

Energy Storage

Ørsted activities and ambitions

Ørsted

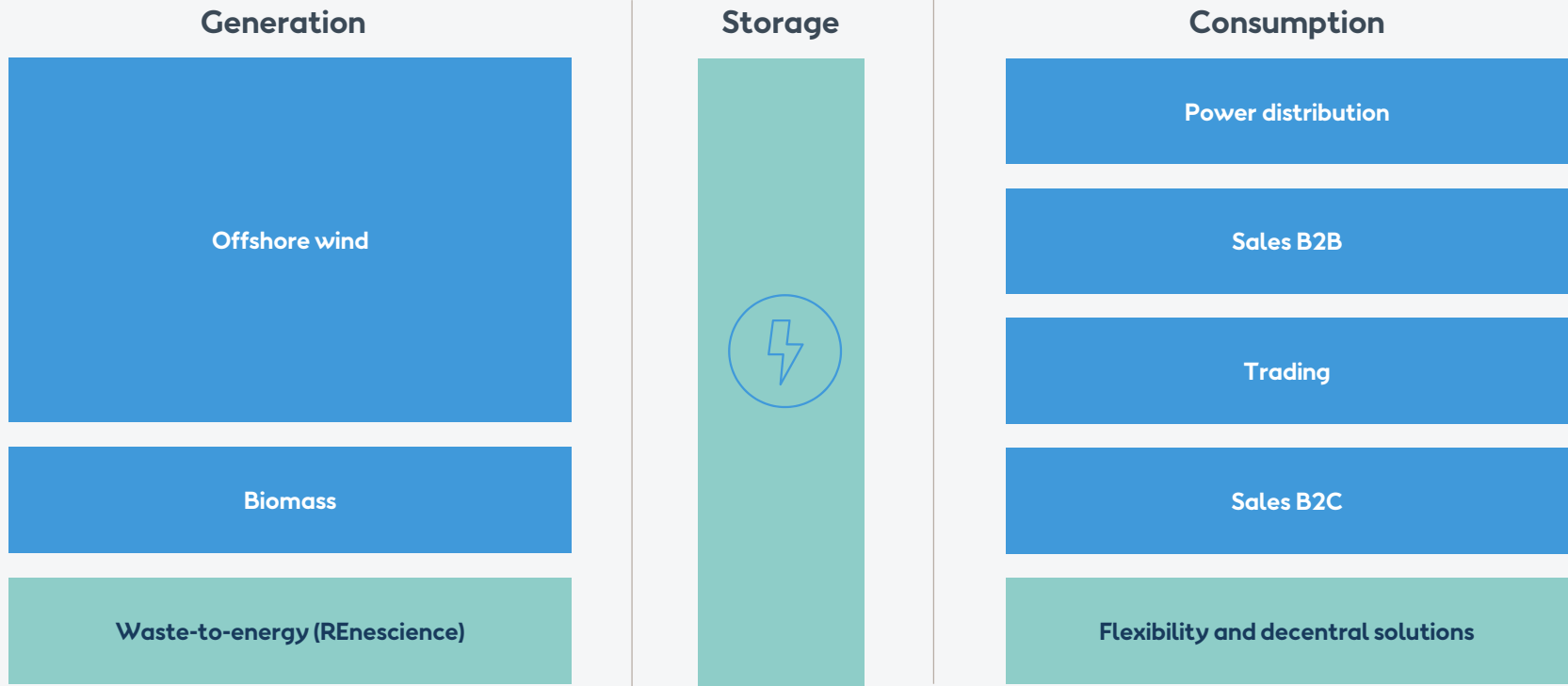
Energy Storage & Solar
21 March 2018





Let's create a world run
entirely on green energy

Ørsted has made the strategic choice to engage in energy storage

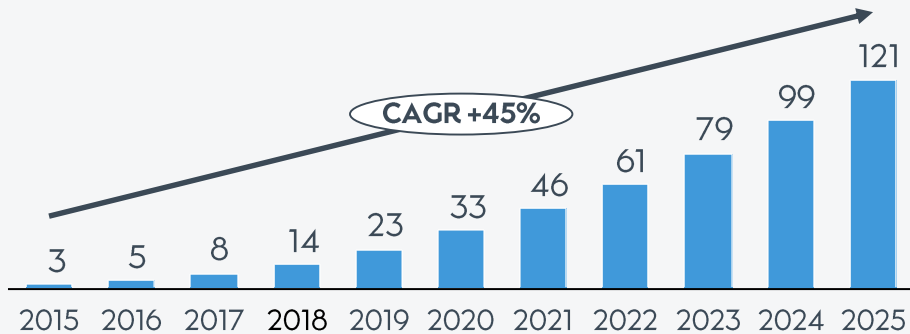


■ Established position ■ Proving the formula

