HOPKINS STUDENT WIND ENERGY TEAM

Project Development Report

Johns Hopkins University Collegiate Wind Competition 2023

Email: jhuwindenergy@gmail.com

| **Project Development Team** | | |
|---|---|---|
| **Siting Team** | **Finance Team** | |
| Julia Choe (Lead) | Jacob Brunner (Co-Lead) | Lulu Grubb |
| William Chavez | Jayden Chiu (Co-Lead) | Grace Qiu |
| Adriana Pena | Victor Aldridge | Jonathan Spangler-Sakata |
| Marisa Thomas | Adit Bajaj | |

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## Executive Summary

The [Johns] Hopkins Student Wind Energy Team (hereafter, referred to as "HSWET," the "developer," or the "sponsor") has developed a report for a 540 MW wind farm off the coast of Port Fourchon, Louisiana. After extensive research into the siting characteristics and financials for the region, HSWET has created a development plan for an offshore wind project featuring 36 Vestas Turbines. Siting aspects of the project were visualized using Furow (by Solute) and ArcGIS while the financial analysis for the project was done using the System Advisory Model (hereafter, referred to as "SAM") and the Pivotal180 Tax Equity Model for Renewable Finance. The project offers attractive economics to both the sponsor equity and tax equity investor with 11.78-15.73% and 12.55%-13.72% returns, respectively, along with a high capacity factor of 40.71%. Based on its cost of energy and cash flow analysis, HSWET proposes a maximum bid price of $61,000,000 or $6,100 per acre of its selected lease area.

The wind farm is attractive to investors for various reasons, including HSWET's optimized layout and energy transmission plan, attention to environmental risks, and well structured capital stack. The developer's project finance consists of tax equity, sponsor equity, and back-leveraged loans with refinancing options. Cash flows stem from Virtual Power Purchase Agreements with two investment-grade oil and gas companies.

## 1.0 Site Analysis

Various features of the auction area were analyzed to select a site. Average wind speeds within the auction area range from 7.2 to 7.6 m/s at a height of 140 m.[1] Significant wave heights range from 0.6 to 5.6 m.[2] The composition of the ocean floor is muddy sand throughout, and there are no significant areas of rock or gravel on the seafloor.[3] The water is shallowest (15 m depth) at the north end of the lease area and gets deeper to the southeast (maximum 75 m depth). Furthermore, a dead zone (also known as a hypoxic zone) exists closer to shore, which is characterized by having a dissolved oxygen (DO) content of less than 2 mg/L. The topmost blocks in the Grand Isle area are hypoxic for 50-75% of the year. The level of hypoxia decreases as depth increases.[4] The southern edge of the lease area is outside of the hypoxic zone.

There are two shipping ports near the selected lease area: Port Fourchon and Port Grand Isle. HSWET has decided to use Port Fourchon due to its ability to accommodate the draft of current Wind Turbine Installation Vessels (WTIV's) and its sufficient laydown surface area and quayside length.[5] Additionally, Port Fourchon supports 95% of current oil and gas activities in the Gulf of Mexico, so its oil and gas support mechanisms can easily be transitioned to support offshore wind farms (OWF).[6]

Commercial and government-sponsored marine activities can impact the lease block selection. Per Title 33, Chapter I, Subchapter P, Part 166 of the Code of Federal Regulations, artificial structures are prohibited within federally designated shipping lanes. Another limitation involves the blocks within the auction area that have already been leased out, as well as the numerous oil and gas platforms that exist across the auction area.[7] Moreover, pipelines run across the area floor.[7] Damaged pipes, even unused ones, could lead to oil or natural gas leaks, affecting nearby aquatic life and resources. However, this is a risk that must be assumed because the majority of available lease blocks contain at least one section of a pipeline. HSWET must also consider any routine military operations that occur in the area. The 8th Coast Guard District's jurisdiction includes the Gulf of Mexico's coastline and the adjacent offshore waters and outer continental shelf.[8] Outside of the Coast Guard's standard patrolling, no other or military operations occur in the area.[9] Another consideration is sites or resources with archaeological or historical importance. Section 106 of the National Historic Preservation Act requires federal agencies to consider the effects of their proposed federal and federally-funded undertakings under their jurisdiction on historic properties in any state, including the state's submerged lands and waters.[10] One classification of prominent sites subject to the act are shipwrecks (considered historic period sites).

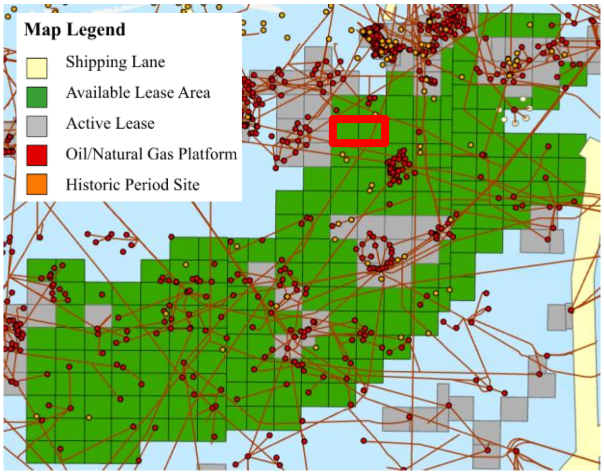


**Figure 1:** An illustration of shipping lanes, active lease areas, platforms, pipelines, and shipwreck locations in the auction area.

HSWET has chosen blocks 56 and 57 in the South Timbalier area for the preliminary site based on the aforementioned characteristics. The water depths in blocks range from 20 to 24 m. Having two blocks provides HSWET enough space to optimize the OWF layout using the chosen turbines to reduce wake effect energy losses.

While HSWET would prefer to use blocks closer to shore to decrease costs, siting closer to shore near Grand Isle (in the northeast of the leasing area) could pose greater threats to wildlife in the Mississippi River Delta. For example, Elmer's Island on Grand Isle is home to protected species, including the mottled duck, common nighthawk, and loggerhead sea turtles.[11] Additionally, Grand Isle tourism could be negatively impacted by aesthetic losses caused by a visible offshore project. Relevant literature analyzing existing wind farms suggests that moderately sized facilities of 100 turbines are easily seen at distances of 35 km.[12] Through HSWET's choice of leasing blocks, the closest block to Grand Isle would be about 50 km away, which could alleviate most visual impacts while keeping the site close to Port Fourchon.

## 1.1 Wind Farm Design

The wind farm will use 36 Vestas V236-15.0 MW turbines to have a total installed capacity of 540 MW. The sponsor chose to use turbines with high rated power curves to minimize the total number of turbines needed for the OWF. Achieving a large total wind farm capacity with few turbines is desirable because fewer turbines equates to lower wake losses. While still a prototype in testing, this turbine draws from the proven Vestas EnVentus and 9 MW platforms, helping to ensure its success in the field. The turbine's specifications are listed in Table 1. The hub height was chosen to be 140 m to allow for the turbine towers to be manufactured and shipped locally while still receiving sufficiently high wind speeds.

**Table 1**: V236-15.0 MW specifications[13]

| Rated Power | Rotor Diameter | Hub Height | Cut-In Speed | Cut-Out Speed | Nominal Voltage | Wind Class |
|---|---|---|---|---|---|---|
| 15000 kW | 236 m | 140 m | 3 m/s | 30 m/s | 66 kV | IEC S |

Each turbine will be placed on an Inward Battered Guide Structure (IBGS), otherwise known as a twisted jacket foundation. IBGS has proven to help oil and gas rigs withstand the extreme storms including Hurricane Katrina.[14] Due to the prevalence of hurricanes in the Gulf, the twisted jacket will help minimize maintenance and damage costs. Furthermore, their installation costs rival that of monopile foundations, which would be the typical foundation choice for water depths less than 40 m.[15]

Furow was used to test various turbine layouts to maximize energy yield while minimizing transmission cable length. Figure 2 shows the team's layout determined in Furow. 36 turbines will be placed in a four-by-nine array four rotor diameters apart from each other. While turbines would typically be placed at a minimum of three rotor diameters apart, arranging them with more space in between decreases wake losses. The annual yield is 1,926,729.4 MWh and the net capacity factor is 40.7308%.

Once the turbine placements were determined, the cable pathways were drawn. Figure 2 shows the cable layout. Turbines were grouped into six components of a parallel circuit. An offshore substation will be placed in between turbines 18 and 19 at the center of the farm. This was done to minimize cable length.[16]

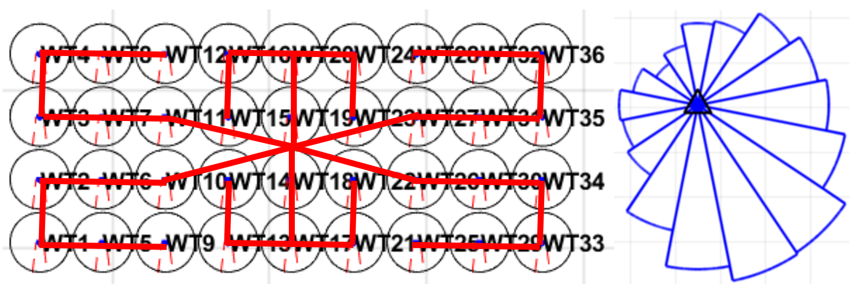


**Figure 2**: (Left) Layout of 36 V236-15.0 MW turbines in blocks 56 and 57. An offshore substation will be placed in between turbines 18 and 19 at the farm's center. (Right) A wind rose depicting the wind patterns at the chosen site.

