



Learning from the Experts Webinar Series

How Does an Offshore Wind Supply Chain Work?



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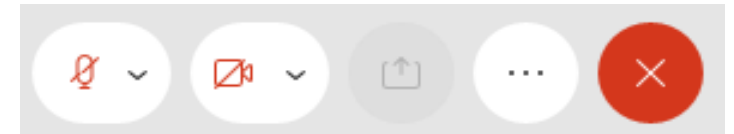
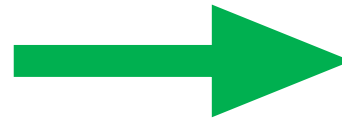
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Meeting Procedures

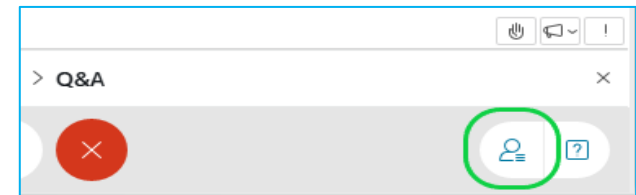
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Learning from the Experts

This webinar series is hosted by NYSERDA's offshore wind team and features experts in offshore wind technologies, development practices, and related research.

DISCLAIMER:

The views and opinions expressed in this presentation are those of the presenter and do not represent the views or opinions of NYSERDA or New York State.