Energy storage displays key indicators of an industry emerging

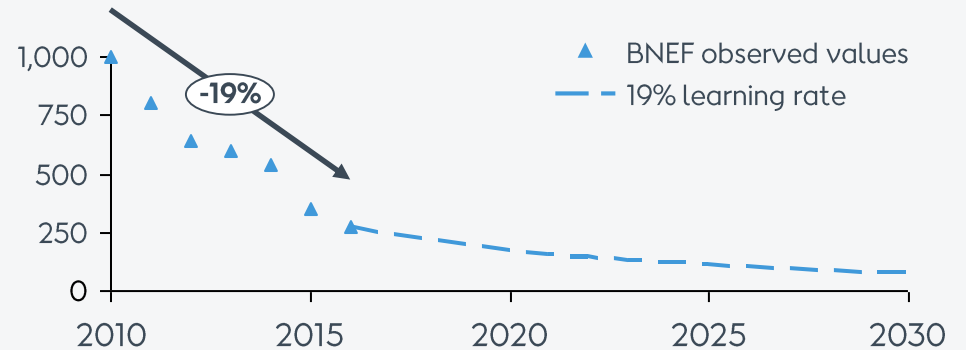
Energy storage expected to grow rapidly over the next decade

Cumulative storage deployment (GWh)¹



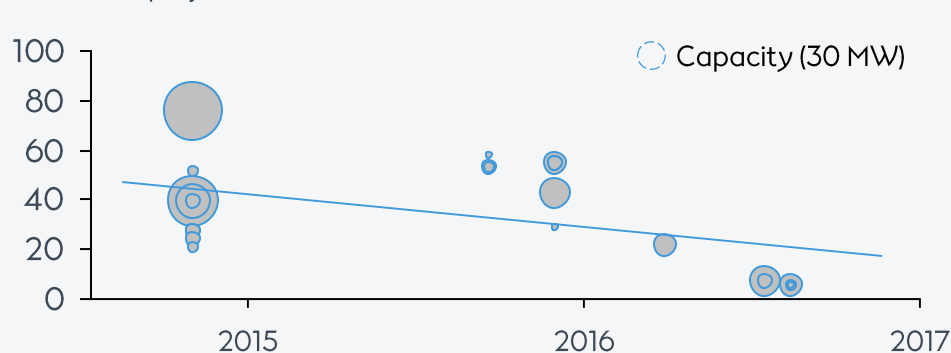
Rapid cost declines within battery technology

Lithium-ion battery pack prices (\$/kWh)



