Under the Sea[1]: A New Platform for Offshore Wind Decommissioning to Support Ocean Ecosystem Conservation

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[1] "Under the Sea" is a song composed for the 1989 animated movie, *The Little Mermaid*, where Sebastian the crab pleads for Ariel the mermaid to remain under the sea. Miguel Salazar, *The Meaning Behind The Song: Under The Sea by Disney*, OLD TIME MUSIC (Oct. 12, 2023), https://oldtimemusic.com/the-meaning-behind-the-song-under-the-sea-by-disney/.

[2] *The author thanks UHLC Professor Gina Warren and the Energy & the Environment Seminar class for helpful comments on this Article.*

<u>Table of Contents</u>

I. Introduction

Throughout history, the mystery and power of the ocean has influenced humankind. Storytellers, traders, free-divers, and conservationists alike have ventured into the depths of the sea trying to understand it. The vastness of the ocean is incomprehensible[3] but "affects all forms of life on the planet."[4] However, the ocean is as fragile as it is magnificent. As UN Secretary-General António Guterres said at the 2022 UN Ocean Conference, "the ocean connects us all…[but] [s]adly, we have taken the ocean for granted and today we face … an 'Ocean Emergency.'"[5] "We must turn the tide."[6]

The ocean faces devastating consequences of climate change that upset its balance and that of the entire planet.[7] Under the Paris Agreement, the most important legally binding international climate change treaty to date, parties have stressed the importance of limiting global temperature rises to 1.5 degrees Celsius this century.[8] Because electricity production is responsible for about a quarter of greenhouse gas emissions globally, the electricity sector will need to focus on decarbonization and development of new renewables.[9] The expansion of offshore wind projects to generate renewable energy is a growing priority in the solution to address global climate goals and ocean conservation.[10]

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[3] The ocean accounts for 71% of the Earth's surface, but only about 5% of the ocean has been explored by humans. Marta Fava, *How much of the Ocean has been explored?*, UNESCO OCEAN LITERACY PORTAL (May 9, 2022), https://oceanliteracy.unesco.org/ocean-exploration/.

[4] The ocean is the largest ecosystem on Earth, containing 94% of the planet's wildlife, and generates over half the oxygen we breathe through Phytoplankton that live on the ocean surface. *Id*.

[5] António Guterres, *Secretary-General's opening remarks to United Nations Ocean Conference*, UNITED NATIONS (June 27, 2022), https://www.un.org/sg/en/content/sg/speeches/2022-06-27/secretary-generals-opening-remarks-united-nations-ocean-conference.

[6] *Id*.

[7] *Id*.

[8] JOEL A. MINTZ & TRACY HESTER, MASTERING ENVIRONMENTAL LAW 21-22 (Carolina Academic Press 2019).

[9] *Responsible Offshore Wind to Address the Climate Crisis*, OCEAN CONSERVANCY, https://oceanconservancy.org/climate/offshore-wind/ (last visited Dec. 13, 2023).

[10] *Id*.

Offshore wind is a viable renewable energy source to address the causes of climate change, but it also provides an unexpected *solution* to address the consequences on our ocean ecosystem: the artificial reef effect.[11] Artificial reefs are structures placed on the seabed to imitate the function of a natural reef by enhancing or restoring marine ecosystems.[12] The hard structures of offshore wind farms create an ocean ecosystem where marine life thrives. But, once the structures are obsolete, U.S. regulations obligate decommissioning the structure. Decommissioning requires extracting the wind farm from the seabed, thereby destroying the artificial reef, "to restore the seabed in its prior condition."[13] Because a typical offshore wind farm lifespan can be over 20 years,[14] the removal of the farm takes all the vibrant ocean life with it.

In this Article, I propose solutions for the inadequate end-of-life requirements for offshore wind projects, specifically focusing on areas to prioritize ocean conservation. Part II provides context on the offshore wind energy industry and how a wind farm works. Part III provides an overview of the jurisdiction over the oceans to explain how offshore wind projects are authorized and completed. Part IV delves into the disconnect between what scientific research has shown us about the positive effects of offshore wind farms on ocean ecosystems and the unintended consequences of current decommissioning regulations. Part V discusses the national decommissioning regulations and the shortcomings in preserving our ocean. Finally, in Part VI, I propose a three-part solution that the U.S. should adopt to remedy the offshore wind

[11] Oliver Gordon, *Offshore wind farms could turn the tide for ocean biodiversity*, ENERGY MONITOR (July 12, 2022), https://www.energymonitor.ai/tech/renewables/offshore-wind-farms-could-turn-the-tide-for-ocean-biodiversity/?cf-view&cf-closed.
[12] Carolina Bracho-Villavicencio et al., *Artificial Reefs around the World: A Review of the State of the Art and a Meta-Analysis of Its Effectiveness for the Restoration of Marine Ecosystems*, 10 ENVIRONMENTS 1, 1-2 (2023) (finding that artificial reefs can restore marine ecosystems that have been negatively impacted by activities like mining, oil and gas extraction, and overfishing); María-Isabel Toledo et al., *Ecological succession of benthic organisms on niche-type artificial reefs*, 9 ECOLOGICAL PROCESSES 1 (2020).
[13] Angeliki Spyroudi, *End-of-life planning in offshore wind*, ORE CATAPULT 1, 1 (2021).

decommissioning problem. First, to ensure that the best end-of-life option is achieved on a case-by-case basis, I propose adopting a new decommissioning alternative analysis standard that creates a duty to select the Least Environmentally Damaging Practicable Alternative (LEDPA). Second, to aid lessees with implementing a viable alternative, I recommend designing a "Renewables-to-Reefs" program that facilitates the preservation of artificial reefs where practicable. Third, to address the knowledge gaps in the impact of decommissioning on ocean ecosystems, I recommend investing in research and technology development for nature-conscious end-of-life solutions. These three comprehensive solutions will help to ensure that when offshore wind farms reach the end of their lives, the industry is prepared to responsibly repurpose the platform.

II. Laying the Foundation: Offshore Wind Overview

A. Offshore Wind as a Viable Energy Source

Offshore wind power is a renewable energy source taken from the force of powerful winds at sea.[14] Essentially, it utilizes a modern version of a windmill called a wind turbine to create electricity that has the potential to power much of our lives.[15] Although offshore wind has faced valid opposition,[16] including concerns from ocean conservationists, offshore wind power has many advantages that make it attractive to address long-term climate goals.

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[14] *What is offshore wind power?*, NAT'L GRID, https://www.nationalgrid.com/stories/energy-explained/what-offshore-wind-power (last visited Dec. 2, 2023, 11:49 AM).

[15] *How does a wind turbine work?*, NAT'L GRID, https://www.nationalgrid.com/stories/energy-explained/how-does-wind-turbine-work (last visited Oct. 12, 2023, 7:34 PM).

[16] Opposition to offshore wind projects include higher upfront costs than onshore wind power, cumulative impacts on migratory birds are not fully understood, NIMBYism (Not-In-My-Back-Yard), changes in navigation paths for the shipping industry, and waste management concerns due to the near impossibility of recycling wind turbines today. *See What are the advantages and disadvantages of offshore wind farms?*, AM. GEOSCI. INST., https://www.americangeosciences.org/critical-issues/faq/what-are-advantages-and-disadvantages-offshore-wind-farms (last visited Dec. 2, 1:57 PM); Lieutenant Lowen M. Hobbs, *Offshore Wind Energy: A Rising Challenge to Coast Guard Operations*, U.S. NAVAL INST. (July 2023), https://www.usni.org/magazines/proceedings/2023/july/offshore-wind-energy-rising-challenge-coast-guard-operations (explaining the U.S. Coast Guard finds that the establishment offshore structure can impact the safety and navigation for all vessels); *See generally* Sophia Sepulveda Harms, *Not Gone with the Wind: The Looming Turbine Blade Waste Problem*, AMERICAN BAR ASSOCIATION (Oct. 29, 2021),

Offshore wind is an appealing alternative energy because it is abundant, relatively consistent, and generates electricity without creating harmful greenhouse gas emissions.[17] A 2019 International Energy Agency Report found that by 2040, global offshore wind has the potential to generate over 420,000 terawatt-hours of electricity per year.[18] This is 11 times the current global electricity demand.[19] At a national level, offshore wind has the potential to generate 4 times the current energy production in the U.S.[20] Because offshore wind farms are located near dense coastal communities,[21] transmission is easier and more cost effective because electricity does not need to be transmitted across the country to reach local demand.[22] Furthermore, in comparison to onshore wind, its offshore counterpart is considered more stable due to higher and more uniform speeds of sea wind.[23] It also creates long-term sustainable jobs that can replace declines in the offshore oil and gas (O&G) industry.[24] Finally, the idea on which this Article is premised, offshore wind farms are an unexpected source to address ocean ecosystem conservation through the artificial reef effect.[25]

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https://www.americanbar.org/groups/environment_energy_resources/publications/wrr/20211029-not-gone-with-the-wind/ (explaining that turbine blade material is currently difficult to recycle so they end up in landfills).

[17] NAT'L GRID *supra* note 14.

[18] Laura Cozzi et al., *Offshore Wind Outlook 2019*, INT'L ENERGY AGENCY REPORT 1, 50 (2019).

[19] *Id*.

[20] Lily Cohen, *Offshore Wind Energy and the Potential of State-Led Development*, 46 HARV. ENV'T L. REV. 70, 72 (2022).

[21] Almost half the world's population lives on coasts, and 40% of the U.S. population lives in a coastal community. *Offshore Wind: Can the United States Catch up with Europe?* ENV'T & ENERGY STUDY INST. (Jan. 4, 2016), https://www.eesi.org/papers/view/factsheet-offshore-wind-2016.

[22] *See id*.

[23] *Onshore vs offshore wind energy: what's the difference?*, NAT'L GRID, https://www.nationalgrid.com/stories/energy-explained/onshore-vs-offshore-wind-energy (last visited Dec. 2, 2023, 11:56 AM).

[24] *See Rapid Job Growth Could Help Accelerate the Country's Transition to a Carbon-Free Power Grid*, OFFICE OF ENERGY EFFICIENCY & RENEWABLE ENERGY (Oct. 18, 2022), https://www.energy.gov/eere/articles/national-lab-study-charts-path-toward-significant-growth-offshore-wind-workforce (explaining that offshore wind job demand spans the entire life cycle of an offshore wind farm).

[25] Gordon, *supra* note 11.

While Europe and Asia are leading the world in offshore wind capacity, it is a fairly nascent industry in the U.S.[26] Currently, the U.S. only has 2 operating offshore wind projects.[27] In 2016, a 30 megawatt (MW) capacity wind farm called Block Island was erected off the coast of Rhode Island.[28] Since then, a smaller 12 MW capacity pilot called Coastal Virginia has also been installed.[29] Although the U.S. has been slow to embrace the winds of change, the U.S. is on the cusp of transforming itself into a strong source of offshore wind power.[30] Under the Biden administration, the offshore wind industry has gained momentum with a bold goal to deploy at least 30 gigawatts for offshore wind in the U.S. by 2023.[31] This is enough to power 10 million homes.[32] Through the Inflation Reduction Act of 2022, Congress provided an incentive for offshore wind development with a 30% investment tax credit to projects that start construction before 2026.[33] The U.S. is certainly making offshore wind energy a priority.

To make offshore wind goals a reality, the U.S. Bureau of Ocean Energy Management (BOEM) intends to conduct auctions for new lease sales and finalize the review of many Construction and Operations Plans (COPs).[34] Driven by BOEM's new leasing activity, the U.S. offshore wind pipeline has grown 15% from May 2022 with an estimated capacity of 52,687

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[26] H.J. Mai, *Biden's Offshore Wind Plan Could Create Thousands Of Jobs, But Challenges Remain*, NPR (Jan. 4, 2023), https://www.npr.org/2023/01/24/1145384765/biden-offshore-wind-jobs-challenges.