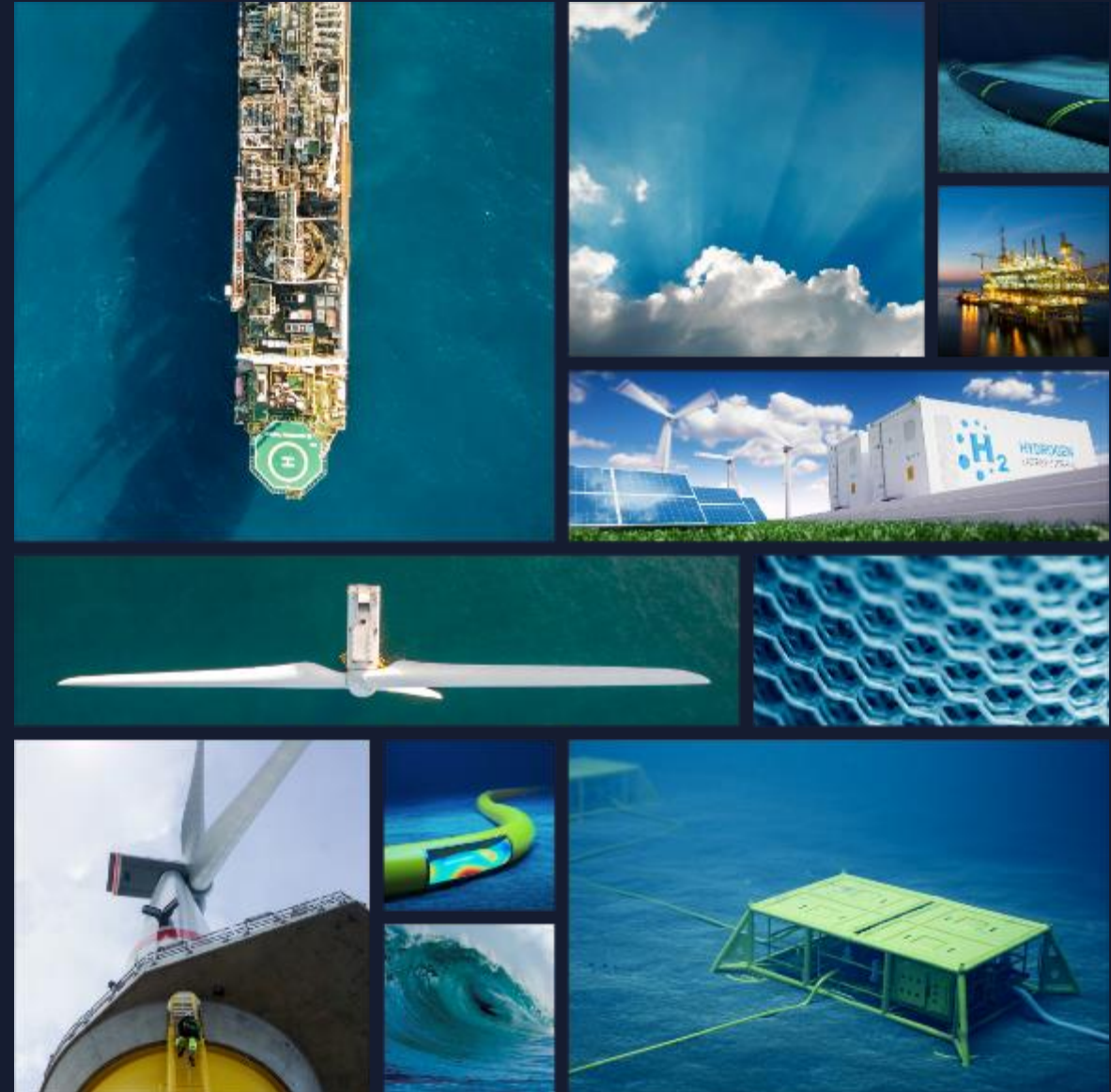




The Supply Chain of an Offshore Wind Farm

Jamie MacDonald / Jeff Tingley

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XODUS RENEWABLES

Our unique range of skills and services encompass:



- Procurement & tender support
- Supply chain analysis
- Due diligence
- Route to market analysis
- LCOE modelling
- Wind yield analysis

- Site selection
- Feasibility studies
- Concept design
- Cable routing
- Floating technology due diligence & selection
- Hydrogen/energy storage studies

- Consenting strategy & planning
- Site investigation & design
- Environmental impact assessments
- Stakeholder engagement
- Post consent & operational support



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Agenda

- Taxonomy of an Offshore Wind Farm
- Contracting Strategies
- Offshore Wind Supply Chain Assessment Methodology
- US Trends
- Questions



Taxonomy of an Offshore Wind Farm

Taxonomy of an offshore wind farm

- 8,000 components
- Multiple 'tiers' of supply
- Procurement processes launched years ahead of final investment decision
- Most suppliers do not engage directly with project developers





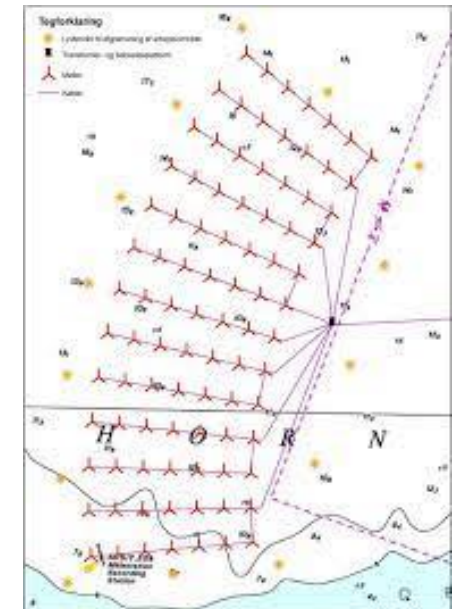
Project development

Who is the buyer?: Project developer

What are they buying?: Permitting services, environmental impact surveying and assessment, metocean and resource assessment, geological and hydrological surveys, engineering and design, project management services

When are they buying?: Up to 10 years before project commissioning

Procurement approach: Sourced competitively by project developer, often with a local bias where possible.





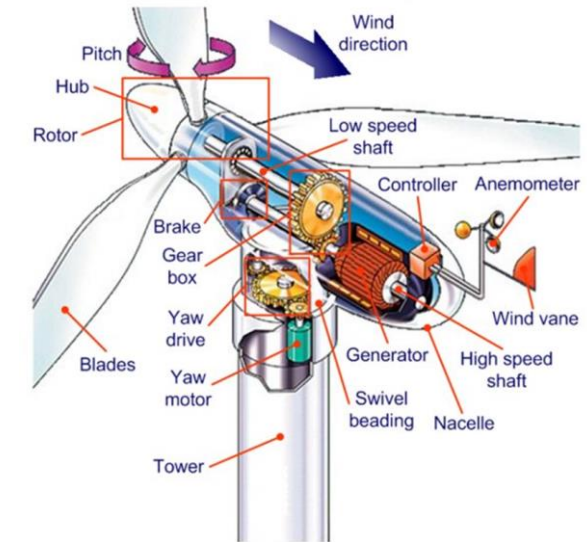
Wind turbine generator

Who is the buyer?: Tier 1 turbine OEM, tier 2 tower OEM

What are they buying?: Tower internals, nacelle housing, structural fasteners, yaw/pitch drives, power cables, cooling system, ducting, commissioning, etc.

