Offshore Wind

Battery Energy Storage System

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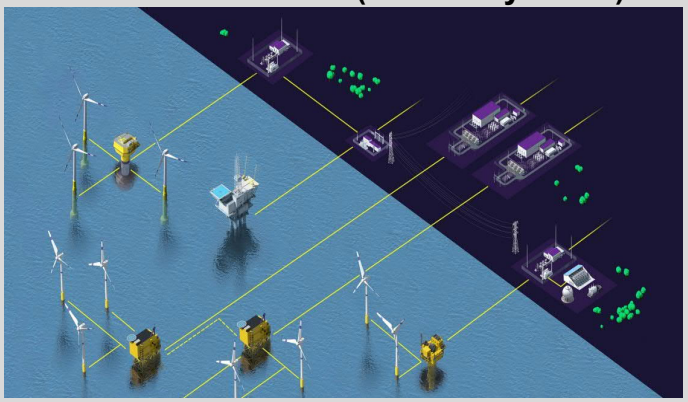
Offshore Wind: Typical Grids

Offshore Windfarms (Electricity or H2)



Possible challenges
- Grid stability
- Capacity Firming
- FR & VC
- Black start
- Ramping flexibility
- System balancing (Generation)

Possible opportunities
- Investment deferral
- Arbitrage

Offshore Wind: O&G decarb or non-grid connected island

Possible challenges
- Grid stability
- Black start
- System balancing (Generation)

Possible opportunities
- OPeX decrease
- CO2 emission lowering
- Investment deferral

Challenges
- IMO requirements
- OPeX decrease
- Reliability, Availability and Safety

Opportunities
- Green profile
- Preferred supplier in the offshore renewable

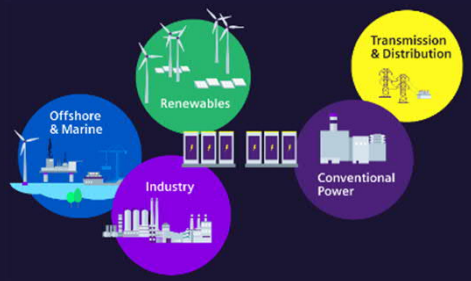
Offshore Wind vessels

Our Storage Offerings
Portfolio Overview

Storage

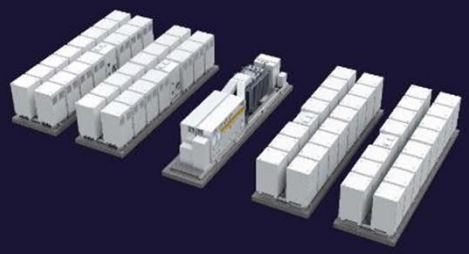
Storage capabilities

- Offer turnkey solutions for battery energy storage systems (BESS), including system design and grid integration
- Additionally provide I&C delivery, performance monitoring software as well as service concepts



Grid-connected solutions

Provide modular and scalable grid connected BESS for various use cases, such as grid balancing, peak shaving, capacity firming, provision of backup power and grid stability improvement.

