Turning Offshore Wind Power On in Puerto Rico

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INTRODUCTION

In 2010, Puerto Rico passed Acts 82 and 83, also known as the Public Policy on Energy Diversification by Means of Sustainable and Alternative Renewable Energy in Puerto Rico Act, establishing a renewable portfolio standard ("RPS") and requiring that the Puerto Rico Electric Power Authority ("PREPA") source twelve percent of its power from renewables by the end of 2015, fifteen percent by the end of 2020, and twenty percent by 2035.[1] Nonetheless, in 2015 fifty-one percent of Puerto Rico's electricity came from petroleum, thirty-one percent from natural gas, and sixteen percent from coal.[2]

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1 2010 P.R. Laws 248–361.

2 *Puerto Rico Territory Energy Profile*, U.S. ENERGY INFO. ADMIN. (Mar. 17, 2016), https://www.eia.gov/state/print.php?sid=RQ.

Renewables provided less than two percent of the island's electricity, with 1.06% coming from wind, 0.33% from central station solar photovoltaic, 0.33% from hydro power, and 0.12% from distributed generation.[3] Puerto Rico's electricity prices are almost twice those on the U.S. mainland, in large part due to the island's heavy reliance on petroleum products to run its electric generators.[4] To alleviate the cost of energy, PREPA seeks to establish over 380 megawatts of power production from wind sources as part of its renewable energy portfolio.[5] According to the National Renewable Energy Laboratory (NREL), Puerto Rico has 840 MW of potential wind power and only 120 MW of installed capacity.[6] Two wind farms supplied nearly two-thirds of Puerto Rico's renewable generation in 2015; one of them, the 95 MW Santa Isabel facility, is the largest wind farm in the Caribbean.[7] Nonetheless, by developing its two wind energy projects onshore, Puerto Rico has failed to maximize its potential for wind power extraction.

The benefits of offshore wind energy in Puerto Rico were previously recognized in a University of Puerto Rico study in 2008. The study presented a preliminary assessment of offshore wind energy potential and concluded that offshore wind energy could provide more than 13,700 MW of power.[8] Although encouraging, studies on offshore wind energy in the island have not addressed the legal barriers of developing this technology in Puerto Rico. This paper, therefore, will focus on the legal barriers to developing offshore wind energy projects in Puerto Rico and will seek to provide viable solutions to these issues in order to promote offshore wind projects in the island. Specifically, although offshore wind energy technology development in Puerto Rico will likely face many barriers, this paper will focus on two main legal issues: (1) investment

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[3] *Id.*
[4] *Id.*
[5] *See generally* HÉCTOR M. RODRÍGUEZ, GERARDO CARBAJAL & EDWAR ROMERO, PRELIMINARY COST ASSESSMENT FOR OFFSHORE WIND ENERGY IN PUERTO RICO (2015), http://www.laccei.org/LACCEI2015-SantoDomingo/RefereedPapers/RP186.pdf.
[6] *Energy Snapshot Puerto Rico*, NAT'L RENEWABLE ENERGY LAB. (Mar. 2015), http://www.nrel.gov/docs/fy15osti/62708.pdf.
[7] U.S. ENERGY INFO. ADMIN, *supra* note 2.
[8] *See generally* AGUSTÍN A. IRIZARRY-RIVERA, JOSÉ A. COLUCCI-RÍOS & EFRAÍN O'NEILL-CARRILLO, ACHIEVABLE RENEWABLE ENERGY TARGETS FOR PUERTO RICO'S RENEWABLE ENERGY PORTFOLIO STANDARD (2008), http://www.uprm.edu/aret/docs/ARET_for_PR_RPS.pdf.

issues due to offshore wind's high initial capital costs and (2) transmission and grid connection issues. For the high initial costs issue, I propose several solutions, such as tailoring the current RPS to include specific goals for offshore wind, preferential tax treatment for offshore wind project developers, and enforcing power purchase agreements (PPAs) as a matter of public policy. Regarding the transmission and grid connection issue, I propose that the most efficient way to connect to PREPA's grid and transmit the power onshore involves building an offshore transmission backbone, properly planned in the context of PREPA's grid. Using this system, individual offshore wind farms can then simply "plug in" to this transmission line instead of building their own cables to shore.

Part II of this paper begins with a brief overview of the basics of offshore wind power and its pros and cons. Part III delves deeper into two of the biggest challenges to the development of offshore wind power. Part IV describes the current state of wind energy in Puerto Rico and proposes different solutions for how the island can tackle offshore wind power grid connection and transmission constraints and investment issues.

I. OVERVIEW OF OFFSHORE WIND POWER

A. The Basics of Offshore Wind Energy

An offshore wind farm is similar to an onshore wind farm in that the farm is made up of multiple turbines that generate wind energy for a nearby electricity grid. A wind farm is defined as an "array[] of about 4 or more turbines connected as a group to export electricity to a grid network."[9] Although onshore and offshore wind power production are similar, offshore turbines have unique features in addition to larger size and greater output.[10] The structure of an offshore turbine is driven by the ocean environment they will face, including water depth; wind and wave conditions; and seabed geology.[11] An

[9] Ashlyn N. Mausolf, *Clearing the Regulatory Hurdles and Promoting Offshore Wind Development in Michigan*, 89 U. DET. MERCY L. REV. 223, 226 (2012).
[10] *Id.*
[11] *Id.*

offshore turbine generally has undersea electrical collection and transmission cables that connect offshore turbines together and to a transformer "where the combined electricity is converted to a high voltage for transmission via undersea cables to a substation."[12] The electricity is then connected to the onshore electricity grid.