When are they buying?: 2-3 years before project construction

Procurement approach: Design is often unique to turbine OEM product and may be single sourced. Strong relationship with OEM required.





Balance of plant

Who is the buyer?: Tier 1, 2 and 3 supply companies

What are they buying?: Secondary steel, cable accessories; scour protection; corrosion protection, onshore infrastructure; offshore substation facilities, transportation, etc.

When are they buying?: 2-3 years before project construction

Procurement approach: Subcontracting can be sourced on a competitive basis by the Tier 1 OEM and provided based on an OEM design





Installation

Who is the buyer?: Tier 1, 2 and 3 service providers

What are they buying?: Port and marine services; support vessels; marine coordination; weather forecasting; logistics; commissioning; onshore civils and construction; etc.

When are they buying?: 1-3 years before project construction

Procurement approach: Subcontracting can be sourced on a competitive basis by the Tier 1 providers





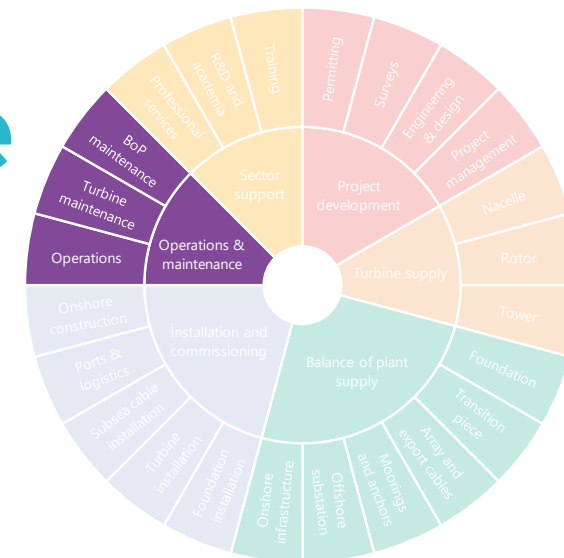
Operations and maintenance

Who is the buyer?: Project developer (operator), third party service provider or turbine OEM

What are they buying?: Offshore inspection, maintenance and repair services (mechanical, electrical, structural, etc.); port and marine services; etc.

When are they buying?: Duration of project lifetime (~ 30 years)

Procurement approach: Sourced competitively, often with a local bias where possible. Mix of framework contracts and ad hoc supply

