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Offshore Wind Farms Europe 2010

by Hermann Koch

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Energy Sector

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Wind Farms in Europe

- Wind engines on land have reached high level
  – Germany: > 30 GW installed, > 10 GW delivered

- Next step in wind energy is: Offshore

- Offshore wind energy forecast in Europe:
  – 3 to 4 GW of offshore wind energy installed by 2010
  – 10 to 15 GW of offshore wind energy installed by 2015
  – 20 to 40 GW of offshore wind energy capacity operating in EU by 2020

- Europe looking to offshore wind energy to meet future renewable energy growth targets of 20% by 2020

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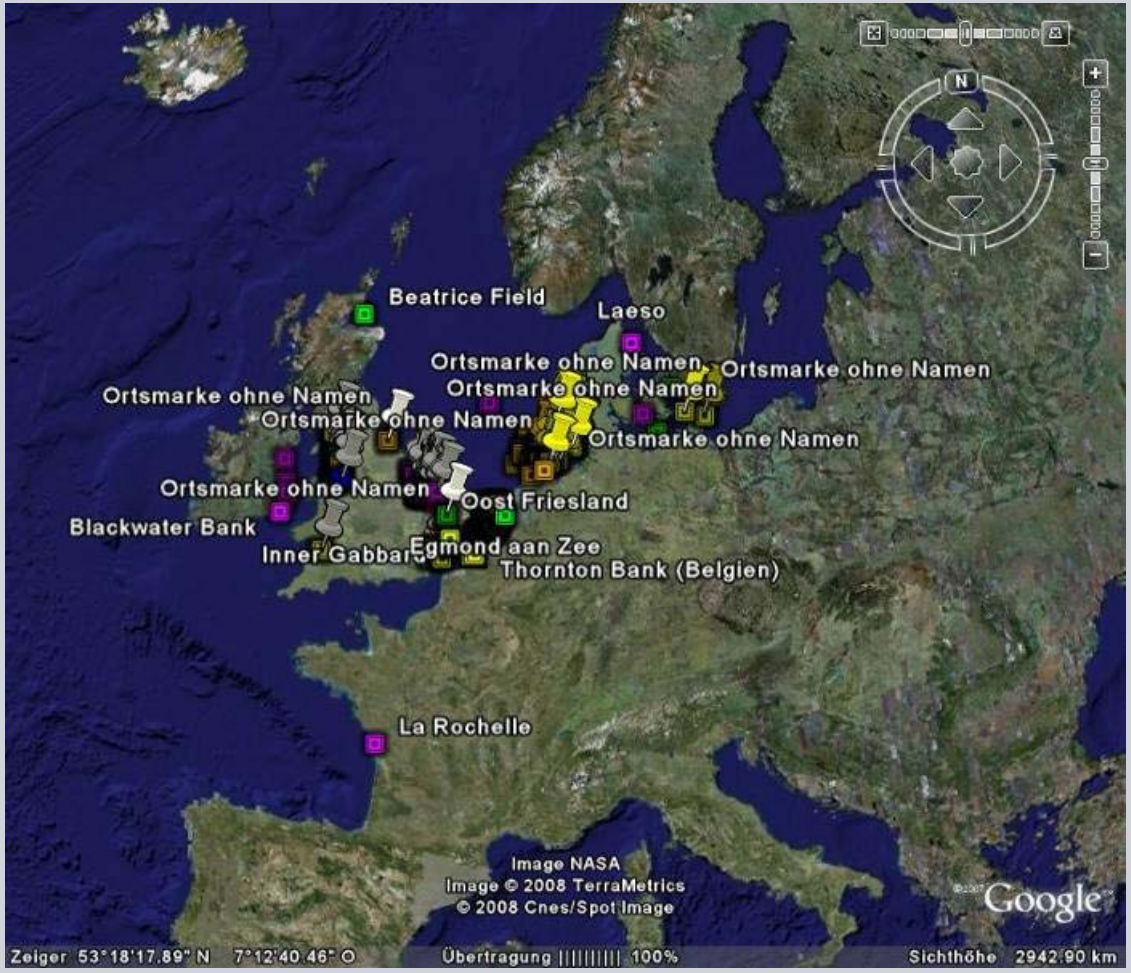
Offshore Wind Parks in Europe



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Offshore Wind Farms in Europe
Capital Spend Forecast 2008 - 2012