## 1.2 Transmission Plan

During brainstorming for the proposed project, numerous energy utilization strategies were reviewed. Direction connection to oil and gas platforms was considered due to high platform prevalence around the proposed lease blocks. This technique was used in the Beatrice Wind Farm Demonstrator Project off the coast of Scotland.[17] However, the large projected capacity of the farm combined with an increasing number of soon-to-be decommissioned platforms in close proximity to new development work made this plan difficult to achieve. Another potential strategy was to use the energy generated from the project to power an electrolyzer that separates water into oxygen and hydrogen gas. The green hydrogen gas could then be piped to shore.[18] Given that green hydrogen is a developing technology with little precedent, HSWET opted to not use green hydrogen as part of its transmission plan.[19]

The chosen transmission plan sends energy directly to shore and onto the local grid. It consists of two aspects: the inter-array cables within the OWF and the export cable from the OWF to shore. Guidance for transmission cable specifications was taken from the Construction and Operation Plan for Vineyard Wind in Massachusetts because of its comparable size.[20] For the HSWET project, 66 kV inter-array cables connect individual turbines to the offshore substation located at the farm's center. From the offshore substation, a 275 kV HVAC submarine cable carries the farm's generated electricity to shore. This cable spans 29 km which is within the 50 km limit in which underwater HVAC cables are preferred to HVDC.[21] These cables run parallel to an existing pipeline going through block 57 at a separation distance of 450 m to improve logistical planning. The cables are buried at a depth of 1.5 m to 2.5 m to prevent electromagnetic field disruption, and are alternatively protected by rock placement, concrete mattresses, or half-shell pipes when burying said line is not possible. The cable makes landfall on Port Fourchon

Beach at the red dot in Figure 3 and will travel 6.7 km up A O Rappelet Road to reach an onshore substation and interconnection point located to the right of Moran's Marina LLC Office.


**Figure 3**: (Left) Cable pathway onshore to the interconnection point. (Right) A closer image of the interconnection point from the farm-to-shore transmission line.

## 1.3 Environmental Analysis

Per the Threatened and Endangered Species List for the state of Louisiana, provided by the National Oceanic and Atmospheric Administration (NOAA) Fisheries, the following marine species are currently listed as endangered and can be found in the selected site: the Kemp's ridley sea turtle, the leatherback sea turtle, the hawksbill sea turtle, the sperm whale, and the Rice's whale.[22]

The maximum sound level of installing jacket foundations at Block Island Wind Farm in Rhode Island was measured to be 145 dB 25 m away from the source;[23] HSWET used this value for their analysis of noise impact to species. Using a damped cylindrical spreading model,[24] sound exposure levels at various distances were calculated, shown in Figure 4. From the model, HSWET concluded that species with high frequency hearing ranges will experience permanent auditory damage if they are less than 2.5 m away from the construction site. A soft-start technique will be utilized to protect these species from construction noise, giving species nearby time to leave the area before the sound reaches dangerous levels.

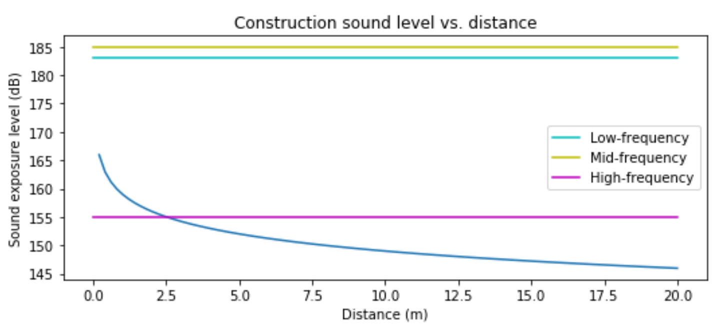


**Figure 4**: Sound exposure levels at distances up to 20 m from the source expected from pile driving and the hearing thresholds for each hearing group. The hearing thresholds cannot be exceeded to prevent permanent changes in hearing sensitivity.[25]

The available auction blocks also coincide with various avian migration routes.[26] The Endangered Species Act recognizes three threatened and two endangered avian species in Louisiana.[27] From analysis of population abundance and migration routes, it is predicted that the OWF will not harm these sensitive species. The migration routes of the endangered Whooping Crane and the threatened avian species rarely enter the OWF boundaries.[28] The endangered Red-Cockaded Woodpecker does not migrate but may travel to new habitats due to habitat destruction.[29] Therefore it is possible that the species may collide with the OWF during a forced migration.[30] Regardless, HWSET will monitor species' abundance and distribution prior to and post construction in order to effectively plan environmental mitigation techniques.

Louisiana categorizes certain native animals as Species of Greatest Conservation Need (SGCN).[31] Not including the aforementioned bird species, at least 18 species on this list are trans-Gulf migrants.[32] Mitigation strategies for bird collision with turbines include painting one blade and the base of every turbine black, which assists vision-impaired species.[33] The MERLIN Avian Radar System will be implemented to collect real-time information of nearby bird and bat populations.[34] The OWF will also comply with Federal Aviation Administration (FAA) regulations on implementing flashing red lights.[35] A FFA Form 4760-1m will be submitted to propose changing the light color to blue-green, which can significantly reduce bird attraction to artificial light.[36]

In order to be approved, the project must mitigate its impact on the Louisiana shrimping industry, which produces $1.3 billion annually.[37] Due to factors such as the visual impacts of OWF and high oil and gas platform densities, lease blocks closer to higher hypoxia frequencies, which would have a lower impact on said industries, could not be used.[38] While the proposed blocks experience less hypoxia frequency, they are located in an area that historically receives less brown and white shrimp trawling and catch per unit efforts.[39] Brown shrimp migrate away from low dissolved oxygen levels and travel as far as 14 km away from the edge of hypoxic areas, which may lure some shrimp into the proposed lease blocks.[40] Additionally, the installation of the twisted jacket foundations and the Seabed Scour Control System (SSCS) create an artificial reef effect, which could increase the shrimp population within the proximity of the proposed project.[41] The polypropylene found in SSCS is chemically inert which reduces nearby marine ecosystems impact.[42]

## 1.4 Site Development and O&M

In February of 2023, Crowley reached a Right of First Refusal agreement with Port Fourchon to lease and construct a 40-acre wind terminal, which HSWET will use for staging and O&M ports.[43] Upon comparing the proposed port's dimensions with other newly constructed ports in Portsmouth Marine Terminal and Salem, the facility will be available before HSWET's construction begins.[44] At the moment, V236-15.0 MW blades and nacelles are only sourced from Vestas' factories in Denmark.[45] Hence, blades and nacelles will be sourced from Vestas' blade factory in Nakskov[46] and nacelle factory in Lindø.[47] CS Wind will provide turbine towers from Pueblo, Colorado; however, since their facility is undergoing expansion until 2028, HSWET will notify them ahead of time for the required OWF components[48] to prevent delays.

Dominion's *Charybdis* will administer on-site turbine installation as it is currently the only Jones Act-compliant wind turbine installation vessel (WTIV) and can use Port Fourchon's facilities for project construction.[49] However, given that construction is predicted to commence in late 2027, the *Charybdis* may be unavailable.[49] In that case, installation will be managed by a Jones Act compliant feeder vessel and foreign built WTIV.[50] A motion compensated feeder vessel will be provided by C-Job x Ampelmann, which allows for an efficient installation process due to minimized destability.[51] Jan De Nul's *Voltaire*, a foreign flagged WTIV, will manage installation. The *Voltaire* is a jack-up vessel that can carry up to 16,000 t of payload and can operate within the water depths of the proposed lease blocks.[52]

In 2022, The U.S. Customs and Border Protection ruled that the Jones Act is not applicable to cable laying vessels.[53] Hence, a foreign vessel, supplied by Jan De Nul's *Isaac Newton*, will be used. The *Isaac Newton* provides both inter-array and export cable installation and can install up to 10,700 t of cables.[54]

O&M transportation will be provided by one Atlantic Wind Transfer crew transfer vessel (CTV). Optimization for O&M recommends CTV over service operation vessels (SOVs) usage with OWF located less than 40 km from shore with smaller farms. The farthest proposed lease blocks are 32.73 km from Port Fourchon and will hold 36 turbines; given our OWF conditions, SOV usage is unnecessary.[55]

For a Site Assessment Plan (SAP), geophysical, geotechnical, and metocean surveys will be conducted through two nearshore survey vessels from Furgo for six months before SAP submission.[56] Furgo's nearshore vessels will have no issue operating in the auction block's bathymetry.[57] HSWET will then submit a SAP and expect to receive results the following year.[58] If approved, Furgo will append data collection with two SEAWATCH Wind Lidar buoys, which are of sufficient quantity given the proposed block parameters.[59] A Constructions and Operations Plan (COP) will be sent to BOEM at the earliest convenience after SAP approval. The COP will contain an Environmental Impact Statement, Visual Impact Assessment, and Archaeological Resources Survey. If the COP is approved, HSWET will subsequently submit a Safety Management System, a Facility Designs Report, and a Fabrication and Installation Report. The COP approval is estimated to take around two years, with post-approval documents undergoing a further 60 day review.[60] From construction timelines of OWF with similar size and characteristics, HSWET predicts that construction will take three years.[61]

## 2.0 Capital Expenditures

The capital cost of developing an offshore wind project consists of turbine and balance of plant (BOP) costs. The CapEx used in the report stems from publicly available sources, input from industry mentors (when specific costs were too confidential to have publicly available data), and calculations using NREL's System Advisory Model (SAM). HSWET determined the CapEx of the project to be $1.81 billion.

HSWET plans to use the Vestas V236-15.0 MW turbine. The first reason for this choice is that the large swept area of the rotor and the recent improvements in turbine technology allow the farm to benefit from a capacity factor of 40.71%, which is significant given that the Gulf of Mexico experiences lower average wind speeds than other areas along the coast of the US. Additionally, the 15 MW nameplate capacity of the turbines allow a greater nameplate capacity for the farm while reducing the number of turbines needed, decreasing the associated Balance-of-Plant costs. Due to the confidential nature of the offshore turbine industry, a specific cost per turbine could not be identified. However, when consulting NREL's *2021 Cost of Wind Energy Review*, it was determined that the cost per turbine was $1,300,000/MW, or $19,500,000 per turbine.[62]

The additional element that significantly impacts the capital cost is the Balance of Plant (BOP) cost. The BOP includes construction costs excluding the cost of the turbines, consequently consisting of items such as the foundations, cabling, substations, etc. HSWET's total BOP CapEx will be $918 million, or approximately $1,700/kW as can be seen in Table 2 below.