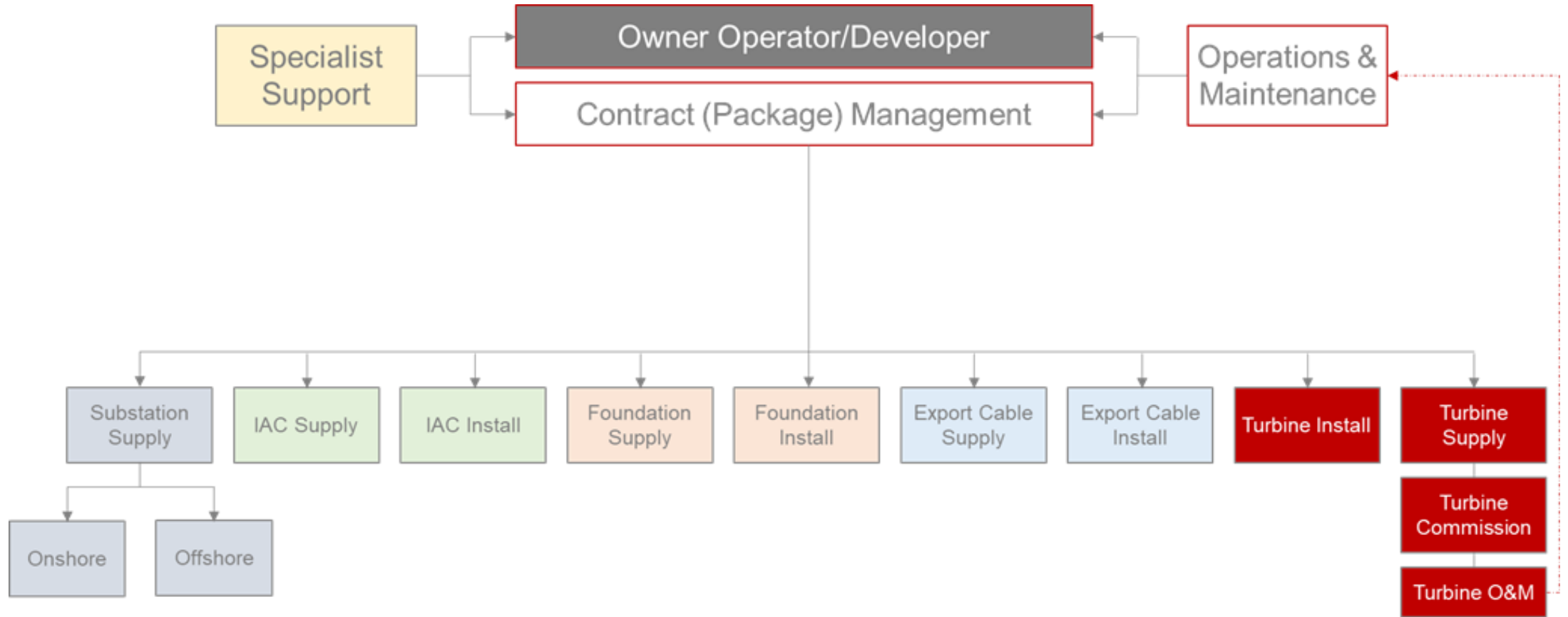




Contracting Strategies

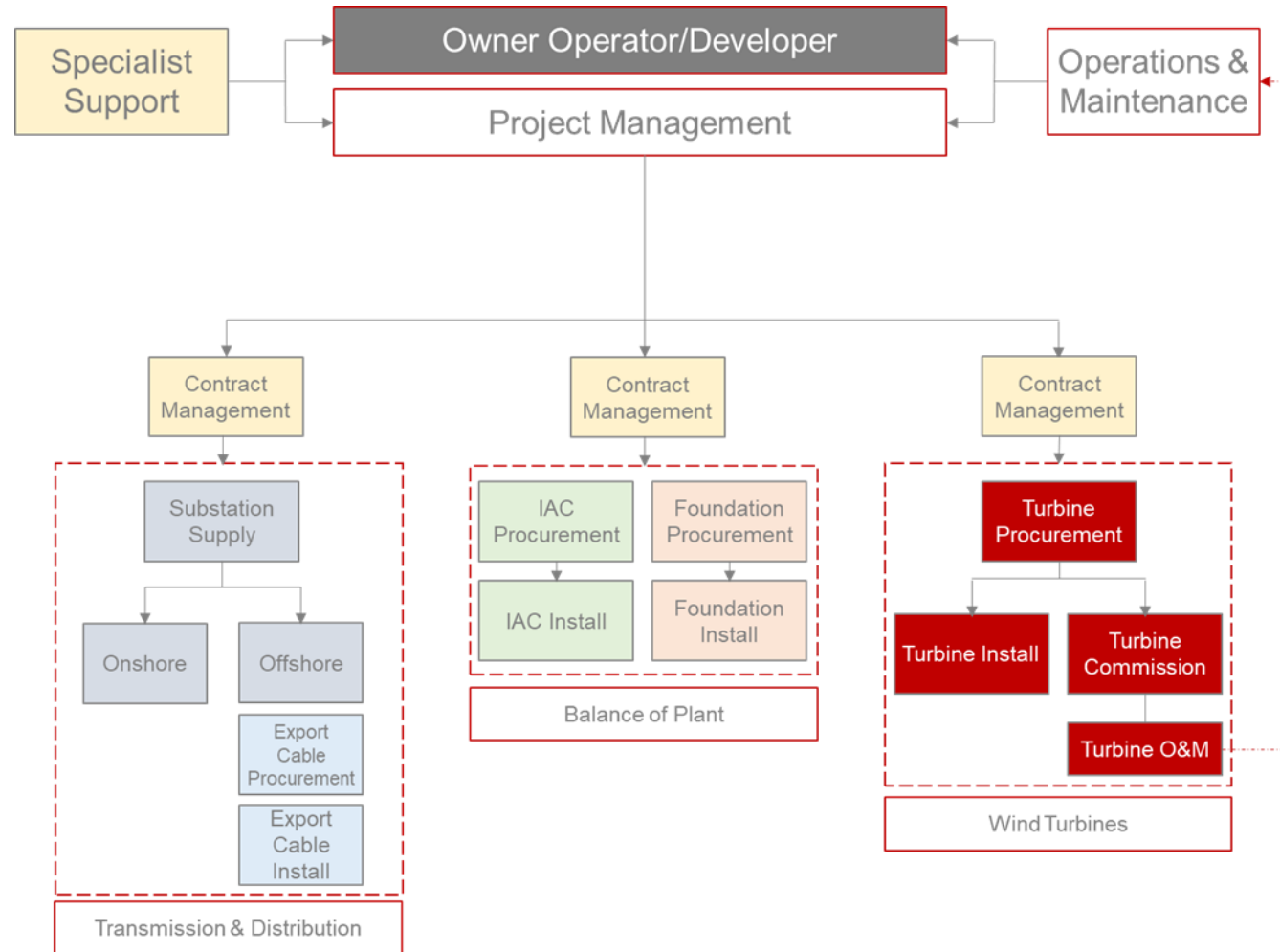


Contracting models – Multicontracting



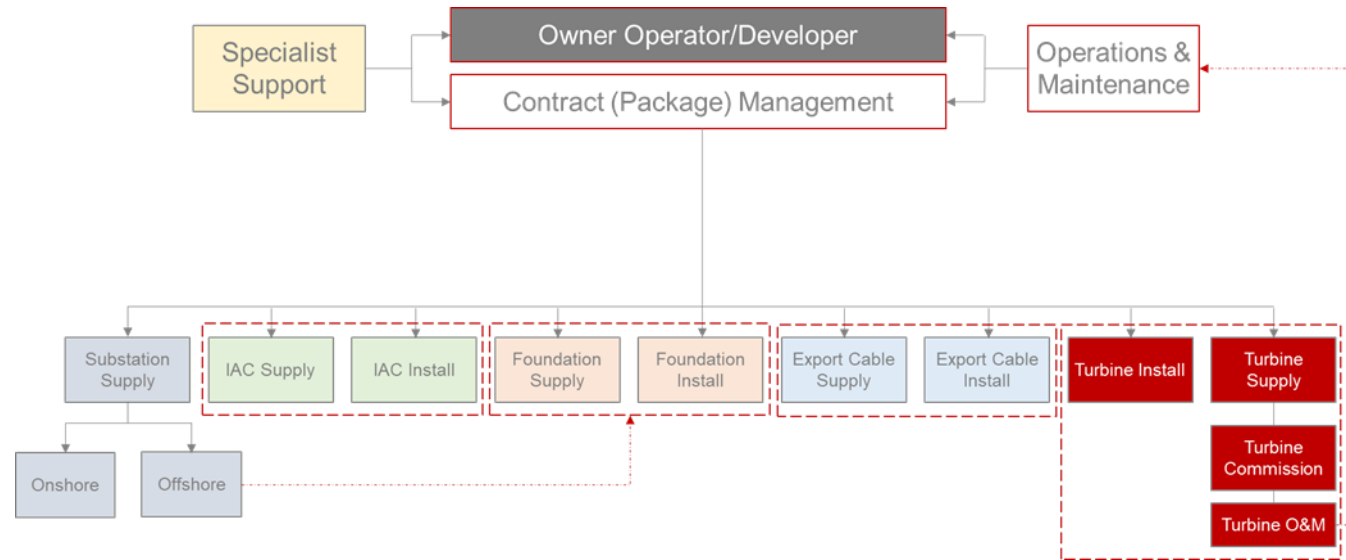


Contracting models - EPCI





Contracting models - Hybrid



Reducing Interface, Cost & Schedule Risk with Reduced Project Oversight

Increasing Interface, Cost & Schedule Risk with Enhanced Project Oversight



Offshore Wind Supply Chain Assessment



Assessing the OSW supply chain opportunity

Assessment of the supply chain identify sectors where companies are well positioned to meet, or adapt to meet, the OSW industry's requirements.

