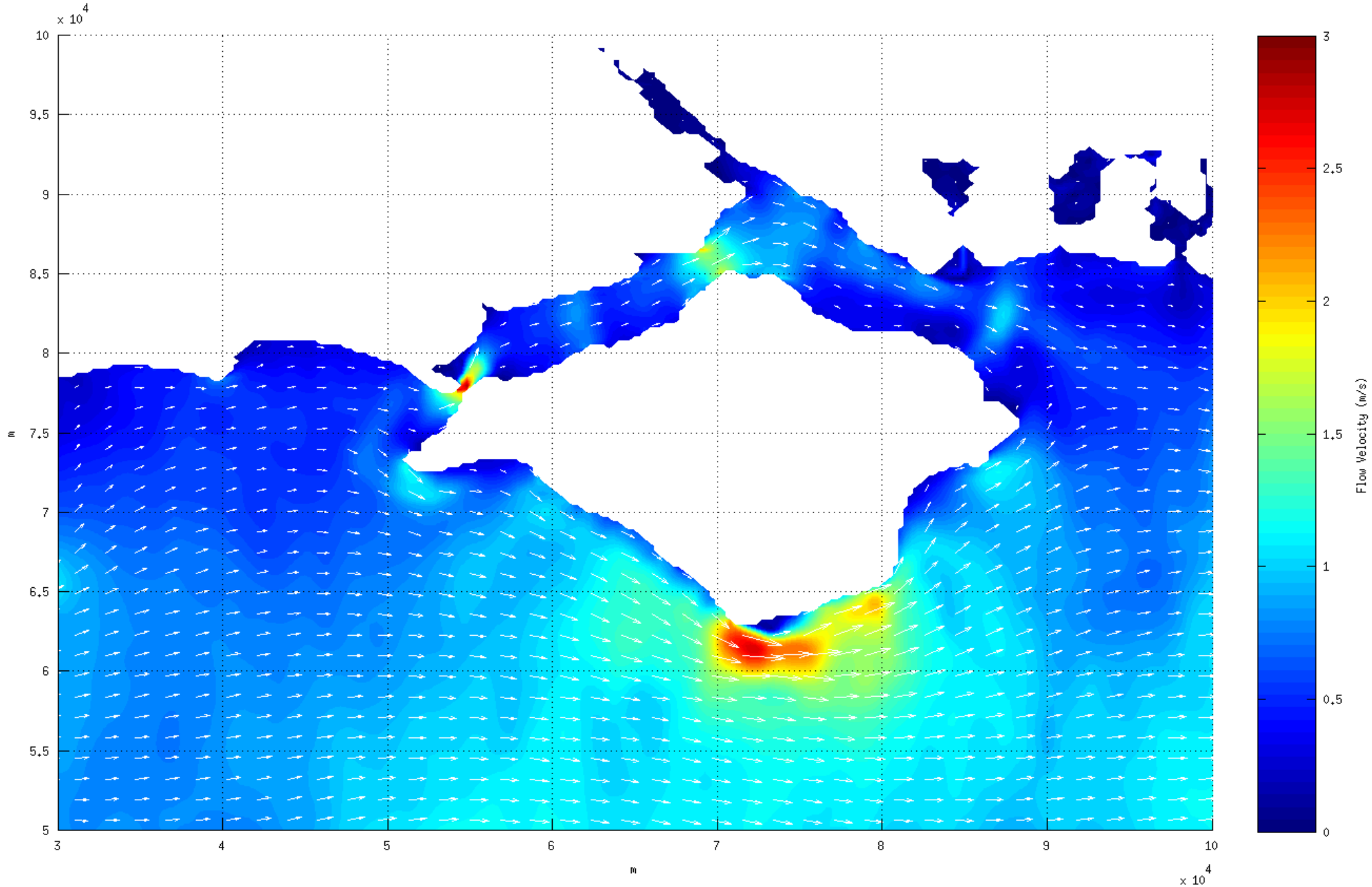
# Perpetuus Tidal Energy Centre

## (& the tidal resources in the Solent region)

(Red and Orange indicate usable energy resource)


x 10^4
10
9.5
9
8.5
8
7.5
7
6.5
6
5.5
5
m
3
4
5
6
7
8
9
10
m
x 10^4
3
2.5
2
1.5
1
0.5
0
Flow Velocity (m/s)