[27] Walter Musial et al., *Offshore Wind Market Report: 2023 Edition*, U.S. DEP'T. OF ENERGY 1, 84 (2023).

[28] *Id*.

[29] *Id*.

[30] Ipek Candan Snyder et al., *Fast Forward For Us Offshore Wind*, WHITE & CASE, https://www.whitecase.com/publications/insight/fast-forward-us-offshore-wind (last visited Sept. 15, 2023, 12:32 PM).

[31] Seth Kerschner, *Environmental Laws and Regulations Affecting US Offshore Wind*, WHITE & CASE (June 25 2021), https://www.whitecase.com/insight-our-thinking/environmental-laws-and-regulations-affecting-us-offshore-wind.

[32] Cohen, *supra* note 20, at 72.

[33] Kirsti Massie & Paul J. Astolfi, *The Law off the Land: Why Offshore Wind Developers, Utilities, and Investors Should Give Early Consideration to Environmental Law Risks*, MAYER BROWN (Jan. 2022) https://www.mayerbrown.com/en/perspectives-events/publications/2022/01/the-law-off-the-land-why-offshore-wind-developers-utilities-and-investors-should-give-early-consideration-to-environmental-law-risks.

[34] Kerschner, *supra* note 31.

MW.[35] In May 2023, the first 2 commercial-scale offshore wind farms in the U.S.,Vineyard Wind[36] and South Fork Wind,[37] began wind turbine installation and are expected to become fully operational by 2024.[38] Other projects in the environmental review portion of BOEM's permitting process include Empire Wind off the coast of New York, Ocean Wind off the coast of New Jersey, and Revolution Wind off the coast of Rhode Island.[39] Most recently, BOEM approved the COP for a giant 2.6 GW project also called Coastal Virginia which could be the largest offshore wind farm in the U.S., powering more than 900,000 homes.[40]

B. How does it work?

Offshore wind power is generated by utilizing wind turbines placed in the ocean to capture the wind's energy which in turn generates electricity.[41] The main structure of a wind turbine consists of a set of blades, a box called a nacelle, and a shaft.[42] The wind from the sea makes the blades spin, creating kinetic energy.[43] The rotating blades turn the shaft in the nacelle box, which

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[35] Musial et al., *supra* note 27, at 8.

[36] Vineyard Wind will be an 800 MW wind farm located off the coast of Massachusetts, with enough potential to power more than 400,000 homes. Mai, *supra* note 26.

[37] South Fork Wind will be a 132 MW wind farm located off the coast of New York, with enough energy to power 70,000 homes. *About South Fork Wind*, SOUTH FORK WIND, https://southforkwind.com/about-south-fork-wind (last visited Dec. 2, 2023).

[38] Musial et al., *supra* note 27, at 10.

[39] Kerschner, *supra* note 31.

[40] Brad Plumer, *Biden Administration Approved Biggest Offshore Wind Farm Yet, in Virginia*, N. Y. TIMES (OCT. 31, 2023), https://www.nytimes.com/2023/10/31/climate/biden-wind-farm-virginia.html; *Coastal Virginia Offshore Wind*, BUREAU OF OCEAN ENERGY MGMT., https://www.boem.gov/renewable-energy/state-activities/CVOW-C (last visited Dec. 2, 2022) (stating that on October 31, 2023, the Department of Interior announced the approval of the construction and operation of the Coastal Virginia Offshore Wind project).

[41] *Offshore Wind 101*, NYSERDA https://www.nyserda.ny.gov/All-Programs/Offshore-Wind/About-Offshore-Wind/Offshore-Wind-101#:~:text=Offshore%20Turbines%20capture%20the%20wind%27s%20energy%20and%20generate%20electricity.&text=Electricity%20flows%20through%20a%20buried,to%20the%20existing%20transmission%20network (last visited Nov. 27, 2022).

[42] *Id*.

[43] NAT'L GRID *supra* note 15.

then converts this kinetic energy into electrical energy.[44] Finally, the electrical energy passes through an offshore substation and subsea cables to an onshore substation and a transmission network that connects to the national grid.[45]

In addition to the wind turbine itself, offshore wind requires a support infrastructure, including a foundation and scour protection. The foundation secures the wind turbines to the ocean floor, and the scour protection prevents erosion at the submerged foundation.[46] There are two main types of foundation designs that have been utilized in the offshore wind industry: fixed bottom foundations and floating foundations.[47] Currently, most of the offshore wind projects have utilized fixed bottom structures called monopiles[48] to secure wind turbines to the seabed.[49] Monopile foundations typically consist of a large steel pipe, known as the pile, that is installed into the seabed to provide support.[50] Because a monopile foundation depends on the seabed for lateral resistance to stay in place, scour protection is also installed around the base of the monopile.[51] Scour protection consists of rocks positioned on the seabed around the foundation to prevent erosion.[52]

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[44] *Id*.

[45] NYSERDA, *supra* note 41.

[46] *Id*.; Hongwang Ma et al., *Effect of scour on the structural response of an offshore wind turbine supported on tripod foundation*, 73 APPLIED OCEAN RESEARCH 179, 179 (2018).

[47] Hesam-Edin Hayati Soloot & Shahab Moghadam, *Introducing Different Types of Offshore Wind Turbine Foundations: Fixed and Floating,* WIND EDITION (Aug. 2, 2022, 5:43 AM), https://www.windedition.com/introducing-different-types-of-offshore-wind-turbine-foundations-fixed-and-floating/#:~:text=Monopile%20and%20Jacket%20%3A%20(lattice%20structure,between%2020%20and%2040%20 meters.

[48] In shallow water with depths of 0 to 30 meters, fixed bottom structures called monopiles are generally used. In transitional depths of 30 to 60 meters, fixed bottom solutions that have been adapted from the O&G industry such as jacket structures are widely deployed. Walter Musial & Bonnie Ram, *Large-Scale Offshore Wind Power in the United States*, NATIONAL RENEWABLE ENERGY LABORATORY 6 (Sept. 2020), https://www.nrel.gov/docs/fy10osti/49229.pdf.

[49] Ma et al., *supra* note 46, at 179.

[50] Sarah Horwath et al., *Comparison of Environmental Effects from Different Offshore Wind Turbine Foundations*, BUREAU OF OCEAN ENERGY MGMT. 1, 5 (2021).

[51] *Id*.

[52] Jan van der Tempel et al., *The effects of Scour on the design of Offshore Wind Turbines*, DELFT UNIV. OF TECH. (2004), https://ocw.tudelft.nl/wp-content/uploads/Scour___MAREC_2004.pdf.

This scour protection "resemble[s] a marine rocky reef and could have important ecosystem functions."[53]

In deep water with depths of over 60 meters, however, fixed-foundation turbines are often not feasible.[54] The floating wind turbine is a novel solution where an offshore wind turbine is mounted on a floating structure.[55] As technology improves and more offshore wind projects are deployed into deeper waters, floating offshore wind foundations will become increasingly used.[56] Because monopile foundations are most commonly used in offshore wind development today, this Article focuses on the effects of fixed bottom foundations instead of floating foundations.

III. Jurisdiction over the Oceans: Legal Background

While this Article is about the impact of current U.S. decommissioning regulations in the U.S., it is important to first understand the complex regulatory schemes for offshore wind projects. Jurisdiction over the world's oceans extends across various adjoining and overlapping zones of authority.[57] As such, jurisdiction over these waters is determined by both international convention and the domestic laws of coastal nations.[58] In this part, I will give a brief overview of the global legal framework for ocean jurisdiction. Next, I will provide a detailed look at the U.S. system that regulates offshore wind development in federal waters. Specifically, I will explain where the U.S. gets its jurisdiction over parts of the ocean, how the U.S. federal leasing process for offshore wind energy works, and what environmental reviews impact offshore wind development.

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[53] Maria Glarou et al., *Using Artificial-Reef Knowledge to Enhance the Ecological Function of Offshore Wind Turbine Foundations: Implications for Fish Abundance and Diversity*, 8 J. MAR. SCI. ENG. 1, 1 (2020).
[54] *See* Musial & Ram, *supra* note 48, at 5.
[55] Úna Brosnan & Andrew Thompson, *Offshore Wind Infrastructure*, ATKINS 61 (Oct. 2019), https://www.atkinsrealis.com/~/media/Files/S/SNC-Lavalin/documents/trade-releases/offshore_wind_us_brochure_2019.pdf.
[56] *Id*. at 7.
[57] AARON M. FLYNN, CONG. RSCH. SERV., RL32658, WIND ENERGY: OFFSHORE PERMITTING 1, 1 (2005).
[58] *Id*.

A. Global Framework: United Nations Convention on the Law of the Sea

The United Nations Convention on the Law of the Seas (UNCLOS) is often thought of as "the constitution of the oceans."[59] It was created in part to "promote the peaceful uses of the seas and oceans, the equitable and efficient utilization of their resources, [and] the conservation of their living resources…"[60] Importantly, UNCLOS emphasizes the necessity of the "study, protection and preservation of the marine environment."[61] This Convention recognizes that while coastal nations have a right to use the oceans, waters beyond the limits of national jurisdiction "are the common heritage of mankind."[62]

The UNCLOS legal framework gives coastal nations the authority to build offshore wind farms within their jurisdiction.[63] There are two maritime zones defined by UNCLOS that are relevant to the jurisdiction of federal offshore wind development: the territorial sea and the exclusive economic zone (EEZ).[64] The *territorial sea* is defined as the 12 nautical miles from a coastal nation's baseline.[65] Every coastal nation has full sovereign jurisdiction over its territorial sea.[66] This jurisdiction extends over the sea, air space, seabed, and subsoil within a coastal nation's territorial sea.[67] The *exclusive economic zone (EEZ)* is defined as 200 nautical miles from a coastal

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[59] Will Schrepferman, *Hypocri-sea: The United States' Failure to Join the UN Convention on the Law of the Sea*, HARV INT'L REV. (Oct. 31, 2019), https://hir.harvard.edu/hypocri-sea-the-united-states-failure-to-join-the-un-convention-on-the-law-of-the-sea-2/.

[60] United Nations Convention on the Law of the Sea at 25, Dec. 10, 1982, 21 I.L.M. 1261, (entered into force Nov. 16, 1994) [hereinafter UNCLOS].

[61] UNCLOS, *supra* note 60.

[62] *See id*.

[63] Captain Lawson W. Brigham, *Global Offshore Wind Energy: Emerging Ocean Use*, U.S. NAVAL INST. (Jan. 2021) https://www.usni.org/magazines/proceedings/2021/january/global-offshore-wind-energy-emerging-ocean-use#:~:text=Two%20maritime%20zones%20defined%20by,exclusive%20economic%20zone%20(EEZ); ADAM VANN, CONG. RSCH. SERV., RL40175, OFFSHORE WIND ENERGY DEVELOPMENT: LEGAL FRAMEWORK 1 (2023).

[64] Brigham, *supra* note 63.

[65] UNCLOS, *supra* note 60, at art. 3.

[66] *Id*.

