OFFSHORE WIND IN THE ATLANTIC

Growing Momentum for Jobs, Energy Independence, Clean Air, and Wildlife Protection

NATIONAL WILDLIFE FEDERATION 2010

Vestas Wind Systems A/S

Report

CONFRONTING GLOBAL WARMING

Acknowledgments

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Executive Summary

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The Atlantic states are uniquely positioned to forge a clean, independent energy future. The region's current dependence on fossil fuels has far-reaching and devastating impacts — affecting residents' health, draining their pocketbooks, causing air and water pollution, and warming the planet. Many Atlantic states have already become leaders in energy efficiency and renewable energy technologies that create jobs, lower energy costs, cut pollution, and reduce our reliance on dirty fossil fuels. These efforts will greatly benefit people and wildlife for generations to come.

It is time for Atlantic states to build on these successes by tapping one of the region's most significant renewable resources: offshore wind. Key findings of this report include:

- **The vast wind resources of the Atlantic Ocean have not been tapped.** In contrast, European countries have 948 turbines installed at 43 offshore wind farms and are producing over 2.3 gigawatts (GW), enough electricity to power 450,000 – 600,000 homes. China recently completed its first major offshore wind farm, totaling 102 megawatts (MW). Not a single offshore wind turbine is spinning off the Atlantic coast of the United States.

- **The European Union and China's offshore wind goals dwarf those of the United States.** The European Union and the European Wind Energy Association have set a target of 40 GW of offshore wind by 2020 and 150 GW by 2030. China has established a target of 30 GW of offshore wind by 2020. The United States Department of Energy (USDOE) recently proposed the development of 10 GW of offshore wind by 2020 and 54 GW by 2030.

- **At over 212 GW of prime offshore wind potential, the Atlantic Ocean can become a major source of clean energy while creating jobs and economic growth across the region.** A September, 2010, National Renewable Energy Laboratory (NREL) report classified 1,283.5 GW of total potential offshore wind in the Atlantic Ocean. NREL further classifies 212.98 GW of offshore wind potential in shallow waters with high wind speeds after environmental and socioeconomic factors are taken into account (see Figure 1).

- **Approximately 6 GW of Atlantic offshore wind projects have been proposed or are advancing through the permitting process.** Specifically, wind developers and the Atlantic states have proposed or advanced 5.32 - 6.47 GW of offshore wind projects, the equivalent of 4 - 6 average coal-fired power plants and enough to power roughly 1.5 million average U.S. homes (see Figure 4, p. 21). Generating this much electricity from fossil fuels would emit more than nine million metric tons of carbon dioxide, the equivalent amount of carbon dioxide emitted by close to two million cars annually.

- **Approximately 3 GW of Atlantic offshore wind projects are advancing through the permitting process.** Of the 6 GW total, approximately half of the offshore wind projects have taken concrete steps forward on issues such as leasing, permitting, and power contracts. Specifically, 2.84 - 3.25 GW of offshore wind projects have been proposed while an additional 2.47 - 3.22 GW of projects are advancing (see Figure 4, p. 21).

- **According to NREL, the Atlantic States would generate $200 billion in new economic activity and create more than 43,000 permanent, high-paying jobs if 54 GW of the 212.98 GW of available offshore wind resources were utilized.**

- **Offshore wind farms have significant environmental benefits over fossil fuel energy.** 54 GW of offshore wind production would generate as much energy as is produced by 52 coal-fired plants in the United States each year. Generating an equivalent amount of electricity from fossil fuels would emit 97.2 million metric tons of carbon dioxide annually — the amount of carbon dioxide emitted by almost 17.7 million cars annually.

REpower

- **While the most extensive European study concluded that offshore wind farms do not appear to have long-term or large-scale ecological impacts, major data gaps for the Atlantic Ocean still exist and site-specific impacts need to be evaluated.** A coordinated, comprehensive, and well-funded effort is needed to address these gaps and improve the permitting process. Such an effort would better inform the public and decision-makers on the extent of potential environmental impacts and benefits, reduce research costs and environmental requirements for project developers, increase community acceptance, and reduce risks to financial investors.

Profile

TOM GILMORE

"As the President of New Jersey Audubon, an avid fly fisherman, and a proud grandfather, it is clear to me that the path forward for people and wildlife is a clean energy economy.

New Jersey Audubon researchers have been hard at work to understand the full impacts of offshore wind farms. Without question, more research is needed. We also know that locating projects further offshore and avoiding shoals and inlets appear to reduce harm to wildlife. We will continue to support the development of appropriately sited offshore wind as a critical component of a broader strategy to protect wildlife from climate change."

Tom Gilmore has been the President of the New Jersey Audubon Society since 1983. Under Tom's leadership, New Jersey Audubon has become one of the most important conservation organizations in the country with over 70 staff. Selected as one of "101 Most Influential People in New Jersey" by New Jersey Monthly, Tom is also the author of many important books, including "Flyfisher's Guide to the Big Apple. Great Waters Within 100 Miles of New York City," "False Albacore: A Comprehensive Guide to Fly Fishing's Hottest Fish," and "Tuna On The Fly: A Comprehensive Guide to Fly Fishing's Ultimate Trophy Fish."

This report calls on government and stakeholders to create the political climate and economic conditions necessary to jumpstart the offshore wind industry in the Atlantic Ocean. A concerted, diverse, and well-organized effort is needed. This must include initiatives to:

1. **Accelerate the transition from fossil fuels to clean energy.** The region's economic and environmental future depends on increasing energy efficiency and the use of renewable energy technologies.

2. **Jumpstart the offshore wind industry and individual projects in the Atlantic Ocean by:**

- Improving the offshore wind permitting process;
- Supporting policies and investments that spur offshore wind development;
- Identifying and reviewing high priority zones off the Atlantic Coast with minimal conflict to the environment and to other ocean users that can be prioritized for quicker permitting;
- Increasing research on offshore wind technologies and their associated benefits and risks, including wildlife and fishing impacts;
- Advancing efforts to promote jobs from this industry, especially manufacturing and other high-paying jobs;
- Promoting appropriately-sited offshore wind farms;
- Coordinating regional planning and economic development, including ports, vessels, transmission investment, and other shared opportunities; and
- Educating policymakers and the public about the benefits of offshore wind.

3. **Ensure the protection of the Atlantic Ocean and its precious resources.** While each Atlantic state is unique in terms of the availability of offshore wind, local politics, and mix of energy sources, the one constant should be a comprehensive effort to protect the Atlantic Ocean as a priceless and connected ecosystem. Offshore wind can help protect the Atlantic Ocean from climate change and studies show that projects can be sited to avoid large-scale and long-term ecological impacts.

4. **Create a diverse and powerful Atlantic offshore wind network.** In order to realize the full potential of offshore wind, organizations (including labor representatives, conservation groups, community groups, commercial and recreational fisherman, consumer organizations, and businesses) must create a clear regional vision for Atlantic offshore wind and create the political power needed to advance key policies and projects.

Profile

STEWART ACUFF

"Offshore wind development presents a tremendous job creation opportunity for America. In these difficult economic times, it is critical that we promote industries that have the potential to grow quality, high-paying jobs here at home. Offshore wind is perhaps the most promising game in town for expansion of a full range of new energy jobs, providing a compelling opportunity for substantial job growth and related economic benefits. Our members stand ready and willing to take advantage of these new jobs and help lead America in this exciting new direction."

Stewart Acuff is Chief of Staff at the Utility Workers Union of America AFL-CIO (UWUA), one of the most successful unions in the labor movement representing over 50,000 members working in the electric, gas, water, and nuclear industries across the United States. UWUA is both innovative and relentless in protecting utility jobs, and the wages, benefits and working conditions that their members enjoy in their jobs.

WHAT IS A GW?

"Kilowatt" (KW), "megawatt" (MW), and "gigawatt" (GW) are units used to measure electrical energy (1 GW equals 1,000 MW; 1 MW equals 1,000 KW). According to the Department of the Interior, 1 GW of wind-generated electrical energy can supply approximately 225,000 to 300,000 average U.S. homes.[1] Thus, 1 MW would supply electricity to approximately 225 to 300 households. The approximate average size of a coal-fired power plant in the United States is 667 MW.[2]

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FIGURE 1: ATLANTIC OCEAN: PRIME OFFSHORE WIND

The Atlantic's shallow water characteristics combined with excellent wind speed make it an ideal location for offshore wind farms: 93 percent (42 out of the 45) of offshore wind projects worldwide are in shallow waters (zero to 30 meters deep);[3] and close to 50 percent (49.7) of the United States' shallow water offshore wind is along the Atlantic coast.[4] New promising technologies are being deployed in depths greater than 30 meters as well.[5]

	Total offshore wind in areas <30 miles out and <30 meters deep (GW)	Potentially limited by environmental or socioeconomic factors[6] (GW)	Approximate available offshore wind resource[7] (GW)
New England & New York	100.2	60.12	40.1
New Jersey – North Carolina	298.1	178.86	119.24
South Carolina – Florida	134.1	80.46	53.64
Totals	532.4	319.44	212.98

Source: National Renewable Energy Laboratory[8]

DWIA and GWEC

FIGURE 2: REGIONAL OPPORTUNITIES AND DIFFERENCES

	Advantages	Challenges
New England & New York	Strong and consistent wind Many shallow water sites Storms are usually within design standards	Some good wind sites are in deeper water, especially in Maine
Mid-Atlantic (New Jersey – North Carolina)	Large areas of shallow water that are very well-suited for current offshore technology Northern states: strong wind Southern states: wind speeds diminish slightly, but milder climate and shallower water may provide overriding benefits	Hurricanes, especially in North Carolina Southern states: electricity costs are relatively low
South Atlantic Bight (South Carolina – Florida)	Large area of shallow water farther from shore Milder climate and shallower water may provide overriding benefits	Hurricanes Wind speeds are lower Electricity costs are relatively low Based on current technology, Florida's offshore wind potential is limited

Source: National Renewable Energy Laboratory, U.S. Energy Information Administration[9]

Center for Marine and Wetland Studies

Center for Marine and Wetlands Studies staff pull wind monitoring buoys from waters off South Carolina's coast.

Profile

FARA COURTNEY

"These are exciting times for clean energy initiatives and especially for offshore wind. I've watched the offshore wind industry in the United States inch forward for the past ten years, with individual developers and state initiatives leading the way. It seems like we've finally reached a tipping point where all these disparate activities are starting to come together.

For the Atlantic Coast in particular, it's all about location: the Atlantic's great wind resources are close to large metropolitan areas where the need for electricity is the greatest. Buying local, clean-generated power means more local jobs and economic development opportunities, in addition to the long-term environmental and public health benefits of heading down a clean energy path.

I am proud of the U.S. Offshore Wind Collaborative's efforts to spark the offshore wind industry across the country through information-sharing, problem-solving, and capacity-building among government, industry, academia, energy, and environment advocates. There's a lot of work to be done, but I am very optimistic about the future of the U.S. offshore wind industry with wind turbines spinning in the Atlantic in the next few years."

In 2010, Fara Courtney became the Executive Director of the U.S. Offshore Wind Collaborative (USOWC). Fara worked with the Steering Committee as a consultant and leader during all stages of development of the USOWC, including the stakeholder process resulting in "A Framework for Offshore Wind in the United States (2005)," and as a co-author of "U.S. Offshore Wind Energy: A Path Forward (2009)." She has extensive experience in coastal development, ocean policy, state/federal regulatory programs, and civic engagement.

An Opportunity for Change: Atlantic States Must Transition from Fossil Fuels to a New Clean Energy Economy

"In 2008, we sent $386 billion overseas to pay for oil — much of it going to nations that wish us harm...It puts us in the untenable position of funding both sides of the conflict and directly undermines our fight against terror."

Vice Admiral Dennis McGinn, retired Deputy Chief of Naval Warfare Requirements and Programs[10]

Despite warnings from a string of presidents from Jimmy Carter to George W. Bush that America is addicted to fossil fuels, our country's reliance on coal, oil, and natural gas continues to grow. In the summer of 2010, electricity demand reached record levels for most of the Atlantic states.[13] By 2030, the amount of miles driven by vehicles in the region is expected to increase by over 100 percent.[14] The U.S. Energy Information Administration (EIA) estimates that U.S. consumption of liquid fuels will increase from 20 million barrels/day in 2008 to 22 million barrels/day in 2035. Consumption of coal is expected to grow substantially over the next 25 years if no action is taken.[15]

FOSSIL FUEL: A COSTLY ADDICTION

Any discussion of the costs of fossil fuels must start with the significant national security threat posed by our reliance on foreign energy sources. As Vice Admiral Dennis McGinn, retired Deputy Chief of Naval Warfare Requirements and Programs, stated: "In 2008, we sent $386 billion overseas to pay for oil — much of it going to nations that wish us harm. This is an unprecedented and unsustainable transfer of wealth to other nations. It puts us in the untenable position of funding both sides of the conflict and directly undermines our fight against terror."[16]

In its 2010 Quadrennial Defense Review, the Department of Defense stated: "climate change and energy are two key issues that will play a significant role in shaping the future security environment. Although they produce distinct types of challenges, climate change, energy security, and economic stability are inextricably linked.[17]

Our addiction to fossil fuels also results in devastating public health and environmental impacts, including:

Human Health Impacts

- The extraction of fossil fuels is an inherently dangerous activity: in the past decade, approximately 400 deaths have been caused by mine accidents and more than 10,000 people have died from black lung disease.[18] Recent tragic events are a sad reminder of this reality, with 11 killed in the BP Gulf oil disaster and 29 dead in West Virginia's Massey

Profile

Bruce Dean

GREG WATSON

"The United States has a tremendous offshore wind energy resource that is currently untapped. There are a variety of reasons contributing to the delay in launching a U.S. offshore wind industry. Until recently, the biggest obstacle was the absence of a regulatory framework, however the Department of the Interior's Bureau of Ocean Management, Regulation, and Enforcement (formerly the Minerals Management Service) is working on improving the offshore wind permitting process. It has become clear that each state acting independently to develop projects in their adjacent state and federal waters might produce some successful projects, but may not lead to the creation an offshore wind industry in the U.S. Within this context, regional collaboration emerges as the key to the creation of a sustainable offshore wind industry in the U.S."

Greg Watson is Senior Advisor for Clean Energy Technology within the Massachusetts Executive Office of Energy and Environmental Affairs, Vice President for Sustainable Development with the Massachusetts Clean Energy Center, and Vice Chair of the board of the U.S. Offshore Wind Collaborative. Greg's career of exemplary, cutting-edge public service has included serving as: Executive Director of the Dudley Street Neighborhood Initiative; Director of Educational Programs for Second Nature; and Director of The Nature Conservancy's Eastern Regional Office.

coal mine.[19] According to one study, a transition to renewable energy could prevent 1,300 fatalities in the fossil fuel industry alone over the coming decade.[20]

- Air pollution from burning fossil fuels causes a range of public health impacts, including 20,000 premature deaths each year in the United States as a result of criteria air pollutants such as ground level ozone, or smog.[21] More than 76.5 million Americans are exposed annually to dangerous short-term levels of particle pollution, which has been shown to increase heart attacks, strokes, emergency room visits for asthma and cardiovascular disease, and the risk of death.[22] Even when levels are low, exposure to these fine particles can also increase the risk of hospitalization for asthma, damage to the lungs, and premature death.[23]
- A Harvard University study found that harmful air pollutants released from two coal-fired power plants in Massachusetts led to 110 premature deaths, 1,710 emergency room visits,

Profile

MICHAEL HERVEY

"As the Chief Operating Officer of the nation's second largest public owned utility, I am proud of Long Island Power Authority's (LIPA) clean energy accomplishments. We have been rated in the top 10 of all utilities in the country for solar installations with only one other utility from the East Coast.

However, these programs alone will not achieve our company and the nation's goal to transition to a clean energy economy. We simply need to pursue offshore wind opportunities to achieve our renewable portfolio goals. To that end, LIPA, Con Ed, and New York Power Authority have partnered to propose a 350-700MW offshore wind farm located 13-17 miles off the Rockaway Peninsula in the Atlantic Ocean and have encouraged other developers to consider offshore wind to meet our state's renewable energy goals.

I am strongly encouraged by the preliminary analysis which demonstrates that an offshore wind project can work in our service territory. I remain committed to not only continue with the next phase of the process, but also to bring this wind project to fruition if we can make it cost effective for our customers. To address these cost issues, we need utilities, businesses, labor, conservation organizations, and others to show their steadfast support for common sense clean energy policies that will create jobs across the region."

Michael Hervey, as the COO of the Long Island Power Authority (LIPA), oversees an $11 billion company with a $4 billion annual operating budget that serves more than 1.1 million customers. LIPA has been a leader in energy efficiency and renewable energy.

43,300 asthma attacks, and 298,000 daily incidents of upper respiratory problems.[24] Based on the Harvard case study, the U.S. Army Corp of Engineers indicated that the total economic costs of the health impacts (illness and premature deaths) caused by both power plants are estimated to be $481.6 million.[25]

- Extracting and burning fossil fuels results in an array of toxic chemical emissions. Diesel emissions alone may be responsible for 125,000 cancer cases in the U.S.[26] In addition, coal and oil combustion releases high levels of mercury pollution and other reproductive toxins.[27]

Environmental Damage

- Air pollution deposition from coal-fired power plants, including mercury and acid rain, has destroyed lakes and resulted in the toxic contamination of fish and a wide range of other wildlife in both freshwater and marine ecosystems across the country.[28] The State of New Jersey estimates that more than one-third of the state's smog-forming pollution, fine particulate pollution, and mercury deposition originate from upwind, out-of-state coal and dirty-energy production facilities.[29]
- The extraction of fossil fuels causes a range of direct water pollution discharges from mining, mountaintop removal, drilling, and, more recently, the environmentally dangerous "fracking" for natural gas along the East Coast in the Marcellus Shale region.[30] Mountaintop removal, a particularly devastating mining practice, has permanently destroyed 1.2 million acres in central Appalachia, including 500 mountains in Kentucky, West Virginia, Virginia, and Tennessee.[31]
- The refining and transportation of fossil fuels creates water pollution from spills and direct discharges from oil refineries.[32]
- America's addiction to fossil fuels, and our corresponding dependence on automobiles and trucks, has fueled suburban sprawl and resulted in fragmented forests, loss of prime agricultural land, and degraded water quality.[33, 34]
- Wildlife are particularly sensitive to the full life cycle of our fossil fuel dependence. Extraction (drilling, mountaintop removal) and transmission (power lines, roads) destroy habitat, and the air and water pollution caused by fossil fuel combustion and oil spills limits wildlife's reproductive success and lifespan.

Climate Change

- An international team of scientists from the U.S. National Oceanic and Atmospheric Administration

Tami A. Heilmann/DOI

"We sit on 3 percent of the world's oil reserves. We consume 25 percent of its oil. Our dependence on foreign oil is a national security problem, an environmental security problem, and an economic security problem."

U.S. Department of Interior Secretary Ken Salazar, 2010. [11, 12]

recently reaffirmed that global warming is undeniable and clearly driven by humans and the greenhouse gas emissions caused by our fossil fuel use.[35]

- This decade has been the hottest on record and scientists expect this trend to continue[36] along with more severe storms and hurricanes that threaten the Atlantic states.[37]
- Our oceans are at grave risk from climate change. A recent study identified climate change as a leading cause for a 40 percent decline in certain kinds of phytoplankton that are a key food source for marine life.[38] Additionally, ocean acidification has accelerated due to greenhouse gas emissions, causing severe impacts to coral reefs and creating an imminent threat to many marine species.[39]
- In 2009, the U.S. Environmental Protection Agency (EPA) found that sea levels are rising along the Atlantic coast and that climate change is likely to further accelerate the rate of sea-level rise during the next century — leading to increased flooding and coastal storm damage.[40]
- The continued use of fossil fuels and the acceleration of global warming are particularly catastrophic to animals, marine wildlife, and their natural habitats.[41]

Economic Impacts

- All these above impacts combined have severe economic consequences — directly affecting jobs, economic security, tax policies, and other real "pocketbook" issues. The EPA estimates that a dramatic reduction in air pollution, such as sulfur dioxide and nitrogen oxide, could save $120 billion a year in avoided health costs, while preventing 1.9 million missed work days and thousands of emergency room visits for nonfatal respiratory illnesses.[42] According to the National Research Council, air pollution-related health damages, such as respiratory illnesses, cost the United States an estimated $120 billion in 2005.[43]
- Climate change threatens our region's critical infrastructure including expensive highways, sewage lines, bridges, and water treatment facilities.[44]
- Despite all the dire consequences of America's fossil fuel addiction, the federal government gave an estimated $72 billion worth of subsidies and tax-breaks to fossil fuel companies between 2002 and 2008.[45]

THE GULF OIL DISASTER

The recent Gulf of Mexico oil disaster illustrates the inherent and devastating risks associated with offshore oil drilling. The BP spill is just the latest example that there are no comprehensive protections in place to ensure the safety of humans and wildlife from the consequences of our oil addiction. It also clearly points to the need for the United States to wean itself off of oil through the use of clean energy technologies.

