Status Update on Floating Offshore Wind in California

California Marine Affairs and Navigation Conference Fall Meeting 2023 ***Sacramento, CA***

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California's Climate and Clean Energy Goals

Energy and Climate Goals:

- Reduce GHG emissions to 40% below 1990 levels by 2030 and be net-zero GHG emissions by 2045 and net-negative thereafter
- RPS of 60% by 2030
- Zero carbon resources for retail electricity sales: 90% by 2035, 95% by 2040 and 100% by 2045
- Clean transportation

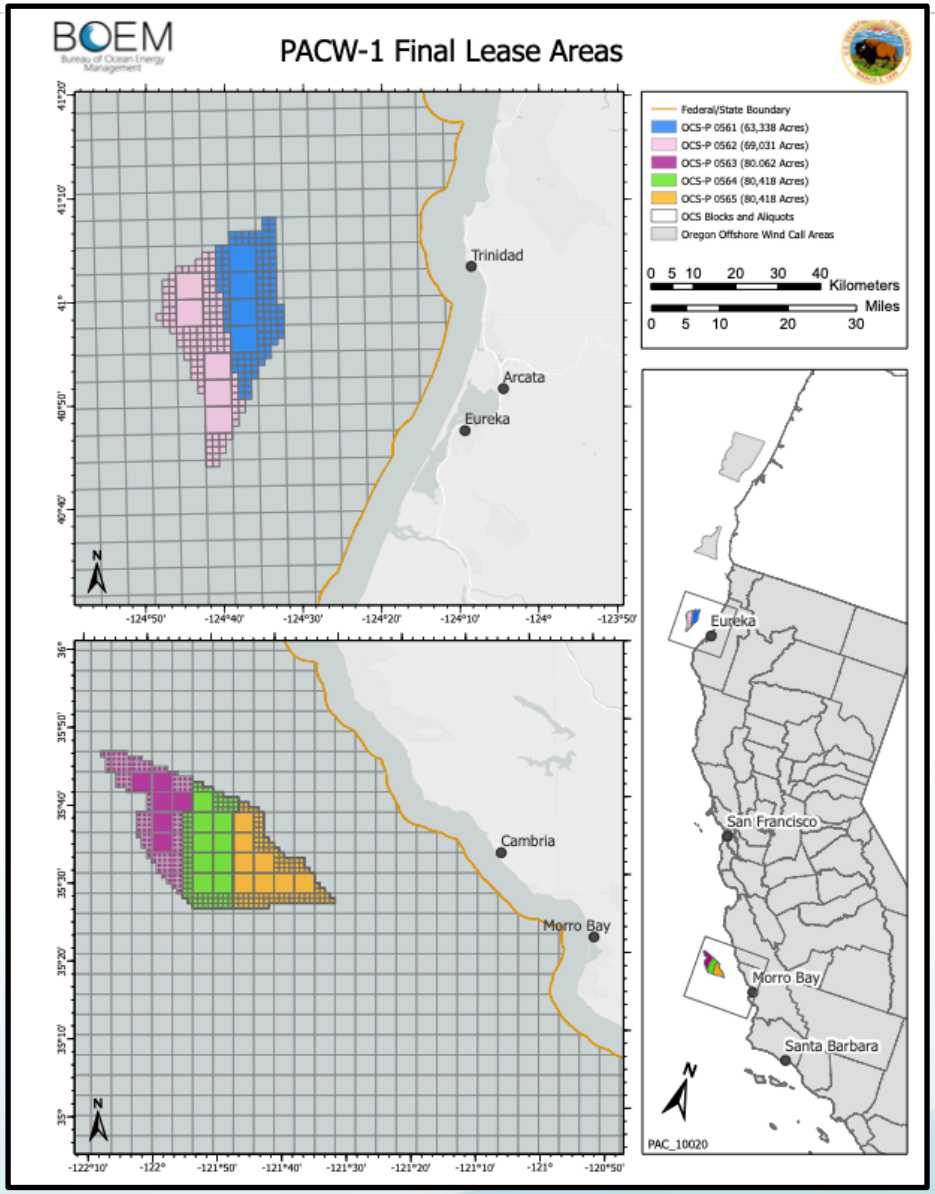
Key findings from the 2021 SB 100 joint agency report:

- Need for sustained record setting build rates
- Additional work is needed to understand the potential of emerging technologies including offshore wind

California
Clean Electricity Resources

	Existing Resources	Projected New Resources	
	2019*	2030**	2045**
Solar (Utility-Scale)	12.5 GW	16.9 GW	69.4 GW
Solar (Customer)	8.0 GW	12.5 GW	28.2 GW
Storage (Battery)	0.2 GW	9.5 GW	48.8 GW
Storage (Long Duration)	3.7 GW	0.9 GW	4.0 GW
Wind (Onshore)	6.0 GW	8.2 GW	12.6 GW
Wind (Offshore)	0 GW	0 GW	10.0 GW
Geothermal	2.7 GW	0 GW	0.1 GW
Biomass	1.3 GW	0 GW	0 GW
Hydrogen Fuel Cells	0 GW	0 GW	0 GW
Hydro (Large)	12.3 GW	N/A†	N/A†
Hydro (Small)	1.8 GW	N/A†	N/A†
Nuclear	2.4 GW	N/A†	N/A†