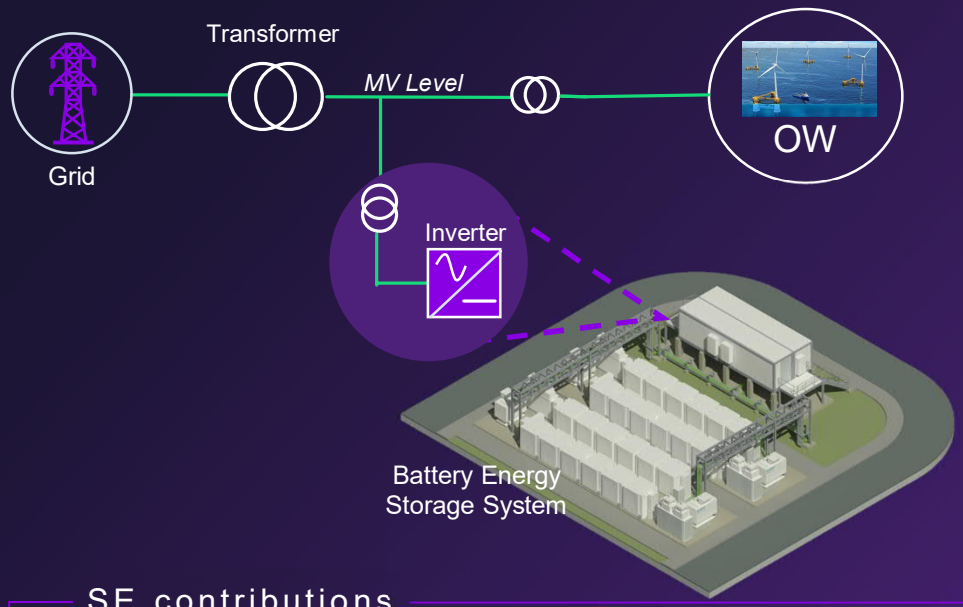


Short time solutions

- Offer storage solutions for off-grid applications offshore or onshore locations
  with high requirements for safety and reliability
- Improve the security of energy supply

Visit the website

BESS + Offshore Wind



SE contributions

+ Transformer
+ I&C Integration
+ Power Control Centre (MV)
+ Cabling / Steelwork
+ Electrical Integration
+ Erection & Commissioning
+ Project execution
+ System design
+ Storage Integration Engineering
+ Integration into customer infrastructure
+ HV connection

[1] Trademark needs to be defined

Improvements of

Environment | Flexibility | Availability | Revenue

Benefits

- Extend plant capability and flexibility – Avoid curtailment
- Capacity firming – Enable discharge in time no wind/sun is available / avoid drops during no wind or clouds
- Capacity payment – Participate in capacity/ grid service market

Typical Power / Capacity – Losses & Duration

- Power: 2 – 100MW (up to >500MW)
- Capacity: 2 – 400MWh (up to >1000MWh)
- Standby Losses: ~ 1% / month
- Discharge Duration: Typically 1 - 4h

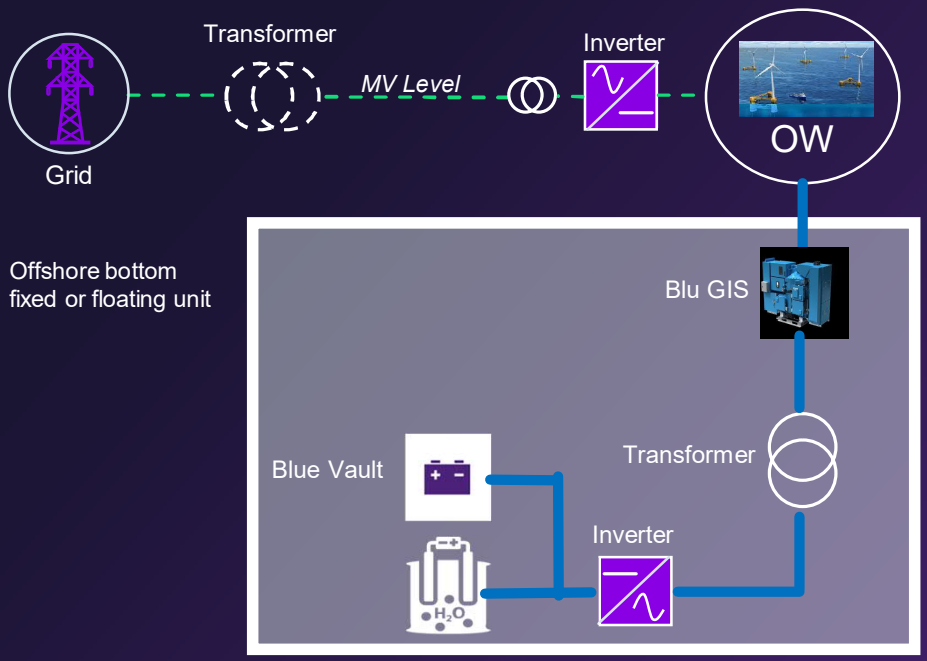
Typical footprint

- 1MWh ~ 25 - 50m² (ground level arrangement)
- 1MWh ~ 12 - 25m² (multi-level arrangement)

