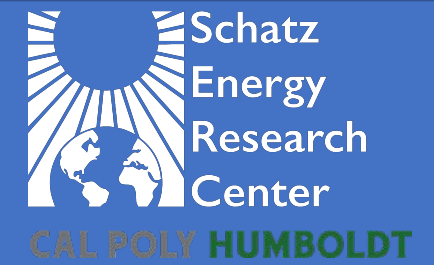


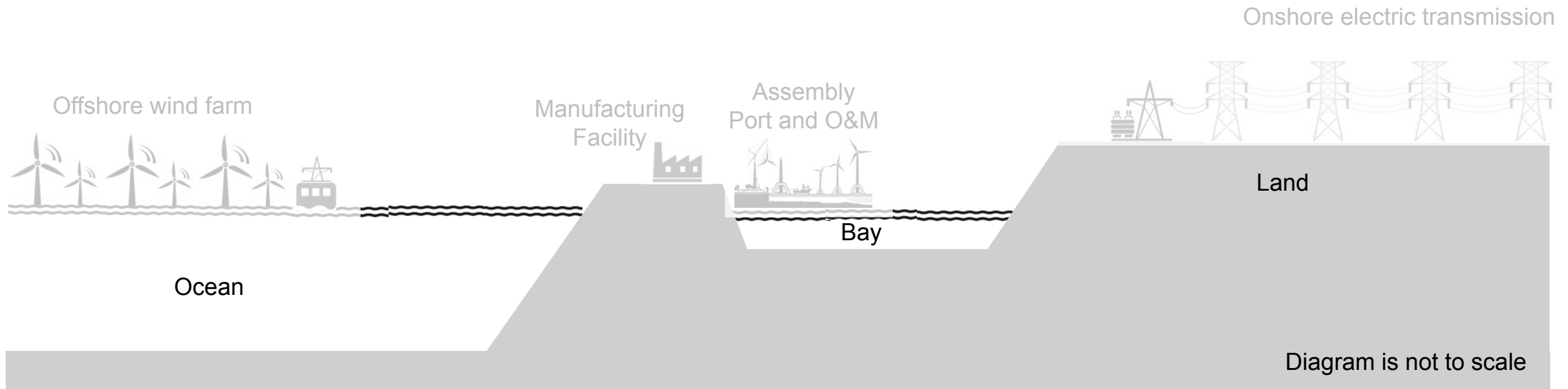
California Floating Offshore Wind Professional Labor Assessment



Presented by Tanner Etherton
November 14, 2025



Offshore wind development involves four main types of infrastructure:
(1) offshore wind farms, (2) ports (import/export, assembly, O&M),
(3) electric transmission (and conversion), (4) component supply chains.

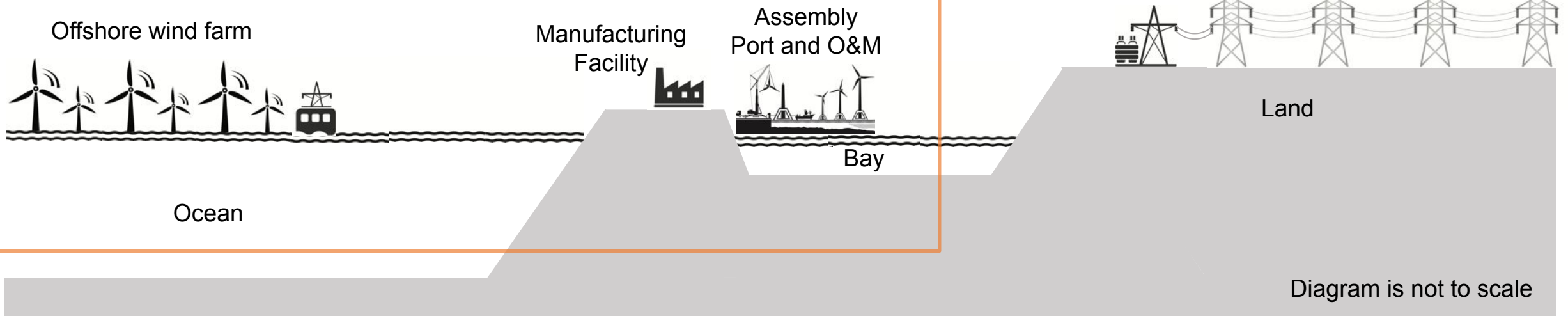


Objective: Assess Professional Labor Demand in CA Offshore Wind

- Evaluate existing workforce analyses and models
- Assess professional labor demand across the FOSW industry...
- And the development of port and transmission infrastructure
- Identify educational pathways to employment through Cal Poly Humboldt