B. Advantages of Offshore Wind Energy

1. Environmental Benefits

Wind energy is one of the cleanest and most environmentally friendly energy sources available.[13] Once built, a wind project involves only minimal environmental impacts compared to traditional electricity generation.[14] Wind power emits negligible amounts of traditional air pollutants, such as sulfur dioxide, carbon dioxide, and other greenhouse gases.[15] Lower emissions of traditional air pollutants mean fewer air quality-related illnesses.[16] Lower greenhouse gas emissions will help to combat climate change.[17] In addition, wind power does not incur the additional environmental costs associated with nuclear power or fuel production for traditional electricity generation, such as coal mining and natural gas extraction.[18]

2. Stronger Wind Power Generation

Offshore wind power has further advantages compared to onshore wind power production. Wind speeds are stronger and more consistent offshore,[19] largely due to

[12] *Id.*
[13] The U.S. Department of Energy considers wind power to be "one of the cleanest and most environmentally neutral energy sources in the world today." Michael P. Giordano, *Offshore Windfall: What Approval of the United States' First Offshore Wind Project Means for the Offshore Wind Energy Industry*, 44 U. RICH. L. REV. 1149, 1149-50 (2010).
[14] Erica Schroeder, *Turning Offshore Wind On*, 98 CAL. L. REV. 1631, 1639 (2010).
[15] *Id.*
[16] *Id.*
[17] *Id.*
[18] *Id.*
[19] Wind speeds are consistently higher offshore—perhaps twenty-five percent greater than its onshore counterpart. Mausolf, *supra* note 9, at 229.

reduced wind shear and roughness on the open ocean.[20] While long grass, trees, and buildings will slow wind speeds significantly, water is smooth and exerts less effect on wind speeds. The reduced wind shear allows offshore wind farms to last up to fifty years, while onshore wind farms usually last only twenty-five years.[21] In addition, because offshore wind projects face fewer barriers to their expansion, both natural and manmade, offshore developers can take advantage of economies of scale and build larger wind farms that generate more electricity.[22]

C. Disadvantages of Offshore Wind Energy

Three interrelated barriers have worked in concert to deter offshore wind developers in the past: (1) initial capital costs; (2) environmental costs; and (3) transmission constraints. While this paper will briefly address all three main concerns of offshore wind power, the focus will be on the high capital costs and the difficult transmission challenges implicated by offshore wind development.

1. High Capital Costs

Cost is perhaps the greatest obstacle that has impeded the widespread development of offshore wind energy. Offshore wind farms are more expensive to build and more difficult to install and maintain than onshore wind farms or other common forms of electricity generation like coal-fired power plants.[23] The United States Offshore Wind Collaborative estimates that a fully installed offshore wind farm will cost as much as $4,600 per kilowatt of installed electric capacity, almost twice the cost of an onshore wind farm.[24] The higher price tag for offshore wind projects results from higher "costs related to turbines, installation, [operation and maintenance], support structures, electrical

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[20] *Id.*
[21] *Id.*
[22] Schroeder, *supra* note 14, at 1639-40.
[23] Giordano, *supra* note 13, at 1152.
[24] *Id.*

infrastructure, and engineering and management."[25] Further costs arise because offshore wind turbines must endure harsher weather conditions than their onshore counterparts.[26] Costs are also higher because offshore wind farms must be larger than onshore farms in order to offset additional costs of cabling and installation in deeper water far from shore.[27] Short-term and long-term technical improvements could help to lower offshore wind costs, however.[28]

2. Environmental Costs

In addition to high capital costs, opponents of offshore wind power projects frequently cite the environmental costs of offshore wind power. These costs are site specific and can involve harm to plants, animals, and their habitats.[29] Specific impacts on birds include disruption of migratory patterns, destruction of habitat, and bird deaths from collision with the turbine blades.[30] These adverse impacts, however, are generally less dramatic than those associated with fossil fuel extraction and generation, and in a well-chosen site they can be negligible. An exhaustive study of the environmental impact of major offshore wind farms in Denmark, a leader in offshore wind, revealed that "offshore wind farms, if placed right, can be engineered and operated without significant damage to the marine environment and vulnerable species."[31]

3. Transmission and Grid Connection Issues

A major portion of the installation and operating costs of offshore wind farms involve electrical connections, both among the turbines within the farm and from the farm to the electrical grid onshore. Although the cables within the wind farm are not always buried, the cable from the farm to the shore must be buried beneath the seafloor to

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[25] *Id.* at 1153.
[26] *Id.*
[27] *Id.*
[28] Schroeder, *supra* note 14, at 1641.
[29] *Id.*
[30] *Id.*
[31] *Id.*

avoid interference with fishing and shipping.[32] Burying and maintaining this cable requires specialized equipment, vessels, and personnel, which are costly and in short supply.[33]

Once an offshore wind farm goes online, another major challenge involves the integration of the power it generates into onshore electricity networks to effectively meet demand. Electricity generated by offshore turbines must be made compatible with onshore delivery systems.[34] In addition, the intermittent nature of wind power means that power generation often does not correspond with period of high demand. With no way of storing wind power for future use, the operator of the electricity network may require the wind farm to restrict production during periods of strong wind when offshore farms generates more electricity than the grid requires.[35] On the other hand, when winds are weak, an offshore farm cannot generate sufficient electricity to meet demand and conventional generating plants must be available to provide backup power.[36] Consequently, the intermittency of wind energy, combined with the costs and burdens of integrating offshore wind generated electricity with the onshore grid, is yet another factor that has slowed the development of offshore installations.