[67] *Id*. at art. 2.

nation's baseline.[68] Coastal nations do not have full jurisdiction over this area, but do enjoy sovereign jurisdiction over the "natural resources" of a declared EEZ.[69] This includes activities such as the "establishment and use of artificial islands, installations and structures" for the "production of energy from the water, currents and winds."[70] Therefore, coastal nations can develop and "regulate offshore wind farms and the subsea cables that connect them to land" within their EEZ.[71] The same EEZ framework was adopted during the Reagan administration[72] even though UNCLOS has not been ratified by the U.S.[73] President Reagan recognized that the jurisdiction of the seas must be in accordance with international law.[74]

B. U.S. Ocean Jurisdiction: Submerged Lands Act (SLA) and Outer Continental Shelf Lands Act (OCLSA)

The Submerged Lands Act (SLA) of 1953 sets "the federal government's title and ownership of submerged lands at three miles from a state's coastline."[75] The SLA grants individual states rights to the natural resources of submerged lands from the coastline to no more than 3 nautical miles (or 3 marine leagues for Texas and Florida) into the ocean.[76] In doing so, the SLA

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[68] *Id*. at art. 57.
[69] *Id*. at art. 56.1(a).
[70] *Id*. at art. 56.1(a)-(b)(i).
[71] Brigham, *supra* note 63.
[72] President Reagan established by Presidential Proclamation 5030 that the U.S. Exclusive Economic Zone (EEZ) extends up to 200 nautical miles from the coastline. Proclamation No. 5030, 48 FR 10605 (Mar. 10, 1983); *BOEM Governing Statutes*, BUREAU OF OCEAN ENERGY MGMT., https://www.boem.gov/about-boem/regulations-guidance/boem-governing-statutes (last visited Nov. 27, 2023) (explaining that the Proclamation is important to the jurisdiction of the U.S. Department of Interior for offshore wind projects "because it defines the limits of federal authority under [the The Outer Continental Shelf Lands Act]").
[73] VANN, *supra* note 63, at 1.
[74] *See* Proclamation No. 5928, 54 Fed. Reg. 777 (Dec. 27, 1988) (applying provisions of UNCLOS to U.S. jurisdiction over the territorial seas).
[75] *OCS Lands Act History*, BUREAU OF OCEAN ENERGY MGMT., https://www.boem.gov/oil-gas-energy/leasing/ocs-lands-act-history#:~:text=The%20Outer%20Continental%20Shelf%20Lands,which%20are%20under%20U.S.%20jurisdiction. (last visited Nov. 27, 2023).
[76] *BOEM Governing Statutes*, *supra* note 72.

affirmed the federal claim to the lands of the outer continental shelf (OCS) beyond state jurisdiction.[77]

The Outer Continental Shelf Lands Act (OCLSA) was passed by Congress in 1953 to affirm that the federal government had exclusive jurisdiction and control over the OCS.[78] The U.S. OCS includes "all submerged lands lying seaward and outside of the area of lands beneath navigable waters . . . and of which the subsoil and seabed appertain to the United States."[79] As OCSLA states, the OCS "is a vital national resource reserve held by the Federal Government for the public, which should be made available for expeditious and orderly development, subject to environmental safeguards, in a manner which is consistent with the maintenance of competition and other national needs."[80]

The primary purpose of OCLSA is to grant the federal government authority – through the Secretary of the Department of the Interior (DOI) – to administer leases for offshore mineral and energy resource development.[81] Within the DOI, the Bureau of Ocean Energy Management (BOEM) and the Bureau of Safety and Environmental Enforcement (BSEE) manage and regulate offshore energy resources. The Office of Natural Resources Revenue (ONRR) under the DOI is also authorized to manage monetary transactions from leases across the Outer Continental Shelf.[82] OCSLA was amended several times, most recently as a result of the Energy Policy Act of 2005.[83]

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[77] *Id*.
[78] *Id*.
[79] 43 U.S.C. § 1331(a).
[80] *Id*. § 1332(3).
[81] *Id*.
[82] *Offshore Oil & Gas*, U.S. DEP'T INTERIOR NAT. RES. REVENUE DATA, https://revenuedata.doi.gov/how-revenue-works/offshore-oil-gas/#:~:text=The%20Outer%20Continental%20Shelf%20Lands,to%20carry%20out%20that%20authority (last visited Nov. 27, 2023).
[83] *OCS Lands Act History*, *supra* note 75.

This means that within these regulations, the federal government has authority over offshore wind development.

C. Offshore Wind Jurisdiction: Energy Policy Act of 2005 ("EPAct")

The Energy Policy Act of 2005 (EPAct 2005) amended OCSLA to give the Department of Interior (DOI) jurisdiction over *renewable energy activities* on the OCS.[84] This includes federal authority over offshore wind development on the OCS.[85] In order to develop energy projects on federal lands such as the OCS, you need permission in the form of a lease, easement, or right-of-way.[86] Therefore, Congress authorized DOI to promulgate regulations for "leases, easements, and rights-of-way on the OCS for activities that produce or support the production, transportation, storage, or transmission of energy from sources other than oil and gas."[87] On April 29, 2009, the DOI published a final rule in the *Federal Register* establishing a regulatory framework for its OCS renewable energy program."[88] Promulgated in 30 CFR part 585, BOEM was originally assigned responsibility over the OCS renewable energy program.[89]

Earlier this year,[90] the DOI made effective a final rule that transferred *safety and environmental regulatory oversight and enforcement* of OCS renewable energy activities from BOEM to BSEE.[91] This final rule simply reflected DOI's delegation of responsibilities to BSEE

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[84] *BOEM Governing Statutes*, *supra* note 72.
[85] David Wochner & Ankur Tohan, *Laws and Regulations Shaping Offshore Wind Development*, 2 K&L GATES 1, 13 (2019).
[86] VANN, *supra* note 63, at 1.
[87] 88 FR 6376; U.S. DEP'T INTERIOR, REORGANIZATION OF TITLE 30—RENEWABLE ENERGY AND ALTERNATE USES OF EXISTING FACILITIES ON THE OUTER CONTINENTAL SHELF INTO 30 CFR PARTS 285, 585, AND 586, 1 (2023) [hereinafter REORGANIZATION OF TITLE 30 WHITE PAPER], https://www.bsee.gov/sites/bsee.gov/files/2023-03/NTL%202023-N01%20-%20Reorganization%20of%20Title%2030%E2%80%94Renewable%20Energy%20and%20Alternate%20Uses%20of%20Existing%20Facilities%20on%20the%20Outer%20Continental%20Shelf%20(Updated%202-3-23)_0.pdf.
[88] 74 FR 19638; REORGANIZATION OF TITLE 30 WHITE PAPER, *supra* note 87, at 2.
[89] On October 18, 2011, BOEM was assigned responsibility under DOI. REORGANIZATION OF TITLE 30 WHITE PAPER, *supra* note 87, at 2.
[90] On Jan. 31, 2023, the Department of the Interior made the Reorganization of Title 30 effective. 88 FR 6376.
[91] *Id.*

and BOEM, and did not make any substantive changes to the existing regulations.[92] BSEE's authority does not supplant the authority other agencies have over environmental and permitting processes related to protected species and the National Environmental Policy Act (NEPA), which I will discuss later in this section.[93] The final rule provides clarity around the authority and oversight responsibilities BOEM and BSEE have over offshore renewable development such as wind power.

D. Overview of the U.S. Federal Leasing Process for Offshore Wind Energy

Although actual decommissioning – the removal of obsolete offshore wind farms from the ocean – is executed when an offshore wind turbine reaches the end of its life, decommissioning planning is imposed during the OCS leasing and permitting program. This means a decommissioning plan must be in place from the onset in order for the project to move forward. In this section, I provide an overview of this federal leasing process managed together by BOEM and BSEE. BOEM is responsible for managing the offshore wind leasing program in an "environmentally and economically responsible way."[94] Whereas BSEE's authority extends to the development, oversight, and enforcement of safety and environmental standards for offshore energy operations.[95] There is considerable overlap in the responsibilities, so the organizations work in close partnership to execute the program. I will briefly mention applicable decommissioning obligations throughout the leasing process; however, Part V will dive deeper into the decommissioning regulations.

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92 REORGANIZATION OF TITLE 30 WHITE PAPER, *supra* note 87, at 2.

93 Joseph Webster & Elina Carpen, *US offshore wind's growing pains: Permitting and cost inflation*, ATLANTIC COUNCIL (June 26, 2023), https://www.atlanticcouncil.org/blogs/energysource/us-offshore-winds-growing-pains-permitting-and-cost-inflation/.

94 Christy Lan & Wright Frank, *Reorganization of Title 30—Renewable Energy and Alternate Uses of Existing Facilities on the Outer Continental Shelf*, BUREAU OF SAFETY AND ENV'T ENF'T 9 (Feb. 2, 2023), https://www.bsee.gov/sites/bsee.gov/files/bsee-boem-split-rule-workshop-bsee-boem-020223.pdf.

95 *Id*.

BOEM's renewable wind energy program "occurs in four distinct phases: (1) Planning and Analysis, (2) Lease Issuance, (3) Site Assessment, and (4) Construction and Operations."[96] The Planning and Analysis phase takes about 2 years to complete.[97] During this initial phase, BOEM identifies suitable areas for wind energy ("wind energy areas" or "WEAs") leases and gauges the commercial interest.[98] This is the phase when BOEM conducts environmental compliance reviews and consultations for lease issuance.[99]

The Leasing Issuance phase may take between 1 and 2 years to complete.[100] After identifying WEAs, BOEM may issue leases through a noncompetitive process or a competitive lease auction.[101] This phase results in the issuance of a commercial wind energy lease from BOEM.[102] The lessee has the exclusive right to seek BOEM approval to develop on the OCS.[103] However, BOEM must approve plans for development before the lessee can move on to the next stage of the process.[104]

The Site Assessment phase may take up to 5 years to complete; 1 year for the lessee to submit and receive approval of a site assessment plan (SAP) and up to 5 years to complete site assessments.[105] After obtaining a lease, the lessee must submit a SAP containing a detailed

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[96] BUREAU OF OCEAN ENERGY MGMT., WIND ENERGY COMMERCIAL LEASING PROCESS FACT SHEET, [hereinafter WIND LEASING PROCESS FACT SHEET], https://www.boem.gov/sites/default/files/documents/about-boem/Wind-Energy-Comm-Leasing-Process-FS-01242017Text-052121Branding.pdf#:~:text=The%20Process,(4)%20construction%20and%20operations.
[97] Keith J. Billotti et al., *The Next Frontier for the Maritime Industry: Offshore Wind Farms*, SEWARD & KISSEL https://www.sewkis.com/wp-content/uploads/Offshore-Wind-Project-Life-Cycle-Notice_6.pdf (last visited Oct. 23, 2023).
[98] Massie & Astolfi, *supra* note 33.
[99] WIND LEASING PROCESS FACT SHEET, *supra* note 96.
[100] Billotti et al., *supra* note 97.
[101] Massie & Astolfi, *supra* note 33.
[102] WIND LEASING PROCESS FACT SHEET, *supra* note 96.
[103] *Id*.
[104] *Id*.
[105] Massie & Astolfi, *supra* note 33.

proposal for the construction of the installation on the leasehold.[106] The SAP includes feasibility studies, geophysical surveys, environmental reviews, design studies, and legal and financial services.[107] During the site assessment phase, the lessee must develop a conceptual decommissioning plan for the proposed site assessment facilities.[108] BOEM must approve the plan before any site assessment activities start.[109] Once BOEM conducts the appropriate environmental and technical review of the SAP, BOEM may approve, approve with modification, or disapprove a lessee's SAP.[110]

Finally, the Construction and Operations phase takes up to 2 years for review and approval.[111] In this final phase, the lessee must submit a Construction and Operations Plan (COP) to BOEM for review and approval.[112] The COP describes the detailed plan for construction, operations, and conceptual decommissioning activities of the offshore wind project.[113] The lessee must also submit decommissioning financial assurance to BOEM.[114] Similar to the SAP process, environmental and technical reviews must occur before BOEM approves, approves with modification, or disapproves the COP.[115] The plan to decommission the facility must be submitted before the end of the lease term.[116] This means that decommissioning decisions are often initiated

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[106] WIND LEASING PROCESS FACT SHEET, *supra* note 96.
[107] Billotti et al., *supra* note 97.
[108] BUREAU OF OCEAN ENERGY MGMT., SUPPORTING NATIONAL ENVIRONMENTAL POLICY ACT DOCUMENTATION FOR OFFSHORE WIND ENERGY DEVELOPMENT RELATED TO DECOMMISSIONING OFFSHORE WIND FACILITIES 2 (2022), https://www.boem.gov/sites/default/files/documents/renewable-energy/state-activities/Decommissioning%20White%20Paper.pdf [hereinafter NEPA GUIDANCE FOR DECOMMISSIONING].
[109] *Id*.
[110] WIND LEASING PROCESS FACT SHEET, *supra* note 96.
[111] Massie & Astolfi, *supra* note 33.
[112] *Id*.
[113] *Id*.
[114] Steve Hillier, *Offshore Wind Overview*, ATKINS 81 (Oct. 2019), https://www.atkinsrealis.com/~/media/Files/S/SNC-Lavalin/documents/trade-releases/offshore_wind_us_brochure_2019.pdf.
[115] WIND LEASING PROCESS FACT SHEET, *supra* note 96.
[116] *Id*.

over 20 years before they happen. Once a project is approved, a lessee can then construct, operate, and maintain the offshore wind farm. Upon termination of the lease, the lessee is given 2 years to fully decommission their operations on the OCS unless an alternative is approved.[117]

E. Environmental Review Regulations for Offshore Wind Projects

The offshore wind leasing process includes federal permitting and development on federal land which implicates a "major federal action significantly affecting the quality of the human environment."[118] This means National Environmental Policy Act (NEPA) review is required. NEPA is the primary environmental law that assures BOEM and BSEE give consideration to the environment prior to approving offshore wind projects.[119] BOEM coordinates with other federal and local agencies to ensure all NEPA requirements are considered before approving any leases.[120] Both the Site Assessment Plans and Construction and Operations Plans must comply with NEPA.

