



Statoil

Batwind



*Status, markeder og muligheter for
storskala energilagring*

27 September Bellona & CEDREN

Our strategy

SHORT TERM



Faster and deeper cost reductions

- Strict financial discipline
- Capturing the upturn in oil and gas prices

MEDIUM TERM



Build the next generation portfolio

- Maximizing value and seek opportunities
- Build renewables portfolio consistently towards a material scale

LONG TERM

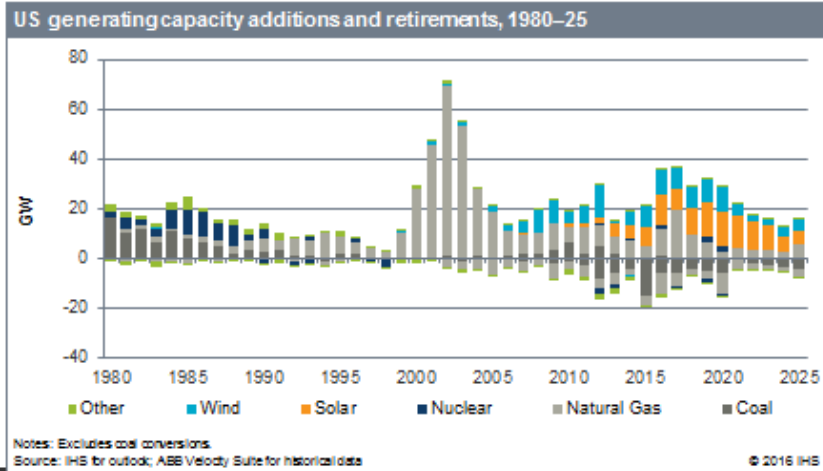


Provide energy for a low-carbon future

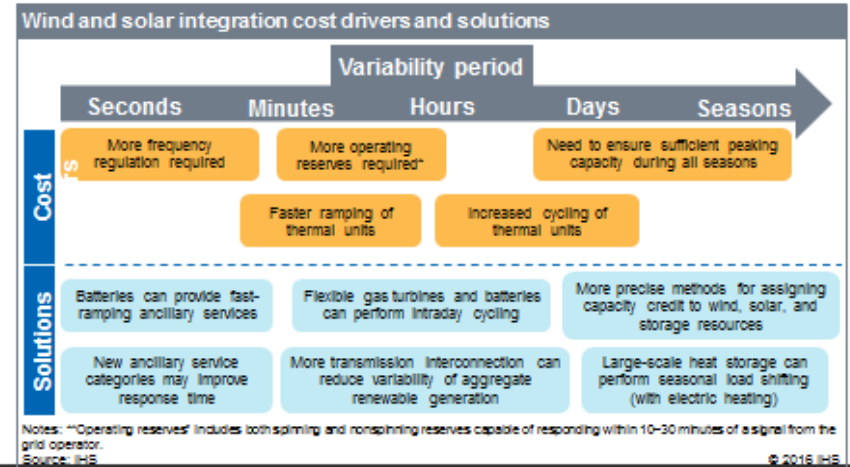
- A resilient upstream portfolio
- A material renewable energy portfolio



Wind and solar will dominate US capacity additions over the next 10 years

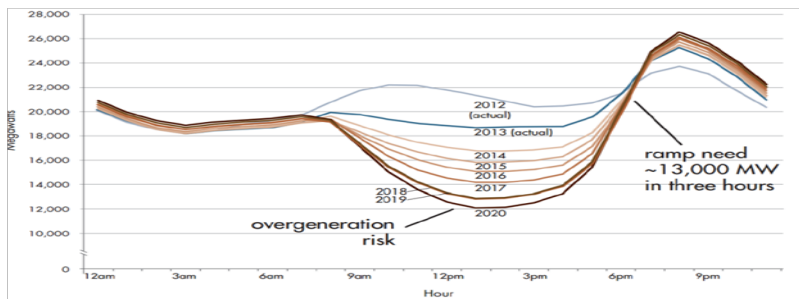


Integration cost drivers and solutions



The Duck Curve**

Lack of flexibility, ramping issues and curtailment



To summarise:

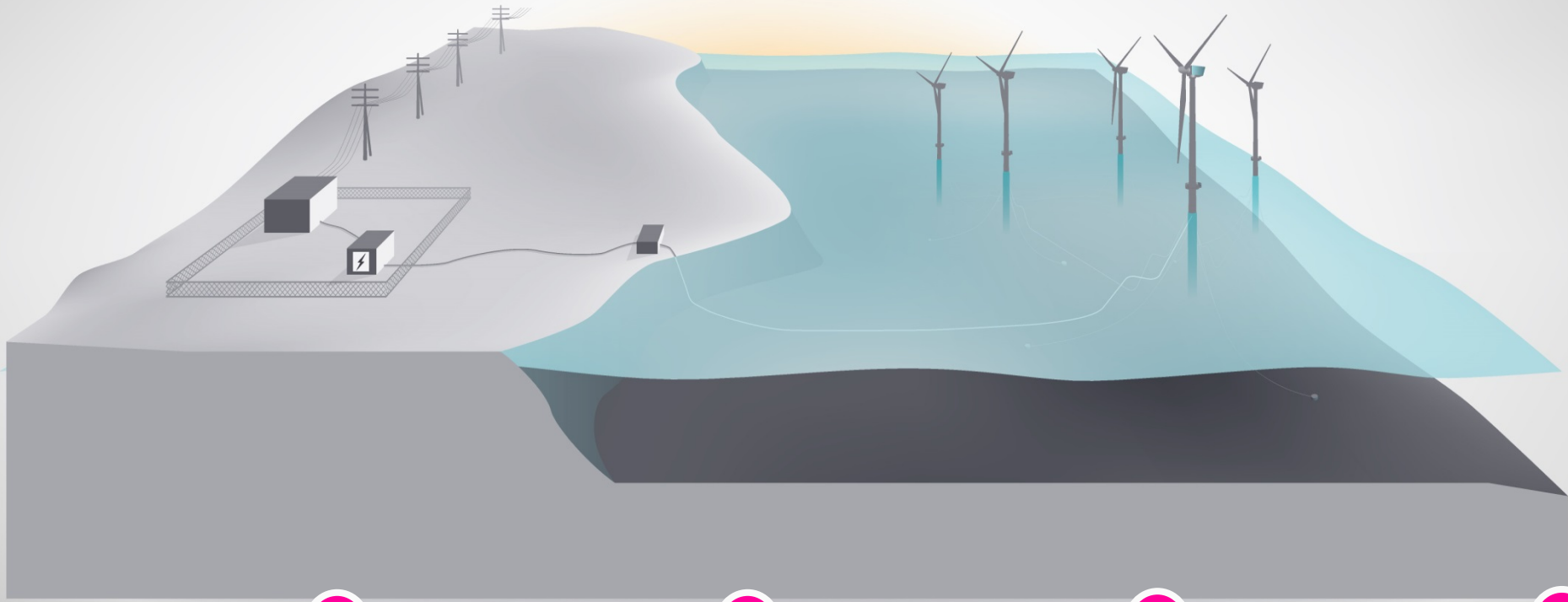
1. Transmission and integration hurdles will become increasingly important to the value proposition of wind and solar.
2. Peaking capacity and ancillary services compensation will become even more critical for markets to function effectively.
3. Longstanding retail rate structures will be challenged by distributed solar and storage.
4. Opportunities are being created for new “flexible” resources, including batteries and end-user energy services.

** Impact of high PV and Wind penetration on loads, CAISO example, NREL

Piloting Batwind concept @ Hywind Scotland

Floating Wind + Storage + Grid

- ✓ *Increase the value of floating wind*
- ✓ *Start developing new business models around storage*



1
Capture wind overshoots

Ability to store excess electricity for sale when capacity is free

2
Reduce balancing cost

Introduce own regulation of power supply

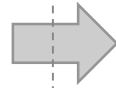
3
Increase power market value

Capture price peaks through arbitrage

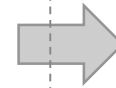
4
Deliver system services

Provide frequency regulation and other system services

Pilot



Scale-up



Wider application

build – measure –learn

next commercial applications

build new business models

Piloting Batwind concept @ Hywind Scotland

- Battery and converter as integrated part of Hywind project
- = 1 MWh storage capacity in pilot