II. CHALLENGES TO THE DEVELOPMENT OF OFFSHORE WIND POWER

A. High Initial Capital Costs

One of the major barriers to offshore wind development is, and will likely continue to be, its high capital cost compared to other forms of energy production. The costs associated with nearly every aspect of the construction, operation, and maintenance of offshore wind farms are significantly higher than the cost of onshore installations.[37]

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[32] Ed Feo & Josh Ludmir, *Challenges in the Development and Financing of Offshore Wind Energy*, 14 ROGER WILLIAMS U. L. REV. 672, 675 (2009).
[33] *Id.*
[34] *Id.* at 675-76.
[35] *Id.* at 676.
[36] *Id.*
[37] *See supra* Part II.

The construction and installation of offshore turbines' specialized foundations can account for up to thirty percent of total turbine costs, while constituting only seven percent of the cost of onshore units.[38] The cost of connecting offshore wind farms to onshore electricity networks, which increases the farther offshore the installations are located, accounts for between seventeen to thirty-four percent of the total cost.[39] Additionally, "[m]aintenance also adds a hefty sum to the cost of offshore wind given the harshness of the marine environment . . . and the lack of specialized maintenance equipment and personnel."[40]

Nonetheless, although the capital costs seem to outweigh offshore wind power benefits, because the offshore wind market is relatively new, cost savings are expected as the technology, planning, manufacturing methods, and offshore platforms continue to improve. A study performed by the Brattle Group, a consulting firm based in Cambridge, Massachusetts, revealed that there is great value in investing in offshore wind energy development.[41] Specifically, the results of the study showed the following: (1) the investment required to develop fifty-four gigawatts of offshore wind energy would range between $18.5 billion and $150 billion; by comparison, subsidies to the oil industry from 1950 to 2010 were $369 billion, consisting of $104 billion to the coal industry and $121 billion to the natural gas industry; (2) offshore wind energy development would result in an average monthly-rate increase for American consumers ranging from 0.2 percent to 1.7 percent: as little as twenty-five cents per month for the average household electricity bill; and (3) even with natural gas prices at an all-time low, the cost of electricity from offshore wind could equal the cost of electricity from gas turbines in about a decade.[42]

1. How the U.S. Has Dealt with High Initial Capital Costs

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38 *See* Feo & Ludmir, *supra* note 32, at 677.
39 *Id.*
40 *Id.* at 678.
41 Michael Conathan, *Making the Economic Case for Offshore Wind*, AM. PROGRESS (Feb. 28, 2013, 10:58 AM), https://www.americanprogress.org/issues/green/reports/2013/02/28/54988/making-the-economic-case-for-offshore-wind/.
42 *Id.*

Although this may change with the Trump administration, the United States recognizes the opportunities and benefits that offshore wind power provides, but also acknowledges the high initial capital costs that investors must undertake. As a result, both the federal and state governments have developed incentives to promote offshore wind deployment and help with the high capital costs challenges.

i. Federal Tax Credits

Federal tax credits for renewable energy, in particular the production tax credit (PTC) and investment tax credit (ITC), have served as one of the primary financial incentives for renewable energy deployment over the last two decades in the United States. Since their initial inception, however, the federal renewable tax credits have expired, been extended, modified, and renewed numerous times.

The PTC was first enacted as part of the Energy Policy Act of 1992 and has played a significant role in supporting wind energy.[43] The PTC was designed to stimulate the deployment of renewable energy technologies by offering a ten-year federal tax credit for certain renewable energy projects based upon their grid-connected electrical output.[44]

While the PTC aims to incentivize wind energy development, it has less importance for offshore wind developers. Offshore wind turbines rely on newer technology in areas where energy has not yet been harnessed. This reliance creates greater uncertainty and unpredictability around offshore wind projects' electricity generation output and thus the size of their PTC.[45] Additionally, "[o]ffshore wind projects also have longer timeframes than onshore wind projects for permitting and construction, rendering a credit that predicates eligibility upon near term grid-

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[43] *See* Benjamin Fox, *The Offshore Grid: The Future of America's Offshore Wind Energy Potential*, 42 ECOLOGY L.Q. 651, 658 (2015).
[44] *Id.*
[45] Richard W. Caperton et al., *Encouraging Investment Is Key to U.S. Offshore Wind Development*, AM. PROGRESS (Jan. 12, 2012, 9:00 AM), https://www.americanprogress.org/issues/green/news/2012/01/12/10951/encouraging-investment-is-key-to-u-s-offshore-wind-development/.

connectivity suboptimal."[46] Instead, the extended timeframe and energy production uncertainty of offshore wind makes the ITC the more attractive financial incentive for developers. Although the ITC previously applied only to small-scale wind projects (100 kilowatts or less), the American Recovery and Reinvestment Act of 2009 expanded it to include wind projects of all sizes.[47]

