



The Potential for Tidal Lagoons in the Severn Estuary

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Sustainable Severn – April 2017

About ITPowered

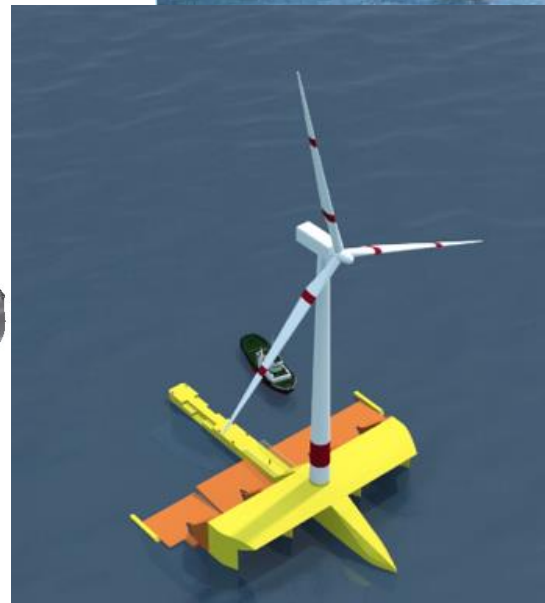
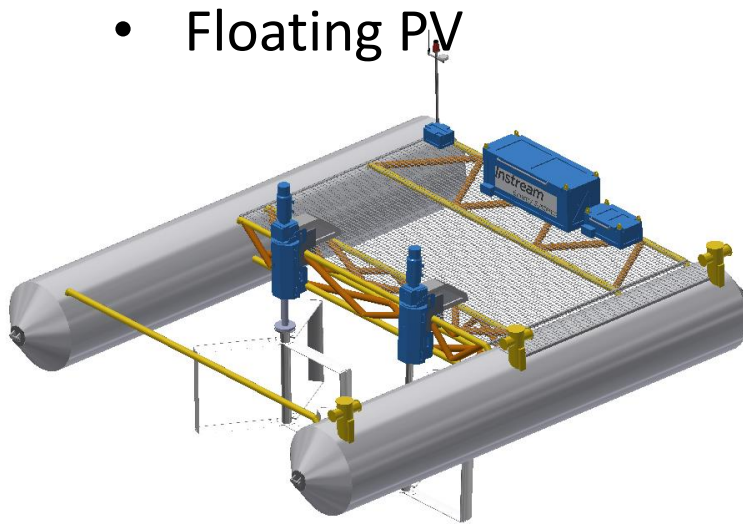
ITPowered is a leading consultancy offering energy, environmental, engineering, technical advisory and asset management services



ITPowered was formed in 2016 following the acquisition of ITPowered Consulting by Energised Environments

