
TIDAL LAGOON
POWER

Tidal lagoon snapshot

- Large marine barrier with one ingress/egress
- Bidirectional Kaplan bulb turbines enabling generation on the ebb and flood tides
- Total power depends on:
  1. the tidal “head”; and
  2. surface area of the lagoon (scalable)
- Takes three years to build
- Design life is 120 years
- Lagoon interior “flushed” 4 x a day

Renewable energy at nuclear scale

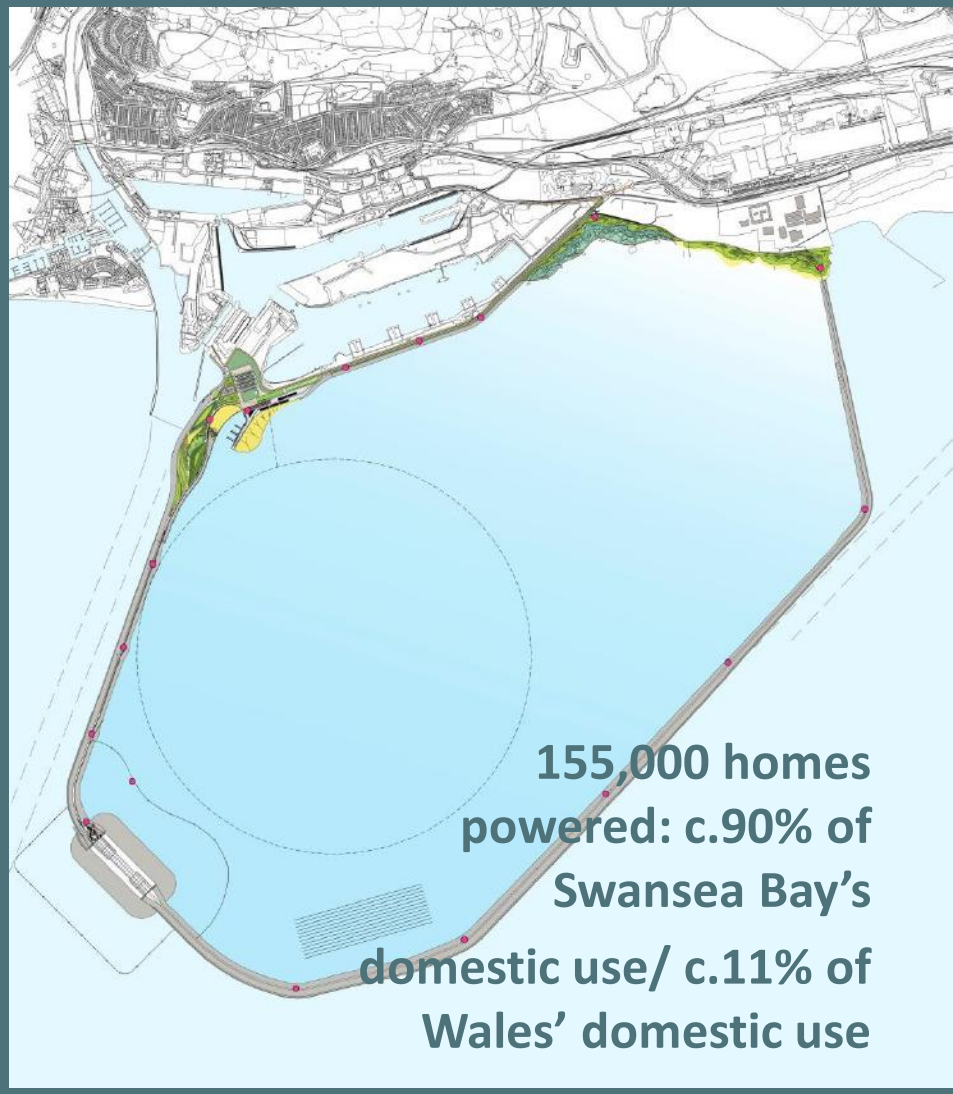
But with:

- Faster deployment
- Longer life
- British ownership
- British supply chain
- Safe and inexpensive decommissioning
- Coastal flood protection
- Amenity value through tourism and recreation
- Education, cultural and arts programmes
- Conservation, restocking and biodiversity programmes