Atlantic Offshore Wind: The Right Choice

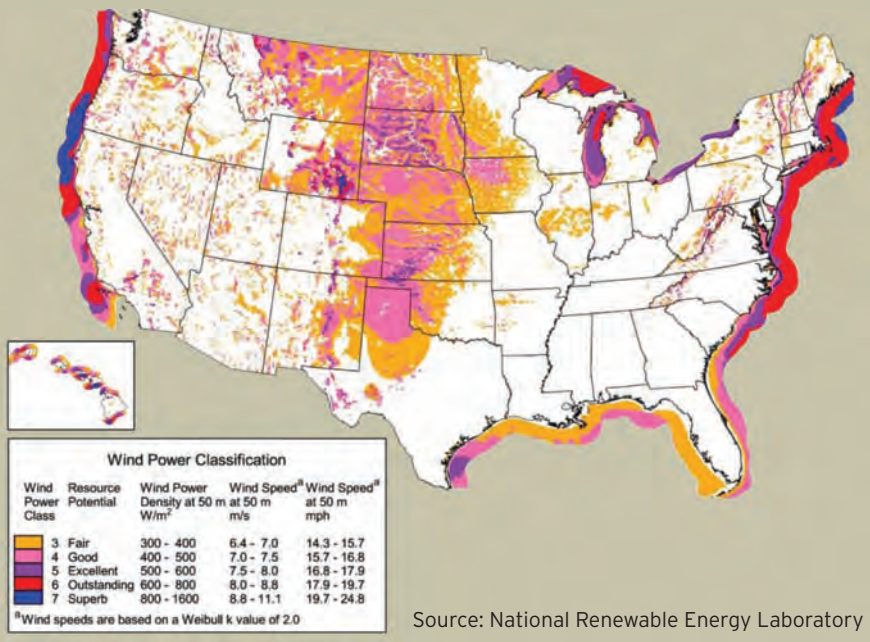
The Atlantic states have access to a unique, home-grown resource that has the potential to meet a significant portion of the region's energy needs.

STRONG, CONSISTENT WINDS

Consistent wind speed and water depth are two crucial elements of making offshore wind economically viable.[46] As Figure 3 documents, offshore winds in the Atlantic Ocean are strong and reliable, and the Outer Continental Shelf (OCS) has relatively shallow ocean depths many miles off the coast.

Beyond shallow water, the Atlantic states have significant additional wind resources. A September, 2010, National Renewable Energy Laboratory (NREL) report classified 1,283.5 GW of total potential offshore wind in the Atlantic Ocean.[47] Because of these factors, Atlantic states are well positioned to take advantage of current wind turbine technology (5 MW) and future generations of larger, even more efficient wind turbines (8 – 10 MW) that can be built further away from the coast — reducing visual impacts and other potential conflicts. The United States Department of Energy (USDOE) has recently proposed the development of 10 GW of commercially-competitive offshore wind by 2020, and 54 GW by 2030.[48]

FIGURE 3: UNITED STATES OFFSHORE WIND RESOURCE



Source: National Renewable Energy Laboratory

U.S. land-based and offshore wind resource estimates at 50-m height (wind classes 3-7)

JOBS AND ECONOMIC GROWTH

The development of an offshore wind industry, from research to construction to operations, will create jobs and economic growth in the region.[49] Many Atlantic States and academic partners have written a range of studies on the economic and job growth potential of offshore wind. Highlights of these findings include:

1. **Virginia Coastal Energy Research Consortium, 2010:** Development of 3,200 MW of offshore wind potential off Virginia's coast over the next two decades could create 9,700 to 11,600 career-length jobs.[50] A hypothetical 588 MW offshore wind project is estimated to bring $403 million of investment to Virginia's local economy.[51]

2. **University of Maine, 2010:** Development of 5,000 MW of offshore wind in Maine would create 16,700 new or retained jobs per year for 20 years.[52]

3. **Clemson University, 2007:** During the two-year construction phase of a 480 MW wind farm, the equivalent of 1,881 full-time jobs would be created by direct, indirect, and induced effects.[53] The report also predicted that employment will permanently increase by the equivalent of up to 155 full-time jobs over the currently predicted baseline. South Carolina's annual economic output is predicted to increase by as much as $287 million, and annual disposable income is expected to increase by up to $93 million.

The findings of these state reports are supported by both U.S. Government and European Wind Energy Association reports:

1. **National Renewable Energy Laboratory, 2010:** Building 54 GW of offshore wind energy facilities would generate $200 billion in new economic activity and create more than 43,000 permanent, high-paying

jobs in manufacturing, construction, engineering, operations, and maintenance.[54] To maximize job growth, it will be critical to grow the offshore wind manufacturing sector here in the United States, which currently lags behind other nations in this field.[55]

2. European Wind Energy Association, 2009: Over 15 jobs are created in the European Union for every MW of installed wind capacity.[56] More jobs are created by installing, operating, and maintaining offshore wind turbines than onshore wind projects.[57] Currently 41,396 European individuals are employed with offshore wind jobs in 2010.[58] By 2030, the European Union expects to host 215,000 offshore wind jobs.[59]

The largest costs of offshore wind energy are from labor-intensive and high paying job sectors, such as research and development, wind turbine and platform construction, marine transport vessel construction and operation, and overall maintenance. These are quality jobs that cannot be easily exported to foreign countries. Growth in these sectors also builds off of existing strengths of the Atlantic coastal economy and infrastructure, including shipbuilding, fishing, port operations, and other industries.

A BETTER INVESTMENT THAN NEW FOSSIL FUEL PLANTS

The Atlantic states have a tremendous opportunity to replace a fleet of aging and dirty electric power plants with offshore wind farms. According to a recent industry analysis, "The long-term economic viability of much of the coal-fired generation facilities across the U.S. is at risk ... over the last decade, less than 30 GW of power plants have been retired in North America, mostly representing old gas and oil-fired steam generators. Over the next 10 years, retirements could double to 60 GW, mainly from coal plants."[61]

Despite current high initial capital costs, offshore wind energy has no fuel costs and is not subject to price fluctuations that many states have witnessed over the last five years due to unpredictable natural gas and coal prices. Offshore wind would also diversify the region's energy portfolio — which is necessary to ensure energy security, price stability, and pollution reductions.

The draft 2010 U.S. Department of Energy strategic offshore wind plan seeks to build 10 GW of offshore wind by 2020 at a price of 13 cents/kWh and 54 GW by 2030 at 7 – 9 cents/kWh.[62] The average price for electricity in the New England region is 15 cents/kWh, and 14.78 cents/kWh for the Middle Atlantic region.[63] These high prices make offshore wind competitive.

NEW JERSEY STUDY FINDS OFFSHORE WIND AND WILDLIFE PROTECTION ARE COMPATIBLE

In July, 2010, the New Jersey Department of Environmental Protection released one of the most comprehensive environmental and socioeconomic studies to date of the impact of offshore wind farms. The two-year, $7 million study focused on 1,360 nautical miles of state and federal waters off the New Jersey coastline.[60] Key findings included:

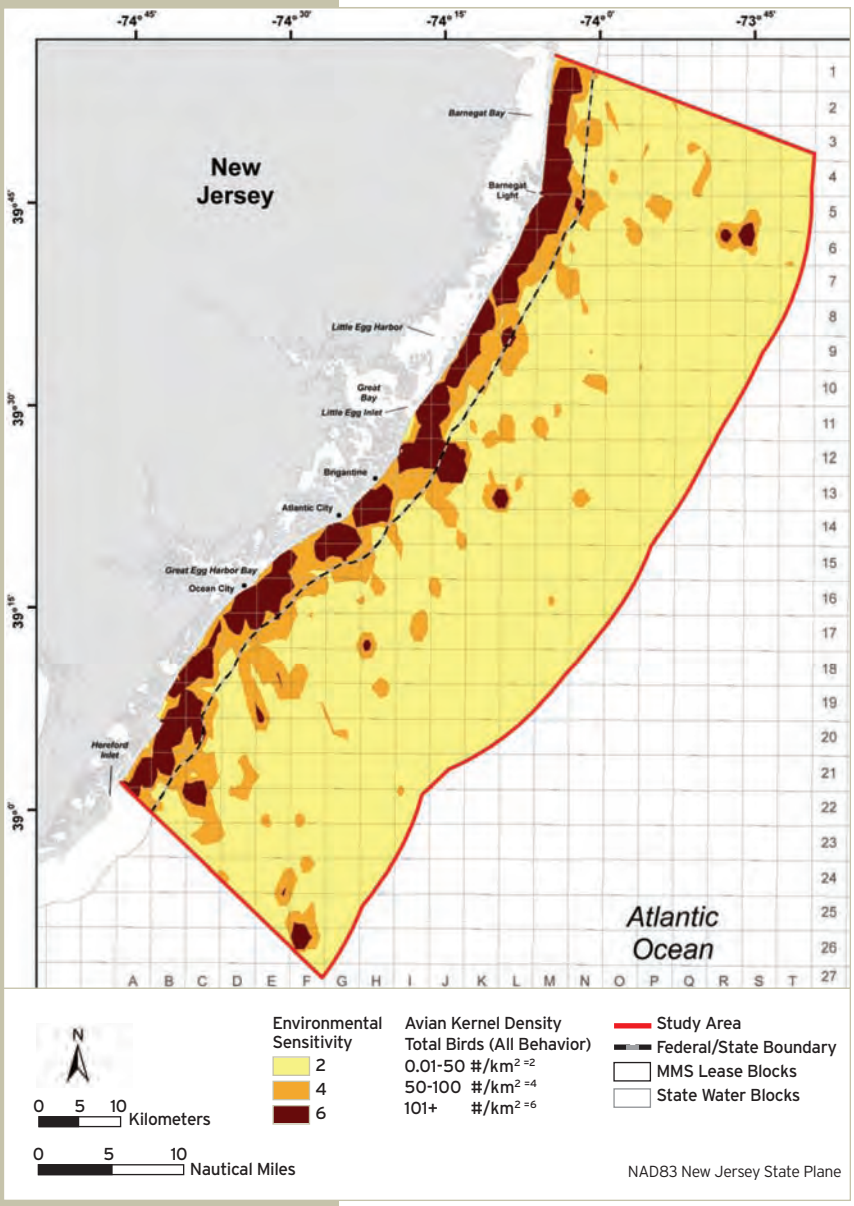
- The highest density of bird populations was found closest to the shore. Further offshore, beginning about 7.6 miles out, the number of birds significantly declined. These findings were more pronounced in winter than in summer.

- When birds were present in the offshore study area, they were consistently concentrated near shoals (shallow areas offshore).

- Of the more than 70,000 flying birds recorded, 3,433 (4.8%) were found in the potential turbine rotor zone. Almost one-third of the birds found in the potential turbine zone were Scaup (*Aythya* spp.) that were recorded during a severe cold snap in January 2009, illustrating the potential effects of a major weather event on avian movements.

- Dolphins were the most common marine mammals observed in the study area, with far fewer sightings of other mammals such as whales and seals. Additionally, there were few sightings of sea turtles, with just two species observed and those only during summer months.

- The study also found that mitigation steps could be used to limit negative impacts on birds and marine mammals, including brief turbine shutdowns during peak migration seasons and techniques to ease the strain of noise on dolphins and whales.



Gary A. Buchanan/NJDEP

Researchers from study author, Eco-Marine Inc., conduct wildlife observations off the New Jersey coast.

Profile

NICK RIGAS

"Diversifying our nation's energy portfolio to include clean, indigenous energy resources like offshore wind is not only an investment for today but for future generations. Our future, our economy, our nation's security, and the health of our environment can no longer be held hostage by fossil fuel resources. This emerging industry needs supportive public policies and new innovation to realize its full potential.

At Clemson University, we are committed to working with industry and government leaders to accelerate the introduction of new cutting-edge offshore wind technologies into the market through our new wind turbine testing facility — currently under construction. Our goal is to facilitate the development of innovative offshore wind technologies that can maximize energy generation and bring down costs. As a university whose mission is educating the leaders of tomorrow, we are being proactive to help address the challenges of offshore wind power. Offshore wind power is a clean, vital resource that can play a large role in our country's sustainable future. Now we must capture this opportunity."

Nicholas C. Rigas, Ph.D. is Director of the renewable energy focus area of Clemson University's Restoration Institute (CURI). Dr. Rigas also serves as the Vice President of Project Development for EcoEnergy where he is responsible for the development of more than 3,000 MW of wind power projects throughout the Midwest and Arizona. He works at CURI to promote the development of South Carolina's indigenous clean energy resources for economic development, energy security, improving the environment, and increasing the quality of life for the state's citizens.

The South Atlantic region is close to the national average at 10.03 cents/kWh, making the economics of offshore wind slightly more challenging in this region.

Initial costs of offshore wind projects will be much higher than U.S. DOE's goal of 13 cents/kWh by 2020. The most advanced offshore wind project, Cape Wind, is currently priced at 18.7 cents/kWh in the first year, with a 3.5 percent increase each year.[64] These are direct costs to electric consumers and do not take into account the economic benefits of direct and indirect job growth due to these investments being made in the region rather than relying on foreign oil or Midwest coal plants for this energy.

AVOIDED WEST-EAST HIGH-POWERED TRANSMISSION LINES

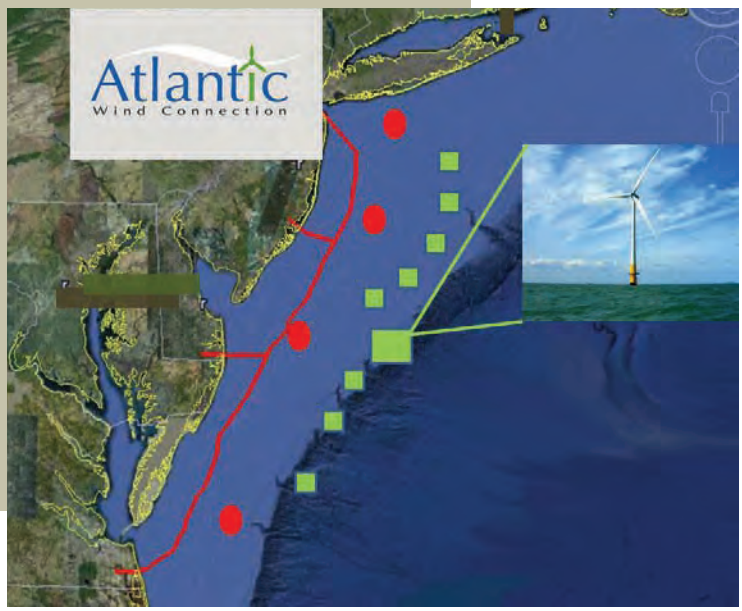
Offshore wind farms can provide clean energy to large load centers, such as New York City and Boston.[65] Currently, a significant amount of the power that travels to the East Coast from existing power lines is dirty coal power, and there is no guarantee that new transmission lines will be any different. NREL has found that an aggressive offshore wind scenario would eliminate the need to construct four 800-KV terrestrial transmission lines, including a total of 5,642 miles of transmission lines needed to meet clean energy goals by 2024.[66] This is the equivalent of 17 transmission lines running from New York City to Portland, Maine.[67] Transmission lines cost billions of dollars, cut through communities, disrupt wildlife habitat, fragment natural ecosystems, and could bring more dirty coal power to the region.

A case study by ISO-NE, the New England regional transmission organization, concluded that an aggressive offshore wind scenario would result in the most cost-effective use of new and existing transmission infrastructure.[68] New transmission will still be needed under all scenarios.[69]

A key initiative that could benefit offshore wind development and economics is the proposal for a transmission line along the Atlantic coast from Maine to Georgia. In 2010, a University of Delaware study demonstrated how this initiative could add more reliability to the transmission system and further "even out" wind fluctuations and shift power seasonally as needed.[70, 71] In October, 2010, Google and Good Energies agreed to invest in a proposed $5 billion 6,000 MW transmission line in the seabed 15 – 20 miles offshore. The first phase of the project, a 150-mile stretch from northern New Jersey to Rehoboth Beach, Delaware, may be in service by 2016, with the rest of the project scheduled for completion in 2021 or later.[72, 73]

THE PROPOSED GOOGLE ATLANTIC WIND CONNECTION

In October, 2010, Google and other investors proposed a $5 billion offshore transmission line with the first phase involving a 150-mile stretch from New Jersey to Delaware.



PUBLIC AND ENVIRONMENTAL HEALTH BENEFITS

Wind produces energy with almost no pollution, reducing a range of harmful emissions such as mercury, smog-forming pollution, and greenhouse gases. As described earlier, fossil fuels have significant negative public health and environmental impacts. Renewable energy, such as offshore wind, reduces these impacts with substantial economic benefits.

Based on federal government calculations, installing 54 GW of offshore wind energy would yield enormous benefits, including generating 172.8 million mWh of electricity annually,[74] enough energy to replace 52 coal-fired plants.[75] Generating an equivalent amount of electricity from fossil fuels would emit 97.2 million metric tons of carbon dioxide annually — the equivalent amount of carbon dioxide emitted by almost 17.7 million cars annually[76] and by 14.5 million average households.[77]

REPOWERING TRANSPORTATION

To truly kick our oil addiction, America must electrify the transportation sector. Cars and trucks account for more than 60 percent of U.S. oil consumption.[78] Offshore wind can play a critical role in transitioning our fossil fuel-based transportation system to clean energy. Large scale adoption of electric vehicles will increase our national demand for electricity, particularly at night, but offshore winds can help ensure that the power that fuels our cars is the cleanest possible. Projects across the United States and overseas are installing and testing "smart grid" and "vehicle to grid" technologies that enable the grid to "talk" with vehicle batteries when they're plugged in.[79] These technologies will help ensure vehicles are charged at the cleanest and lowest-cost times. Technology is also being tested to assess the potential of wind power to keep electric cars recharged, and to maximize the potential of electric cars to store wind and other renewable energy for electric sector use.

Siel via flickr.com

MANY ATLANTIC STATES ARE ALREADY CLEAN ENERGY LEADERS

Many Atlantic States have laid the groundwork for a clean energy economy by prioritizing pollution limits, energy efficiency, and various sources of renewable energy. Highlights of these important initiatives include:

- The Regional Greenhouse Gas Initiative (RGGI), the first successful mandatory market-based cap and trade emissions reduction program for carbon dioxide in the country;[80]
- New agreements to develop a Low Carbon Fuel Standard and a Transportation and Climate Initiative to reduce emissions from transportation;[81]
- State-mandated renewable energy portfolio standards;[82]
- Energy efficiency program advancements, where five of the Northeast states rank in the top 10 nationally;[83]
- Major incentives for solar energy, especially in New Jersey which has been called "the Solar Capital of the East;"[84]
- An expanding regional onshore wind market, particularly in New York which has 1,369 MW of onshore wind energy operating or under construction;[85] and
- A wide range of biomass energy projects, especially in Florida, Georgia, and South Carolina.[86]

These forward-thinking energy policies and programs provide a critical foundation for dramatically increasing offshore wind deployment in the Atlantic states, diversifying the region's energy portfolio and moving away from fossil fuel dependence.[87]

EUROPE AND CHINA: SUCCESS WITH OFFSHORE WIND

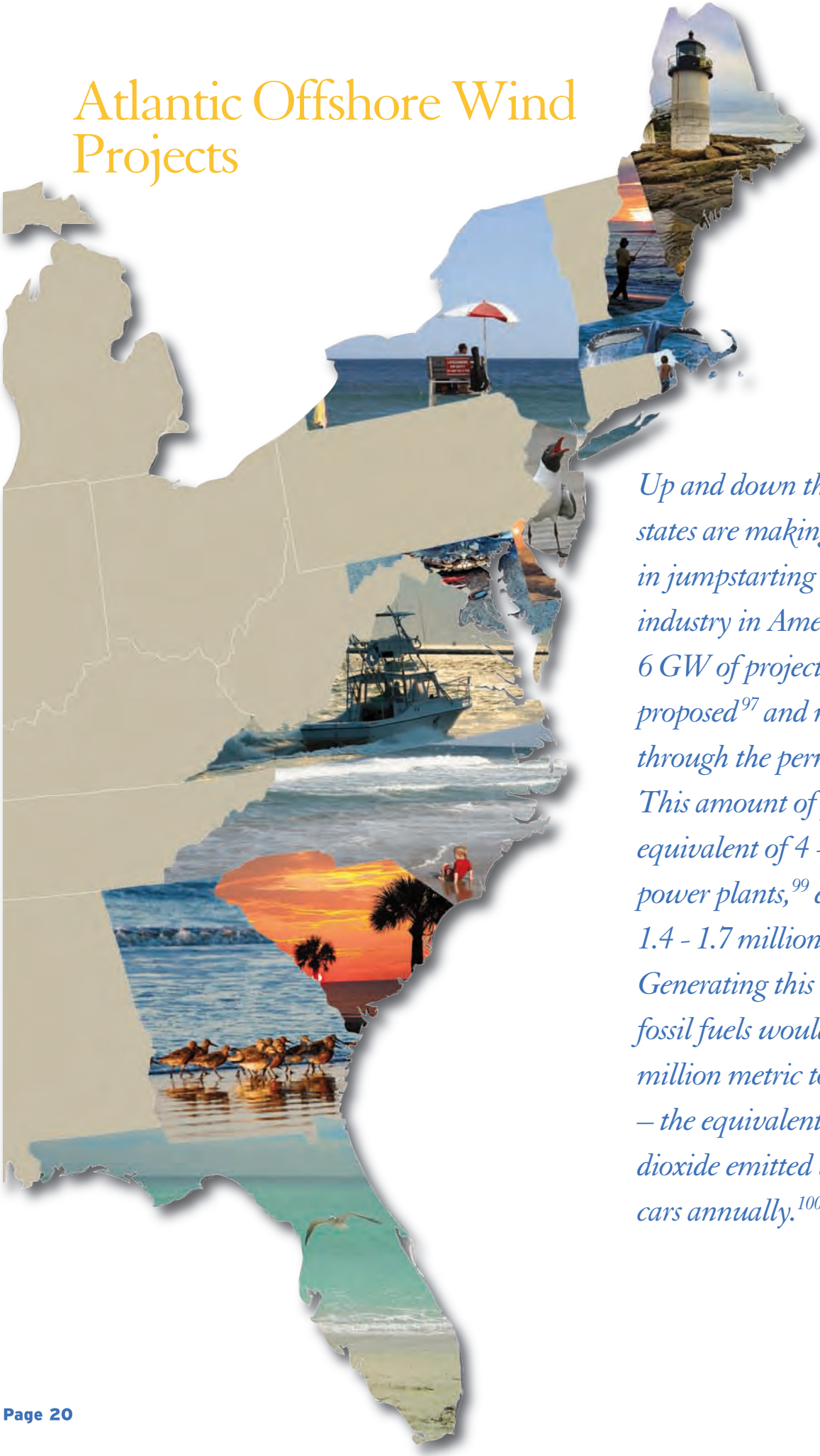
In Europe, 948 offshore turbines have been installed at 43 wind farms and are producing over 2,300 MW, enough electricity to power 450,000 – 600,000 homes.[88] Furthermore, a total of 100,000 MW of offshore wind is in the planning stages. If realized, these projects would produce 10 percent of the European Union's electricity supply, power nearly 30 million homes, and avoid 200 million tons of carbon dioxide emissions each year. The European Union and the European Wind Energy Association (EWEA) have set a target of 40 GW of offshore wind by 2020 and 150 GW by 2030.[89]