Onshore electric transmission

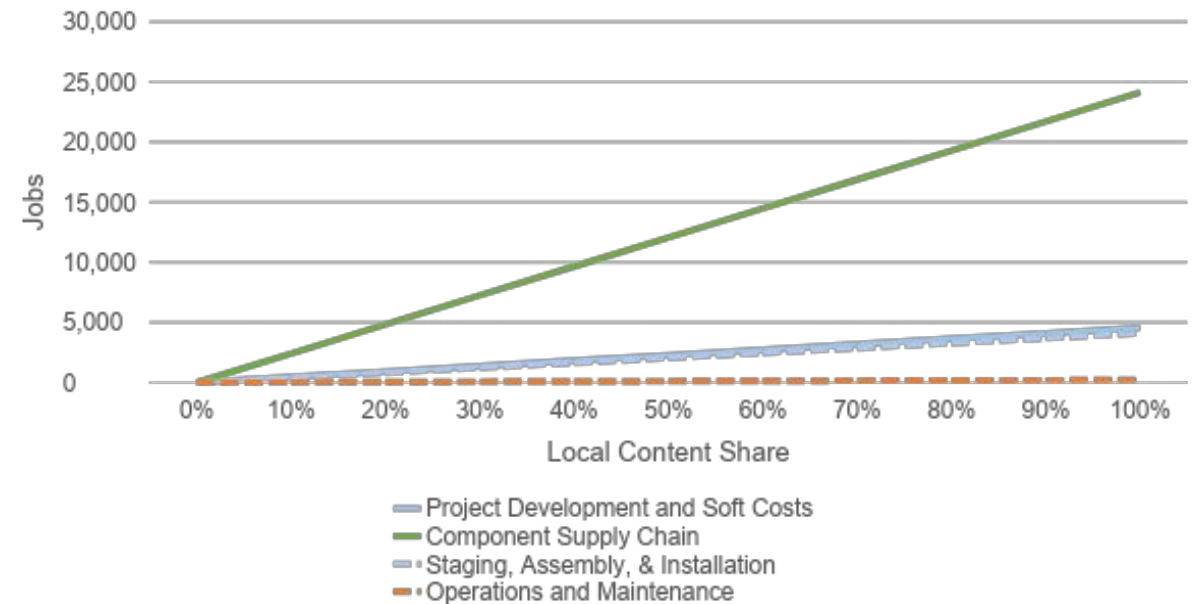


- AB 525 Offshore Wind Strategic Plan – Workforce Development studies showed major variation across workforce demand by 2030; 2,375 – 8,280 Jobs (~6,000 job range)
- Major factors driving difference:
 1. Project Scale/Timeline – pre-dating CA current FOSW Energy Targets of 3-5 GW by 2030, and 25 GW by 2045
 2. Level/type of In-state Supply Chain Participation
- *AB 525 Workforce Readiness Plan (2023)* – 2-5 GW by 2030 – High Supply Chain Participation – 3,177 jobs in 2030

Estimated CA Floating Offshore Wind Jobs in 2030

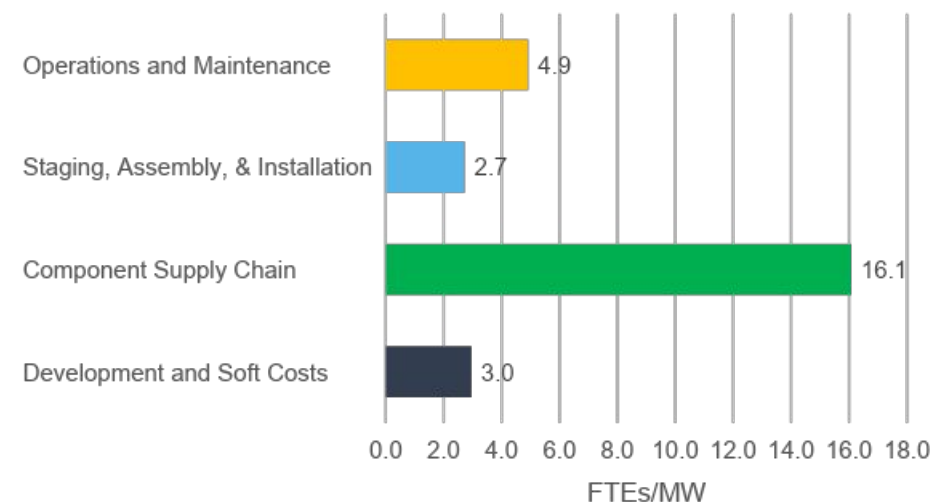
Source/Model	Project Scale/Timeline	Supply Chain Participation	Supply Chain Jobs	Construction Jobs	Operations & Maintenance Jobs	Total Jobs
American Jobs Project (2019)	18 GW by 2045	N/A	2,100	350	1,200	3,650
NREL (2016)	16 GW by 2050	25% Nacelles, 50% Blades, 100% Towers	5,490	1,130	1,660	8,280
Guidehouse (2022)	3 GW by 2030, 20 GW by 2050	50% blades	1,936	125	314	2,375
Total Range			1,936 - 5,490	125 - 1,130	314 - 1,660	2,375 - 8,280

