The Offshore Valuation

A valuation of the UK's offshore renewable energy resource

www.**OffshoreValuation**.org

What is the value of our offshore renewable energy resource?

The Offshore Valuation Group

1. The Department of Energy & Climate Change
2. The Scottish Government
3. The Welsh Assembly Government
4. The Crown Estate
5. Energy Technologies Institute
6. Public Interest Research Centre
7. Scottish & Southern Energy
8. RWE Innogy
9. E.ON
10. DONG Energy
11. Statoil
12. Mainstream Renewable Power
13. Renewable Energy Systems
14. Vestas

Approach

- Five offshore renewable technologies
- High level analysis
- Drawing on existing research and expertise
- Common appraisal of practical resource
- Long term, European viewpoint

the electricity **equivalent of 1 billion barrels of oil** could be generated annually, matching North Sea oil and gas production and making Britain a net electricity exporter;

carbon dioxide reductions of 1.1 billion tonnes would be achieved by the UK between 2010 and 2050 – a major contribution towards 2050 climate targets;

145,000 new UK jobs could be created by industry

Key Enablers

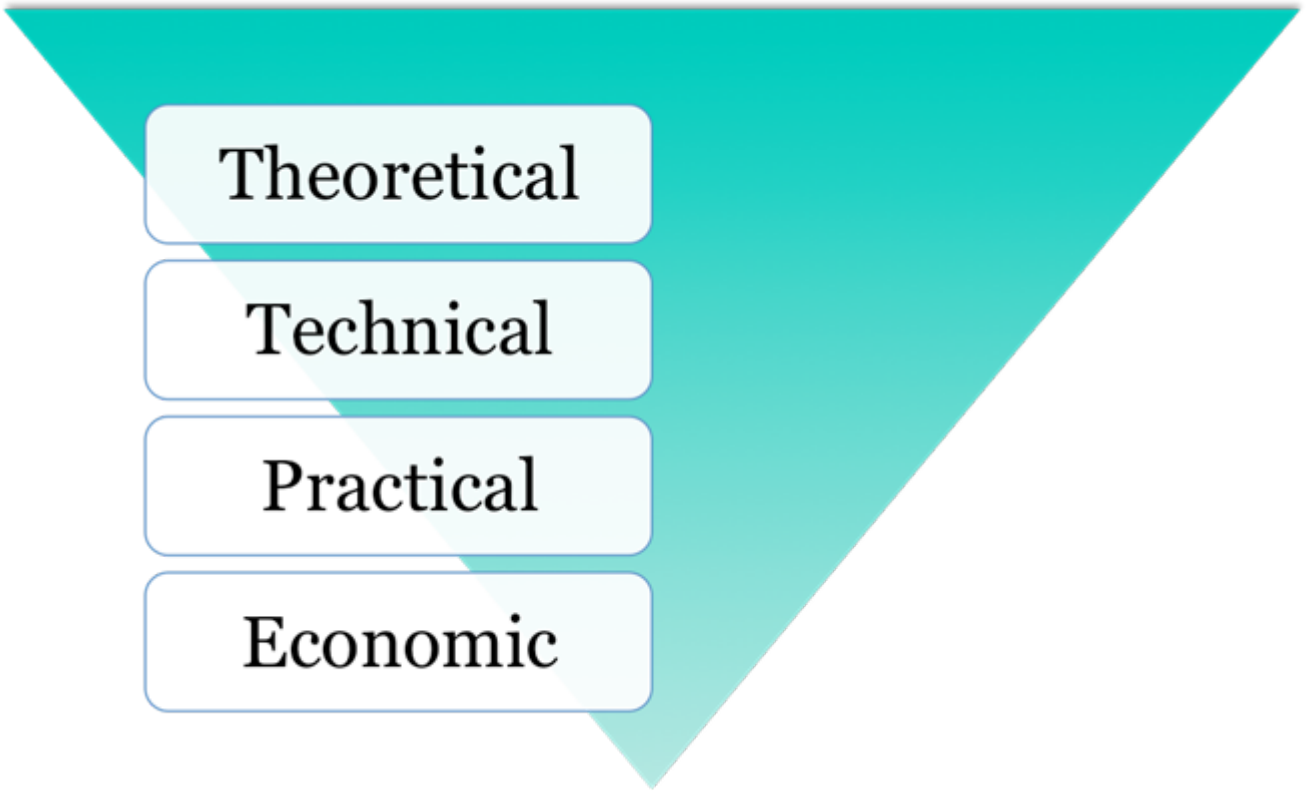
- Make Round 3 grid connections 'super-grid compliant'
- Take a leadership role in the current EU super-grid negotiations
- Continue to develop the UK supply chain
- Evaluate and where appropriate, facilitate new financing structures