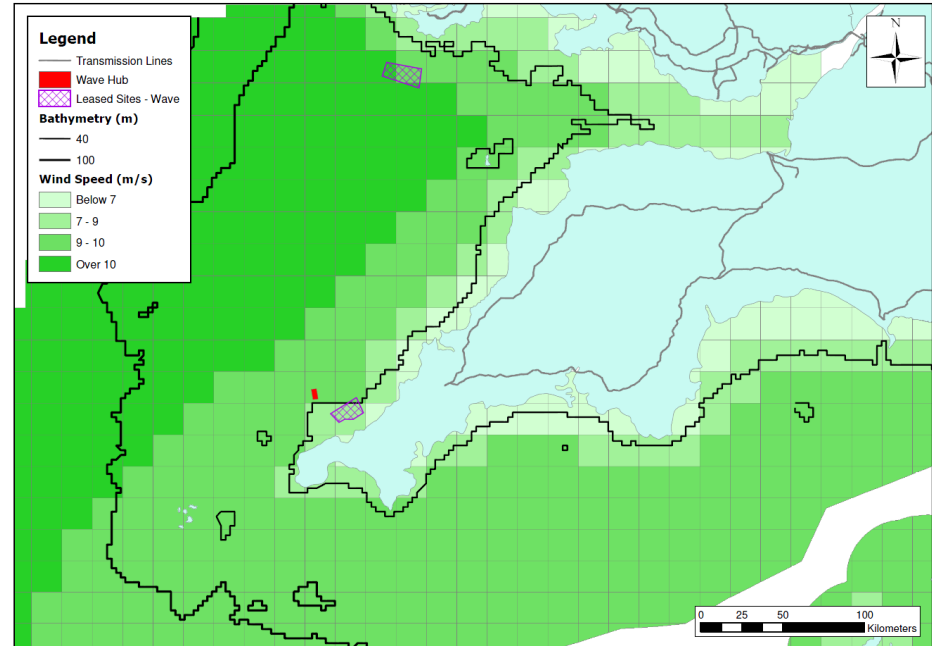
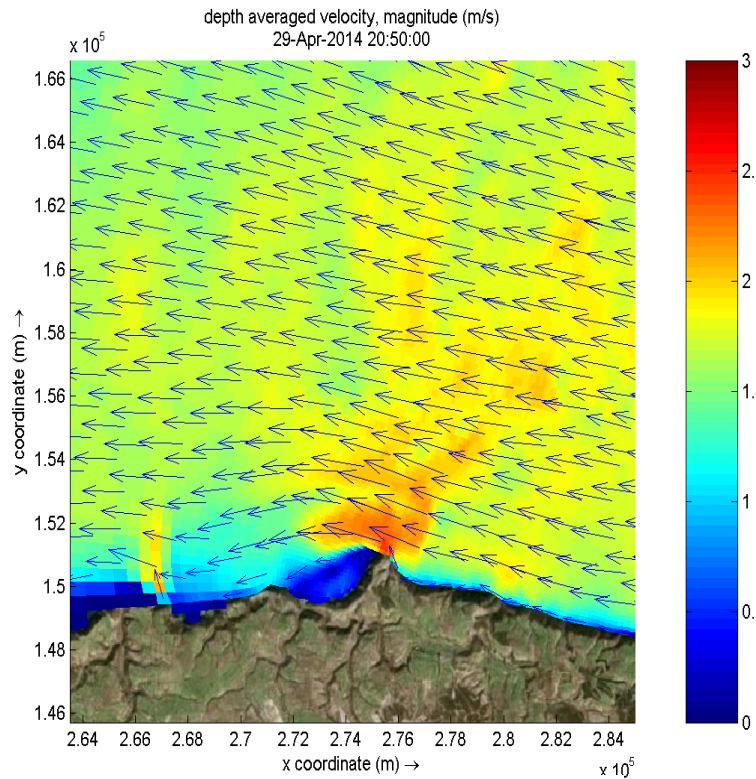
RE Options for the Severn & Bristol Channel

- Tidal stream energy and tidal fences
- Tidal Lagoons & Barrages
- Floating & Offshore Wind
- Wave Energy
- Floating PV



Images from Instream Energy Systems, Floating Power plant and Pulse Tidal

The Resource in the Severn



Coastal Science Ltd

Offshore Renewable Energy Services

As part of the BEIS (formerly DECC) technical specialist framework, ITP appointed as Technical Advisor to the Independent Review of Tidal Lagoons (Hendry Review)



Independent consultants:

- Prof. Roger Falconer
- Prof. Chris Binnie

“ITPE were appointed to assess and validate the technical aspects of the evidence provided and identify gaps in the evidence base for a wider tidal lagoon programme in the UK and, where feasible, undertake work to address these gaps”

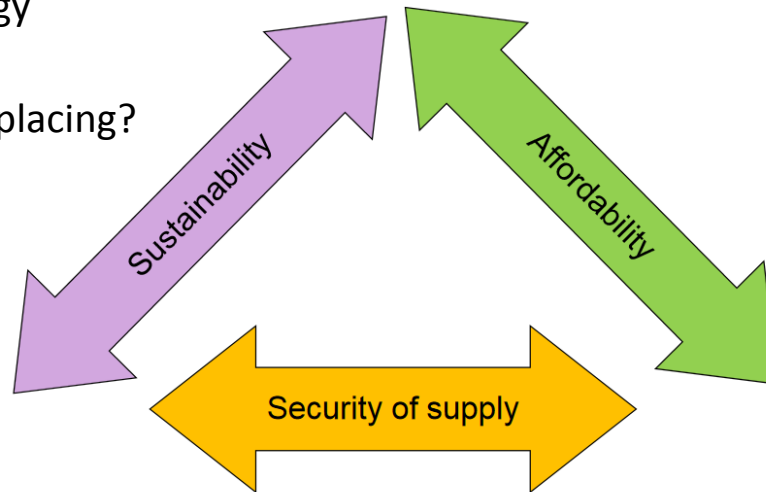
The Independent Review of Tidal Lagoons (Hendry Review)