- NREL Job and Economic Impact (JEDI) Model estimates economic output of energy infrastructure projects based on project inputs.
- Modeled for a 1.5 GW offshore wind power plant in the Humboldt WEA (100, 15 MW turbines)
- Job output expressed in **FTEs (Full Time Equivalents)** - One FTE represents a full-time job for one year (2,080 hours)
- Cost of the project is distributed across expenditures in four OSW Activity Areas.
- **Local Content Share** – Portion of expenditures that occur in the geographic area of focus (CA).

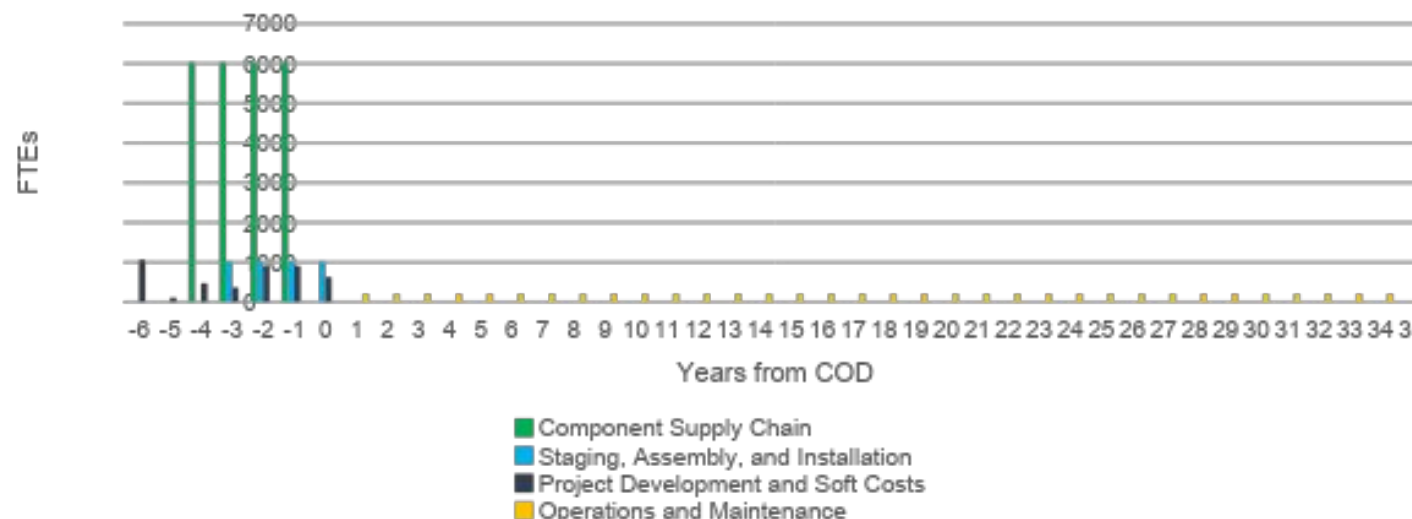


- **Component supply chain activities**
 - 60% of total jobs – 16 FTEs/Megawatt (MW)
 - 76% of these are associated with “material costs” (Tier 2-4 manufacturing).
- **Staging, assembly, and installation**
 - 10% of total jobs – 2.7 FTEs/MW
 - 44% of these are associated with specialized vessel operations.
- **Development and soft costs**
 - 11% of total jobs – 3 FTEs/MW
 - 31% of these are associated with onshore electrical interconnection
 - 7% associated with site assessment activities.
- **Operations and maintenance (O&M)**
 - 18% of total jobs – 4.92 FTEs/MW
 - These jobs will occur throughout the operational life of a project.

