The Power of Offshore Wind

A Source of Clean, Reliable, Affordable Electricity for Maryland's Future

ENVIRONMENT MARYLAND
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Executive Summary

The wind blowing over the ocean along Maryland's coast is a vast, untapped energy resource. Capturing just a fraction of this resource can help to modernize Maryland's electricity system for the 21st century and give the state greater control over its energy destiny.

Wind turbines deployed offshore could deliver large amounts of pollution-free electricity at a stable price – a bargain-rate insurance policy against unpredictable spikes in the cost of electricity and against the serious prospect of global warming. Offshore wind, as a local resource, can also reduce the need for Maryland to develop new power transmission lines to import electricity from coal-fired power plants in Pennsylvania or West Virginia.

Accordingly, Maryland's Public Utility Commission should take action to encourage development of the state's offshore wind energy resources, setting a goal of commercial operation of the first major offshore wind farm by 2014.

Maryland is facing a crisis in its electricity system.

- Since 2002, average Maryland electricity prices have climbed by more than 75 percent, even after adjusting for inflation.
- Maryland's dependence on fossil fuels and other states for its electricity supply leaves it vulnerable to further supply disruptions and price spikes. The Maryland Public Service Commission has warned of rolling blackouts by 2011 without action to curb power demand and/or increase supply.
- New power lines are under consideration to increase the stability of Maryland's electricity supply. However, these lines could increase the state's dependence on polluting resources, export more of Maryland's energy dollars out of state, and face high political hurdles before construction could go forward.

- At the same time, Maryland's electricity system is dominated by outdated and polluting technologies. Nearly 60 percent of the state's electricity generation comes from coal-fired power plants. In addition, the state imports nearly a third of its electricity supply from coal-fired power plants in West Virginia and Pennsylvania.
- Consumption of electricity from coal-fired power plants is Maryland's leading source of the pollution that drives global warming. Without significant action, global warming will cause dramatic flooding of coastal areas as sea levels rise, yield stronger and more damaging storms, and threaten public health with intensified heat waves and smog.

Facing a crisis in its electricity system, Delaware chose offshore wind power to regain control over its energy future.

- As rate caps mandated under electricity market restructuring came off in 2006, customers of Delmarva Power faced a 59 percent increase in the cost of power. The state legislature directed the Delaware Public Service Commission to search for local solutions that would improve price stability.
- In May 2007, after receiving citizen comments in favor of offshore wind power by a 10-to-1 margin, the Public Service Commission approved the construction of the Bluewater Wind Farm and instructed Delmarva Power to negotiate a contract to purchase the power.
- Bluewater entrepreneurs had recognized that the winds off the coast of Delaware were well-suited for power generation, blowing steadily during the day, when demand for electricity is often high. They also were able to offer a promise of stably-priced electricity for 25 years – something that no traditional power plant running on fossil fuels could match.
- Commission staff found that the new wind farm could provide electricity to customers of Delmarva Power for an average of less than $1 per month more than under a reference case scenario. In the event that fuel costs or the cost of emitting global warming pollution increase – which the commission found likely – offshore wind could provide net savings.

Offshore wind stands out as one of Maryland's best local clean energy solutions.

- Maryland can also turn to offshore wind power as one piece of a 21st century electricity system. With today's technology, wind turbines placed in shallow waters along the Mid-Atlantic Bight from Massachusetts to North Carolina (excluding areas inappropriate for development, such as bird flyways and shipping lanes) could supply one third of the region's annual electricity needs. With tomorrow's technology, resources in deeper waters could meet the region's entire energy needs, and more.

Offshore wind can help stabilize electricity prices, reduce the need for politically unpopular transmission lines, and help fight global warming.

- Wind energy offers the advantage of price stability. Because most of the cost is for building and installing the wind turbine – and the "fuel" is free

The Liligrund offshore wind farm, located near the south coast of Sweden, generates enough electricity to power about 60,000 homes. *Photo: Siemens*

– the price of wind power does not fluctuate over time. For example, under its 2008 contract with Bluewater Wind, Delmarva Power will purchase offshore wind power for 11.7 cents per kWh, with future costs escalating at less than typical rates of inflation. The Delaware Public Service Commission determined that the small price premium this potentially represented was a bargain-rate insurance policy compared to its recent experience with unpredictably skyrocketing electricity rates.

- Offshore wind can also be built close enough to power-hungry cities to reduce the need for long, expensive, and politically unpopular transmission lines. By connecting to the power grid relatively near to where the electricity will be used, an offshore wind farm would provide a local supply of electricity, improving the reliability of the electricity system. Coupled with substantial efforts to reduce peak demand through energy efficiency and solar energy systems, an offshore wind farm would likely help the state maintain a reliable electricity system through 2025.
- Offshore wind can reduce Maryland's contribution to global warming. One offshore wind farm with 600 megawatts (MW) of generating capacity could prevent more than 2 million metric tons of global warming pollution per year. That is equivalent to 4 percent of

Maryland's global warming pollution from electricity consumption, or the equivalent of eliminating pollution from nearly 1 in 10 vehicles on Maryland roads.