- What is the value of having predictable, intermittent renewable energy on the system?
- System Operability: How are huge amounts of power on the system at times when it is not needed managed?
- What is the impact of multiple lagoons in the Severn – including grid connectivity issues and cumulative environmental and navigation issues?
- What are the design options for a fleet of lagoons, including optimal size of the programme; potential for delivering power on a 24 hour basis, through a series of connected lagoons in different parts of the country; maximising benefits and minimising cumulative negative impacts?
- What are the potential costs for future lagoons - what is the potential for cost-effective deployment outside the Severn?
- What are the options for decommissioning lagoons?
- What is the scale of global opportunities for tidal lagoons and the potential of a global industry?

The Value of Energy from Tidal Lagoons

What is the value of having predictable, intermittent renewable energy on the system?

- How do lagoons help the UK towards emissions targets and renewable energy targets?
- What are lagoons replacing?
- What are the carbon savings?



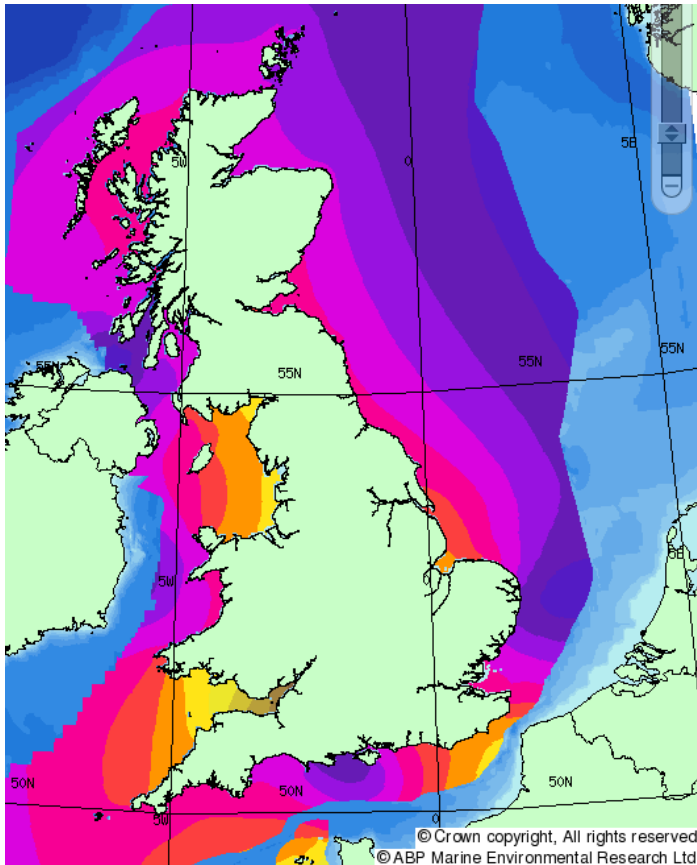
How do you evaluate cost for a 120 year project:

- LCOE?
- Cost to household bill?
- Total subsidy?
- Impact on LCF?
- Strike price over time?

- Nature of the generation
- Predictability?
- Dispatchability?

