Supporting large scale offshore wind deployment

Foundation Ex

Ana Vega Kurson

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Motivation

How large is large?

35 GW – 2020 installed capacity

Global Offshore Wind Report 2021, GWEC

400 GW – 2035 predictions

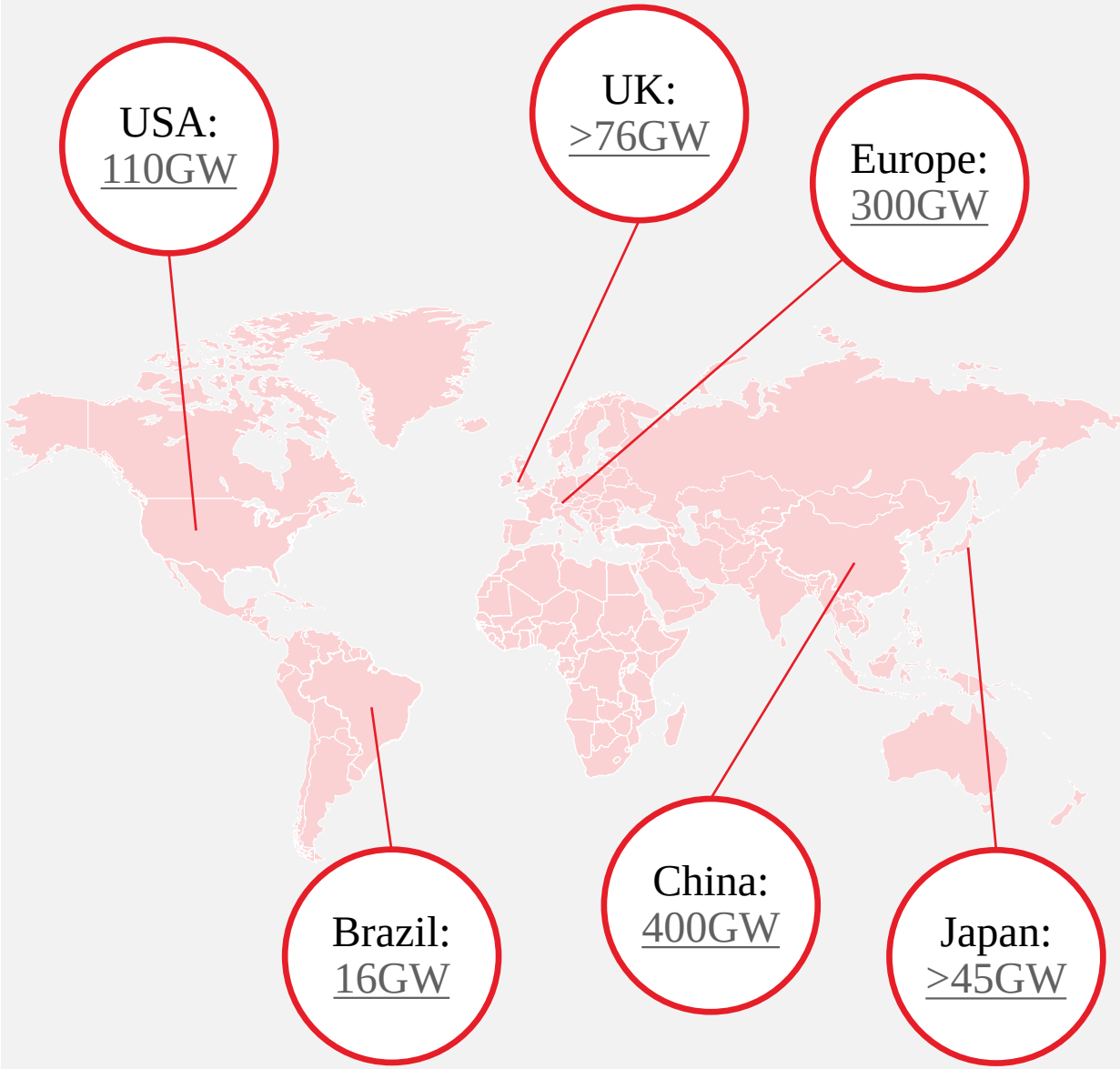
2H 2021 Offshore Wind Market Outlook, Bloomberg NEF

