NEW YORK OFFSHORE WIND SUPPLIER FORUM

Connect to grow your business

November 15, 2018 | New York, NY
NEW YORK OFFSHORE WIND SUPPLIER FORUM

9:30 a.m.–10:00 a.m.  Welcome and Introductory Remarks
                      Richard Kauffman, Chairman of Energy and Finance for New York
                      Welcome and Introductory Remarks
                      Hon. Kathy Hochul, Lieutenant Governor, New York State

10:00 a.m.–11:00 a.m.  Intro to Offshore Wind and New York State Program Update

11:00 a.m.–11:45 a.m.  Panel 1: U.S. Offshore Wind: A 2030 Forecast

11:45 a.m.–12:00 p.m.  Break

12:00 p.m.–12:45 p.m.  Panel 2: Translating European Supply Chain Experience to New York

12:45 p.m.–1:00 p.m.  Keynote Address
                      Alicia Barton, President and CEO, NYSERDA

1:00 p.m.–1:45 p.m.  Lunch

1:45 p.m.–2:00 p.m.  Break

2:00 p.m.–4:00 p.m.  Matchmaking Roundtables

4:00 p.m.  Closing Remarks
NEW YORK OFFSHORE WIND SUPPLIER FORUM

Program Update and Intro to Offshore Wind

New York State Offshore Wind

New York State Energy Research and Development Authority
New York State will commit to building:

up to 2,400 megawatts of offshore wind power by 2030, enough to power up to 1.2 million homes
Achievement of New York’s offshore wind goals will result in significant benefits across the State.
Roadmap for advancing the development of offshore wind in a cost-effective and responsible manner.
Collaborating in a 10 GW Regional Market
Advancing interactions between stakeholders

Environmental

Maritime

Commercial Fishing

Jobs and Supply Chain
New York issued a comprehensive solicitation to develop 800 MW or more of offshore wind.
Competitive solicitation to purchase ORECs for projects from 200 to 800 MW or more for up to 25 years

Released: November 8, 2018
Bids Due: February 14, 2019
Award(s): April 2019
Contract(s): June 2019
2018 Solicitation: Evaluation Criteria

70% Price
20% Economic Benefits
10% Project Viability
2018 Solicitation: New York Supply Chain Opportunity

- Economic Benefit Criteria
- NY Supplier Opportunity Requirement
- NY Supply Chain Database
- Project Labor Agreements
- Prevailing Wage Requirements
Empire State Development

ESD offers incentives that make New York an attractive and cost-competitive location for offshore wind businesses.

Beyond traditional incentives, ESD invests in major infrastructure projects that benefit communities and industry.
Fostering offshore wind by investing $15 Million in workforce development and infrastructure advancement
Supporting the growth of an industry by studying New York’s ports and manufacturing assets.
National Offshore Wind Research and Development Consortium

the first federally funded public-private partnership focused on advancing research and development to accelerate the offshore wind industry in the United States
Components of the Offshore Wind Supply Chain

Turbine Array Connected to Shore
Components of the Offshore Wind Supply Chain

Wind Turbines

8–12 MW
Components of the Offshore Wind Supply Chain
Foundations, Offshore Substation, and “Wet Transmission”
Components of the Offshore Wind Supply Chain
Cable-landfall and On-shore Transmission
Components of the Offshore Wind Supply Chain
On-shore Marshalling and Equipment Staging
Offshore Wind Supply Chain Ecosystem

Offshore Wind Developer

Project Development

Component Manufacturing ("OEMs & Tier 1")

Raw Materials, Parts, and Supply ("Tier 2, 3")
Offshore Wind Supply Chain Ecosystem

Offshore Wind Developer

- Resource Assessment, Engineering, and Permitting Studies
- Logistics
- Transmission and Interconnection
- Construction and Installation Services
- Turbine Supply Agreements

Project Development

Component Manufacturing (“OEMs & Tier 1”)

Raw Materials, Parts, and Supply (“Tier 2, 3”)

New York Phase 1 Projects

2019-2025
NEW YORK OFFSHORE WIND SUPPLIER FORUM

Offshore Wind Supply Chain Ecosystem

Offshore Wind Developer

- Resource Assessment, Engineering, and Permitting Studies
- Logistics
- Transmission and Interconnection
- Construction and Installation Services
- Turbine Supply Agreements

Project Development

2019-2025
New York Phase 1 Projects

- Blades
- Towers
- Nacelle
- Generator
- Foundations

Component Manufacturing ("OEMs & Tier 1")

Raw Materials, Parts, and Supply ("Tier 2, 3")

NYSERDA
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Offshore Wind Developer

Resource Assessment, Engineering, and Permitting Studies
Logistics
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Component Manufacturing ("OEMs & Tier 1")

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2019-2025
New York Phase 1 Projects

Raw Materials, Parts, and Supply ("Tier 2, 3")