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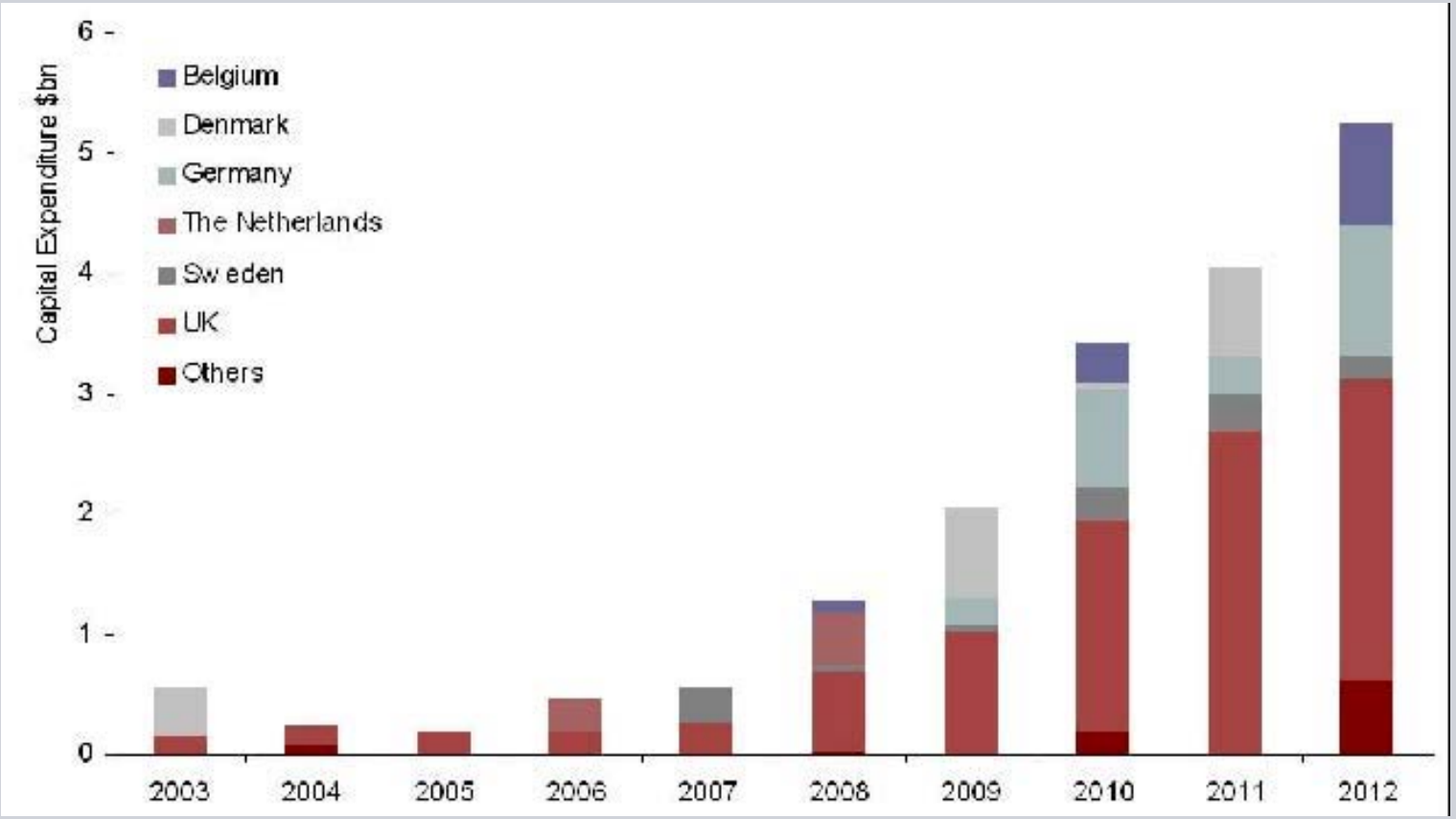

Douglass Westwood; The World Offshore Wind Report

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Offshore Wind Farms in Europe
Steps

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- First installations in Denmark: Horns Rev
  - close to the coast line and new wind park will come
- Germany: Alpha Ventus for research 5 MW in operation
  - more than 30 GW are planned
- UK Round 2 projects of large scale (> 500 MW) since 2009
  - far from coast line (20-50 km)
- UK Round 3 to be launched in 2010 with large scale (> 500 MW)
  - more far from coast line (up to 200 km)
- Netherlands starts large offshore wind parks (>500 MW) now
- Spain begins its offshore development in 2012 – 2015