Significant reductions in time to market

Time from project announcement to CoD (months)²



Industrial players are increasingly offering energy storage solutions

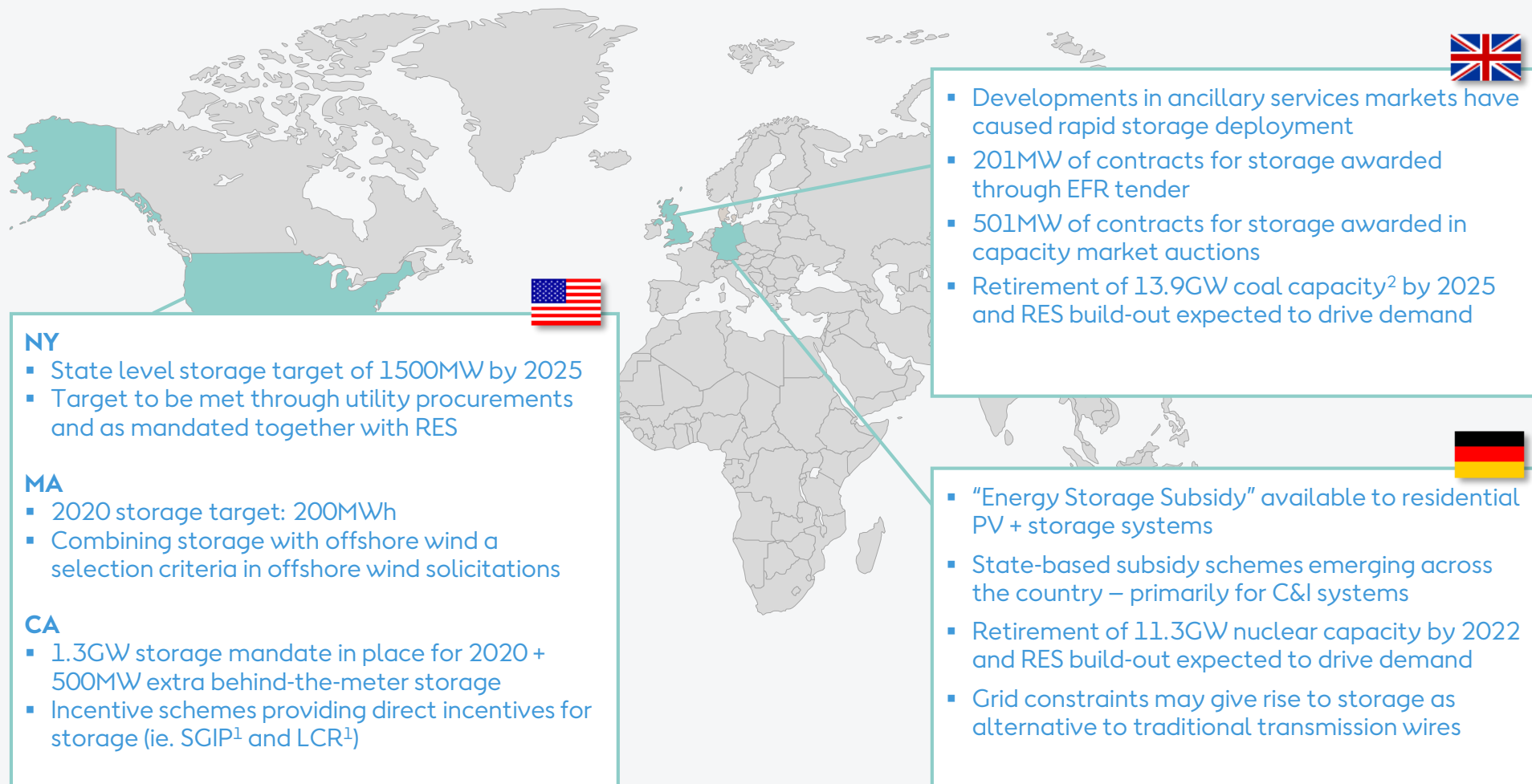


Source: IHS grid connected energy storage market tracker – H1 2017 (2017); BNEF Bottom up cost scenarios for lithium-ion batteries (2017), BNEF Aliso Canyon leak: energy storage and demand response (2016), press searches

1. Technologies included are batteries, flywheels and small-scale compressed air solutions – practically all capacity from batteries, with Li-Ion clearly dominating with 82% of global deployment

2. Energy storage projects procured by Californian utilities

A number of initiatives in our key markets show commitment to energy storage through regulatory initiatives and market design



Source: IHS grid connected energy storage market tracker – H1 2017 (2017), GTRM US Energy storage monitor (2016), Department for Business, Energy & Industrial