Typical project lead time

- 12 – 18 months depending by the battery technology and size

BlueWind for H2 in Offshore Wind



Battery Energy Storage System

SE contributions

+ Transformers
+ I&C Integration
+ Blue GIS
+ Cabling / Steelwork
+ Electrical Integration
+ Erection & Commissioning
+ Project execution
+ System design
+ Storage Integration Engineering
+ Integration into customer infrastructure
+ HV connection

[1] Trademark needs to be defined

Improvements of

Environment | Flexibility | Availability | Revenue

Benefits

- Capacity firming – Enable electrolyser working in stable conditions also with wind fluctuations
- Capacity payment – Increase H2-production
- High safety requirements for working in areas with H2
- Marine & Offshore class approved BESS
- Fast response and high charge/discharge rate

Typical Power / Capacity – Losses & Duration

- Power: 50 – 500MW
- Capacity: 1 – 10MWh (up to >100MWh)
- Discharge Duration: Typically up to 1h

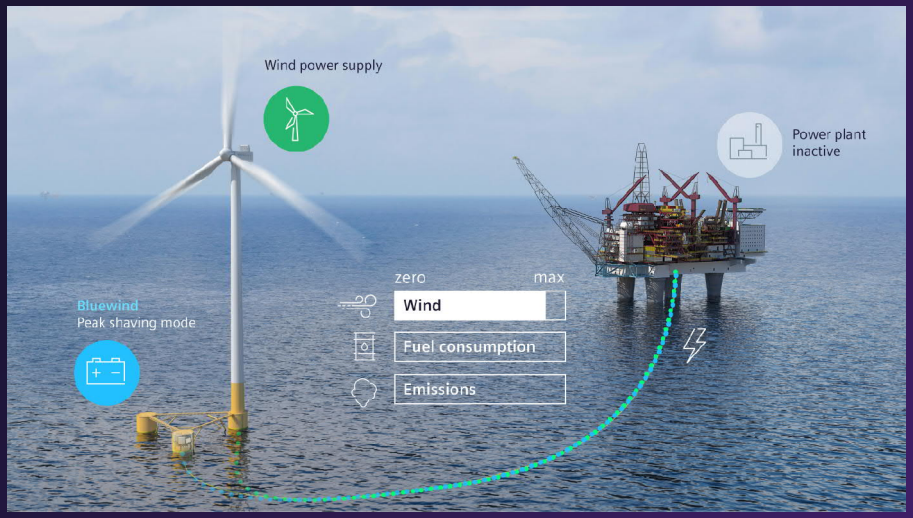
Typical footprint

- 2MWh ~ 40” container including PCS and up to 33kV transformer (ground level arrangement)

Typical project lead time

- 12 – 15 months depending by the size

BlueWind for Off-grid: Decarbonization and electrification of existing O&G assets or islands not connected to Grid



BlueWind The next generation of the offshore wind microgrid enabling decarbonization (up to 70%) and electrification (up to 55%) of O&G assets when connected to Offshore Wind

Key Features

- **Standard solution. TRL = 7**
- **Easy interface. No need for modification on the O&G asset**
- **Increased Efficiency**
- **Blackout Prevention**
- **Grid and Frequency Stability**
- **Remote Condition & Performance Monitoring**

Operational Benefits

- **Up to 70% emissions reduction**
- **45% - 55% electrification of the O&G asset**
- **High charge/discharge rate fit for space constraint plants**
- **Significant OPEX reduction (fuel and maintenance cost savings)**
- **Increased revenue**
- **Increased powerplant reliability**
- **Increased safety and HSE (less noise and vibrations)**