Under NEPA, offshore wind projects undergo environmental analyses called an Environmental Assessment (EA) or an Environmental Impact Statements (EISs).[121] These assessments evaluate the need for the proposed projects, identify and assess reasonable alternatives, and consider the environmental impacts of the proposed project and any alternatives.[122] Importantly, NEPA does not require actually choosing the alternative, even if the environmental impact of the alternative is less than the proposed project.[123]

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[117] *See* 30 CFR §585.433.

[118] National Environmental Policy Act of 1969 § 102(2)(C), 42 U.S.C. § 4332(C).

[119] *See Summary of the National Environmental Policy Act*, EPA (Sept. 6, 2023), https://www.epa.gov/laws-regulations/summary-national-environmental-policy-act.

[120] *Id*.

[121] *Id*.

[122] *Id*.

[123] NEPA is a procedural requirement and does not require a particular result. But public review and comment is a procedural requirement of NEPA, so opponents of offshore wind development can still use NEPA to challenge projects. *See id*.

The Block Island Wind Farm provides an early example of BOEM's offshore wind NEPA review process in action. In July 2012, BOEM released an EA that considered the reasonably foreseeable environmental impacts associated with the approval of site assessment activities for the Block Island Wind Project.[124] The EA was revised in June 2013 and a Finding of No Significant Impact (FONSI) was issued.[125] This means that BOEM found that the reasonably foreseeable environmental impacts associated with the issuance of the Block Island lease would not significantly affect the environment.[126]

In addition to the role cooperating agencies may play under NEPA, other federal agencies have independent jurisdiction over offshore wind projects through other environmental statutes.[127] Relevant statutes include the Endangered Species Act (ESA), Marine Mammal Protection Act (MMPA), National Historic Preservation Act, Coastal Management Zone Act (CZMA), and Migratory Bird Treaty Act (MBTA).[128] Agencies with authority over these statutes do not have final authority over offshore wind leasing decisions "but are likely to be involved in the environmental review process leading to a final DOI decision."[129] Lastly, if it is found that the development project will potentially harm designated species of plants and animals, the lessee must receive authorization for an incidental take permit under the MMPA, ESA, MBTA, the Bald and Golden Eagle Protection Act, and the Magnuson-Stevens Fishery Conservation and Management Act.[130]

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124 Mitchell Hokanson, *Avoiding the Doldrums: Evaluating the Need for Change in the Offshore Wind Permitting Process*, 44 COLUM. J. ENV'T L. 181, 207-8 (2019).
125 *Id*.
126 *Id*.
127 VANN, *supra* note 63, at 8.
128 *Id*.
129 *Id*.
130 *Permitting and Approvals*, NYSERDA, https://www.nyserda.ny.gov/All-Programs/Offshore-Wind/Focus-Areas/Permitting (last visited Dec. 3, 2023).

IV. Issue: The Disconnect between Decommissioning Requirements and Ocean Ecosystem Conservation

Despite the changes offshore wind can have on ocean ecosystems, there is great potential for development to have a net positive impact on subsea marine habitats through the artificial reef effect.[131] Offshore wind structures are an unlikely source of thriving communities of marine biodiversity.[132] But, at the end of the structure's life, regulations around the world require removal of all the wind farm parts. This policy of digging up wind farms is based on the idea that "leaving the seabed as you found it will minimize negative impacts on the marine environment."[133] This assumption is outdated and does not account for the complexity of a *living* man-made structure.

Although total decommissioning is currently the industry default, the time has come to consider ocean-forward alternatives. In this part, I will discuss scientific research showing the effects of offshore wind farms on the ocean ecosystem and the negative consequences of removing these ecosystems during the decommissioning of obsolete wind farms. Finally, I will convey the call to action from Europe to re-envision decommissioning regulations with a stronger focus on ocean conservation.

A. The Potential of Offshore Wind to Expand Marine Life Habitats

As offshore wind development increases, concerns have been raised over the footprint on the deep blue sea.[134] Curious bedfellows like political pundit Tucker Carlson and commercial fishing interest groups have teamed up to block developments.[135] The commercial fishing industry

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[131] Steven Degraer et al., *Offshore Wind Farm Artificial Reefs Affect Ecosystem Structure And Functioning: A Synthesis*, 33 OCEANOGRAPHY 48, 49 (2020).
[132] Gordon, *supra* note 11.
[133] Ashley M. Fowler et al., *Environmental benefits of leaving offshore infrastructure in the ocean*, 16 FRONTIERS IN ECOLOGY AND THE ENV'T, 571, 571 (2018).
[134] Degraer et al., *supra* note 131 at 49.
[135] Debra Khan, *How Tucker Carlson (and NIMBYs) are blocking offshore wind*, POLITICO (July 18, 2023), https://www.politico.com/newsletters/the-long-game/2023/07/18/how-tucker-carlson-and-nimbys-are-blocking-offshore-wind-00106788.

has voiced concerns over losing lucrative fishing grounds and driving fish away from turbines.[136] Other concerns center around the negative impacts of high-intensity pile-driving noise on marine animals during the construction and operation phases.[137] Another well-established impact of construction is the loss of soft-bottom habitat due to the introduction of hard substrata from the offshore infrastructure.[138] Offshore wind farms certainly have the potential to cause long-term ecological disruptions. However, with careful planning to work *with* instead of *against* the ocean ecosystem, these challenges can likely be avoided.

i. Offshore wind artificial reefs create new habitats that support marine life.

In a 2021 study, BOEM explored the potential effects of offshore wind foundations on the marine environment.[139] The ecological groups BOEM evaluated in their study were pelagic[140] (i.e., residing in open water) and benthic[141] (i.e., bottom-dwelling) organisms.[142] BOEM recognized that submerged "offshore wind farm foundations and associated scour protection act like artificial reefs" by creating new habitats that support marine life.[143] An offshore wind structure is initially

[136] Degraer et al., *supra* note 131 at 49.

[137] Shashidhar Siddagangaiah et al., *Impact of pile-driving and offshore windfarm operational noise on fish chorusing*, 8 REMOTE SENSING IN ECOLOGY AND CONSERVATION 119, 120 (2022); Degraer et al., *supra* note 131 at 49 (finding that "marine mammals such as the harbor porpoise (Phocoena phocoena) flee the area during pile-driving activities" and "migratory fish such as tuna (Thunnus spp.) may be disturbed by the operational sounds" of active offshore wind farms).

[138] Glarou et al., *supra* note 53, at 21, 10 (noting that "loss of soft-bottom substrate arising from … installations may occasionally decrease the abundance of soft-bottom fish species; however, due to the small amount of area covered by scour protection within an OWF (approximately 0.8%), possible negative impacts are considered insignificant at the population level.").

[139] BOEM also evaluated the avian community, but this Article focuses on subsea species. Horwath et al., *supra* note 50, at 1-2.

[140] Pelagic communities include important species such as phytoplankton, zooplankton, open-water fish, marine mammals, and sea turtles. Horwath et al., *supra* note 50, at 19.

[141] Benthic communities are bottom dwelling species that live on or in the seabed or substrate. Soft-bottom benthic communities such as algae, clams, sponges and groundfish, occur where the seabed consists of fine-grained sediment and mud. In contrast, hard-bottom benthic communities such as algae, mussels, and black sea bass make their homes where rock or hard substrates exist. Horwath et al., *supra* note 50, at 2, 19.

[142] Horwath et al., *supra* note 50, at 2.

[143] Horwath et al., *supra* note 50, at 1, 39; Degraer et al., *supra* note 131 at 49 (finding that the changes to the marine ecosystem are caused in part because the submerged parts of offshore wind structures naturally act as artificial reefs).

installed in areas of soft sediment.[144] The installation process introduces manmade hard substrata and scour protection that leaves a footprint on the environment because it can resemble a rocky reef.[145] This new artificial habitat sets the stage for the colonization of indigenous and nonindigenous species that otherwise would not survive in that area.[146] Although the construction of offshore wind farms leads to the loss of soft sediment habitats, the new structure provides two distinct types of artificial habitats called hard vertical substrates and complex horizontal habitats.[147] These enhanced habitats, with attributes unique to offshore wind infrastructure, increase biodiversity, abundance, and biomass of marine ecosystems.[148]

Research has shown that several hard-bottom species such as algae, mussels, and black sea bass especially benefit from the reef effect.[149] 27 miles off the coast of Virginia, 2 offshore wind turbines have become an artificial reef habitat for a variety of hard-bottom species.[150] Algae and mussels, species that require hard surfaces to attach to, have attached themselves to the steel foundations of the wind turbines.[151] As a result of the presence of species like mussels, fish in search of food are attracted to the artificial reef.[152] Moreover, other marine species have found a new home inside the offshore wind structure itself.[153] Finally, top predators benefit from the

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144 *Offshore wind decommissioning*, THOMSON (Sept. 13, 2021), https://www.thomsonec.com/news/offshore-wind-decommissioning/.
145 *Id.*; *See* Glarou et al., *supra* note 53, at 1.
146 Degraer et al., *supra* note 131 at 49.
147 *Id*. at 50.
148 Horwath et al., *supra* note 50, at 3.
149 Glarou et al., *supra* note 53, at 2.
150 *This is how offshore wind farms can become havens for marine life*, WORLD ECON. F. (Nov. 11, 2021), https://www.weforhttps://www.weforum.org/agenda/2021/11/offshore-wind-farms-boost-ocean-biodiversity/um.org/agenda/2021/11/offshore-wind-farms-boost-ocean-biodiversity/ [hereinafter WORLD ECON. F.]; Coastal Virginia Offshore Wind, DOMINION ENERGY, https://www.dominionenergy.com/projects-and-facilities/wind-power-facilities-and-projects/coastal-virginia-offshore-wind (last visited Nov. 20, 2023) (explaining that Dominion Energy's Coastal Virginia Offshore Wind project installed two wind turbines currently in operation and they avoid up to 25,000 tons of carbon dioxide emissions annually).
151 WORLD ECON. F. *supra* note 150.
152 Schools of fish such as mahi, sea bass and bait fish circle the foundation for food. *Id.*
153 *Id.*

ecological changes that occur as a result of the installation process.[154] These predators target the offshore wind structures for food and refuge.[155] Many different levels of the food chain benefit from the artificial reef effect, thereby supporting a balanced ocean ecosystem.

ii. Offshore wind artificial reefs increase the abundance of existing ocean communities.

