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<tr>
<td><strong>Project Title:</strong></td>
<td>California Offshore Renewable Energy</td>
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<td><strong>Document Title:</strong></td>
<td>Presentation - Offshore wind lease areas in California: criteria for site selection in the near term</td>
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<td><strong>Description:</strong></td>
<td>By Martin Goff 3-3-17</td>
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<td><strong>Organization:</strong></td>
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Offshore wind lease areas in California: criteria for site selection in the near term

Martin Goff - Development Manager, Offshore Wind, Statoil
3rd March 2017
Offshore wind projects delivering up to 1100 MW

- **Sheringham Shoal**: In operation, 317 MW, 2012-
- **Dudgeon**: In construction, 402 MW, 2017
- **Arkona**: In construction, 385 MW, 2019
- **Dogger Bank**: Consented, 4 x 1200 MW, 2020-
- **New York**: In development, 1000 MW, 2025

**Other Projects**
- **Hywind Demo**: 2.3MW, 2009
- **Hywind Scotland 30MW**: 2017
- **Utility Scale Hywind**: 2020+

*All capacity figures on 100% basis*
Site selection criteria

- Safe to construct and operate
- Safe for other users
- Lowest environmental impacts and use conflicts
- Lowest technical challenges
- Acceptable wind, economics and Levelized Cost of Energy (LCOE)
- Grid connection and Power Purchase Agreement (PPA) opportunities
Northern California
- Very good wind resource, suitable water depths
- Smaller market, limited grid to other markets
- Potential for the longer term

Central California
- Good winds, close to markets
- Potential permitting challenges
- Potential for medium term

Southern California
- Good wind resource in places
- Close to the market and grid infrastructure
- Permitting opportunities in the right areas

Phased ‘zone appraisal’ approach
Environmental

- Ornithology
- Marine mammals
- Fish & shellfish
- Benthic ecology
- Marine ecology
- Marine protected areas, protected species
- Marine physical processes
- Marine sediment & water quality

Use conflicts

- Shipping & Navigation
- Military
- Recreational shipping, fishing, tourism, visual
- Commercial fisheries
- Oil & gas, aggregates, mining, renewables
- Aviation
- Tribes, cultural
- Radar

Hard constraints, technical

- Water depth
- Wind resource
- Distance from shore
- Geology,
- Wrecks, UXO, archaeology
- Cables, pipelines, installations

MarineCadastre data and mapping tool
Legend

Areas between 15km and 120km from land (8-65NM)

Legend

- Screened in – water depth 100-500m (330-1650ft)
- Screened out – size <50km$^2$ (<19 miles$^2$)
Protected species

Viewshed, tourism, recreation

Military, radar

Experiences from site selection and EIAs in Europe and US

Shipping & Navigation

Civilian Aviation

Protected areas
Technical Appraisal

Included, but not limited to:

- Wind resource (modelled)
- Export cable route:
  - Distance
  - Complexity
  - Landfall & grid connection
- Water depth:
  - Inter-array cables
  - Moorings
  - Installation complexity;
- Metocean conditions:
  - Installation
  - O&M
- Distance from landfall / grid connection:
  - O&M accessibility
  - Transmission losses
  - Transmission solutions
- Levelized Cost of Energy (LCOE)
  - Comparison of sites
  - Comparison on phased approach
Potential lease areas

-300 - -120
-500 - -300
-700 - -500
-1000 - -700

Wind Speed at 90m (NREL) m/s

1.875 - 8.0
8.1 - 8.2
8.3 - 8.4
8.6 - 8.7
8.8 - 8.9
9.1 - 9.2
9.3 - 9.4

Distance from Shore Nautical miles

0 - 5
5 - 10
10 - 15
15 - 20

Potential grid connection

Classification: Open

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Offshore Wind Lease Areas
California ‘near-term’
Martin Goff, Development Manager
Offshore Wind
Statoil

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