**Table 2**: Use of Funds Table

| Cost Type | Subtype | Total Cost ($) | $/MW | % Breakdown |
|---|---|---|---|---|
| **Development Fees and Financing** | | | | |
| | Development Fees | $76,709,476.83 | $142,054.59 | 4.24% |
| | Financing | $19,170,000.00 | $35,500.00 | 1.06% |
| | Total | $95,879,476.83 | $177,554.59 | 5.30% |
| **Turbine Cost** | | | | |
| | Vestas V236-15.0 | $794,248,565.45 | $1,470,830.68 | 43.93% |
| **Balance of Plant** | | | | |
| | Wind Turbine Installation | $81,461,391.33 | $150,854.43 | 4.51% |
| | Foundation | $125,586,311.63 | $232,567.24 | 6.95% |
| | Foundation Installation | $41,862,103.88 | $77,522.41 | 2.32% |
| | Cabling | $117,012,630.17 | $216,690.06 | 6.47% |
| | Cabling Installation | $29,290,104.04 | $54,240.93 | 1.62% |
| | Onshore Substation | $169,711,231.93 | $314,280.06 | 9.39% |
| | Offshore Substation | $282,852,053.22 | $523,800.10 | 15.64% |
| | Other BOP | $39,712,428.27 | $73,541.53 | 2.20% |
| | Decommissioning | $30,548,021.75 | $56,570.41 | 1.69% |
| | Subtotal | $918,036,276.22 | $1,700,067.18 | 50.77% |
| | | | | |
| **Total Cost** | | **$1,808,164,318.51** | **$3,348,452.44** | **100.00%** |

## 2.1 Financing Plan

HSWET has secured initial sources of funding for the proposed project. The capital cost of the project is approximately $1.81 billion, and will be financed through a combination of sponsor equity, tax equity, and back-leveraged debt. The capital stack of the project is shown in Table 3 below:

**Table 3**: Capital Stack Summary

| Sources | Cost ($M) | Percentage of Total |
|---|---|---|
| Debt | $1,096.80 | 52.12% |
| Tax Equity | $820.00 | 38.96% |
| Sponsor Equity | $187.74 | 8.92% |
| **Total Sources** | **$2,104.54** | **100.00%** |

The project's financing structure will be a partnership-flip with back leveraged debt. The tax equity partner will be JP Morgan, a firm that has the tax base to cover the extent of the tax benefits from the project. Bank of America, due to its size, connections, and significant experience with renewable energy funding will provide the back-leverage debt. The sponsor equity will be funded by HSWET, as HSWET has a significant backing of capital provided by numerous well-endowed partners.

As a result of the large investment tax credit, the project experiences numerous pre-flip tax benefit arrangements. In year one, the tax equity partner will receive 99% of the tax equity benefits, while the cash equity partner will receive 1%. Starting at year two and continuing until the partnership flip in year six, the tax equity partner will receive 20% of the tax equity benefits, while the cash equity partner will receive 80% of the tax equity benefits. The cash benefits to the tax equity investor stay at 5% until the partnership flip. After the partnership flip, both the tax benefits and the cash benefits to the tax equity investor are 5%, while the tax benefits and the cash benefits to the cash equity partner are 95%.

The project's back-leveraged debt is structured to allow the project to take advantage of favorable refinancing. Due to the current stressed financial marketplace, increased risk as a construction loan, and inherent risk of the project, the interest rate on the mini-perm loan and the tax equity bridging loan will be the 10-year SOFR swap rate (annual/annual) plus 280 basis points, totaling 5.904%.[63] The loan will be refinanced at year five because years of production prove certainty of cash flows and allow for favorable refinancing opportunities. However, since the cost of debt is high due to uncertainty within financial markets and the inherent risk of the project's location, HSWET estimates an average interest rate of 5.5% over the project's 20-year lifespan.

While the 20-year cash flows with both the tax equity partner and cash equity partner holding ownership of the project were modeled, HSWET deemed it important to understand the risks and benefits of additional strategies, as shown in Table 4 below. If the tax equity partner expressed a desire to leave the partnership after the partnership flip (referenced in the table as the "Tax Equity Call, Sponsor Equity Hold" scenario), the tax equity model provided an estimated buyout option price of $42.18 million. If HSWET decided to sell the project after purchasing the shares of the tax equity partner (referenced in the table as the "Tax Equity Call, Sponsor Equity Sale of Project" scenario, then HSWET's ownership in the project would have an NPV at the time of sale of $297.23 million.

**Table 4**: Sponsor and Tax Equity Hold, Call, and Sale Scenarios

| Scenario | Tax Equity Buyout Option Price ($ Million) | Sponsor Equity Sale Price ($ Million) | Tax Equity IRR | Sponsor Equity IRR |
|---|---|---|---|---|
| Tax Equity and Sponsor Equity Hold | N/A | N/A | 12.55% | 11.78% |
| Tax Equity Call, Sponsor Equity Hold | $42.18 | N/A | 13.72% | 11.79% |
| Tax Equity Call, Sponsor Equity Sale of Project | $42.18 | $297.23 | 13.72% | 15.73% |

## 2.2 Power Purchase Agreement

When considering offtake options, HSWET decided to sign a virtual power purchase agreement (VPPA). A VPPA provides revenue certainty and ensures project bankability which are advantages over selling power directly into the energy market at MISO's Houma Node or signing a hedge agreement.

The VPPA will be split between two offtakers: Chevron Corporation and ExxonMobil Corporation. The price of the VPPA for both offtakers will be **$85/MWh**, with a duration of 20 years and an escalation rate of 1% in order to mirror the escalation rate of the O&M costs. Because of the location of the offtakers, a VPPA is necessary as physical power delivery to the offtakers is not possible. Under the VPPA, HSWET sells its power at MISO's Houma node, but settles at MISO's Louisiana Hub. Oil majors were chosen as ideal offtakers due to their near term climate goals and reliable credit ratings. Further, oil majors have a large presence in the Gulf Coast area which makes them logical off takers of renewable energy. Moreover, both Chevron and Exxon both have goals of being netzero on carbon emissions by 2050 or sooner, which is supplemented by the expressed desire of both firms to expand within the hydrogen production industry.  The renewable generation of the proposed project will allow for the future production of green hydrogen if either/both offtakers decide to do so.

The first offtaker, Chevron Corporation, who will take 40% of the energy from the project, is a leading American multinational energy company with its headquarters located in San Ramon, California.[64] As of May 3, 2023, Chevron's market capitalization stands at $299.56 billion, making it the second-largest integrated energy company in the US with a stock price of $157.97 on the same day.[65] Chevron is also recognized for its financial stability, earning a strong investment-grade rating of AA- by S&P Global Ratings.[66] In response to mounting public pressure for companies to take action on climate change, Chevron joined the net-zero initiative and took steps to contribute to a more sustainable energy future. In conjunction with these goals, Chevron has invested in blue and green hydrogen technologies.[67] Given Chevron's commitments, HSWET believes that forging an agreement with Chevron as an energy offtaker is feasible.

Similarly, HSWET is looking to partner with Exxon Mobil, who will provide 60% of the power offtake. Exxon Mobil Corporation is a multinational oil and gas company headquartered in Irving, Texas. As of May 3, 2023, it has a market capitalization of $436.36 billion and a stock price of $107.93[68]. The company boasts a high level of investment credibility with a credit rating of AA- from S&P Global Ratings[69]. In 2022, ExxonMobil also announced its commitment to achieve net-zero Scope 1 and 2 greenhouse gas emissions from its operated assets by 2050, and outlined its strategy in detail in its Advancing Climate Solutions - 2022 Progress Report. As a result of this, HSWET has determined that partnering with Exxon Mobil would benefit both parties.

All of the electricity produced by the farm will be able to be utilized by the specified offtakers. Approximately 0.17 kWh of electricity is required to refine one gallon of hydrocarbon equivalent, and given that the project is expected to produce 5,276 MWh of electricity per day, HSWET is able to produce electricity equivalent to 738,935 barrels per day.[70] Considering the off takers listed above, the combined demand for Chevron's Pascagoula refinery in Mississippi and Exxon's Baton Rouge refinery in Louisiana is 800,100 barrels per day assuming a 90% refinery utilization rate.[71] Consequently, the proposed project can cover 92.26% of the necessary electricity for refining.

As part of the agreement, Renewable Energy Certificates (RECs) generated from the project will be transferred to Chevron and Exxon. At the moment, Louisiana does not have a statewide market for RECs, although this is stated goal in the Climate Action Plan approved by Governor John Bel Edwards. Until the eventual establishment of a Louisiana REC market, the project's energy production would generate Voluntary RECs. These RECs will be Green-e certified in order to increase their value. Recent statistics have quantified a Green-e Certified RECs at $8 per REC.[72] The transfer of RECs to Chevron and Exxon will provide an added incentive to sign onto the project's offtake agreement, with potential for greater future value if a statewide REC market is introduced.

## 2.3 Market Conditions

The location of the project near Port Fourchon puts it within the Midcontinent Independent System Operator (MISO), specifically, MISO South. Although the project has a set off-taker with a specified price under the PPA, it is important to consider the market conditions in order to effectively develop the project and present a viable PPA price. Because the PPA is not a physical PPA, and is instead a virtual PPA, HSWET's power will sell at the nearest node and the VPPA will settle at the Louisiana Hub.