In other cases, offshore wind structures have increased the abundance of existing communities rather than changing the composition of species.[156] For example, Danish offshore wind farm developer Ørsted has installed 4 artificial reefs on the Borssele 1 & 2 wind farm off the Netherlands coast.[157] One of Ørsted's goals is to develop offshore wind projects in a nature-inclusive way that has a net positive impact on biodiversity.[158] Researchers at Wageningen Marine Research teamed up with Ørsted to study Atlantic cod, which is a key species that can indicate whether reefs are also suitable for other species of marine life.[159] They conducted a 2021 study on the Borssele 1 & 2 wind farm showing "that [Atlantic] cod can often be found near the [Ørsted] artificial reefs and use them as a base."[160] Consistent with the knowledge that cod "prefer hard substrate such as artificial reefs in their immediate habitat," the research indicated that the cod loved the wind farm artificial reefs.[161]

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[154] Degraer et al., *supra* note 131 at 49.
[155] *Id*.
[156] *See* Horwath et al., *supra* note 50, at 21.
[157] Wageningen University, *Research shows that cod love the artificial reef at a wind farm*, PHYS ORG (April 18, 2023) https://phys.org/news/2023-04-cod-artificial-reef-farm.html.
[158] *Id*.
[159] *Id*.
[160] *Id*. (explaining that "45 Atlantic cod were fitted with acoustic transmitters ("tags") to track their movements" in July 2021, revealing "the effect of the four artificial reefs: Atlantic cod are attracted to the reef and like to stay in its vicinity.").
[161] *Id*.

In the U.S., recreational fisheries have also seen increased abundances of certain fish at wind farms like Block Island in Rhode Island, USA.[162] Collectively, studies on artificial reefs in the offshore wind farm context have observed an "increase in abundance and diversity of fish species associated with hard-bottom habitats" because hard-bottom habitats provide food, shelter and environments suitable for reproduction.[163]

While studies show that offshore wind can be optimized for expanding habitats for marine life, the legal duty to decommission the offshore structure[164] will inevitably disturb this offshore ecosystem.

B. The Unintended Consequences of Offshore Wind Decommissioning

Decommissioning is often conceptualized as the "reverse procedure of the commissioning of an offshore wind farm."[165] However, this idea does not consider that over a 20-year lifespan, ecosystems may have been generated on the offshore structures.[166] The failure to account for the impacts of removing these ecosystems when decommissioning could have grave impacts on marine life.[167] In this section, I will discuss the technical background and environmental impacts of decommissioning offshore wind farms. Part V will dive deeper into decommissioning from a U.S. regulatory perspective.[168] As we better understand the impacts of decommissioning, we must

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[162] Degraer et al., *supra* note 131 at 49; Dave Monti, *Fishing Report: Block Island wind farm still impresses*, THE PROVIDENCE J. (Sept. 23, 2022) https://www.providencejournal.com/story/sports/outdoors/2022/09/23/fishing-report-block-island-wind-farm-still-impresses/8084974001/ (explaining that a seven-year study on the Block Island Wind Farm released in 2022 showed that "fish abundance of cod and black sea bass was greater at the Block Island Wind Farm than in two control areas south and east of the wind farm.").

[163] Glarou et al., *supra* note 53, at 10.

[164] *See infra* Part V.

[165] JOHAN FINSTEEN GJØDVAD & MORTEN DALLOV IBSEN, ODIN-WIND: AN OVERVIEW OF THE DECOMMISSIONING PROCESS FOR OFFSHORE WIND TURBINES 403 (W. Ostachowicz et al. eds., 2016).

[166] Rebecca Hall et al., *Environmental impacts of decommissioning: Onshore versus offshore wind farms*, 83 ENV'T IMPACT ASSESSMENT REVIEW 1, 9 (2020).

[167] Serious consequences for removing offshore ecosystems in the decommissioning process include biodiversity loss and further diminished fish stocks. Fowler et al., *supra* note 133, at 572.

[168] *See infra* Part V.

ask: *How do we improve end-of-life planning to protect ocean ecosystems relying on artificial reefs created by offshore wind infrastructure?*

i. <u>What is decommissioning?</u>

Although offshore wind is a relatively new industry, the first big wave of decommissioning will happen within the next two decades.[169] About 3.5 GW of offshore wind capacity globally is estimated to reach a designed operational lifespan of 20 to 25 years by 2035.[170] Around the world, that amounts to about 600 offshore wind turbines that will be up for decommissioning.[171]

Decommissioning may seem straightforward. But, each process should be unique because of the complexity of the structure and seabed conditions.[172] Each decommissioning process is impacted by factors such as size and type of wind farm, as well as the local regulations.[173] Due to the complexities of decommissioning offshore, it is imperative that a detailed decommissioning plan is considered at the design stage. Doing so will prevent the situation the O&G industry is experiencing. The failure to consider the potential requirements for decommissioning at an early stage in O&G has resulted in significant underestimation of the challenges associated with decommissioning.[174]

During the decommissioning process, most of the basic components such as the wind turbines, foundations, cables, offshore substations, onshore elements, and scour material must be removed.[175] This removal process involves a variety of techniques such as cutting, lifting, and

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[169] Billotti et al., *supra* note 97.
[170] Heather O'Brian, *Why repowering is key to wind power industry's growth*, WIND POWER MONTHLY (Dec. 23, 2021), https://www.windpowermonthly.com/article/1735687/why-repowering-key-wind-power-industrys-growth.
[171] Spyroudi, *supra* note 13, at 5.
[172] *Id*.
[173] Billotti et al., *supra* note 97.
[174] *See* GJØDVAD & IBSEN, *supra* note 165.
[175] Eva Topham & David McMillan, *Sustainable decommissioning of an offshore wind farm*, 102 RENEWABLE ENERGY INT'L J. 470, 471 (2017).

leaving parts *in situ*.[176] For example, when removing a monopile foundation, a cutting method is used to cut below the seabed and excavate the foundation.[177] A crane hook from a decommissioning vessel is then used to lift the foundation out of the seabed.[178] While some subsea cables will be wholly removed, other cables may be left *in situ* because it is recognized that complete removal can cause damage to the seabed.[179]

ii. UNCLOS and the origins of decommissioning.

The duty to decommission originates from the UNCLOS. UNCLOS specifies that "any installations or structures which are abandoned or disused shall be removed to ensure safety of navigation."[180] It is important to note, UNCLOS specifies that "such removal shall also have due regard to … the protection of the marine environment."[181] Although UNCLOS specifies "removal" as the default option, it allows for installations or structures to "not [be] entirely removed" so long as "appropriate publicity … [is] given to the depth, position and dimensions of any installations or structures not entirely removed."[182] A strict textual reading of the UNCLOS provision demonstrates there is no absolute obligation to completely remove all parts of an offshore wind structure; rather, alternatives to total decommissioning are allowable.[183]

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176 *See id.* at 472-75.

177 For example, piled foundations consisting of metal cylinders are driven into the seabed. Upon decommissioning, the piles are cut to 1 meter below the seabed level, and removed. *Offshore wind decommissioning*, THOMSON, *supra* note 144; *See* Topham & McMillan, *supra* note 175, at 472-73.

178 *See* Topham & McMillan, *supra* note 175, at 473.

179 *Id*. at 474.

180 UNCLOS art. 60.3.

181 *Id*.

182 *Id*.

183 Seline Trevisanut, *Decommissioning of Offshore Installations: a Fragmented and Ineffective International Regulatory Framework*, 90 THE L. OF THE SEABED 431, 435 (2020).

iii. Impacts of decommissioning on the ocean ecosystem.

We now know that the artificial reef effect of offshore infrastructure has the potential to support entire ocean ecosystems.[184] Therefore, decommissioning an offshore wind structure that has been a habitat for decades will impact more than just the structure itself.[185] If the structure were to be decommissioned and the seabed restored to its prior condition, the reef habitat created over the lifetime of the offshore wind turbine would be destroyed as well.[186] Decommissioning could cause even larger-scale disturbance if groups of turbines within the wind farm have become ecologically interconnected over time.[187]

As such, there is a global call for revising decommissioning policies to include alternatives that expand the environmental considerations on which end-of-life decisions are based.[188] Each end-of-life scenario – including life extension, repowering, repurposing, or decommissioning – will have positive and negative impacts that must be weighed carefully.[189] For instance, the Ecological Society of America published a 2020 report concluding that the "complete removal of a platform resulted in 95% or more reduction in the average fish biomass and annual somatic production at the site, while partial removal resulted in far smaller losses, averaging 10% or less."[190] Although this report evaluated the impacts in the O&G sector, it provides an example of the unintended consequences of offshore decommissioning.

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[184] Fowler et al., *supra* note 133, at 571.
[185] THOMSON, *supra* note 144.
[186] *Id*.
[187] Fowler et al., *supra* note 133, at 577.
[188] Ashley. M. Fowler et al., *The ecology of infrastructure decommissioning in the North Sea: what we need to know and how to achieve it*, 77 ICES J. OF MARINE SCI., 1109, 1110 (2020).
[189] *See* Fowler et al., *supra* note 133, at 577.
[190] Erin L. Meyer-Gutbrod et al., *Forecasting the legacy of offshore oil and gas platforms on fish community structure and productivity*, 30 ECOLOGICAL APPLICATIONS 1, 1 (2020).

The expansion of offshore wind energy must incorporate measures to protect and expand ocean ecosystems from cradle to grave – which includes reevaluating the decommissioning phase. Assessing the implications of different end-of-life scenarios is vital to prevent loss of these unexpected marine habitats.[191] Current regulations around the world do not allow for a path to alternatives that prioritize ocean conservationism.[192]

C. Call to Action: Europe's Perspective on Ocean Conservation Gaps in Decommissioning Regulations

Because offshore wind is a relatively new industry, countries around the world have struggled to implement effective regulations regarding decommissioning offshore wind farms. As the dominant player in offshore wind development,[193] Europe is steering the ship through the murky waters of decommissioning. The first decommissioning of an offshore wind farm called Yttre Stengrund, happened in 2016 off the coast of Sweden.[194] Alternatives to total decommissioning were considered for the Yttre Stengrund project but were quickly rejected because of the lack of financial and technical viability.[195] Soon after, the world's first offshore wind farm was decommissioned in Denmark after operating for 26 years.[196] Since then, 5 other offshore wind farms have been decommissioned.[197]

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[191] Hall et al., *supra* note 166, at 3.
[192] *Id*.
[193] In 2016, studies found that Europe had more than 90% of the world's total installed offshore wind capacity. ENV'T & ENERGY STUDY INST., *supra* note 21.
[194] Yttre Stengrud, a 10 MW project with five 2 MW turbines was the first offshore wind decommissioning project in the world. Topham & McMillan, *supra* note 175, at 470.
[195] *Id.* at 471.
[196] Vindeby in Denmark was the world's first offshore wind farm. Yang Liu et al., *Reborn and upgrading: Optimum repowering planning for offshore wind farms*, 8 ENERGY REPORT 5204, 5204 (2022).
[197] Mahmood Shafieeaand & Tosin Adedipe, *Offshore wind decommissioning: an assessment of the risk of operations*, 41 INT'L J. OF SUSTAINABLE ENERGY 1057, 1057 (2022).