1,400 GW – 2050 aspirations

The Power of Our Ocean, OREAC

71,000 GW – global potential

Global Offshore Wind Technical Potential, The World Bank



2050 ambitions

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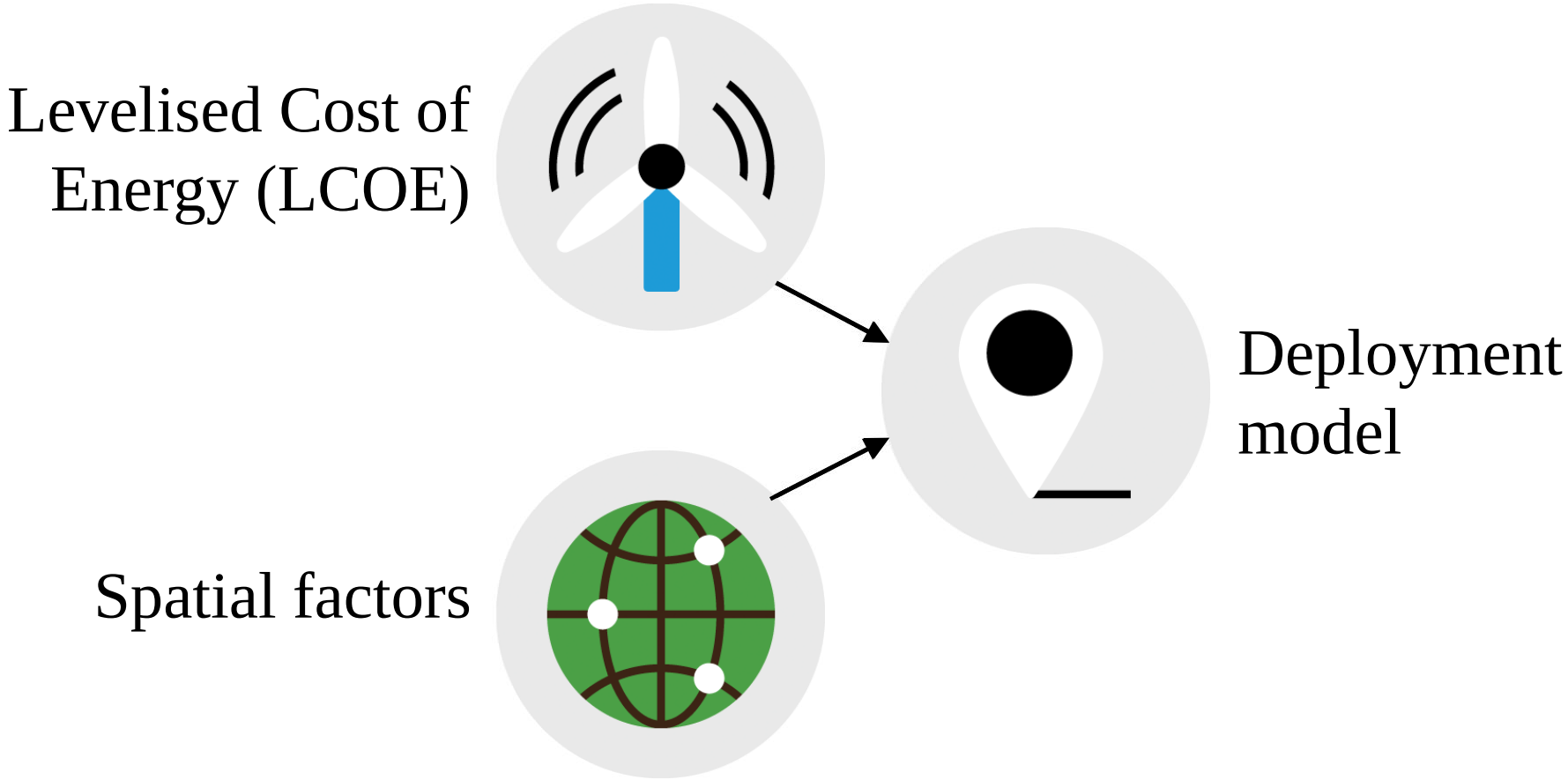
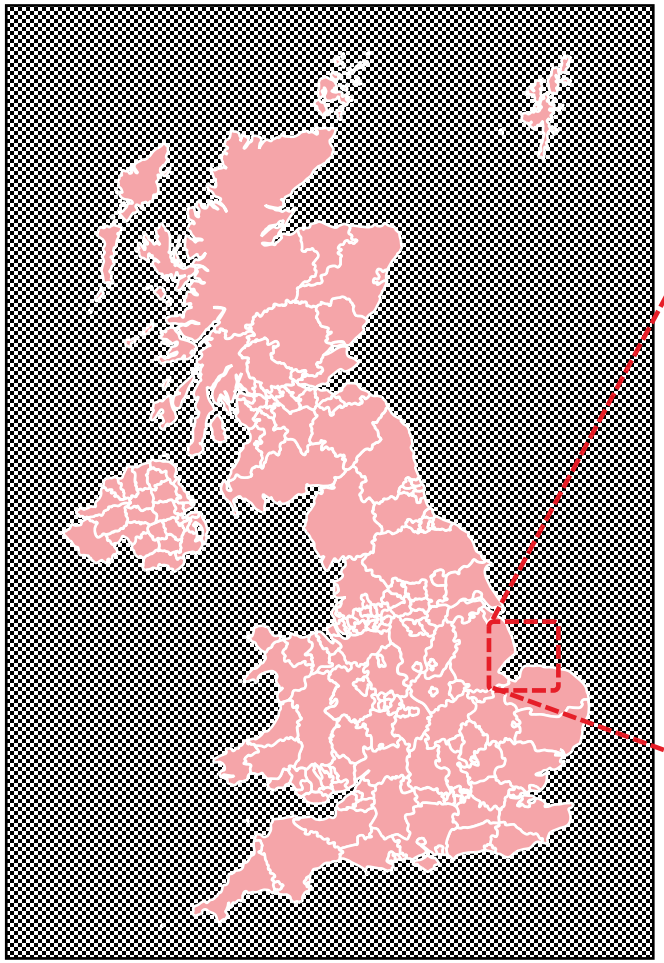
Delivering data-driven insight

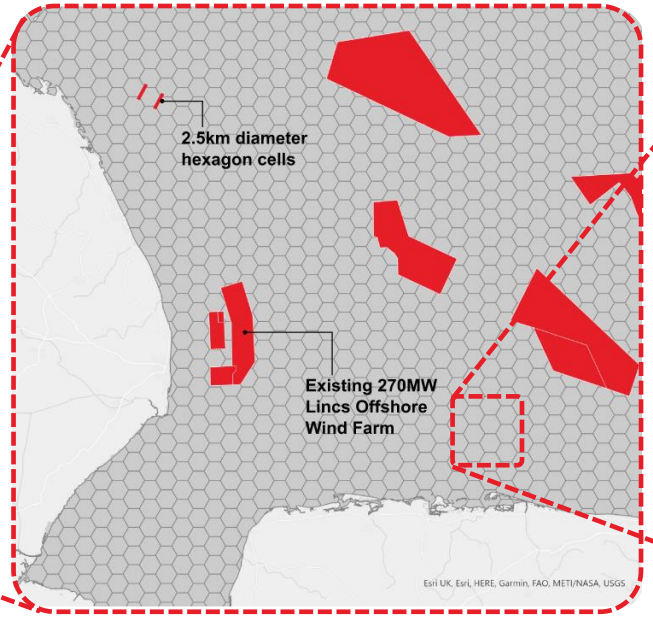
SCALE

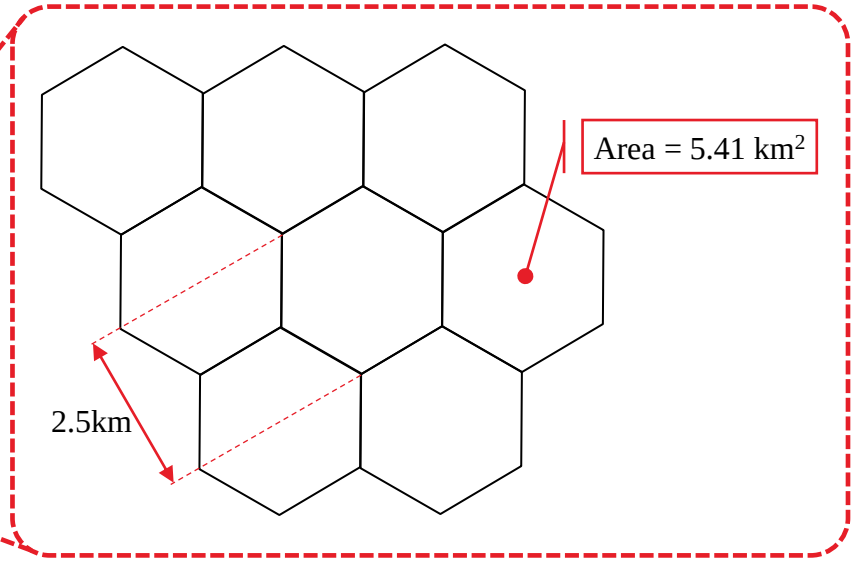


Model setup

SCALE

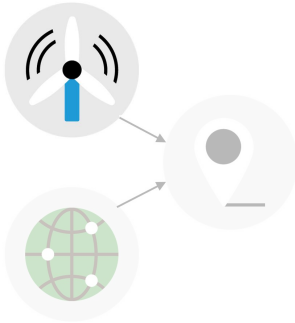






LCOE

Calculation



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$$LCOE = \frac{\sum \text{lifetime costs}}{\sum \text{lifetime energy generation}}$$