MISO makes up a large part of the United States and is composed of subregions with different energy characteristics. Although MISO North has a significant wind power presence, MISO South's renewable energy source is predominantly solar. The shape of the solar generation curve is different from that of the wind generation curve in the Gulf of Mexico, so the presence of the HSWET wind project will be complementary to solar projects in the area. Because solar generation typically peaks during times when wind generation is lowest, constructing a battery energy storage system (BESS) would be unnecessary.

## 2.4 Incentives and Depreciation

With the passage of the Inflation Reduction Act (IRA), the Investment Tax Credit (ITC) has been extended under the 48D credit after 2024.[73] The 48D credit will begin to phase down 25% per year from projects that begin construction after either 2032 or the year in which the Secretary of the Treasury determines that annual greenhouse gas (GHG) emissions in the US are 25% or less than 2022 levels. Given the extensive permitting process necessary for offshore wind farms, HSWET anticipates a start of construction date of 1/1/2028 which allows it to qualify for the full value of the ITC. Due to the project's location in Louisiana, the project is subject to a blended 27% federal and state corporate income tax rate.

According to current guidelines, the base rate that the project qualifies for is a 6% ITC. To be eligible for the full ITC of 30%, HSWET's offshore wind project would meet certain prevailing wage and apprenticeship requirements. According to the U.S. Government, the prevailing wage rate is defined "as the average wage paid to similarly employed workers in a specific occupation in the area of intended employment".[74] Within the Houma-Thibodaux, LA Metropolitan Statistical Area (MSA), the mean hourly wage of construction is $23.00, installation, repair, and maintenance is $24.67, and architecture and engineering is $39.87.[75] In HSWET's contract agreements with the EPC contractor (Kiewit) and the O&M contractor (Vestas), language would be implemented to ensure that the employed laborers and mechanics would be paid prevailing wages for the duration of the construction of the facility and the first five years of commercial operation for any alteration and repairs of the facility. The contract agreements would also stipulate that 15% of total labor hours for the construction, alteration or repair work of the project must be performed by qualified apprentices. Kiewit and Vestas would bear the responsibility of meeting such requirements through their hiring, training, and payroll processes, and would absorb any penalties to the Treasury for failing to meet the prevailing wage and apprenticeship requirements. Federal regulations would also allow the project to claim 100% 5-years MACRS depreciation on the project.

Based on the bootstrap principle adopted by the IRS, offshore wind farms qualify for the Energy Community Adder if the onshore substation is in an energy community.[76] Based on the onshore substation location, the project is located in the Houma-Thibodaux MSA (MSA Code 26380) of Louisiana.[77] This area falls under the Treasury/IRS-defined MSAs for the IRA Energy Community Tax Credit Bonus of 10%, thus allowing the project to claim a 40% ITC.[78]

The developer's project may also be able to qualify for an additional 10% ITC for meeting the domestic content requirements under the IRA. Kiewit has a major supply chain presence in the US, particularly its 555-acre fabrication facility for offshore projects near Corpus Christi, Texas, and recent expansion efforts made by Vestas may allow for the domestic manufacturing of the V236-15.0 nacelle and blades. However, the IRS has not issued guidance on this adder, so HSWET cannot claim it at this time.

In terms of state incentives, Louisiana's Governor John Bel Edwards has approved a Climate Action Plan with the goal of achieving 100% of electricity generation derived from renewable or clean resources by 2035.[79] To do so, Louisiana plans to adopt a Renewable and Clean Portfolio Standard (RCPS), requiring electricity used in the state to be generated from an increasing percentage of renewable or clean sources. At the moment, there are no financial incentives from the state government, but HSWET will closely monitor any developments and adjust the financial projections accordingly.

## 2.5 O&M Costs

Given that the project will be using the Vestas V236-15 turbine, HSWET has decided to use Vestas' own in-house O&M services as the O&M contractor. Vestas has the best understanding of the needs and potential of its products, so they can implement the most advantageous solutions and technologies to optimize the project's operations. Vestas currently services the largest wind fleet in the world with a global portfolio of more than 140 GW and over 55,000 turbines.

HSWET would enter a fixed-price contract with Vestas for a service agreement with 1% escalating costs. Included in the contract will be a clause stipulating minimum production guarantees and liquidated damages for non-performance. Data from NREL 2022 Offshore Wind Market Report estimates the O&M cost "to range from $59/kW-year to $89/kW-year for U.S. projects with a COD between 2021 and 2030".[80] While the lead time associated with the project drives O&M costs up, oil and gas infrastructure and labor that exists in the Gulf area help keep O&M help keeps costs from ballooning.

## 2.6 Risks

**Political Risk**

Fluctuations in federal and state policy could limit the access to key tax incentives and undermine the financial viability of the project. The project will no longer be eligible for the full ITC if greenhouse gas emissions from the US power sector fall to 25% of 2022 levels and the project has not received a "Notice to Proceed" (NTP), or if the project does not commence construction before 2033.[81]

The IRA links new offshore wind leasing to offshore oil and gas leasing. BOEM cannot issue a wind lease unless 60 million acres were leased for oil and gas the year before. If this isn't met, wind leasing could be restricted and delayed.

The Inflation Reduction Act, led by the Biden Administration, heavily relies on support from Democratic lawmakers for climate and clean energy goals. A Republican majority in future elections may hinder renewable energy efforts, potentially leading to cuts in investment returns and project profitability.

Local stakeholders often pose fierce opposition to renewable energy projects, primarily due to negative effects on the fishing sectors, harm to wildlife, and impairment to landscape aesthetics. HSWET plans to mitigate the opposition from the local stakeholders by offering prevailing wage, apprenticeship programs, and local job opportunities. By offering more employment opportunities to an area that once had high fossil fuel employment, HSWET can mitigate some of the opposition to the project. Furthermore, HSWET will try to compensate for the losses incurred in the fishing industries during the construction period by providing compensation through the fisheries compensatory mitigation funds. After COD, artificial reef effects will also contribute to improving any lost fishing grounds.[83]

**Weather Risk**

There are two sources of weather risk: inaccurate wind resource data and inclement weather. Both factors could seriously impact operations and project revenue. HSWET has made significant measures to obtain the highest quality weather data available. Taking into account the effects of weather variability, HSWET has conducted a 20-year P50/P75/P90 analysis to forest investor returns under each scenario.

**Table 5**: 20 Year P50/P90 Projections

| Scenario | Annual Electricity to Grid (MWh) | Tax Equity 20 yr IRR (Hold) | Sponsor Equity 20 yr IRR (Hold) |
|---|---|---|---|
| P50 | 1,925,746.00 | 12.55% | 11.78% |
| P75 | 1,733,172.14 | 11.46% | 4.75% |
| P90 | 1,540,596.80 | 2.85% | 0.34% |

The Gulf of Mexico is known as a hurricane-prone region where the wind speed can exceed 115 miles per hour.[84] The V236-15 turbine can withstand wind speeds up to 57 m/s, equivalent to Category 3 (50 m/s - 57 m/s) hurricanes.[85] Besides damaging the nacelle and blades, high category hurricanes can also buckle the supporting tower but leave the twisted jacket foundation unharmed. A Category 2 hurricane will buckle up to 6% of the turbine towers in a wind farm, and Category 3 will buckle up to 46% of the towers.[86] Given the damage a hurricane can inflict and the high number of hurricanes present in the Gulf of Mexico, many oil rig facilities self-insure due to monumental insurance prices. In accordance with this strategy, HSWET plans to set aside 5% of the revenue to hedge against the hurricane risks.

**Financing Risk**

Interest rate risks present the largest financing risk to the project. The current 12-month US inflation rate remains elevated at 5.0%,[87] and the Effective Federal Funds Rate recently rose to 5.25%.[88] However, inflation is expected to fall to 2.5% by the end of 2024,[89] and the Fed signaled easing toward the end of 2024 or in 2025.[90] Moreover, due to recent financial instability, lending markets may be tighter, increasing the interest rate. Since HSWET will negotiate the initial construction loan toward the end of the permitting process around 2027, borrowing costs are expected to fall. Thus, HSWET projects the average interest rate across the initial mini-perm construction loan and subsequent refinanced loan to be 5.50%.

Another financial risk is that limitations exist on the capacity of the tax equity market, potentially driving up the relative price of tax equity.  However, due to the project's qualification of the 40% ITC and the implementation of transferability of tax credits within the IRA, HSWET expects that the increased tax equity demand will be satisfied. A resulting credit crunch may raise borrowing costs. Therefore, HSWET has performed stress tests to examine the effects of higher interest rates on investor returns and the debt-service-coverage-ratio (DSCR).

**Table 6**: Interest Rate Stress Test

| **Scenario** | **Interest Rate** | **Minimum DSCR** | **Tax Equity 20 yr IRR (Hold)** | **Sponsor Equity 20 yr IRR (Hold)** |
|---|---|---|---|---|
| Base Case Scenario | 5.50% | 1.4 | 12.55% | 11.78% |
| Scenario 1 | 6.00% | 1.31 | 12.84% | 10.18% |
| Scenario 2 | 6.25% | 1.28 | 12.86% | 9.11% |

| | | | | |
|---|---|---|---|---|
| Scenario 3 | 6.50% | 1.25 | 12.90% | 8.00% |

Due to the favorable regulatory environment from the recent passage of the IRA, a sound offtake plan, a top-tier service agreement from the manufacturer, and a built-in financial cushion pulled from the project cash flows, a total average debt service coverage ratio (DSCR) of 1.40x is viable. The minimum DSCR of the project will be 1.30x, as a DSCR below this benchmark will reduce the bankability of the project due to the risks that the project already faces. The interest rate stress test analysis shows that the project can withstand a 0.50% increase in interest rates before it becomes unfinanceable.