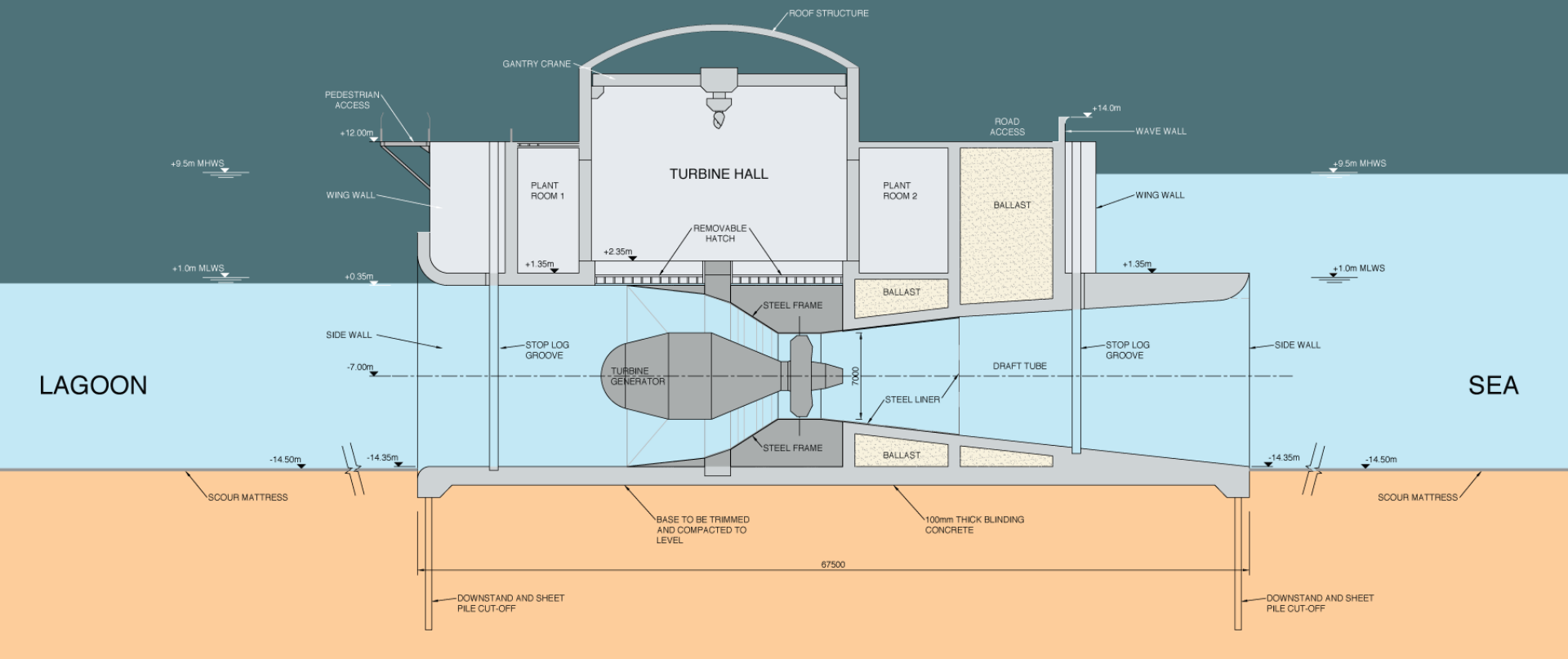
Big ▪ Sustainable ▪ Safe ▪ Certain ▪ Ours ▪ Here now

Establishing a blueprint: Swansea Bay Tidal Lagoon

Wall length:	9.5km
Area:	11.5km^2
Rated capacity (@4.5m head):	240MW
Installed capacity:	320MW
Daily generating time:	14 hours
Annual output (net):	495GWh
Annual CO^2 savings:	236,000 t
Design life:	120yrs
Height of wall:	5-20m
Wall above low water:	12m
Wall above high water:	3.5m
Tidal range Neaps:	4.1m
Tidal range Springs:	8.5m