DEVEX
- Engineering
- Met station
- Surveys
- Lease option fees

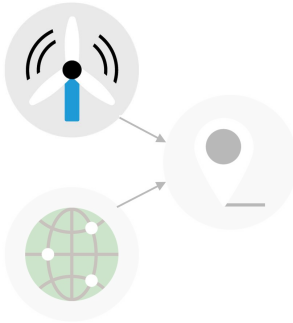
CAPEX
- Turbine
- Foundations
- Substations
- Transmission

OPEX
- Major, minor and preventive maintenance
- Transmission charges
- Seabed leasing

DECEX
- De-installation

LCOE

Inputs



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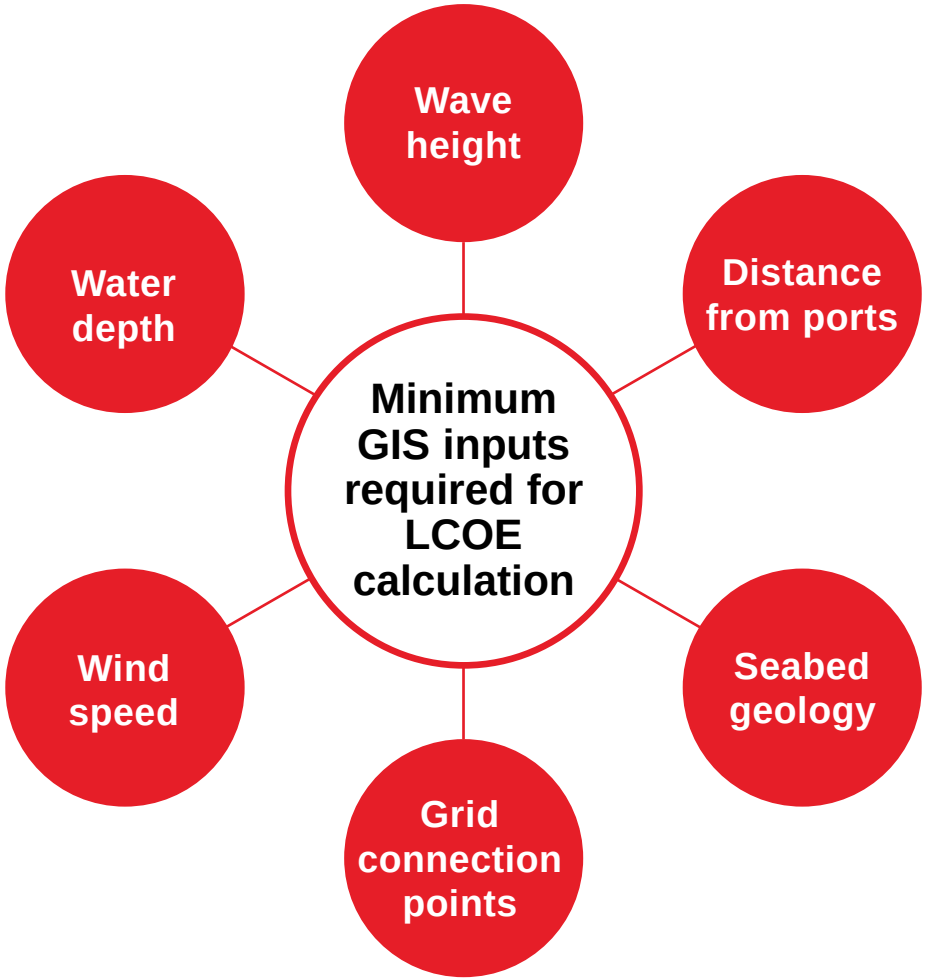
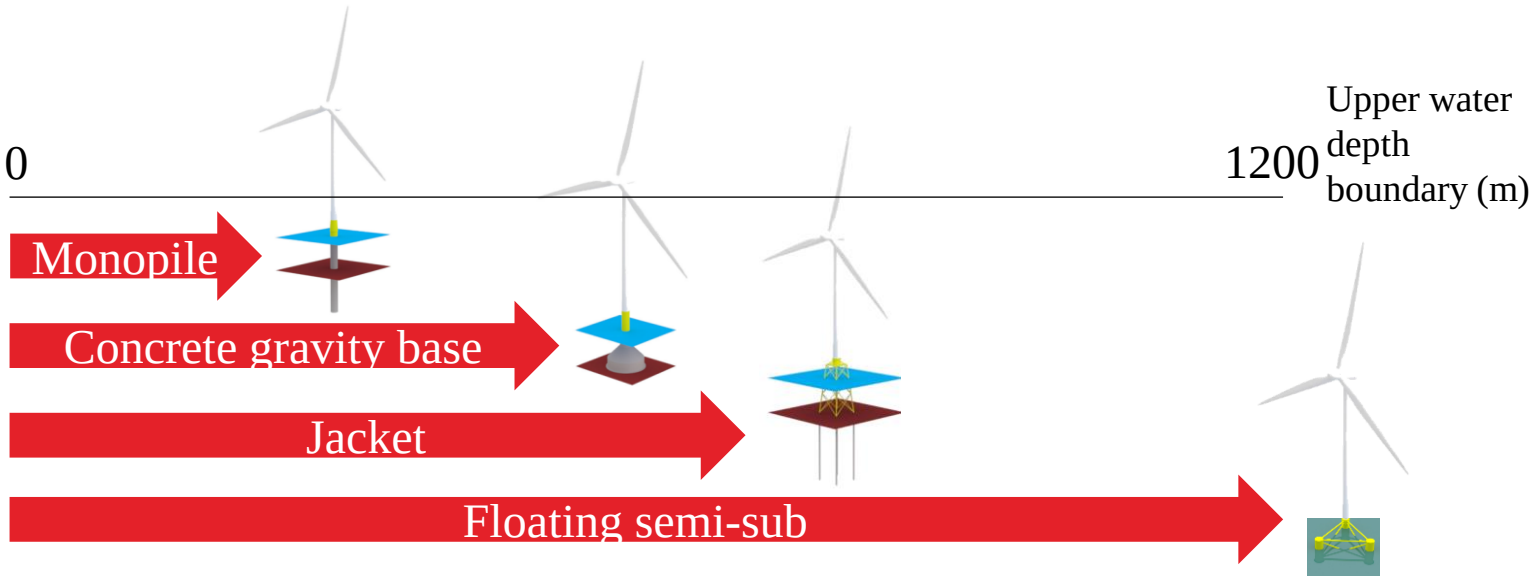
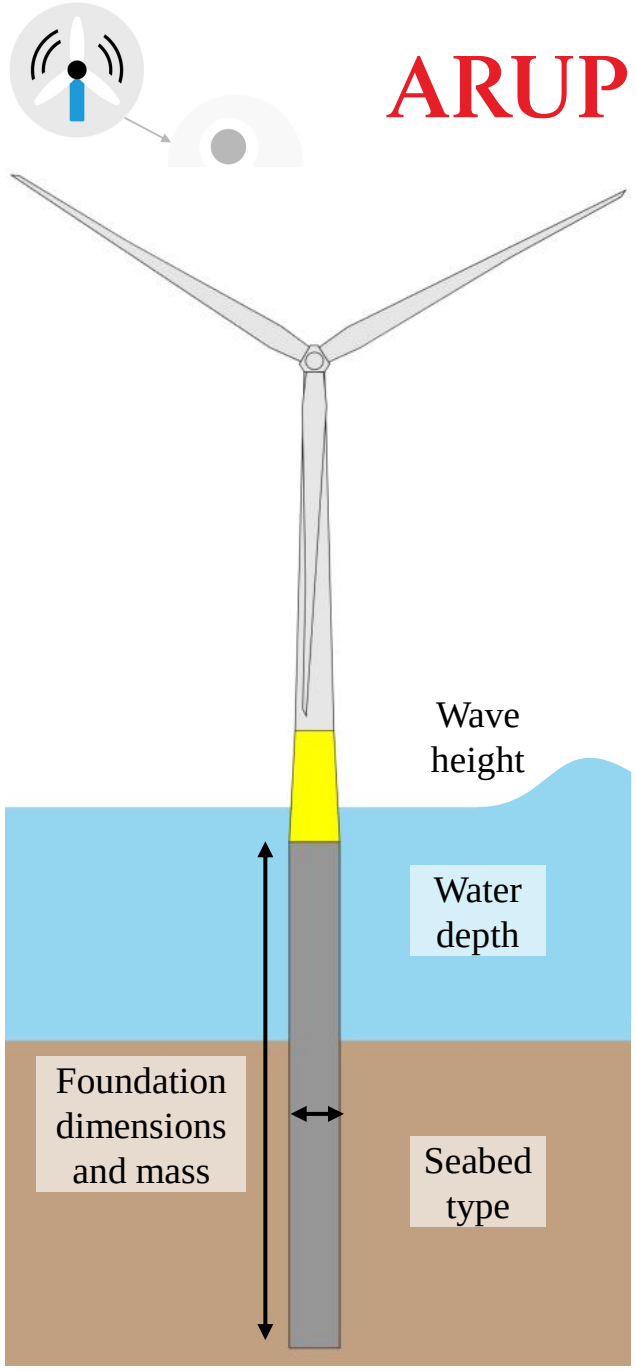