**Construction and Supply Chain Risk**

A "full-wrap" EPC contract would also help HSWET mitigate construction and supply chain risk. A fixed-price contract would prevent price volatility for materials and other supply chain fluctuations. HSWET's selection of an EPC contractor, Kiewit, is one of the largest construction and engineering firms with extensive experience and a good track record. In addition, Kiewit has a 555-acre fabrication facility for offshore foundations near Corpus Christi, Texas.[91] The relative proximity would minimize risks associated with long-distance or international shipping. To provide protection against unexpected O&M costs, supply chain disruptions, and other factors resulting in unexpected project downtime, HSWET would secure operation insurance with Munich RE. Munich RE is a German multinational insurance company with over a decade of work in the offshore wind industry.

**Node-Hub Basis Risk**

Under the specifications of the VPPA signed with Chevron, the power produced will be sold at the node while the VPPA will settle at the hub. The potential for a price difference between the two locations is classified as basis risk and needs to be accounted for in the modeling of the project. However, due to the low presence of other wind projects in the area, we do not expect any serious congestion issues which reduces differences between the node and hub prices and thus reduces basis risk.

## 3.0 Optimization

The first set of parameters that HSWET sought to optimize were the site design elements. The size of the wind farm was limited by physical constraints including active lease sites, pipelines, platforms, and shipwrecks. Furthermore, the farm's location needed to balance transmission, shipping, repair, and maintenance costs with community concerns. A compromise was made between these two factors by choosing blocks located in the South Timbalier area, allowing the site to be close to Port Fourchon while remaining far from Grand Isle.

HSWET then began to optimize the wind farm design within blocks 83, 84, 85, 89, 90, 91, and 126. To determine the optimal number of wind turbines for the farm, simple array parallelogram layouts were tested with 25, 30, and 35 V236-15.0 turbines, spacing them at a minimum of 3 rotor diameters apart. After running financial analyses on these three layouts, it was determined that all three layouts would bring economies of scale. In the interest of developing a reasonably large wind farm, subsequent layouts were designed with 35 turbines. To minimize the amount of blocks needed, a second layout of a rectangular array was tested. This array was made to have as many columns that could fit into 2 blocks. Ultimately, increasing space between turbines decreases wake losses, so turbines were spaced 4 rotor diameters apart instead of the typically used 3, which fit 9 columns. The smaller area allows for less cables to be laid and gives HSWET the opportunity to move to blocks 56 and 57, decreasing the distance to shore by 12 km and thereby decreasing shipping, transmission, maintenance, and repair costs. This array layout was also tested by tilting them at 10, 20, and 30 degrees counter-clockwise. While they do decrease wake losses by 0.06, 0.14, and 0.16 percent respectively, each tilted layout would require more lease blocks, forcing the farm to be 12 km farther from shore and for HSWET to bid for more acreage.

After the siting of the wind farm, it was necessary to optimize the financing of the project. The initial capital expenditure, modeled using SAM and preliminary inputs, was approximately $2.9 billion. However, it was noticed that there were significant redundancies within the BOP cost estimate provided by SAM. Consequently, HSWET utilized a combination of the outputs from the SAM BOP, outside research, and industry mentors' inputs to develop a more realistic capital expenditure of $1.81 billion. Moreover, it was determined that due to the project's location in the Gulf of Mexico, where significant operations infrastructure already exists, the O&M cost of the project could be lower than initially estimated. Furthermore, HSWET used the tax equity model to sculpt both the term loan and the partnership flip structure in order to optimize returns to the tax equity and the cash equity investors. Finally, HSWET built into the PPA price the inclusion of certified RECs despite the lack of a Renewable Portfolio Standard within Louisiana, providing greater value within the PPA to the offtakers of the energy.

## 3.1 Bid Amount

Given all of the above considerations, HSWET is willing to bid **$61,000,000**. This is based on the size of the two leasing blocks that HSWET has selected, 5,000 acres each and adds up to 10,000 acres in total. Based on historical data for the Gulf of Mexico Outer Continental Shelf Region Oil and Gas Lease Term, BOEM's minimum bid requirement for leasing areas with water depths 0-200 meters is $25 per acre.[92] If HSWET had bid the minimum, the bid amount would be $250,000 which is unlikely to be competitive in an auction. With an NPV to HSWET of over $113 million in income if the project is held over its duration, HSWET can afford to increase the bid amount significantly without affecting investors' returns.

A comparison to existing leasing block bid prices is difficult. Along the Atlantic coast, the leasing block bid prices were much higher, with the New York Bight auction resulting in a price per acre range of $6,619 to $10,696, with an average of $8,951.[93] Within the Gulf of Mexico, the only price available for reference from oil and gas lease sales, which has a historical average of $1,043.[94] HSWET could justify a lower price compared to the Atlantic Coast since the Gulf of Mexico is an unproven and riskier area with lower wind speeds. Nonetheless, HSWET expects the bid price for the Gulf of Mexico to be much higher than the historical average bid price for oil and gas lease sales in the area. This is because BOEM has recently issued a Proposal Sale Notice (PSN) for areas offshore Lake Charles, Louisiana and Galveston, Texas.[95] The IRA has also introduced important incentives for green hydrogen development, and the Gulf has been touted as a potential hub for green hydrogen production fueled by renewable energy sources.

Taking these factors into account, HSWET has decided to bid $6,100 per acre, a number that maintains the overall financial viability and attractiveness of the project, reflects the uncertainty and lower potential in the Gulf, but still remains highly competitive with other potential bidders in a lease auction.

The bid price of $61 million represents a monetary cash value that HSWET is willing to pay for the lease blocks. However, HSWET notes that BOEM has recently rolled out a bidding credit scheme with the California auction which would also be implemented in the recently proposed lease areas in the Gulf.

With a 30% bid credit of $14,076,923, the cash bid would be reduced to $46,923,077.[95] To claim the maximum 30% bid credit, HSWET will fulfill the three bid credit evaluation criteria proposed by BOEM: 1) Workforce Training, 2) Supply Chain Development, and 3) Fisheries compensatory mitigation fund.[96] HSWET would use the equivalent bonus credit value of $14,076,923 to fulfill the three requirements in partnership with Kiewit and Vestas.

## References

[1] "Offshore Gulf of Mexico Wind Data Download API: NREL: Developer Network." *NREL*, https://developer.nrel.gov/docs/wind/wind-toolkit/offshore-gulf-of-mexico-download/.
[2] US Department of Commerce, National Oceanic and Atmospheric Administration. "National Data Buoy Center NWS Marine Forecast." *NDBC*, 8 Dec. 2022, https://www.ndbc.noaa.gov/data/Forecasts/FZNT24.KNHC.html.
[3] "Gulf of Mexico Data Atlas." *National Centers for Environmental Information, National Oceanic and Atmospheric Administration*, https://www.ncei.noaa.gov/maps/gulf-data-atlas/atlas.htm?plate=Bottom+Sediments+-+Properties.
[4] Rabalais, Nancy N., and R. Eugene Turner. "Gulf of Mexico Hypoxia: Past, Present, and Future." *Association for the Sciences of Limnology and Oceanography*, Wiley Online Library, https://aslopubs.onlinelibrary.wiley.com/doi/10.1002/lob.10351.
[5] "Port Infrastructure." *Greater Lafourche Port Commission*, https://portfourchon.com/seaport/port-infrastructure/.
[6] Parker, Halle. "Oil and Gas Built Port Fourchon; Now the Seaport Is Finding Its Role in a Future without It." *WWNO*, New Orleans Public Radio, 8 Aug. 2022, https://www.wwno.org/coastal-desk/2022-08-02/oil-and-gas-built-port-fourchon-now-the-seaport-is-finding-its-role-in-a-future-without-it.
[7] *Geographic Mapping Data in Digital Format*, Bureau of Ocean Energy Management, https://www.data.boem.gov/Main/Mapping.aspx.
[8] "United States Coast Guard Atlantic Area." *District 8*, U.S. Department of Homeland Security, https://www.atlanticarea.uscg.mil/Our-Organization/District-8/.
[9] "Louisiana Military Bases: 4 Bases." *Military Bases*, 3 Jan. 2018, https://militarybases.com/louisiana/.
[10] Bureau of Ocean Energy Management Gulf of Mexico Regional Office. *Wakes Across the Gulf: Historic Sea Lanes and Shipwrecks in the Gulf of Mexico*. U.S. Department of the Interior, Aug. 2021, https://www.boem.gov/sites/default/files/documents/regions/gulf-mexico-ocs-region/office-environment/TR-BOEM-2021-057.pdf.
[11] "Elmer's Island Wildlife Refuge Management." *Louisiana Wildlife Federation*, 6 Mar. 2017, https://lawildlifefed.org/resolution/elmers-island-wildlife-refuge-management/.
[12] Sullivan, Robert G., et al. "Offshore Wind Turbine Visibility and Visual Impact Threshold Distances." *Environmental Practice*, https://blmwyomingvisual.anl.gov/docs/EnvPractice_Offshore%20Wind%20Turbine%20Visibility%20and%20Visual%20Impact%20Threshold%20Distances.pdf.
[13] *V236-15.0 MW Facts and Figures*. Vestas, https://nozebra.ipapercms.dk/Vestas/Communication/Productbrochure/OffshoreProductBrochure/v236-150-mw-brochure/?page=6.
[14] Dvorak, Paul. "Meet Keystone Engineering's Twisted Jacket, an Offshore Wind-Turbine Foundation." *Windpower Engineering & Development*, 14 June 2018, https://www.windpowerengineering.com/meet-keystone-engineerings-twisted-jacket-an-offshore-wind-turbine-foundation/.
[15] Keystone Engineering. "IBGS, the 'Twisted Jacket.'" *Issuu*, 7 Apr. 2013, https://issuu.com/keystoneengineering/docs/ibgs_brochure.
[16] El Mokhi, Chakib, and Adnane Addaim. "Optimization of Wind Turbine Interconnections in an Offshore Wind Farm Using Metaheuristic Algorithms." *MDPI*, Multidisciplinary Digital Publishing Institute, 17 July 2020, https://www.mdpi.com/2071-1050/12/14/5761.
[17] Shenton, Sally. *A Novel Offshore Wind Transfer Technique: Experiences from the Beatrice Demonstration Site*. Catapult Offshore Renewable Energy, Apr. 2016, https://ore.catapult.org.uk/wp-content/uploads/2017/12/A-novel-offshore-wind-transfer-technique.-Experiences-from-the-Beatrice-Demonstration-Site.pdf.
[18] Rousseau, Joseph. "Three Design Concepts Put Green Hydrogen Production Offshore." *JPT*, JPT, 4 Aug. 2022, https://jpt.spe.org/three-design-concepts-put-green-hydrogen-production-offshore.