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Project Description

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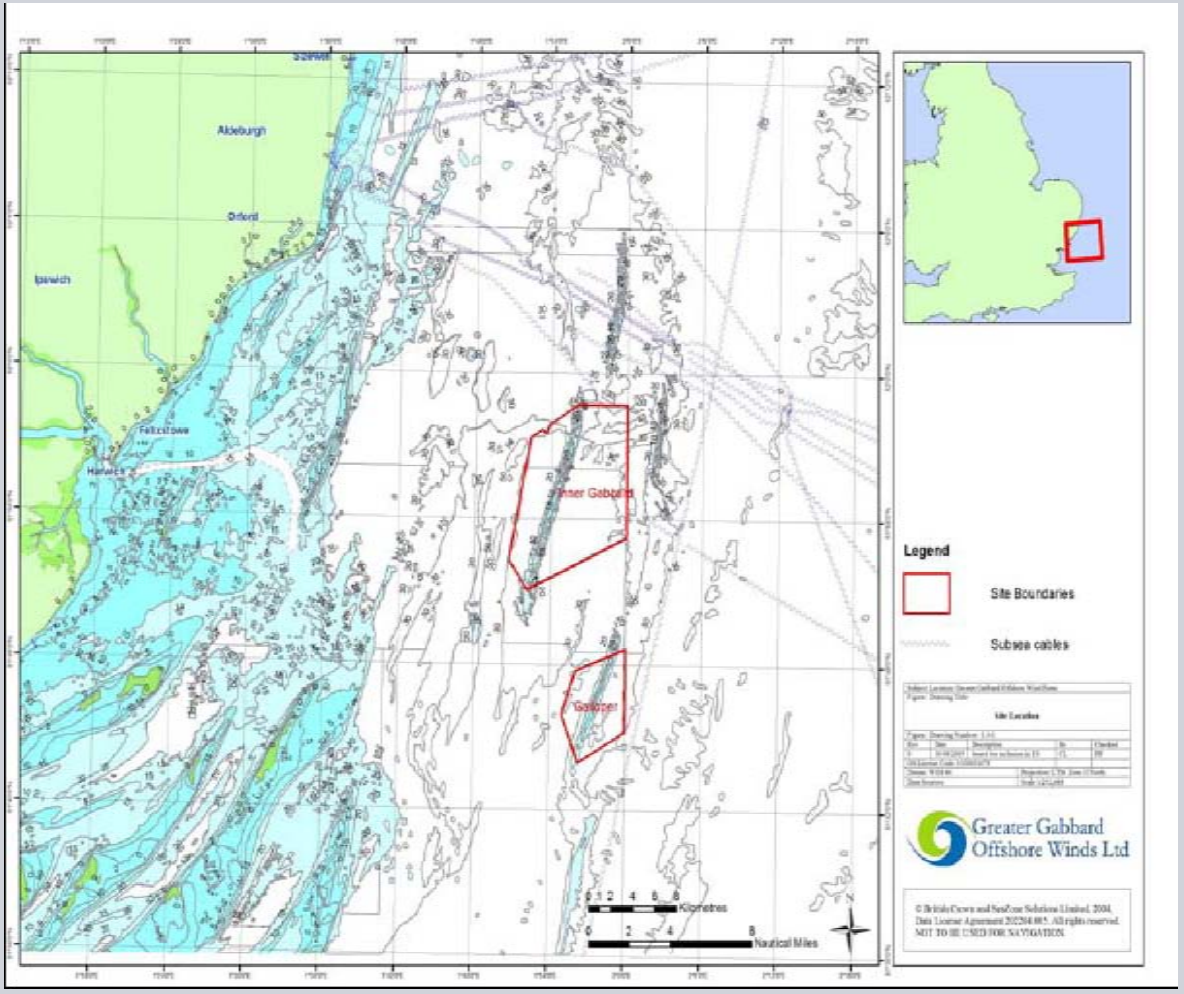
Project Description
- 500 MW Offshore Wind Farm Project
- Electricity output: 1.8TWh/yr
- 140 x 3.6 MW Siemens wind turbines

Project Site
- Outer Thames Estuary, U.K.
- 25 km offshore
- Site area = 147 km^2



