Applied Economics Clinic
Economic and Policy Analysis of Energy, Environment and Equity

POLICY BRIEF

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Economic Impacts of Offshore Wind in Connecticut

This Applied Economics Clinic policy brief—prepared on behalf of the Connecticut Roundtable on Climate and Jobs (CRCJ)—presents the economic impacts associated with installing and operating 2,000 megawatts (MW) of offshore wind resources in Connecticut to meet the State's 2030 target. The benefits of wind procurement need not flow to Connecticut's economy if neighboring states undertake industrial development efforts and Connecticut does not. AEC's analysis finds that a concerted policy effort to develop Connecticut's offshore wind industry would allow the addition of these offshore wind resources to create a total of 39,880 in-state job-years (i.e., one job-year is the equivalent of one person working full-time for one year) between 2024 and 2049 as well as an estimated $5,529 million in state economic output and $4,190 million in labor income.

Connecticut's offshore wind goals

Connecticut Public Act No. 19-71 authorized the Commissioner of the Department of Energy and Environmental Protection (DEEP) to solicit proposals for up to 2,000 MW of offshore wind nameplate capacity.[1] These procurements are in service of Connecticut's aim to achieve net-zero carbon electricity by 2040 and reduce greenhouse gas emission by 45 percent below 2001 levels by 2030 and 80 percent by 2050.[2]

Connecticut's proximity to other states bordering the Long Island Sound (New York and Rhode Island)—as shown in Figure 1—means it is not guaranteed that economic benefits of offshore wind development will flow into the state.

Figure 1. Map of Long Island Sound

To secure sufficient offshore wind capacity to meet its climate goals and economic benefits to its economy from developing an offshore wind industry, Connecticut must make investments and pursue industrial policy to prioritize the growth of a wind industry within the state. Doing so will stimulate jobs, higher incomes, and demand for adjacent industries during the energy transition. This AEC policy brief assesses the economic benefits of offshore wind and highlights industries and workforces that State policies must support to ensure growth of Connecticut's offshore wind industry.

Economic impact of offshore wind investments by Connecticut

Investments to build 2,000 MW of offshore wind in Connecticut represent an economic opportunity. Money spent on construction and the subsequent operation of offshore wind facilities will increase economic output and boost employment and labor income. However, these benefits will not necessarily flow to Connecticut's businesses or municipalities. Connecticut will have to procure skilled labor, materials, and services to build offshore wind. Some of those inputs will come from outside Connecticut—either from neighboring states like New York and Rhode Island or from further afield.

If Connecticut wants to see a larger share of the economic benefits from offshore wind remain in the state, it will have to prioritize investments and procurement accordingly. Moreover, economic development can follow from the money spent by new workers in the state and from the growth of Connecticut's industries supporting offshore wind.

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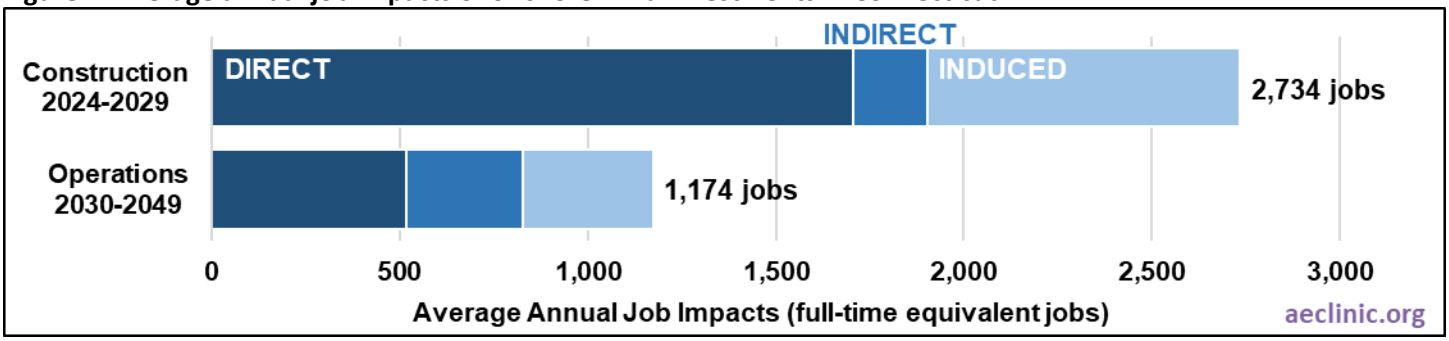
Figure 2. Average annual job impacts of offshore wind investments in Connecticut



Installing 2,000 MW of offshore wind in Connecticut creates an average of 2,734 full-time jobs per year during the six-year construction period from 2024 to 2029, while operating these offshore wind resources creates an average of 1,174 full-time jobs per year during the 20-year operating period from 2030 to 2049 (see Figure 2). In total, the addition of these offshore wind resources in Connecticut creates 39,880 job-years[3] (16,403 of which occur during construction and the remaining 23,476 job-years during operations).