LCOE

WTG + Foundations

- CAPEX includes:
  - Supply
  - Installation

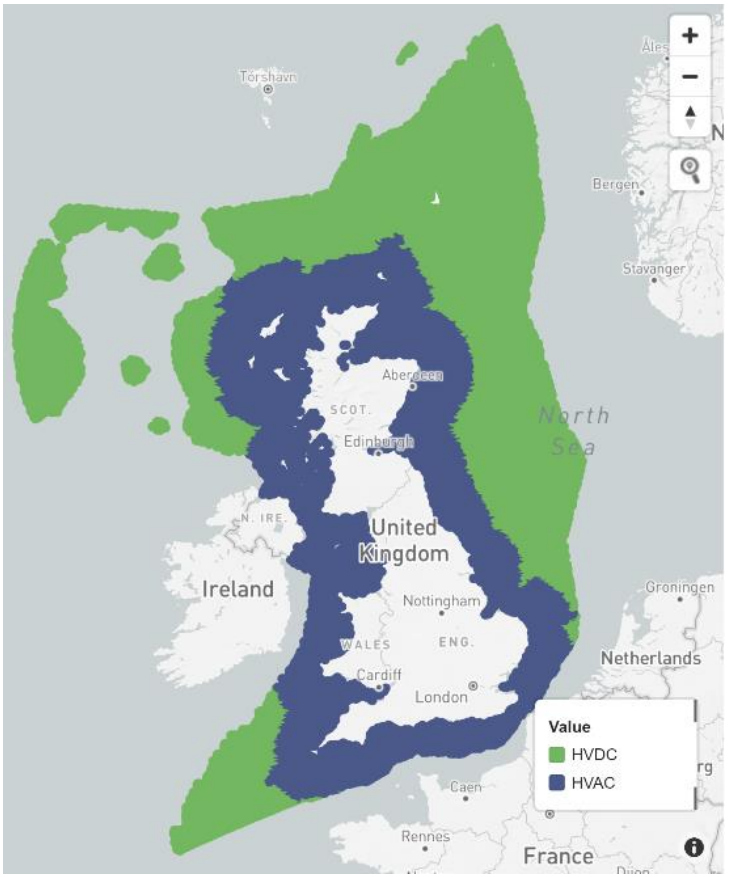




LCOE

Transmission

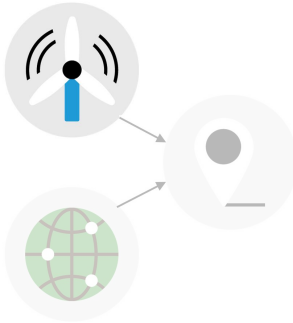
Onshore substation connection points



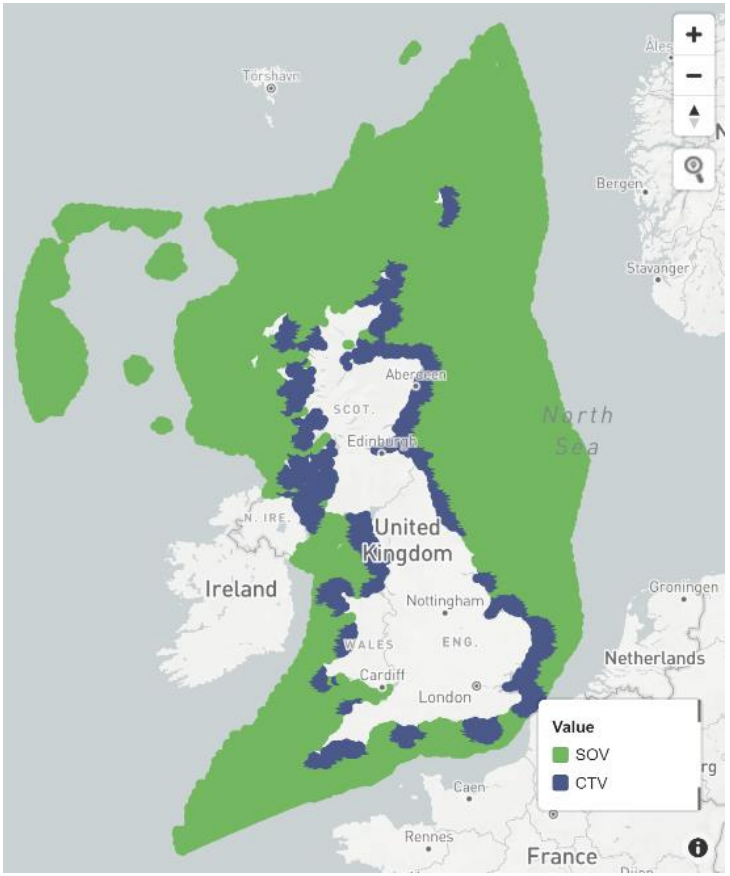
HVAC vs HVDC

LCOE

Operations & maintenance



- OPEX O&M considers:
  - Major/minor/preventive repairs
  - Distance to port
  - Maintenance strategy
  - Metocean conditions