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Site Layout

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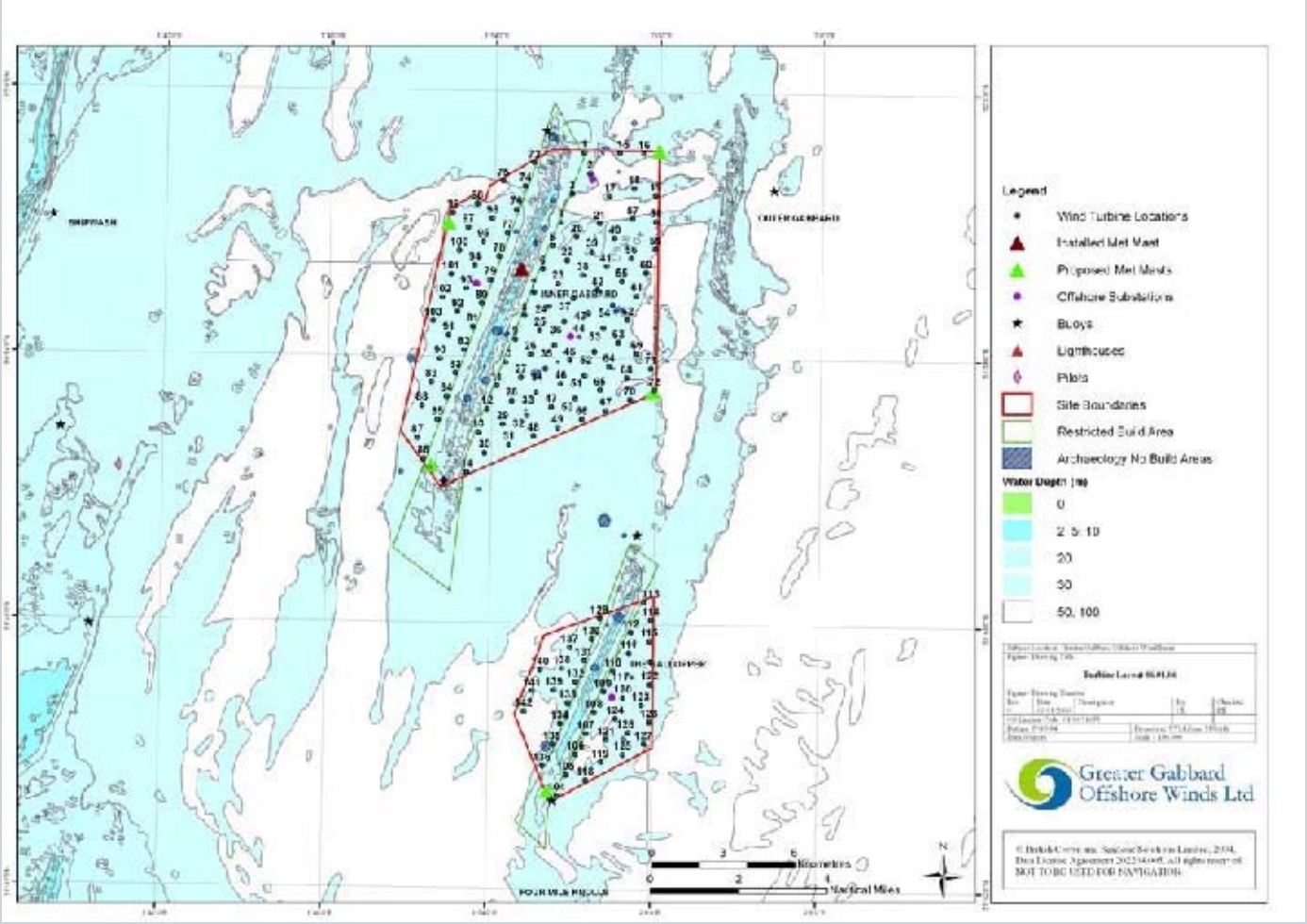