Analysis should be carried out using a consistent set of criteria applied to each supply chain element, suggested to be:

Experience in OSW: The number of companies in-state who have supplied to the OSW sector, either in the US or elsewhere in the world;

Experience in adjacent industries: The strength and applicability of supply chain expertise in state supplying relevant adjacent industries, such as the marine and energy sectors;

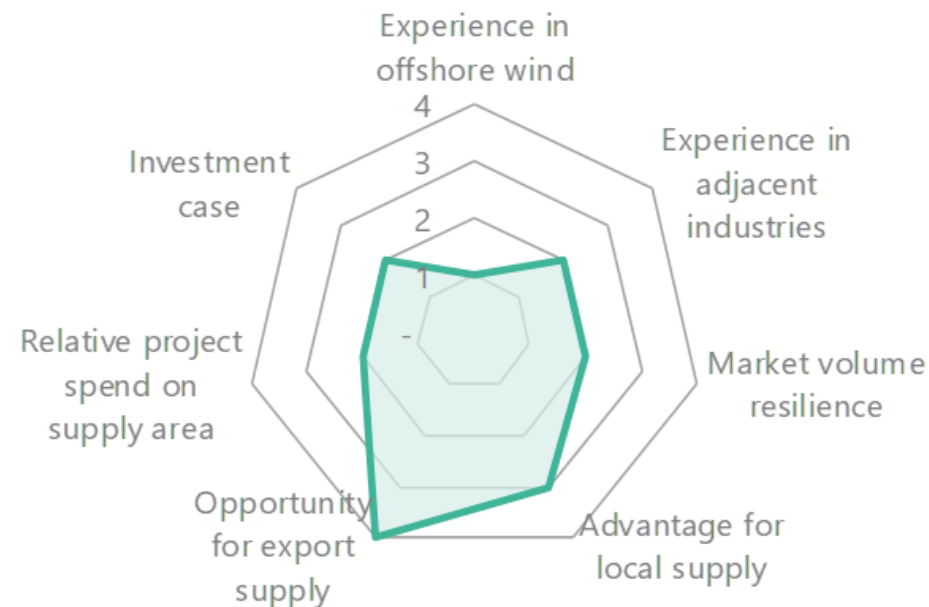
Market volume resilience: How much the success of supply chain companies will depend on the volume of installed OSW project capacity;

Advantage for local supply: The nature of any competitive advantage for supply from in-state, considering possible logistics benefit or existing supply chain strength;

Opportunity for export supply: The potential for in-state companies to supply projects down the US east coast or beyond, should capability be established;

Relative project spend on supply area: Proportion of total lifetime project spend typically attributable to the supply chain category; and

Investment case: Level of investment and market confidence needed to develop supply chain capability.



Capital Region Supply Chain Assessment Started

- Work has begin in Capital region to assess OSW supply chain in Capital Region
 - Port of Albany
 - Port of Coeymans
- Both existing supply chain and adjacent supply chain identification
- Recommendations for filling gaps based on workforce, physical assets and OEM/Tier1 needs
- Early 2022 delivery