BOEM California Offshore Wind Leasing

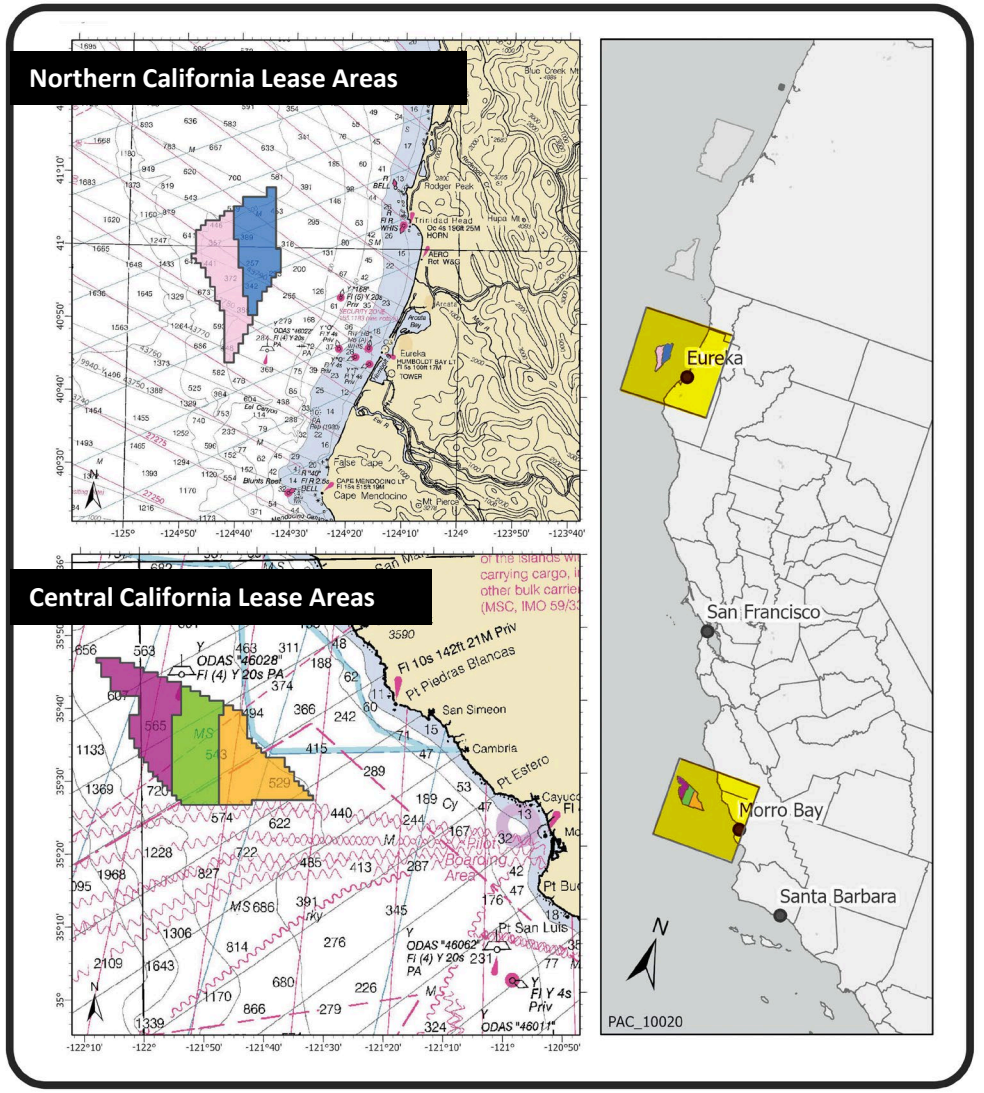


- BOEM-CA Intergovernmental Renewable Energy Task Force
- May 2021 announcement from Biden and Newsom Administrations
- California Coastal Commission consistency determinations and California state agency comment letter on Proposed Sale Notice
- December 6, 2022, BOEM PACW-1 Lease Sale
- Multi-factor auction design with up to 30% in bidding credits, 5 lease holders, communications plans with tribes, fishermen, and agencies
- Biden-Harris Administration Floating Offshore Wind Shot and 15 GW of floating technology nationwide by 2035

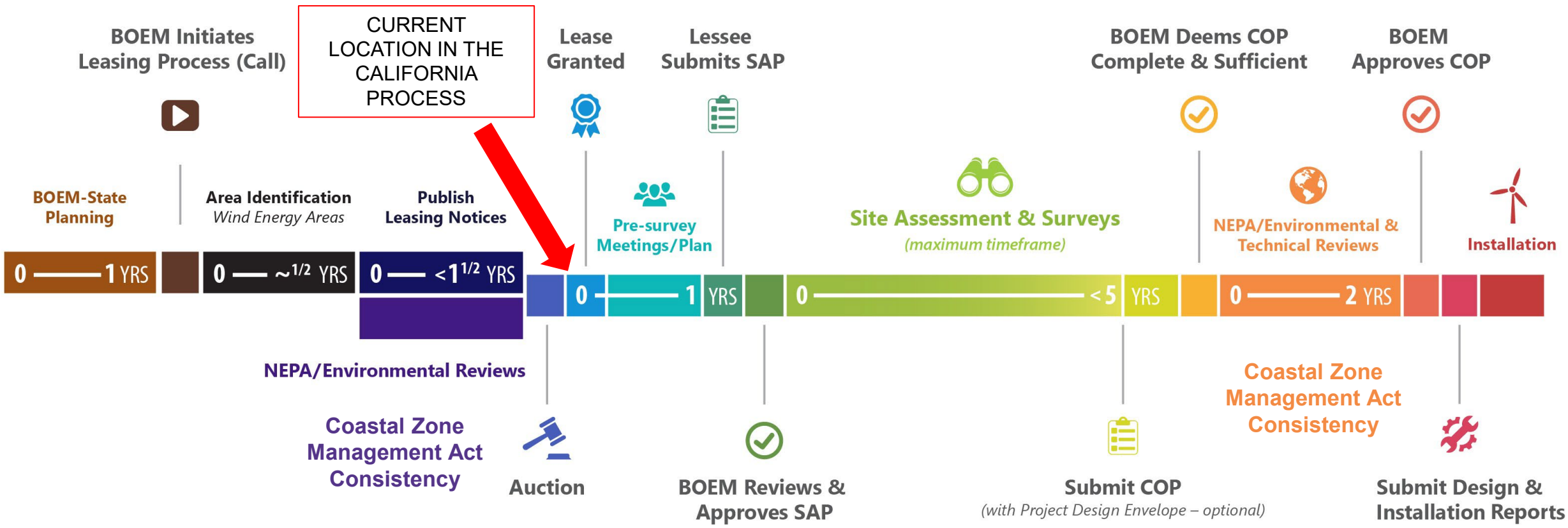
California Lease Sale Results

$757 Million in High Bids

Lease Number	Lessee	Total Bid
OCS-P 0561	RWE Offshore Wind Holdings LLC	$157,700,000
OCS-P 0562	California North Floating LLC	$173,800,000
OCS-P 0563	Equinor Wind US LLC	$130,000,000
OCS-P 0564	Golden State Wind LLC	$150,300,000
OCS-P 0565	Invenergy California Offshore LLC	$145,300,000



BOEM Commercial Offshore Wind Authorization Process: California Example



California Offshore Wind Auction: Bidding Credits

Workforce training and/or supply chain development: 20% bidding credit for commitments to support ***workforce training programs*** for the ***U.S. floating offshore wind industry***, development of a ***U.S. domestic supply chain*** for the ***floating offshore wind industry***, or both.