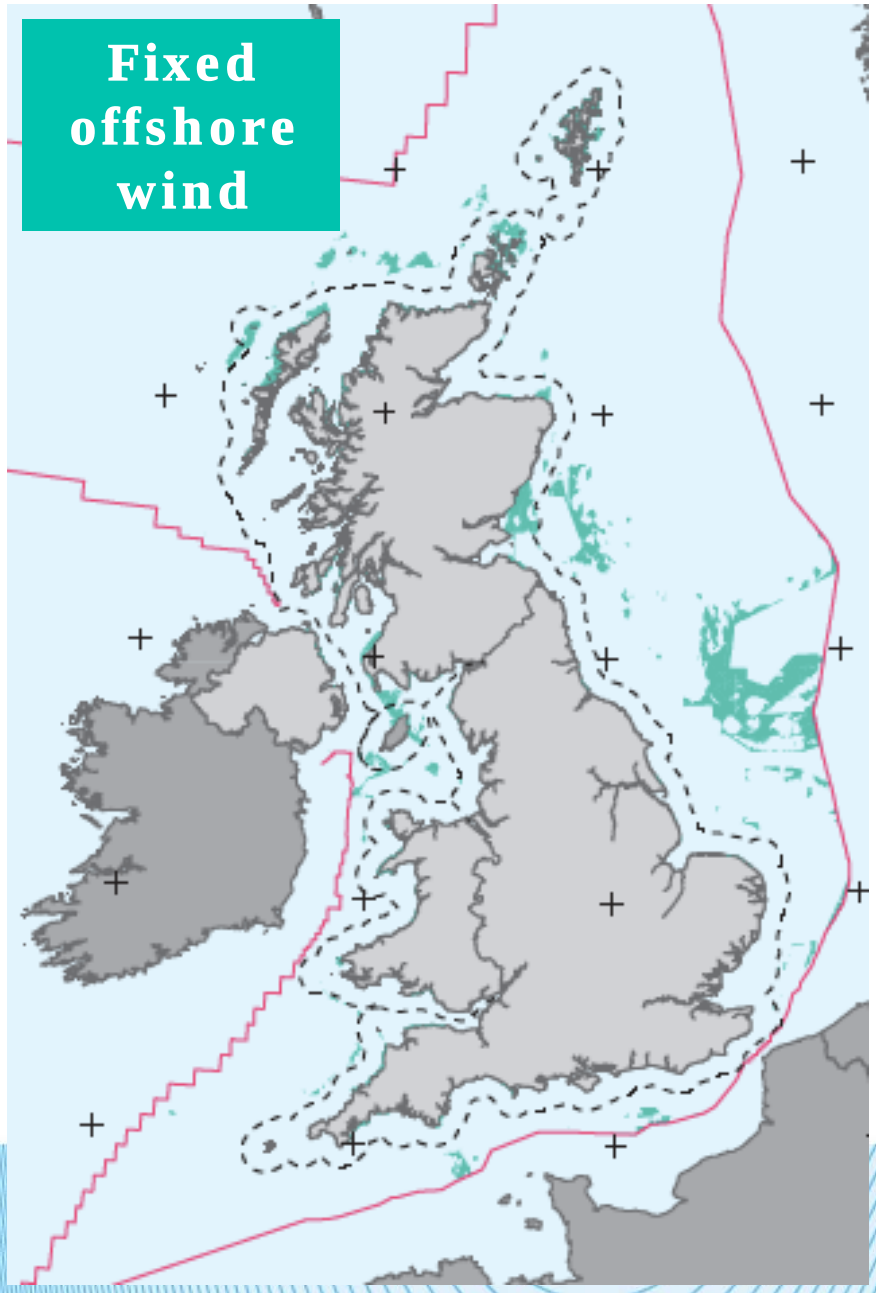
Electricity demand over time

- Underlying demand growth driven by GDP
- 10-30% reduction due to energy efficiency
- Partial electrification of transport & heat to reach 2050 targets
- ~75% decarbonisation by 2030; near 100% by 2050

Central scenario: 75% increase in demand

Practical resource sets an upper bound on deployment




Fixed offshore wind


Floating offshore wind

Wave resource

Theoretical resource	Technical resource	Practical resource
1,000km 40 kW/m	Conversion efficiencies	Practical constraints and frequency losses
350 TWh	**70 – 105 TWh**	**~ 40 TWh**