States across the Mid-Atlantic and the Northeast are moving to develop local offshore wind energy resources to increase energy security and reduce global warming pollution.

- In October 2008, New Jersey Governor Jon Corzine issued an energy master plan that calls for the construction of 3,000 MW of offshore wind energy facilities by 2020. The state has selected Garden State Offshore Energy to construct the first wind farm 16 to 20 miles off of the Jersey Shore. The facility is expected to be operational by 2012.
- Encouraged by New York Governor David Paterson, New York City Mayor Michael Bloomberg, and state policy supporting renewable energy, the Long Island Power Authority and Consolidated Edison are soliciting proposals for a 350 MW wind farm to be located 13 miles off the coast of the Borough of Queens. This wind farm will be one of the first capable of supplying large amounts of renewable power directly to the densely populated New York City area.
- Rhode Island Governor Donald Carcieri is working with Deepwater Wind to build an offshore wind farm capable of meeting 15 percent of the state's electricity needs by 2012, coupled with a turbine manufacturing facility expected to create 800 jobs.
- Massachusetts Governor Deval Patrick has set a goal of building 2,000 MW of wind power by 2020. Most of the state's wind energy potential is located offshore – symbolized by the Cape Wind project proposed for the shoals off of Cape Cod. Although wealthy property owners have effectively blocked Cape Wind to date, the U.S. Interior Department gave the project a favorable environmental review in January 2009, and Massachusetts authorities issued tentative siting approval. With final approval from the Obama administration, the facility could begin generating electricity by 2011 or 2012.

Maryland should facilitate the construction of a large wind farm along its shores by 2014.

- The Maryland Public Utilities Commission should solicit proposals for a wind farm to be built off of Maryland's coast.
- The PUC should then direct utilities to negotiate long-term power supply contracts with the wind developer, following the lead of state officials in Delaware.

Introduction

Maryland's electricity system poses a grave threat to the future of our society. Our heavy dependence on coal-fired power plants to generate the energy we need to light our homes, power our industries, and facilitate communication creates vast amounts of global warming pollution – which is poised to cause dramatic disruptions to our way of life through rising sea levels, stronger storms, and intensifying heat waves.

At the same time, Maryland electricity consumers are vulnerable to the fluctuations of the regional power market, with electricity rates climbing radically faster than inflation.

Finally, the reliability of our electricity system is in doubt. Since no new large-scale power plants have been built in Maryland in decades – and since energy efficiency efforts were allowed to falter as the electricity market was restructured – the Public Utilities Commission has asked utilities to identify more local electricity generation resources to forestall the potential for blackouts.[1]

The writing is on the wall: business as usual is no longer an option. Solving all of these problems will require creating a new, clean energy future for Maryland's electricity system. By transitioning away from outdated technologies and toward efficient use of renewable energy, Maryland can ensure a reliable supply of electricity, with minimal emissions of health-threatening and global warming pollution, available at a reasonable cost.

Maryland's leaders have taken the first steps toward this new energy future. The state has enacted a renewable electricity standard requiring 20 percent of the state's electricity supply to come from renewable energy resources such as wind and solar by 2022.[2] The state has also taken meaningful steps toward greater energy efficiency, including the EmPOWER Maryland initiative.[3] In April 2009, Maryland put a firm, legally enforceable cap on allowable global warming pollution.[4]

And in September, Maryland took the first steps toward enabling the construction of a wind farm along its Atlantic coast.[5]

By taking these steps, Maryland is moving to seize control of its energy destiny and build an electricity system for the 21st century. By capturing local renewable energy resources, the state can increase its energy independence and strengthen its economy.

Many European countries, and many states in the Northeast and Mid-Atlantic, are already leading the way forward. With limited local land area available for wind energy development, these areas are turning to the wind blowing over the ocean as a source of unlimited energy to drive their economies.

Offshore wind power promises vast amounts of pollution-free electricity, produced relatively close to power-hungry coastal cities. It offers freedom from the price spikes that come from fossil fuel supply disruptions and insulation from any price impacts of new regulations on global warming pollution. Moreover, developing offshore wind resources can stimulate local manufacturing industry, creating jobs in making the steel towers, turbine blades, and other components necessary to effectively harness the wind.

Building on the technological advances gained from offshore oil and gas drilling platforms, European wind energy companies have already installed hundreds of wind turbines in the ocean along their coasts, and plan to install thousands more. And American companies are preparing to begin a wave of wind energy construction off the coasts of states from Delaware to Massachusetts.