FTEs/MW by Supply Area



Annual FTEs for Supply Areas by Years from Commercial Operations Date



Development and Soft Costs	Component Supply Chain	Staging, Assembly, & Installation	Operations and Maintenance
• Site Auction Price • BOEM Review • Construction Operations Plan • Construction Operations Activities • Design Install Plan • Site Assessment Plan • Site Assessment Activities • Commissioning • Construction Finance • Construction Insurance • Contingencies • Decommissioning • Electrical Interconnection	Material and labor costs for; • Nacelle • Blades • Tower • Mooring System • Semisubmersible Foundation • Array Cable System • Export Cable System • Offshore Substation	Costs associated with staging assembling and installing for; • Semisubmersible Foundation • Mooring System • Turbine Components • Array Cable System • Export Cable System • Offshore Substation	Labor costs for; • Offshore Technicians • Operation Management and General Administration

- **High-Investment Scenario** (Based on projections from the *AB 525 Workforce Readiness Plan*)
 - assumes significant domestic manufacturing of major components (nacelles, towers, and blades), resulting in higher overall job creation, with a larger share of professional employment – 41% of total jobs.
- **Low-Investment Scenario** (NREL JEDI model)
 - Assumes little to no domestic manufacturing of major components, leading to a decrease in professional employment to 37% of the workforce.

Supply Area	Low-Investment Scenario	High-Investment Scenario ¹
Wind turbine supply	No local manufacturing of major components.	Nacelle assembly by 2030; one blade manufacturing facilities by 2030; towers manufacturing from 2030.
Balance of plant supply	Foundation assembly; no manufacturing or assembly of nacelles, cables, moorings nor anchors.	Local workforce for foundation assembly by 2030; nacelle manufacturing by 2030;

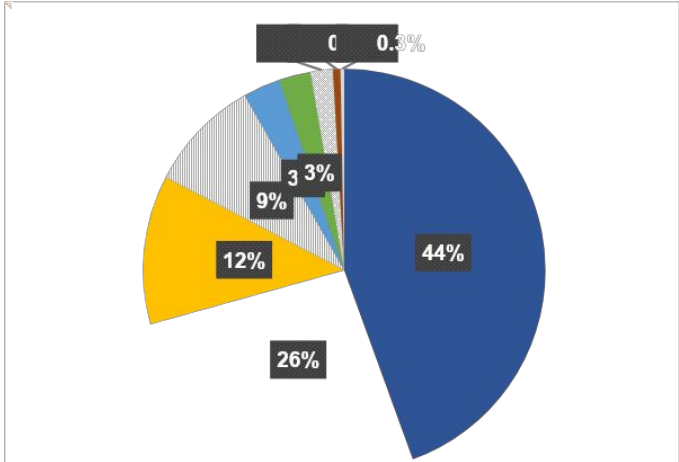
Proportion of Jobs Requiring a University Degree

41%

37%

^[1] California State Lands Commission. *AB 525 Workforce Development Readiness Plan*. Final Report. June 16, 2023.
Table 2.1. Available at: <https://www.slc.ca.gov/renewable-energy/workforce-development-readiness-plan/>.

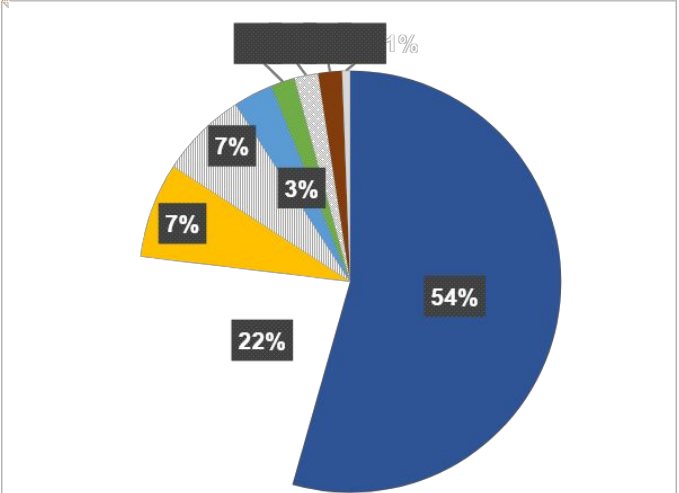
49%



Architecture and Engineering Occupations (2030)

- Mechanical Engineers
- Civil engineer
- Environmental consultant/engineer
- Electrical engineer
- Industrial Engineers
- Engineers, All Other
- Marine Engineers and Naval Architects
- Architects, Except Landscape and Naval
- Chemical Technicians