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- Cable Layout

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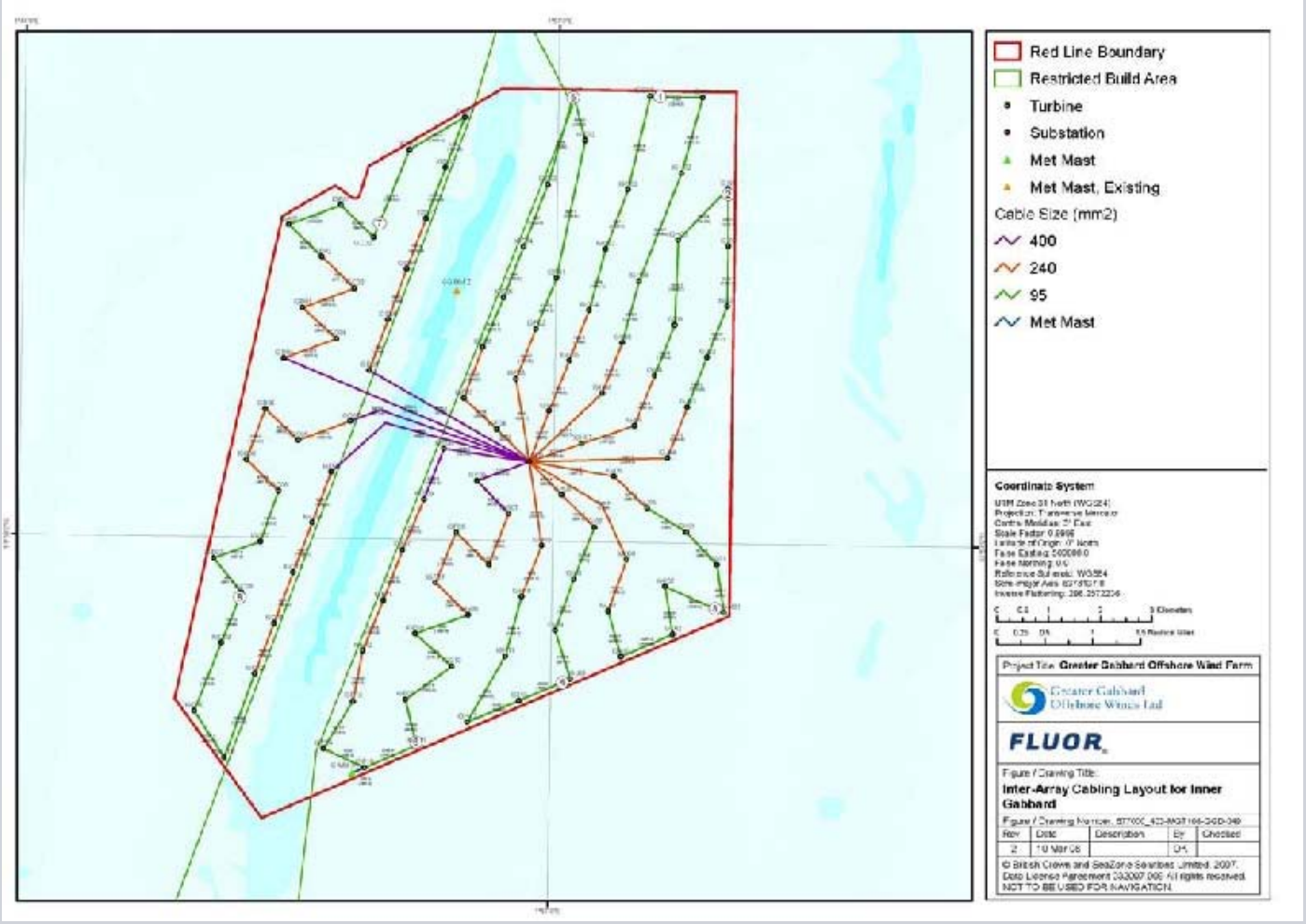

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Greater Gabbard Cables

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Armouring hang-offs for the five inter array 33kV cables and 150kV export cable on the substation at Horns Rev