UK Programme of Lagoons

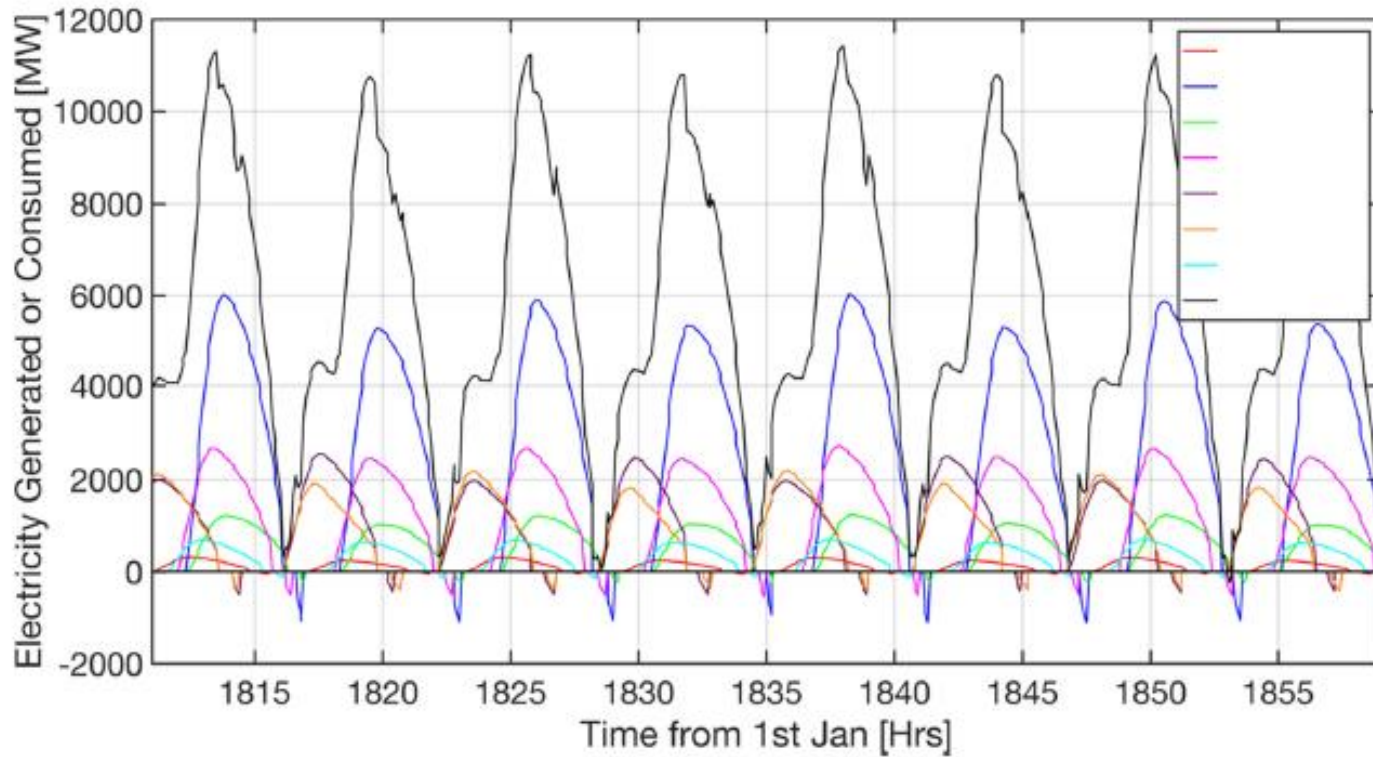
AEPs for 18 potential Lagoons were modelled individually.



ITPE Modelling:

- Identification of potential lagoon locations - Sites of interest to developers and sites with promising resource
- Considered at the bathymetry, topography and a potential bund design
- Collected data on the resource at each site
- Identified 18 potential schemes and individually modelled their AEP and costs

UK Programme of Lagoons



An Optimal Programme

What is a Optimal Programme of Lagoons?