Lease Area Use CBA: 5% bidding credit for executing a community benefit agreement with one or more communities, stakeholder groups, or Tribal entities ***whose use of the geographic space of the Lease Area, or whose use of resources harvested from that geographic space,*** is expected to be impacted by the Lessee's potential offshore wind development.

General CBA: 5% bidding credit for executing a community benefit agreement with one or more communities, Tribes, or stakeholder groups that are ***expected to be affected by the potential impacts on the marine, coastal, and/or human environment*** *(such as impacts on visual or cultural resources) from activities resulting from lease development that are* ***not otherwise addressed by the Lease Area Use CBA****.*

California Lease Requirements for Communications, Engagement, and Reporting

- **Three required communications plans:**
  - Native American Tribes Communications Plan (Lease Addendum C, 3.1.2)
  - Agency Communications Plan (3.1.3)
  - Fisheries Communications Plan (6.2)
- **Engagement (3.1.1):** The Lessee will make reasonable efforts to engage with Tribes and parties that may be potentially affected by the Lessee's project activities on the OCS, including, but not limited to:
  - Coastal communities
  - Commercial and recreational fishing industries and stakeholders
  - Educational and research institutions
  - Environmental and public interest non-governmental organizations
  - Federal, state, and local agencies
  - Tribes
  - Mariners and the maritime industry
  - Ocean users
  - Submarine cable operators
  - Underserved communities, as defined in Section 2 of Executive Order 13985
- **Coordinated Engagement (3.1.4):** To the maximum extent practicable, the Lessee must coordinate engagement activities with other regional lessees…to decrease the communication and consultation burden
- **Progress Report (3.1):** Every 6 months, describe overall progress, document engagement

Assembly Bill 525 Strategic Plan for Offshore Wind

- Energy Commission established aspirational offshore wind planning goals of 2 to 5 gigawatts (GW) of floating offshore wind technologies in federal waters off the California coast by 2030 and 25 GW by 2045
- December 31, 2022:
  - Complete a preliminary assessment of economic benefits related to seaports and workforce development needs and standards
  - Develop a permitting roadmap for wind energy facilities and associated electricity and transmission infrastructure off the coast of California
- June 30, 2023 [this will now occur by end of 2023]: Energy Commission to submit a strategic plan to the Legislature and Natural Resources Agency

Identify suitable sea space for areas in federal waters sufficient to accommodate offshore wind planning goals of 2 GW to 5 GW by 2030 and 25 GW by 2045 and identify impacts

Based on the suitable sea space develop a plan to improve waterfront facilities that could support a range of floating offshore wind development activities

Assess the transmission investments and upgrades necessary, including subsea transmission options, to support the offshore wind planning goals

AB 525 Coordinating State Agencies

CALIFORNIA NATURAL RESOURCES AGENCY

CALIFORNIA DEPARTMENT OF FISH & WILDLIFE

PUBLIC UTILITIES COMMISSION EUREKA STATE OF CALIFORNIA

CALIFORNIA GOVERNOR'S OFFICE OF BUSINESS AND ECONOMIC DEVELOPMENT

CALIFORNIA OCEAN PROTECTION COUNCIL

CALIFORNIA COASTAL COMMISSION

CALIFORNIA STATE LANDS COMMISSION STATE OF CALIFORNIA

LABOR & WORKFORCE DEVELOPMENT AGENCY

GOVERNOR'S OFFICE OF PLANNING AND RESEARCH STATE OF CALIFORNIA

Ports, Waterfront Facilities, and Supply Chain

- Assembly Bill 525 strategic plan
- Humboldt Bay Harbor, Recreation, and Conservation District
- Existing and ongoing studies
- $45 million appropriated to support waterfront facility improvements
- Bidding credits and supply chain statement of goals resulting from the BOEM PACW-1 lease sale

Roadmap for the AB 525 Port Readiness Plan

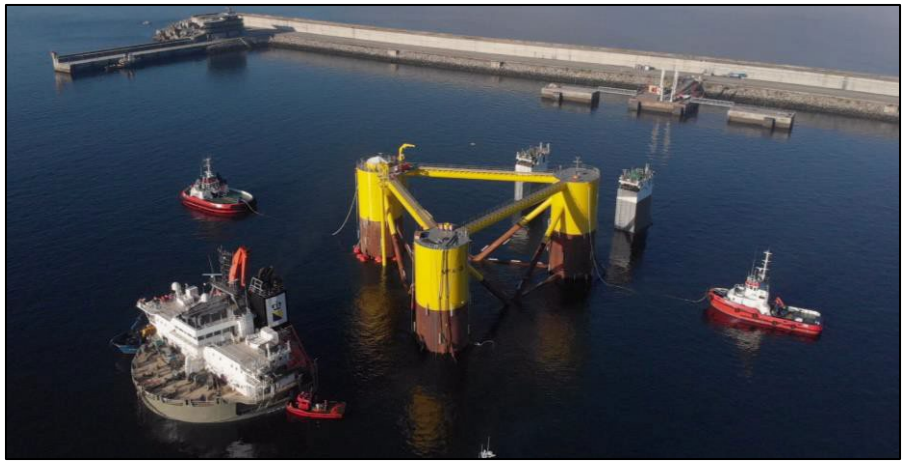
1. Determine Port Needs for Offshore Wind Use
2. Determine How Many Port Sites are Required
3. Identify Potential Port Sites
4. Determine Port Improvements Required
5. Evaluate and Compare Port Sites
6. Publish AB 525 Seaport Strategy Report