[19] Garanovic, Amir. "World's First Offshore Green Hydrogen Production Platform Inaugurated in France." *Offshore Energy*, 23 Sept. 2022, https://www.offshore-energy.biz/worlds-first-offshore-green-hydrogen-production-platform-inaugurated-france/.
[20] Vineyard Wind, LLC, 2020, *Draft Construction and Operations Plan*, https://www.boem.gov/sites/default/files/documents/renewable-energy/Vineyard%20Wind%20COP%20Volume%20I_Section%203.pdf. Accessed 8 Dec. 2022.
[21] Williams, Andrew. "Reuters Events: Renewables." *HVDC vs. HVAC Cables for Offshore Wind | Reuters Events | Renewables*, 22 July 2011, https://www.reutersevents.com/renewables/wind-energy-update/hvdc-vs-hvac-cables-offshore-wind.
[22] Fisheries, NOAA. "Threatened and Endangered Species List Louisiana." *NOAA*, 21 July 2022, https://www.fisheries.noaa.gov/southeast/consultations/threatened-and-endangered-species-list-louisiana.
[23] Jennifer L. Amaral, James H. Miller, Gopu R. Potty, Kathleen J. Vigness-Raposa, Adam S. Frankel, Ying-Tsong Lin, Arthur E. Newhall, Daniel R. Wilkes, Alexander N. Gavrilov; Characterization of impact pile driving signals during installation of offshore wind turbine foundations. *J Acoust Soc Am* 1 April 2020; 147 (4): 2323–2333. https://doi.org/10.1121/10.0001035
[24] Zampolli, Mario, et al. "Validation of Finite Element Computations for the Quantitative Prediction of Underwater Noise from Impact Pile Driving." *AIP*, AIP Publishing, 3 Jan. 2013, https://pubs.aip.org/asa/jasa/article/133/1/72/930265/Validation-of-finite-element-computations-for-the.
[25] Office of Protected Resources National Marine Fisheries Service. *2018 Revision to: Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing (Version 2.0) Underwater Thresholds for Onset of Permanent and Temporary Threshold Shifts*. 2018, https://media.fisheries.noaa.gov/dam-migration/mystic_acoustic_technical_guidance_spreadsheet_508_%283%29.pdf.
[26] Wilson, Randy. "Birds and Migratory Pathways: An Overview of the Gulf of Mexico." *BOEM*, 2020, https://www.boem.gov/sites/default/files/documents/renewable-energy/state-activities/USFWS-Migratory-Birds-Randy-Wilson_0.pdf. And Gauthreaux, Sidney A. "Weather Radar Quantification of Bird Migration." *JSTOR*, 1 Jan. 1970, https://www.jstor.org/stable/1294752?seq=2#metadata_info_tab_contents. And Gauthreaux, Sidney A. "A Radar and Direct Visual Study of Passerine Spring Migration in Southern Louisiana." *OUP*, 1 Apr. 1971, https://academic.oup.com/auk/article/88/2/343/5196931. And Morrison, M L. "Bird Movements and Behaviors in the Gulf Coast Region: Relation to Potential Wind Energy Developments." *PNNL*, June 2006, https://tethys.pnnl.gov/sites/default/files/publications/Morrison_2006.pdf. And Horton, Kyle G, et al. "Holding Steady: Little Change in Intensity or Timing of Bird Migration over the Gulf of Mexico." *Wiley*, 8 Jan. 2019, https://onlinelibrary.wiley.com/doi/10.1111/gcb.14540.
[27]"Listed Species Believed to or Known to Occur in Louisiana." *FWS*, https://ecos.fws.gov/ecp/report/species-listings-by-state?stateAbbrev=LA&stateName=Louisiana&statusCategory=Listed.
[28] Pearse, Aaron T, et al. "Map of Whooping Crane Migration Corridor." *ScienceBase*, 16 Feb. 2018, https://www.sciencebase.gov/catalog/item/5a314a72e4b08e6a89d707e0. And Watts, Bryan D. "Status and Distribution of the Eastern Black Rail along the Atlantic and Gulf Coasts of North America." *RCNgrants*, 2016, https://rcngrants.org/sites/default/files/final_reports/RCN%202011-1%20CCBTR-16-09_Eastern%20Black%20Rail%20Status%20Assessment_final.pdf. And Loring, Pamela H. "Mapping Piping Plover Migration." *ArcGIS*, Esri, 7 Aug. 2020, https://storymaps.arcgis.com/stories/5bab01fc5fa445f58ee54c062b4d2f3d. And "Piping-Plover Migration." *UNL*, https://ternandplover.unl.edu/piping-plover-migration. And Bognar, John, et al. "Tracking the Red Knot." *ArcGIS StoryMaps*, Esri, 28 May 2022, https://storymaps.arcgis.com/stories/c22de70e09ab458186cce9b1bc4912a5. And "Red Knot." *All About Birds*, https://www.allaboutbirds.org/guide/Red_Knot/overview.

[29] "Forest Resources: Red-Cockaded Woodpecker." *TAMU*, https://tfsweb.tamu.edu/uploadedFiles/TFSMain/Manage_Forest_and_Land/Landowner_Assistance/Stewardship(1)/Red-Cockaded_Woodpecker.pdf. And "Red-Cockaded Woodpecker." *Audubon*, https://www.audubon.org/field-guide/bird/red-cockaded-woodpecker.
[30]"Red-Cockaded Woodpecker (Picoides Borealis)." *FWS*, https://ecos.fws.gov/ecp/species/7614.
[31] "Listed Species Believed to or Known to Occur in Louisiana." *FWS*, https://ecos.fws.gov/ecp/report/species-listings-by-state?stateAbbrev=LA&stateName=Louisiana&statusCategory=Listed.
[32]"Trans-Gulf Migrants." *TPWD*, https://tpwd.texas.gov/huntwild/wild/birding/migration/transgulf_migrants/.
[33] Stokke, Bård G, et al. "Effect of Tower Base Painting on Willow Ptamirgan Collision Rates with Wind Turbines." *Wiley*, 29 Apr. 2020, https://onlinelibrary.wiley.com/doi/10.1002/ece3.6307. And May, Roel, et al. "Paint It Black: Efficacy of Increased Wind Turbine Rotor Blade Visibility to Reduce Avian Fatalities." *Wiley*, 26 July 2020, https://onlinelibrary.wiley.com/doi/full/10.1002/ece3.6592.
[34]"Wind Energy Bird & Bat Radars." *DeTect*, https://detect-inc.com/wind-energy-bird-bat-radars/.
[35] "FAA Acts to Reduce Bird Fatalities." *FAA*, 23 Mar. 2016, https://www.faa.gov/newsroom/faa-acts-reduce-bird-fatalities.
[36] "Advisory Circulation." *FAA*, 16 Nov. 2020, https://www.faa.gov/documentLibrary/media/Advisory_Circular/Advisory_Circular_70_7460_1M.pdf. And Van de Laar. "Green Light to Birds." *PNNL*, Dec. 2007, https://tethys.pnnl.gov/sites/default/files/publications/van-de-Laar-2007.pdf. And Poot, Hanneke, et al. "Green Light for Nocturnally Migrating Birds." *JSTOR*, Dec. 2008, https://www.jstor.org/stable/pdf/26267982.pdf.
[37] "The Economy of Seafood." *Louisiana Seafood*, https://www.louisianaseafood.com/industry.
[38] Briggs, Kevin B, et al. "Macrobenthos and Megabenthos Responses to Long-Term, Large-Scale Hypoxia on the Louisiana Continental Shelf." *ScienceDirect*, Elsevier, 23 Nov. 2016, https://www.sciencedirect.com/science/article/pii/S0141113616302951.
[39] "White Shrimp." *National Centers for Environmental Information, National Oceanic and Atmospheric Administration*, https://www.ncei.noaa.gov/maps/gulf-data-atlas/atlas.htm?plate=Invertebrates+-+White+Shrimp. And Montero, Jose T, et al. "Brown Shrimp (Farfantepenaeus Aztecus) Density Distribution in the Northern Gulf of Mexico: an Approach Using Boosted Regression Trees." *Wiley*, 6 Apr. 2016, https://onlinelibrary.wiley.com/doi/full/10.1111/fog.12156.
[40] Briggs, Kevin B, et al. "Macrobenthos and Megabenthos Responses to Long-Term, Large-Scale Hypoxia on the Louisiana Continental Shelf." *ScienceDirect*, Elsevier, 23 Nov. 2016, https://www.sciencedirect.com/science/article/pii/S0141113616302951. And Renaud, Maurice L. "Detecting and Avoiding Oxygen Deficient Sea Water by Brown Shrimp, Penaeus Aztecus (Ives), and White Shrimp Penaeus Setiferus (Linnaeus)." *ScienceDirect*, Elsevier, 12 Mar. 1986, https://www.sciencedirect.com/science/article/pii/0022098186902182?via%3Dihub. And Craig, J Kevin. "Aggregation on the Edge: Effects of Hypoxia Avoidance on the Spatial Distribution of Brown Shrimp and Demersal Fishes in the Northern Gulf of Mexico." *Int-Res*, 20 Jan. 2012, https://www.int-res.com/articles/meps2011/445/m445p075.pdf.
[41] Horwath, Sarah, et al. "Comparison of Environmental Effects from Different Offshore Wind Turbine Foundations." *BOEM*, Aug. 2021, https://www.boem.gov/sites/default/files/documents/environment/Comparison-Environmental-Effects-Different-OWT-Foundations-2021.pdf. And Jones, Bryan N, et al. "Artificial Frond System for Seabed Scour Control at Wind Farm Platforms in Nantucket Sound, Massachusetts." *SSCSystems*, 2006, http://www.sscsystems.com/application/files/7114/3204/2336/CEO6_Scourmat_Paper_r1.pdf.
[42] Tucker, Adam. "Artificial Seagrass for Permanent Scour Prevention." *LinkedIn*, 9 Mar. 2018, https://www.linkedin.com/pulse/artificial-seagrass-permanent-scour-prevention-adam-tucker/.