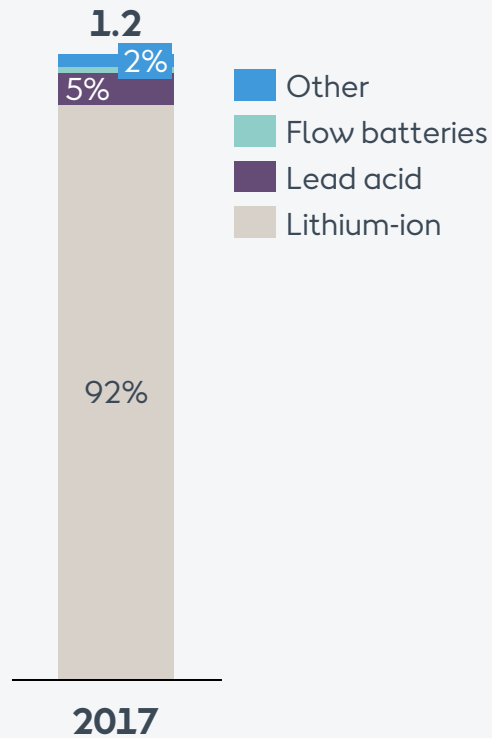
Strategy coal generation in Great Britain (2016), European Nuclear Society

1. Self-Generation Incentive Program

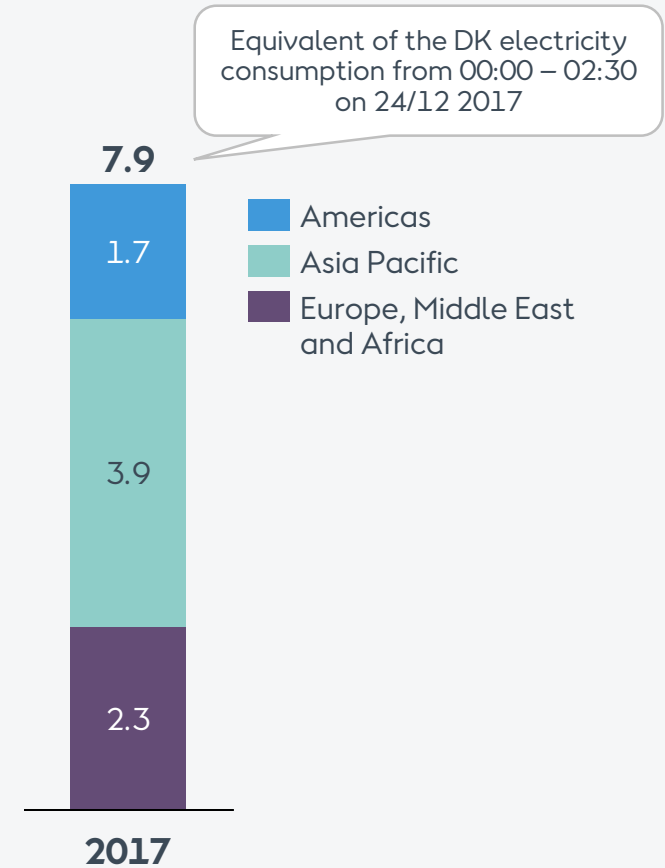
2. UK Government plan on closing down all unabated coal capacity by 2025