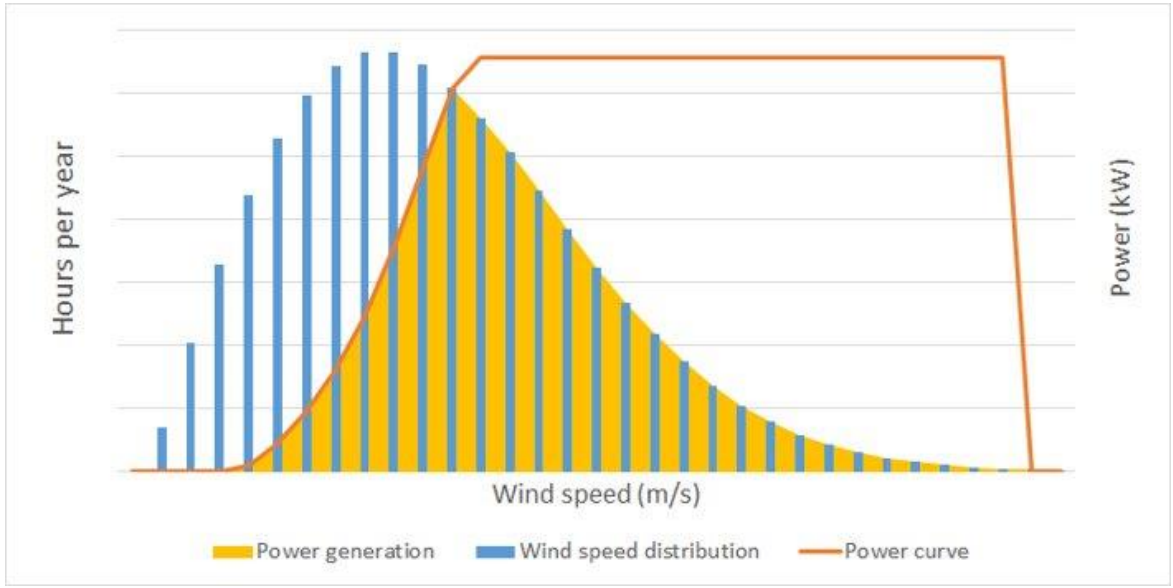


CTV vs SOV

LCOE

Annual Energy Production

- Net capacity factor is calculated taking into account:
  - turbine, wind speed - AEP
  - availability - calculated considering weather downtime
  - electrical losses
  - wake losses
  - 1% 'other' losses



Geospatial factors

Other considerations

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Environmental

- Environmentally protected sites
- Earthquakes zones
- Volcanic areas
- Hurricane paths

Infrastructure

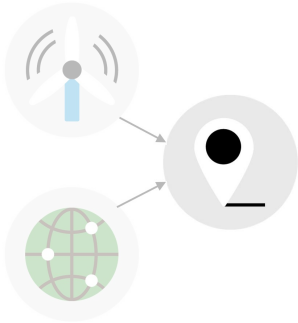
- Existing renewable leasing sites
- Cables and pipes
- O&G platforms
- CCS lease areas
- Mineral exploitation

Industry

- Fishing areas
- Shipping lanes
- Traffic separation schemes
- Military areas
- Airport and radar