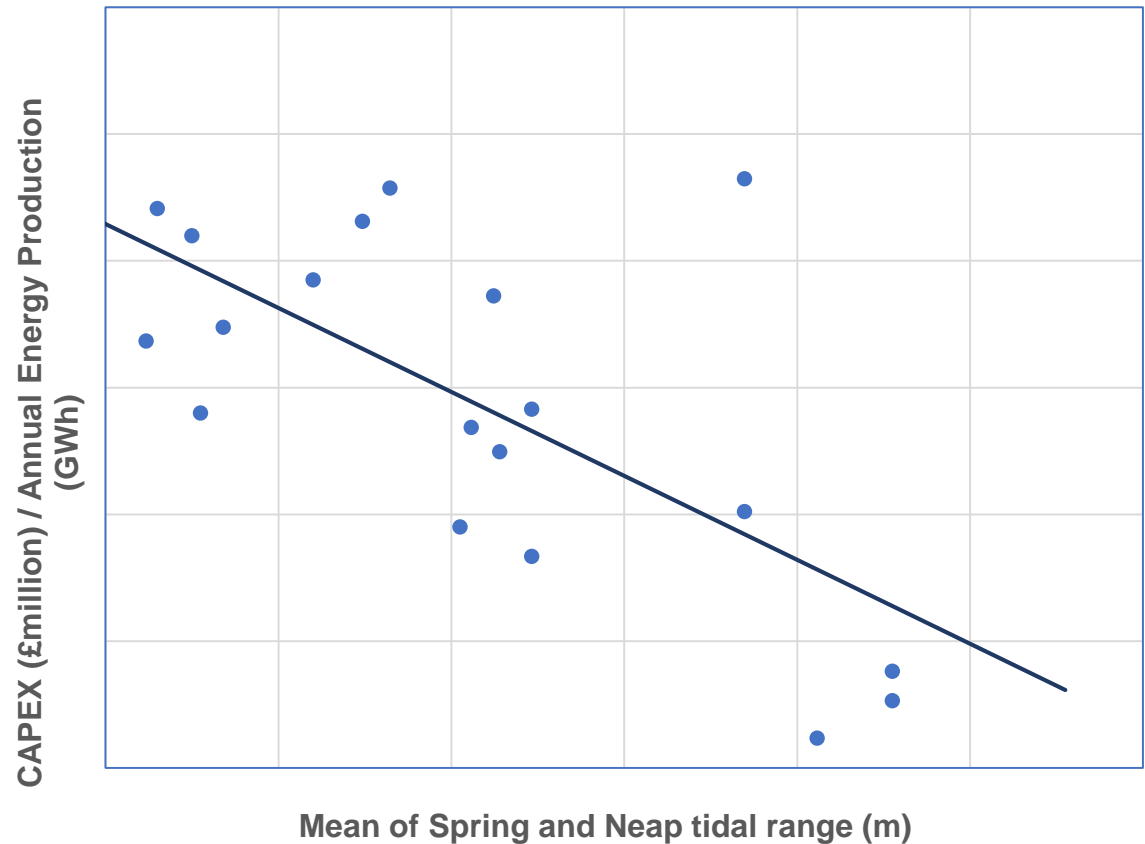
- Installed capacity
- Best phasing
- Lowest environmental impact
- Value for money

Scenario	Capacity [GW]	CAPEX [£bn]	Annual Gen. [TWh]
Value for Money	18	55	31
Generation Output Phasing	14	44	22
Specified Energy Generation	23	71	38
Installed Capacity	25	79	41
Lowest Impact	11	37	17
TLP's Programme	17	51	27

Economics of Lagoons

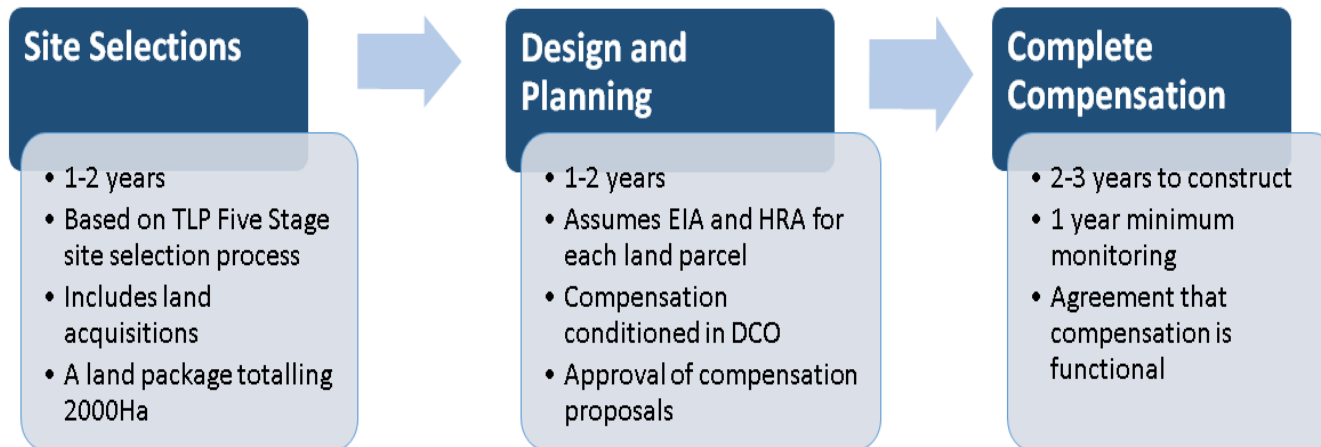
Lagoon economics are dictated by:

- Resource
- Coastline and topography
- Lagoon Size
- Bathymetry
- Basin area at low tide
- Environmental sensitivity
- Existing infrastructure
- Cost of finance