...however, energy storage is still at an emerging stage

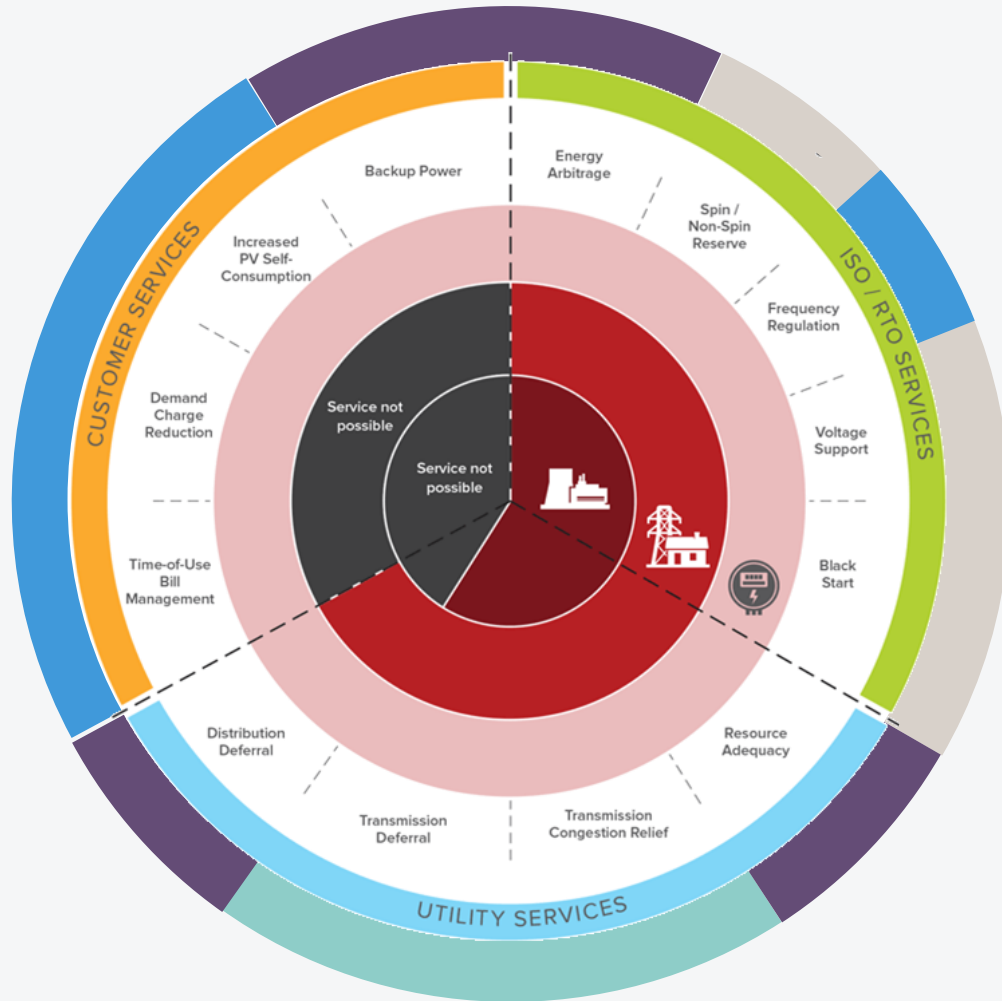
Global annual energy storage deployment¹
GW