Across Europe, the decommissioning process and associated regulations are inconsistent and insufficient to address ocean conservation concerns. In Belgium and Germany, for example, there is considerable uncertainty around decommissioning as regulations surrounding any end-of-life planning have not been defined.[198] In Denmark, the wind farm owner has a responsibility to restore the site to its original state.[199] The Netherlands and the United Kingdom are a bit farther along, but still have limited regulations around end-of-life requirements. In the Netherlands, a bank guarantee and a decommissioning plan specifying that installed materials must be disposed is presented in order to receive a permit.[200] Similarly, in the United Kingdom, before permits to develop are issued, a full decommissioning plan with procedures and estimated costs is required.[201]

Interreg North Sea Region, an EU program supporting regional development and cohesion across the European Union,[202] published a 2022 analysis focused on the gaps in offshore wind decommissioning regulations in Europe.[203] The analysis showed that most of the regulations regarding the decommissioning of offshore wind in Europe are related to economics rather than environmental impacts.[204] They found that "[t]he absence [of] or limited dedicated maritime regulations may lead to decisions that can harmfully disturb the marine environment."[205] Although the disruption to the ocean ecosystem is still being studied, researchers are calling for changes to the decommissioning regulations that consider ocean preservation.[206] Decommissioning

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198 Thomas Hajonides van der Meulen et al., *Offshore Wind Farm Decommissioning*, SMART PORT 1, 20 (2020).
199 To accomplish this, a decommissioning plan must be submitted to the government two years in advance of actual decommissioning activities, and a bank guarantee must be submitted to ensure the plan can be implemented. *Id*.
200 *Id*. at 21.
201 *Id*. at 20.
202 *Cooperating for the future*, INTERREG NORTH SEA REGION, https://northsearegion.eu/about-the-programme/ (last visited Dec. 3, 2023).
203 H. Kororaal et al., *Gap Analysis Rules and Regulations Decom Tools 2022*, INTERREG NORTH SEA REGION 8 (Oct. 27, 2022), https://northsearegion.eu/media/22266/gap-analysis-document.pdf.
204 *Id*. at 36.
205 *Id*.
206 *Id*.

regulations should focus not on restoring what once was, but rather on the enrichment of the biodiversity created by the artificial reef effect.[207] Europe's call to action should motivate the U.S. to reevaluate its own decommissioning regulations.

V. Dead in the Water: Ocean Conservation Gaps in U.S. Decommissioning Regulations

The U.S. offshore wind industry is still in its early stages. We have yet to see how decommissioning will work in practice. For now, the duty to decommission exists as a conceptual duty promulgated in 30 CFR § 285. BSEE oversees the decommissioning activities to fulfill this duty in partnership with BOEM, which conducts environmental analyses under NEPA.[208] In this part, I will outline how "decommissioning" is defined and implemented under current U.S. regulations. Next, I will provide an overview of current alternatives to decommissioning. Lastly, I will discuss the shortcomings of existing decommissioning regulations in addressing ocean ecosystem conservation.

A. Defining Decommissioning Under Current U.S. Regulations

When a party becomes a lessee and installs, constructs, or acquires an offshore wind farm on the OCS, they accrue decommissioning obligations.[209] Within 2 years following the termination of an offshore wind lease, the lessee "*must* remove or dispose of all facilities, installations, and other devices permanently or temporarily attached to the seabed on the OCS" to a depth of 15 feet below the mud line.[210] If a lessee fails to decommission or comply with an approved alternative plan, BOEM will issue a notice of noncompliance with actions on how to come into compliance,

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[207] *See id.*; *See* Eva Topham et al., *Challenges of decommissioning offshore wind farms: Overview of the European experience*, 1222 J. OF PHYS. CONF. SER. 1, 4 (2019).
[208] Lan & Frank, *supra* note 94, at 18.
[209] *See* 30 CFR § 585.901.
[210] *Id*. §§ 585.433(b), 585.902, 585.910 (emphasis added).

and has authority to call for forfeiture of the financial assurance.[211] The lessee will ultimately be liable for the removal and disposal costs associated with their failure to decommission.[212]

BSEE may also approve departures from these regulations on a case-by-case basis to "(1) [f]acilitate the appropriate activities on a lease or grant; (2) [c]onserve natural resources; (3) [p]rotect life (including human and wildlife), property, or the marine, coastal, or human environment; or (4) protect sites, structures, or objects of historical or archaeological significance."[213] Importantly, these departures must "[p]rotect the environment and the public health and safety to the same degree as if there was no approved departure from the regulations."[214] In the required decommissioning application, the lessee may also request that certain facilities remain in place or be "converted into an artificial reef."[215] BOEM has published a white paper with offshore wind decommissioning guidance stating that factors considered in granting a decommissioning exemption "include potential adverse impacts to the surrounding marine environment, competing uses of the OCS, and impacts to national defense and security."[216]

B. Overview of Decommissioning Process

The decommissioning process includes both conceptual and actual decommissioning requirements. Prior to construction of the offshore wind farm, the lessee must submit conceptual decommissioning plans as part of the SAP and COP stages.[217] According to BOEM's guidance, conceptual decommissioning plans in the SAP must include "the nature, intensity, and duration of disturbances to the sea bottom, an evaluation of biological resources and potential impacts to them,

211 *Id*. § 285.913.
212 *Id*.
213 *Id*. §§ 285.103(a); 285.904.
214 *Id*. § 285.103(b).
215 *Id*.§585.909; NEPA GUIDANCE FOR DECOMMISSIONING *supra* note 108, at 6.
216 NEPA GUIDANCE FOR DECOMMISSIONING *supra* note 108, at 6.
217 *Id*. at 2.

impacts to water quality and benthic footprint, and environmental monitoring methods."[218] The COP requires more specific decommissioning plans including "potential impacts to the surrounding environment and potential mitigation measures."[219] BSEE conducts the relevant technical and regulatory reviews of the plan, and ultimately approves these conceptual decommissioning plans.[220] Approval gives the green light to commence site assessment or construction and operations activities, not decommissioning and site clearance.[221]

Once the offshore wind farm nears the end of its life, actual decommissioning includes three distinct stages: (1) the decommissioning application, (2) the decommissioning notice, and (3) the final notice.[222] This procedure ensures the lessee will be in compliance with regulatory requirements[223] as it fulfills its decommissioning obligations.[224]

As early as 2 years before the expiration of the lease, the lessee must submit a decommissioning application – unique from the previously submitted conceptual plans – before beginning the decommissioning activities.[225] The decommissioning application must include specific information about the decommissioning activities such as a description of the infrastructure components designated for removal, a proposed decommissioning schedule, and a description of removal methods and procedures.[226]

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218 *Id*.
219 *Id*. at 3-4.
220 30 CFR § 285.902(c).
221 NEPA GUIDANCE FOR DECOMMISSIONING *supra* note 108, at 2.
222 *Id*. at 4.
223 In addition to the decommissioning-specific regulations, decommissioning compliance with the NEPA, ESA, Magnuson-Stevens Fishery Conservation and Management Act, Coastal Zone Management Act and other Federal, state, and local regulations is required. BOEM and BSEE prepare the environmental assessments and consult with other agencies to ensure compliance. *Id*.
224 *Id*.
225 *See* 30 CFR § 585.905.
226 *Id*. § 585.906.

Once the application is approved by BSEE, the lessee must also submit a distinct decommissioning notice at least 60 days before beginning any activities.[227] This decommissioning notice must include "[a] description of any changes to the approved methods and procedures in [the] approved decommissioning application … and [a]n updated decommissioning schedule." [228] Finally, the lessee must provide final notice to BSEE verifying the site was decommissioned within 60 days after removal.[229] The final notice must include a "summary of removal activities…[and] a description of any mitigation measures."[230]

C. Legal Shortcomings of U.S. Decommissioning Regulations and Process

The current decommissioning regulations fall short in prioritizing ocean conservation at the end of an offshore wind farm's life. Two major shortcomings of the current U.S. decommissioning regulations and process are: (1) the decommissioning default creates a confirmation bias and narrow scope in environmental assessments, and (2) current alternatives simply delay the decommissioning process rather than plan for a sustainable end-of-life solution.

i. <u>Environmental reviews offer no flexibility to challenge decommissioning obligations.</u>

Because the regulations that address end-of-life planning default to total decommissioning, a bias in favor of total decommissioning can be seen in the NEPA EIS reviews. The current regulations and processes do not leave much room or guidance to consider alternatives that would prevent the destruction of biodiversity created by offshore wind artificial reefs. Instead, the regulations support a narrow focus on total decommissioning when an offshore wind farm becomes obsolete.

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[227] *Id*. §585.908(a).
[228] *Id*. §585.908(b).
[229] *Id*. §585.912.
[230] *Id*. §585.912; NEPA GUIDANCE FOR DECOMMISSIONING *supra* note 108, at 4-5.

Studies from the U.K have found that the impacts of hard substrate on the ecosystem and loss of biological communities that have developed on the infrastructure itself are rarely assessed in the decommissioning environmental impact assessments.[231] The same can be said for the U.S. EIS process. For example, BOEM's March 2021 Final Environmental Impact Statement (FEIS) for Vineyard Wind 1 Offshore Wind Energy Project (Vineyard Wind) did not actually consider any alternatives to total decommissioning.[232]

Vineyard Wind is a 800 MW project located 14 miles off the coast of Martha's Vineyard.[233] The Vineyard Wind FEIS assessed the "potential environmental, social, economic, historic, and cultural impacts that could result from the construction, operation, maintenance, and eventual decommissioning" in its COP.[234] Seven final alternatives to the project, including a "no-action" alternative, were considered. All except the no-action alternative included "eventual decommissioning" of the entire offshore wind farm.[235] In BOEM's impact analysis, the FEIS acknowledged that the artificial reef effect creates a positive ecosystem for hard-bottom benthic communities that colonize the structure.[236] However, BOEM found the decommissioning impact to be minor at most because "removal of cables would return the benthic environment to its previous soft-bottom community."[237]

The Vineyard Wind FEIS demonstrates the bias towards the idea that returning the seabed as you found it is better for ocean ecosystems. This idea does not account for our incomplete

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231 Fowler et al., *supra* note 188, at 1110.
232 *See* Bureau of Ocean Energy Management, *Vineyard Wind 1 Offshore Wind Energy Project Final Environmental Impact Statement Volume I*, 1 BUREAU OF OCEAN ENERGY MGMT. E-1, E-1 (2021), https://www.boem.gov/sites/default/files/documents/renewable-energy/state-activities/Vineyard-Wind-1-FEIS-Volume-1.pdf.
233 *Id*.
234 *Id*.
235 *Id*. at 2-1-3.
236 *Id*. at 3-31.
237 *Id*.

understanding of the impact of decommissioning. The impact of removing these offshore wind structures may be "positive or negative in ecological terms and should be examined without preconception."[238] A more comprehensive environmental review standard that considers the conservation of an evolving ocean ecosystem, rather than an outdated policy steeped in antiquity, is needed.

ii. Current "alternatives" to decommissioning do not provide a long-term solution

If the lifetime of an offshore wind farm can be extended or repowered, a lease extension may be authorized so long as the activities are "substantially similar activities as were originally authorized under the lease or grant."[239] Throughout this Article, I have emphasized the benefits of repurposing an offshore wind structure at the end of the turbine's life into a permanent artificial reef. However, because repurposing an offshore wind structure into an artificial reef has yet to be tested in the U.S. So, it is imperative we consider existing alternatives.

Life extension and repowering are short-term alternatives to decommissioning an offshore wind project. The lifespan of an offshore wind farm is determined conservatively to come into compliance with technical and legal arrangements.[240] This means the actual lifetime of an offshore wind farm can be longer than the originally planned operational period.[241] When a wind farm is close to the end of its anticipated lifetime, an assessment can be made to determine the overall condition of the structure.[242] If it is viable, the lifetime of a wind turbine may be extended by conducting minor and low-cost repairs.[243] Repowering an offshore wind farm is another alternative

[238] I.S. Fortune & D. M. Paterson, *Ecological best practice in decommissioning: a review of scientific research*, 77 ICES J. OF MARINE SCI., 1079, 1089 (2019).
[239] 30 CFR § 285.425.
[240] Hillier, *supra* note 114.
[241] *Id*.
[242] THOMSON, *supra* note 144.
[243] Spyroudi, *supra* note 13, at 6.

to total decommissioning that could improve the overall performance of a wind farm. Repowering involves upgrading major components with more modern equivalents.[244] Owners now have a variety of ways they could upgrade a wind farm. They could replace the wind farm with modern turbines that have higher capacity to produce more energy.[245] Danish company Momentum provides an example of the first partial repowering of an offshore wind farm. In 2018, Momentum replaced the nacelles and blades of the 20-year-old turbines at its wind project.[246] Additional technology upgrades increased the capacity from 2.75 MW to 3.3 MW[247] Ultimately, life extension and repowering provide a "second life to offshore wind farms and reduce the capital costs of a new project."[248]

Additionally, there are new regulations for the "Alternate Uses of Existing Facilities on the Outer Continental Shelf."[249] Under 30 CFR § 586, BOEM can receive and process requests for an Alternate Use Right-of-Use and Easement (RUE) for energy or marine-related purposes.[250] BOEM will essentially evaluate the suitability of existing structures for potential alternate-use applications.[251] Alternative uses may include repurposing the platform to an offshore solar facility or an artificial reef. However, decommissioning obligations still exist and only get more complicated with multiple responsible parties involved. When an alternate use is approved, the holder of an Alternate Use RUE is still responsible for "all decommissioning obligations that accrue following the issuance of the Alternate Use RUE and which pertain to the Alternate Use

[244] THOMSON, *supra* note 144.
[245] A. M. Jadali et al, *Decommissioning vs. repowering of offshore wind farms—a techno-economic assessment*, 112 THE INT'L J. OF ADVANCED MFG. TECH. 2520, 2521 (2021).
[246] O'Brian *supra* note 170.
[247] *Id.*
[248] Spyroudi, *supra* note 13, at 6.
[249] 30 CFR § 586.
[250] *Id.* § 586.102.
[251] Lan & Frank, *supra* note 94, at 19.