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Landfall - Beaches vary

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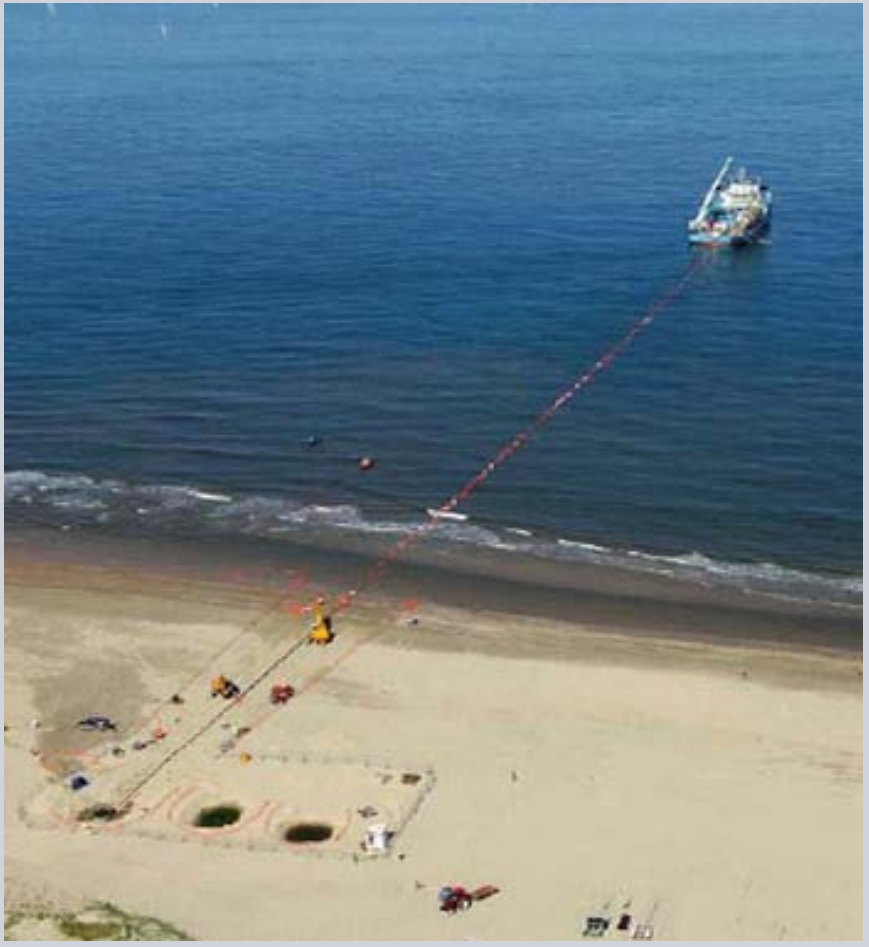

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Main Platform

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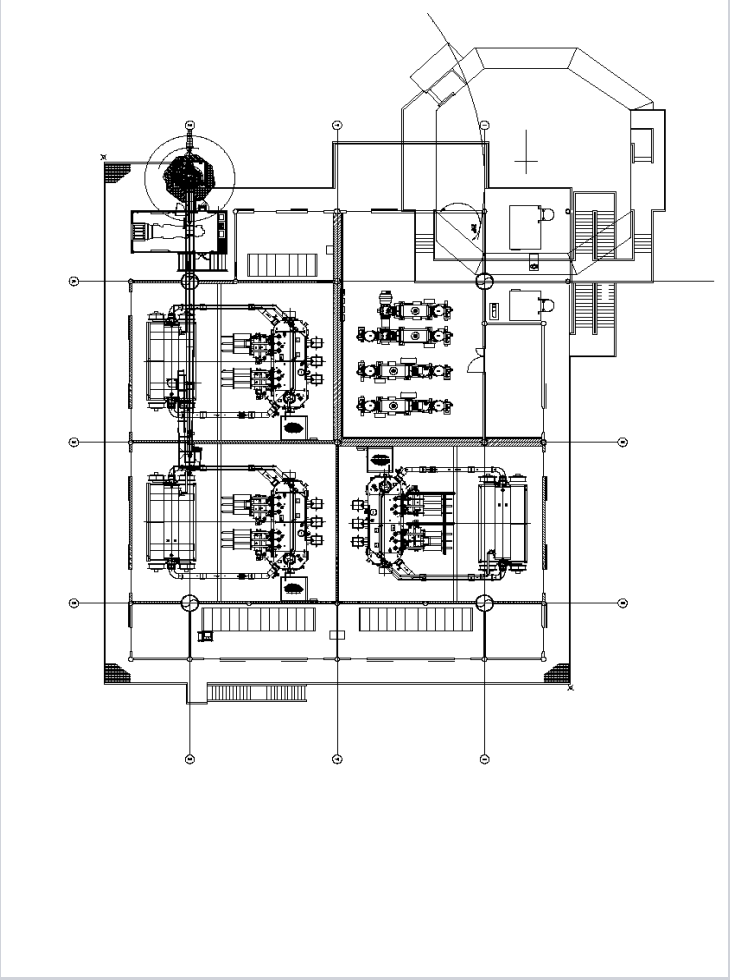

2 Decks, Topside approx. 2000 t:

- 16 incoming 33 kV Cables from Wind Turbine Array
- 3 GIS 33 kV Switchboards
- 3 x 33/132 kV Transformers, 3 Winding 90/90/180 MVA
- Auxiliary/Earthing Transformers
- 4 GIS 132 kV Circuit Breakers
- 132 kV Cable Connections to Transformers
- Generator, Refuge, Fire Suppression, Metering, etc.
- Helipad