Blades
Towers
Nacelle
Generator
Foundations

PPE
Brakes
Barges
Coatings
Tugboats
Yaw Motors
Pitch Motors
Steel
Rubber
Castings
Concrete
Aluminum
Lubricants
Composites
Railings & Ladders
Piping & Conduits
Fall-Arrest Systems

25y O&M

NEW YORK OFFSHORE WIND SUPPLIER FORUM

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Piping & Conduits
Fall-Arrest Systems

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NEW YORK STATE OF OPPORTUNITY

NYSERDA
Questions?

nyserda.ny.gov/offshore wind
offshorewind@nyserda.ny.gov
Panel 1

US Offshore Wind: A 2030 Forecast

**Moderator:** Doug Pfeister  
*Managing Director, North America Renewables Consulting Group (RCG)*

**Panelists**

- Bill White, EnBW
- Christer af Geijerstam, Equinor
- Sunny Gupta, Ørsted
- Lars Thaaning Pedersen, Vineyard Wind
Cumulative Offshore Wind Power Contracts Forecast
For six northeastern states through 2030

Source: RCG analysis
Cumulative Offshore Wind Power Contracts Forecast

Example – foundations and vessels

Source: RCG analysis
Cumulative Offshore Wind Power Contracts Forecast

Denmark is a dominant force in European offshore wind turbine manufacturing

Source: RCG analysis
Projects On Line:
• EnBW Baltic 1 – Baltic Sea (48 MW)
• EnBW Baltic 2 – Baltic Sea (288 MW)

Projects Under Development:
• Hohe See – North Sea (497 MW)
• Albatros – North Sea (112 MW)
• He Dreih – North Sea (900 MW)

Future Areas for Development:
• Formosa 3 – Taiwan
• Castle Wind – CA
• East Wind – MA, NY, NJ
U.S. Market Entry Priorities:
• Offices in NJ, MA, and CA
• Focus on market opportunities in:
  o New England
  o New York
  o New Jersey
  o California

Goal:
• Develop cost-effective clean energy while maximizing local content, close collaboration with communities and stakeholders
Empire Wind

**Site Key Data**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td><strong>Area</strong></td>
<td>79,350 acres</td>
</tr>
<tr>
<td><strong>(sqm)</strong></td>
<td>(124 sqm)</td>
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<tr>
<td><strong>Water Depth</strong></td>
<td>65-130 ft</td>
</tr>
<tr>
<td><strong>Distance to shore</strong></td>
<td>From 14 miles</td>
</tr>
<tr>
<td><strong>Capacity</strong></td>
<td>Up to 2 GW</td>
</tr>
</tbody>
</table>
Ørsted pioneered the offshore wind industry and is the global leader with a footprint across Europe, Asia, and the US.

Unrivalled track-record in offshore wind
Ørsted cumulative constructed offshore wind power capacity (MW)

Pre-2009: Project by project

Post-2009: Industrialised approach to planning and execution of offshore wind projects

Selected projects

**Vindeby**
First offshore wind farm in the world
- Turbine capacity: 0.45 MW
- Nr. of turbines: 11
- Rotor diameter: 35 m
- Distance to shore: 18 km

**Horns Rev 1**
First large scale offshore wind farm in the world
- Turbine capacity: 2 MW
- Nr. of turbines: 80
- Rotor diameter: 80 m
- Distance to shore: 18 km

**Walney Extension**
The largest operational offshore wind farm in the world
- Turbine capacity: 7-8.25 MW
- Nr. of turbines: 87
- Rotor diameter: 154-164 m
- Distance to shore: 19 km

**Hornsea 1**
The world’s largest offshore wind farm once constructed
- Turbine capacity: 7 MW
- Nr. of turbines: 174
- Rotor diameter: 154 m
- Distance to shore: 120 km

Note 1: Ørsted will, in accordance with the Dutch tender regulation, build Barnsley 1 and 2 within four years from November 2016 with a flexibility of 1 year.
Ørsted US Offshore Wind’s Portfolio

Robust and geographically diverse portfolio of offshore wind assets: potential for 10GW

Northern Lease Area 2GW
Southern Lease Area 3.5GW
Virginia 12MW

Block Island 30MW
South Fork 130MW
Skipjack 120MW
Revolution Wind 600MW
RI/MA leases 1.3GW
Garden State Offshore Energy 1.2GW

Deepwater Wind projects in operation
Deepwater Wind projects with revenue contracts secured/soon to be secured
Deepwater Wind development projects

Ocean Wind
Garden State Offshore Energy
South Fork
Skipjack
Garden State Offshore Energy
### Offshore Wind Installation Harbors

#### The Harbor Case Studies

#### Port of Esbjerg, Denmark

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Port Specifics</th>
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<tbody>
<tr>
<td>Harbour Investments</td>
<td>USD 150m (phase 2)</td>
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<tr>
<td>Area Size for Wind</td>
<td>600K sqm / 150 acres</td>
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<tr>
<td>Local Jobs (project*)</td>
<td>150</td>
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</table>