Offshore wind sees investments in two phases: (1) construction and (2) operations. Both phases see money spent on different industries and lead to different impacts if the money is spent in Connecticut. The total economic impact of these activities is modeled in three separate categories:

- **Direct impacts:** These represent the jobs at the site of the investment. For instance, the workers installing wind turbines on a wind farm count as "direct jobs," as would operations and maintenance (O&M) workers.
- **Indirect impacts:** These represent the jobs from providing supplies and services for the investment. For instance, the workers producing wind blades used to build a wind turbine are classified as "indirect jobs."
- **Induced impacts:** These represent the jobs associated with direct and indirect workers re-spending their wages in the local economy. For instance, jobs at restaurants patronized by wind farm technicians.

During the six-year construction period, installing offshore wind resources creates an average of 1,705 direct jobs on an annual basis, as well as 197 indirect jobs and 831 induced jobs (see Table 1). During the 20-year operating period, offshore wind resources yield an average of 517 direct jobs per year, as well as 312 indirect jobs and 345 induced jobs. In addition to job creation, these additional offshore wind resources in Connecticut result in an estimated $2,248 million in state economic output, or overall economic impact, over the construction period and another $3,281 million during the operating period. Labor income associated with Connecticut's job creation is an estimated $4,190 million across both the construction and operating periods by investing in additional offshore wind resources in the state.

Table 1. Average annual economic impacts of offshore wind investments in Connecticut

Annual Average Impacts	Impact Type	Construction Period *2024-2029*	Operating Period *2030-2049*
Jobs *(FTEs)*	Direct	1,705	517
	Indirect	197	312
	Induced	831	345
	Total	**2,734**	**1,174**
State GDP *(2021$, millions)*	Direct	$239	$75
	Indirect	$27	$44
	Induced	$109	$44
	Total	**$375**	**$164**
Labor Income *(2021$, millions)*	Direct	$215	$63
	Indirect	$19	$32
	Induced	$62	$26
	Total	**$297**	**$120**

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The results of AEC's modeling show the total potential jobs and income created within Connecticut from expenditures on offshore wind (if located in Connecticut's waters) and its sub-industries (see below for more on these industries).

However, that need not mean all of those jobs and incomes are received entirely by Connecticut residents; money for procurement could be spent on firms based in New York, Rhode Island, or elsewhere. The results presume Connecticut begins construction of offshore wind immediately in 2024 and that the increased economic output and labor income are direct benefits to Connecticut from prioritizing procurement of offshore wind within the state. For more information on the methodology of this economic impact analysis, see the final section of this memo.

Developing offshore wind in CT

If Connecticut is to meet its grid decarbonization and emissions reductions targets, additional renewable energy capacity will be necessary. As of June 2023, over 90 percent of net electric generation located in Connecticut was composed of gas-fired resources.[4] The 2,000 MW of offshore wind procurement would aid in replacing Connecticut's gas-fired capacity. However, Connecticut must also invest in the industries and workforces that make up the offshore wind industry if it hopes to see a dramatic increase in new capacity.

The offshore wind industry is composed of six main types of sub-industries or activities: (1) Production and manufacturing of turbines, including suppliers and component manufacturers; (2) Project planning and development, including land use planning, location selection, and selection of plant configuration; (3) Financing and insurance institutions; (4) Construction industries, including transport, logistics, and construction companies; (5) Testing and certification of wind facilities; and (6) Operation and maintenance of offshore wind facilities.[5]

Targeted investment and policy support for these industries would facilitate:

- **Additional economic benefits** from offshore wind to Connecticut relative to other states;
- **Stable and accelerated procurement** and scaling of offshore wind capacity in advance of Connecticut's climate deadlines;
- **Further employment and income opportunities** for workers in Connecticut relative to other states.

Connecticut should also take steps to secure the supply chain for offshore wind: component parts, port facilities, and the vessels that build and maintain offshore wind so that production can be scaled up without delay or cost spikes. Connecticut's investment in workforce training for the following occupational categories would help funnel jobs created in the state to workers living or migrating to the state (see Table 2).

Table 2. Workforce occupations and job opportunities

Occupational Category	Examples
Regional professionals	Administrators, sales and marketing teams, and human resources staff.
Factory-level management	Production and manufacturing engineers.
Design and engineering	Design and testing engineers and supply chain analysts.
Quality and safety	Logistics managers, quality assurance specialists and engineers, safety officers or advisors.
Facilities maintenance	Maintenance technicians and engineers.