US Trends

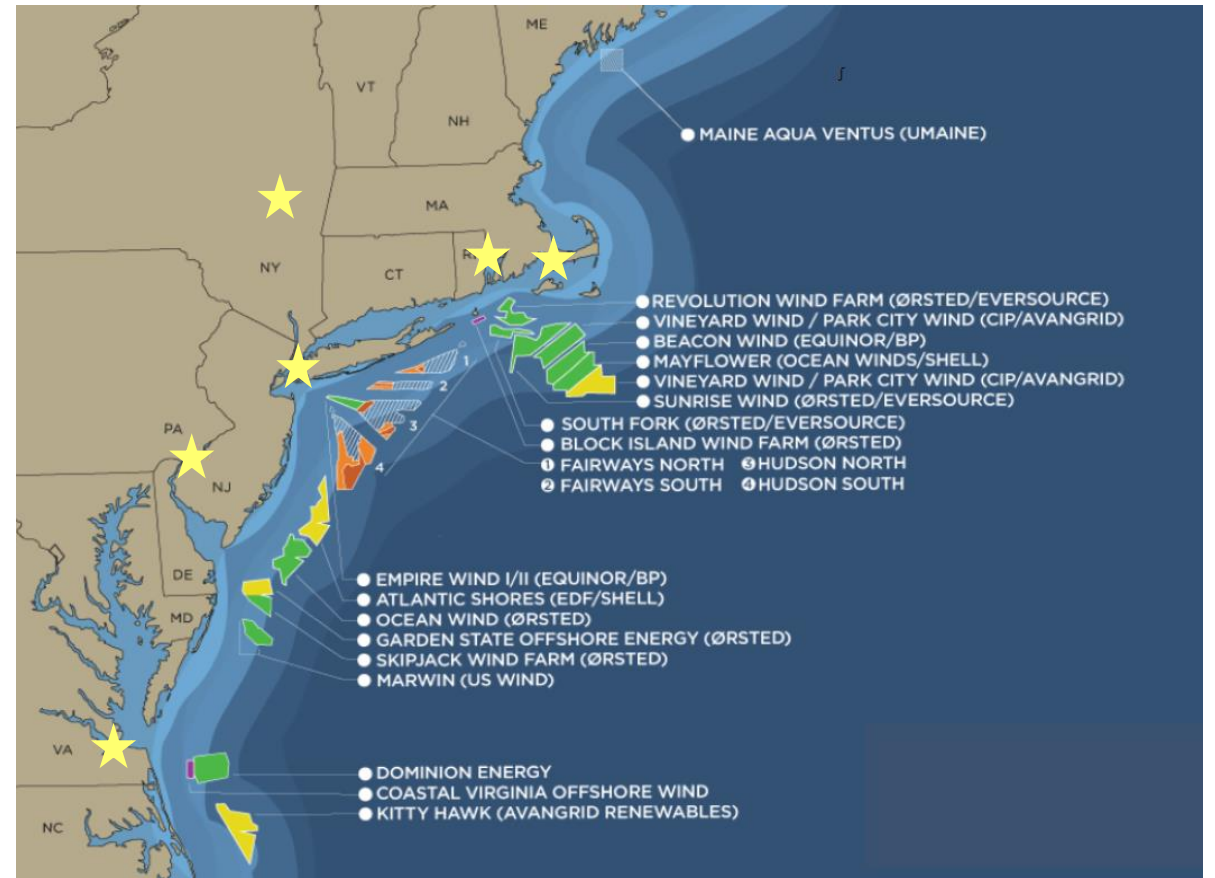


US Trends: Supply Chain Clustering

Clustering around ports, OEMs and Tier 1 suppliers

Likely Cluster areas:

- Port of New Bedford, MA
- ProvPort, RI
- South Brooklyn Marine Terminal, NY
- Albany, NY
- Wind Port, NJ
- Hampton Roads, VA
- (Baltimore, MD)



US Trends: Adjacent Industries and Timeline Challenges



- Project approval process can take 10+ years; limited line of sight for approved projects.
- Lack of experience with OSW project timelines and qualification processes has been identified as a significant risk factor in local supply chain development; less awareness of strict HSE protocols that must be adhered to in the offshore.
- Adjacent industries must fill supply chain gaps - necessary to ensure that these companies are ready to meet project timelines and that they have a trained and certified workforce.
- Long periods between engagement and revenue is unfamiliar to local companies that operate on a quarterly basis.