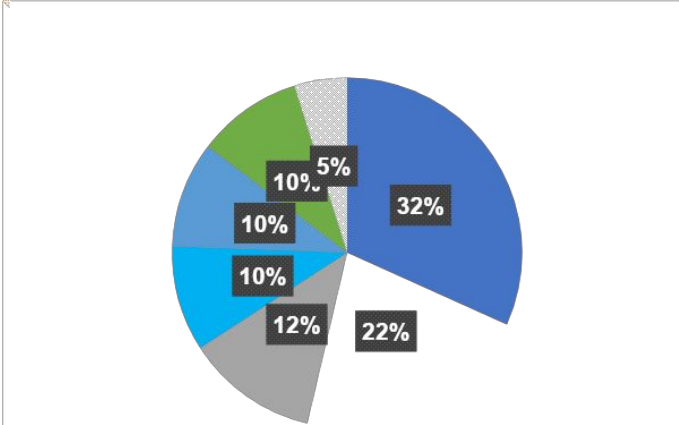
25%



Management Occupations (2030)

- Managers, All Other
- Administrative Services and Facilities Managers
- Purchasing Managers
- Industrial Production Managers
- Emergency Management Directors
- General and Operations Managers
- Training and Development Managers
- Construction Managers
- Architectural and Engineering Managers

12%



Life, Physical, and Social Science Occupations (2030)

- Biological Scientists, All Other
- Atmospheric and Space Scientists
- Archeologist
- Animal Scientists
- Geoscientists, Except Hydrologists and Geographers
- Hydrologists
- Zoologists and Wildlife Biological Scientists, All Others

Professional Occupations in FOSW

- Professional occupations will make up 41% to 37% of FOSW jobs in California, under two investment scenarios.
- Engineering occupations**
 - 49.8% (High Investment) to 47.0% (Low Investment) of professional jobs in 2030.
 - Mechanical engineers:** 44.5% - 26.9% of engineering jobs
 - Civil engineers:** 26.2% - 41.0% of engineering jobs
- Life and physical sciences occupations**
 - 12.2% - 18.0% of professional jobs in 2030
- Management occupations**
 - 24.5% - 20.5% of professional jobs in 2030

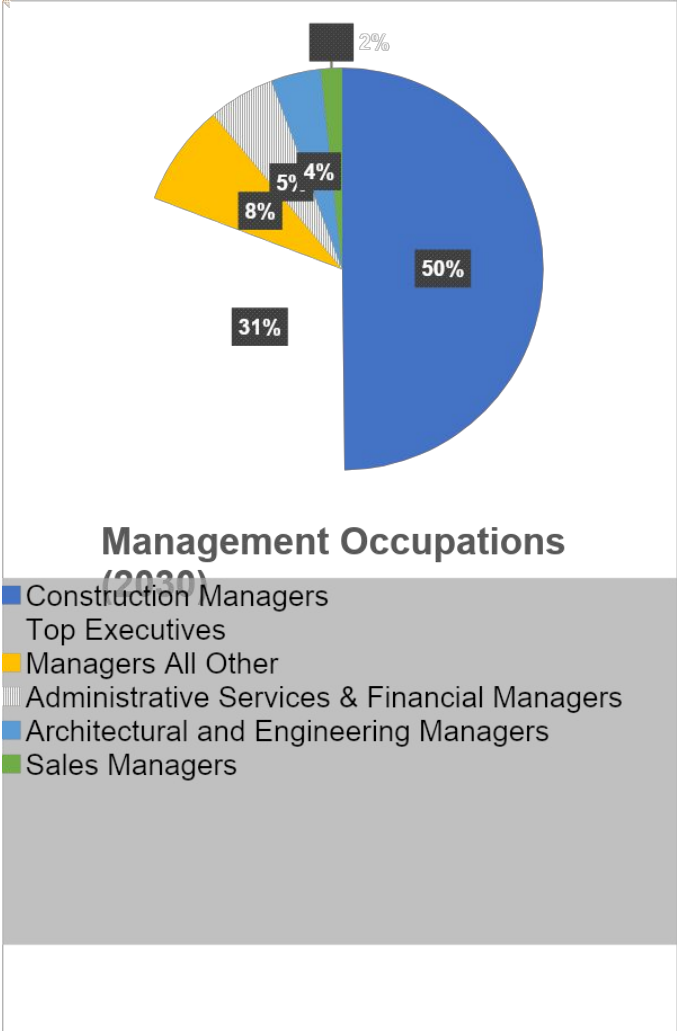
SOC	Occupation	Number of jobs in 2030 ¹	Experience in Related Occupation ²	Percent with Advanced Degree ³
17-2141	Mechanical Engineers	297	None	25%
11-9199	Managers, All Other	179	Less than 5 years	21%
17-2051	Civil Engineers	175	None	30%
17-2081	Environmental Engineer	80	None	43%
11-3012	Administrative Services Managers	70	Less than 5 years	19%
17-2071	Electrical Engineers	61	None	34%
19-1029	Biological Scientists, All Other	52	None	55%
13-1071	Human Resources Specialists	50	None	20%
19-2021	Atmospheric and Space Scientists	36	None	35%
13-1081	Logisticians	26	None	12%

^[1] California State Lands Commission. *AB 525 Workforce Development Readiness Plan*. Final Report. June 16, 2023. 88-92. Available at: <https://www.slc.ca.gov/renewable-energy/workforce-development-readiness-plan/>.