DWIA and GWEC

EWEA estimates that the European offshore wind industry could reach 40,000 – 55,000 MW of cumulative capacity by 2020.[90] Annual investments in the European economy from offshore wind power are expected to increase from $4.23 billion in 2011 to $11.29 billion in 2020.[91] The offshore wind industry employed 34,232 people in 2010 and is projected to provide 293,746 jobs across the European Union by 2030.[92]

China is not far behind: In 2007, a 1.5 MW test turbine was installed, and in May, 2010 its first offshore wind project, the 102 MW Donghai Bridge Offshore Wind Farm, was completed. Domestic energy companies in China are expected to soon submit responses to a request from China to build four additional offshore wind projects with an estimated combined capacity of 1,000 MW.[93] By 2020, it is predicted that China will have spent $100 billion for 30 GW of offshore wind installed capacity.[94] China has established a target of 30 GW of offshore wind by 2020,[95] but recent projections indicate that it may well exceed this target earlier than 2020.[96]

Atlantic Offshore Wind Projects



Up and down the coast, the Atlantic states are making significant progress in jumpstarting the offshore wind industry in America. Approximately 6 GW of projects have been proposed[97] and many are advancing[98] through the permitting process. This amount of power is the equivalent of 4 - 6 average coal-fired power plants,[99] enough to power 1.4 - 1.7 million average U.S. homes. Generating this much electricity from fossil fuels would emit 9 - 10.8 million metric tons of carbon dioxide – the equivalent amount of carbon dioxide emitted by 1.6 - 2.0 million cars annually.[100]

FIGURE 4: ATLANTIC OFFSHORE WIND PROJECTS

STATE	PROPOSED PROJECTS **Proposed projects** have been publicly announced and are at a variety of initial stages in the planning process. MW is listed nameplate capacity.	ADVANCING PROJECTS **Advancing projects** meet all of the criteria for proposed projects, and have taken additional steps, including leasing, permitting, power contracts, and other concrete steps toward project completion.
MAINE		Demonstration Offshore Wind Farm – 25MW Monhegan Island deep water testing site – 110 KW
NEW HAMPSHIRE	1 test turbine – 10KW	
MASSACHUSETTS	Hull Offshore Wind Energy Project – 12 MW	Cape Wind – 468 MW
RHODE ISLAND	Rhode Island Sound Wind Farm – 384 MW	Block Island Wind Farm – 28.8 MW
NEW YORK		Long Island-NYC Offshore Wind Project – 350 MW to 700 MW
NEW JERSEY	OffshoreMW – 350 MW	Garden State Offshore Energy Project – 350 MW Fisherman's Energy Atlantic City – 20 MW Fisherman's Energy Wind Farm – 330 MW NRG Bluewater Wind Project – 350 MW OffshoreMW – 350 MW
DELAWARE		NRG Bluewater Wind Park – 200 MW to 600 MW
MARYLAND	Ocean City Wind Farm – 600 MW	
VIRGINIA	Apex Hampton Roads Wind Project – 500 MW Seawind Renewable Energy Corp. Wind Farm – 400 - 800 MW Hampton Roads Demonstration Project – 3 test turbines	
NORTH CAROLINA	Outer Banks Ocean Energy Project – 600 MW	
SOUTH CAROLINA	Palmetto Wind Project, Clemson University wind monitoring project	
GEORGIA	Southern Winds Project – exploratory lease application for monitoring towers	
FLORIDA	No current offshore wind projects	
TOTALS:	2.84 – 3.25 GW	2.47 – 3.22 GW
GRAND TOTAL:	5.32 – 6.47 GW	

The calculations in this chart are based on the offshore wind projects that are listed in the individual state summaries found on pgs. 32 - 53.

Federal and Regional Initiatives and Policies

FEDERAL INITIATIVES

The Obama Administration has taken several important steps to advance offshore wind in the Atlantic Ocean, including:

- Dramatically increasing investments in clean energy, including funding for offshore wind initiatives and research.[101]
- Providing leadership by offering a strategic vision on how the offshore wind industry can become a major U.S. industry, and setting goals for wind development in general and offshore wind specifically.[102]
- Fostering regional coordination, including the establishment of the Atlantic Offshore Wind Energy Consortium, to coordinate the efforts of coastal states and the federal government to develop offshore wind energy. The Administration has also pledged to establish a new Atlantic offshore wind office to help states coordinate and expedite offshore wind projects off the Atlantic Coast and encourage increased regional cooperation.[103]
- Working to improve the offshore wind permitting process. In the wake of the BP oil disaster, the Department of the Interior tasked the new Bureau of Ocean Energy Management, Regulation, and Enforcement (BOEMRE) to oversee the development of energy and minerals on the Outer Continental Shelf.[104, 105] In November, 2010, Secretary Salazar announced a series of steps that will be pursued in the next year to shorten the project permitting timeline while ensuring thorough environmental review. A federal and state collaborative effort will identify high priority offshore wind areas in federal waters off of 6 – 8 Atlantic states, with a new inter-agency working group focused on ensuring that sensitive resources are considered and protected. The administration will then lease these high-potential, low-conflict areas to wind developers through a quicker process, shaving potentially a year or two off the current timeline. Projects will still require a full Environmental Impact Statement and other permits for final approval.[106]
- Approval of key leases, including Cape Wind and wind monitoring towers.[107]
- Issuing an Executive Order establishing the National Ocean Council (NOC), which is dedicated to overseeing and implementing Task Force recommendations to protect, maintain, and restore the health and biodiversity of the oceans, coast, and Great Lakes. The NOC will facilitate the development of ecosystem-based coastal and marine spatial plans, which are intended to broaden the scope of considerations involved in existing permitting for competing offshore uses.[108]
- Establishing the Department of Energy's Offshore Wind Innovation and Demonstration (OSWInD) Initiative — a set of planned activities, subject to appropriations, that will promote and accelerate responsible commercial offshore wind development in the U.S. by addressing two critical objectives: lowering the cost of energy produced by offshore wind turbines and reducing the timeline for deploying wind turbines.

In 2010, Congress considered but did not take final action on several offshore energy initiatives, including:

- **The Program for Offshore Wind Energy Research and Development (POWERED) Act of 2010:** Introduced in April, 2010, by a group of bipartisan U.S. Senators, the act would provide grants to conduct research and analysis on implementation of offshore wind power projects, expand incentives for offshore wind development, and require the U.S. DOE to develop a comprehensive roadmap to overcome the technical and regulatory barriers to deployment of offshore wind.[109]
- **Carper-Snowe-Brown-Collins Offshore Wind Bill:** Introduced in the Senate in May, 2010, this bipartisan bill would provide the offshore wind industry with enhanced stability by extending production and investment tax credits for offshore wind until 2020.[110]
- **House amendments to the "Spill Bill":** In response to the BP oil disaster, the House passed the Consolidated Land, Energy and Aquatic Resources (CLEAR) Act (H.R. 3534), which addresses oil drilling directly but also amends existing Outer Continental Shelf (OCS) leasing regulations, requiring "a more balanced approach to energy development that acknowledges the other resources of the OCS, and to emphasize that energy-related activities should be conducted in a manner that minimizes impacts to the marine, coastal, and human environments."[111] A companion Senate bill was drafted in August, 2010 and awaits action by the Senate.[112]

Dong Energy

REGIONAL INITIATIVES

The Atlantic States have formed various regional offshore wind and related initiatives, including:

- **Atlantic Offshore Wind Energy Consortium:** In June, 2010, Secretary Salazar signed a Memorandum of Understanding with 10 Atlantic Governors to create the Atlantic Offshore Wind Energy Consortium, a formal partnership to advance the region's offshore wind efforts by facilitating cooperation on critical issues such as transmission, improving market demand for offshore wind, and creating local job opportunities.[113]
- **The U.S. Offshore Wind Collaborative:** A nonprofit working to bring states, federal agencies, industry, and the environmental community to the table to advance a sustainable offshore wind industry in America.[114]
- **The American Wind Energy Association (AWEA) Offshore Wind Working Group:** An AWEA subcommittee that coordinates information exchange among AWEA members and stakeholders.[115]
- **Offshore Wind Development Coalition:** In July, 2010, OffshoreWindDC was founded in cooperation with AWEA and a group of seven U.S. offshore wind developers to promote offshore wind energy through advocacy and education.[116]
- **Regional Ocean Councils:** Three regional councils exist to collaboratively address the region's priority ocean issues, such as offshore wind development, including: Northeast Regional Ocean Council; Mid-Atlantic Regional Ocean Council; and the South Atlantic Alliance.[117]

- **Regional Ocean Observing Systems:** The Northeastern Regional Association of Coastal Ocean Observing Systems (NERACOOS), Mid-Atlantic Coastal Ocean Observing Regional Association (MACOORA), and the Southeast Coastal Ocean Observing Regional Association (SECOORA) provide the primary framework to coordinate ocean observing activities and are responsible for the design and coordinated operation of sub-regional coastal ocean observing systems within their respective regions.[118]
- **Governors' Wind Energy Coalition:** A bipartisan coalition of 29 governors, which offers recommendations to Congress on offshore wind development issues, including permitting processes and transmission infrastructure.[119]

Potential Fish and Wildlife Impacts

The Atlantic Ocean and its estuaries and coastal areas are home to a rich array of fish and wildlife species. While extensive research in Europe reveals that offshore wind projects do not appear to have long-term or large-scale impacts,[120] major data gaps for the Atlantic Ocean still exist and site-specific impacts need to be evaluated. A coordinated, comprehensive, and well-funded effort is needed to address these gaps and improve the permitting process. Such an effort would better inform the public and decision-makers on the extent of potential environmental impacts, reduce research costs and environmental requirements for project developers, increase community acceptance, and reduce risks to financial investors. Currently, the burden for this research has unfairly fallen on the first generation of individual project developers.[121]

The U.S. Department of Energy's "20% Wind Energy By 2030" report discusses Europe's major scientific effort to study the environmental and human effects from installed offshore wind facilities, including over 280 research studies and assessments currently underway. The report concludes:

> **Denmark has conducted the most extensive before-after-control-impact study in the world. The most recent environmental monitoring program from this study, spanning more than five years, concluded that none of the potential ecological risks appear to have long-term or large-scale impacts (DEA 2006).[122]**

European studies are useful, but different conditions do exist in the Atlantic. As with any major construction activity, sound science should guide the development of siting standards to help developers avoid, minimize, and mitigate direct and indirect impacts of wind energy on our ocean resources. Atlantic Coast habitats and environmental resources that may be directly or indirectly impacted by offshore wind include seafloor habitats, coastal habitats, fishery resources, marine mammals, marine and coastal birds, and bats.[123]

Fishery resources can be impacted by offshore space-use conflicts, artificial reef effects, habitat alteration, noise from pile driving, and effects from electromagnetic fields.[124] Benthic studies have found that the addition of hard structures associated with wind turbine monopoles in the North Sea actually increase local aquatic diversity.[125] The artificial reef effect from offshore wind is likely to change localized fisheries, making them more or less productive for fishermen.[126] While more studies are needed, certain approaches to mitigate impacts on fishery resources can be utilized. Bubble-curtains, air gaps, and the quietest equipment and techniques can potentially reduce the temporary and localized noise impacts from pile driving. Habitat alteration from power cables could be avoided through alternative routes or minimized through horizontal directional drilling, while burying cables and properly shielding them could help reduce electromagnetic fields.[127]

Baseline information that would help predict the presence and absence of certain marine mammals off the Atlantic Coast remains limited, and increasing our understanding of key species' life history traits and critical habitat is important. As to the ability of offshore wind energy development to coexist with marine mammals, some post-construction monitoring studies in Europe, primarily the North Hoyle offshore wind farm, are finding "no measurable indication that any significant environment impact has occurred" and that construction

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Profile

TOM FOTE

"As a recreational angler, and Legislative Director of the Jersey Coast Anglers Association, I support offshore wind development in the Atlantic Ocean. Having lived and fished in New York and New Jersey all my life, I know how harmful this country's fossil fuel addiction has been for fish and all the ocean and coastal wildlife. I have worked for years to get toxins out of our waters. Now climate change is an additional threat that will acidify our ocean, making it even harder to sustain healthy populations of key fisheries, such as weakfish, striped bass, and the forage species that all predators depend on. While offshore wind farms will have some impact on fish, it will also provide structure (artificial reefs) for marine life to grow on. The impact on fish and marine resources will be minor compared to what fossil fuels are doing to our marine ecosystem. All you have to do is look at the oil spill disaster in the Gulf to prove this point. We need to find renewable alternatives to oil that will not destroy the marine ecosystem."

Tom Fote is a retired Army Captain and disabled Vietnam veteran. Tom's personal experiences with Agent Orange inspired him to make a lifelong commitment to environmental issues. Tom has been active for over 30 years with the Jersey Coast Anglers Association and serves on the Board of Directors of the New Jersey Federation of Sportsman Clubs. He is an appointed member of the Atlantic States Marine Fisheries Commission.

impacts dissipate within a year or two. Nevertheless, we know that anthropogenic sound can temporarily or permanently impair marine mammals' vitally important ability to process and use sound. More information is needed on potential effects from the noise produced from construction and operation of offshore wind, as well as the nonacoustic effects of facility footprint and infrastructure on migration.[128]

Much like onshore wind development, there is the potential for Atlantic offshore wind turbines to impact marine and coastal birds and bats, including millions of migratory birds that traverse the Atlantic Flyway, pelagic species (petrels, shearwaters, etc), and those that nest and winter along the Atlantic Coast. Expanding our knowledge about the seasonal distribution and abundance of key species will be critical to understanding the potential risk of collision or behavioral change from offshore wind development. There is

Getty Images

some evidence of localized coastal wind turbines placed near tern colonies resulting in a surprisingly high avian mortality rate. Avian studies in the North Sea have found indirect impacts through habitat loss or fragmentation. While some seabirds return to the offshore wind turbine matrix post-construction, studies indicate that others, such as Long-tailed Ducks, will no longer utilize the area. This "avoidance" can include displacement from foraging areas and disruption of daily or seasonal movement patterns.

Beyond research, another key siting priority is to ensure that decisions on offshore wind are part of the federal and state governments' vision for the sustainable use of their coastal and marine resources. Under the President's recent Executive Order on ocean policy, a new legal framework has been established for coastal and marine spatial planning, one that calls for an unprecedented degree of collaboration among federal and state agencies. This is a crucial opportunity for coordination of wind energy development with the many other uses of coastal and marine resources. Federal and state government agencies participating in this planning framework should not delay current and proposed wind projects. Instead, they should work collaboratively with other key stakeholders to guide offshore wind development in a manner that protects key interests including fish and wildlife resources.

Finally, it is crucial that policy makers create a workable framework for siting individual projects. It must focus on minimizing risks to coastal and marine habitats, fish and wildlife, and other key resources while allowing flexibility for wind developers to design unique avoidance, minimization, and mitigation measures to address site-specific conditions. Key features of such a framework should:

- Give priority to areas where current state or federal landscape-scale analyses indicate:
  - minimal impacts on fish and wildlife and other key resources;
  - a strong and consistent wind resource; and
  - opportunities to connect to the grid through an existing onshore substation or through the proposed Atlantic Wind Connection transmission line.
- Minimize wind siting in biologically-sensitive areas, such as:
  - shoals, boulder reefs, and rocky cobble areas which support large aggregations of fish and wildlife populations;
  - the mouths of inlets — hot-spots for daily and seasonal fish and wildlife movement between estuarine and near-shore ecosystems;
  - threatened or endangered species habitats; and
  - areas critical to migration, breeding, wintering, or other sensitive life stages needed to sustain healthy populations of wildlife.
- Steer projects further offshore, thus helping avoid environmental and other potential conflicts, such as military needs and navigation. In general, avian species abundance and diversity declines further from the shoreline.[129]
- Utilize best management practices and mitigation strategies to minimize project risks.
- Establish comprehensive monitoring programs that facilitate an adaptive management approach to projects and support continuous improvement in project development.
- Ensure that funds are available to address unavoidable impacts on fish and wildlife, including cumulative impacts.
- Consider future shifts in wildlife geographic ranges and other ecological changes that will result from climate change.
- Gather information on cumulative impacts and integrate such information into decision-making processes.
- Address potential impacts on commercial and recreation fisheries, transportation routes and vessel traffic safety, scenic resources, coastal communities, historic and cultural resources (including shipwrecks), radar, military readiness, and other technical challenges.
- Ensure a meaningful opportunity for stakeholders to comment and shape proposals.

CLIMATE CHANGE — THE DEATH KNELL FOR RED KNOTS?

Herb Houghton

The Red Knot, an amazing shorebird with only a 20 inch wingspan, makes one of the longest annual migrations in the animal kingdom: 9,300 miles from South America to Northern Canada. Red Knot populations have dramatically declined over the last 30 years, from 100,000 - 150,000 to possibly below 18,000 - 30,000.[130] After a long migratory flight over the Atlantic, a critical stop on their route is the Delaware Bay. Red Knots arrive on the bay emaciated, even breaking down their organs and muscle tissue to muster the energy to fly over the Atlantic. Feasting on the Delaware Bay's fat-rich horseshoe crab eggs, Red Knots can double their body weight in less than two weeks before continuing their journey north. To ensure the availability of this food source, New Jersey and surrounding states have restricted or eliminated the harvest of horseshoe crabs.[131]

However, according to the U.S. Fish and Wildlife Service, this recovery — and the survival of many other shorebirds — is jeopardized by the cumulative impacts of climate change.[132] Climate change is likely to devastate the critical Delaware Bay stopover, destroying beaches used by both Red Knots and spawning horseshoe crabs. A recent U.S. Geological Survey study has found that climate change appears to have already played a role in reducing horseshoe crab numbers, and sea-level rise and water temperature fluctuations are predicted to cause further population declines.[133] Finally, the Red Knot's breeding habitat will be fundamentally altered by the rapid shifts in temperature and precipitation patterns affecting the Arctic and South America.[134]

Herb Houghton

Red knots could be exposed to some additional risk by offshore wind farms during migration in the Atlantic.[135] Major research is currently being funded by the federal government to assess potential interactions between Red Knots and offshore wind facilities.[136] This research will help lead to changes in facility siting and use of mitigation systems and other technologies to minimize impacts to Red Knots and other wildlife species.

Other Obstacles to Offshore Wind

Dong Energy

The January, 2010, U.S. Department of Energy's "20% by 2030" report makes clear that the offshore wind technology exists and is being deployed in other countries.[137] Major barriers that can be overcome with political support include:

- **High Initial Capital Costs and Market Structure:** In the current market, largely as a result of policies that support and subsidize fossil fuel and nuclear power, offshore wind has one significant disadvantage — relatively high capital construction costs.[138] According to the International Energy Agency 2010 World Energy Outlook, fossil-fuel government subsidies totaled $312 billion in 2009 compared to $57 billion for renewables.[139] While the wind is free, the costs associated with wind turbine and platform construction and fabrication are currently high. The lack of a long-term predictable revenue stream to finance these costs severely restrains the development of capital-intensive offshore wind projects.[140] Research and development investments like those proposed in the U.S. DOE strategy (see p. 22) will help bring these costs down over time.
- **Transmission Lines:** While construction costs for transmission lines associated with offshore wind projects are expensive, alternative scenarios of building transmission lines to import onshore wind from the Midwest and Great Plains are more expensive. Regional coordination on offshore wind can decrease overall costs associated with transmission lines.[141]
- **Regulatory Structure:** Despite the recent approval of the Cape Wind project and efforts to streamline the federal permitting process, it is clear that the permitting of offshore wind facilities must be significantly improved. The U.S. Department of Energy has stated: "Offshore wind projects face uncertain permitting processes that substantially increase the financial risk faced by potential project developers and financiers and that discourage investment both in projects and in the development of supply chain and other supporting infrastructure." These challenges are presented by both federal and state laws and authorities.[142]
- **Lack of Political Support:** While many excellent initiatives have been launched to support offshore wind, no clear regional goal has been established for offshore wind in the Atlantic Ocean, and there is no diverse regional advocacy campaign working every day to ensure that this goal is met.[143]

UNIVERSITY OF MAINE LEADS ON DEEPWATER WIND TECHNOLOGY

AEWC Advanced Structures and Composites Center

In the past year, AEWC Advanced Structures and Composites Center, located at the University of Maine, has been awarded nearly $40 million in funding to pursue research in deep-water offshore wind energy technology.

The Center is currently constructing a 37,000 sq. ft. expansion that will make the University of Maine the only laboratory in the United States to include complete development capabilities: designing, prototyping, and performance characterization of large structural hybrid composite and nanocomposite components for the deepwater offshore wind energy industry. All structural components for floating wind turbines will be studied including wind blades, towers, anchors, and foundation systems.

"Maine is ready to lead on deep-water offshore wind technology. Our new 37,000 sq. ft. laboratory will be critical for this effort, but we are also taking this technology out of the lab and out to sea. We are working hard to ensure that the first ocean-based wind turbine will be installed off Monhegan Island in 2012, followed by one turbine 20 miles offshore in 2013, and then several turbines in a wind farm also located 20 miles offshore in 2016. These initial wind turbines will provide data on the durability of the materials, the designs, the environmental impact, and other factors that will fine-tune offshore wind development as it moves forward."

Dr. Habib Dagher, P.E., Director, University of Maine Advanced Structures & Composites Center, standing in front of the structural testing lab in Orono, Maine.