Siemens Energy / Offshore Wind farm related vessels references

Esvagt
Europe's largest SOV operator

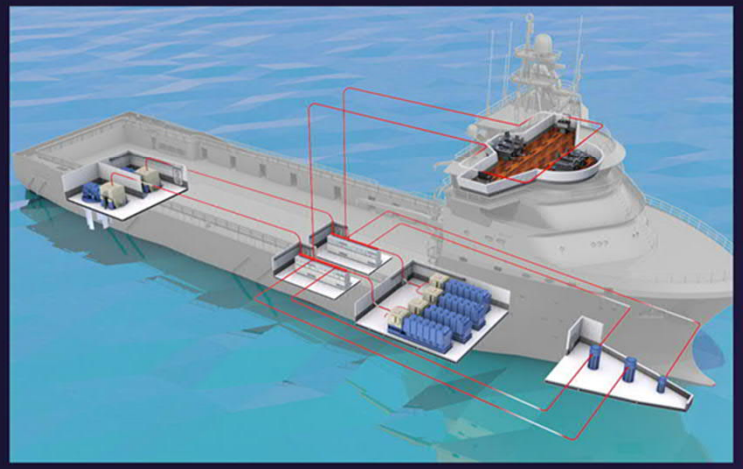
SIEMENS energy

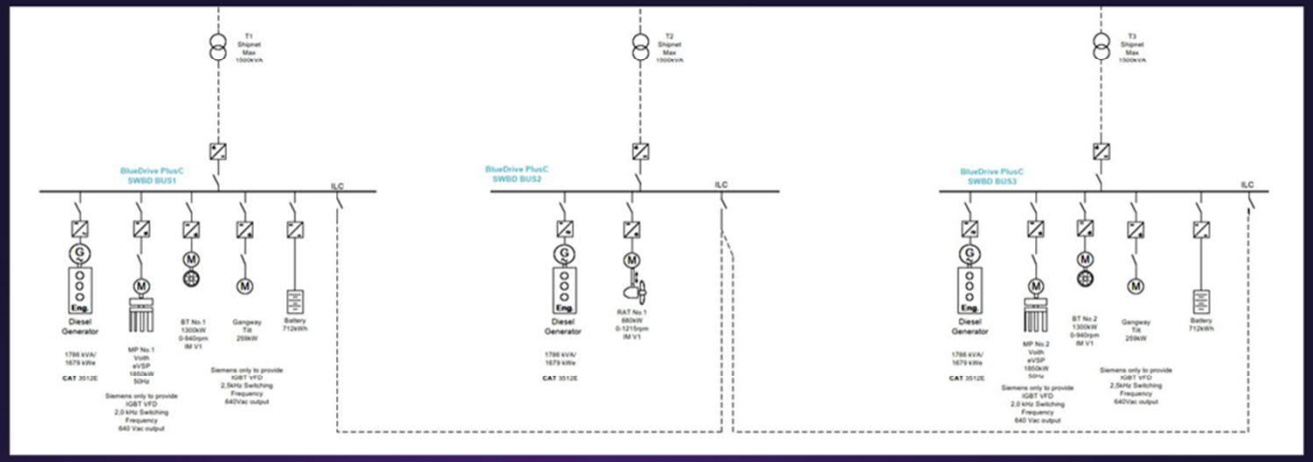
Edda Wind
New build program – 12 Vessels
all vessel`s built ZE ready (H_2/LOHC)

SIEMENS energy

Bernhard Schulte – Two (2) SOVs
- Ordered 2016 for operation in Gemini and Sandbank offshore wind farms

Siemens Energy / Scope of Supply
BlueDrive PlusC/BlueVault – Hybrid Power plant with DC distribution





Fuel and environmentally friendly solution

- ✓ Only one(1) variable speed genset in operation during w2w operation
- ✓ Battery system to handle Peak Shaving and Spinning Reserve
- ✓ Siemens Energy SOVs daily fuel consumption in wind park 3-5 ton MGO
- ✓ Standard for SOVs daily fuel consumption 8-10 ton MGO