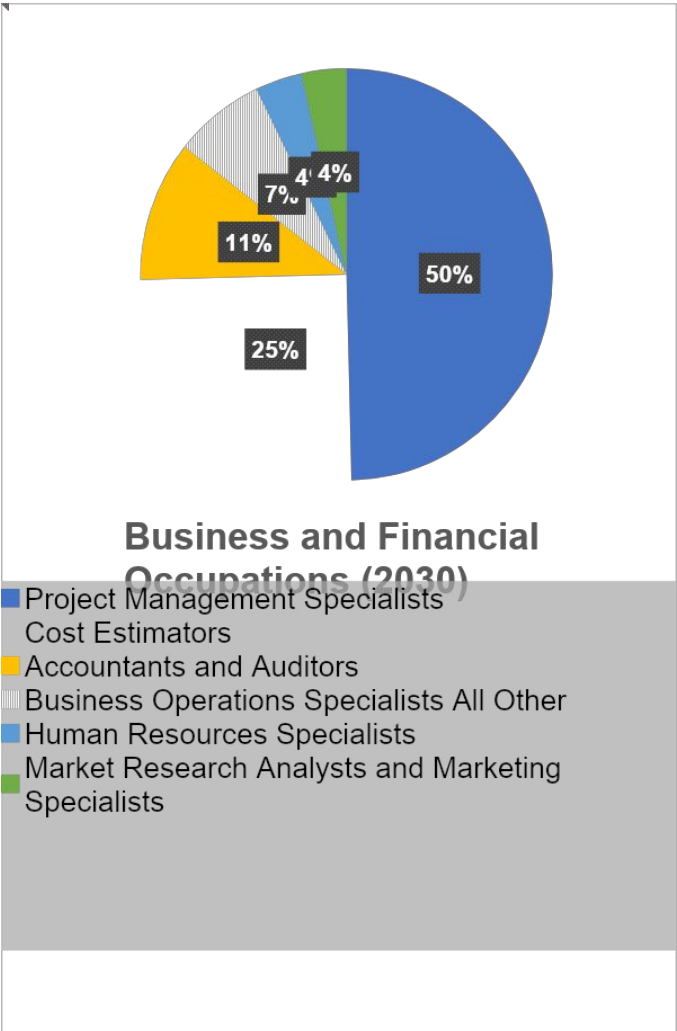
^[2] U.S. Bureau of Labor Statistics, *Education and Training Assignments by Detailed Occupation*, last modified September 6, 2023, <https://www.bls.gov/emp/tables/education-and-training-by-occupation.html>

^[3] U.S. Bureau of Labor Statistics, *Educational Attainment for Workers 25 Years and Older by Detailed Occupation*, last modified September 6, 2023, <https://www.bls.gov/emp/tables/educational-attainment.html>.