Tidal stream resource

Shallow Wave

Bottom Friction

Farm method

Kinetic Energy Flux

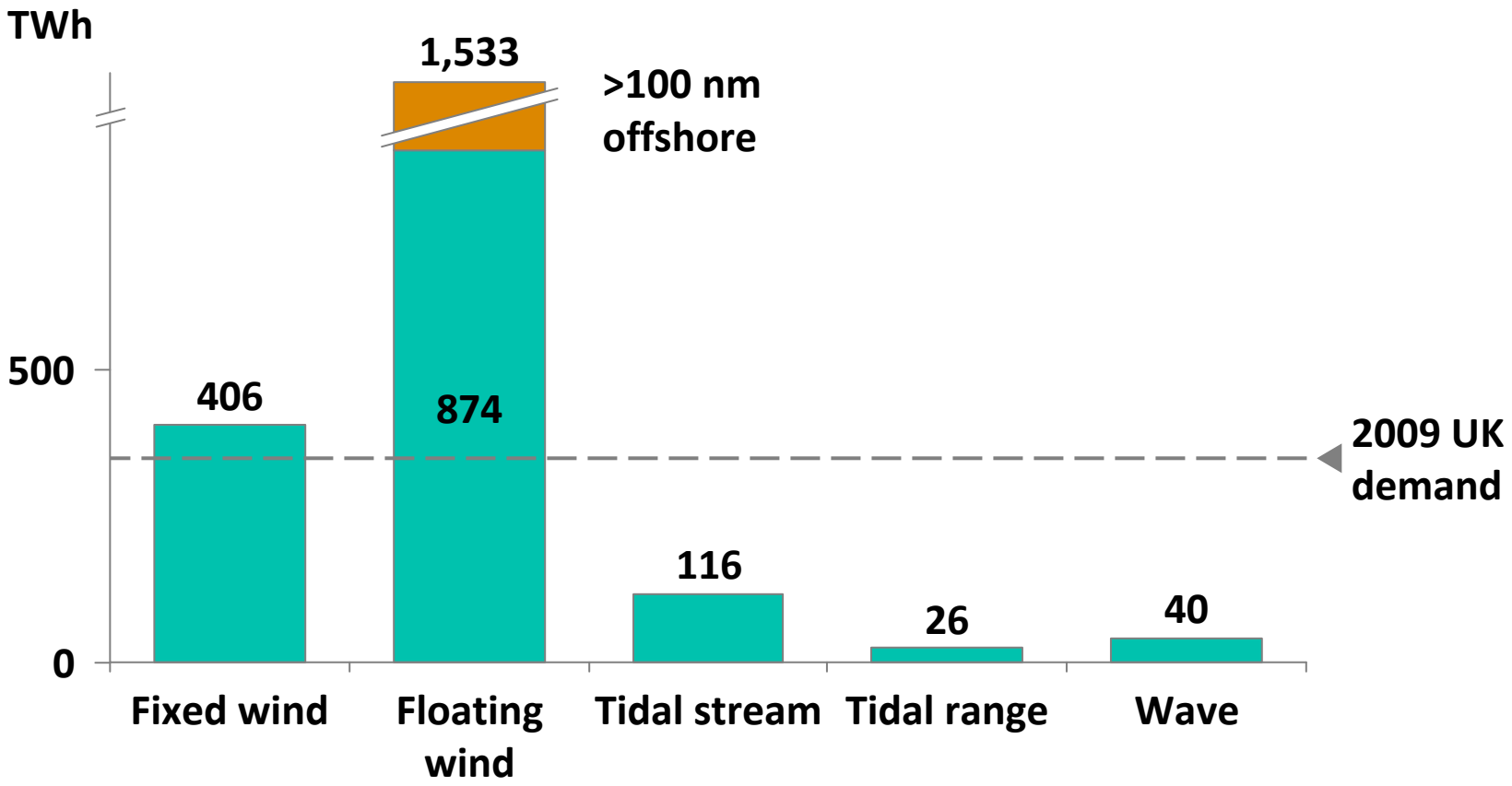
Closest fit with approach used for other technologies

Practical resource

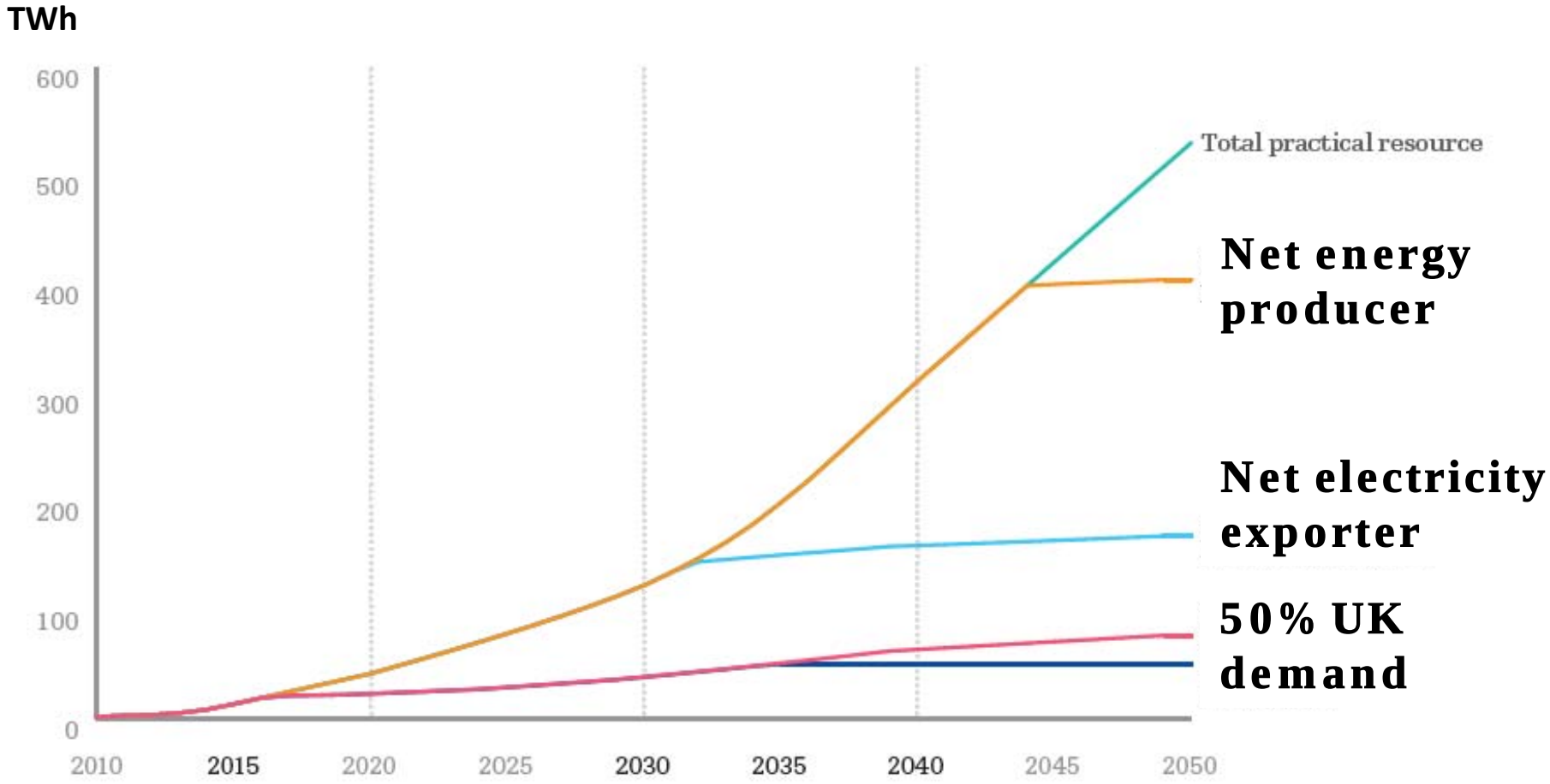
Water depth
Flow speed
Power density
Constraints