Global cumulative installed storage capacity¹
GWh



The relevant storage use case varies from market to market



Timing of use cases as primary market drivers

-  Phase I
-  Phase II
-  Phase III
-  Phase IV

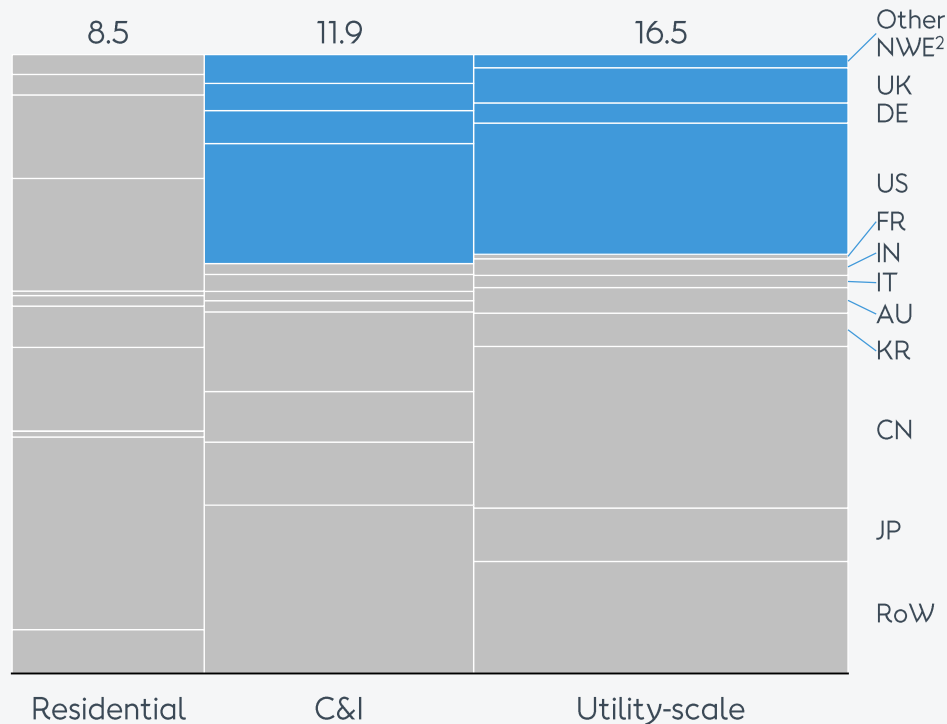
Transmission
 Distribution
 Behind-the-Meter

Ørsted will focus on utility-scale and C&I segments across NWE and the US – a USD 9.3bn investment opportunity through 2025

■ Target markets and segments

Global cumulative investments in energy storage estimated to exceed USD 35bn until 2025, amounting to USD 9.3bn in target markets and segments

Global energy storage market size, 2017-2025 (USDbn)¹



Target market selection rationale

- Utility-scale**
 - ✓ Largest near term energy storage segment
 - ✓ Fits well with Ørsted's experience in large assets
- C&I**
 - ✓ Largest medium term energy storage segment
 - ✓ Fits B2B customer experience and channels
- NWE**
 - ✓ Make up 12% of utility-scale and C&I markets
 - ✓ Good fit with Ørsted's footprint
- US**
 - ✓ Largest energy storage market globally
 - ✓ Fits Ørsted's emerging US footprint

Source: IHS grid connected energy storage market tracker – H1 2017 (2017); BNEF Global energy storage forecast 2016-24 part 2 (2016)

- IHS does not split the BTM market size between residential and C&I – value split has been based on the capacity split. Site specific costs are not included in the investment figure. These include installation, land, permitting, etc. and typically add ~25% on top
- Other Northwestern Europe includes Denmark, the Netherlands, Norway, Sweden, Finland, Estonia, Lithuania, Latvia, Austria, Belgium, Ireland and Luxembourg. Note that IHS does not split up Europe more than in DE, UK, IT and FR. Relative split of different EU regions from BNEF used to split the IHS "Rest of Europe" category





Our regulated distribution company Radius is demonstrating the impact of storage together with local universities and industry



Facts

- **Project:** Nordhavn Battery System
- **Location:** Nordhavn, Copenhagen
- **Start date:** Commissioned in Jan-17
- **Technology:** Lithium-ion
- **Size:** 630 kW / 460 kWh. Capable of meeting the electricity demand of 60 households for 24 hours
- **Partners:** ABB, Radius, Technical University of Denmark (DTU)