Although these incentives are helpful to jump-start offshore wind power projects, investors cannot attain full confidence from them because the incentives usually expire every three to four years.[48] The final extension of the tax credits occurred in the FY16 Omnibus Appropriations Bill, which passed on December 18, 2015.[49] The tax credits, which were extended through 2019, have begun phasing down by twenty percent each year beginning in 2017.[50] For the PTC, wind projects that started construction in 2015 and 2016 receive a full value PTC of 2.3 cents per kilowatt hour.[51] For projects that begin construction in 2017, the credit is at eighty percent of full value; for 2018, sixty percent PTC; and for 2019, forty percent PTC.[52] On the other hand, for the ITC, projects that started construction in 2015 and 2016 are eligible for a full thirty percent ITC; for 2017, a twenty-four percent ITC; for 2018, an eighteen percent ITC; and for 2019, a twelve percent ITC.[53] While the extension of these credits help with capital costs, the offshore wind industry and its investors need long-term incentives that will remain in place for at least ten years in order to promote significant growth in the field. Unfortunately, with the change in Administration, it seems that Congress will be unable to deliver long-term certainty to investors, and the future of tax credits remain unclear.

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[46] Fox, *supra* note 43, at 658.
[47] *Business Energy Investment Tax Credit (ITC),* U.S. DEP'T OF ENERGY, https://energy.gov/savings/business-energy-investment-tax-credit-itc (last visited March 3, 2018).
[48] Giordano, *supra* note **Error! Bookmark not defined.**, at 1155.
[49] *Production Tax Credit,* AM. WIND ENERGY ASS'N, http://www.awea.org/production-tax-credit (last visited March 2, 2018).
[50] *Id.*
[51] *Id.*
[52] *Id.*
[53] *Id.*

ii. Power Purchase Agreements

A PPA is an essential step in the development process for an offshore wind project. A PPA "ensures that an energy project receives payment for the generation of electricity from the resource."[54] PPAs provide offshore wind developers long-term stability and price certainty, which ultimately serve to partially offset the initial higher costs. Cape Wind, in Massachusetts, made the first attempt to jumpstart the U.S. offshore wind industry. Nonetheless, after overcoming various legal, economic, and regulatory obstacles for sixteen years, the U.S. offshore wind flagship project Cape Wind was finally terminated in 2017.[55] For the purposes of this paper, note that the Cape Wind project was financially on-track before its ultimate demise.[56] Because the power that Cape Wind produced would be substantially more expensive than that of other power plants in the area, its financial success depended on the government policy support it received at both the state and federal levels.[57] "At the State of Massachusetts' direction in its 2008 Green Communities Act, Cape Wind signed [PPAs] with National Grid and [Eversource], the state's two largest electric utilities, requiring the utility companies to purchase 77.5% of Cape Wind's output at an above-market rate."[58] Cape Wind also qualified for a thirty percent ITC.[59] Nonetheless, because of its inability to meet contractual deadlines, National Grid and Eversource canceled their PPAs, stalling financing and development.[60] Many commenters believe that this cancellation was the obstacle that ultimately lead to the project's termination in 2017.[61] This emphasizes that

[54] JOHN P. DANIEL ET AL., NATIONAL OFFSHORE WIND ENERGY GRID INTERCONNECTION STUDY EXECUTIVE SUMMARY 33 (2014), https://www.energy.gov/sites/prod/files/2014/08/f18/NOWEGIS%20Executive%20Summary.pdf.
[55] *Kennedys, Kochs help kill planned wind farm off Cape Cod*, FOX NEWS (Dec. 4, 2017), http://www.foxnews.com/us/2017/12/04/kennedys-kochs-help-kill-planned-wind-farm-off-cape-cod.html.
[56] Lawrence Susskind & Ryan Cook, *The Cost of Contentiousness: A Status Report on Offshore Wind in the Eastern United States*, 33 VA. ENVTL. L.J. 204, 221 (2015).
[57] *Id.*
[58] *Id.*
[59] *Id.*
[60] *Id.*
[61] *Id.* at 222; Jeff St. John, *Cape Wind's Demise Comes Amidst a Resurgence for US Offshore Wind*, Greentech Media (Dec. 6, 2017), https://www.greentechmedia.com/articles/read/in-cape-winds-demise-lessons-for-resurgent-u-s-offshore-wind#gs.7yHm2Gs.

PPAs are an important—almost necessary—tool that offshore wind project developers may use to overcome the hurdle of high initial capital costs.

B. Transmission and Grid Connection Issues

Even with all the necessary financing, an offshore wind project could not become a reality if the power system is not ready for it. The intermittent and fluctuating nature of wind energy generation gives rise to a myriad of challenges—not only for offshore wind projects, but to electric utilities as well. Utilization of offshore wind farms requires a reliable and efficient transmission system. Ultimately, this will require upgrading existing grid connections and building new transmission lines to accommodate greater volumes of wind generation without destabilizing the grid. This would ensure continuing maintenance of network security, and hence security of supply, while allowing a greater volume of wind farms to connect to the grid.