# What does the project involve?

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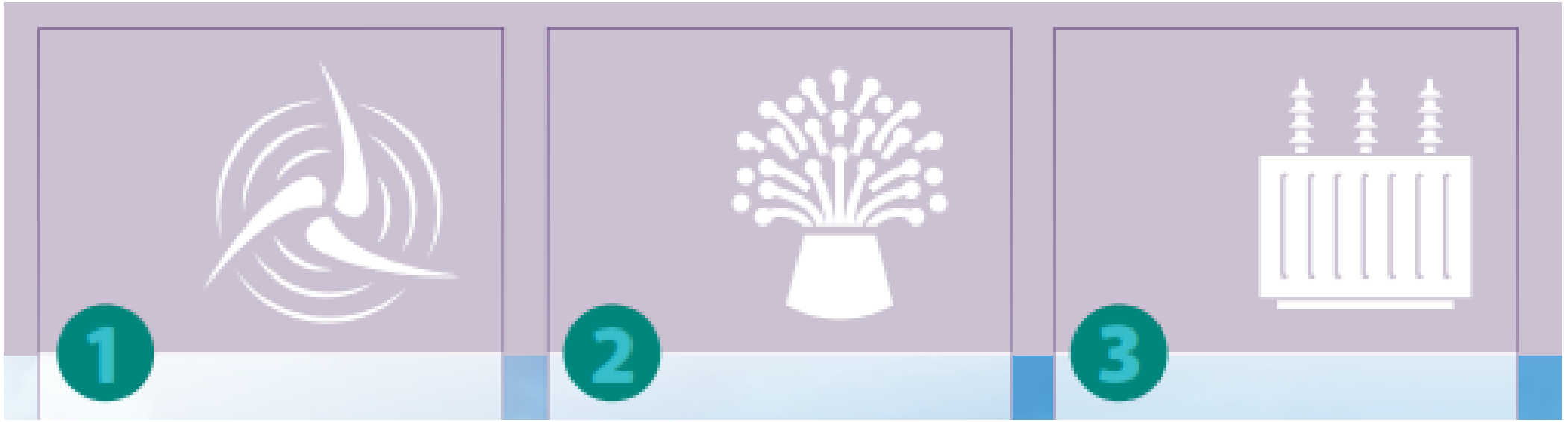