Next Steps: Realizing the Potential of Offshore Wind

"You may delay, but time will not."

Benjamin Franklin[144]

A man goes out on the beach and sees that it is covered with starfish that have washed up in the tide. A little boy is walking along, picking them up and throwing them back into the water.

'What are you doing, son?' the man asks. 'You see how many starfish there are? You'll never make a difference.'

The boy paused thoughtfully, picked up another starfish, and threw it into the ocean.

'It sure made a difference to that one,' he said.

Hawaiian parable[145]

In the race to become a world leader in offshore wind, Atlantic states already lag behind Europe and China. The race, however, is far from over. As documented in this report, states up and down the Atlantic coast have just joined the race: wind monitoring buoys are being deployed in South Carolina; Cape Wind in Massachusetts has its critical federal approvals; and Maine has broken ground on a deepwater testing facility.

Just like the boy in the parable, we must start somewhere on this long journey.

Offshore wind is a unique resource that holds the potential to fundamentally alter the way Atlantic state residents power their homes and businesses and fuel their cars — creating jobs, energy independence, less pollution, economic growth, and stable energy prices well into the future.

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There are many offshore wind initiatives that need to occur to realize the full potential of this technology in the Atlantic Ocean, but four immediate priorities rise to the top:

1. **Accelerate the transition from fossil fuels to clean energy.** The region's economic and environmental future depends on increasing energy efficiency and the use of renewable energy technologies.

2. **Jumpstart the offshore wind industry and individual projects in the Atlantic Ocean by:**

- Improving the offshore wind permitting process;
- Supporting policies and investments that spur offshore wind development;
- Identifying and reviewing high priority zones off the Atlantic Coast with minimal conflict to the environment or to other ocean users that can be prioritized for quicker permitting;
- Increasing research on offshore wind technologies and their associated benefits and risks, including wildlife and fishing impacts;
- Advancing efforts to promote jobs from this industry, especially manufacturing and other high-paying jobs;
- Promoting appropriately-sited offshore wind farms;
- Coordinating regional planning and economic development, including ports, vessels, transmission investment, and other shared opportunities; and
- Educating policymakers and the public about the benefits of offshore wind.

3. **Ensure the protection of the Atlantic Ocean and its precious resources.** While each Atlantic state is unique in terms of the availability of offshore wind, local politics, and mix of energy sources, the one constant should be a comprehensive effort to protect the Atlantic Ocean as a priceless and connected ecosystem. Offshore wind can help protect the Atlantic Ocean from climate change and studies show that projects can be sited to avoid large-scale and long-term ecological impacts.

Dong Energy

4. **Create a diverse and powerful Atlantic offshore wind network.** In order to realize the full potential of offshore wind, advocacy organizations (including labor representatives, conservation groups, community groups, commercial and recreational fisherman, consumer organizations, and businesses) must coordinate locally and nationally to create a clear regional vision for Atlantic offshore wind and create the political power needed to advance key policies and projects.

The National Wildlife Federation and our partner organizations are committed to building on current momentum by mobilizing support for offshore wind incentives, research, and individual projects. For the latest on National Wildlife Federation's Offshore Wind Campaign, contact: Catherine Bowes (802-272-1243, bowes@nwf.org) or visit www.nwf.org/offshorewind.

Environment America and NWF have joined forces to advance offshore wind. For more information about Environment America's offshore wind initiatives, contact: Matt Elliot (609-392-5151, melliott@environmentnewjersey.org) or visit www.environmentamerica.org.

State Summaries

Maine

TOTAL WIND POTENTIAL AND TARGETS

The State of Maine has estimated the Gulf of Maine's offshore wind resource to be 149 GW within 50 nautical miles of the coast.[147] This figure has been supported by the 2010 NREL Assessment, identifying 156.6 GW of offshore wind within 50 nautical miles of the coast.[148] Maine has implemented legislation that sets an ambitious target of producing 5 GW of electricity from offshore wind turbines by 2030.[149] The University of Maine estimates that the $20 billion expenditure necessary to develop this 5 GW of deep-water wind off of Maine's coast would generate about 16,700 new or retained jobs per year for 20 years.[150] Maine already has a head start: Maine leads New England in development of onshore wind with 266 MW currently operating or under construction, with a goal of 2,000 MW by 2015.[151]

PROJECTS

Three deep-water wind demonstration sites:

- Following the implementation of the Governor's Ocean Energy Task Force into state law, the Maine Department of Conservation identified three deep-water wind testing sites in the Gulf of Maine: Boon Island, Damariscove Island, and Monhegan Island. Each demonstration site is limited to two turbines.
- The Monhegan Island project was awarded to the University of Maine and the DeepCWind consortium for the construction of two wind turbines totaling 110 KW, with proposed completion in 2011. The remaining two test sites are open to wind developers.[152]
- Offshore wind site for up to 25 MW: A competitive bidding process began in September, 2010 with the Maine Public Utilities Commission issuing a request for proposals for long-term contracting from deep-water offshore wind energy pilot projects of up to 25 MW, and/or tidal demonstration projects of up to 5 MW.[153] Proposals are due in May, 2011.[154]

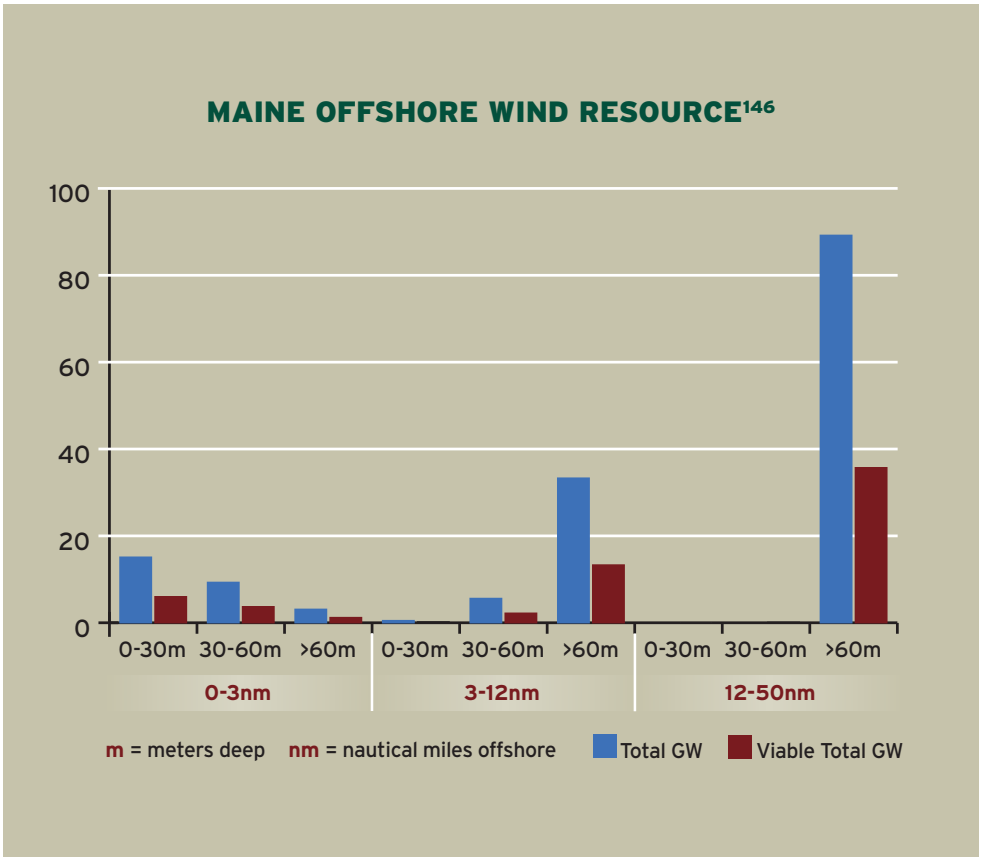
POLICY & POLITICAL ENVIRONMENT

State Support

- June, 2010: Voters approved a $26.5 million bond package which allocates $10 million to the University of Maine for the development of a deep-water wind energy test site located 20 – 50 miles offshore, and generates $24.5 million in match funding from federal and other sources for offshore wind development.[155]
- The Governor's Ocean Energy Task Force issued a series of recommendations that were enacted into state law (LD1810), which streamlined the state permitting and leasing process for offshore wind resource development.[156] An additional joint state-federal Task Force has been formed between the Bureau of Ocean Energy Management, Regulation, and Enforcement and the State of Maine to facilitate coordination between local, state, tribal, and federal stakeholders.[157]
- A wide variety of businesses, academic institutions, and other non-profit organizations have formed the Maine Wind Industry Initiative, a collaboration focused on developing the supply chain for all aspects of wind resource development in the state.[158]

Federal Support

- October, 2009: U.S. DOE awarded a $8 million grant through the



Profile

JAN BLITTERSDORF

"To achieve the Department of Energy goal of producing 20% of our electricity from wind by 2030, we must create stable, long-term policies that get people back to work, rebuild our manufacturing base and meet the climate change imperative. If we do this successfully, the wind industry alone could create 500,000 new jobs.

Atlantic states have great wind potential on-shore and off-shore. Last decade, many European countries were ahead of the United States on land-based wind. Today, the United States has caught up to, and in some cases surpassed, their European counterparts. It is time we do the same for offshore wind.

To advance this common agenda, clean energy advocates must work together, including initiatives like the Wind Energy and Wildlife Institute which NRG Systems helped create."

Jan Blittersdorf, President and CEO of NRG Systems, has been in the wind industry for 20 years. NRG Systems is a leading manufacturer of wind measurement equipment for the global wind energy industry. Founded in 1982, the company's products are on every continent — in 135 countries. NRG Systems employs 110 people at its LEED-Gold headquarters in Hinesburg, Vermont.

American Recovery and Reinvestment Act (ARRA) to the University of Maine-led consortium DeepCWind for deployment of the deep-water offshore wind test center at Monhegan Island, construction of an Offshore Wind Laboratory, and deployment of a testing site in New Hampshire.[159]

- January, 2010: The U.S. Commerce Department's National Institute of Standards and Technology (NIST) awarded a $12.4 million grant to the University of Maine to build the Advanced Nanocomposites in Renewable Energy Laboratory — a first-of-its-kind facility for research and development of deep-water offshore wind technology.[160]
- February, 2010: The Federal Department of Transportation awarded a $14 million grant to revitalize Maine's ports and position them to move wind turbines and other clean technology freight.[161]
- June, 2010: U.S. DOE awarded a $20 million grant to further state efforts to develop deep-water offshore wind technology.[162]

Academic Partners and Support

- University of Maine's Advanced Structures and Composites Center is widely supported at both state and federal levels for launching offshore wind technology and testing in Maine.
- DeepCWind, a University of Maine led-consortium of over 30 academic institutions, industry leaders, utility companies, and nonprofit organizations, will construct the testing site at Monhegan Island and build a cutting-edge offshore wind laboratory.
- Bird and bat impact study: University of Maine and the New Jersey Audubon Society have collaborated to monitor the migratory patterns of birds and bats at the Monhegan Island test site. The study runs from July to December, 2010.[163]

Profile

JACK CLARKE

"The consequences of this country's addiction to fossil fuel are many — climate change, oil spills, strip mining, and air pollution to name a few. Wildlife is one of the biggest casualties in this dire situation. For instance, rising sea levels caused by warming will flood low-lying barrier beaches and islands that we all enjoy and that serve as critical habitat for coastal birds, including the endangered roseate tern and threatened piping plover.

The consequences of climate warming compel us to increase energy conservation and rapidly deploy renewable energy, including offshore wind built in a responsible way to minimize the impact on the environment. The benefits and detriments of offshore wind projects such as Cape Wind must be balanced against the significant threats to Nantucket Sound posed by fossil fuel use and rapid climate change. We are proud to say that Cape Wind meets those requirements, including extensive monitoring of wildlife and habitat, creating a model for the nation. We are hopeful that future offshore wind projects can meet and exceed these high standards for clean energy productions and wildlife protection."

Jack Clarke is the Director of Public Policy & Government Relations at Mass Audubon, the largest conservation organization in New England. Founded in 1896, Mass Audubon has 100,000 members, cares for 34,000 acres of conservation land, provides educational programs for 225,000 children and adults annually, and advocates for sound environmental policies at local, state, and federal levels. He is the former Chair of the U.S. Offshore Wind Collaborative.

New Hampshire

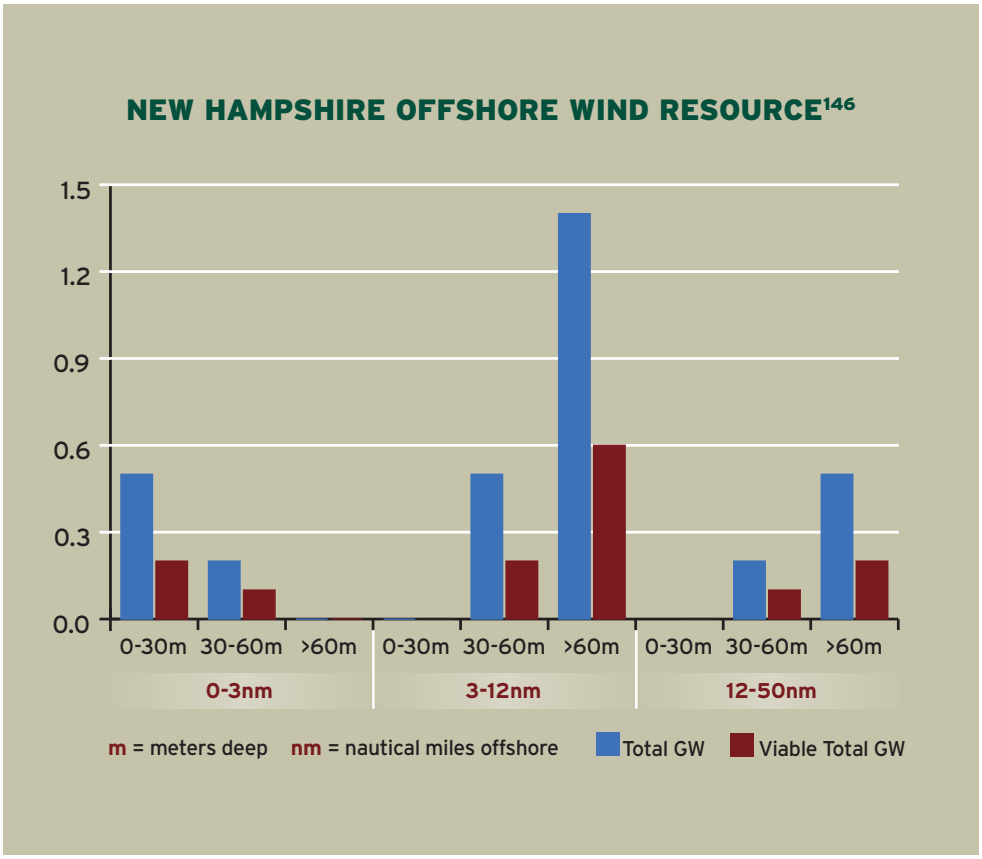
Michael D. D'Agostino

TOTAL WIND POTENTIAL AND TARGETS

The 2010 NREL Assessment lists New Hampshire's offshore wind resource at 3.4 GW within 50 nautical miles of the coast.[164] The University of New Hampshire has been an active participant in offshore wind research.

PROJECTS

One small-scale, 10 KW test turbine will be installed on an existing mooring grid just south of the Isle of Shoals in waters bordering Maine. The project is led by the University of New Hampshire's Center for Ocean Renewable Energy (CORE), in partnership with DeepCWind, and is scheduled to be completed by the end of 2010.



POLICY & POLITICAL ENVIRONMENT

Federal Support

- October, 2009: $700,000 was awarded to the University of New Hampshire's CORE from the $8 million DOE grant awarded to the DeepCWind consortium.[165]

iStockphoto, www.istockphoto.com

Massachusetts

TOTAL WIND POTENTIAL AND TARGETS

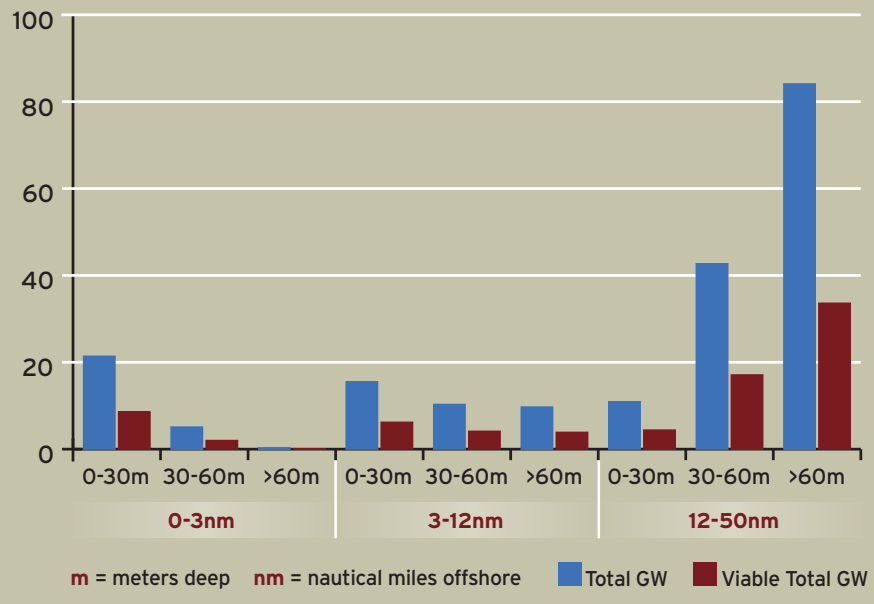
Massachusetts estimates that state and federal waters provide over 6 GW of technical potential for offshore wind in the state.[166] The 2010 NREL Assessment lists Massachusetts' offshore wind resource at 200 GW within 50 nautical miles of the coast.[167] In January, 2009, Governor Deval Patrick set a goal of developing 2 GW of onshore and offshore wind capacity by 2020.[168]

PROJECTS

Cape Wind Energy Project

- A 130-turbine wind farm in 25 square miles of the Nantucket Sound with a maximum generation capacity of 468 MW (average of 182 MW), expected to be operational in 2013.[169]
- On October 6, 2010, the Department of the Interior and Cape Wind Associates (CWA) signed a 28-year lease for 25 square miles of federal waters off Cape Cod and the Islands.[170] This makes Cape Wind the first utility-scale commercial wind farm to be leased in federal waters on the U.S. Outer Continental Shelf.
- Cape Wind has received strong environmental support from an array of conservation organizations, including Mass Audubon, Conservation Law Foundation, Union of Concerned Scientists, Environmental League of Massachusetts, Environment Massachusetts, Clean Power Now, and many others. The U.S. Army Corps of Engineers submitted a Draft Environmental Impact Statement detailing the public and environmental benefits of the project.[171] The former Minerals Management Service (MMS) issued a draft Environmental Impact Statement for the project in 2008 and a favorable Final Environmental Impact Statement in 2009.
- After intervention from the state Attorney General, National Grid and Cape Wind agreed to a revised 15-year Power Purchase Agreement whereby National Grid will pay 18.7 cents/kWh for half of the electricity and associated Renewable Energy Certificates, ISO-New England Forward Capacity Market value, and other attributes produced by the project. In November, the Department of Public Utilities approved the Power Purchase Agreement for 50 percent of Cape Wind's power and declined to approve a separate contract dealing with the remaining 50 percent because that contract was not yet final.[172]
- Conservation Law Foundation, Union of Concerned Scientists, Natural Resources Defense Council, and Clean Power Now intervened in the proceeding in support of the Power Purchase Agreement, introducing extensive expert testimony regarding the considerable economic benefits from Cape Wind's displacement of some of the most expensive and dirty fossil fuel-fired generation in the region.
- Wal-Mart Stores, Inc. intervened in the Department of Public Utilities proceeding in opposition to National Grid's Power Purchase Agreement with Cape Wind but did not actively participate and filed no post-hearing briefings (thus assuming a neutral posture in the proceeding).[173] Transcanada Power has also challenged the Power Purchase Agreement, arguing that the state's bidding process is unconstitutional and discriminates against out-of-

MASSACHUSETTS OFFSHORE WIND RESOURCE[146]



state energy suppliers.[174] The Associated Industries of Massachusetts and the Alliance to Protect Nantucket Sound have also objected to the Power Purchase Agreement and have threatened legal proceedings pending the decision by the Department of Public Utilities.[175]

- Some citizen groups, individuals, and the Town of Barnstable also have launched federal lawsuits against the project, citing negative impacts to environmental and historic resources.[176] These lawsuits have been consolidated before the U.S. District Court for the District of Columbia.

Hull Offshore Wind Energy Project

- Four offshore turbines proposed with a total generation capacity of 12 MW, led by the Town of Hull Municipal Light Plant.
- Project began with $1.8 million from the Massachusetts Technology Collaborative for a feasibility study. In March 2009, the project received $951,000 from a federal spending bill to support ongoing environmental and economic studies.[177]
- Project is currently delayed, primarily due to cost concerns.