RUE."[252] Additionally, the original leaseholder "will remain responsible for decommissioning obligations that accrued before issuance of the Alternate Use RUE, as well as for decommissioning obligations that accrue following issuance of the Alternate Use RUE to the extent associated with continued activities authorized under other parts of this title."[253] Therefore, the same issues regarding a default decommissioning obligation persist.

Alternatives such as extending the lifetime, repowering, or repurposing an existing offshore wind farm provide positive short-term alternatives to total decommissioning. These opinions can offer "higher yields, lower maintenance costs and environmental benefits by delaying and preventing disposal."[254] While these short-term alternatives are important to defer the decommissioning costs and lower the lifetime costs of electricity, they does not remove the obligation to decommission.[255] Current alternatives simply kick the can down the road. Therefore, a major shortcoming of the decommissioning regulations is that there is no clear guidance that has been published or tested on how to get a permanent alternative to decommissioning approved for the offshore wind projects. The shortcomings outlined in this section can be solved through the development of a new legal framework expanding end-of-life options for offshore wind farms.

VI. The Solution: A Three-Part Framework for Offshore Wind End-of-Life Planning

The potential for ocean ecosystem destruction during the decommissioning of offshore wind farms is a multi-faceted problem that impacts the health of our oceans. Solving the problem of destructive decommissioning requires a multi-part solution that addresses both the limitations of current environmental reviews and the lack of a structured decommissioning alternative

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[252] 30 CFR §586.218(a)
[253] *Id.* §586.218(a)
[254] Spyroudi, *supra* note 13, at 6.
[255] Hillier, *supra* note 114.

program that supports the benefits of the artificial reef effect. I thus propose a three-part solution that includes (1) adopting a new alternative analysis standard for decommissioning; (2) implementing a "Renewables-to-Reefs program that facilitates the preservation of artificial reefs where practicable; and (3) investing in research and technology development for nature-conscious end-of-life solutions.

A. Adopting the Least Environmentally Damaging Practicable Alternative (LEDPA) Standard for Decommissioning: Lessons from the Clean Water Act

First, to address the potential of unintended ecosystem destruction, the decommissioning regulations need to adopt a new standard during the COP phase that prioritizes alternatives which conserve the ocean during the decommissioning process. In conjunction, the regulations must also suspend the obligatory removal requirement by changing the term "decommissioning" to "end-of-life." Finally, the regulations must change from removal "to a depth of 15 feet below the mud line" to "5-10 feet above seabed (where non-indigenous species are) and leave rest in place."
This combination of changes would allow for end-of-life planning to be based on a holistic comparative framework that incorporates the complexity of ocean ecosystems, rather than an exercise that defaults to decommissioning. In this section, I will focus specifically on my proposal for a new alternative analysis standard.

i. <u>What is LEDPA?</u>

Under Section 404 of the Clean Water Act, any project involving the discharge of dredged or fill material into waters of the U.S. requires a 404 permit.[256] The permit program ensures steps are taken to preserve the aquatic environment and avoid significant degradation to U.S. waters.[257] A

[256] Permit Program under CWA Section 404, U.S. ENV'T PROTECTION AGENCY (March 31, 2023), https://www.epa.gov/cwa-404/permit-program-under-cwa-section-404.
[257] *Id.*

404 permit applicant must demonstrate that the proposed project is the least environmentally damaging practicable alternative (LEDPA) to achieve the project's purpose.[258]

Under the 404(b)(1) Guidelines for the LEDPA analysis, "the term *practicable* means available and capable of being done after taking into consideration cost, existing technology, and logistics in light of overall project purposes."[259] Although the term "practicable" leaves room for case-by-case determinations, LEDPA analysis is intended to avoid negative impacts on the aquatic ecosystem, not merely mitigate them.[260] If there is a LEDPA determination "which would have less adverse impact on the aquatic ecosystem," the proposed project shall not be permitted.[261] A LEDPA determination is "often the 'steepest hurdle' in obtaining a 404 permit."[262] The 404(b)(1) Guidelines for LEDPA are binding regulations; therefore, a LEDPA determination can be fatal to a project."[263]

ii. <u>LEDPA creates a duty that NEPA does not.</u>

A LEDPA analysis does have overlap with NEPA analysis, but they are not the same. There are crucial differences between the LEDPA standard and the NEPA requirements offshore wind developers already have to fulfill. For example, while the 404(b)(1) Guidelines for LEDPA focus on alternatives that can practicably be accomplished, NEPA requires a consideration of all

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[258] Jon Schutz, *The Steepest Hurdle in Obtaining a Clean Water Act Section 404 Permit: Complying with EPA's 404 (b)(1) Guidelines' Least Environmentally Damaging Practicable Alternative Requirement*, 24 UCLA J. ENV'T L. & POL'Y 235, 235-36 (2005).
[259] 40 CFR § 230.3(l).
[260] Compensatory mitigation is not allowed as an alternative to reduce environmental impacts under LEDPA analysis. US Environmental Protection Agency and US Department of the Army, *Memorandum of Agreement Between the Environmental Protection Agency and the Department of the Army Concerning the Determination of Mitigation Under the Clean Water Act Section 404(b)(1) Guidelines*. 1990. II.C(1).
[261] 40 CFR § 230.10(a).
[262] Schutz, *supra* note 258, at 235-36.
[263] *Id.* at 235-37.

reasonable alternatives.[264] NEPA's reasonableness standard is overbroad and waters down the complexity needed in this context. Most importantly, the 404(b)(1) Guidelines mandate that only the LEDPA can be approved, whereas NEPA does not require any decision on an alternative, even if the proposed project has significant adverse environmental consequences to the ocean.[265]

Such a standard would also provide a gateway for getting alternatives approved such as repowering or transitioning a foundation to an artificial reef. Because the LEDPA guidelines are inherently flexible, it would leave room for discretion in determining compliance with end-of-life planning on a case-by-case basis. This is needed for offshore wind, where the lifetime of a wind structure is estimated to last 25 years or longer.

Although the Army Corps of Engineers manages the Clean Water Act LEDPA process and grants or denies 404 permits accordingly,[266] BOEM and BSEE should oversee the LEDPA process here. BOEM and BSEE have jurisdiction over the offshore wind leasing process from planning to decommissioning. Joint ownership over the process can create a regulatory commons problem, but this is not an issue I will address in this Article. Ultimately, a LEDPA standard forces explicit consideration of ocean conservation while expanding the range of allowable end-of-life options.[267]

B. *Implementing a "Renewables-to-Reefs" Program that Preserves Artificial Reefs*

Second, to ensure that there is a viable alternative to decommissioning, BSEE should implement a national program with state participation that supports the conversion of offshore wind farms at the end of their life to long-term artificial reefs. U.K. researchers have proposed the

[264] Cody Wheeler, *U.S. Army Corps of Engineers Poudre River Basin Water Supply Projects Permit Process and Update*, U.S. ARMY CORPS OF ENGINEERS 1, 6 (2015) https://watercenter.colostate.edu/wp-content/uploads/sites/91/2019/03/2015-01-09-Wheeler-presentation-to-PRTI.pdf.
[265] *See id*. at 11.
[266] *Background on Compensatory Mitigation*, ENV'T L. INSTITUTE, https://www.eli.org/compensatory-mitigation/background-compensatory-mitigation#_edn17 (last visited Nov 25, 2023).
[267] *See* Fowler et al., *supra* note 188, at 1110.

concept of "renewables-to-reefs" for wind farms based on the U.S. rigs-to-reefs program for offshore oil rigs.[268] In support of this recommendation, I propose applying it – with requirements for liability and funding– to the U.S. offshore wind regulatory framework.

i. What is the O&G Rigs-to-Reefs Program?

The O&G sector has a wealth of experience in decommissioning that the nascent offshore wind industry does not have today. In the last 30 years, over 4,000 offshore O&G structures have been decommissioning in the Gulf of Mexico alone.[269] From 1987-2019, 558 of these federal structures have been reefed through the Rigs-to-Reefs program.[270] In response to growing concerns about the loss of marine life during the decommissioning of O&G structures, Congress passed the 1984 National Fishing Enhancement Act.[271] This Act created a National Artificial Reef Plan and established a reef-permitting system to convert obsolete O&G structures into artificial reefs.[272] The Rigs-to-Reefs program is managed by both federal and state agencies.[273]

Under this program, BSEE can grant exceptions to decommissioning requirements by allowing offshore O&G operators to donate platforms to coastal states to serve as artificial reefs.[274] A coastal state must have an approved, state-specific artificial reef plan to be considered for this program.[275] The state will then decide whether they want to take the structure and acquire a permit

[268] Katie Smyth et al., *Renewables-to-reefs? – Decommissioning options for the offshore wind power industry*, 90 MARINE POLLUTION BULLETIN 247, 255 (2015).
[269] Gillian Smith & Graeme Lamont, *Decommissioning of Offshore Wind Installations - What we can Learn*, DNV GL 1, 4 (2017).
[270] Douglas Peter, *Rigs - to - Reefs Program History and Policy Overview*, BUREAU OF SAFETY AND ENV'T ENF'T, 1, 10 (2020) https://www.bsee.gov/sites/bsee.gov/files/technical-presentations//lmoga-12-15-2020.pdf.
[271] *Rigs-to-Reefs*, BUREAU OF SAFETY AND ENV'T ENF'T, https://www.bsee.gov/what-we-do/environmental-compliance/environmental-programs/rigs-to-reefs (last visited Nov. 22, 2023).
[272] *Id.*
[273] *Decommissioning FAQs*, BUREAU OF SAFETY AND ENV'T ENF'T, https://www.bsee.gov/subject/decommissioning-faqs?page=2 (last visited Dec. 7, 2023)
[274] *Rigs-to-Reefs*, *supra* note 271.
[275] *Id.*

from Army Corps of Engineers.[276] Finally, approval of the artificial reef plan is contingent upon compliance with U.S. Coast Guard navigational requirements, BSEE engineering and environmental reviewing standards,[277] NEPA, and other relevant federal statutes.[278]

ii. Strengths and challenges of O&G Rigs-to-Reefs state programs.