1. Connecting to the Onshore Grid in the United States

In 2016, Block Island, off the coast of Rhode Island, became the United States' first successful offshore wind farm.[62] The Block Island 30 MW wind farm, developed by Deepwater Wind, consists of five turbines that are capable of powering around 17,000 homes.[63] The project has been integrated effectively into Rhode Island's grid via a twenty-mile undersea cable between the Rhode Island mainland and Block Island.[64] The cable is connected to a new substation that the utility company National Grid constructed on Block Island and to an existing substation on the mainland.[65]

Although Block Island's undersea cable seems like the simplest way for an offshore farm to connect to the electric grid, this will likely prove inefficient as more and

[62] Tatiana Schlossberg, *America's First Offshore Wind Farm Spins to Life,* N.Y. TIMES (Dec. 14, 2016), https://www.nytimes.com/2016/12/14/science/wind-power-block-island.html?_r=0.
[63] *Id.*
[64] Barry Cassell, *National Grid Marks Progress on Power Line for Block Island Wind Project*, RENEWABLE ENERGY WORLD (July 6, 2016), http://www.renewableenergyworld.com/articles/2016/07/national-grid-marks-progress-on-power-line-for-block-island-wind-project.html.
[65] *Id.*

more projects come online and connect to the grid. A project called the Atlantic Wind Connection (AWC) sheds light on another way to approach the interconnection challenge.[66] AWC "is an offshore, undersea transmission [line] that will span the mid-Atlantic region, beginning in northern New Jersey and eventually extending to southern Virginia. The transmission line will connect wind farms that are built in the federally-designated 'Wind Energy Areas,' at least ten miles off the coast."[67]

Transmission is a key piece in building a robust offshore wind industry in the U.S., yet the transmission grid currently serving the east coast is already congested and siting new transmission lines on land would face significant hurdles. An offshore "backbone" such as the AWC would therefore be easier to site because it is buried offshore. It would also bring additional benefits, including lowering the cost of offshore wind projects.[68] One of the most notable benefits of a transmission backbone like the AWC is that each offshore wind farm developer could avoid having to develop, permit, and build multiple "radial" lines connecting to shore.[69] Without the AWC, each wind developer would have to plan, acquire rights of way, permit, conduct environmental reviews and then construct each radial line. With the AWC, individual wind farms would simply "plug in" to the transmission line rather than building their own cable to shore. Absent a transmission backbone like the AWC, the cost of building individual radial lines sufficient to deliver at least 6,000 MW of installed wind capacity to the onshore grid is estimated at between $3.4 and $5.3 billion.[70]

In addition, a project like the AWC will provide grid stability because it can transmit wind energy from a producing wind farm to an area that needs power. Further, when the wind is calm, it can transmit energy produced at conventional generating plants

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[66] *Atlantic Wind Connection*, ATLANTIC WIND CONNECTION, http://atlanticwindconnection.com/projects/ (last visited Apr. 10, 2017).
[67] *Id.*
[68] Johannes Pfeifenberger & Samuel Newell, *An Assessment of the Public Policy, Reliability, Congestion Relief, and Economic Benefits of the Atlantic Wind Connection Project: Executive Summary*, 4 (Dec. 1, 2010), http://files.brattle.com/files/8015_an_assessment...wind_connection_project_exec_summary_pfeifenberger_newell_dec_21_2010.pdf.
[69] *Id.* at 2.
[70] Fox, *supra* note 43, at 670.

from areas of surplus to areas that need power.[71] Finally, this type of transmission project helps improve grid reliability and security: during times of grid stress, a system like the AWC keeps the lights on by providing an alternative offshore path for moving power away from damaged or overloaded terrestrial transmission lines.[72] Moreover, underground transmission lines are less exposed to damage, improving the potential for these lines to support and restore the grid.[73]

III. TURNING OFFSHORE WIND ON IN PUERTO RICO

Puerto Rico should encourage offshore wind development for several reasons. First, as discussed above, there are advantages to offshore wind technologies generally, including environmental benefits. Second, the benefits from offshore wind are greater than those generated from onshore wind and, although many people oppose offshore wind energy because of its high costs, the benefits of offshore wind power are significant and frequently outweigh its costs. Third, islands like Puerto Rico are in a unique position to profit from offshore wind. Finally, Puerto Rico is suffering from a dire economic situation and could benefit from offshore wind investments and job creation.

A. Wind Energy in Puerto Rico

Like most Caribbean islands, Puerto Rico produces no conventional fuel and relies heavily on imported petroleum to meet its energy needs.[74] Puerto Rico's electricity prices are almost twice as much as those on the U.S. mainland, in large part due to the island's heavy reliance on oil products to run its electric generators.[75] Consumers, the

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[71] Pfeifenberger , *supra* note 68, at 5.
[72] *Id.*
[73] Peter Fairley, *Utilities Bury More Transmission Lines to Prevent Storm Damage*, IEEE Spectrum (Jan. 26, 2018), https://spectrum.ieee.org/energy/the-smarter-grid/utilities-bury-more-transmission-lines-to-prevent-storm-damage.
[74] U.S. ENERGY INFO. ADMIN, *supra* note 2.
[75] *See id.*

main stakeholders of PREPA, have already voiced concerns regarding their high monthly energy bills.[76]