- 1** Capture wind overshoots
Ability to store excess electricity for sale when capacity is free
- 2** Reduce balancing cost
Introduce own regulation of power supply
- 3** Increase power market value
Capture price peaks through arbitrage
- 4** Deliver system services
Provide frequency regulation and other system services

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Practical testing of:
Value drivers and Business Models
Operations and technology
Market drivers and regulatory

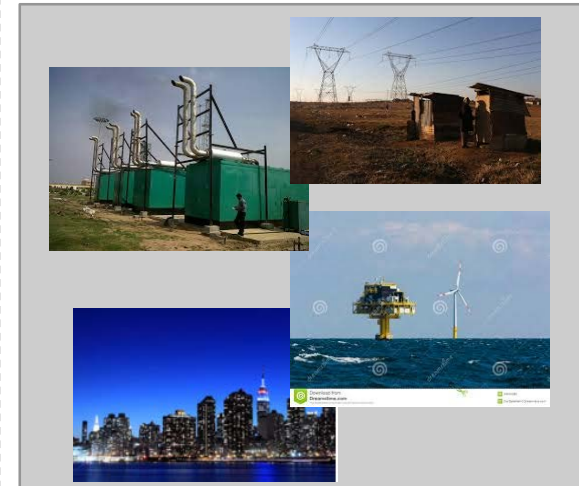


XBatwind:

Full scale implementation at XXXDeploy
 50-100 MWh of storage at overplanted

HyBatwind:

A 6 MW Hywind turbine is furnace with ~1 MWh battery

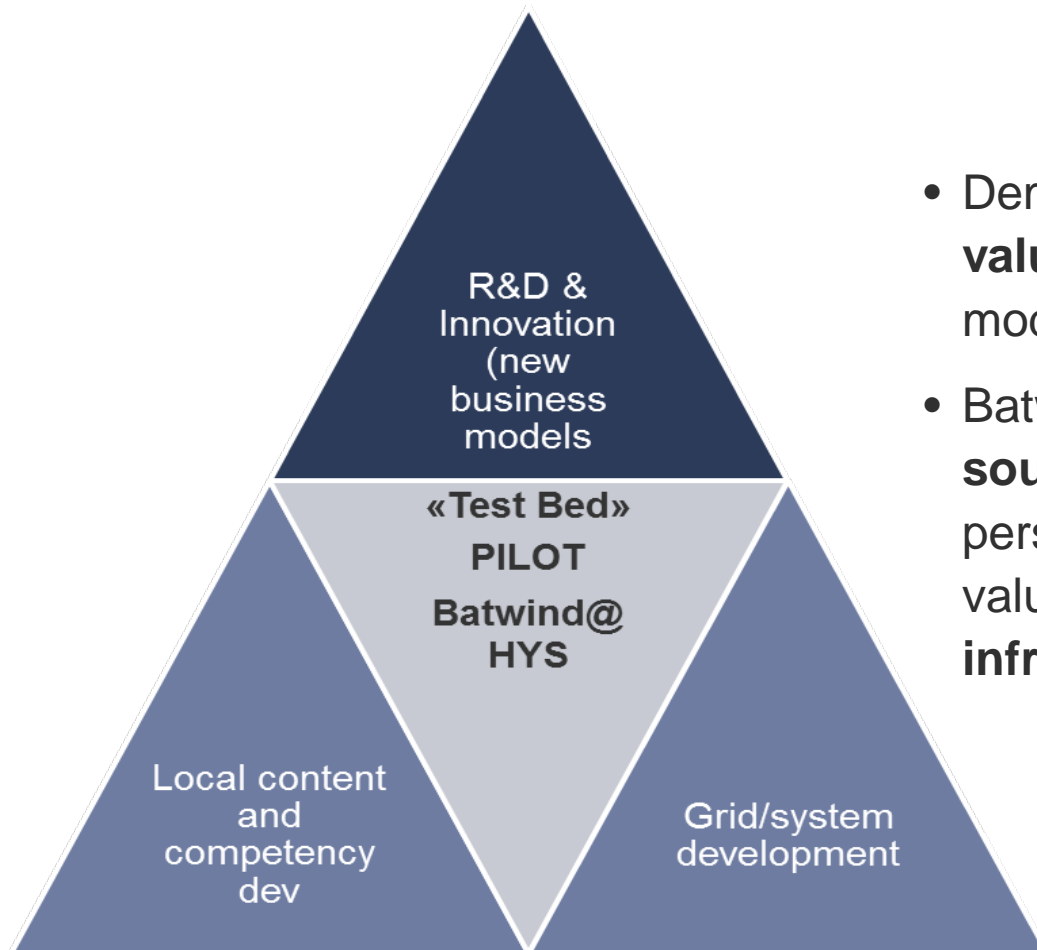


Weak grid
Diesel Competition
Offshore Storage
 «Gotham City»

Why Batwind?

Batwind distinguish from most other battery + grid projects by:

- Demonstrating and qualify a **wider range of value drivers**, technology and business models for storage.
- Batwind encompasses **both the energy sources** (wind farm) – **and system** (grid) perspective. This combination will drive value for **consumers**, the **industry** and **infrastructure owner/regulator**.



Operational Modes

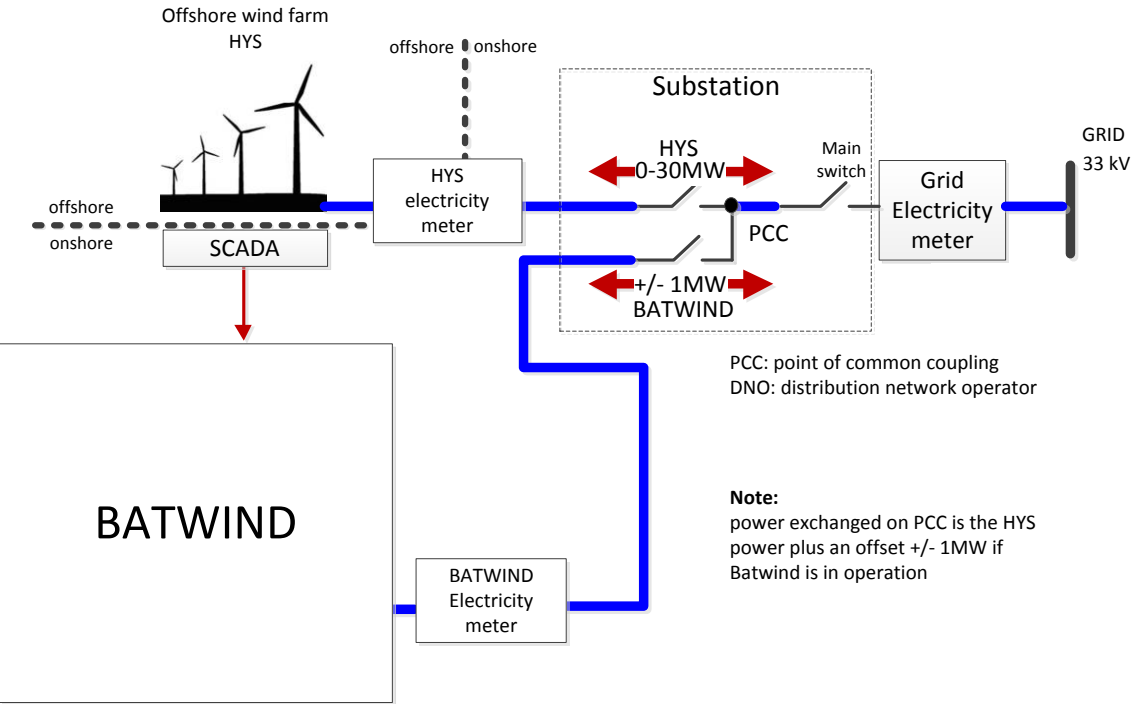
Market data, real time production, user input, Wind forecast

Batwind algorithm

- Arbitrage
- Balancing
- Testing
- Smoothing
- System services

Charge / Discharge

BATWIND



PCC: point of common coupling
DNO: distribution network operator

Note:
power exchanged on PCC is the HYS power plus an offset +/- 1MW if Batwind is in operation

BATWIND

- Data communication
- AC power
- DC power

Statoil. The Power of Possible

Presentation title

Presenters name/title, etc

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