Deployment model

Combining cost and geospatial factors



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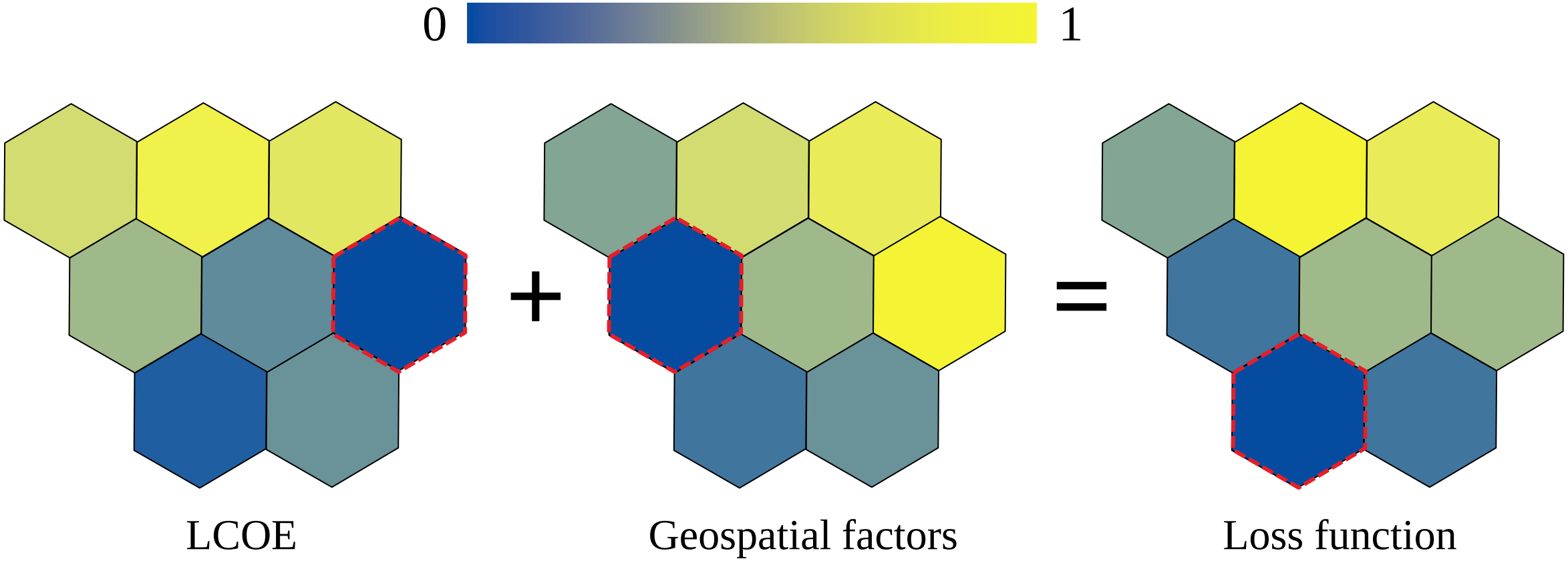
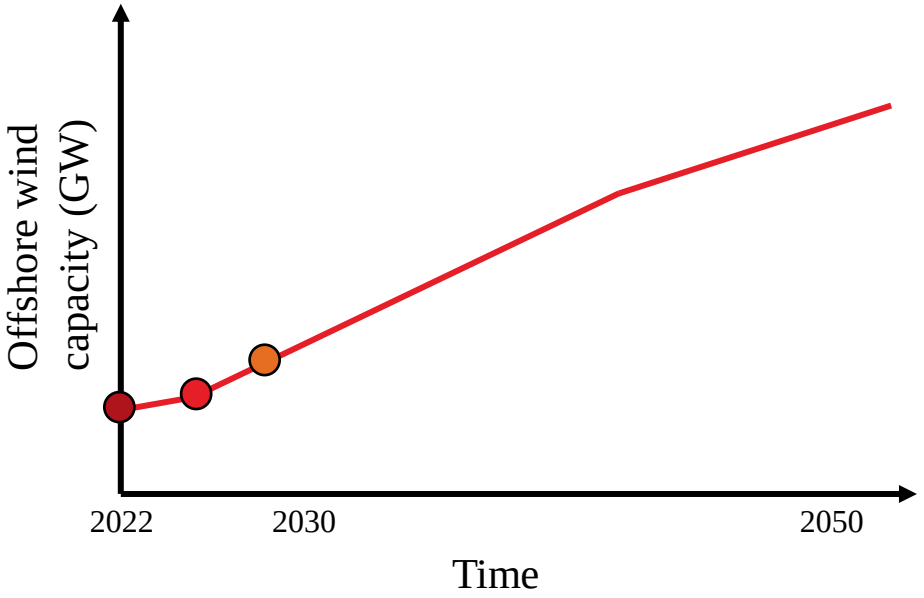
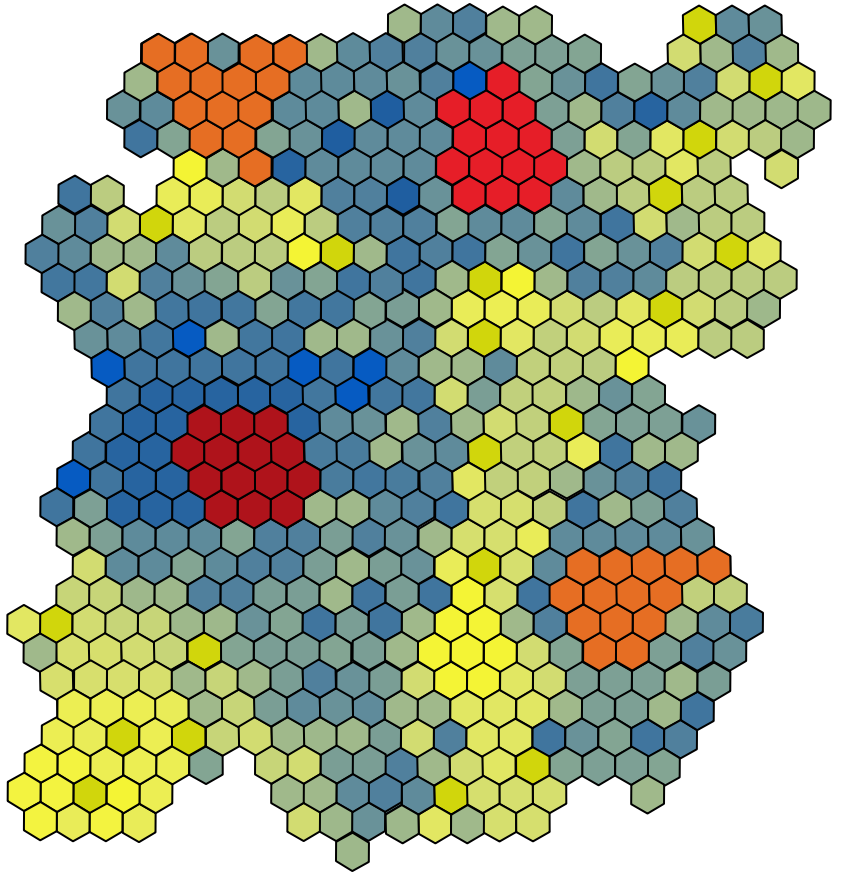