In an attempt to lower energy costs and diversify PREPA's energy mix, Act 82 was passed in 2010 to establish an RPS requiring that PREPA, the island's sole public utility, have twelve percent of its power from renewables by the end of 2015; fifteen percent by the end of 2020; and twenty percent by 2035.[77] Nonetheless, PREPA determined in 2015 that there was neither enough time to build new renewable facilities nor enough flexibility in its generating system to integrate the renewables needed to meet the 2015 RPS target.[78] As of 2015, fifty-one percent of Puerto Rico's electricity came from petroleum, thirty-one percent from natural gas, and sixteen percent from coal. Renewables provided less than two percent of the island's electricity, with 1.06% coming from wind, 0.33% from central station solar photovoltaic, 0.33% from hydro power, and 0.12% from distributed generation.[79]

To alleviate the cost of energy and comply with the RPS, PREPA has focused on wind, solar, and waste-to-energy projects. Specifically, PREPA seeks to establish over 380 MW of electrical power from wind sources as part of its renewable energy portfolio.[80] According to the NREL, Puerto Rico has 840 MW of potential wind power, but has only installed 120 MW of that capacity.[81] Multiple wind projects have been proposed, but Puerto Rico's onshore wind resource is limited and proposed sites have faced substantial local opposition.[82] Only two wind farms have been completed, accounting for nearly two-thirds of Puerto Rico's renewable generation in 2015.[83] Nonetheless, by developing its two wind energy projects onshore, Puerto Rico has failed to maximize its potential for wind power extraction. None of the existing or future

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[76] Ramón Luis Nieves, *'America's Greece' and its insolvent electric utility*, UTILITY DIVE (Apr. 11, 2017), http://www.utilitydive.com/news/americas-greece-and-its-insolvent-electric-utility/440266/.
[77] U.S. ENERGY INFO. ADMIN, *supra* note 2.
[78] *See id.*
[79] *See id.*
[80] RODRÍGUEZ ET AL., *supra* note 5, at 1.
[81] NAT'L RENEWABLE ENERGY LAB., *supra* note 6.
[82] U.S. ENERGY INFO. ADMIN, *supra* note 2.
[83] *See id.*

projects consider an offshore wind energy farm, even though that the NREL noted that the greatest potential for wind power extraction in Puerto Rico resides offshore.[84]

1. The Need for Offshore Wind in Puerto Rico

Puerto Rico is currently experiencing an energy and economic crisis. The high cost of energy is not only a direct burden on individuals, but also a critical barrier to economic development in the island. Moreover, PREPA faces a financial crisis, with more than $5 billion in debt stemming from its outdated oil plants, which are inefficient, costly, and noncompliant with environmental regulations.[85] Developing the offshore wind potential of Puerto Rico's coasts will help the island meet its RPS goals, spur economic growth,[86] and push it toward deeper cuts in greenhouse gas emissions.

Offshore wind represents "the largest single potential source of renewable energy for Puerto Rico."[87] Aside from the benefits that offshore wind provides, highlighted above, a study sponsored by the Puerto Rico Energy Affairs Administration (PREAA) suggests that "[o]ffshore wind farms offer a very high potential of electricity production in Puerto Rico."[88] The study identified two main areas in the east and south coast that are appropriate for offshore wind development.[89] The two identified areas can result in a total installed wind capacity of 13,275 MW.[90]

B. Tackling High Initial Capital Costs Issues

In 2010, the Puerto Rico legislature passed Act 83, also known as the Green Energy Incentives Act, which provided a series of short, medium, and long-term

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84 RODRÍGUEZ ET AL., *supra* note 5, at 1.
85 Nieves, *supra* note 76.
86 For every 100 MW of installed wind capacity, an estimated six to ten permanent operations and maintenance jobs are created. Margaret Bryant, *Wind Energy in Texas: An Argument Developing Offshore Wind Farms*, 4 ENVTL. & ENERGY L. & POL'Y J. 127, 136 (2009).
87 *See generally* PUERTO RICO RENEWABLE ENERGY SELF SUFFICIENCY COMMITTEE, PUERTO RICO, RENEWABLE ENERGY SELF-SUFFICIENCY ROADMAP (2011).
88 IRIZARRY-RIVERA ET AL., *supra* note 8, at 1–14.
89 *Id.*
90 *See id.*

economic incentives to encourage the creation of a new and solid renewable energy industry.[91] Through this Act, the government of Puerto Rico sought to co-invest $290 million in renewable energy projects and other initiatives from 2010 to 2020.[92] Through the Green Energy Fund, PREAA offers cash rebates up to fifty percent for companies on the cost of installing projects not exceeding 1 MW of capacity.[93] This is an ineffective incentive for offshore wind development because "[o]ffshore turbines generally have nameplate capacities between 2 MW and 5 MW."[94] A project like the Block Island offshore wind farm, for example, has wind turbines with peak capacities of 6 MW each that comprise the 30 MW wind farm.[95] Puerto Rico should therefore seek alternatives that will provide direct support to offshore wind developers that face high costs and risks.