Environmental Considerations

- Environmental legislation (e.g. Habitats Directive)
- Water quality and Flood protection
- Flora and Fauna
- Compensatory measures
- Navigation
- Environmental screening of lagoons
- Options for decommissioning



Timeline for introducing Compensatory Habitats

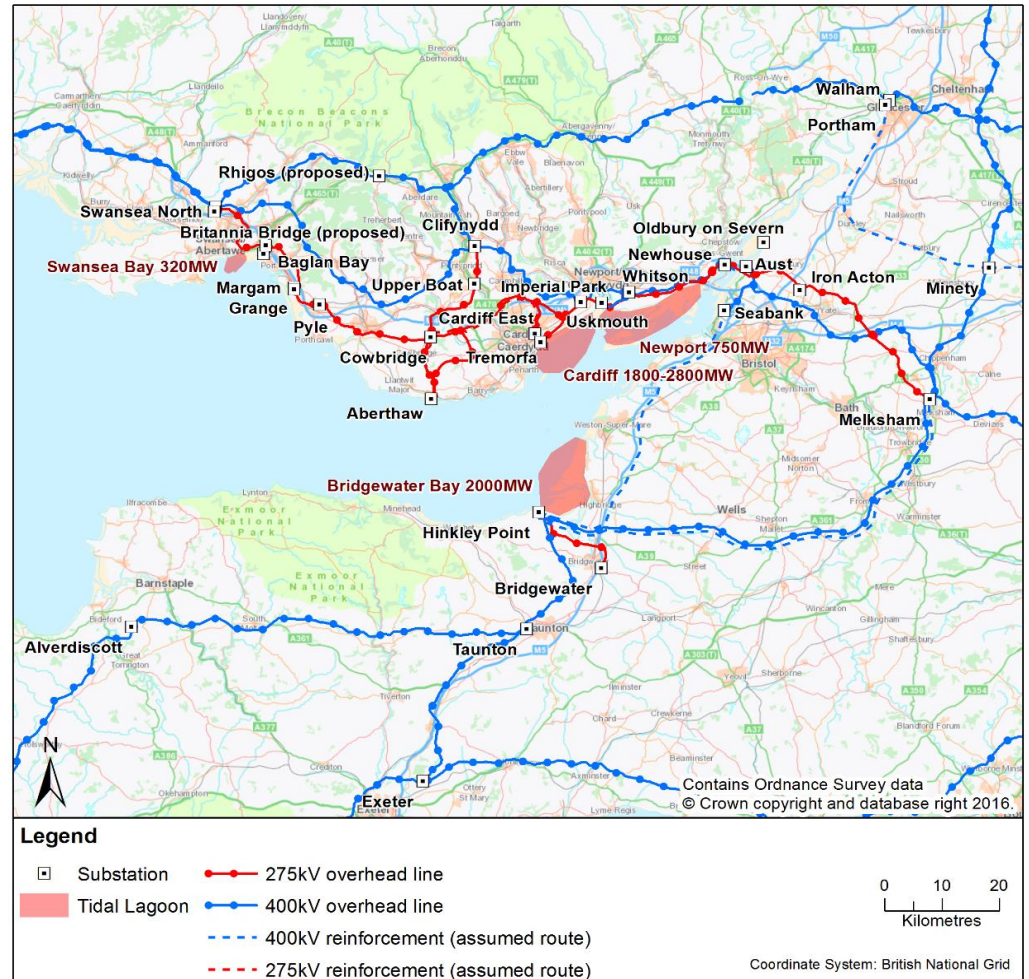
Grid and System Operability

Grid Connection in the Severn

- Costs and design of reinforcement works and connection for the TLP Lagoons in the Severn were considered

System Operability

- Synchronous Vs Asynchronous generator sets
- Commercial Framework for managing the power?



Additional Benefits

- Floating Solar within the lagoon
- Aquaculture
- Recreation and tourism
- Flood protection
- Global opportunities for the supply chain?



Image: London's Queen Elizabeth II reservoir. Photograph from www.theguardian.com

Conclusions from the Hendry Review

Charles Hendry –

- On the pathfinder lagoon - *“Moving ahead with a pathfinder lagoon is, I believe, a no-regrets policy”*
- On the costs - *“the evidence is I believe clear that tidal lagoons can play a cost-effective part of the UK’s energy mix.”*

Contact

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