Deployment model

Time domain



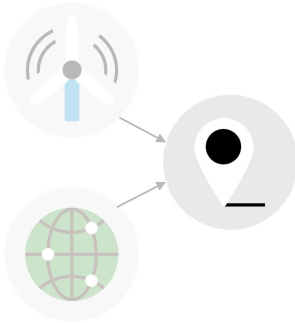
Deployment timeline



Loss function

Deployment model

Automating



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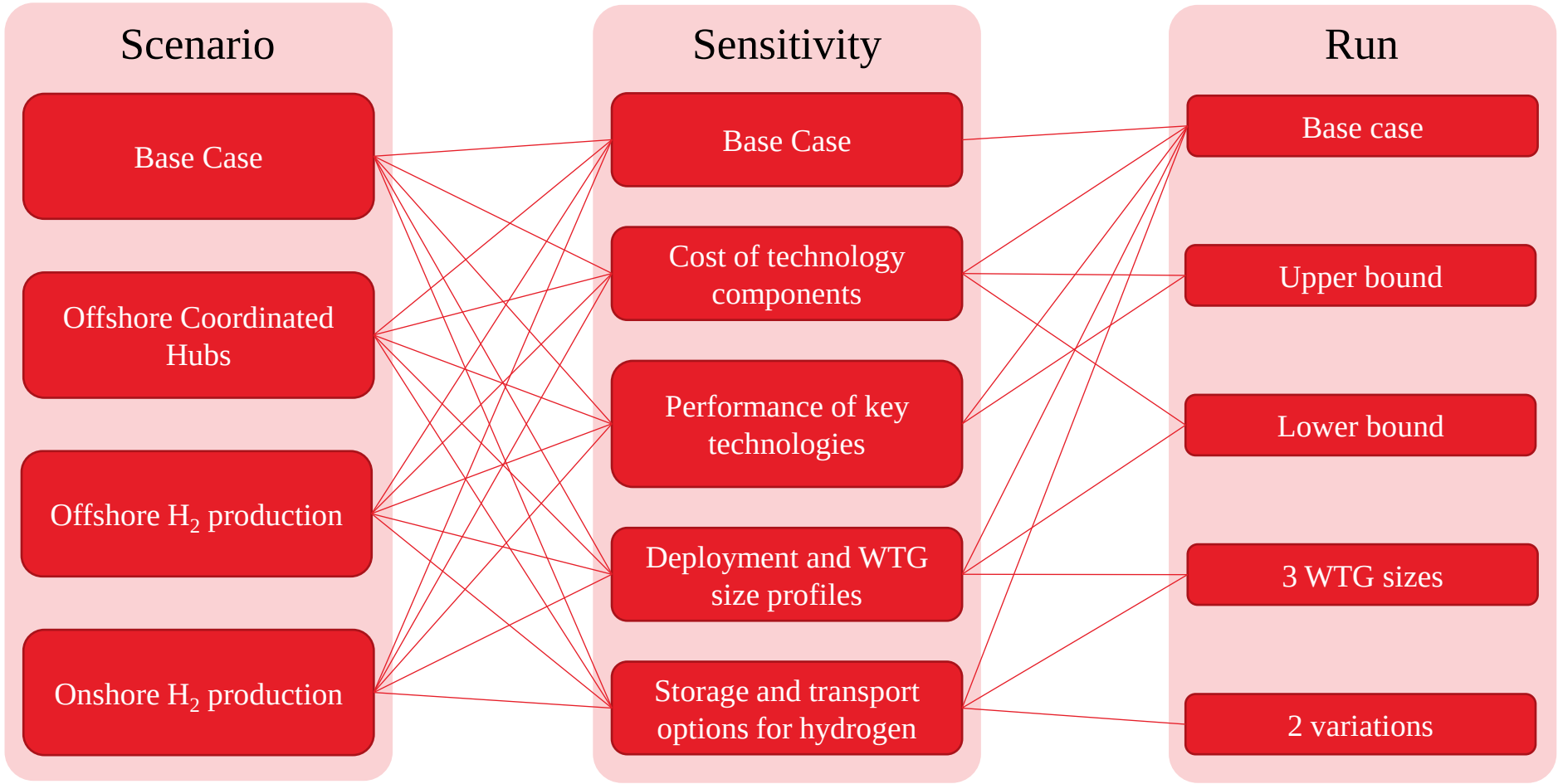
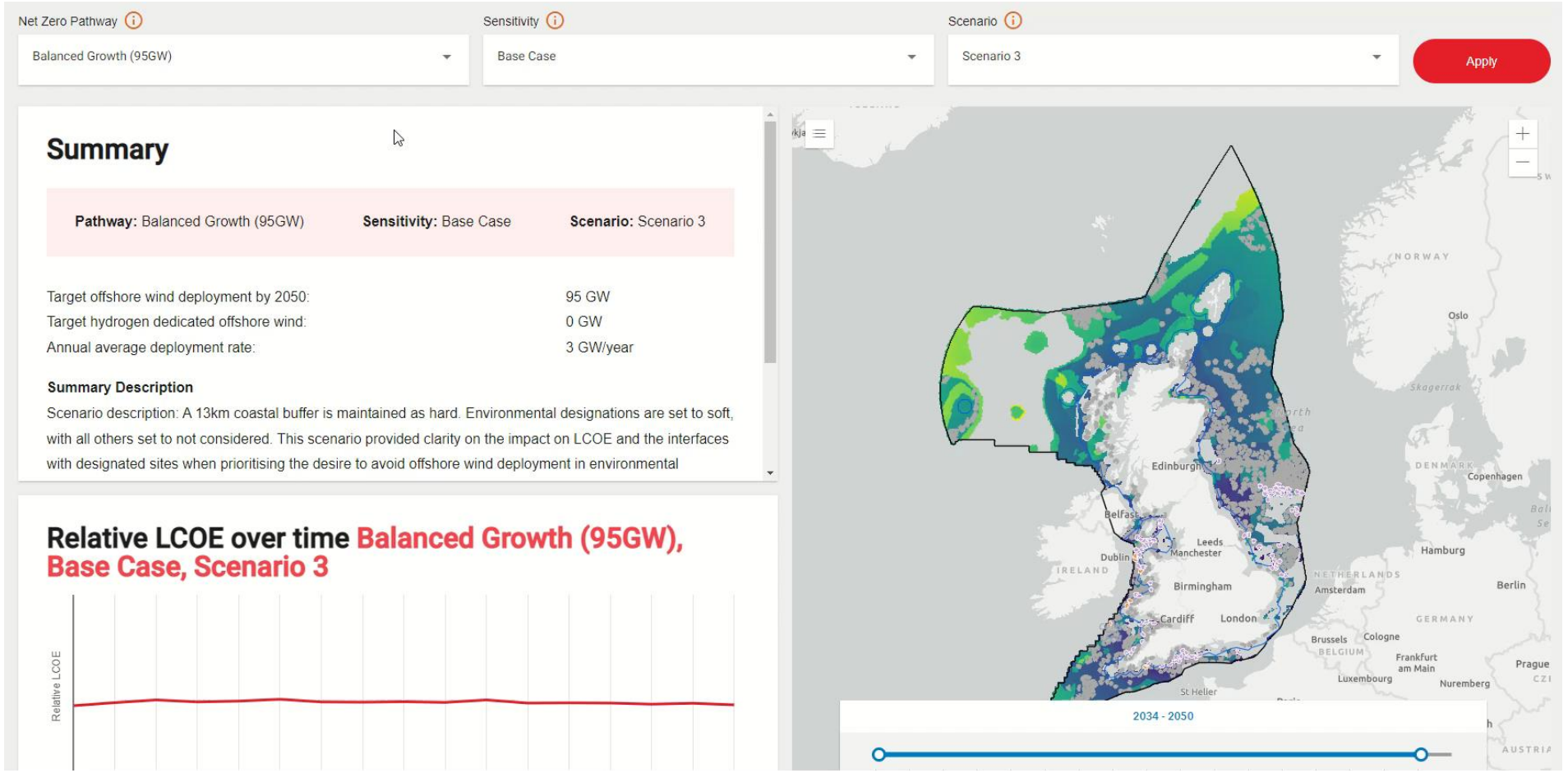


