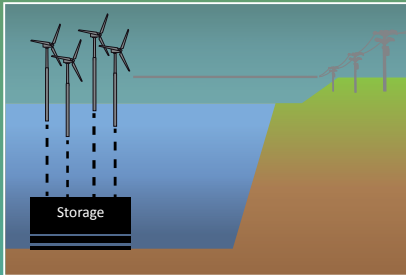


Value-added of Offshore Energy Storage for Deep-sea Wind Farms



Use Case:

Wind Farm

- 400 MW offshore wind farm
- Located 30 km away from shore
- Connected to the UK grid
- NOWITECH 10 MW reference turbine

Energy Storage

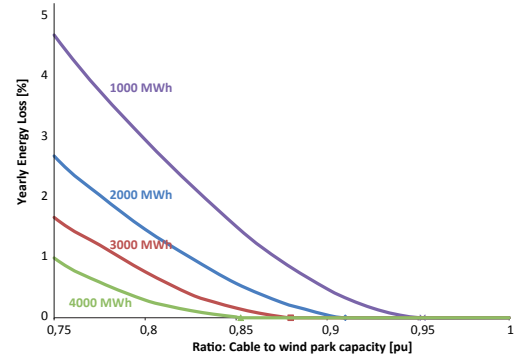
- 300 MW storing and generation capacity
- 2000 MWh energy storage capacity
- 85 % round-trip efficiency

Objective:

Estimate the gross value of an offshore energy storage

Why Offshore?

- Reduced required cable capacity
=> lower initial investment
- Reduced influence of NIMBY
- Limited ecological impact compared to onshore alternative



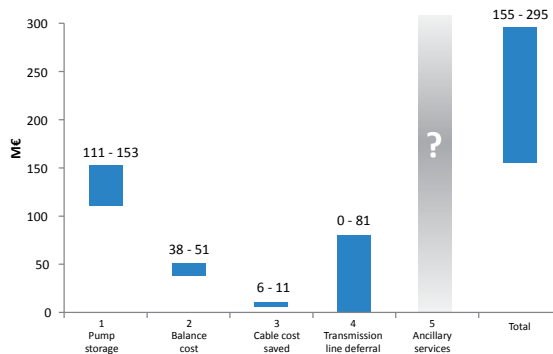
Right: Required cable capacity decreases with increasing storage capacity

Results:

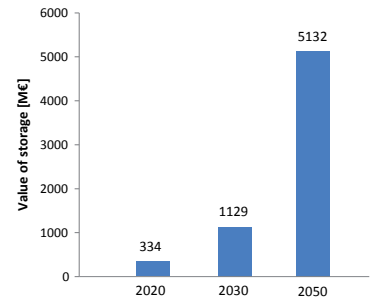
The value is quantified assuming the following benefits:

- 1 Classical pumped-storage operation
- 2 Countering wind forecast error to avoid balance cost
- 3 Reduced cable capacity rating
- 4 Avoiding the need for onshore infrastructure reinforcements
- 5 Offering ancillary services

The study is giving indicative values only, relying on literature survey and simplistic calculations.



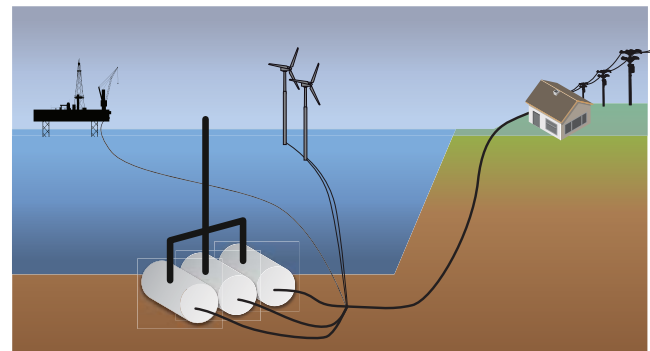
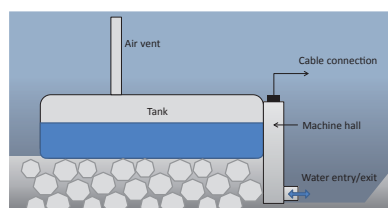
Total value of the energy storage unit broken into individual parts (20yr period, 7% annuity factor).



The total value of the energy storage will increase for future scenarios. Source: Carbon Trust

Subhydro Storage Concept

- Large scale pumped storage
- Sub-sea installation at depths up to 1000m
- Energy production by letting water in
- Energy storage by pumping water out



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