**TIDAL TURBINES:**

- 5km² area
- 2.5km south of St Catherine's Point
- 6km from Ventnor

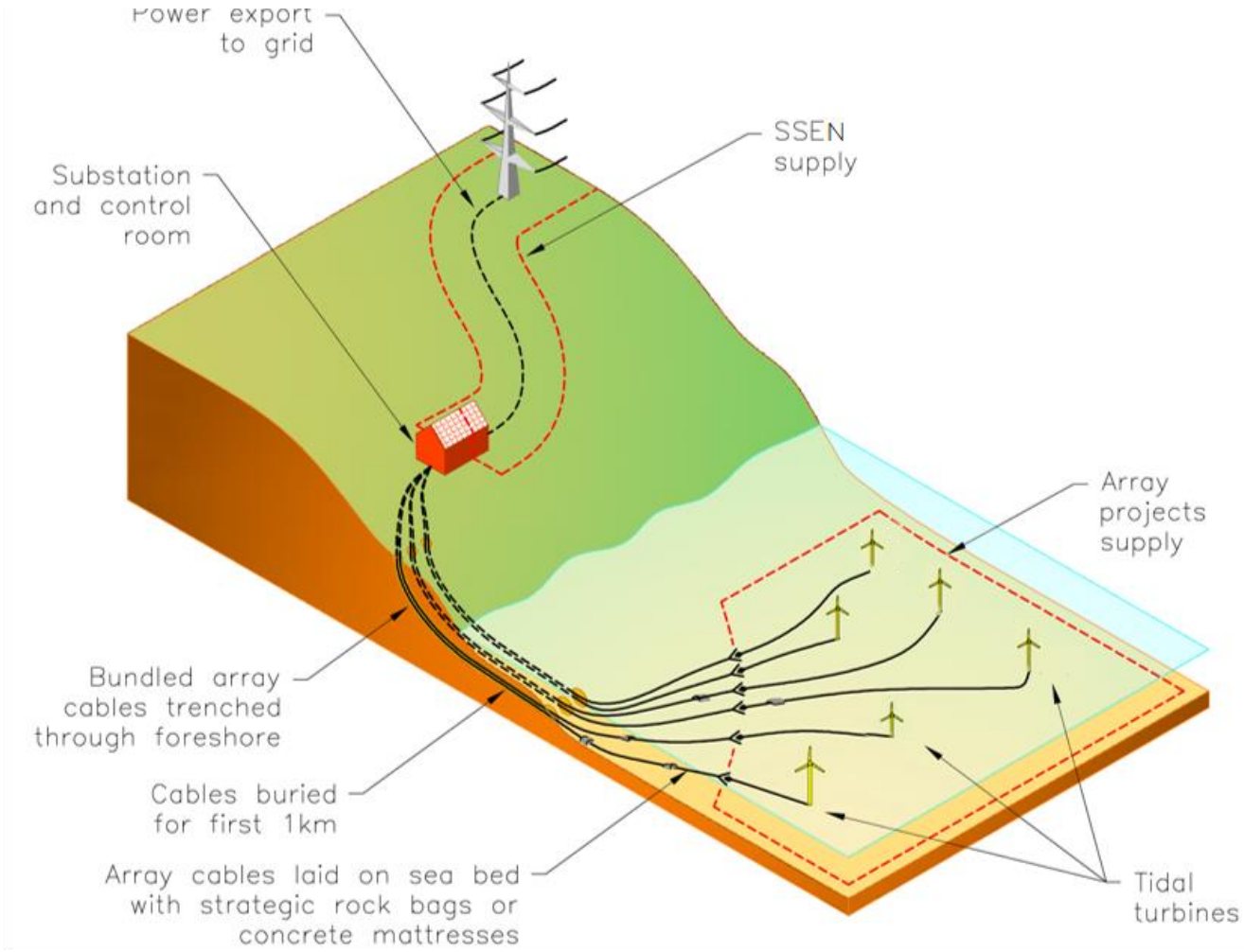
**UNDERSEA CABLES:**

- Coming to shore near Flowers Brook

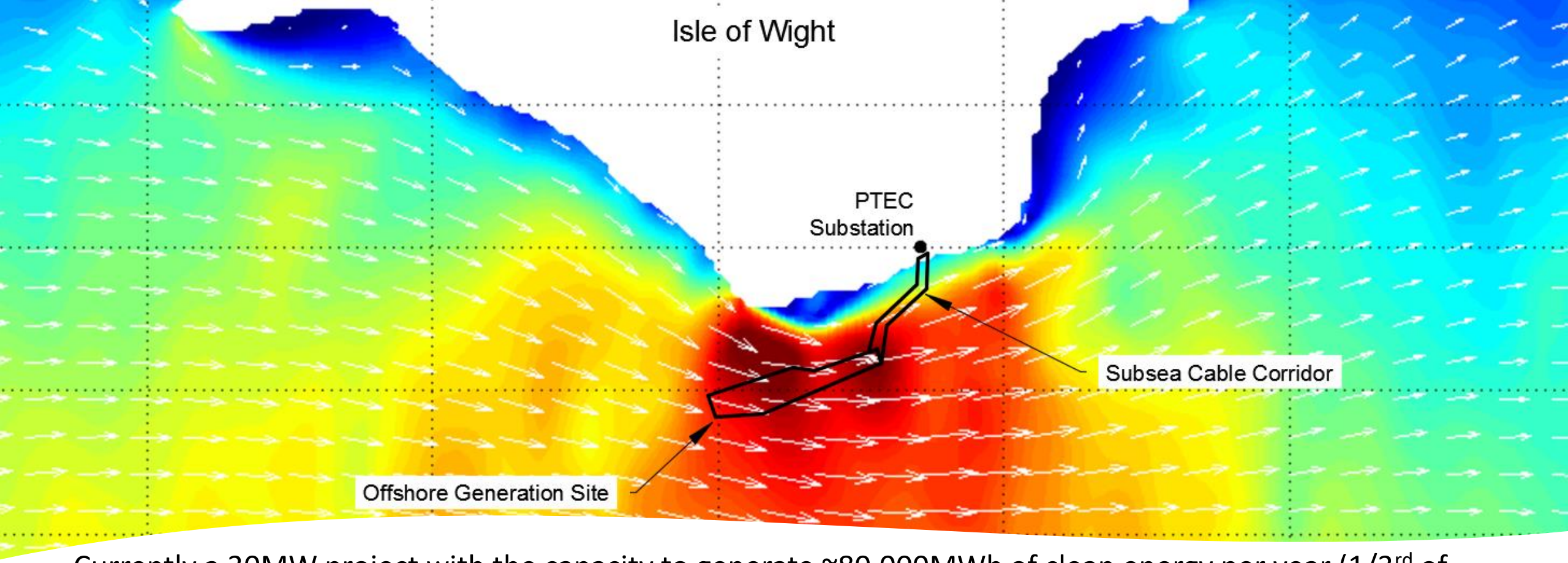
**SUBSTATION:**

- On Southern Water land at Flowers Brook
- Maximum size 37.5m by 12.0m

# Project Schematic




The 5km$^2$ offshore site lies 2.5km south of St Catherine's Point, off the Isle of Wight. The onshore site will be located 100m inland from the Isle of Wight's south coast, 20-25m above mean sea level




Currently a 30MW project with the capacity to generate ~80,000MWh of clean energy per year (1/3rd of IoW capacity

- Turbines to be located in the sea south of St Catherine's Point
- Lead the commercial adoption of tidal energy worldwide
- Fully consented 2016; delayed by government policy changes
- Future 300MW potential for Grid or Green Hydrogen

# Turbine Technology Selection

Top left and right: Orbital Marine Power
Top middle: Sustainable Marine
Bottom left: QED / Tocardo

# Orbital Turbines

https://www.youtube.com/watch?v=9hN3dBpPu8Q

# Our Partnership with the European Marine Energy Centre

- A not for profit with 18 years of tidal projects
- Based in Scotland in Orkney
- £35.3 million value to Orkney
- 250 full time jobs supported directly
- £23 million invested in local infrastructure
- Specialist in Island Communities

EMEC
THE EUROPEAN MARINE ENERGY CENTRE LTD

# Timeline

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*Indicative dates


# Benefits to the Isle of Wight and Solent

- Create new supply chains , develop new skills,  jobs, careers and retain talent
- Investment in local business and infrastructure
- Create a renewables and sustainability cluster or hub on the IoW drawing together CCUS, Green Hydrogen, Hydrogen gas grids and Hydrogen storage
- Attract business visitors and students
- Solent Industrial readiness - 21% Solent labour employed in Maritime industries + Grid at Fawley + IoW H2 gas grid (SGN) + Fawley refinery for H2 storage
- Local Market for H2 – Ferries, heating (IoW Gas Grid), fuel cells