Turbine housing

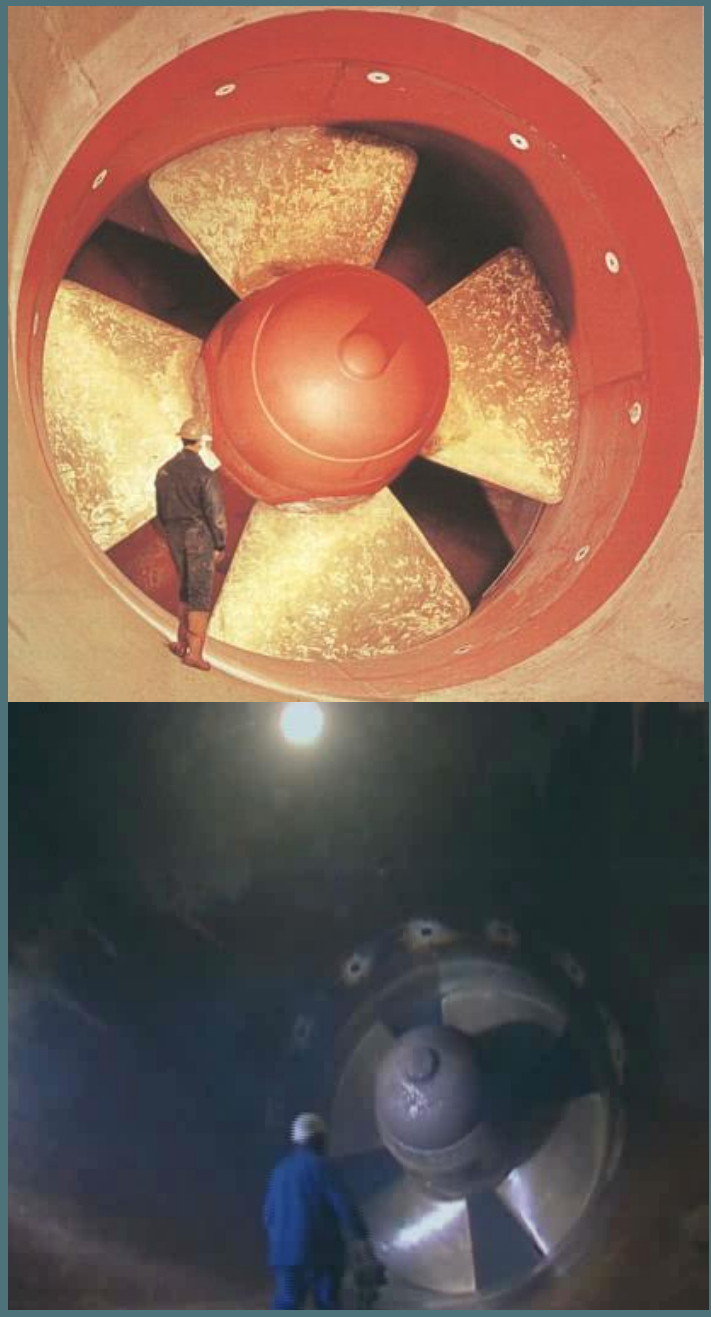


Over 45 years of field data

La Rance, salt water, 240MW tidal range power station, Brittany, France

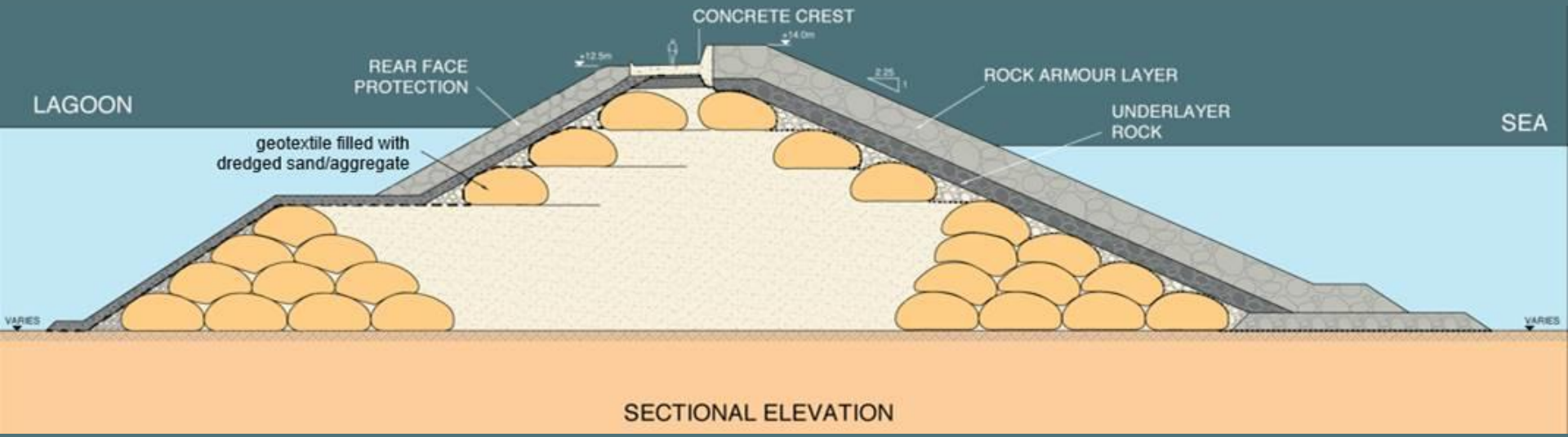
97% availability in the 47 years
93% efficiency on the ebb
75% efficiency on the flood