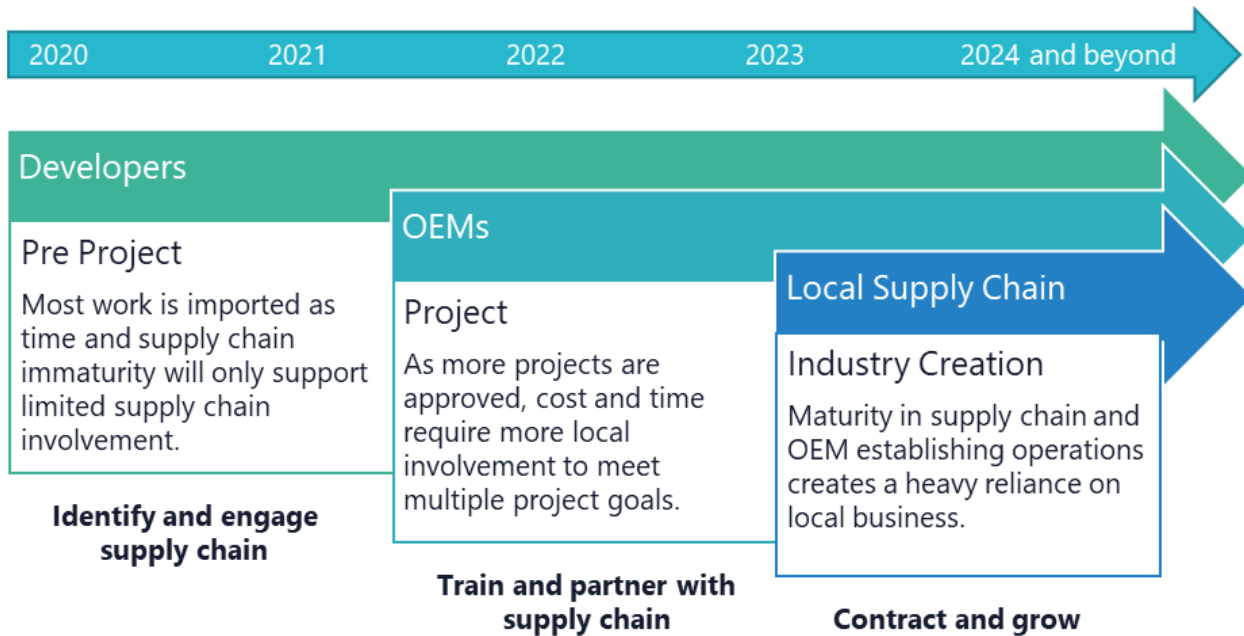
Opportunity: Experienced OSW industry companies to become involved early on to act as a guide and/or provide support for adjacent industry companies in establishing local content for later stage projects.





US Trends: External to Local Supply Chain

- Immature supply chain means early projects will rely heavily on external suppliers and expertise – not sustainable in long term.
- Intense focus on maximizing local content, meaning local supply chain development and job growth.



Opportunity: New York companies to get involved in projects now as the industry gains momentum and large package suppliers look to build out local supply chain.



US Trends: PPA Pricing and Local Content

- Significant drop in the cost per kWh of electricity delivered since the first PPAs were signed.
- Most expensive PPA prices for the lowest capacity projects, while the lowest prices are for much larger projects.
- Sourcing local content can create price pressure, especially as benchmarks are yet to be established (Skipjack vs. Mayflower).
- Still room for PPA price reductions due to nascency of industry.

Project	State	Award Year	Contract Size (MW)	Cost (¢/kWh)
South Fork	NY	2015	132	13.7
MarWin	MD	2017	248	13.2
Skipjack	MD	2017	120	13.2
Vineyard Wind	MA	2018	800	7.0
Revolution Wind	CT/RI	2018	704	9.6
Mayflower Wind	MA	2019	804	7.8
Ocean Wind	NJ	2019	1,100	9.8
Empire Wind	NY	2019	816	8.3
Sunrise Wind	NY	2019	880	8.3

Opportunity: With local content a driving factor in many projects, OEMs and tier 1 companies are incentivized to support local businesses to meet local content requirements.

Other US Trends

- Matchmaking

- Developers, OEMs and Tier 1 companies want to engage the local supply chain and want to help in the communication process with potential partners.
- Local EDOs and industry associations taking an active role in the matchmaking process.

- Diversity, Equity, and Inclusion

- States/Developers may require OEM/Tier 1s to submit plans detailing how DEI goals will be achieved in RFPs.
- Push to hire as much union labor as possible, although project labor agreements tend to be negotiated on a project-to-project basis.

- Major Infrastructure Upgrades

- Strong focus on grid upgrades as well as other infrastructure such as substations, access roads and bridges, etc.
- Opportunities for NY Supply chain is not only offshore as major onshore upgrades and enhancements need to be completed.





Thank you

Questions?

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