1. Proposed Solutions

Addressing economic challenges and making offshore wind projects more attractive to investors will take a strong commitment from Puerto Rico's government. To spur offshore wind project development in the island, the Puerto Rican government needs to establish a commitment to offshore wind development with funding and incentives for such development. First, Puerto Rico should amend its current RPS and tailor it to include specific goals for offshore wind development. Tailoring the existing RPS to include offshore wind mandates would develop a strong market for offshore wind farms and send a clear message to developers and investors that Puerto Rico's policy goals about building offshore are more than lofty rhetoric. Just as studies show that a state's

[91] 2010 P.R. Laws 281.
[92] *Puerto Rico Aggressively Pursuing Renewable Energy*, PR NEWSWIRE (July 21, 2010), http://www.prnewswire.com/news-releases/puerto-rico-aggressively-pursuing-renewable-energy-98932864.html.
[93] *Id.*
[94] *Offshore Wind Energy*, BUREAU OF OCEAN ENERGY MGMT., https://www.boem.gov/Offshore-Wind-Energy/ (last visited Apr. 14, 2017).
[95] Rod Adams, *Is Offshore Wind Finally Ready To Serve U.S. Power Needs?*, FORBES (Aug. 17, 2016), https://www.forbes.com/sites/rodadams/2016/08/17/is-offshore-wind-finally-ready-to-serve-us-power-needs/#6899ccd123b2.

passage of an RPS is a driver in alternative energy investment within that state,[96] catering the RPS to ensure that goals include offshore wind energy would signal to investors that Puerto Rico wants to take steps to encourage offshore development.

Puerto Rico should also bolster investor certainty in offshore wind projects through preferential tax treatment. For example, New Jersey has successfully increased investor certainty with its offshore wind renewable energy certificate program and 100 percent tax credit for large-scale offshore wind projects.[97] In the wake of perpetually uncertain and potentially expiring federal tax credits for offshore wind energy, Puerto Rico's government could amend its tax laws to extend similar tax incentives that would mitigate developer risk arising from the high upfront capital costs of offshore wind farms and transmission infrastructure. In addition to these tax credits, Puerto Rico can play a role in financing offshore projects by providing loans or loan guarantees that lower the cost of debt for developers. Offshore wind is a new technology, which makes traditional lenders hesitant to support project developers. By guaranteeing a project's debt, the government lowers the costs of financing these projects.

A third way Puerto Rico can incentivize the development of offshore wind projects is through PPAs, guaranteeing investors long-term opportunities to purchase the electricity the offshore wind projects will produce. The PPAs can be used to guarantee an above-market price for offshore projects that will be preferable for policy reasons—for example, to comply with the new offshore wind goals in the revised RPS. Moreover,

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[96] *See* SOJI ADELAJA & YOHANNES G. HAILU, LAND POL'Y INST., PROJECTED IMPACTS OF RENEWABLE PORTFOLIO STANDARDS ON WIND INDUSTRY DEVELOPMENT IN MICHIGAN 20 (2007), http://scandiawind.com/images/MSU%20econ%20impact.RPS_121207%5B1%5D%204.1.10.pdf.

[97] Fox, *supra* note 46, at 668. On August 19, 2010, New Jersey Gov. Chris Christie signed into law the Offshore Wind Economic Development Act (OWEDA). The bill directs the New Jersey Board of Public Utilities to develop an offshore renewable energy certificate program that calls for a percentage of electricity sold in the state to be from offshore wind energy. This percentage would be developed to support at least 1,100 MW of generation from qualified offshore wind projects. OWEDA authorizes the New Jersey Economic Development Authority (EDA) to provide up to $100 million in tax credits for offshore wind-energy facilities. For any facility, the EDA is authorized to issue tax credits up to 100 percent of the capital investments of $50 million or more for offshore wind projects. Michael Drewniak, *Governor Christie Signs Offshore Wind Economic Development Act to Spur Economic Growth, Encourage Energy as Industry*, STATE OF NEW JERSEY (Aug. 19, 2010), http://www.state.nj.us/governor/news/news/552010/approved/20100819a.html.

PPAs will provide stable and certain prices to offshore wind developers. To PREPA, higher prices in the present will be partially offset by the long-term stability of these prices. These PPAs should be enforced as a matter of public policy because, in cases where U.S. states have not enforced PPA agreements between developers and utilities, offshore wind project financing became substantially more difficult.[98] The lack of a Massachusetts law requiring a PPA for new offshore wind projects has also been seen as a major reason for the unusually low bids for the Massachusetts Wind Energy Area.[99] On the other hand, in Maine, the legislature passed the 2010 Ocean Energy Act, which directed the Maine Public Utilities Commission (PUC) to procure up to 25 MW of offshore wind energy through a competitively bid PPA.[100] Central Maine Power, the state's largest electricity transmission and distribution utility, was an unwilling partner to the initial PPA with Statoil, a developer with experience developing offshore wind projects in the North Sea, but was ultimately forced by the state's law to negotiate—a requirement that was then reinforced by the PUC.[101] Therefore, one may argue that, even if PREPA were opposed to an offshore wind project or were an unwilling partner, the Puerto Rico legislature could pass an act that forces the public utility to negotiate PPAs with developers.