Application

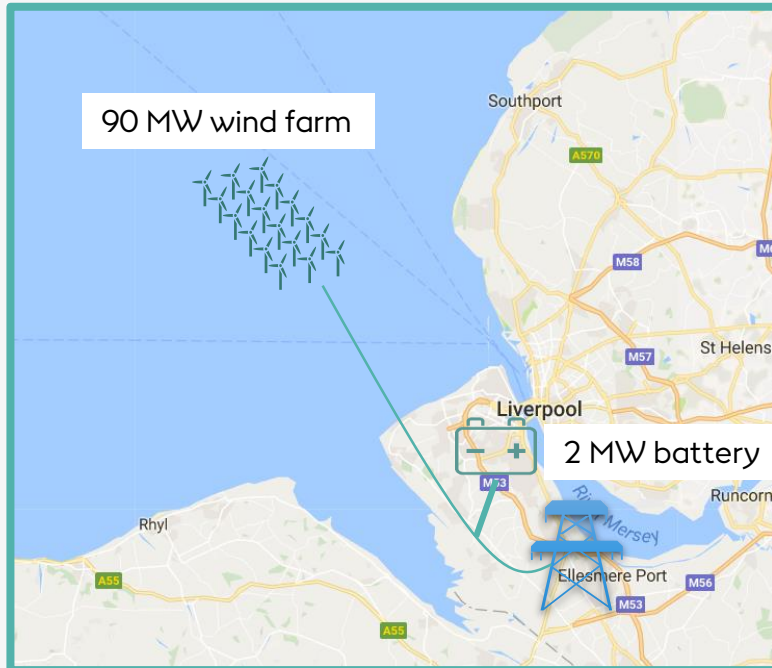
-  Defer conventional grid investments
-  Participate in ancillary services markets

Project objectives

-  Test latest technology in energy storage in realistic environment
-  Demonstrate control protocols and business models for an energy storage for both distribution and commercial purposes
-  Obtain data to discuss and recommend best possible regulatory landscape for energy storage in the distribution network





Through the World's first storage-offshore wind connection, Ørsted has experience in integrating storage and renewables





Facts

- Project: Storage at Burbo Bank Offshore Wind Farm
- Location: Liverpool, UK
- Technology: Lithium-ion
- Partners: ABB

Application

-  Deliver frequency response to the grid, helping National Grid maintain grid frequency of 50 Hz
-  Reduce potential imbalance charges – penalties for inaccurately forecasting demand and supply

Ørsted objectives

-  Improve knowledge on frequency response solutions
-  Test battery integration with offshore wind

90 MW
wind farm



2MW /2MWh
battery system



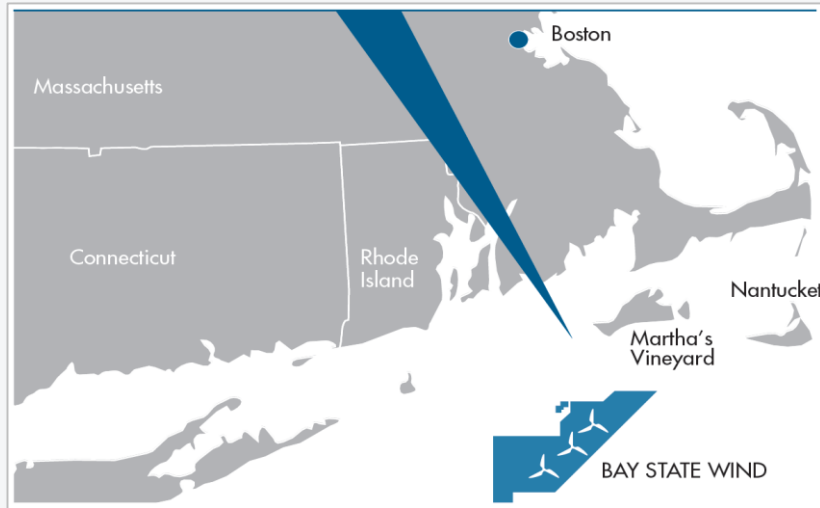
Onshore
substation





As part of plans to develop offshore wind in USA, a letter of intent has been signed to build one of world's largest storage facilities

Ørsted has bid to build ~800MW offshore wind in Massachusetts



- Massachusetts has set 1.6GW offshore wind target by 2023
- Ørsted is bidding in the Bay State Wind project together with New England utility Eversource
- Winning bidders will be announced in H1 2018