POLICY & POLITICAL ENVIRONMENT

State & Federal Support

- **Massachusetts Ocean Management Plan** (January, 2010): Developed pursuant to the Massachusetts Oceans Act of 2008, the plan establishes siting and performance standards and new environmental protections to be associated with future offshore energy facilities, including deep-water wind projects that primarily would be located in adjacent federal waters.[178] The plan designated only two wind energy areas suitable for commercial scale development in MA state waters: (1) a site off Cuttyhunk Island and part of the town of Gosnold (Gosnold Wind Energy Area); and (2) a site south of Nomans Land and part of Chilmark (Martha's Vineyard Wind Energy Area).[179]
- **Wind Technology Testing Center:** The U.S. DOE awarded a $25 million grant, to be combined with $15 million in state funds, for the construction of the nation's first large wind turbine blade testing facility and further offshore wind technology. Completion is expected by February, 2011, and over 300 jobs will be created.[180]
- **Federal draft 'Request for Interest':** The federal Bureau of Ocean Energy Management, Regulation, and Enforcement's (BOEMRE) Massachusetts Renewable Energy Task Force has issued a draft 'Request for Interest' to gauge specific interest in commercial development of wind energy resources on the state's outer continental shelf in federal waters. BOEMRE has identified an area for federal offshore leasing near Massachusetts that begins 12 miles offshore and covers 2,542 square nautical miles. A final Request for Interest is expected to be released by the end of 2010.[181]
- **Rhode Island-Massachusetts Collaborative Project:** In 2010, Rhode Island and Massachusetts signed a Memorandum of Understanding as stakeholders on equal terms to develop offshore wind projects in a 400 square mile area of mutual interest in the Rhode Island Sound and adjoining federal waters.[182] The Rhode Island Coastal Resources Management Council is finalizing a Special Area Management Plan (SAMP) that will act as the governing assessment and planning document for the project. In September, 2010, both states held stakeholder outreach meetings and are currently in the process of formally identifying a site for the project. Rhode Island is in the process of finalizing the SAMP and will seek its formal approval under the Coastal Zone Management Plan process.[183]

Academic and Partner Support

- **UMass-Dartmouth's Marine Renewable Energy Center (MREC):** MREC has proposed the development of the National Offshore Renewable Energy Innovation Zone, an ocean-based laboratory to be located southwest of Nantucket that would conduct wind and tidal resource assessments and eventually support full-scale testing of offshore technologies. In support of the innovation zone, MREC has received $1.5 million in federal grants and federal officials have set aside several potential leasing blocks for the development of the zone.[184]
- **Massachusetts Ocean Partnership:** A nonprofit group working in collaboration with state agencies on a $2.5 million, five-year research plan that will further investigate the impacts of offshore wind facilities as part of the Massachusetts Ocean Management Plan.
- **Massachusetts Technology Collaborative (MTC):** The MTC conducted a six-month stakeholder process with over 40 groups to review the Cape Wind project proposal and its potential impact on various stakeholders, the environment, and the local economy.[185] Until recently, the MTC administered the Massachusetts Renewable Energy Trust Fund that allocates approximately $25 million per year toward renewable energy projects. Oversight was moved in 2009 to the newly-established Massachusetts Clean Energy Center.

Rhode Island

Ann Marie Jakubielski

TOTAL WIND POTENTIAL AND TARGETS

A 2008 study commissioned by the State of Rhode Island determined that 15 percent, or approximately 150 MW, or more of Rhode Island's electricity requirement could be supplied by offshore wind farms and that 10 specific areas were suitable for consideration as wind farm locations.[186] The report further concluded that "the total offshore resource, if fully developed using technology available today and without any additional siting constraints, could supply as much as five times the 15 percent goal."[187] The 2010 NREL Assessment lists Rhode Island's offshore wind resource at 25.6 GW within 50 nautical miles of the coast.[188]

PROJECTS

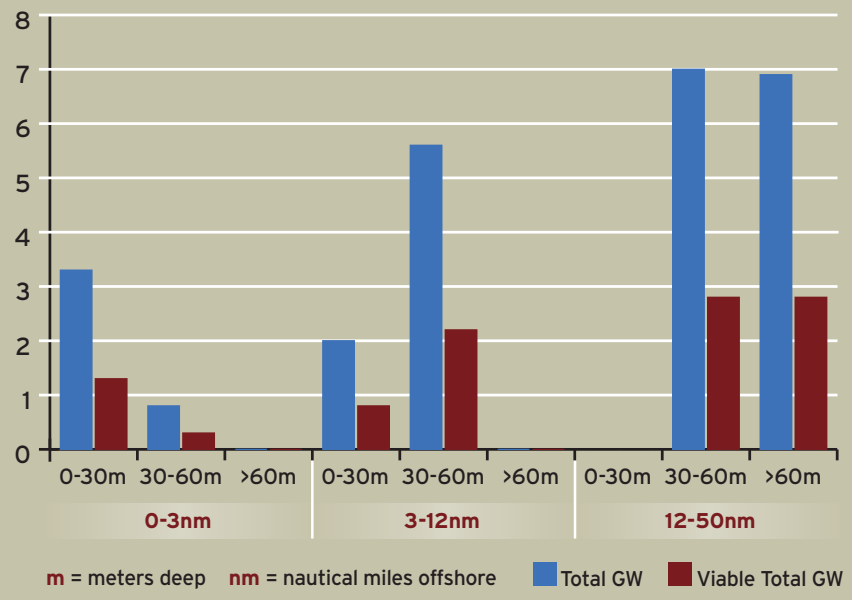
Block Island Wind Farm

- Proposed construction by Deepwater Wind LLC of an 8 turbine demonstration project approximately 3 miles off of Block Island in state waters. The project has a nameplate generation capacity of 28.8 MW and is expected to cost approximately $200 million.[189]
- In response to the Rhode Island Public Utility Commission's (PUC) rejection of a Power Purchase Agreement between Deepwater Wind and National Grid, which effectively cancelled the project by deeming it to be 'commercially unreasonable,' the state legislature enacted a law in June, 2010 that dramatically narrows the PUC's window to assess the agreement and its grounds for rejection.[190] The Conservation Law Foundation, Environmental Council of Rhode Island, and other environmental groups opposed this legislation.
- In August, 2010, the PUC agreed to a 20 year Power Purchase Agreement that calls for National Grid to buy energy from Deepwater Wind at 24.4 cents/kWh for the first year, with 3.5 percent annual increases. The project is expected to be fully operational by 2012 or 2013.[191]
- Attorney General Patrick Lynch and the Conservation Law Foundation have appealed the Power Purchase Agreement to the state Supreme Court, calling it unconstitutional and a 'sweetheart deal' for Deepwater Wind.[192] The state Supreme Court has not yet set a date for the hearing.[193]

Rhode Island Sound Wind Farm

- The Rhode Island Sound Wind Farm involves the construction of more than 100 turbines in federal waters approximately 15 – 20 miles from the coast, creating a 384 MW, utility-scale project that will generate 15 percent of the state's electricity.
- The project's zoning will depend on the conclusions of the Ocean Special Area Management Plan described below.[194] Federal permits need to be acquired as well, setting the project's target completion date in 2014.
- July, 2010: Advisory opinion from the Rhode Island Economic Development Corporation estimated that the overall economic benefits attributable to the phase 1 Block Island Wind Farm would be $92 million in net present value; for the phase 2 Rhode Island Sound Farm, the overall economic benefits are

RHODE ISLAND OFFSHORE WIND RESOURCE[146]



estimated to be $659 million in net present value. Additional qualitative economic benefits include significant job creation, a long-term increase in the training and preparedness of the Rhode Island workforce, and the furtherance of America's energy independence.[195]

POLICY & POLITICAL ENVIRONMENT

State & Federal Support

- February, 2010: Rhode Island received a $22.3 million TIGER grant, as part of the American Reinvestment and Recovery Act (ARRA), to redevelop Quonset Business Park into a base of operations for offshore wind power producers.[196]
- **Rhode Island-Massachusetts Collaborative Project:** In 2010, Rhode Island and Massachusetts signed a Memorandum of Understanding as stakeholders on equal terms to develop offshore wind projects in a 400 square mile area of mutual interest in the Rhode Island Sound and adjoining federal waters.[197] The Rhode Island Coastal Resources Management Council is envisioning that the Special Area Management Plan (SAMP) will act as the governing assessment and planning document for the project. In September, 2010, both states held stakeholder outreach meetings and are currently in the process of formally identifying a site for the project.[198]

Academic and Partner Support

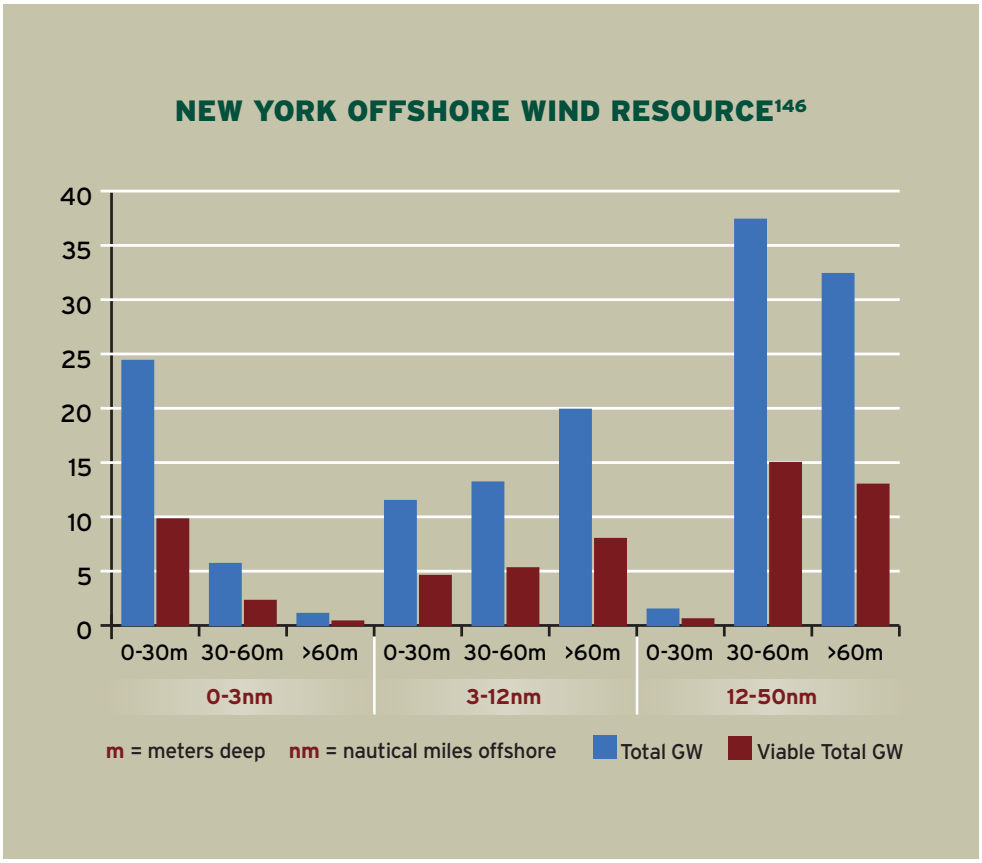
- October, 2010: The Rhode Island Coastal Resources Management Council approved the 'Ocean Special Area Management Plan'. The plan includes a series of policies related to the protection of marine wildlife and the mitigation of negative impacts to coastal habitats.[199] Federal agencies have proposed amendments to the plan which will be reviewed through a separate stakeholder process that is expected to be completed by the end of 2010.

New York

Vanessa M. Dobre

TOTAL WIND POTENTIAL AND TARGETS

The 2010 NREL Assessment lists New York's combined Atlantic and Great Lakes offshore wind resource at 147.2 GW within 50 nautical miles of the coast.[200] The State of New York has established a goal of meeting 45 percent of its electricity needs through improved energy efficiency and renewable sources by 2015.[201] While the state has considerable onshore wind development, a state Renewable Energy Assessment found that offshore wind production is even better correlated with the region's peak demand than onshore sources.[202, 203]



PROJECTS

Long Island-NYC Offshore Wind Project

- Public-private collaborative for the development of an offshore wind site 13 – 15 miles emanating off the Rockaway Peninsula in federal waters with generation capacity of 350 MW, with the potential for expansion to 700 MW.[204]
- Members of the Long Island-New York City Offshore Wind Collaborative are the Long Island Power Authority (LIPA), Con Edison, New York Power Authority (NYPA), New York City Economic Development Corporation, New York State Energy Research Development Authority (NYSERDA), Metropolitan Transportation Authority, and the NY/NJ Port Authority.
- On behalf of the Collaborative, NYPA is filing a request for a lease from BOEMRE for 64,500 acres of land beneath the Atlantic Ocean about 13 – 15 miles off of the Long Island coast for development of the Long Island-New York City Offshore Wind Project.[205]
- The Collaborative expects to issue a Request for Proposals in 2011, inviting bids from private development firms to build the project and enter into agreements to sell the clean energy it produces. It is also conducting feasibility studies covering transmission, water-to-land interconnections, geophysical, economic, public support, and the environment. [206]

POLICY & POLITICAL ENVIRONMENT

State & Federal Support

- November, 2010: The New York State Climate Action Interim report was released, calling for a doubling of the state's renewable energy sources by 2030.[207]
- New York's 2009 State Energy Plan recommends improved offshore wind siting guidance and increased state and regional coordination on offshore wind, including the development of a New York offshore ocean plan.[208]
- The New York State Department of State is in the process of amending its Coastal Management Program (CMP) to develop specific criteria and analyze resource and use information for the siting of offshore wind projects, and to enhance protection of important offshore habitats (Atlantic Ocean Amendment).[209] A state with an approved Coastal Management Program has the authority to approve or deny a proposed federal action if it may affect the state's coastal resources.[210]
- NYSERDA administers a program of production incentives for wholesale renewable energy generators under the Renewable Portfolio Standard which could include offshore wind turbines in addition to onshore wind turbines.[211]
- The Bloomberg Administration in New York City has identified offshore wind potential as a key element of

the City's push for renewable energy. The Administration estimates that turbines placed offshore from the windy coasts of Queens, Long Island, and Brooklyn could generate up to 10 percent of the city's electricity needs within 10 years.[212]

- Atlantic Ocean Amendment: According to the federal Coastal Zone Management Act of 1972, a state with an approved Coastal Management Program has the authority to approve or deny a proposed federal action if it may affect the state's coastal resources. New York is in the process of amending its Coastal Management Program to develop specific criteria for the siting of offshore wind projects and ensure the protection of its coastal resources.[213]
- There has been significant progress in developing New York's wind resources in the Great Lakes.[214]

Profile

MARY HALLISEY HUNT

"When it comes to renewable energy, one size does not fit all in this country. By taking a short step back to consider a balance between regional and/or political "energy cultures" and the national (and global) need to address broad-based energy concerns, innovative technology and policy can be attained.

In the case of offshore wind energy, many independent and regionally diverse studies have shown that offshore wind resources along the Atlantic coast can contribute significantly to a new U.S. clean energy economy. By incentivizing offshore wind power production during its early stages of growth, the U.S. could encourage a stable and productive energy market sector that could provide economic and environmental benefits across a broad spectrum of constituencies for many years to come."

Mary Hallisey Hunt is the director of special projects for Georgia Tech's Strategic Energy Institute. She has been engaged in research and policy projects investigating offshore wind energy since 2004, including "Southern Winds: A Study of Wind Power Generation Potential Off the Georgia Coast," "Innovative Partnerships for Offshore Wind Development," and "Georgia's Offshore Renewable Energy Potential: Spatial Mapping and Planning." Mary serves on the Board of the U.S. Offshore Wind Collaborative, is an active member of the American Wind Energy Association Offshore Wind Working Group, and a founding member of the Georgia Wind Working Group.

New Jersey

TOTAL WIND POTENTIAL AND TARGETS

In April, 2010, Governor Chris Christie outlined an energy policy that included an emphasis on the development of offshore wind.[215] The 2010 NREL Assessment lists New Jersey's offshore wind resource at 99.7 GW within 50 nautical miles of the coast.[216] In October, 2008, then-Governor Jon Corzine issued an Energy Master Plan that called for the construction of 3 GW of offshore wind energy facilities by 2020, with at least 1 GW installed by the end of 2012.[217]

PROJECTS

Garden State Offshore Energy (GSOE)

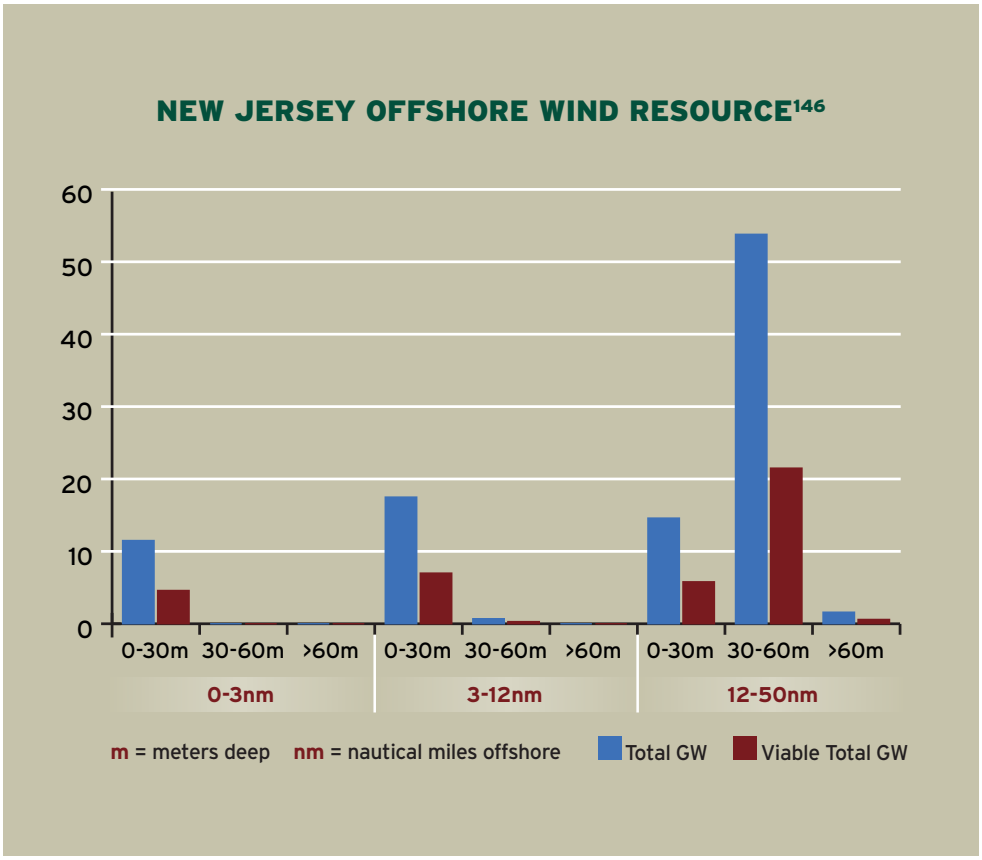
- Collaborative project between Deepwater Wind and PSEG Renewable Generation for the construction of a 350 MW project, consisting of 96 wind turbines located 16 – 20 miles off the New Jersey shore in federal waters, with a projected cost of $1.5 billion. Project was selected by the New Jersey Board of Public Utilities (NJBPU) in October, 2008 and awarded a $4 million grant for the completion of baseline studies and permitting applications.[218]
- In December, 2008, GSOE was awarded $4 million by the NJBPU for the installation of a deep ocean meteorological tower to gather essential data.[219] In June, 2009, the federal government awarded Deepwater Wind two federal exploratory leases: one for 12 – 15 miles from the New Jersey coast, and the other 15 – 18 miles out. The leases will enable Deepwater Wind to construct meteorological towers in federal waters and collect data in support of the project.[220]
- Upon completion of baseline studies and zoning recommendations from the New Jersey Department of Environmental Protection (NJDEP), GSOE will be eligible to apply for state and federal permits. Project is expected to be fully operational by 2013.
- In October, 2010, the NJBPU approved a permit for the deployment of an advanced wind resource assessment buoy, signaling key support for the project's advancement. The buoy is expected to be installed by the end of 2010 pending receipt of federal permits.[221]

Fisherman's Energy (2 Phases)

- Phase 1 involves a 20 MW, 6 – 8 turbine demonstration project 2.8 miles off the coast of Atlantic City in state waters with the ability to power an estimated 6,000 homes in South Jersey. Depending on state permitting approval, the project can be operational by the end of 2011 or in early 2012. In April 2010, an environmental monitoring buoy was launched in support of Phase 1.[222]
- Phase 2 is a 330 MW utility-scale project, with 66 offshore turbines located 7 miles off the New Jersey coast in federal waters. Like GSOE, Phase 2 of this project was awarded $4 million by the NJBPU for the construction of a meteorological tower and awarded a 5-year exploratory lease for environmental studies and data collection.
- The project must procure permits from state and federal agencies in order to proceed with construction.

NRG-Bluewater Wind

- Proposal for a 350 MW utility-scale project with 80 – 100 turbines, located more than 13 miles from the coastline in federal waters.[223]



- The project has also received $4 million to construct a meteorological tower as well as a 5-year federal exploratory lease. However, NRG Bluewater Wind has not received all of the necessary federal permits for the construction of the meteorological tower itself, delaying placement of the tower until 2011.[224]

OffshoreMW

- OffshoreMW submitted an unsolicited lease application to the Minerals Management Service (now BOEMRE) in January, 2010. The proposed lease area is sufficient for 700 MW, to be developed in two phases of approximately 350 MW each.
- The proposed site is notable in that it was identified using data from the New Jersey Baseline Study in direct consultation with regulators, and it is located further offshore in deeper water than other proposed project sites.

POLICY & POLITICAL ENVIRONMENT

State & Federal Support

- On October 7, 2010, Governor Chris Christie signed the Offshore Wind Economic Development Act. The Act directs NJBPU to develop an offshore renewable energy certificate program that calls for a percentage of electricity sold in the state to come from offshore wind energy. This percentage would be developed to support at least 1,100 MW of generation from qualified offshore wind projects. The State will offer 100 percent tax credits for capital investments of $50 million or more in offshore wind projects, with an initial cap of $100 million for all projects (which can be extended by the NJDEP to $1.5 billion total).[225]
- June, 2010: Groundbreaking two-year $7 million report released by the NJDEP shows minimal environmental impact would occur at sites proposed for several wind energy projects 8 – 20 miles off the coast of New Jersey.[226] The report provides a composite sensitivity index allowing for informed decisions to be made regarding better and worse places to site a large-scale facility. NJDEP has stated numerous times publicly that the report was not an official Environmental Impact Statement, nor could it be used as a surrogate.
- April, 2006: Final report submitted to then-Governor Corzine from the Blue Ribbon Panel on Development of Wind Turbine Facilities in Coastal Waters. Establishes benchmark policy recommendations for offshore wind projects in New Jersey, including the need to determine environmental and conservation related impacts.[227]

Academic and Partner Support

- Rutgers University Institute of Marine and Coastal Sciences: Provided the NJBPU with offshore and coastal wind resource assessments to indicate cost-effective and environmentally sensitive wind energy resource areas.[228]

Profile

WILLIAM MOORE

"The time is now for the Atlantic states to produce energy from their wind resources to light our buildings, fuel our hybrid and electric cars, create good-paying jobs, and become more energy independent from foreign energy sources. We have never been so close to constructing wind farms in the Atlantic. I am proud of Deepwater Wind's commitment to make this happen, but we cannot do it alone. We need the support of a diverse range of businesses, labor, environmentalists, urban leaders, and most importantly from the public. The wind is certainty available along the Atlantic coast — what the offshore wind industry needs is a positive energy policy and regulatory environment to attract private capital. I am confident that, with the coalition forming to support offshore wind, we will succeed and soon see wind turbines spinning in the Atlantic."