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Offshore Substation

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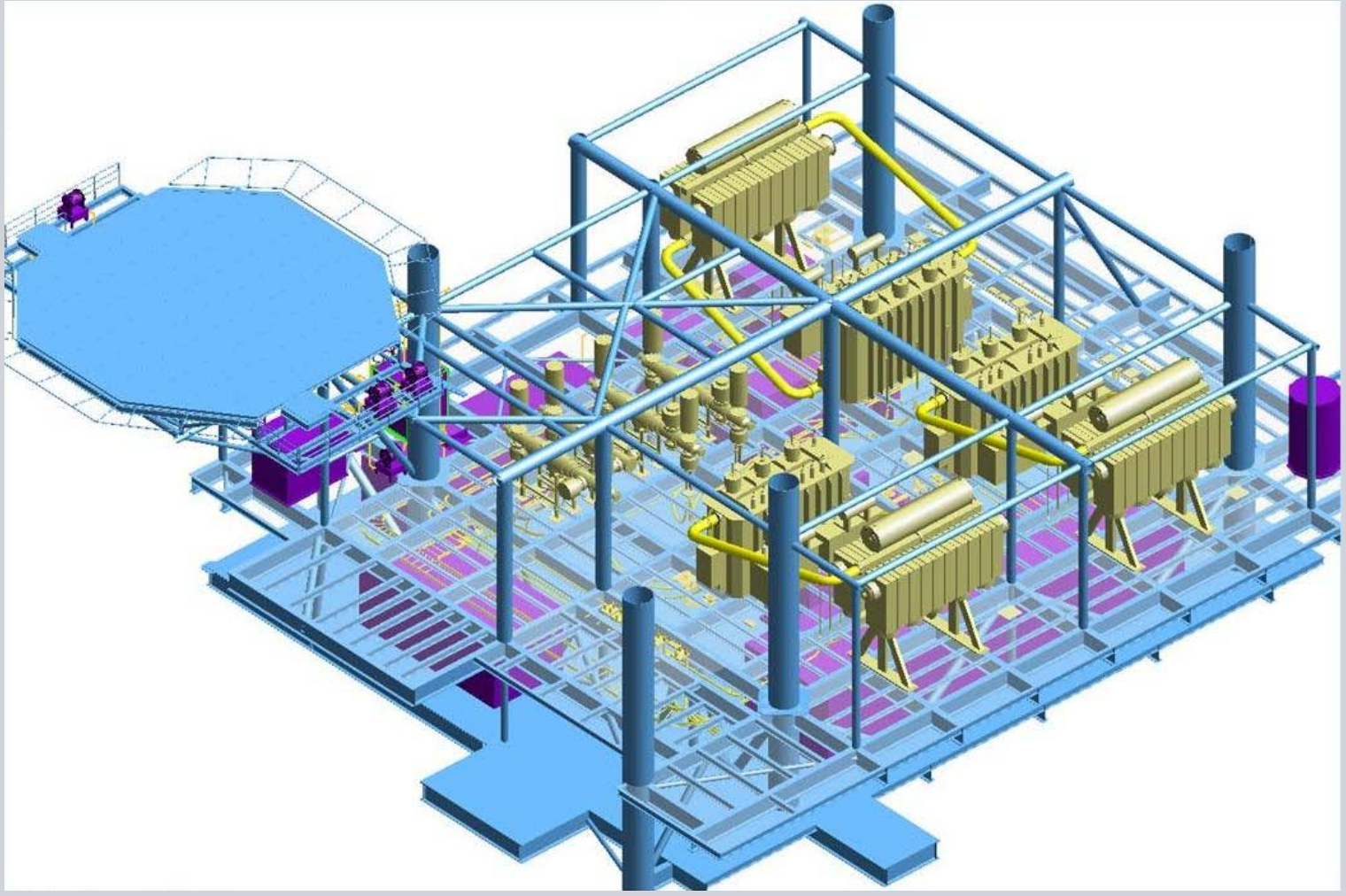

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On the barge before sailing

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Sailing Out

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Installing onto Jacket

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Removing the Lifting Frame

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Offshore Substation installed on Jacket