#### Port of Belfast, United Kingdom

<table>
<thead>
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<th>Characteristics</th>
<th>Port Specifics</th>
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<tbody>
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<td>Harbour Investments</td>
<td>USD 90m (phase 1)</td>
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<tr>
<td>Area Size for Wind</td>
<td>200K sqm / 50 acres</td>
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<tr>
<td>Local Jobs (project*)</td>
<td>200</td>
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</tbody>
</table>

#### Port of Taichung, Taiwan

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<th>Port Specifics</th>
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<tr>
<td>Harbour Investments</td>
<td>70 (phase 1)</td>
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<tr>
<td>Area Size for Wind</td>
<td>200K sqm / 50 acres</td>
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<tr>
<td>Local Jobs (project*)</td>
<td>250</td>
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#### Supporting Supply-chain Categories:

- Terminal Operations
- Secondary Steel
- Stevedoring
- Coating Services
- Marine Services
- Equipment Repairs
- Tugboat Services
- Crane Services
- Transport & Logistics
- Construction
- Hospitality Services
- Engineering
- Ship Chandler Services
- Professional Services

#### Supporting Vocational Categories:

- Electricians
- Mariners
- Carpenters
- Linesmen
- Mechanics
- Crane drivers
- Welders
- Truck drivers
- Painters
- Engineers
- Longshoremen
- Office admin

(*) = estimated per installation project excl. port construction and primary component manufacturing related jobs
50/50 PARTNERSHIP:
UNIQUE BLEND OF LOCAL AND GLOBAL EXPERTISE

- **Leading provider** of renewable power in the United States with more than 6,500 MW of owned and operated facilities in 22 states.

- Part of Iberdrola, the **world leader** in the renewable energy industry (30+ GW in operation), and 10 GW of offshore wind under development, construction, or operations.

- One of the world’s leading **Renewable Infrastructure fund management** companies with over $7 billion under management.

- **Long-term, clean energy infrastructure focus** with 6,000+ MW offshore development portfolio in North America, Europe, Asia and Australia.

**VINEYARD WIND**

- **JV Team lead from and focused only on Massachusetts**
  - Offices in New Bedford and Boston
  - World-class technical team with experience building some of the earliest and largest offshore wind farms in the world matched with local staff with first-hand knowledge of the waters, shores, and communities where the project is located
PROJECT OVERVIEW

COMPETITIVE PRICING

✓ 800MW project for MA includes a fixed, low cost for generation and transmission.

FIRST IN THE WATER

✓ December 2017: Submitted state and federal permits with MEPA, EFSB, and BOEM. Most mature large-scale offshore project in US.

✓ PPA submitted for regulatory approval.

✓ EFSB hearing and SDEIR conducted.


ECONOMIC BENEFITS

✓ Project will generate $1.87 billion of direct economic benefits to Massachusetts.

✓ Project will create 3,600 new jobs, beginning in 2018, over 80% of which will be located in Southeastern MA.

✓ Host Community Agreement with Barnstable providing town revenue during project lifetime.
Panel 2

Translating European Supply Chain Experience to New York

Moderator: Liz Burdock
CEO and President, Business Network for Offshore Wind

Panelists
Joshua Weinstein, DNV-GL
Ketil Arvesen, Fred Olsen
David Nemetz, JDR Cables
Jason Folsom, Siemens Gamesa
Dirk Kassen, Smulders
# Project Timeline

<table>
<thead>
<tr>
<th>MW</th>
<th>Pre-Bid Planning</th>
<th>Site Control</th>
<th>Permitting [SAP]</th>
<th>Off-Take Agreement</th>
<th>Permitting [COP]</th>
<th>Approved</th>
<th>Financial Close</th>
<th>Operating</th>
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<td>1) 400 MW 2021 2) 400 MW 2022</td>
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<td>Bay Wind • MA • Ørsted</td>
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<td>Revolution Wind • MA • Deepwater Wind</td>
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<td>2023</td>
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<td>100</td>
<td>South Fork • RI • Deepwater Wind</td>
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<td>Empire Wind • NY • Equinor</td>
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<td>Garden State • DE • Deepwater Wind</td>
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<td>-2024</td>
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<td>120</td>
<td>Skipjack • DE • Deepwater Wind</td>
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<td>2022</td>
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<td>246</td>
<td>Maryland Project • MD • US Wind</td>
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<td>2021</td>
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<td>Research Lease • VA • DMME/DOEH</td>
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</tbody>
</table>

## US Offshore Wind Project Timeline

Business Network for Offshore Wind

Data has been taken by U.S. DOE and validated by developers. It is based on the best information available at the time of publication. However, it is subject to change. The purpose of the information is to provide insights into the timeline of the U.S. Offshore Wind Industry up to 2021. Some biology and definitions are adapted from US DOE's 2017 Offshore Wind Technologies Market Update.
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