Increasing penetration of offshore wind power generation

2022-06-28

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Technology outlook – Offshore Wind Connections

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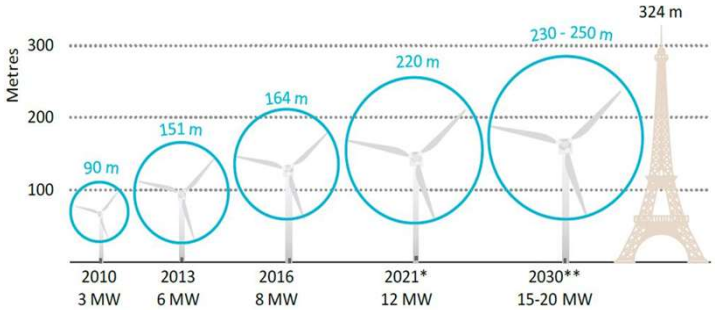
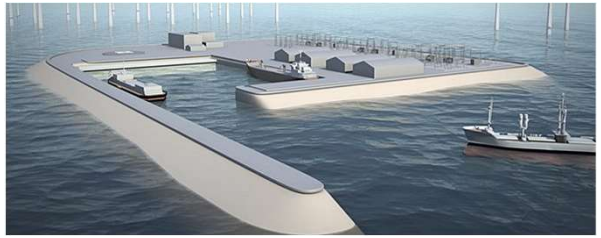
- **Wind Turbine Generators (WTGs) increasing in size towards 15-20 MW**
- **Collection grid voltage 66 kV => 110/ 132 kV**
- **2 GW HVDC Links**
  - Driven by economy of scale
  - 525 kV Bipolar solutions
- **Design for customer standard platforms**
- **Offshore power hubs / Energy Islands**
- **Hybrid solutions (Interconnection + OWC)**
- **Meshed DC grid**
- **Mainland grid reinforcement**
- **Power 2X – Hydrogen**
- **Energy storage**
- **Floating wind farms**





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The future of offshore wind

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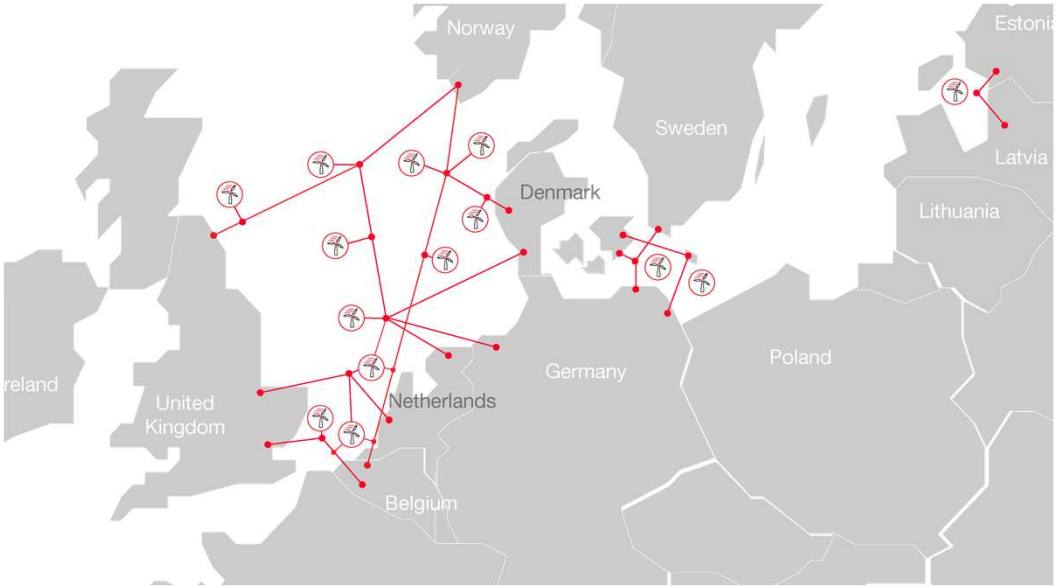
Offshore wind farms will evolve: Point-to-Point – Energy HUB – MPI – Meshed grid

- Accelerate deployment of offshore wind and enable efficient integration and exchange of renewables in line with European goals
- Increased security of supply across Europe
- Allows higher utilization of infrastructure
- Strengthens European energy markets



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Offshore DC technology development

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HVDC technology is ready for the emerging offshore wind farm development

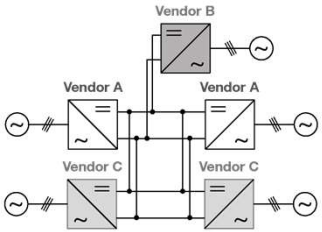
Multi-terminal

Ability to manage different DC lines from 1 station

TRL[1] level 8, HAPG demonstrated the technology

Multi-terminal ready and multi-terminal prepared

Project examples: NordBalt and Shetland



DC breaker

Ability to isolate fault current on DC mesh

TRL[1] level 7, HAPG demonstrated the technology

Demonstration in 2020: 350 kV, 20 kA power range

Demonstration as part of EU-funded PROMOTION

DC grid control and protection

Ability to supervise power flows across a DC meshed grid

TRL[1] level 6, HAPG active in CIGRE WG

Technology development of C&P algorithm done

Simulation part of DC grid program

HVDC GIS

Ability to isolate AC fault current on DC station

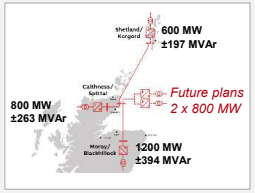
TRL[1] level 8, HAPG PGHV developing the technology

Type test on 320 kV

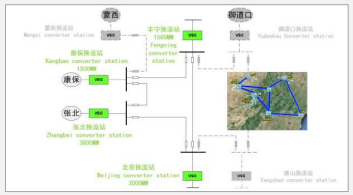
Test at KEMA as part of EU PROMOTION project

Real-world hybrids and DC grids

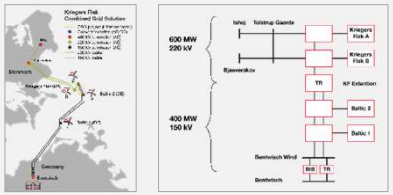
Caithness-Moray Shetlands grid



Zhangbei DC grid project



Kriegers Flak CGS



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Move to 525 kV to meet new capacity and efficiency requirement

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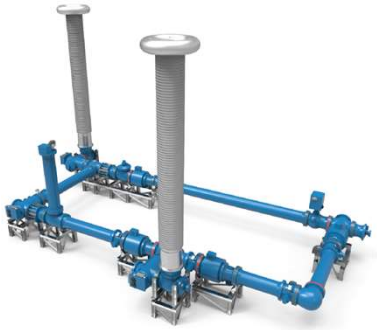
DC Breaker

- DC breaker at 350 kV reached TRL 7
- DC breaker at 525 kV development required
- New functions and compactness
- Ecofriendly SF6 free design



HVDC GIS

- HVDC GIS at 320 kV reached TRL 8
- HVDC GIS at 525 kV development required
- New functions and compactness
- Ecofriendly SF6 free design

R&D and manufacturing investment needed in Europe to deliver offshore wind deployment of the future

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Conclusive remarks

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- HVDC wind farm connections will evolve (Point-to-Point – Energy HUB – MPI – Meshed grid)
- Hitachi Energy has been, is, will be key active player in European industrial initiatives
- All concepts are in place, risk is manageable
- 525 kV DC breaker and HVDC GIS development required

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