Floating OSW Wharf-side Assembly & Loadout

1) Fabrication

2) Loadout onto semi sub

3) Float off



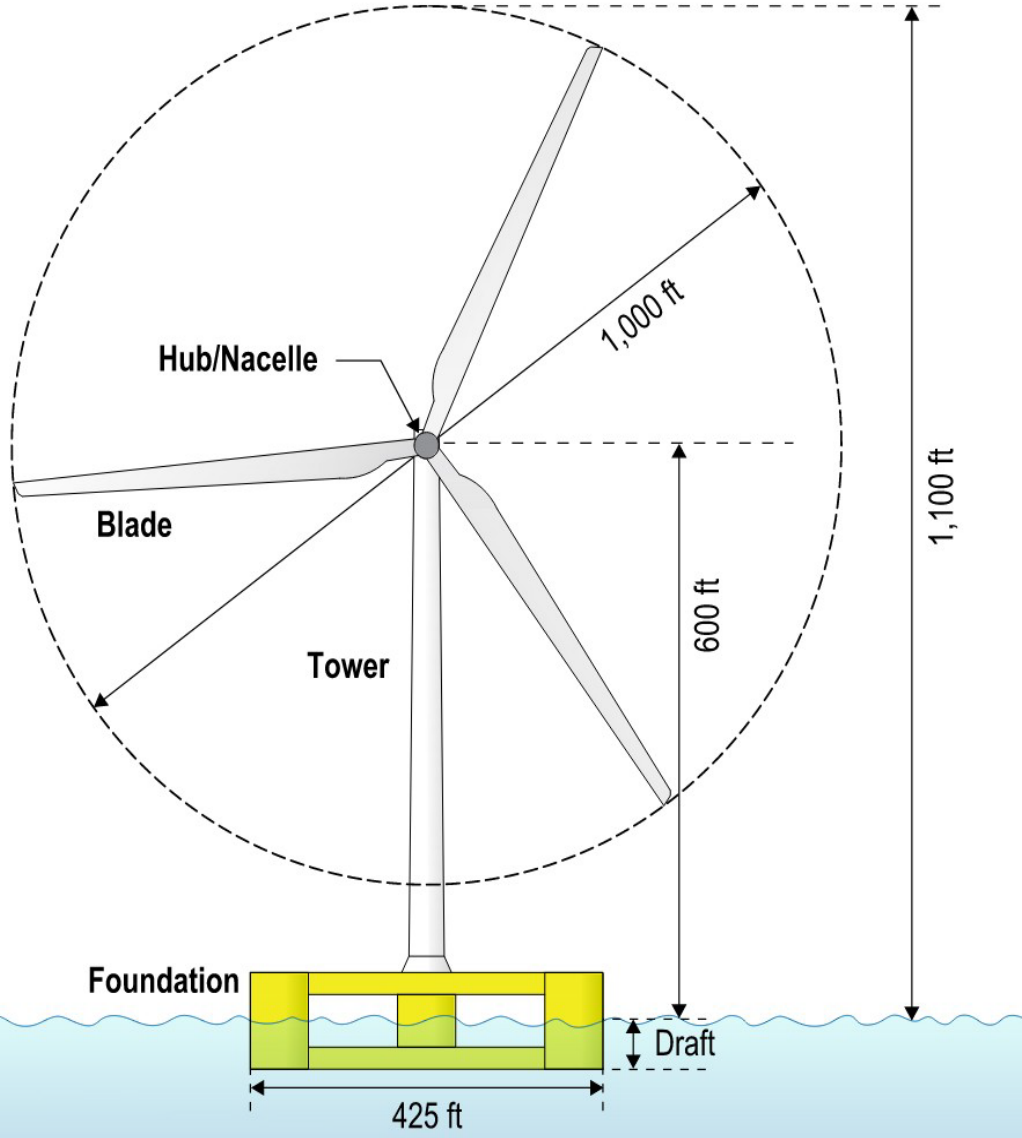
4) WTG Integration

5) Tow to Installation Site

Photo reference: 1, 2, 4, and 5 by Principle Power; 3 by EDP Renewables

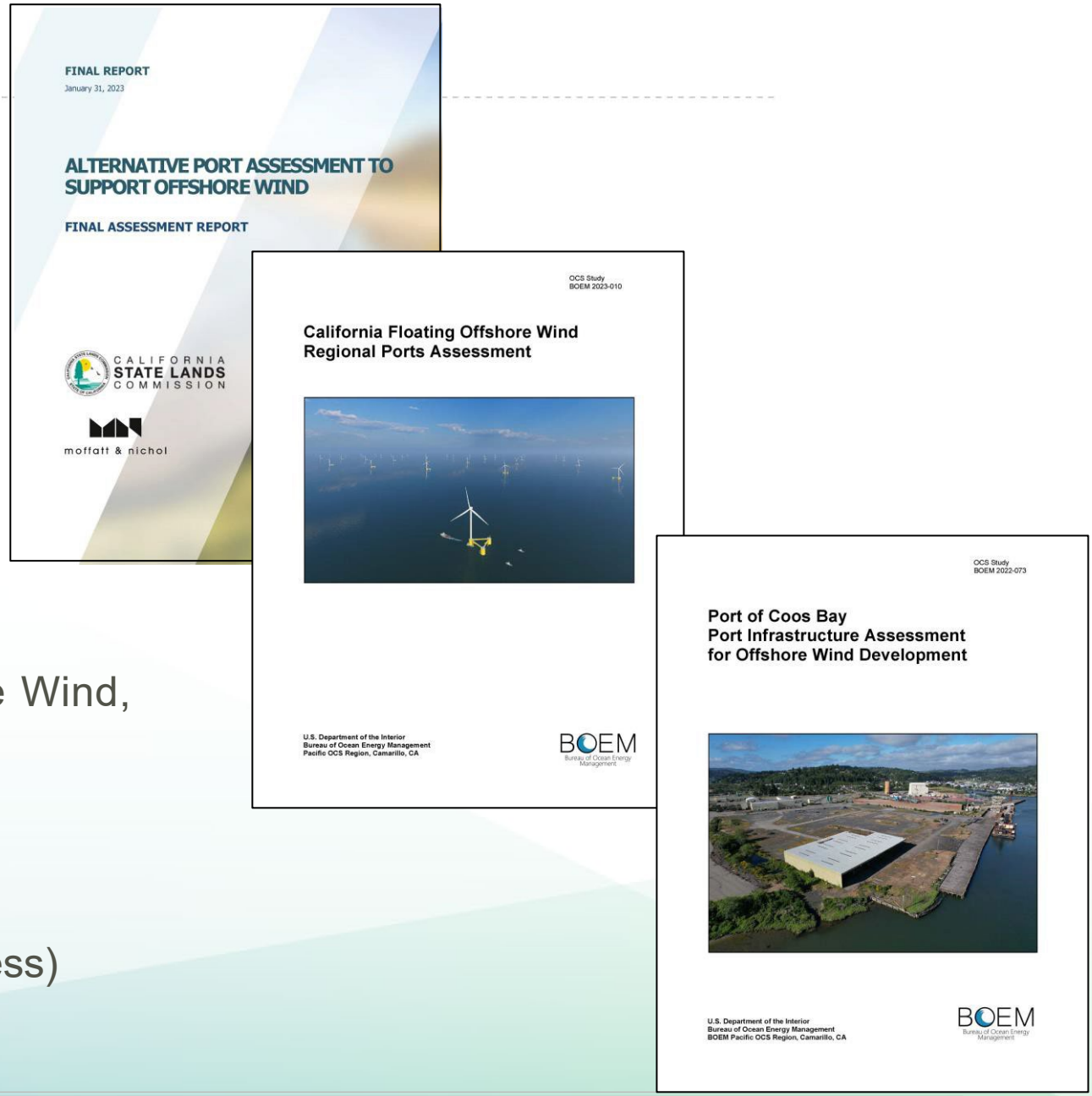
Floating OSW Turbine Dimensions

Floating Offshore Wind Turbine	Approximate Dimension [ft]	Approximate Dimension [m]
Foundation Beam / Width	Up to 425 ft x 425 ft	Up to 130 m x 130
Draft (Before integration)	15 to 25 ft	4.5 to 7.5 m
Draft (After integration)	20 to 50 ft	6 to 15 m
Hub/Nacelle Height (from Water Level)	Up to 600 ft	Up to 183 m
Tip Height (from Water Level)	Up to 1,100 ft	Up to 335 m
Rotor Diameter	Up to 1,000 ft	Up to 305 m



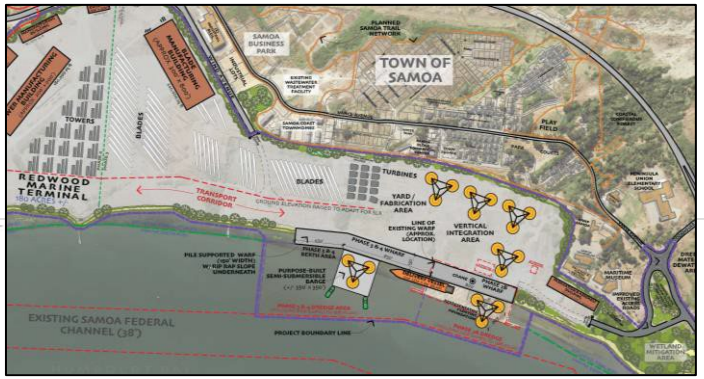
OSW Port Studies US West Coast

- **Bureau of Ocean Energy Management**
  - Port of Coos Bay, Port Infrastructure Assessment for OSW Development, BOEM 2022-073
  - California Floating OSW Regional Ports Assessment, BOEM 2023-010
  - California Floating OSW Regional Ports Feasibility Analysis, 2023 (published)
- **California State Lands Commission**
  - Alternative Port Assessment to Support Offshore Wind, January 2023
  - AB 525 Port Readiness Plan, 2023 (published)
- **National Renewable Energy Laboratory**
  - West Coast Port Strategy Study, 2023 (in progress)



Types of OSW Port Terminals

- **Staging and Integration (S&I) Site:** a port site to receive, stage, and store offshore wind components and to assemble the floating turbine system for towing to the offshore wind area.
  - **Turbine Maintenance Site:** a facility to perform major maintenance on a fully assembled turbine.
  - **End of Life Decommissioning Site:** a site to decommission, disassemble, recycle, and dispose of turbine systems that are at end of life.
- **Manufacturing/Fabrication (MF) Site:** a port site that receives raw materials via road, rail, or waterborne transport and creates larger components in the offshore wind supply chain.
- **Operation and Maintenance (O&M) Site:** a base of wind farm operations with warehouses/offices, spare part storage, and a marine facility to support O&M vessels for crew transfer
- **Construction Support Facilities:**
  - **Installation Support Site:** a base of construction operations for the fleet of construction vessels necessary for construction and commissioning of the offshore wind farm.
  - **Mooring Line, Anchor, and Electrical Cable Laydown Site:** a site to receive and stage mooring lines, anchors, and electrical cables



Staging and Integration

Manufacturing Port (Foundations Shown)

Operations & Maintenance

Photo reference (top to bottom): Humboldt Harbor District; Port of Long Beach, REACH & Mott MacDonald