~ 116 TWh

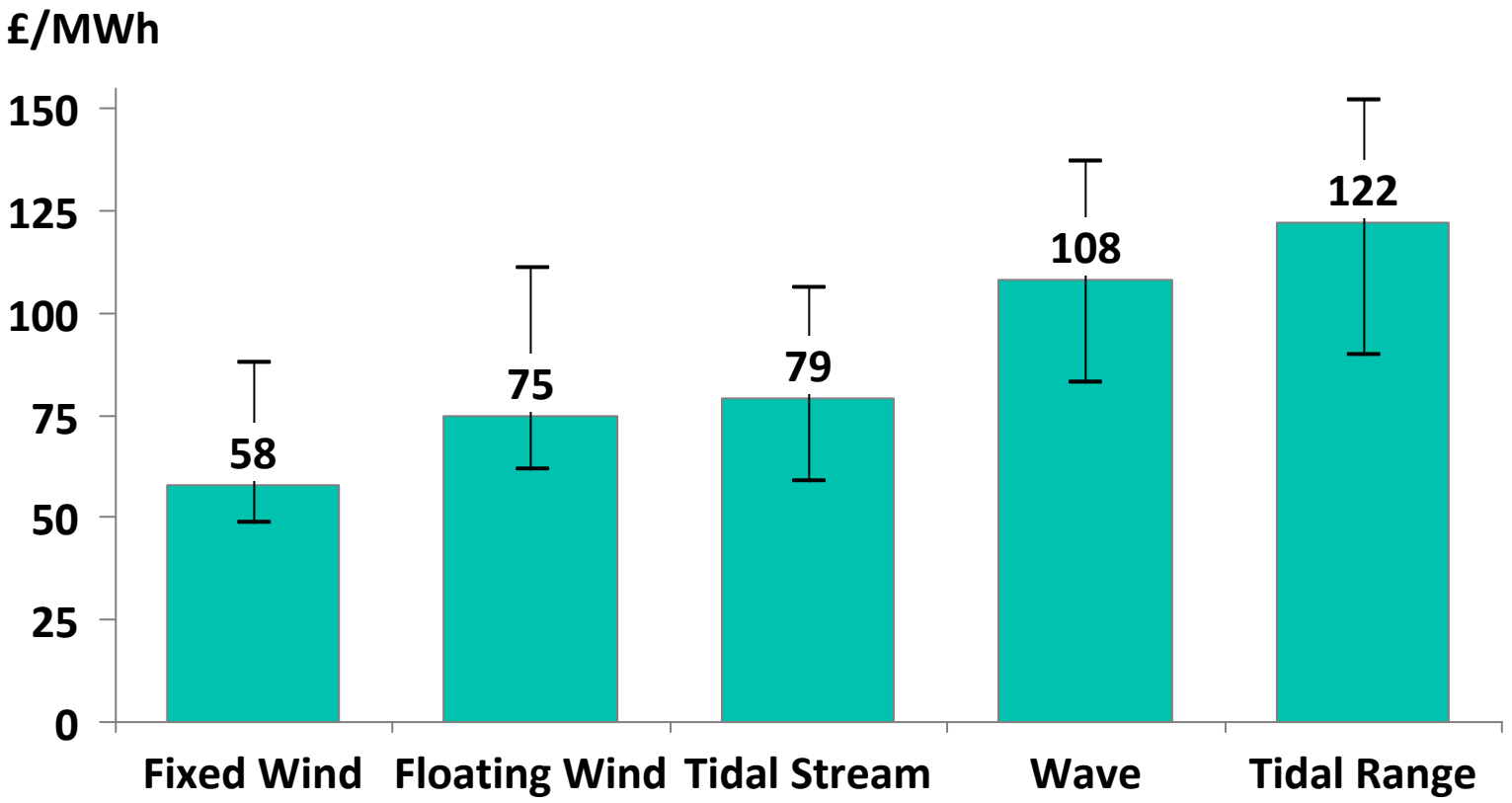
Practical resource : 2,100 TWh



Three deployment scenarios



Estimated costs in 2050



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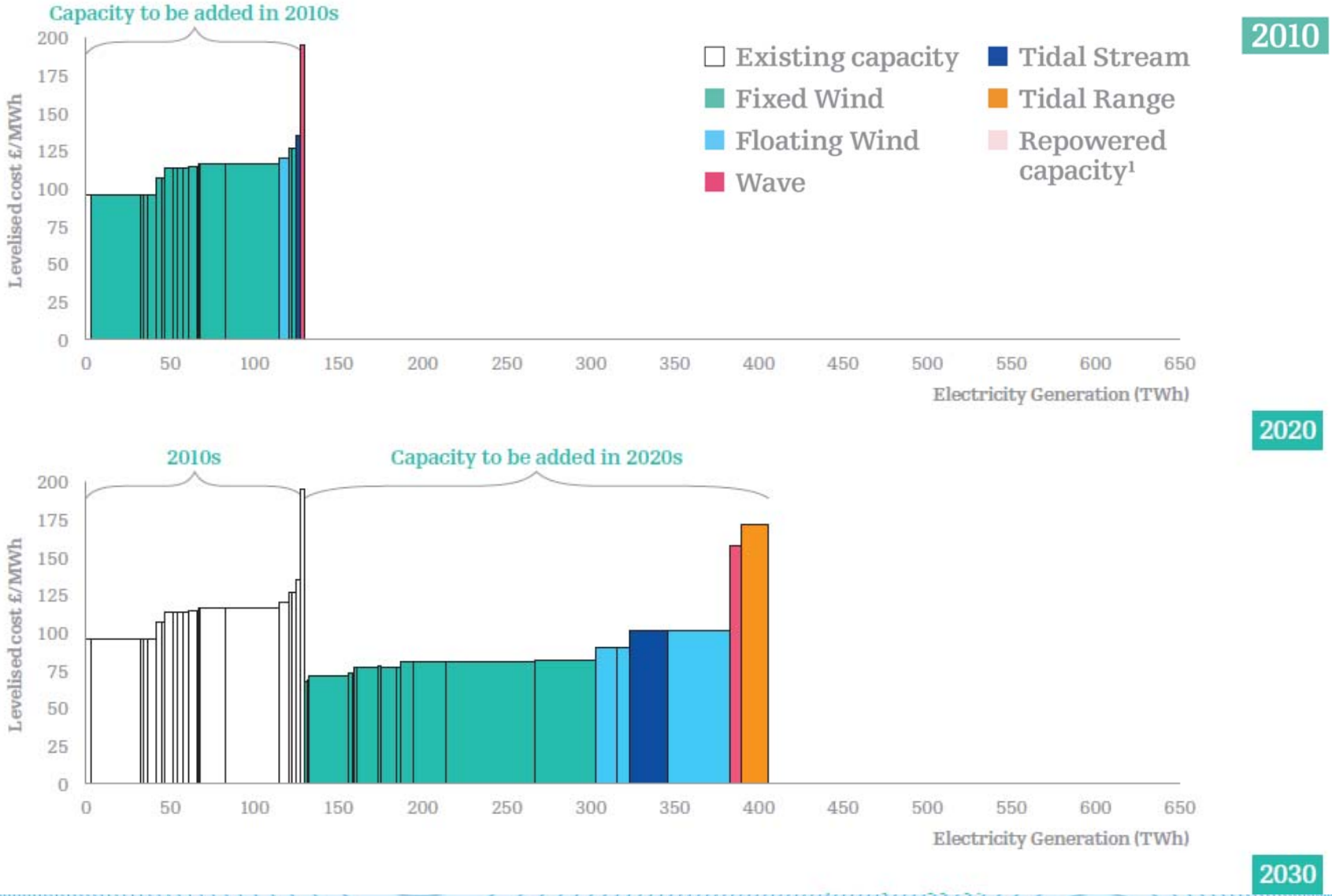
Net electricity exporter