C. Tackling Transmission and Grid Connection Issues

Under Puerto Rico's current RPS, PREPA is required to have twenty percent renewable generation by 2035. Nonetheless, PREPA has indicated that this goal is "unrealistic without the necessary modernization of PREPA's existing generation fleet due to the curtailment of renewable energy that would otherwise be produced."[102] Curtailment is "energy that the renewable projects could have produced but cannot be

[98] Susskind & Cook, *supra* note 56, at 251.
[99] *Id.* at 251–52.
[100] *Id.* at 226.
[101] *Id.* at 251.
[102] *Exploring Energy Challenges and Opportunities Facing Puerto Rico*: *Hearing Before the Subcomm. on Energy and Mineral Res.*, 114th Cong. 5 (2016) (statement of Lisa Donahue, Chief Restructuring Officer, PREPA).

safely accepted in the system... This [produced] energy has to be paid... and hence has a cost."[103] Essentially, PREPA alleges that its outdated infrastructure cannot handle the rapid development of renewable resources over the next twenty years and, therefore, compliance with the RPS is improbable.

Although PREPA's outlook is grim, there are opportunities to help diversify PREPA's portfolio of electricity with offshore wind power through the utilization of PPAs, mentioned above. These agreements would allow PREPA to purchase electricity from the newer offshore wind turbine generators. These offshore wind projects would then interconnect with PREPA's transmission or subtransmission system. Nonetheless, as noted above, transmission and grid connection poses one of the greatest obstacles to offshore wind development. Below, I propose a solution to overcome the transmission and grid connection hurdle.

1. Proposed Solution

Currently, there is no legal limit on the total capacity that may be connected to PREPA's transmission system.[104] Additionally, under section 210 of the Public Utility Regulatory Policies Act of 1978 (PURPA), which applies to Puerto Rico, electric utilities are directed to purchase power from and interconnect with qualifying facilities (QFs).[105] QFs fall into two categories: (1) qualifying small power production facilities and (2) qualifying cogeneration facilities.[106] For the purposes of this paper, I will focus on qualifying small power production facilities.

Small power production facilities use biomass, waste, or renewable resources, including wind, to produce electric power and have a power production capacity which, together with any other facilities located at the same site, are not greater than 80 MW.[107] Most offshore wind farm projects developed in Puerto Rico will likely qualify as a small

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[103] *Id.*
[104] U.S. ENERGY INFO. ADMIN, *supra* note 2.
[105] 18 C.F.R. § 292.303(a) (2017).
[106] 18 C.F.R. § 292.101(b)(1).
[107] 16 U.S.C. § 796(17)(A)(i)–(ii) (2017).

power production facility and, therefore, may enjoy the benefits conferred upon QFs by PURPA, including the right to interconnect with PREPA by paying a nondiscriminatory interconnection fee. Thus, it seems that under both federal and local law, offshore wind projects should have the necessary legal basis to interconnect with PREPA's system. Nevertheless, a big obstacle still remains—transmitting the electricity onshore.

As discussed above, *supra* Section III. B, the simplest way for an offshore wind project to connect to the grid is to build a line from the project directly to the shore. Nonetheless, this will quickly prove inefficient as more and more projects come online. Each of those connections costs millions of dollars and they may not necessarily connect to the most robust parts of the onshore grid. Therefore, a better way to approach the interconnection and transmission challenge is to build an offshore transmission line, like the Atlantic Wind Connection project discussed above, that is properly planned in the context of PREPA's existing grid. Each project would then easily "plug in" to the line, streamlining offshore wind power delivery. This would provide significant economies of scale by creating a common transmission resource that would allow multiple developers in Puerto Rico to bring generated electricity to the shore. Having the transmission already in place will make it much easier for offshore wind developers to build projects because they would not have to independently plan for grid connections or build individual transmission lines. Without this, each wind developer would have to plan, acquire rights of way, permit, conduct environmental reviews and then construct each individual radial line. Moreover, the cost to construct this transmission line could be allocated among the different project developers. Therefore, although this transmission backbone would be a costly infrastructure investment, eliminating the need to construct individual transmission lines would ultimately lower the costs of offshore wind projects and improve investment certainty.[108] In addition, a transmission backbone will reduce

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[108] A study in the United Kingdom revealed that an offshore transmission backbone can reduce project development costs by as much as 25 percent. CROWN EST., OFFSHORE WIND COST REDUCTION: PATHWAYS STUDY 34 (2012), https://www.thecrownestate.co.uk/media/5493/ei-offshore-wind-cost-reduction-pathways-study.pdf.

any current transmission congestion and increase power flows, which will likely result in lower power prices for consumers.

V. CONCLUSION

Considering Puerto Rico and PREPA's economic situation, the time is ripe for the Puerto Rican government to take serious steps towards incentivizing and promoting the development of offshore wind energy—the single largest potential source of renewable energy for Puerto Rico. Although the road to offshore wind development is one filled with many obstacles, throughout this paper I have discussed various ways Puerto Rico can overcome two of the major barriers: high initial capital costs and transmission and grid connection issues. First, in order to encourage offshore wind investment in the island, Puerto Rico may use different policy tools. Puerto Rico can: (1) tailor its RPS to include specific offshore wind goals; (2) amend its tax laws to provide preferential tax treatment for offshore wind developers; and (3) guarantee investors the long-term purchase of the electricity they will produce through PPAs. Second, to overcome transmission and grid connection issues, Puerto Rico should encourage the construction of an offshore transmission backbone, properly planned in the context of PREPA's existing grid, that will facilitate the transmission of offshore power to the existing grid. Coupled with financial incentives, tailored RPS, PPAs, and a transmission backbone, offshore wind development could soon become a reality in Puerto Rico, bringing the island one step closer to overcoming its energy and financial crisis