Floating OSW Port Requirements

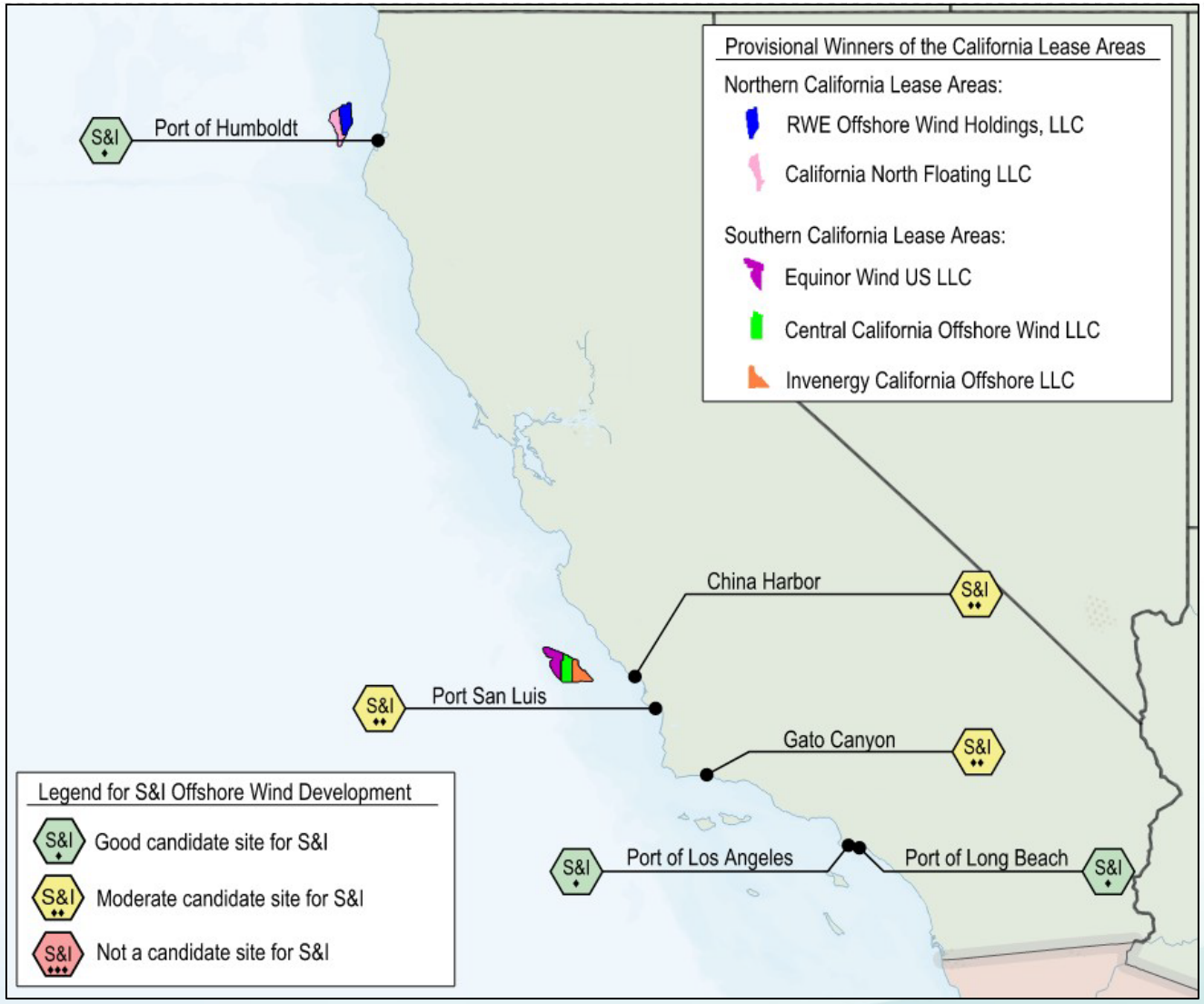
Design Requirement	Staging and Integration (S&I)	Manufacturing (MF)	Operations & Maintenance (O&M)	Anchor & Mooring Line Storage, Construction Support	Electrical Cable Laydown
Acreage, minimum	30 – 100 acres	30 – 100 acres	2 – 10 acres	10 – 30 acres	20 – 30 acres
Wharf Length	1,500 ft	800 ft	300 ft	300 ft	500 ft
Minimum Draft at Berth	38 ft	38 ft	20 – 30 ft	20 – 30 ft	30 – 35 ft
Draft at Sinking Basin	40 – 100 ft	40 – 100 ft	Not Required	Not Required	Not Required
Wharf Loading	> 6,000 psf	> 6,000 psf	100 – 500 psf	500 psf	1,000 psf
Uplands / Yard Loading (for WTG components)	2,000 – 3,000 psf	2,000 – 3,000 psf	100 – 500 psf	500 psf	1,000 – 2,000 psf

Required Number of Port Sites in California 25 GW of OSW by 2045

Type of Site	Low (8 GW)	Low-Med (17 GW)	Medium (25 GW)	Med-High (34 GW)	High (42 GW)
S&I Sites	1	2	**3**	4	5
MF Site (Blade)	1	2	**2**	3	3
MF Site (Tower)	1	1	**1**	1	2
MF Site (Nacelle Assembly)	1	1	**1**	1	1
MF Site (Foundation Assembly)	1	2	**2**	3	4
SOV berths for O&M Activities	3 to 7	6 to 12	**9 to 16**	12 to 20	15 to 23
Mooring Line & Anchor Storage Sites	5 to 15 ac	10 to 25 ac	**20 to 40 ac**	25 to 50 ac	30 to 65 ac
Electrical Cable Laydown Sites	4 to 8 ac	8 to 14 ac	**12 to 22 ac**	16 to 28 ac	21 to 36 ac

- **Need approximately 10 large port sites and 10 small port or harbor sites to meet CA targets by 2045**
- **S&I Site = ~80 acres, Blade & Tower MF Site = ~100 acres, Foundation MF Site = ~80 acres, Nacelle MF = 25 -100 acres**
- **Strategizing the development of manufacturing port sites in California will maximize job creation and economic impact to the State**