Output

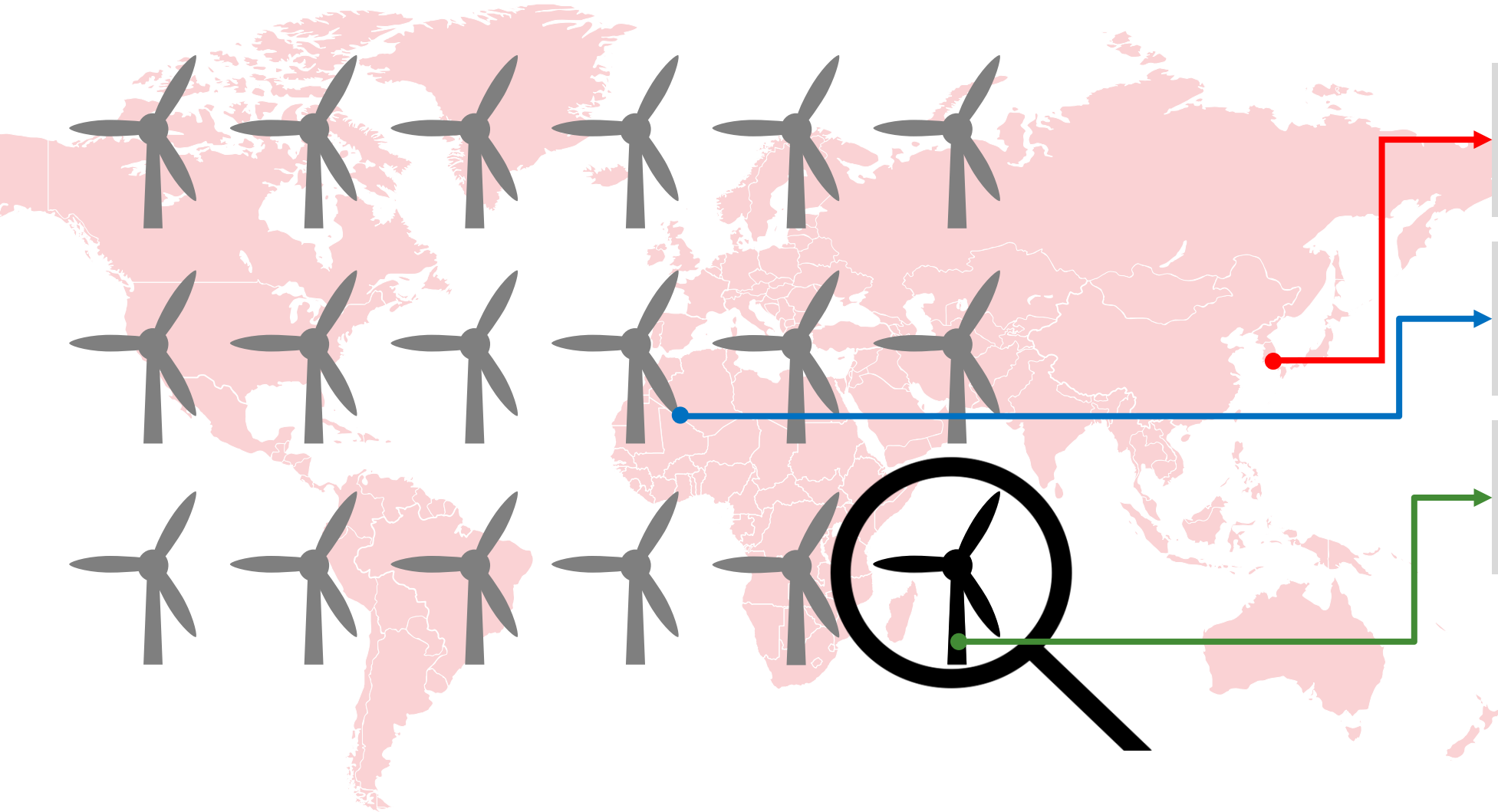
Putting it all together



Example project output from [Future Offshore Wind Scenarios] delivered for BEIS, The Crown Estate and Crown Estate Scotland

Looking forward

What next?

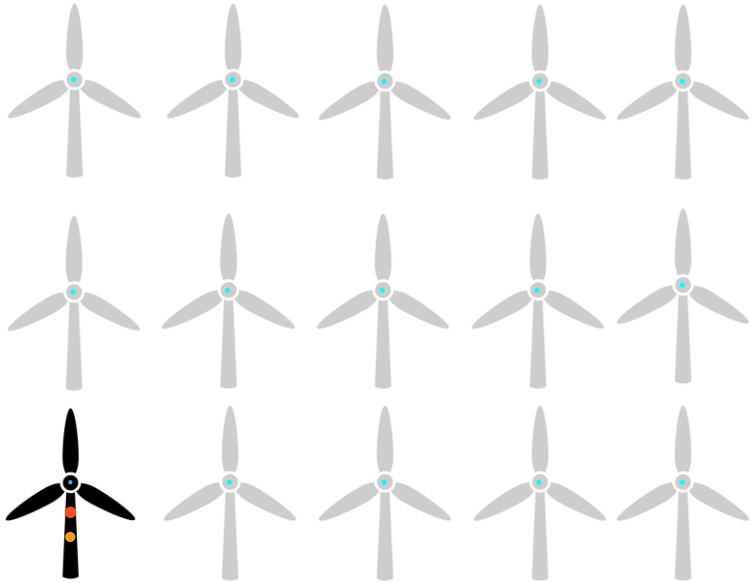


Data – improve the accuracy, reliability and range

Wind farm – develop whole system functionalities

Foundations – expand the range of solutions considered

Data to unlock large scale offshore wind



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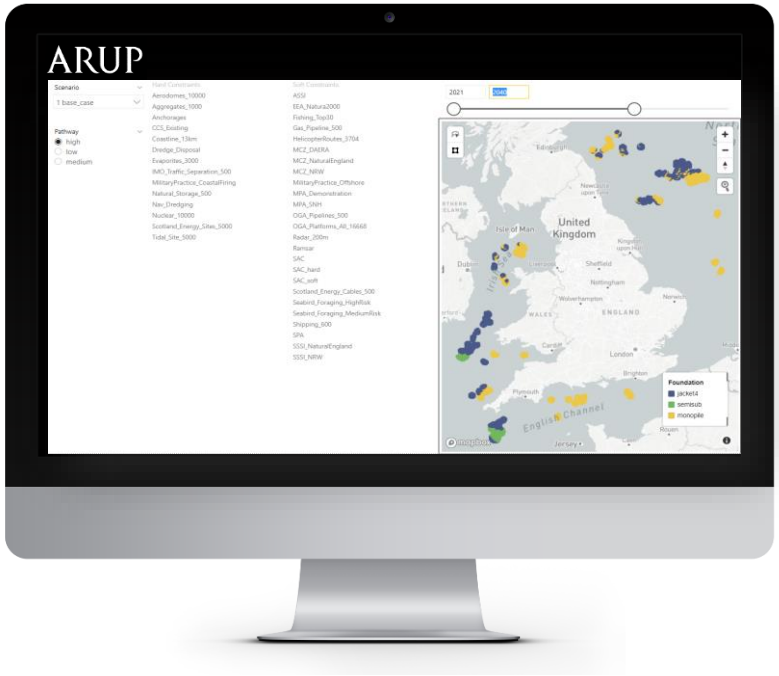

Data driven approach to assess multiple scenarios & risks

Government Departments

Planning Agencies

Developers

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