# RUK COP 26 film

https://www.youtube.com/watch?v=ZxpHgReR4WY&t=10s

# Questions

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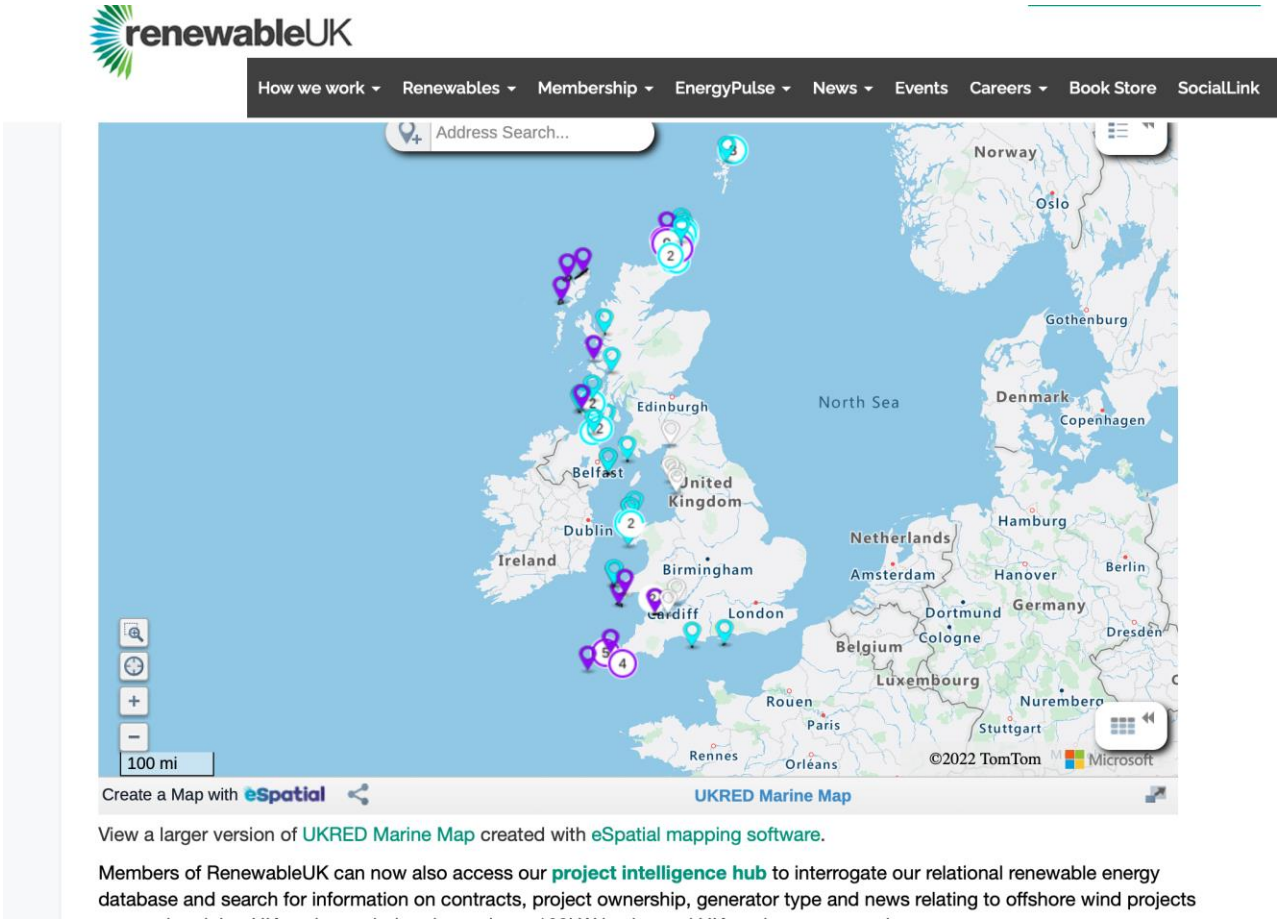
# UK Marine Energy Sites RUK Map




View a larger version of UKRED Marine Map created with eSpatial mapping software.

Members of RenewableUK can now also access our **project intelligence hub** to interrogate our relational renewable energy database and search for information on contracts, project ownership, generator type and news relating to offshore wind projects

According to UK government estimates made in the late 2010s, carbon capture (without storage) is estimated to add 7 GBP per MWh by 2025 to the cost of electricity from a gas-fired power plant: however most $CO_2$ will need to be stored so in total the increase in cost for gas or biomass generated electricity is around 50%.[71]

- By 2030 TSE LCOE will fall to £116±38/MWh
- By 2035 TSE LCOE will fall to £78±25/MWh
- These estimates assume cumulative TSE deployment of 877 MW in the UK and 783 MW in France by 2035. The UK estimate echoes the sentiment by the UK Marine Energy Council (MEC), who are calling on the UK Government to set a target of 1GW of marine energy by 2035. The French estimate mirrors the current ask of French suppliers to the government.
- As well as the LCOE trajectory, this report also promotes additional TSE benefits to advance the economic narrative. These have been sourced from both TIGER and third party projects, and are summarised by the following key messages:
- Cost reduction mechanisms: In the report we describe the key cost reduction drivers for the TSE sector. These will help the industry reach its £78±25/MWh by 2035 potential. Key areas identified include larger rotor and rated power devices (38% LCOE reduction), economies of volume from larger farms (28-50% LCOE reduction) and reduction in WACC (20% WACC reduction leads to 10% LCOE reduction).
- Within a separate TIGER study, described in this report, we identified eight cost reduction drivers that could reduce LCOE by a combined 67.5%. Assuming a present day LCOE of £259/MWh, these together would take LCOE down to £84/MWh and are achievable by 2035.
- Longer term we predict that TSE could reach £60/MWh by 2042 and £50/MWh by 2047.