Bill Moore serves as Chief Executive Officer for Deepwater Wind. Previously, Bill was co-founder of Atlantic Renewable Energy Corporation, the leading developer of commercial wind farms in the eastern U.S, including the Maple Ridge facility, which remains the largest wind plant in eastern North America.

Delaware

TOTAL WIND POTENTIAL AND TARGETS

Lucinda C. Simpson

University of Delaware researchers estimate that Delaware has an offshore wind energy resource of over 7 GW, which is four times the current energy consumption of the entire state.[229] The 2010 NREL Assessment lists Delaware's offshore wind resource at 14.7 GW within 50 nautical miles of the coast.[230]

PROJECTS

NRG-Bluewater Offshore Wind Park

- In July, 2008, Delmarva Power, Delaware's largest state-owned utility, signed the nation's first

Power Purchase Agreement with NRG Bluewater Wind for an offshore wind project of 200 to 600 MW. The initial project is for at least 60 turbines to be constructed 13 miles off Rehoboth Beach.[231]

- In June, 2009, NRG Bluewater Wind was awarded a limited federal exploratory lease for the installation of a meteorological tower 14 miles from the coast.[232] However, NRG Bluewater Wind has not yet received all of the necessary federal permits for the construction of the tower itself, delaying placement until 2011.[233] Based on these delays, Delmarva Power & Light has agreed to a two-year extension of the Power Purchase Agreement, pushing the deadline for delivery of its wind-generated electricity to 2016 instead of the initial 2014 deadline.[234]
- Despite state approval of the project, NRG Bluewater Wind is required to apply for a federal offshore wind lease. In April, 2010, the U.S. Department of the Interior issued a Request for Interest from developers interested in developing a wind farm on the outer continental shelf offshore of Delaware in order to determine whether there are any rival bids.[235] If the submissions produce no commercial alternatives, a federal lease will be awarded to NRG Bluewater Wind.[235]

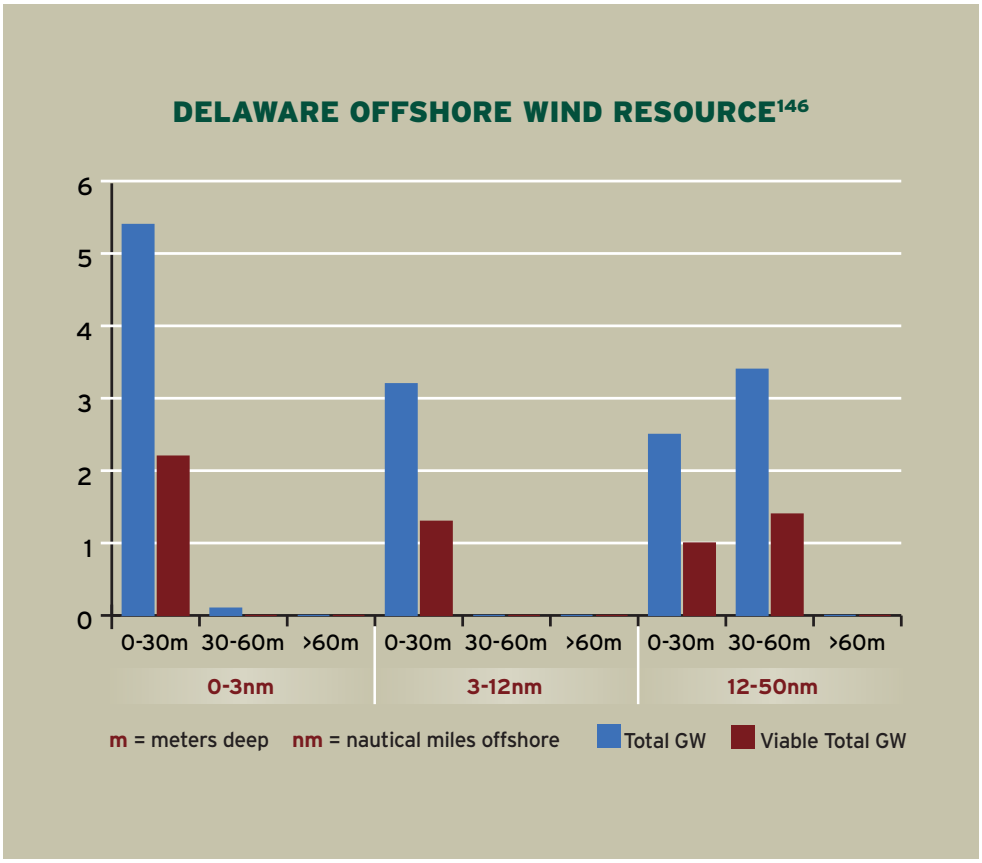
POLICY & POLITICAL ENVIRONMENT

State & Federal Support

- **An Act to Amend Title 26 of the Delaware Code Relating to Offshore Power Wind Installations** (Senate Bill 328, 2008): Offers electric companies regulated by the Public Service Commission (i.e., Delmarva Power & Light, the state's only investor-owned utility) a 350% credit towards the Renewable Portfolio Standard (RPS) for offshore wind facilities sited on or before May 31, 2017.[237]
- **The Clean Energy Jobs Act** (passed in June, 2010): Proposed legislation to amend the state's RPS to facilitate the installation of 1 GW of energy, most likely from offshore wind-related projects, resulting in over 1,000 new jobs by 2029.[238]
- June, 2010: The University of Delaware and the federal National Renewable Energy Laboratory will partner over the next five years to apply to develop a $500,000 shallow-water research zone test site within three miles of Delaware's coast in state waters, where offshore wind technologies can be built and tested.[239]
- July, 2010: The U.S. EPA, per the federal Clean Air Act, has delegated authority to Delaware to enforce and determine offshore wind permits in federal waters in relation to air quality — making Delaware the first state to have such authority.[240]

Academic and Partner Support

- **University of Delaware's Center for Carbon-free Power Integration:** The Center has been actively involved in the development of offshore wind-related policies and legislation and has encouraged commercial investment in offshore wind projects, including supporting NRG Bluewater Wind's successful bid.[241] The University of Delaware campus houses a 2 MW land-based wind turbine, which will be studied to collect data for the development and installation of offshore wind turbines.[242]



Maryland

Mary Hollinger, NOAA

TOTAL WIND POTENTIAL AND TARGETS

Maryland has been classified by the Department of Energy as having "outstanding offshore wind resources," and a recent report prepared by the University of Delaware estimated that the state has an overall offshore wind resource potential of 60 GW.[243] Using existing shallow water technology, Maryland could install 14,625 MW of capacity — enough power to satisfy 67% of Maryland's current energy needs. Whereas importing coal from neighboring states does not benefit the local economy, the report finds that offshore wind projects would bring manufacturing jobs to the state and stimulate the economy.[244] The 2010 NREL Assessment lists Maryland's offshore wind resource at 53.8 GW within 50 nautical miles of the coast.[245]

PROJECTS

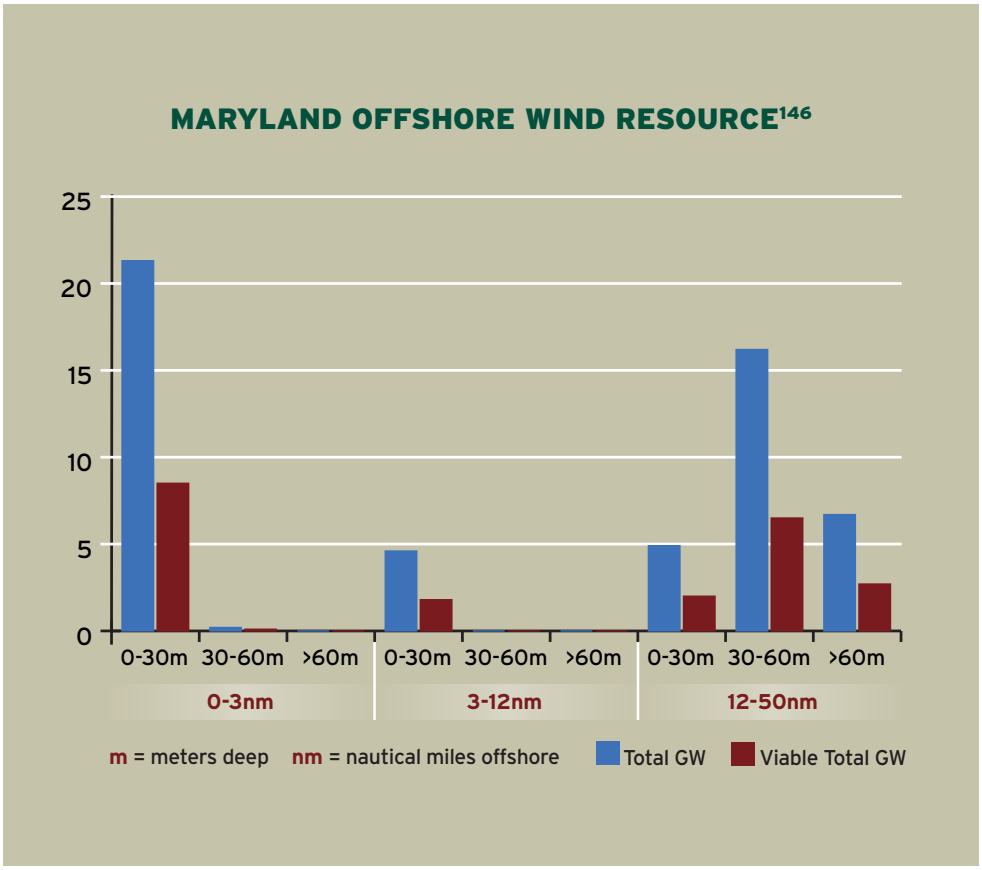
Ocean City Wind Farm

- NRG Bluewater Wind has expressed interest in building a wind farm twelve miles off the coast of Ocean City with a generation potential of 600 MW, or enough to power up to 135,000 homes. Other companies are likely to compete for a project of this magnitude.[246]

POLICY & POLITICAL ENVIRONMENT

State & Federal Support

- The States of Maryland, Virginia, and Delaware signed an agreement in June, 2010 that created a tri-state partnership for the deployment of offshore wind energy in the Mid-Atlantic coastal region. The Memorandum of Understanding creates a formal partnership that will build on the region's significant offshore wind resources to generate clean, renewable energy and a sustainable market that will bring new economic opportunities.[247]
- In September, 2010, the Maryland Department of Natural Resources (DNR) made a formal presentation to environmental and other interested stakeholders to provide an opportunity to be involved in the initial planning and development of a 200-turbine wind farm 12 – 17 miles off the coast of Ocean City.[248]
- November, 2010: BOEMRE issued both a Request for Interest and a map of an offshore wind leasing area in federal waters adjacent to Maryland's Atlantic Coast; Maryland is the second state in the nation to receive this initial planning process approval by the BOEMRE.[249] The Request for Interest's area for proposed wind generation is located approximately 10 nautical miles from the Ocean City coast (western edge) and approximately 27 nautical miles from the Ocean City coast (eastern edge).[250] Potential developers have until January 10, 2011 to submit interest to the BOEMRE.
- **Coastal Atlas:** The Maryland Department of Natural Resources , the Maryland Energy Administration, Towson University, the University of Maryland, The Nature Conservancy, and the National Oceanic and Atmospheric Administration have collaborated to develop the Coastal Atlas — an online mapping and planning tool that allows users to explore data for coastal and ocean planning activities, including renewable offshore energy exploration, and identifies potential conflict zones such as areas that are environmentally sensitive or used for military activities.[251] With a goal of making recommendations for preferred federal leasing sites for offshore wind projects, Maryland is



developing the Coastal Atlas and inviting feedback from offshore wind developers[252] and federal agencies,[253] and engaging targeted stakeholders and the public.[254] Based on collected information and feedback, Maryland will issue guidelines concerning the development of offshore projects.

- **Maryland Offshore Energy Framework:** The Environmental Law Institute compiled a report for the Maryland Department of Natural Resources identifying a streamlined regulatory framework and a new set of environmental protections to be implemented in response to the development of offshore wind projects.[255]
- October, 2010: Governor Martin O'Malley highlighted the job creation potential of offshore wind in Maryland by publicly stating that "A proposed 1 GW wind farm in the waters off of the Delmarva coast could generate as many as 4,000 manufacturing and construction jobs during the five-year development period, with an additional 800 permanent jobs once the turbines are spinning, while securing our energy future and producing sustainable energy solutions for consumers."[256]

Profile

JONATHAN GENSLER

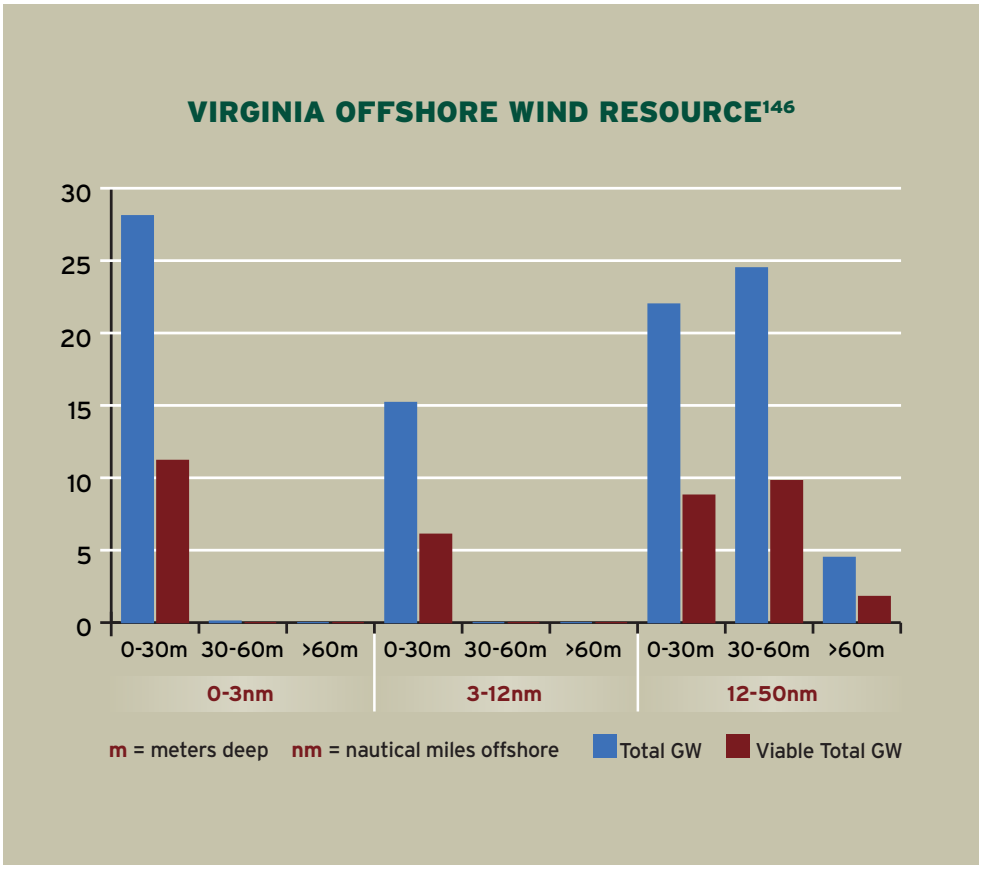
"As an Iraq War veteran and a member of Operation Free, add me to the growing chorus of offshore wind supporters. I was raised in Huntington, West Virginia, where the permanent devastation caused by mountaintop removal mining and the recent Upper Big Branch mine tragedy are deadly reminders of the true costs of coal and other fossil fuels. But my primary concerns are with the tremendous national security threats posed by our addiction to fossil fuels and the destabilizing factor of unmitigated climate change. While the Department of Defense is moving full steam ahead on adopting new clean energy technologies, the private sector remains mired in the 19th century. Developing American wind resources, both offshore and on the ridge-lines of Appalachia, will help transform this equation and provide all Americans with a better and safer future."

Jonathan Gensler is a West Point graduate and a former Army captain who served in Iraq from 2003-2004 as a tank officer leading a 30 man infantry mortar platoon. Jon is currently studying for dual master's degree at the Harvard Kennedy School and MIT Sloan School of Management. In 2009, Gensler participated in the international climate talks in Copenhagen with OperationFree — a coalition of leading veterans and national security organizations who recognize that climate change is a major national security threat. He is also a Fellow with the Truman National Security Project.

Virginia

TOTAL WIND POTENTIAL AND TARGETS

The Virginia Coastal Energy Research Consortium (VCERC) has identified 25 lease blocks with 3.2 GW of potential offshore wind capacity in relatively shallow waters no deeper than 30 meters that are beyond the visual horizon and have Class 6 winds (which are strong and consistent, capable of supporting a utility scale offshore wind project).[257] Assuming a build-out rate of 160 MW per year, within two decades 9,700 – 11,600 career-length jobs can be created that are solely associated with developing this 3,200 MW of offshore wind potential.[258] The 2010 NREL Assessment lists Virginia's offshore wind resource at 94.4 GW within 50 nautical miles of the coast.[259]



PROJECTS

Apex Hampton Roads Wind Project

- Apex Wind Energy Inc. has filed an unsolicited federal lease application for a 180 square mile area 20 miles off Virginia Beach.
- The project could produce up to 1,700 MW built in several phases, and will use 340 – 470 turbines, depending on the turbine size. This would power up to 500,000 homes.
- The first phase of 500 MW could be completed as early as 2015, depending on the BOEMRE leasing and permitting timeline.

Seawind Renewable Energy Corp. Wind Farm

- In September, 2009, Seawind Renewable Energy Corp. filed an unsolicited federal lease application for an area 12 miles off the coast of Virginia Beach.
- The nameplate capacity of the Seawind Virginia project can be up to 1,200 MW, however is expected to be about 400 – 800 MW due to site constraints.[260]

Hampton Roads Demonstration Project

- In July, 2010, Virginia state officials expressed interest to the U.S. DOE in developing a $60 – 80 million demonstration test center, comprised of three fixed offshore wind turbines in the Hampton Roads area.[261]

POLICY & POLITICAL ENVIRONMENT

State & Federal Support

- **State legislation:** In April, 2010, Governor Bob McDonnell signed into law several bills that promote the development of offshore wind, including: the establishment of the Offshore Wind Development Authority, which creates a system to procure up to $4 billion of US DOE loan guarantees and removes regulatory obstacles to potential projects;[262] and modifications to the state's Renewable Portfolio Standard to award offshore wind credits three times the amount given to other forms of renewable energy.[263]
- Virginia officials formed a Task Force with the federal government to discuss renewable energy development.[264]

- An assessment by the Department of Defense concluded that wind turbines could co-exist with military activities off Virginia's coast depending on their locations.[265]

Academic and Partner Support

In addition to VCERC, several organizations have released reports examining Virginia's offshore wind resource potential: the Virginia Marine Resources Commission has evaluated whether sufficient subaqueous land exists in state territorial waters to support offshore wind resource generation, concluding the best potential exists on the Outer Continental Shelf.[266] The Environmental Law Institute, commissioned by the Virginia Coastal Zone Management Program, issued two reports detailing recommended changes to Virginia environmental and regulatory policies in light of offshore wind development.[267] The Virginia Offshore Wind Coalition — a network of developers, manufacturers, utilities, localities, businesses, environmental groups, and other organizations and individuals who have an interest in offshore wind — was formed in January, 2010.[268]

North Carolina

TOTAL WIND POTENTIAL AND TARGETS

There is great potential for offshore wind power off the coasts of North Carolina, due to excellent wind speeds and large areas of shallow water that can be developed.[269] The University of North Carolina (UNC) has estimated there to be over 55 GW of potential offshore wind beyond the Pamlico Sound.[270] The 2010 NREL Assessment lists North Carolina's offshore wind resource at 297.5 GW within 50 nautical miles of the coast.[271] DOE's "20% Wind by 2030" report projects that 50 GW of offshore wind will come from the East Coast, with 5 – 10 GW coming from North Carolina. Under this scenario, the state stands to gain 10,000 – 20,000 new manufacturing jobs.[272]