Bid includes proposal to build one of the world's largest storage facilities

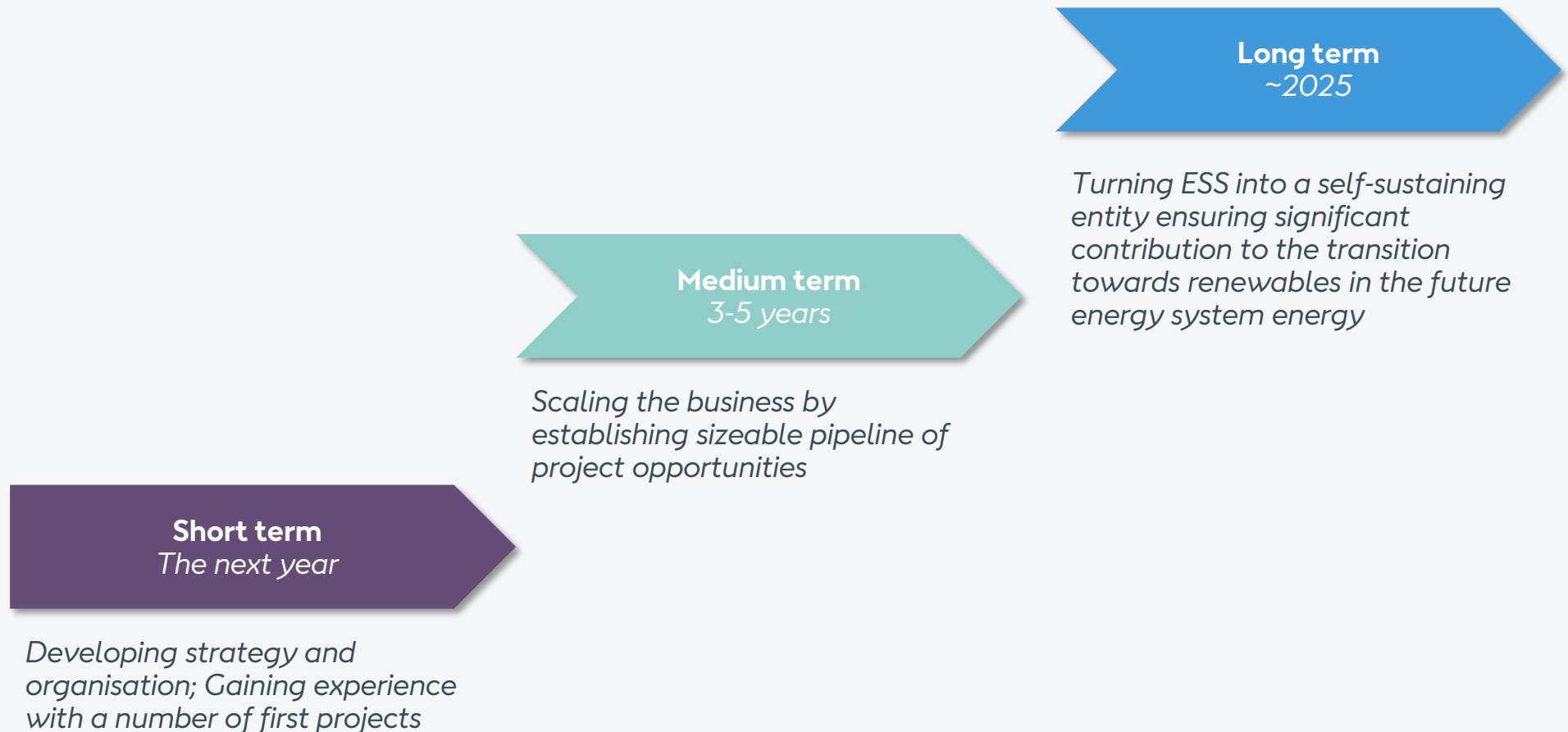
- A battery storage system of 55MW / 110MWh has been proposed as part of the wind farm
- Ørsted and Eversource has signed letter of intent with NEC Energy Solutions to supply the storage system

EVERSOURCE

Ørsted

NEC
NEC ENERGY SOLUTIONS

Long term ambition is to achieve a sizeable business impact for Ørsted



Q&A