Max build rate 8 GW / year

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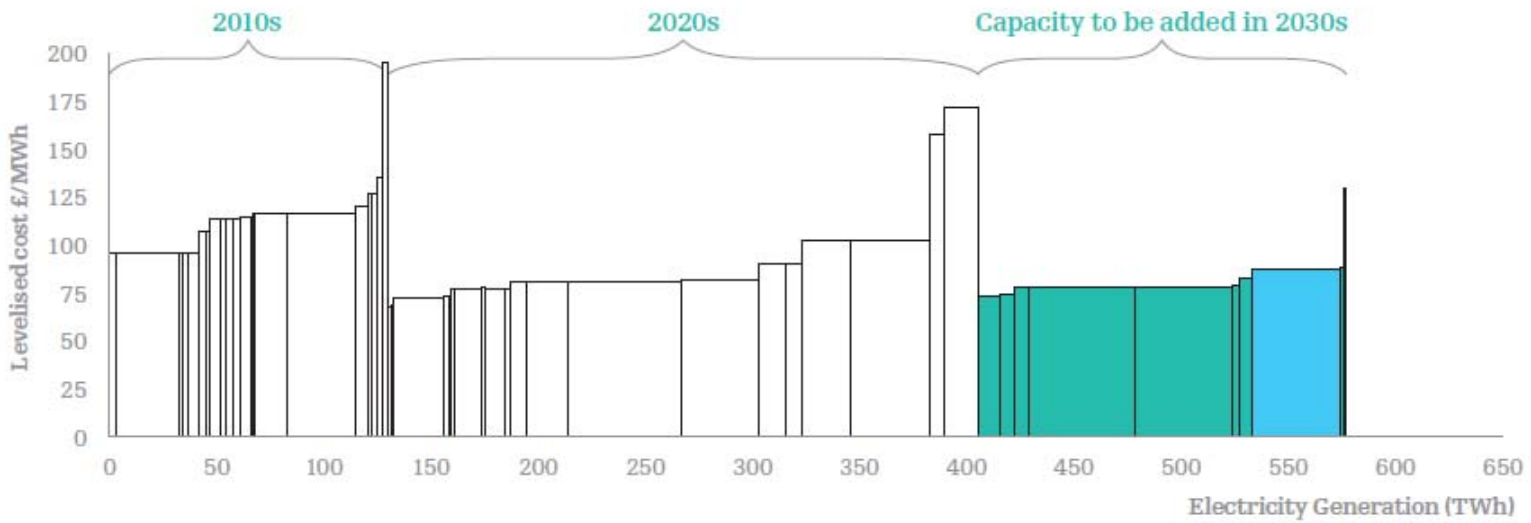
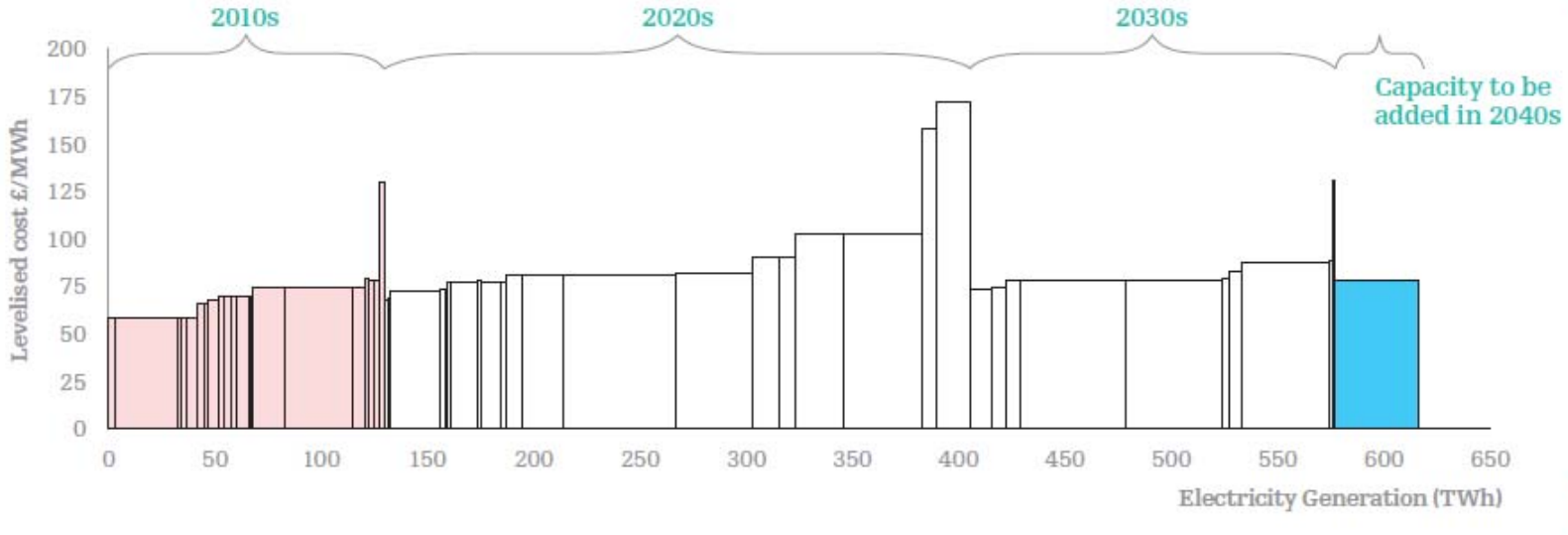
Net electricity exporter



2040



2050

20,000 offshore wind turbines

Principal challenges

- Provision of low cost **financing**
- Managing **variability** of power
- **Grid** connections between centres of supply and demand
- **European demand** and price level