Year 47 – first overhaul of turbines, 5 turbines received replacement parts
Year 48 – control system to be replaced

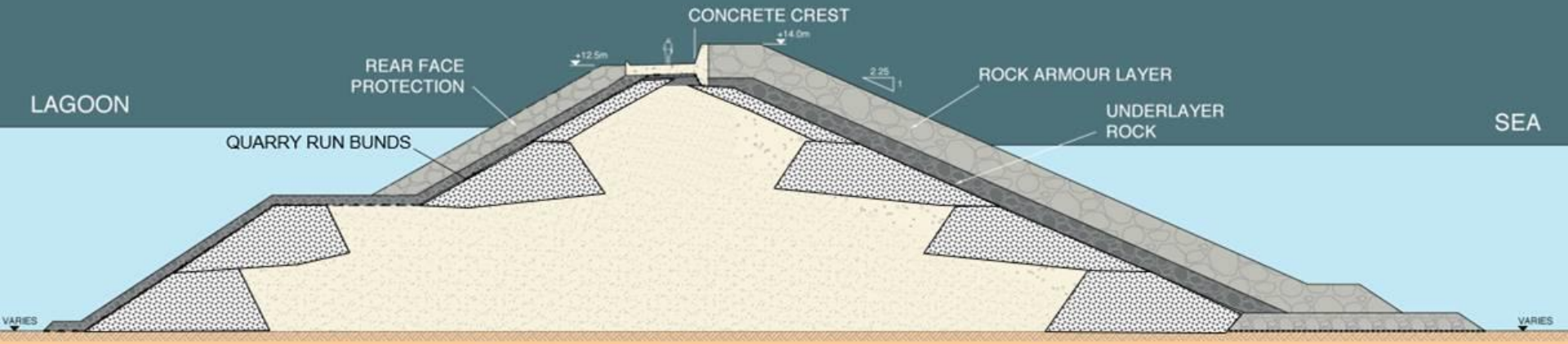


Years 1 and 47

Breakwater design options



SECTIONAL ELEVATION



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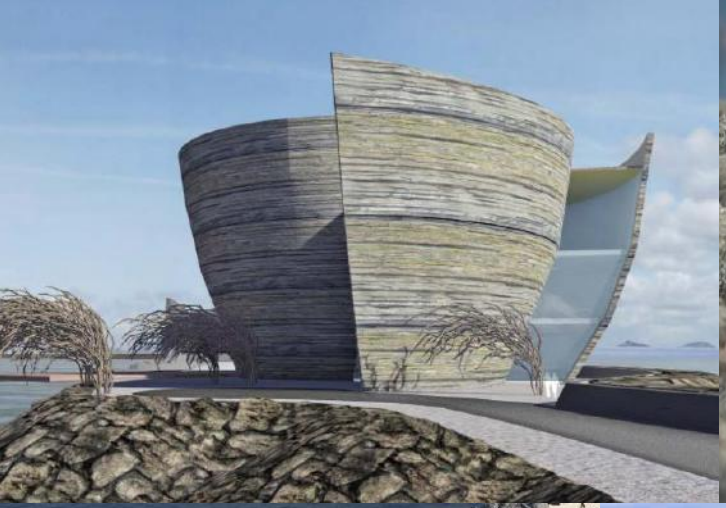







A national fleet of 6 tidal lagoons to deliver …

- Low carbon electricity: 5-10% of UK electricity, secured within a decade
- Energy security: Reliable, home-grown and near continuous power supply from proven technology, lasting 120 years
- Affordable energy: Lowest generation cost of all electricity for 85 years following investment period. Lower support cost than most low carbon electricity; larger lagoons generate cheaper power

6 lagoons

=

30 TWh

=

8% UK electricity*

or

30% UK homes

*Upon completion of 6 lagoons (2027)

Projected UK power generation ‘27 (DECC, 2013) = 361.4 TWh • Average h’hold consumption (DECC, Mar ‘14) = 3.8 MWh • UK h’holds (ONS, 2013) = 26,414,000

6 lagoons

=

4416 offshore wind turbines

=

10 reactors

Installed capacity : 6 tidal lagoons, 15.9 GW ; London Array, 3.6 MW per turbine ; Hinkley Point C, 1.6GW per reactor

'Levelised Costs of Power from Tidal Lagoons'