Methodology

AEC used IMPLAN[6], a regional economic impact model, to estimate the total impacts to employment, labor income, and state economic output resulting from installing and operating 2,000 MW of offshore wind in Connecticut.[7] IMPLAN provides key economic data for 546 industries for a customized region (in this case the entire state of Connecticut), and models interactions between these industries based on the flow of goods, services, and workers from industry to industry and in and out of that region. The model then produces customized "multipliers" that estimate the ripple

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effects of spending on a given industry in the user-specified area. For instance, building a new wind farm is primarily performed by an engineering/construction firm but relies on other industries for supplies,[8] and the firm's workers spend their wages at local businesses. Since IMPLAN's 546 sectors do not include sectors specific to the offshore wind industry, AEC developed its own spending pattern map to supplement our IMPLAN analysis.

Achieving Connecticut's offshore wind goals results in new economic activity from (1) construction or installation of new resources and infrastructure, and (2) operation and maintenance (O&M) of new resources. The economic impact of building or operating resources outside of Connecticut is not included in this analysis. (Note that IMPLAN does not differentiate between "permanent" and "temporary" employment—jobs are reported in the year that they take place.)

The following assumptions were used as defaults in our economic impact analysis:

- **Direct wages.** An average wage for each resource activity was taken from Connecticut-specific data on industry wages from the U.S. Bureau of Labor Statistics (BLS).
- **Labor compensation and wages.** The IMPLAN model works from "labor compensation" which includes wages, benefits, and taxes. IMPLAN offers data for each of the 546 industries to translate wages into labor compensation.
- **Full-time equivalents and employment.** IMPLAN presents "employment" as a headcount of number of workers in each industry; this method counts full and part-time workers as equivalent. The job impacts in this brief are presented in terms of "full-time equivalents" (FTEs)—that is 2,080 hours of work per year. We translated employment into FTEs using sector-specific factors from IMPLAN.
- **Inflation.** State GDP and labor income impacts are presented in terms of real (inflation-adjusted) 2021 dollars.

AEC's customized spending pattern map, used to supplement the IMPLAN analysis, was based on resource-specific research to identify which of IMPLAN's 546 sectors correspond to construction and operation activities that are common to the offshore wind industry. AEC determined both the proper industry to use in IMPLAN for each type of material and worker, and the percentage of total project costs that would be allocated to this industry.

Offshore wind installations require materials necessary to construct the turbine itself (i.e., rotor nacelle assembly, tower) as well as the substructure, foundation, and electrical infrastructure (including underwater cables). The cost breakdown for offshore wind installation, including labor costs, is based on NREL's *Cost of Wind Energy* report, which outlines the levelized cost of energy assumptions for a fixed-bottom offshore wind project. Each cost component was translated into the relevant North American Industry Classification System (NAICS) code, and following that, the relevant IMPLAN industry.

Annual O&M for offshore wind included IMPLAN industries such as "construction of new power and communication structures," "electric power transmission and distribution," and "water transportation."

To estimate the costs associated with installing and operating 2,000 MW of offshore wind, AEC assumes a construction period of 6 years (2024-2029) and an operating period of 20 years (2030-2049). Construction and O&M costs were calculated using estimates for offshore wind resources (Class 6) from NREL's *2023 Annual Technology Baseline*.

Notes

[1] State of Connecticut. June 2019. Public Act No. 19-71. *An Act Concerning the Procurement of Energy Derived from Offshore Wind*. Available at: https://www.cga.ct.gov/2019/act/pa/pdf/2019PA-00071-R00HB-07156-PA.pdf.

[2] State of Connecticut. May 2022. Public Act No. 22-5. *An Act Concerning Climate Change Mitigation.* Available at: https://www.cga.ct.gov/2022/act/pa/pdf/2022PA-00005-R00SB-00010-PA.pdf.

[3] A "job-year" is the number of "jobs per year" added up across multiple years (i.e., one job-year is the equivalent of one person working full-time for one year). For example, a worker that has the same full-time job for 5 years has one job but 5 job-years.

[4] U.S. EIA. 2023. *Connecticut Net Electricity Generation by Source, Jun. 2023.* Available at: https://www.eia.gov/state/?sid=CT

[5] Offshore-Windindustry.com. N.d. "Offshore Wind Industry." Available at: https://www.offshore-windindustry.com/economy/wind-industry

[6] https://implan.com/

[7] Employment or jobs in this brief are in full-time equivalents (FTEs).

[8] IMPLAN modeling accounts for geographic variability in availability of locally produced and sold materials.

Works Cited

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