Managing variability in 2050

Supply uncertainty

Peak reliability

Grid congestion

Backup generation

Storage

Interconnection

Forecasting

Smart grid technologies

50% variable renewables

Including onshore wind

Required grid connections

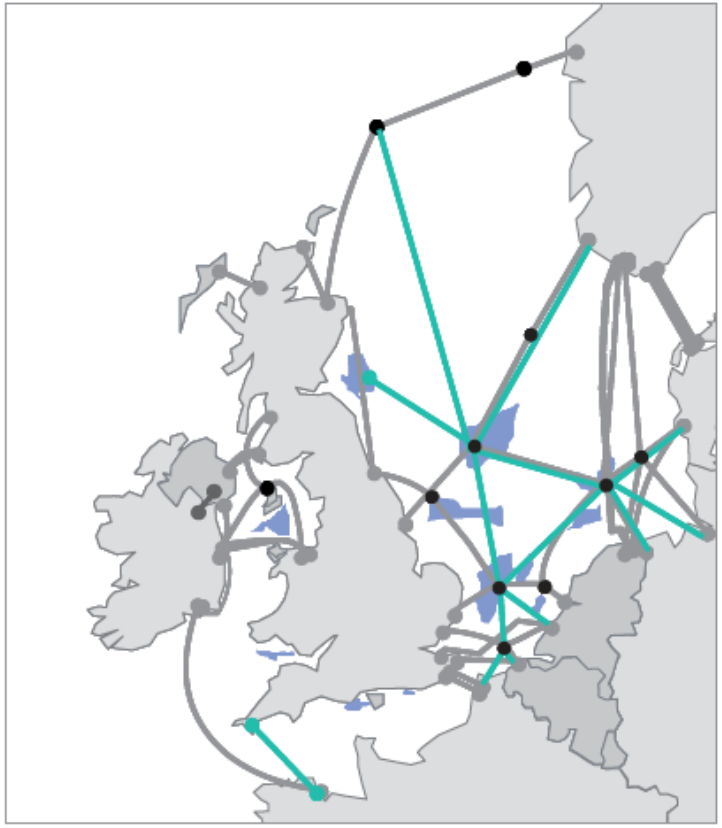
Enhanced Supergrid layout used for cost modelling

- Additional capacity
- North Sea Super Grid
- Mid-sea supernode

50% UK demand = 21 GW

Net electricity exporter = 106 GW

Net energy producer = 342 GW



Overall valuation : Positive NPV of offshore renewables

• 50% UK demand	£ 17 billion
• Net electricity exporter	£ 36 billion
• Net energy producer	£ 55 billion

Conclusions

- the electricity equivalent of 1 billion barrels of oil per year
- carbon dioxide reductions of 1.1 billion tonnes
- £35 billion revenue in 2050 from net electricity exports
- positive Net Present Value