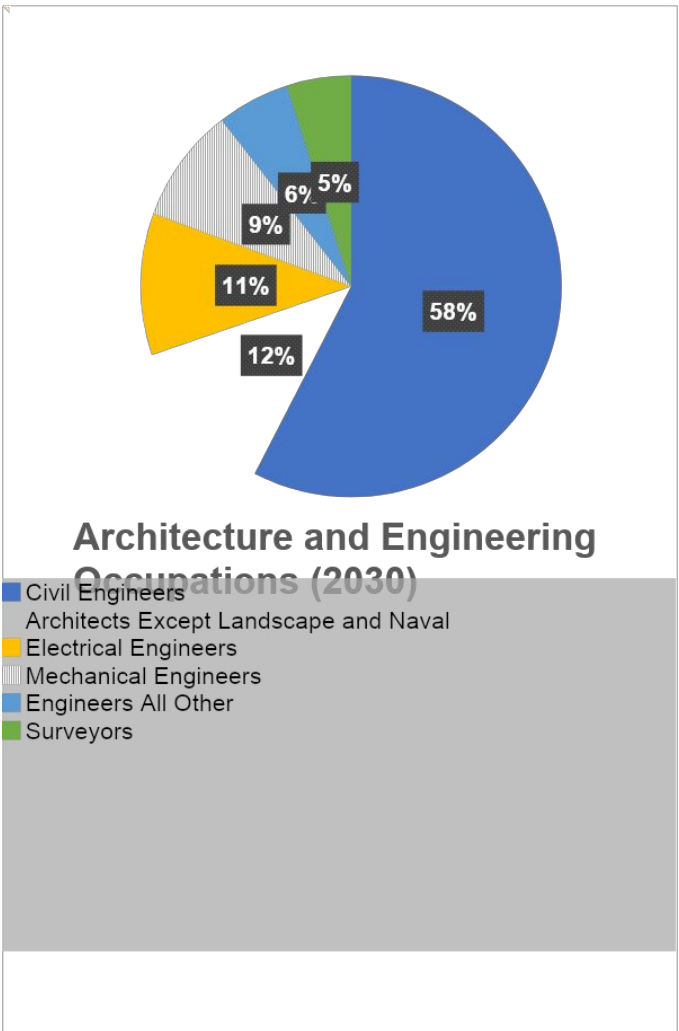
45%



36%



17%



- *AB 525 Workforce Readiness*
- **Management occupations**
 - 45% of professional port development jobs in 2030
 - **Construction Managers: 50%**
 - **Top Executives: 31%**
- **Business and financial occupations**
 - 36% of professional port development jobs in 2030
 - **Project Management Specialists: 50%**
 - **Cost Estimators: 25%**
- **Engineering occupations**
 - 17% of professional port development jobs in 2030
 - **Civil Engineers: 57%**
 - **Architects: 12%**

Professional Occupations in Port Development

SOC	Occupation	Number of jobs in 2030 ¹	Experience in Related Occupation ²	Percent with Advanced Degree ³
11-9021	Construction Managers	409	None	7%
13-1082	Project Management Specialists	324	None	26%
11-1021	General and Operations Managers	240	5 years or more	13%
17-2051	Civil Engineers	175	None	30%
13-1051	Cost Estimators	163	None	6%
13-2011	Accountants and Auditors	72	None	28%
11-9199	Managers, All Other	67	Less than 5 years	21%
13-1199	Business Operations Specialists, All Other	47	None	23%
17-1011	Architects, Except Landscape and Naval	37	None	46%
17-2071	Electrical Engineers	33	None	34%

^[1] California State Lands Commission. *AB 525 Workforce Development Readiness Plan*. Final Report. June 16, 2023. 88-92. Available at: <https://www.slc.ca.gov/renewable-energy/workforce-development-readiness-plan/>.

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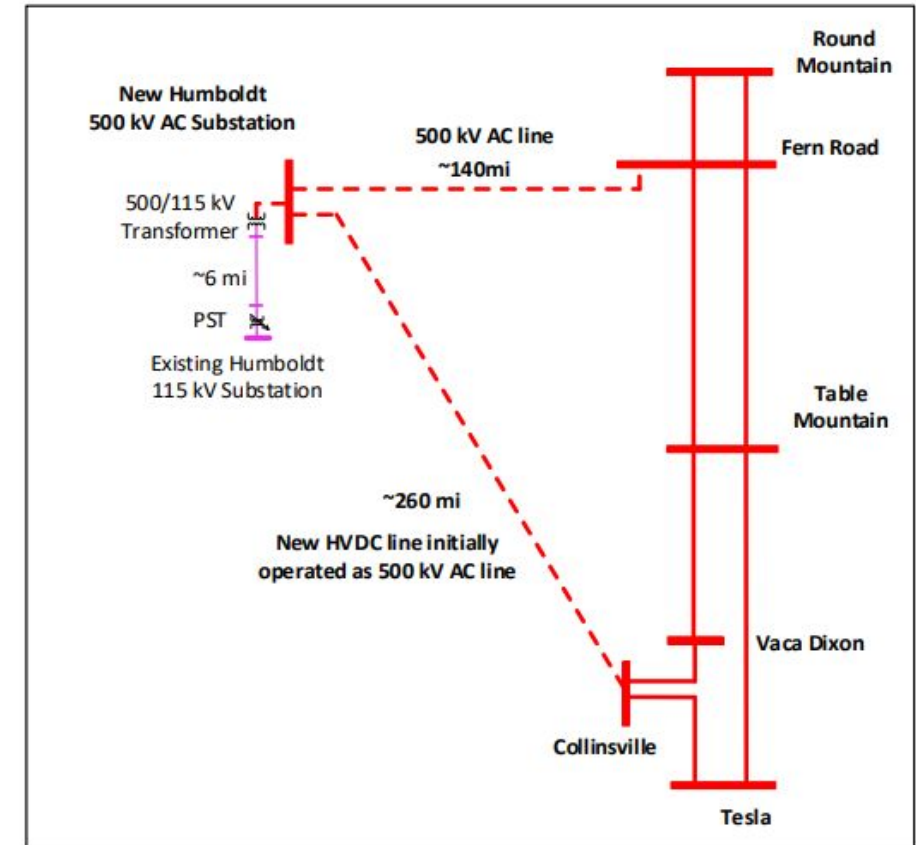
^[3] U.S. Bureau of Labor Statistics, *Educational Attainment for Workers 25 Years and Older by Detailed Occupation*, last modified September 6, 2023, <https://www.bls.gov/emp/tables/educational-attainment.html>.