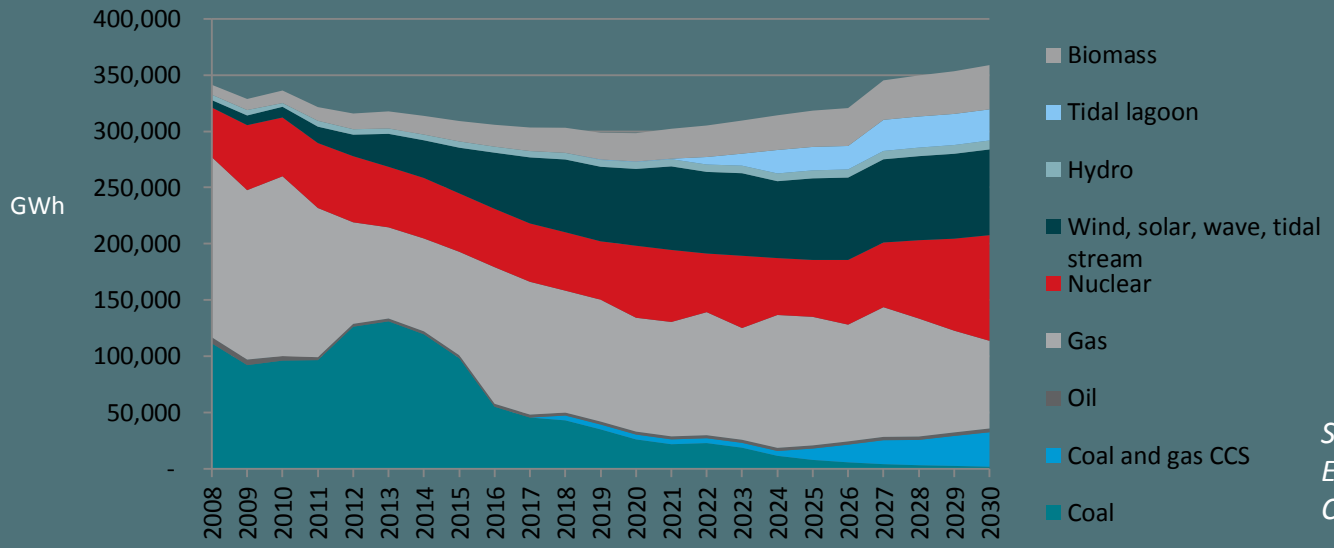
Pöyry, March 2014

Input assumption - central	Units	Lagoon 1	Lagoon 2	Lagoon 3
Installed capacity	MW	320	1500	1800
Net annual power output	GWh	495	2512	4112
Construction time	years	3	4	4
Construction period		2015 - 2018	2016 - 2020	2017 - 2021
Capital cost	£/kW	2853	2370	2338
Total capital cost	£m	913	3555	4209
Capex phasing	%/year	45/30/25	35/30/25/10	35/30/25/10
Operating cost	£/kW/year	31	20	18
Total operating cost	£m/year	9.8	29.5	33
Discount rate (pre-tax, real 2012)	%	6.5%	6.5%	6.5%

Key findings:

1) A volume-weighted levelised cost of energy for the first three lagoons is around £100 MWh
2) Lagoon 3 has a levelised cost of around £90 MWh, broadly similar to onshore wind, large-scale solar PV, nuclear and gas-fired generation
3) Pöyry's central assessment of the required CfD strike price for the three lagoons studied on a volume-weighted average basis is £111 / MWh. Lagoon 3 requires £92 / MWh

'The Economic Case for a UK Tidal Lagoon Industry', Centre for Economics and Business Research, July 2014



Source: DECC Updated Energy & Emissions Projections - September 2013, Cebr projections for 6 UK tidal lagoons

Key findings:

1) A national fleet of 6 lagoons would contribute £27bn to UK GDP during 12 years of construction
2) Creating or sustaining 35,800 jobs on average and 70,900 jobs at its peak
3) In operation, the fleet would contribute £3.1bn per annum to UK GDP
4) Creating or sustaining as many as 6,400 jobs
5) Potential to increase net exports by £3.7bn per year – equivalent to 13% of the current trade deficit

International potential

- **313 GW** of potential tidal range capacity identified to date:
  - Europe: Russia, UK, France, Germany
  - Americas: Canada, US, Mexico, Brazil, Argentina
  - Asia: China, India, S Korea
  - Australia
- At least **80 GW** capacity assessed as holding potential for commercial development
- Valuing the global tidal range pipeline at **£383bn**
- Total potential UK exportable content worth up to **£70bn**

Source: *The Economic Case for a Tidal Lagoon Industry in the UK*, The Centre for Economics and Business Research, July 2014. Analysis including Bernshtein (1996), Baker (1991), Clark (2007)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