Key Enablers

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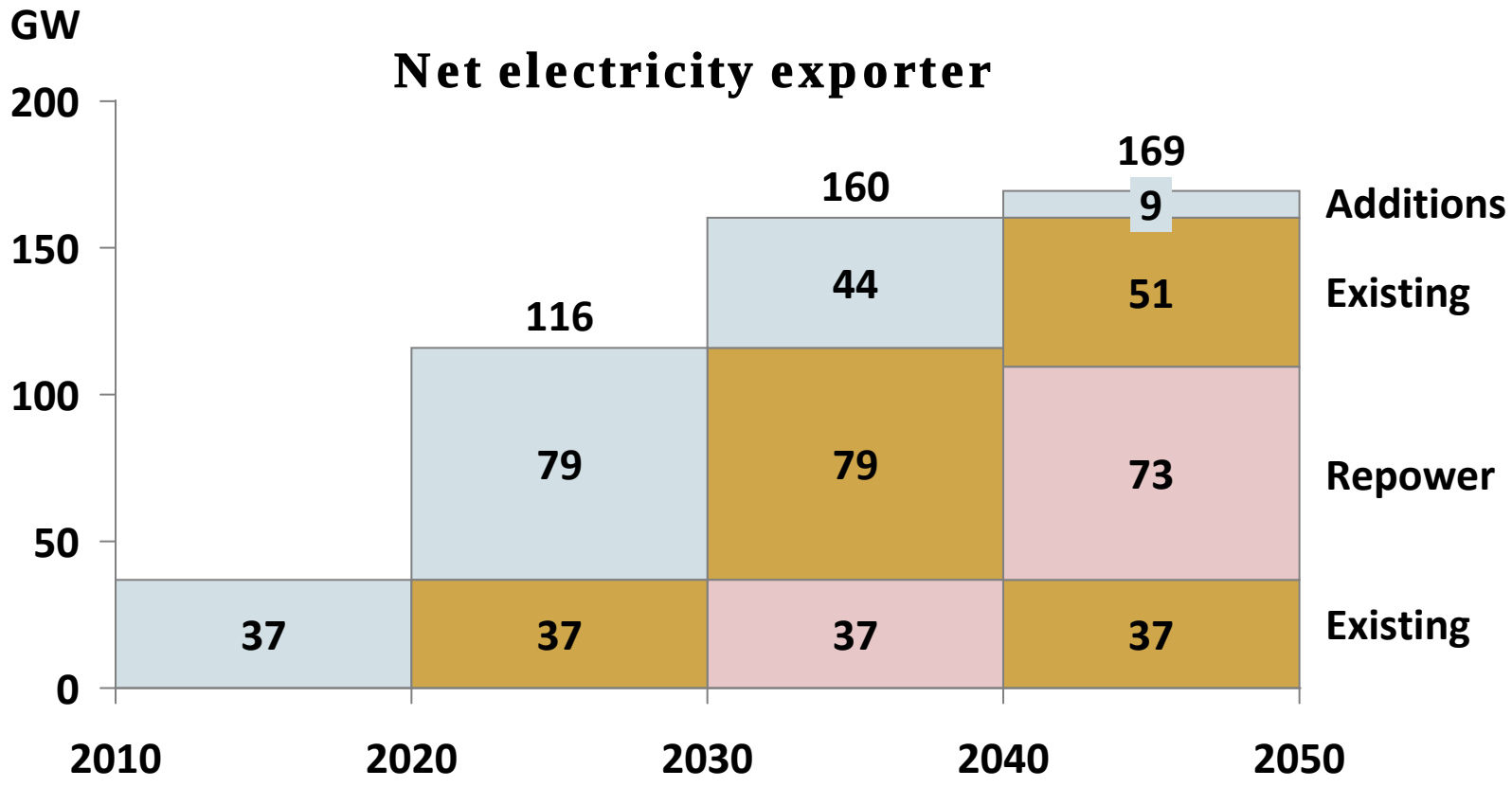
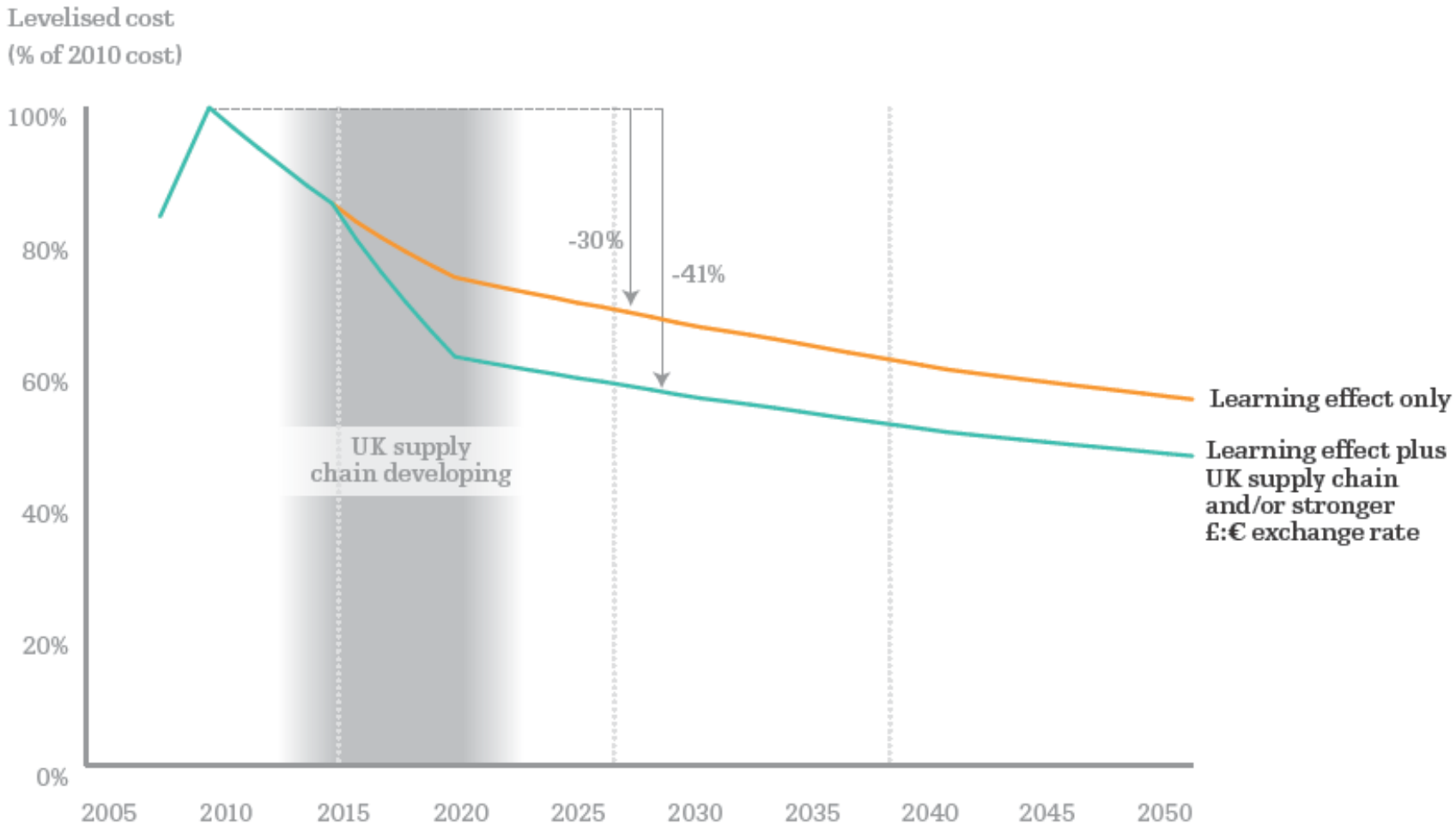
Appendix

Scale of the supply chain




Levelised cost
(% of 2010 cost)
100%
80%
60%
40%
20%
0%
2005
2010
2015
2020
2025
2030
2035
2040
2045
2050
-30%
-41%
UK supply
chain developing
Learning effect only
Learning effect plus
UK supply chain
and/or stronger
£:€ exchange rate

	Installed capacity	Resource utilisation	Capital expenditure	Annual Revenue in 2050	
Scenario 1	78 GW	13%	£170B	£28B	50% UK demand
Scenario 2	169 GW	29%	£443B	£62B	Net *electricity* exporter
Scenario 3	406 GW	76%	£993B	£164B	Net *energy* producer