Project 1:

- **Description:** New Humboldt 500 kV Substation + 500 kV Single Circuit Line to Collinsville
- **Capital Investment:** \$1,165 million

Project 2:

- **Description:** Humboldt to Fern Road 500 kV Single Circuit Line
- **Capital Investment:** \$496 million



California Independent System Operator. *Appendix I: Description and Functional Specifications for Transmission Facilities Eligible for Competitive Solicitation. 2023–2024 Transmission Plan*, 23 May 2024.

<https://www.caiso.com/documents/appendix-i-board-approved-2023-2024-transmission-plan.pdf>

- Used IMPLAN to understand the composition of jobs in the Construction of New Power and Communication Structures industry.
- Only about 14% of the workforce would likely require a bachelor’s degree
- Currently conducting a more comprehensive economic impact analysis for Transmission Infrastructure; including job estimates during construction, and through the life of the project.

Occupations	Percent of professional jobs
Management Occupations	49.2%
Business and Financial Operations Occupations	36.2%
Architecture and Engineering Occupations	7.6%
Life, Physical, and Social Science Occupations	3.4%
Computer and Mathematical Occupations	2.6%
Legal Occupations	0.8%
Sales and Related Occupations	0.3%

Academic Program	Average Annual Graduates 2013-2023	Estimated Graduates 2030	FOSW Jobs 2030	Port Development Jobs in 2030
Engineering	48	335	690	448
Business Administration	161	1128	157	698
Communications	41	288	5	410
Environmental Science and Management	119	830	132	0
Biology	197	1381	68	35
Oceanography	9	66	84	0
Sociology	73	510	58	24
Computer Science	31	214	16	42
Geography	21	148	36	15
Political Science	28	196	8	39
Economics	15	102	0	47
Journalism and Mass Communication	30	209	0	39
Mathematics	19	130	16	20
Geology	22	153	32	0
Wildlife	92	646	16	8
Anthropology	35	244	20	0
Fisheries Biology	19	132	0	8

Engineering programs support ~1,338 jobs (~30% of FOSW and port development professional labor), especially in:

- Mechanical (45%), Civil (26%), and Environmental (12%) engineering.
- Strong potential for growth through new undergrad/grad programs.
- ABET accreditation enhances graduate competitiveness.

Science programs (e.g., Marine Biology, Oceanography, Environmental Science) expected to produce 4,000+ graduates by 2030

- Align well with needs for environmental monitoring, surveying, and research.
- Most science jobs tied to FOSW, not port development—possibly undercounted.

Business/Admin programs support roles mostly in port development (~87%)

- Key occupations: Project Managers, Cost Estimators, Accountants, Logisticians.
- Lack of AACSB accreditation may limit competitiveness.

Graduate degrees may be increasingly necessary, despite BLS estimates

- Offshore wind industry trends suggest higher qualifications preferred.

New Engineering & Technology Building



<https://www.humboldt.edu/facilities-management/capital-projects/engineering-technology-building>

Recommendations:

- **Align Academic Programs with Industry Needs** – Identify curriculum gaps and align courses with FOSW careers.
- **Strengthen Industry Partnerships** – Collaborate with industry to provide experiential learning opportunities.
- **Improve Workforce Data Transparency** – Advocate for clearer modeling assumptions and refined job estimates.

Next Steps:

- **Conduct Economic Impact Assessments** of FOSW onshore transmission infrastructure.
- **Engage Industry to Define Job Roles** and refine workforce projections.
- **Expand Academic Offerings** to support specialized FOSW workforce development.

Long Beach Pier Wind Project Concept



<https://polb.com/port-info/news-and-press/port-of-long-beach-releases-pier-wind-project-concept-05-09-2023/>