All five Gulf of Mexico coast states – Alabama, Florida, Louisiana, Mississippi, and Texas – have incorporated state-specific artificial reef plans.[279] Louisiana, in particular, is known to have the most comprehensive framework to address artificial reef planning.[280] Under the Louisiana Artificial Reef Plan, once an O&G structure is approved and converted to an artificial reef, the State accepts title and liability for the reefed structure.[281] Because National Fishing Enhancement Act does not provide federal funding to offset the costs and ongoing maintenance obligations the state takes on, Louisiana created an Artificial Reef Development Fund.[282] In most cases, although not codified, companies donate half of the savings they realize by reefing versus decommissioning to this Fund.[283]

California, on the other hand, is a prime coastal candidate for a Rigs-to-Reefs program, but has faced significant difficulty in getting a state program approved. The two biggest concerns are

[276] Peter, *supra* note 270, at 7. https://www.bsee.gov/sites/bsee.gov/files/technical-presentations//lmoga-12-15-2020.pdf.
[277] "These include the structure being sound, stable, clean, and overall beneficial to the environment, while protecting the Gulf of Mexico's natural resources." *Rigs-to-Reefs*, *supra* note 271.
[278] P. Scott Burton, *Offshore Platform Sustainable Decommissioning – "Rigs to Reefs" Goes Global*, HUNTON ANDREWS KURTH (Jan. 30, 2020), https://www.huntonnickelreportblog.com/2020/01/offshore-platform-sustainable-decommissioning-rigs-to-reefs-goes-global/.
[279] *Rigs-to-Reefs*, *supra* note 271.
[280] Rachael E. Salcido, *Enduring Optimism: Examining the Rig-to-Reef Bargain*, 32 ECOLOGY L. Q. 863, 893 (2005).
[281] *Rigs-to-Reefs*, *supra* note 271.
[282] Charles A. Wilson et al., *Louisiana Artificial Reef Plan*, LA. DEP'T WILDLIFE & FISHERIES 1, 3, 8 (1987); Salcido, *supra* note 280, at 894.
[283] *Rigs-to-Reefs*, *supra* note 271.

ambiguity over long-term liability, and fears over unjustly enriching oil companies.[284] As a result, California's proposed programs do not "release oil companies from liability for the platforms after the oil wells have been capped" unlike the Gulf Coast state counterparts.[285] Specifically, the program "contains an indemnification clause, which, upon sale, transfers the future liability of a reefed structure back to the oil company."[286] This ambiguous, pseudo-joint liability scheme has proven ineffective in getting a state artificial reef program off the ground. The strengths of the Louisiana program and challenges from California's program provide insight into how to create a successful renewables-to-reefs program for offshore wind.

iii. Renewables-to-Reefs proposal.

I propose implementation of a renewables-to-reefs program under BSEE following the framework of the rigs-to-reefs program with two main changes to clear up ambiguities around liability and strengthen federal commitment. First, inspired by Louisiana's state plan, I propose a federal requirement that all state programs transfer liability from the lessee to the state participant in exchange for mandatory payment from the lessee of half of the savings they realize by reefing. This would incentivize offshore wind developers to consider alternatives to decommissioning while compensating the state for assuming the risk. Unlike the O&G sector where plugging and abandoning all wells is required[287] and accidents like Deepwater Horizon have caused public

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[284] Dan Rothbach, *Rigs-To-Reefs: Refocusing The Debate In California*, 17 DUKE ENV'T L. & POL'Y F. 283, 293 (2007).
[285] Chris Iovenko, *Should California Turn Its Oil Rigs Into Reefs?*, PBS (June 15, 2022), https://www.pbssocal.org/news-community/should-california-turn-its-oil-rigs-into-reefs.
[286] Asher Radziner, *Rigs to Reefs: The Sub-Surface Story of Oil Platform Decommissioning,* MONTECITO J. (Aug. 16, 2022), https://www.montecitojournal.net/2022/08/16/rigs-to-reefs-the-sub-surface-story-of-oil-platform-decommissioning/.
[287] How a Rig Gets Reefed, TEX. PARKS & WILDLIFe, https://tpwd.texas.gov/landwater/water/habitats/artificial_reef/rigs-to-reefs.phtml (last visited Dec. 7, 2023).

outrage towards oil companies,[288] offshore wind does not face the same concerns. Therefore, requiring this type of liability scheme would likely encourage a collaborative environment-based risk analysis.

Second, I propose providing federal funding to state artificial reef programs through a federal funding policy based on the Coastal Zone Management Act (CZMA). Under the CZMA, when a state submits a coastal management program, the National Oceanic and Atmospheric Administration provides federal funding and assistance.[289] I propose BSEE provide federal funding to assist with the remaining 50% of the costs the lessee's contribution does not cover. Currently, there are no East Coast states with respective rigs-to-reefs programs, likely due to the scarcity of offshore oil rigs in that region of the country; however, most of the current and planned offshore wind development is located in the East Coast.[290] Guaranteed federal funding would incentivize coastal states – including California and the East Coast – to implement state renewables-to-reefs programs.

C. *Investing in Research and Development for Nature-Conscious End-of-Life Solutions*

Third, to address the knowledge gap concerning the impact of decommissioning on ocean ecosystems, a robust solution to the decommissioning problem must include increased investments in research and development (R&D) for offshore wind end-of-life planning.

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[288] *BP oil spill: the growing onslaught of public anger*, GUARDIAN (June 15, 2010), https://www.theguardian.com/environment/gallery/2010/jun/15/bp-oil-spill-protest.

[289] Over $2 billion in coastal zone management-related federal grants have been allocated to eligible coastal states since 1972. EVA LIPIEC, CONG. RSCH. SERV., R45460, COASTAL ZONE MANAGEMENT ACT (CZMA): OVERVIEW AND ISSUES FOR CONGRESS 1, 6 (2019).

[290] Jared Anderson et al., *US offshore wind power development expanding beyond the East Coast in 2023*, S&P GLOBAL (May 17, 2023), https://www.spglobal.com/commodityinsights/en/market-insights/latest-news/energy-transition/051723-us-offshore-wind-power-development-expanding-beyond-the-east-coast-in-2023.

i. <u>Call for research to better understand the impacts of end-of-life procedures on ocean ecosystems.</u>

The U.S. Department of Energy's (DOEs) Wind Energy Technologies Office (WETO) leads U.S. efforts to accelerate onshore and offshore wind development.[291] WETO supports the U.S. Offshore Wind Synthesis of Environmental Effects Research (SEER) project in an effort to illuminate the environmental effects, identify knowledge gaps, and call to prioritize future environmental research efforts in offshore wind development.[292] Currently, the 8 specialized areas SEER studies include: underwater noise, cable entanglement risk for marine life, wind turbine collision risk for birds and bats, disturbances to organisms on the seafloor, impacts to fish and their habitats, collision risks for ships and other vessels, displacement of birds and bats, and electromagnetic field effects.[293] The impacts of decommissioning and alternatives are not studied specifically and are rarely mentioned. Where SEER briefly mentions decommissioning, they hypothesize that the effects of decommissioning may follow the same recovery pattern during the construction phase.[294] However, because very few offshore wind farms across the world have actually been decommissioned, SEER recognizes there is a knowledge gap in this issue.[295]

I propose that SEER publish a priority call for research to better understand the decommissioning impact on marine life. Additionally, research is needed to evaluate the impact of all end-of-life strategies, including life extension, repowering, and repurposing the offshore structure by leaving it *in situ* as an artificial reef. Lastly, SEER should collaborate with BSEE to

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[291] *Wind Energy Technologies Office (WETO)*, INT'L ENERGY AGENCY (Aug. 24, 2021), https://www.iea.org/policies/3670-wind-energy-technologies-office-weto.

[292] *Spotlight on SEER: Awareness for Offshore Wind Energy Development*, OFFICE OF ENERGY EFFICIENCY & RENEWABLE ENERGY (Oct. 13, 2021), ttps://www.energy.gov/eere/wind/articles/spotlight-seer-awareness-offshore-wind-energy-development.

[293] *Id.*

[294] *Benthic Disturbance from Offshore Wind Foundations, Anchors, and Cables*, SYNTHESIS OF ENT'L EFFECTS RESEARCH 1, 10 (2022).

[295] *Id.*

create an evaluation framework that assesses the net impact of each end-of-life strategy on the ocean ecosystem. This framework should broaden the "assessment scope to consider ecological connectivity among groups of structures and surrounding ecosystems, rather than single-structure evaluation."[296] This framework can then be used as guidance for the LEDPA analysis.

ii. Create a department of energy fund for end-of-life research and development.

Under the DOE, WETO also funds R&D across the nation to enable wind energy innovation.[297] Since 2011, WETO has partnered with BOEM to advance offshore wind development in the country.[298] As part of this mission, WETO has "allocated over $300 million for competitively-selected offshore wind research, development, and demonstration projects."[299] Currently, there are 138 active or completed offshore wind R&D projects.[300] The funding for these projects generally fall into two major categories: (1) Offshore Wind Energy Resources and the Environment, and (2) Planning, Constructing, and Integrating Offshore Wind Energy.[301] Offshore wind environmental R&D projects include compiling a database of environmental research from across the world, and developing monitoring tools to identify the impact of construction and operations on marine life.[302] For instance, the DOE granted $3.3 million in funding to the

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296 Fowler et al., *supra* note 133, at 577.

297 *Offshore Wind Research and Development*, OFFICE OF ENERGY EFFICIENCY & RENEWABLE ENERGY, https://www.energy.gov/eere/wind/offshore-wind-research-and-development#:~:text=As%20part%20of%20that%20strategy,%2C%20development%2C%20and%20demonstration%20projects.&text=Learn%20more%20about%20our%20investments%20in%20offshore%20wind%20technologies (last visited Dec. 1, 2023).

298 *Id.*

299 *Id.*

300 *Wind Energy Technologies Office Projects Map*, OFFICE OF ENERGY EFFICIENCY & RENEWABLE ENERGY, https://www.energy.gov/eere/wind/wind-energy-technologies-office-projects-map (last visited Dec. 1, 2023).

301 *Offshore Wind Market Acceleration Projects*, OFFICE OF ENERGY EFFICIENCY & RENEWABLE ENERGY, https://www.energy.gov/eere/wind/offshore-wind-market-acceleration-projects#transmission_planning_interconnection (last visited Dec. 1, 2023).

302 *Id.*

Coonamessett Farm Foundation in Massachusetts to survey changes in seafloor habitats at East Coast offshore wind developments.[303]

However, there are no projects slated specifically to study the impact of end-of-life options on the ocean ecosystem. There are no projects that even study the offshore wind decommissioning process, let alone the impact of decommissioning. It is clear there is a gap in end-of-life R&D. Even more, there are limited efforts to fill this gap for the future. Out of the 36 archived and 12 current funding opportunity announcements posted for WETO, zero have focused on offshore wind decommissioning R&D.[304]

In partnership with BSEE and under the purview of DOE, WETO should create a category of funding for offshore wind end-of-life R&D. Specifically, projects should consist of studies focused on understanding the impacts of removing an offshore wind foundation that has served as an artificial reef for its lifetime. Additionally, research should offer innovative nature-conscious approaches to end-of-life planning.

Thus, this proposal is a practical investment in a long-term solution to address the unintended consequences of decommissioning of an offshore wind structure without understanding the net impact on ocean ecosystems.

VII. Conclusion

As the U.S. offshore wind industry grows, artificial reefs will inevitably become a side effect of the proliferation of offshore wind structures.[305]Artificial reefs provide a positive example

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[303] *DOE Announces $13.5 Million for Sustainable Development of Offshore Wind*, OFFICE OF ENERGY EFFICIENCY & RENEWABLE ENERGY (Oct. 13, 2021), https://www.energy.gov/articles/doe-announces-135-million-sustainable-development-offshore-wind.

[304] *EERE Archived Funding Opportunities*, OFFICE OF ENERGY EFFICIENCY & RENEWABLE ENERGY, https://eere-exchange.energy.gov/Default.aspx?Archive=1# (last visited Dec. 1, 2023); *EERE Funding Opportunity Announcements*, OFFICE OF ENERGY EFFICIENCY & RENEWABLE ENERGY, https://eere-exchange.energy.gov (last visited Dec. 1, 2023).

[305] Degraer et al., *supra* note 131 at 49.

of a nature-based solution that both supports offshore wind development and enhances ocean ecosystems. However, current U.S. offshore wind decommissioning regulations inadequately address the unintended consequences on marine life of removing these subsea structures from the ocean. The U.S. Department of Interior should adopt my three-part law and policy solution to prevent avoidable ocean ecosystem destruction and consider leaving offshore wind structures "under the sea."