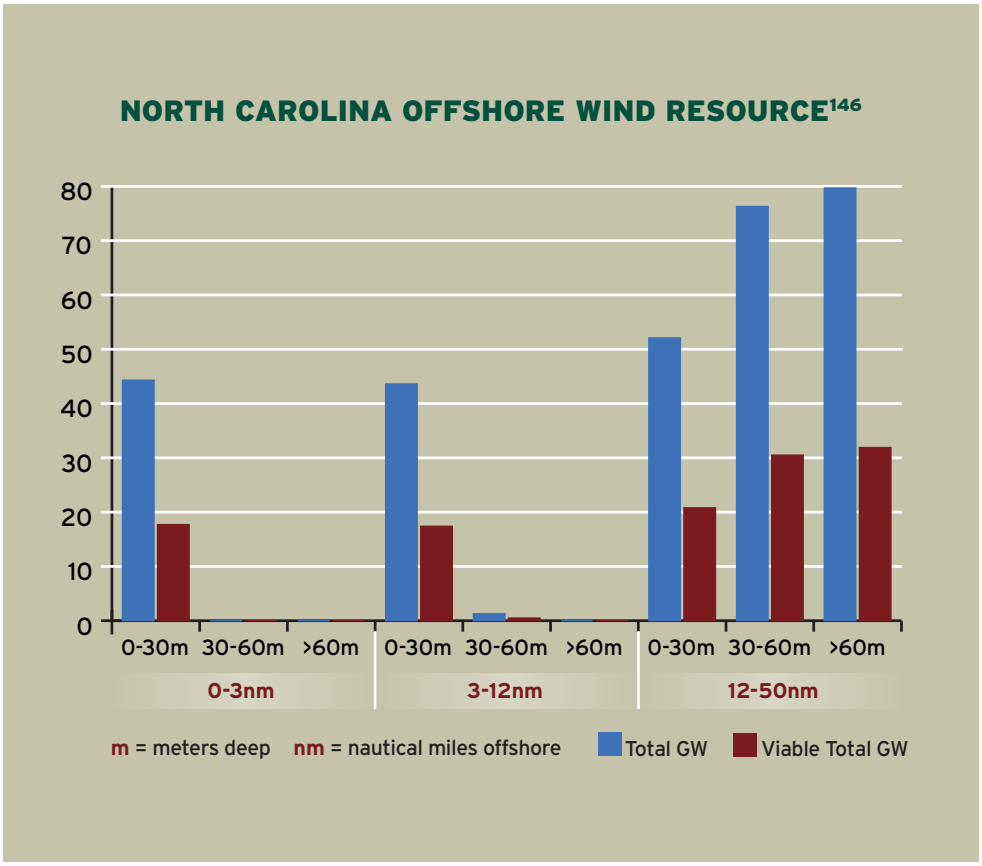
PROJECTS

Outer Banks Ocean Energy Project

- Apex Wind Energy has applied for a federal exploratory lease for 216 square miles of ocean more than 20 miles off the coast.[273]
- The project could involve up to 1,900 MW built in phases over several years and will use 380 – 525 turbines, depending on the turbine size. This would power up to 550,000 homes.
- The first phase of 600 MW could begin construction as early as 2015, depending on the BOEMRE leasing and permitting timeline.
- Press statements indicate that the project will cost $3 billion.[274]

POLICY & POLITICAL ENVIRONMENT

- **Phase 1 study:** In June, 2009, the Department of Marine Sciences at UNC completed a nine-month feasibility study, commissioned by the North Carolina General Assembly, which concluded there is significant potential for utility-scale production of wind energy off the coast and possibly within eastern Pamlico Sound.[275]
- **Phase 2 study:** In June, 2010, Progress Energy Carolinas partnered with UNC on a three-year study to fully map and model North Carolina's viable offshore wind resources. Total cost is about $1 million, with $300,000 coming from federal ARRA funds.[276]
- Duke Energy and UNC are collaborating to help enable large scale offshore wind development in North Carolina.[277] Initial wind turbine assessments found that North Carolina is well positioned to develop offshore wind generation, and that large-scale development of off-shore wind resources is a better approach than enabling small projects that lack economies of scale.[278]



South Carolina

TOTAL WIND POTENTIAL AND TARGETS

The 2010 NREL Assessment lists South Carolina's offshore wind resource at 130.2 GW within 50 nautical miles of the coast.[279] The Southern Alliance for Clean Energy estimates that South Carolina has projected feasible capacity of 4.3 GW.[280, 281]

PROJECTS

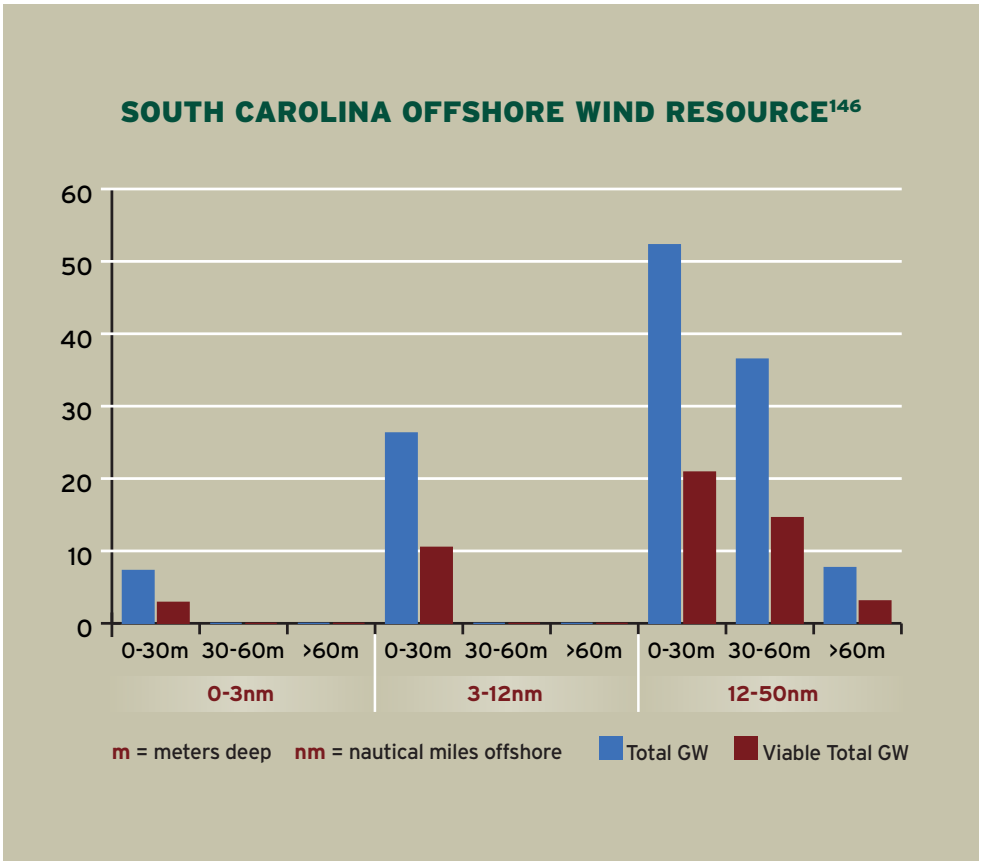
The Palmetto Wind Project

- Exploratory offshore wind initiative off the coast of Georgetown, partners include: Clemson University's Restoration Institute; Santee Cooper; Coastal Carolina University; and the South Carolina Energy Office.
- Launched in March, 2009, and expected to last at least 18 months, this project encompasses multiple activities, including the deployment of six buoys and two land-based stations to measure wind speed and quality.[282]

POLICY & POLITICAL ENVIRONMENT

State & Federal Support

- **Wind Energy Production Farms Feasibility Study Committee** (2008): Established by South Carolina Act 318. Recommendations from the final report issued in January, 2010, included establishing a state target of 1 GW of offshore wind generation capacity by 2018, supported by various state and regional incentives.[283]



- **South Carolina Roadmap to Gigawatt-Scale Coastal Clean Energy Generation: Transmission, Regulation, Demonstration** (2008): U.S. DOE awarded a $500,000 grant to the South Carolina Energy Office and partners for South Carolina to develop an offshore wind infrastructure, including the establishment of the Regulatory Task Force for Coastal Clean Energy in 2009; final reports are expected in 2011.[284]
- **Large Wind Turbine Drivetrain Testing Facility** (November, 2009): Clemson University Restoration Institute and its partners have received $98 million to build and operate a wind drive train testing facility at the institute's research campus on the former Charleston Navy base ($45 million U.S. DOE grant from ARRA funds, $53 million in match funding).[285]
- October, 2010: A year-long study by Santee Cooper (South Carolina's state-owned electric utility) found that offshore wind in South Carolina could supply significant electric power.[286]

Academic and Partner Support

- The South Carolina Consortium for Offshore Wind: In August, 2010, the Consortium installed a SODAR wind measurement tool on a Coast Guard platform off the South Carolina coast in an effort to accurately gauge the state's offshore wind potential, the first sonic wind test of its kind off a North American coast.[287] Members of the Consortium include the Savannah River National Laboratory, the Clemson University Restoration Institute, Santee Cooper, Clemson University's S.C. Institute for Energy Studies, Coastal Carolina University, the Center for Hydrogen Research, and the U.S. Coast Guard.[288]

Georgia

TOTAL WIND POTENTIAL AND TARGETS

The 2010 NREL Assessment lists Georgia's offshore wind resource at 60.4 GW within 50 nautical miles of the coast.[289] The Southern Alliance for Clean Energy projects that Georgia has 1.7 GW of feasible offshore wind potential when technical and conservation-related constraints are taken into account.[290] While Georgia has strong offshore wind potential, the majority of class 4 and higher winds (essential to support a utility-scale offshore wind project) exist in federal waters with the strongest winds located 30 – 100 km from the coast.[291]

PROJECTS

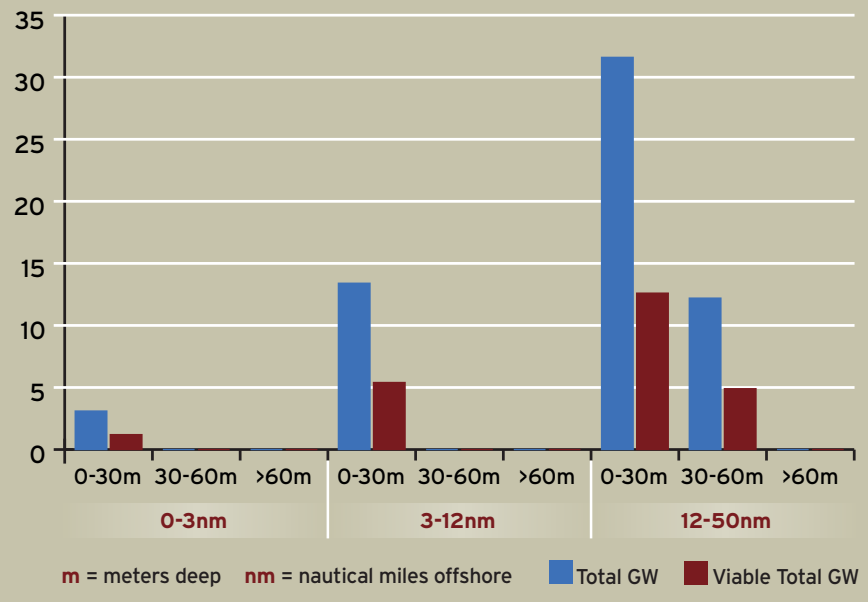
Southern Winds Project

- Two-year feasibility study conducted by Georgia Tech Strategic Energy Institute and Southern Company assessing the viability of wind energy generation off the Georgia coast. The study investigated a project concept involving 3 – 5 turbines with a generation capacity of 10 MW, or enough to power 2,500 homes.[292]
- Final report issued in 2007 identified Georgia as having strong wind resource potential, especially five miles offshore in federal waters, but cited regulatory confusion and cost-related issues as impediments to future projects.[293]
- Southern Company is seeking a permit from the federal government to place meteorological towers off the coast near Savannah and Tybee Island.[294]

POLICY & POLITICAL ENVIRONMENT

- **Georgia Wind Working Group:** Established in 2005, with over 50 members including utilities, wind developers, government, universities, and other stakeholders promoting the development of wind resources. The group includes a Georgia offshore wind committee that has filed public comments on federal testing and leasing policies.[295]
- Georgia's offshore area was the first region to be mapped by NREL's program to produce validated wind resource maps for priority offshore regions of the United States (2006).[296]

GEORGIA OFFSHORE WIND RESOURCE[146]



Florida

Katie M. Hughes

TOTAL WIND POTENTIAL AND TARGETS

A November, 2008 report prepared for the Florida Public Service Commission estimated that Florida has an offshore wind resource potential of 40 GW in waters less than 30 meters in depth and 88 GW in waters 30 – 60 meters in depth.[297] The 2010 NREL Assessment did not analyze Florida's offshore wind resource;[298] such an assessment is needed to accurately assess the state's offshore wind potential.

POLICY & POLITICAL ENVIRONMENT

Despite this potential, Florida has many special circumstances that have delayed the discussion around offshore wind, including the potential for severe hurricanes, military and NASA operations, and the availability of lower-cost solar installations.[299] As the capital cost for wind continues to decrease, Florida's offshore winds will become a more viable energy resource. Some discussions are underway between the U.S. Department of the Interior and the State of Florida to work through some of these barriers.[300]

Academic and Partner Support

In 2009, Florida Atlantic University's Center for Ocean Energy Technology (COET) deployed four current profilers in the Atlantic Ocean to evaluate the state's ocean energy resources in the Gulf Stream, with a focus primarily on tidal energy and hydrokinetic resources.[301]

Endnotes

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[4] Musial, W. and Ram, B. (September 2010); pp. 3, 59 (using data from Table 4-2)

[5] See discussion of University of Maine's deepwater offshore wind research

[6] See: Musial, W. and Ram, B. (September 2010), pp 2, 16. To get a more accurate estimate of the actual wind resources available, NREL reduces total gross wind resources by 60% to account for environmental and socioeconomic constraints. Individual site specific constraints are not considered in this calculation.

[7] Many factors will ultimately determine the likely available offshore wind resources. Larger wind turbines, such as 10 MW turbines, could double these figures since they are calculated utilizing a 5 MW turbine assumption. While many factors, such as wildlife impacts, were factored in the exclusion of 60% for environmentally or socially constraints, these figures could potentially increase due to site specific issues. See: Musial, W. and Ram, B. (September 2010); p. 4

[8] Musial, W. and Ram, B. (September 2010); p. 3

[9] Musial, W. and Ram, B. (September 2010); pp. 56-57. See also footnote 63.

[10] Vice Admiral McGinn, D. (July 30, 2009). Statement before the U.S. Senate Environment and Public Works Committee Hearing on "Climate Change and National Security"; p. 4; available at: http://epw.senate.gov/public/index.cfm?FuseAction=Files.View&FileStore_id=1909f092-e750-4b29-b526-378ee5db1423 (accessed October 26, 2010)

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[16] Vice Admiral McGinn, D. (July 30, 2009). Statement before the U.S. Senate Environment and Public Works Committee Hearing on "Climate Change and National Security"; p. 4; available at: http://epw.senate.gov/public/index.cfm?FuseAction=Files.View&FileStore_id=1909f092-e750-4b29-b526-378ee5db1423 (accessed October 26, 2010)

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[19] From 2000 to 2010, the oil and gas industry accounted for hundreds of deaths, explosions, fires, seeps, and spills as well as habitat and wildlife destruction in the United States. See: National Wildlife Federation (2010). Assault on America: A decade of petroleum company disaster, pollution and profit; pp. 2-3, 16-17; available at: http://www.nwf.org/News-and-Magazines/Media-Center/News-by-Topic/Global-Warming/2010/~/media/PDFs/Global%20Warming/Reports/Assault-on-America-A-Decade-of-Petroleum-Company-Disaster.ashx (accessed October 26, 2010).

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[37] National Wildlife Federation (2010). Odd-ball Winter Weather: Global Warming's Wakeup Call for the Northern United States; p. 3; also available at: http://www.nwf.org/News-and-Magazines/Media-Center/News-by-Topic/Global-Warming/2010/~/media/PDFs/Global%20Warming/Reports/NWF_WinterWeather_Optimized.ashx (accessed October 26, 2010)

[38] Boyce, D.G., Lewis, M.R., and Worm, B. (July 29, 2010). Global phytoplankton decline over the past century. *Nature* 466:591-96; also available at: http://www.nature.com/nature/journal/v466/n7306/abs/nature09268.html (accessed October 26, 2010)

[39] Hood, M. and Broadgate W., Eds. (2009). Ocean Acidification: A summary for policymakers from the Second Symposium on the Ocean in a High-CO2 World; pp. 3, 5; available at: http://www.ocean-acidification.net/OAdocs/SPM-hirez2b.pdf (accessed October 26, 2010). Furthermore, the Rhode Island Ocean Special Area Management Plan (RI SAMP) indicates: "Acidification is a concern for marine animals, many of whom are valuable to the food chain, that have shells or skeletons made of calcium carbonate (such as quahogs, foraminifera, slippershell snails, sea stars, and coral). It is also a concern for corrosion of metals on vessels and infrastructure associated with marine transportation, navigation, ports and harbors. Increased acidification may also cause more rapid deterioration of historic and cultural assets on the seafloor (such as wrecks)." Further acidification impacts are discussed in Chapter 3, Sections 330 and 340 of the RI SAMP. See: RI Ocean SAMP (2010); available at: http://seagrant.gso.uri.edu/oceansamp/documents.html (accessed October 26, 2010)

[40] Coastal Sensitivity to Sea-Level Rise: A Focus on the Mid-Atlantic Region (January 2009). *U.S. Climate Change Science Program: Synthesis and Assessment Product 4.1*; see the Executive Summary; also available at: http://www.epa.gov/climatechange/effects/coastal/pdfs/SAP_4-1_SynthesisandAssessmentProduct.pdf (accessed October 26, 2010). See also a U.S. EPA's staffer's analysis that sea levels are rising and projections estimate that a three-foot rise in sea level will push back east coast shorelines by an average of 300 to 600 feet over the next 90 years, threatening to submerge high density population centers like New York City, Philadelphia and Washington D.C.; available at: http://papers.risingsea.net/index.html (accessed October 26, 2010)

[41] National Wildlife Federation webpage. Effects on Wildlife and Habitat. Available at: http://www.nwf.org/Global-Warming/Effects-on-Wildlife-and-Habitat.aspx (accessed October 26, 2010)

[42] These figures are based on the adoption of the EPA's new "Clean Air Interstate Rule" proposed in July 2010, which aims to cut sulfur dioxide emissions by 71% and nitrogen oxide emissions by 52% from 2005 levels by 2014. See the U.S. EPA's webpage detailing the proposed rule: http://www.epa.gov/airquality/transport/basic.html (accessed October 26, 2010)

[43] The figure is based almost entirely on damages resulting from air pollution-related sickness and premature death, and does not include damages from climate change, harm to ecosystems, effects of certain air pollutants such as mercury and risks to national security. See: National Research Council (2010). The Hidden Costs of Energy: Unpriced Consequences of Energy Production and Use. *National Academies Press*; available at: http://www.nap.edu/catalog.php?record_id=12794 (accessed October 26, 2010). For a report summary, see: The National Academies Press Office (October 19, 2009). Report examines hidden health and environmental costs of energy production and consumption in the U.S.; available at: http://www8.nationalacademies.org/onpinews/newsitem.aspx?RecordID=12794 (accessed October 26, 2010)

[44] Center for Integrative Environmental Research (October 2007). The U.S. Impacts of Climate Change and the Costs of Inaction (Regional highlight: Northeast and Mid-Atlantic). *University of Maryland*; available at: http://www.cier.umd.edu/documents/Northeast-Economic%20Impacts%20of%20Climate%20Change.pdf (accessed October 26, 2010)

[45] Environmental Law Institute (September 2009). Estimating U.S. Government Subsidies to Energy Sources: 2002 – 2008; pp. 3, 6; available at: http://www.elistore.org/Data/products/d19_07.pdf (accessed October 26, 2010)

[46] "For example, currently available mounting technology (monopole) for wind turbines is only suited for projects in water up to about 30 meters in depth. Projects at depths beyond 30 meters require stiffer, more substantial technologies that are just starting to be deployed today but are likely to become more prevalent within the next 5 to 10 years. For depths of greater than 60 meters, floating structures and advanced technologies may be required, and are not likely to be widely used for at least 10 years." See Tierney, S.F., with Okie, A., and Carpenter, S. (December 2009). Strategic Options for Investment in Transmission in Support of Offshore Wind Development in Massachusetts. *Analysis Group*; pp. 3-4; available at: http://www.analysisgroup.com/uploadedFiles/Publishing/Articles/Strategic_Options_Offshore_Wind_12-01-09.pdf (accessed October 26, 2010)

[47] Schwartz, M., Heimiller D., Haymes S., and Musial W. (June 2010). Assessment of Offshore Wind Energy Resources for the United States. *National Renewable Energy Laboratory*. Technical Report NREL/TP-500-45889; pp. 2-4 (Table 1); available at: http://www.nrel.gov/docs/fy10osti/45889.pdf (accessed October 26, 2010)

[48] The United States Department of Energy (US DOE) target is a national goal, though focused on the Atlantic and the Great Lakes. See: US DOE (September 22, 2010). Creating an Offshore Wind Industry in the United States: A Strategic Work Plan for the United States Department of Energy (Predecisional Draft); p. 7; available at: http://www.windpoweringamerica.gov/pdfs/offshore/offshore_wind_strategic_plan.pdf (accessed October 26, 2010)

[49] A University of Massachusetts at Amherst study found investments in wind projects provide 157 percent higher direct and indirect job creation than in the oil and natural gas production sectors. See R. Pollin, J., Heintz, and Garrett-Peltier, H. (June 2009). The Economic Benefits of Investing in Clean Energy: How the economic stimulus program and new legislation can boost U.S. economic growth and employment, *Department of Economics and Political Economy Research Institute (PERI), University of Massachusetts, Amherst*; p. 28; available at: http://www.americanprogress.org/issues/2009/06/pdf/peri_report.pdf (accessed October 26, 2010)

[50] Virginia Coastal Energy Research Consortium (April 2010). Virginia Offshore Wind Studies, July 2007 to March 2010: Final Report; pp. 28-29; available at: http://www.vcerc.org/VCERC_Final_Report_Offshore_Wind_Studies_Full_Report_new.pdf (accessed October 26, 2010).