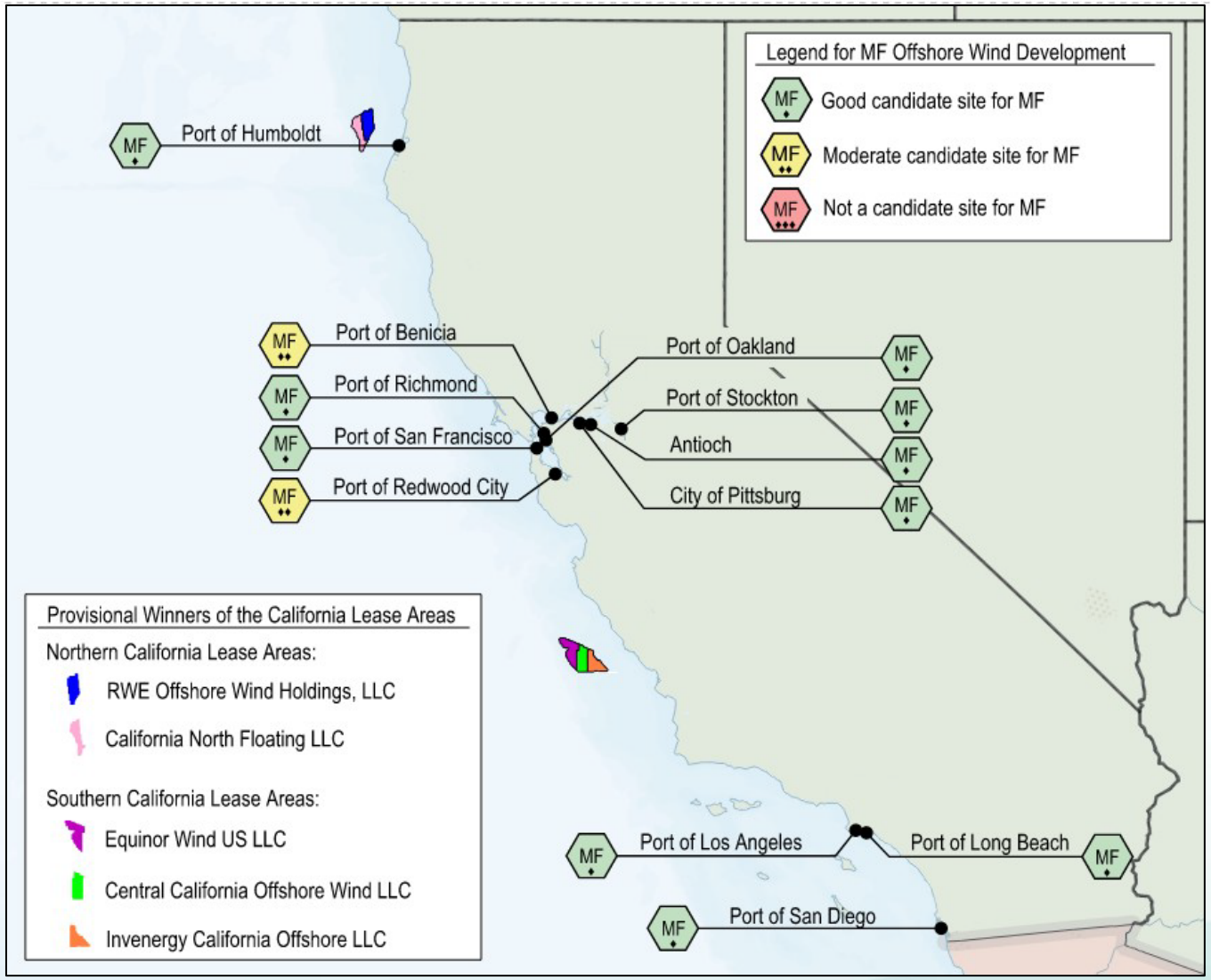
Best CA Port Sites – Staging & Integration



Without these type of sites, OSW development is not possible

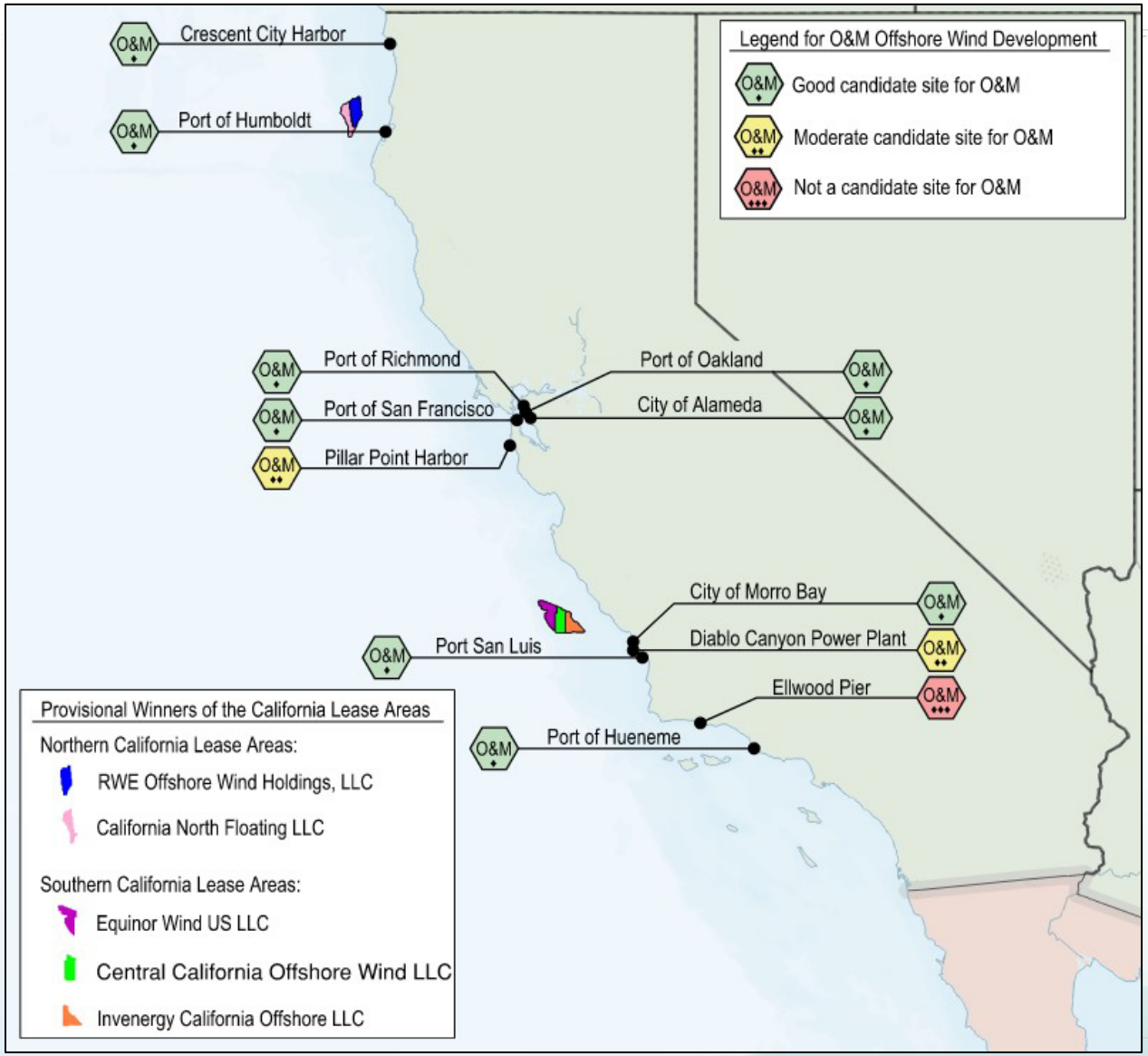
Port of Humboldt and Port of Long Beach have announced projects