[43] Angelloz, Thad. “Crowley Takes Key Step toward Becoming One of Port Fourchon's Newest Tenants.” *Port Fourchon*, 8 Feb. 2023, https://portfourchon.com/crowley-takes-key-step-toward-becoming-one-of-port-fourchons-newest-tenants/.
[44] “Push for Offshore Wind Energy Projects Gains Momentum.” *Professional Mariner*, 2023, https://professionalmariner.com/article/push-for-offshore-wind-energy-projects-gains-momentum/. And “Skanska Selected to Rebuild Offshore Wind Staging Port at Portsmouth Marine Terminal.” *Skanska*, 16 Aug. 2022, https://www.usa.skanska.com/who-we-are/media/press-releases/266239/Skanska-selected-to-rebuild-offshore-wind-staging-port-at-Portsmouth-Marine-Terminal-/. And Bourscheid, John. “Crowley Moves Forward on Salem Wind Terminal with Land Closing.” *Crowley*, 5 Oct. 2022, https://www.crowley.com/news-and-media/press-releases/salem-wind-terminal/. And Buljan, Adrijana. “USD 223 Million-Worth Construction Works Start at Portsmouth Marine Terminal.” *Offshore Wind*, 16 Aug. 2022, https://www.offshorewind.biz/2022/08/16/usd-223-million-worth-construction-works-start-at-portsmouth-marine-terminal/#:~:text=Construction%20began%20July%202022%20and,an%20existing%203%2C540%2Dfoot%20wharf.
[45] “V236-15.0 MW™ Prototype.” *Vestas*, Vestas, https://www.vestas.ca/en-ca/products/offshore/V236-15MW/prototype.
[46] Łysień, Dominika. “Vestas' V236-15.0 MW Prototype Wind Turbine Produces First Kwh.” *Baltic Wind*, 3 Jan. 2023, https://balticwind.eu/vestas-v236-15-0-mw-prototype-wind-turbine-produces-first-kwh/.
[47] Foxwell, David. “Nacelle for V236-15.0 MW Offshore Wind Turbine Arrives at Østerild Test Centre.” *Riviera*, 17 Nov. 2022, https://www.rivieramm.com/news-content-hub/news-content-hub/nacelle-for-v236-150-mw-offshore-wind-turbine-arrives-at-osterild-test-centre-73837.
[48] Davidson, Ros. “CS Wind Breaks Ground on 'World's Largest Wind Tower Factory'.” *Windpower Monthly*, Windpower Monthly, 6 Apr. 2023, https://www.windpowermonthly.com/article/1819061/cs-wind-breaks-ground-worlds-largest-wind-tower-factory.
[49] “Charybdis.” *Charybdis | Dominion Energy*, https://www.dominionenergy.com/projects-and-facilities/wind-power-facilities-and-projects/charybdis.
[50] “POSITIONING FOR U.S. EXPANSION: U.S. PORTS AND VESSELS INNOVATION.” *ABS*, Mar. 2021, https://absinfo.eagle.org/acton/attachment/16130/f-98f8192f-6ba8-4f7c-b2f6-a30a8c41209d/1/-/-/-/-/ABS-Offshore-Wind-Report-Positioning-for-US-Expansion-Ports-and-Vessels-Innovation.pdf.
[51] Mackenbach, Charlotte. “Wind Feeder Vessel – Solution for US Offshore Wind.” *C-Job*, 26 July 2022, https://c-job.com/wind-feeder-vessel-solution-for-us-offshore-wind/.
[52] “Voltaire.” *Jan De Nul*, https://www.jandenul.com/sites/default/files/2022-10/Voltaire%20%28EN%29.pdf.
[53] Burley, Lisa L. “H300962: Coastwise Transportation; Wind Turbines; Scour Protection; 46 U.S.C. § 55102; 46 U.S.C. § 55103; 46 U.S.C. § 55109; 19 C.F.R. § 4.80a; 19 C.F.R. § 4.80b.” *Cross Customs Rulings Online Search System*, 14 Apr. 2022, https://rulings.cbp.gov/ruling/H300962. And Beevers, Richmond W. “H322233: Coastwise Transportation; Offshore Cable; Cable Protection Materials; 46 U.S.C. § 55102; 46 U.S.C. § 55103; 46 U.S.C. § 55109; 19 C.F.R. § 4.80a; 19 C.F.R. § 4.80b.” *U.S. Customs and Border Protection*, 2 Sept. 2022, https://rulings.cbp.gov/ruling/H322233.
[54] Buljan, Adrijana. “Offshore Cabling Works to Start at Taiwan Power's Changhua Phase 1.” *Offshore Wind*, 12 June 2020, https://www.offshorewind.biz/2020/06/12/offshore-cabling-works-to-start-at-taiwan-powers-changhua-phase-1/. And “Isaac Newton.” *Jan De Nul* https://www.jandenul.com/sites/default/files/2020-05/Isaac%20Newton%20%28EN%29.pdf.
[55] Münsterberg, Torsten. “Simulation-Based Evaluation of Operation and Maintenance Logistics Concepts for Offshore Wind Power Plants.” *TUHH*, 2017, https://tore.tuhh.de/bitstream/11420/1376/1/M%C3%BCnsterberg%20(2017)%20-%20Simulation-based%20Evaluation%20of%20Operation%20and%20Maintenance%20Logistics%20Concepts%20for%

20Offshore%20Wind%20Power%20Plants.pdf. And Carroll, James, et al. "Availability, Operation and Maintenance Costs of Offshore Wind Turbines with Different Drive Train Configurations." *Wiley Online Library*, 26 July 2016, https://onlinelibrary.wiley.com/doi/10.1002/we.2011.
[56] "Fugro Site Characterisation Contracts Renewed for Atlantic Shores Offshore Wind." *Fugro*, Fugro, 26 May 2021, https://www.fugro.com/media-centre/news/fulldetails/2021/05/25/fugro-site-characterisation-contracts-renewed-for-atlantic-shores-offshore-wind.
[57] "Survey Vessels." *Fugro*, https://www.fugro.com/about-fugro/our-expertise/vessels-and-jack-up-barges/survey-vessels. And "FOSCV 40 - 40 m Offshore Survey Coastal Vessel ." *Fassmer*, https://www.fassmer.de/fileadmin/user_upload/10_Technical_Data_PDFs/fassmer-40m-offshore-survey-vessel-fugro-technical-data.pdf.
[58] Bennett, James F. "SAP Approval Letter for Lease OCS-0499." *BOEM*, Bureau of Ocean Energy Management, 8 Apr. 2021, https://www.boem.gov/sites/default/files/documents/renewable-energy/state-activities/SAP-Approval-Letter-ASOW.pdf. And Bennett, James F. "SAP Approval for Lease OCS-A 0501." *BOEM*, Bureau of Ocean Energy Management, 10 May 2018, https://www.boem.gov/sites/default/files/renewable-energy-program/State-Activities/MA/Vineyard-Wind-SAP-Approval-OCS-A-0501.pdf.
[59] "Fugro Site Characterisation Contracts Renewed for Atlantic Shores Offshore Wind." *Fugro*, Fugro, 26 May 2021, https://www.fugro.com/media-centre/news/fulldetails/2021/05/25/fugro-site-characterisation-contracts-renewed-for-atlantic-shores-offshore-wind. And "Power Plant Profile: Atlantic Shores Offshore Wind Project 1, US." *Power Technology*, 17 Apr. 2023, https://www.power-technology.com/marketdata/power-plant-profile-atlantic-shores-offshore-wind-project-1-us/#:~:text=Atlantic%20Shores%20Offshore%20Wind%20Project%201%20is%20a%201%2C510MW,%2C%20New%20Jersey%2C%20the%20US. And "Fugro Achieves Highest Rating for Offshore Wind Floating Lidar Buoy." *Hydro International*, 24 Feb. 2022, https://www.hydro-international.com/content/news/fugro-achieves-highest-rating-for-offshore-wind-floating-lidar-buoy.
[60] NYSERDA. "Offshore Wind Cop Review Process (Learning from the Experts)." *YouTube*, YouTube, 17 Aug. 2021, https://www.youtube.com/watch?v=r2j7i-JBm-4.
[61] "Draft High-Level Construction Plan." *BOEM*, Vineyard Wind, Jan. 2022, https://www.boem.gov/sites/default/files/documents/renewable-energy/state-activities/VW1%20Draft%20High%20Level%20Construction%20Schedule.pdf. And Carini, Frank. "As Revolution Wind 1 Moves Through Permitting Process, Developers Propose Second Offshore Wind Project." *EcoRI*, 14 Mar. 2023, https://ecori.org/as-revolution-wind-1-moves-through-permitting-process-developers-propose-second-offshore-wind-project/. And "Vineyard Wind 1." *Vineyard Wind*, https://www.vineyardwind.com/vineyardwind-1. And "About the Project." *Ocean Wind*, https://oceanwindone.com/about-the-project. And "Power Plant Profile: Atlantic Shores Offshore Wind Project 1, US." *Power Technology*, 17 Apr. 2023, https://www.power-technology.com/marketdata/power-plant-profile-atlantic-shores-offshore-wind-project-1-us/#:~:text=Atlantic%20Shores%20Offshore%20Wind%20Project%201%20is%20a%201%2C510MW,%2C%20New%20Jersey%2C%20the%20US.
[62] Stehly, Tyler, and Patrick Duffy. "2021 Cost of Wind Energy Review." *NREL*, Dec. 2022, https://www.nrel.gov/docs/fy23osti/84774.pdf.
[63] "10-Year Swap Rates, Treasuries, Libor, SOFR, Term SOFR." Chatham Financial, https://www.chathamfinancial.com/technology/us-market-rates.
[64] "Highlights of Operations." *Chevron*, 6 July 2022, https://www.chevron.com/worldwide/united-states#:~:text=Chevron%20Corporation%27s%20global%20headquarters%20are,headquartered%20in%20the%20United%20States.
[65] "Chevron Corporation." *Google Finance*, Google, https://www.google.com/finance/quote/CVX:NYSE?sa=X&sqi=2&ved=2ahUKEwidnt-XuNn-AhWJFlkFHePnCBcQ3ecFegQIERAh.