[51] Virginia Coastal Energy Research Consortium (April 2010); p. 28. The U.S. DOE estimated that the cumulative economic impact from just 1,000 MW of wind power in the State of Massachusetts would amount to $1.4 billion in economic benefit, annual CO2 reductions of 2.6 million tons, annual water savings of 1.3 billion gallons, 3,251 new local jobs added during construction, and 462 new local long-term jobs added. See: NREL (March 2009). Massachusetts Wind Benefits Factsheet. *U.S. Department of Energy*; available at: http://www.windpoweringamerica.gov/pdfs/economic_development/2009/ma_wind_benefits_factsheet.pdf (accessed October 26, 2010)

[52] Maine Ocean Energy Task Force (December 2009). Final Report of the Ocean Energy Task Force to Governor John E. Baldacci; pp. 9-10; available at: http://www.maine.gov/spo/specialprojects/OETF/Documents/finalreport_123109.pdf (accessed October 26, 2010)

[53] Flynn, R.J., and Carey R.T. (February 2007). The Potential Economic Impact of an Off-shore Wind Farm to the State of South Carolina. *The Strom Thurmond Institute, Clemson University*; pp. 3,9; available at: http://www.clemson.edu/scies/wind/Paper-Flynn.pdf (accessed October 26, 2010)

[54] Musial, W. and Ram, B. (September 2010); pp. 2, 4, 17. NREL reduces gross wind resources by 60% to account for environmental and socioeconomic constraints.

[55] Asmus, P. (October 20, 2010). U.S. Offshore Wind Industry Gets Not One, but Two Major Boosts. *Renewable Energy World*; available at: http://www.renewableenergyworld.com/rea/news/article/2010/10/u-s-off-shore-wind-industry-gets-not-one-but-two-major-boosts?cmpid=WindNL-Wednesday-October20-2010 (accessed October 26, 2010)

[56] European Wind Energy Association (January 2009). Wind at Work: Wind Energy and Job Creation in the EU; pp. 8; available at: http://ewea.org/fileadmin/ewea_documents/documents/publications/Wind_at_work_FINAL.pdf (accessed October 26, 2010)

[57] European Wind Energy Association (January 2009); p. 22.

[58] Pude, S. and Garratt-Reed, G. (February-March 2010). Beyond Power: Will offshore wind development bring jobs? *The Working Waterfront*; available at: http://www.workingwaterfront.com/articles/Beyond-power-Will-offshore-wind-development-bring-jobs/13695/ (accessed October 26, 2010)

[59] European Wind Energy Association (January 2009); pp. 7-9.

[60] Specifically, the study focused on 75 miles of coastal area from Seaside Park to North Wildwood and explored 1,360 nautical miles. The study assessed the abundance, distribution and migratory patterns of birds, fish, marine mammals and sea turtles. It also examined shipping lanes, pipelines, tug and barge transit routes and undersea utility lines, while mapping artificial reefs, commercial and recreational fishing areas, and marine protected areas. See: New Jersey Department of Environmental Protection (July 2010). Ocean/Wind Power Ecological Baseline Studies: January 2008-December 2009. Prepared by Geo-Marine Inc.; available at: http://www.nj.gov/dep/dsr/ocean-wind/report.htm (accessed October 26, 2010)

[61] Wood Mackenzie (September 17, 2010). Long-term viability of many U.S. coal plants at risk (Press Release); available at: http://www.woodmacresearch.com/cgi-bin/corp/portal/corp/corpPressDetail.jsp?oid=2178098 (accessed October 26, 2010)

[62] US DOE (September 22, 2010). Creating an Offshore Wind Industry in the United States: A Strategic Work Plan for the United States Department of Energy (Predecisional Draft); p. 7; available at: http://www.windpoweringamerica.gov/pdfs/offshore/offshore_wind_strategic_plan.pdf (accessed October 26, 2010)

[63] U.S. Energy Information Administration (October 14, 2010). Average Retail Price of Electricity to Ultimate Customers by End-Use Sector, by State; available at: http://www.eia.doe.gov/cneaf/electricity/epm/table5_6_a.html (accessed October 26, 2010). Figures are based on the average price for electricity for all sectors in July 2010.

[64] Daley, B. (October 10, 2010). Cape Wind backers blew right by cost. *Boston.com*; available at: http://www.boston.com/news/science/articles/2010/10/10/cape_wind_backers_blew_right__by_cost/ (accessed October 26, 2010)

[65] 78% of the country's energy is consumed by coastal states, with only one-fifth of those states being able to meet 20% or more of their energy demands through land-based wind generation. See: Musial, W. (Fall, 2007). Offshore Wind Electricity: A Viable Energy Option for the Coastal United States. *Marine Technology Society Journal*, 42 (3); pp. 32-43.

[66] NREL (January 2010). Eastern Wind Integration and Transmission Study. *Prepared by the EnerNex Corporation*; pp. 114-15; available at: http://www.nrel.gov/wind/systemsintegration/pdfs/2010/ewits_final_report.pdf (accessed October 26, 2010). When comparing Scenarios 1 and 3, see in particular Table 4.4 of the NREL report.

[67] See a letter dated 4 May 2009 sent by 10 Northeast Governors to Congress against transmitting energy from the Midwest. A copy of the letter is available at: http://www.pecva.org/anx/ass/library/96/east-coast-govs-transmission-ltr.pdf (accessed October 26, 2010). See also: Yang, Chi-Jen (August 2009). Electrical Transmission: Barriers and Policy Solutions. *Climate Change Policy Partnership: Duke University*; available at: http://nicholas.duke.edu/ccpp/ccpp_pdfs/transmission.pdf (accessed October 26, 2010).

[68] A case study by ISO-NE on the effective integration of renewable resources into the New England power grid by 2030 concluded that a scenario with the most offshore wind resource integration results in the most cost-effective use of new and existing transmission infrastructure. Similarly, the US DOE has indicated that offshore wind projects would not face the expensive transmission line-related challenges that are inherent to projects that import onshore wind from the Midwest to the Northeast and Atlantic States. See: ISO New-England, Inc. (February 2010). New England Power System Study 2030: Report to New England Governors; pp. 1-4, pp. 14-15 (Table 05); available at: http://www.newengland-rto.com/committees/comm_wkgrps/prtcpnts_comm/pac/reports/2010/economicstudyreportfinal_022610.pdf (accessed October 26, 2010). See also: U.S. DOE/MA Technology Colloborative/General Electric (September 2005). A Framework for Offshore Wind Energy Development in the United States; p. 10; available at: http://www.masstech.org/offshore/final_09_20.pdf (accessed October 26, 2010)

[69] NREL (January 2010); pp. 114-15.

[70] Kempton, W.; Archer, C.L.; Dhanju, A.; Garvine, R.W.; and Jacobson, M.Z. (2007). Large CO2 reductions via offshore wind power matched to inherent storage in energy end-uses. *Geophys*. Res. Lett. Vol 34; article proof; available at: http://www.ceoe.udel.edu/windpower/docs/KemptonEtAl-MAB-PROOF.pdf (accessed October 26, 2010)

[71] Kempton, W.; Pimenta, F.P.; Veron, D.E.; and Colle, B.A. (2010). Electric power from offshore wind via synoptic-scale interconnection. *PNAS Direct Submission*; available at: http://www.pnas.org/content/early/2010/03/29/0909075107.full.pdf (accessed October 26, 2010)

[72] Wald, M. (October 12, 2010). Offshore wind power line wins backing. *New York Times*; available at: http://www.nytimes.com/2010/10/12/science/earth/12wind.html (accessed October 26, 2010)

[73] Eilperin, J. (October 12, 2010). Google helps finance 'superhighway' for wind power. *The Washington Post*; available at: http://www.washingtonpost.com/wp-dyn/content/article/2010/10/12/AR2010101202271.html (accessed October 26, 2010)

[74] 1 GW of installed wind power capacity can generate 3.2 million MW/h of electricity annually; the same amount of electricity generated by fossil fuels would emit 1.8 million metric tons of carbon dioxide. See: US DOE (September 22, 2010). Creating an Offshore Wind Industry in the United States: A Strategic Work Plan for the United States Department of Energy (Predecisional Draft); p. 10; available at: http://www.windpoweringamerica.gov/pdfs/offshore/offshore_wind_strategic_plan.pdf (accessed October 26, 2010)

[75] According to data for 2008 from the US EIA, the net energy generation of the coal industry in the United States was 1,986 million MW/h. Assuming that there are 614 coal plants, this means that on average a single coal plant produces 3.32 million MW/h. Accordingly, it would take 52 coal plants to generate the equivalent energy produced by 54 GW of wind power (and its generation potential of 172.8 million MW/h annually). See the 2008 data set from: U.S. Energy Information Administration. Table 2.1. *Net Generation by Energy Source by Type of Producer*, 1997 through 2008 (Thousand Megawatthours). Net Generation by Energy Source by Type of Producer; available at: http://www.eia.doe.gov/cneaf/electricity/epa/epat2p1.html (accessed October 26, 2010)

[76] According to the US EPA, annual emissions from a typical passenger vehicle should be equatedto 5.5 metric tons of carbon dioxide equivalent. See: U.S. EPA (February 2005). Emission Facts: Greenhouse Gas Emissions from a Typical Passenger Vehicle; p. 2; available at: http://www.epa.gov/oms/climate/420f05004.pdf (accessed October 26, 2010)

[77] The U.S. EPA estimates that "typical" annual carbon dioxide emissions are 14,796 pounds per household (which converts to 6.71 metric tons). See: U.S. EPA (last updated March 3, 2010). Household Emissions Calculator Assumptions and References; available at: http://www.epa.gov/climatechange/emissions/ind_assumptions.html (accessed October 26, 2010)

[78] Crawley, J. (May 21, 2010). U.S. unveils new push for more efficient cars, trucks. *Reuters*; available at: http://www.reuters.com/article/idUSTRE64K4JK20100521 (accessed October 26, 2010)

[79] Wald, M. (July 27, 2010). Wind drives growing use of batteries. *New York Times*; available at: http://www.nytimes.com/2010/07/28/business/energy-environment/28storage.html?_r=1 (accessed October 26, 2010); see also The Edison Project: Electric vehicles in a Distributed and Integrated market using Sustainable energy and Open Networks, information on the project is available at: http://www.dtu.dk/centre/cet/English/research/projects/22_The_EDISON_project.aspx (accessed October 26, 2010); see also: Parsons, S. (March 31, 2010). University of Delaware's electric vehicles give power back to the grid. *Inhabitat*; available at: http://www.inhabitat.com/2010/03/31/university-of-delawares-electric-vehicles-give-power-back-to-the-grid/ (accessed October 26, 2010); see also Austinenergy.com's webpage on "Getting Ready for Plug-in Electric Vehicles": http://www.austinenergy.com/About%20Us/Environmental%20Initiatives/Plug-in%20Hybrid%20Vehicles/index.htm (accessed October 26, 2010); see also PG&E's webpage on "Electric Vehicle Charging Rate and Economics": http://www.pge.com/about/environment/pge/electricvehicles/fuelrates/index.shtml (accessed October 26, 2010)

[80] The program will reduce CO2 emissions from power plants by 10 percent by 2018. See http://www.rggi.org/home (accessed October 26, 2010)

[81] For information on various transportation emission-related agreements, see Georgetown Climate Center's online resource at: http://www.georgetownclimate.org/transportation/index.php (accessed October 26, 2010)

[82] U.S. Energy Information Administration (May 2009); available at: http://apps1.eere.energy.gov/states/maps/renewable_portfolio_states.cfm#chart (accessed October 26, 2010)

[83] The 2009 State Energy Efficiency Scorecard (October 2009). *American Council for an Energy-Efficient Economy*, Report Number E097; available at: http://www.aceee.org/research-report/e097 (accessed October 26, 2010)

[84] See the "New Jersey Clean Energy Program": www.njcleanenergy.com (accessed October 26, 2010).

[85] For details on state wind energy projects, including wind-energy rankings, see the website of the "American Wind Energy Association": http://www.awea.org/projects/default.aspx (accessed October 26, 2010)

[86] For state-by-state profiles on biomass projects and profiles, see information compiled by the U.S. Energy Information Administration, available at: http://www.afdc.energy.gov/afdc/sabre/index.php (accessed October 26, 2010)

[87] The challenge is far greater for southern Atlantic states, which have not advanced as aggressive energy efficiency and renewable energy initiatives. North Carolina's Renewable Energy Portfolio Standard, while mandatory, sets a low bar of only 12.5% by 2021, compared with New York's 29% by 2015 and New Jersey's 22.5 by 2021. For information on state energy initiatives, see the U.S. DOE's 'Database of State Incentives for Renewables & Efficiency (DSIRE): http://www.dsireusa.org/ (accessed October 26, 2010)

[88] Wind Power Engineering (August 10, 2010). In Europe, 118 offshore wind turbines connect to grid in first half of 2010; available at: http://www.windpowerengineering.com/featured/business-news-projects/in-europe-118-offshore-wind-turbines-connect-to-grid-in-first-half-of-2010/ (accessed November 9, 2010). This is based on the American Wind Energy Association's projection that 1 MW of wind energy supplies electricity for 225 to 300 homes per year: http://www.awea.org/faq/wwt_basics.html (accessed October 26, 2010)

[89] US DOE (September 22, 2010); p. 10.

[90] European Wind Energy Association (January 2010). The European Offshore Wind Industry: Key Trends and Statistics, 2009; p. 6; available at: http://www.ewea.org/fileadmin/emag/statistics/2009offshore (accessed October 26, 2010).

[91] European Wind Energy Association (September 2009). Oceans of Opportunity: Harnessing Europe's largest domestic energy resource; p. 13; available at: http://www.ewea.org/fileadmin/ewea_documents/documents/publications/reports/Offshore_Report_2009.pdf (accessed October 26, 2010)

[92] European Wind Energy Association (2010). Factsheet: Employment. *Wind Energy Factsheets*; available at: http://www.ewea.org/fileadmin/swf/factsheet/8_employment.pdf (accessed October 26, 2010)

[93] OffshoreWind.biz (May 7, 2010). China finishes its first offshore wind farm; available at: http://www.offshorewind.biz/2010/05/07/china-finishes-its-first-offshore-wind-farm/ (accessed October 26, 2010)

[94] Fairley, P. (April 5, 2010). Chinese Wind Power Heads Offshore. *MIT Technology Review*; available at: http://www.technologyreview.com/energy/24978/?ref=rss (accessed November 1, 2010)

[95] Adams, M. (October 29, 2010). China: Beijing in the running to take crown for wind turbines. *The Financial Times*; available at: http://www.ft.com/cms/s/0/972a7b8e-e2e8-11df-9735-00144feabdc0.html (accessed November 1, 2010).

[96] According to plans prepared by the Chinese coastal provinces, the installed capacity of offshore wind power is planned to reach 32,800 MW by 2020. See: Junfeng, L. et al (October 2010). China Wind Power Outlook 2010. *Report prepared by Chinese Renewable Energy Industries Association, Global Wind Energy Association and Greenpeace*; pp. 7, 21; available at: http://www.greenpeace.org/raw/content/china/en/press/reports/wind-power-report-english-2010.pdf (accessed November 1, 2010)

[97] Proposed projects have been publicly announced and are at a variety of initial stages in the planning process. MW is list nameplate capacity.

[98] Advancing projects meet all of the criteria for proposed projects, and have taken additional steps, including leasing, permitting, power contracts and other concrete steps toward project completion.

[99] 1 GW of installed wind power capacity can generate 3.2 million MW/h of electricity annually; the same amount of electricity generated by fossil fuels would emit 1.8 million metric tons of carbon dioxide. See: US DOE (September 22, 2010). Creating an Offshore Wind Industry in the United States: A Strategic Work Plan for the United States Department of Energy (Predecisional Draft); p. 10; available at: http://www.windpoweringamerica.gov/pdfs/offshore/offshore_wind_strategic_plan.pdf (accessed October 26, 2010). According to data for 2008 from the US EIA, the net energy generation of the coal industry in the United States was 1,986 million MW/h. Assuming that there are 614 coal plants, this means that on average a single coal plant produces 3.32 million MW/h. Accordingly, it would take 52 coal plants to generate the equivalent energy produced by 54 GW of wind power (and its generation potential of 172.8 million MW/h annually). See the 2008 data set from: U.S. Energy Information Administration. Table 2.1. Net Generation by Energy Source by Type of Producer, 1997 through 2008 (Thousand Megawatthours). *Net Generation by Energy Source by Type of Producer*; available at: http://www.eia.doe.gov/cneaf/electricity/epa/epat2p1.html (accessed October 26, 2010)

[100] According to the US EPA, annual emissions from a typical passenger vehicle should be equated to 5.5 metric tons of carbon dioxide equivalent. See: U.S. EPA (February 2005). Emission Facts: Greenhouse Gas Emissions from a Typical Passenger Vehicle; p. 2; available at: http://www.epa.gov/oms/climate/420f05004.pdf (accessed October 26, 2010)

[101] President Obama's Fiscal Year 2011 budget designates $2.36 billion to the DOE Office of Energy Efficiency and Renewable Energy (EERE), which is a 5 percent increase from last year and does not include ARRA grants. The EERE's budget for wind power programs in FY2011 has increased by 53 percent from FY2010. The budget proposal eliminates more than $2.7 billion in tax subsidies for oil, coal and gas industries, which is estimated to save the federal government $38.8 billion dollars in revenue over the next 10 years. Similarly, the DOI New Energy Frontier initiative includes $73.3 million for renewable energy programs, a 24% increase above FY2010 funding levels, with $34.9 million allocated to the MMS for energy activities on the OCS. See: Eber, K. and Tucker, E. (February 8, 2010). U.S. Government Budget Proposals Increase Clean Energy Funding. Reprinted on *RenewableEnergyWorld.com*; available at: http://www.renewableenergyworld.com/rea/news/article/2010/02/us-government-budget-proposals-increase-clean-energy-funding (accessed October 26, 2010). The American Recovery and Reinvestment Act of 2009 has awarded $16.8 billion to EERE clean energy programs and initiatives. From that amount, at least $116.8 million has been awarded to wind energy projects across the country and an additional $104.7 million to NREL-related wind projects, not including funding for energy efficiency programs that benefit wind projects. For a list of projects that have received funding, see: http://www1.eere.energy.gov/recovery/ (accessed October 26, 2010).

[102] See US DOE (September 22, 2010); p. 15. Also see the various NREL reports mentioned in this report; in particular, see: Musial, W. and Ram, B. (September 2010).

[103] The following 10 states have signed to the Consortium: Maine, New Hampshire, Massachusetts, Rhode Island, New York, New Jersey, Delaware, Maryland, Virginia and North Carolina. A copy of the signed Memorandum of Understanding establishing the Consortium can be found at: http://www.governor.virginia.gov/tempContent/Atlantic_Consortium_MOU-6_08_10.pdf (accessed October 26, 2010)

[104] In April 2009, the US Department of the Interior (DOI) and the Federal Energy Regulatory Commission (FERC) signed a Memorandum of Understanding (MOU) that gave the DOI's Mineral and Management Service (MMS) exclusive jurisdiction over leasing, licensing, and conducting necessary environmental reviews related to non-hydrokinetic projects on the OCS (i.e. offshore wind projects):http://www.ferc.gov/legal/maj-ord-reg/mou/mou-doi.pdf (accessed October 26, 2010). Providing further clarification, the MMS adopted a 'Final Rule' effective June 29, 2009, which established a framework for granting leases for the siting and construction of offshore wind farms on the OCS. Key provisions include: a method for sharing revenues generated from OCS projects with adjacent coastal states; enhanced partnerships between Federal, state and local agencies and tribal governments on ensuring

the cost-effectiveness and environmental sensitivity of projects; and placing responsibility on the MMS to ensure project compliance with relevant federal regulations, such as the National Environmental Policy Act, the Endangered Species Act of 1973, the Coastal Zone Management Act, the Rivers and Harbors Appropriations Act of 1899, among others. See the Rule at: http://www.mms.gov/offshore/RenewableEnergy/PDF/FinalRenewableEnergyRule.pdf (accessed October 26, 2010)

[105] Straub, N. (May 20, 2010). Interior unveils plans to split MMS into 3 agencies. *New York Times*; available at: http://www.nytimes.com/gwire/2010/05/20/20greenwire-interior-unveils-plan-to-split-mms-into-3-agen-72654.html (accessed October 26, 2010)

[106] U.S. Department of the Interior (November 23, 2010) Press Release available at: http://www.boemre.gov/offshore/RenewableEnergy/index.htm

[107] As a result of the streamlined regulations, the MMS has issued several leases for the development of offshore projects on the OCS, including: a Request for Interest for renewable energy development off the coast of Delaware (April 2010), five limited exploratory leases for the construction of meteorological towers off the shores of New Jersey and Delaware to gather data that will assist in determining the optimal sites for wind farms (June 2009), and the approval of a commercial lease for the construction and operation of the Cape Wind Energy Project (April 2010). For the historic 'Record of Decision' by the MMS in regards to the Cape Wind Project, see: http://www.mms.gov/offshore/RenewableEnergy/PDFs/CapeWindROD.pdf (accessed October 26, 2010). See also: U.S. Department of the Interior (October 6, 2010). Press Release: Salazar signs first U.S. offshore commercial wind energy lease with Cape Wind Associates, LLC; available at: http://www.doi.gov/news/pressreleases/Salazar-Signs-First-US-Offshore-Commercial-Wind-Energy-Lease-with-Cape-Wind-Associates-LLC.cfm (accessed October 26, 2010)

[108] The White House Council on Environmental Quality (July 19, 2010). Final Recommendations of the Interagency Ocean Policy Task Force; available at: http://www.whitehouse.gov/files/documents/OPTF_FinalRecs.pdf (accessed October 26, 2010)

[109] OffshoreWind.biz (April 20, 2010). U.S.: Brown introduces new bill to help make clean energy production a reality; available at: http://www.offshorewind.biz/2010/04/20/us-brown-introduces-new-bill-to-help-make-clean-energy-production-a-reality/ (accessed October 26, 2010)

[110] Bradbury, D. (March 15, 2010). Senators prepare bill to bolster nascent deep-water sector. *BusinessGreen*; available at: http://www.businessgreen.com/business-green/news/2259477/senators-prepare-bill-bolster (accessed October 26, 2010)

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