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Access offshore

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View of Transformer

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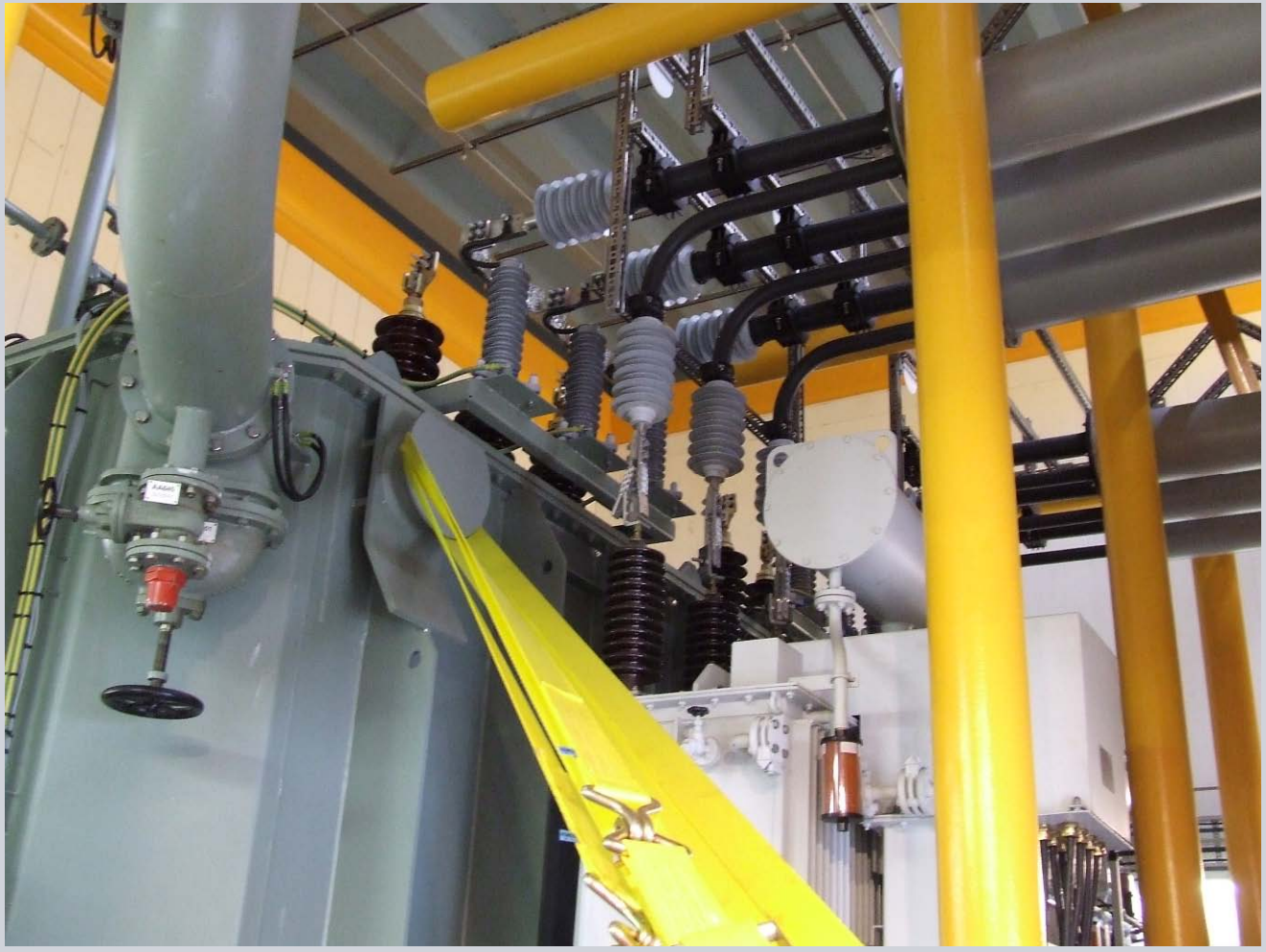

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Platform GIS Switchboard

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33kV Switchroom – installing seaworthy packing

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Galloper
Substation Platform

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Substation Platform

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Lower Level Substation Platform

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Lower Level Substation Platform - Cable Connection

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Upper Level Substation Platform

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Upper Level Substation Platform - 33 kV Switchgear

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Upper Level Substation Platform - 132/33 kV Transformer

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Upper Level Substation Platform - 132 kV GIS

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Offshore Wind Farms Europe 2010
Conclusion

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- The usable wind energy resources in the European North Sea are larger than 100 GW

- New technology for substations on offshore platforms is required to be:
  - compact in design
  - reliable in operation
  - easy to maintain
  - withstand offshore weather conditions

- The future of renewable energy from large scale offshore wind farms has already started in Europe.

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