[66] "S&P Global Ratings Affirms Chevron at 'AA-" (Local Currency LT Credit Rating); Outlook Stable." *Cbonds*, 23 Sept. 2022, https://cbonds.com/news/1977605/#:~:text=Get%20access-,S%26P%20Global%20Ratings%20affirms%20Chevron%20at%20%22AA%2D%22%20(Local,credit%20rating)%3B%20outlook%20stable&text=S%26P%20Global%20Ratings%20affirmed%20the,The%20outlook%20is%20stable.
[67] "New Green Waste-to-Hydrogen Production Facility." *Chevron*, Chevron, 9 Jan. 2023, https://www.chevron.com/newsroom/2023/q1/raven-sr-chevron-hyzon-motors-collaborate-to-produce-hydrogen-from-green-waste#:~:text=Chevron%20holds%20a%2050%25%20equity,Hyzon%20owns%20the%20remaining%2020%25.
[68] "Exxon Mobil Corp (XOM)." *Google Finance*, Google, https://www.google.com/finance/quote/XOM:NYSE?sa=X&ved=2ahUKEwififThrNr-AhUfEVkFHcEfCZoQ3ecFegQIJRAh.
[69] "Issuer Credit Rating." *S&P Global Ratings*, https://disclosure.spglobal.com/ratings/en/regulatory/article/-/view/type/HTML/id/2891394.
[70] "U.S. Refinery Net Production of Crude Oil and Petroleum Products." *U.S. Energy Information Administration*, 28 Apr. 2023, https://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=pet&s=mttrx_nus_1&f=a. And Wang, Michael. "Estimations of Energy Efficiencies of U.S. Petroleum Refineries." *Box*, Mar. 2008, https://anl.app.box.com/s/a8s8qagg9smrl902jh5m6v06oe1ls0r6.
[71] Chevron Policy, Government and Public Affairs. "Refining Crude Oil." *Chevron.com*, 20 Apr. 2020, https://pascagoula.chevron.com/our-businesses/refining-crude-oil.
[72] Ram, Jesse. "RECs Are Expensive. Now What? Alternatives to Meeting Your Sustainability Metrics." *Usource*, 23 Sept. 2021, https://www.usourceenergy.com/blog/recs-are-expensive-now-what-alternatives-to-meeting-your-sustainability-metrics/.
[73] "Inflation Reduction Act Implications for Renewables and Energy Transition." *Orrick*, July 2022, https://www.orrick.com/en/insights/2022/07/inflation-reduction-act-implications-for-renewables-and-energy-transition.
[74] U.S. Department of Labor. "Prevailing Wage Information and Resources." *DOL*, https://www.dol.gov/agencies/eta/foreign-labor/wages#:~:text=The%20prevailing%20wage%20rate%20is,the%20area%20of%20intended%20employment.
[75] "Occupational Employment and Wages in Houma-Thibodaux — May 2021." *BLS*, U.S. Bureau of Labor Statistics, 19 July 2022, https://www.bls.gov/regions/southwest/news-release/2022/occupationalemploymentandwages_houma_20220719.htm#:~:text=Workers%20in%20the%20Houma-Thibodaux%2C%20LA%20Metropolitan%20Statistical%20Area,the%20U.S.%20Bureau%20of%20Labor%20Statistics%20reported%20today.
[76] Martin, Keith, et al. "Energy Community Bonus Credit Guidance." *Project Finance*, 10 Apr. 2023, https://www.projectfinance.law/publications/2023/april/energy-community-bonus-credit-guidance/#:~:text=10%25%20Bonus%20Credit&text=It%20can%20only%20be%20claimed,also%20using%20enough%20domestic%20content.).
[77] "N-2023-29 Appendix A." *IRS*, 4 Apr. 2023, https://www.irs.gov/pub/irs-drop/n-23-29-appendix-a.pdf.
[78] "IRS Clarifies Rules for Energy Community Bonus Tax Credits." *Latham & Watkins LLP*, 6 Apr. 2023, https://www.lw.com/admin/upload/SiteAttachments/IRS-Clarifies-Rules-for-Energy-Community-Bonus-Tax-Credits.pdf.
[79] "Louisiana Climate Action Plan." *Louisiana*, Feb. 2022, https://gov.louisiana.gov/assets/docs/CCI-Task-force/CAP/Climate_Action_Plan_FINAL_3.pdf.

[80] Musial, Walter, et al. “Offshore Wind Market Report: 2022 Edition.” *Energy*, 2022, https://www.energy.gov/sites/default/files/2022-09/offshore-wind-market-report-2022-v2.pdf.
[81] “Production Tax Credit and Investment Tax Credit for Wind Energy.” *WINDExchange*, https://windexchange.energy.gov/projects/tax-credits.
[82] Rosenberg, Amanda, and Daniel Kiely. “Offshore Wind and the US Inflation Reduction Act: Perspectives & Events: Mayer Brown.” Perspectives & Events | Mayer Brown, Aug. 2022, https://www.mayerbrown.com/en/perspectives-events/publications/2022/08/offshore-wind-and-the-us-inflation-reduction-act#:~:text=Now%2C%20offshore%20wind%20projects%20under,if%20certain%20criteria%20are%20met.
[83] Degraer, S., et al. "Offshore wind farm artificial reefs affect ecosystem structure and functioning: A synthesis." Oceanography, vol. 33, no. 4, 2020, pp. 48-57, https://doi.org/10.5670/oceanog.2020.405.
[84] (ICC), International Code Council. “2018 International Residential Code (IRC).” Digital Codes, 2018, https://codes.iccsafe.org/s/IRC2018P4/chapter-2-definitions/IRC2018P4-Ch02-Sec243#:~:text=Areas%20vulnerable%20to%20hurricanes%2C%20defined,Virgin%20Islands%20and%20America%20Samoa.
[85] Martin , Eric, et al. Project Development Report. 2022, https://www.energy.gov/sites/default/files/2022-07/EVERETT_Project_Development_Report_2022-04-24Optimized.pdf.
[86] Rose, Stephen, et al. Quantifying the Hurricane Risk to Offshore Wind Turbines | PNAS. 2012, https://www.pnas.org/doi/10.1073/pnas.1111769109.
[87] “Consumer Price Index Summary - 2023 M03 Results.” U.S. Bureau of Labor Statistics, U.S. Bureau of Labor Statistics, 12 Apr. 2023, https://www.bls.gov/news.release/cpi.nr0.htm.
[88] Cox, Jeff. “Fed Increases Rates a Quarter Point and Signals a Potential End to Hikes.” CNBC, CNBC, 4 May 2023, https://www.cnbc.com/2023/05/03/fed-rate-decision-may-2023-.html.
[89] “First Quarter 2023 Survey of Professional Forecasters.” Federal Reserve Bank of Philadelphia, 2023, https://www.philadelphiafed.org/surveys-and-data/real-time-data-research/spf-q1-2023#:~:text=Over%20the%20next%2010%20years,PCE%20inflation%20is%202.15%20percent.
[90] Li, Yun. “The Fed Forecasts Just One More Rate Hike This Year.” CNBC, CNBC, 23 Mar. 2023, https://www.cnbc.com/2023/03/22/the-fed-projections-call-for-just-one-more-rate-hike-this-year.html.
[91] “Oil, Gas & Chemical.” *Kiewit Corporation*, 4 Nov. 2022, https://www.kiewit.com/markets/oil-gas-chemical/.
[92] “Lease Sales and Fair Market Value.” *Bureau of Ocean Energy Management*, 2023, https://www.boem.gov/oil-gas-energy/energy-economics/lease-sales-and-fair-market-value.
[93] BOEM Lease Sale ATLW-8: New York Bight. 2022, https://www.boem.gov/sites/default/files/documents/renewable-energy/state-activities/Results%20Round%20by%20Round%20v2.pdf.
[94] Sale Day Statistics. 2023, https://www.boem.gov/sites/default/files/documents/oil-gas-energy/leasing/Sale-259-stats.pdf.
[95] “Proposed Sale Notice for Commercial Leasing for Wind Power Development on the Outer Continental Shelf in the Gulf of Mexico (GOMW–1) .” *BOEM*, 24 Feb. 2023,
[96] “BOEM Issues Proposed Sale Notice With Novel Bidding Credits for Gulf of Mexico Offshore Wind.” *Perkins Coie*, 9 Mar. 2023, https://www.perkinscoie.com/en/news-insights/boem-issues-proposed-sale-notice-with-novel-bidding-credits-for-gulf-of-mexico-offshore-wind.html.