Best CA Port Sites – Manufacturing



These type of sites provide significant job creation and economic impact

Best CA Port Sites – Operations & Maintenance



Multi-Port Strategy to Achieve State Offshore Wind Planning Goals

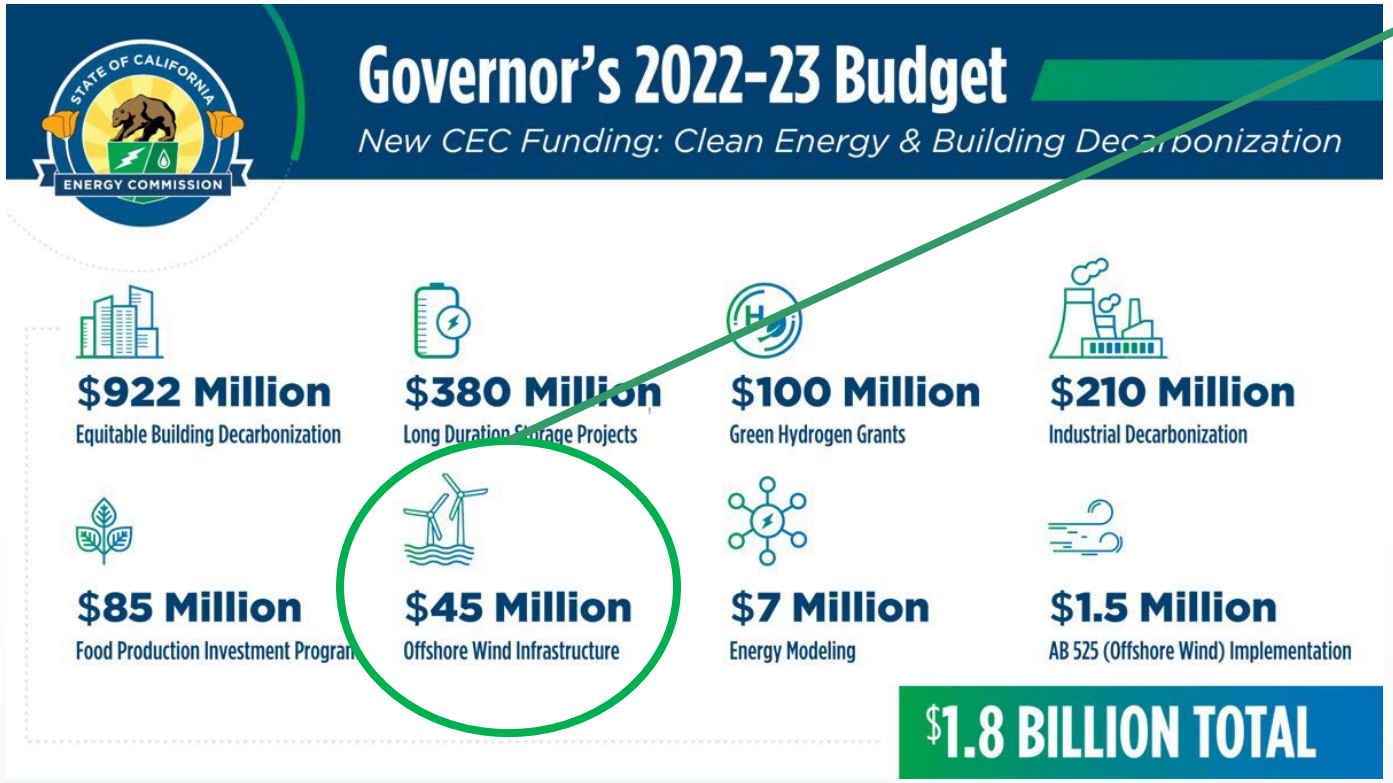
Type of Site	Medium (25 GW)
S&I Sites	3
MF Site (Blade)	2
MF Site (Tower)	1
MF Site (Nacelle Assembly)	1
MF Site (Foundation Assembly)	2
SOV berths for O&M Activities	9 to 16
Mooring Line & Anchor Storage Sites	20 to 40 ac
Electrical Cable Laydown Sites	12 to 22 ac

Need approximately 10 large port sites (>80 acres) and 10 small port or harbor sites (2-10 acres) to meet CA targets by 2045

Strategizing the development of manufacturing port sites in California will maximize job creation and economic impact to the State

California ports and harbors can be ready to support the OSW industry with adequate and timely investments

Program to Support Offshore Wind Infrastructure Improvements (Assembly Bill 209)



- Expend or encumber the funds by June 30, 2025 and make available for liquidation until June 30, 2029.
- …advance the capabilities of California ports, harbors, and other waterfront facilities to support the buildout of offshore wind facilities…
- Eligible applicants…California port authorities, port operators, port commissions, and their respective authorized agents, other California waterfront facilities…
- individual or regional retrofit concepts and investment plans.
- final design, engineering, environmental studies and review, and construction of retrofits.
- cost share funding to an eligible applicant that receives a federal award

Thank You!

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Image Source: Principle Power