> "The idea that wind energy has the potential to replace most of our coal-burning power today is a very real possibility. It is not technology that is pie-in-the sky; it is here and now."
>
> – U.S. Secretary of the Interior Ken Salazar, April 6, 2009[8]

Public support for developing offshore wind energy resources has never been higher. Public comments to the Delaware Public Service Commission supported offshore wind power 10-to-1 over outdated alternatives including coal and natural gas.[6] Surveys of Delaware residents show that more than 75 percent support offshore wind development, while less than 5 percent oppose it.[7] Support in Maryland is likely to be equally widespread.

Maryland, too, can capture the bountiful energy blowing off of its coasts. With strong and consistent support from leaders at the local, state and federal levels, Maryland can seize control of its energy destiny, build a 21st century electricity system, and help to create a healthy, safe and prosperous future for all Marylanders.

Maryland Needs a 21st Century Electricity System

Maryland's outdated electricity system threatens our society's future.

The state's reliance on old coal-fired power plants contributes heavily to the problem of global warming. Without significant action, global warming will cause dramatic flooding of coastal areas as sea levels rise, yield stronger and more damaging storms, and threaten public health with intensified heat waves and smog.

At the same time, Maryland's dependence on fossil fuels and other states for its electricity supply leaves it vulnerable to supply disruptions and price spikes. While the average price for electricity in the state has climbed by more than 75 percent since 2002, demand for electricity threatens to outpace supply. The Public Service Commission has warned of possible forced blackouts by 2011 without action to curb power demand and/or increase supply.

New power lines are under consideration to increase the stability of Maryland's electricity supply. However, these lines would increase the state's dependence on polluting resources, export more of Maryland's energy dollars out of state, and face high political hurdles before construction could go forward.

To solve these problems, Maryland will need to transform its electricity system for the 21st century.

Maryland's Electricity System is Dominated by Outdated and Polluting Technologies

Maryland is heavily dependent on outdated and polluting coal-fired power plants for its electricity supply. Coal-fired power plants produce nearly 60 percent of the electricity generated within Maryland's borders.[9] (See Figure 1.) In addition, Maryland imports nearly a third of its electricity supply, primarily from coal-fired power plants in West Virginia and Pennsylvania.[10] On average, Maryland's coal-fired power plants are more than 35 years old.[11]

In contrast, less than 5 percent of in-state electricity generation comes from renewable sources of electricity, including wood-derived fuels and hydropower.[12] Less than 1 percent of in-state generation comes from wind or solar power, which offer more benefits for public health and the environment than hydropower or biomass combustion.[13]

Electricity Consumption Contributes to Global Warming

Maryland's dependence on old coal-fired power plants contributes heavily to the problem of global warming.

Electricity consumption is the state's leading source of global warming pollution. The use of electric power generated within Maryland and in neighboring states represents 38 percent of the state's total emissions.[15]

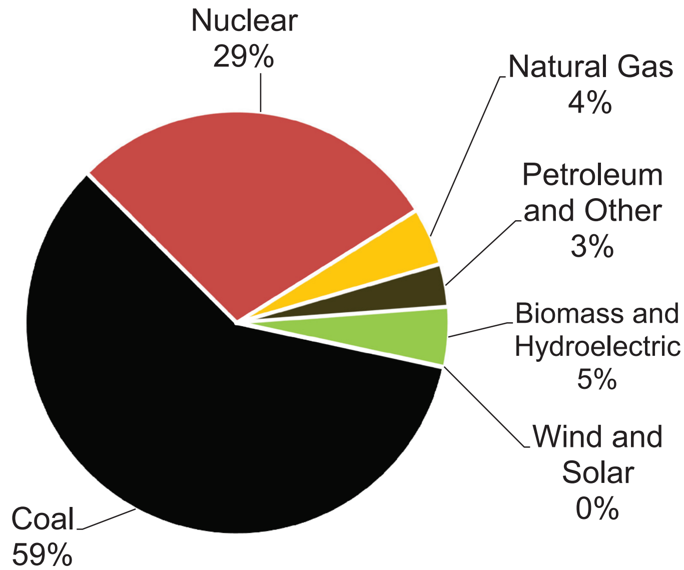
Within the state's borders, coal-fired power plants stand out as the leading contributors to global warming from power generation. Maryland's coal-fired power plants produce more than 90 percent of carbon dioxide emissions from power generation in Maryland, despite the fact that those plants produce less than 60 percent of the power generated in the state.[16]

Global Warming Threatens Maryland and the World

If Maryland, the United States and the world continue to emit large amounts of global warming pollution, the state will face dramatic impacts, including:

- **Heat waves.** The number of days with temperatures higher than 90°F could quadruple, reaching 100 or more days per year.[17] If no action is taken, the world average temperature could increase by a catastrophic 10°F or more by the end of the century.[18]
- **Heavy storms punctuated by drought**. Precipitation is projected to increase by about 10 percent in the winter and spring.[19] Most of this increase is expected to come through heavy downpours, punctuated by extended periods of dry weather. Increased heat will hasten evaporation, making soil conditions dryer in between major storms, paradoxically increasing the likelihood of drought, especially in the summer.[20]
- **Catastrophic sea level rise**. Sea level could rise by as much as 6.5 feet (or 2 meters) by the end of this century, with sea level rise continuing in future centuries.[21] As a result, islands and coastal wetlands will disappear, and coastal cities will be at increasing risk of flooding, particularly during storm surges.[22]

Figure 1: Energy Sources for Electricity Generation in Maryland, 2007[14]



An estimated 380,000 acres of land in Maryland (or six percent of the state's land area) is less than five feet above sea level and is vulnerable to complete submersion or to inundation during high tides.[23] Maryland ranks as the fourth most vulnerable state to sea-level rise in the United States.[24]

- **Less drinking water, a more polluted Bay**. Sea level rise will promote further infiltration of seawater into underground aquifers, reducing the available drinking water supply for Maryland.[25] At the same time, heavy rainstorms caused by global warming will likely boost the amount of runoff and nutrients in the Chesapeake Bay, promoting low-oxygen dead zones. This problem, which already affects more than one-third of the bay each summer, will grow worse as water temperatures rise.[26]
- **Loss of plant and animal species.** Higher temperatures and changes in precipitation will alter the mix of plants and animals that can survive in Maryland. Forested areas may shrink or become less dense. Insect populations may thrive as temperatures increase. As plant types change, birds and other animals may have to move northward to find suitable habitat, including the Baltimore Oriole, the state bird.[27]
- **Threats to public health.** Higher temperatures will increase weather-related illnesses and fatalities. The number of heat-related deaths in Maryland could increase by 50 percent during summer heat waves.[28] Higher temperatures will also increase the formation of smog pollution, a serious threat to respiratory health.[29]
- **Declining agricultural production.** Higher temperatures and increased precipitation would affect Maryland's $1.3 billion agriculture industry. Higher temperatures would decrease corn and hay production, while soybean and wheat production could rise or fall, depending on precipitation changes.[30]

The precise effects of global warming will be unpredictable and may be sudden. Rising sea level may gradually erode shoreline for years, or a hurricane aimed straight up the bay may create an unprecedented storm surge that destroys land and property not typically considered at risk. An unusually dry and hot year could wreak havoc on the state's drinking water supplies and force the development of expensive alternatives. In other words, the impacts of global warming will include severe and unforeseen events, not merely a gradual change in current conditions.

To Fight Global Warming, Maryland Must Shift to Low- or Zero-Carbon Energy Sources

To limit the severity of global warming, Maryland state leaders have committed to reduce global warming pollution by 25 percent below 2006 levels by 2020 through the Greenhouse Gas Reduction Act of 2009.[31] Among the many actions that will be required to meet these targets, Maryland must reduce emissions of global warming pollution from existing power plants and shift its electricity system toward sources of energy that do not produce carbon dioxide.

Several policies are already driving Maryland in this direction. For example, the EmPOWER Maryland Act of 2008 enlists utilities and the state in improving electric energy efficiency. And under Maryland's 2008 renewable electricity standard, 20 percent of Maryland's electricity supply must come from renewable sources of energy – including wind, solar, biomass, geothermal, ocean, and low-impact hydroelectric power – by 2022.[32] The state is also participating in the Regional Greenhouse Gas Initiative, a pact between states that limits allowable carbon dioxide emissions from electricity generation.

Maryland Needs a Reliable Supply of Electricity at a Predictable Price

Maryland's electric system is precariously balanced between demand for electricity and available supply. If demand were to outstrip supply, it would trigger disruptive rolling blackouts much like those experienced in California at the beginning of the century.

At the same time, the deregulation of the electricity market has brought markedly higher costs to Maryland electricity consumers. Electricity bills in Maryland have jumped higher, faster than just about anywhere else in America, pinching family budgets across the state.

To Ensure Electric System Reliability, Maryland Needs to Reduce Demand and/or Increase Supply

In December 2007, the Public Service Commission warned that Maryland could face forced rolling electric blackouts by 2011 without preventative action.[33]

Maryland faces this situation because demand for electricity is threatening to outstrip available supply. Maryland has not built a major power plant in decades. At the same time, Maryland is nearing the limits of its ability to import electricity from nearby states.[34] The U.S. Department of Energy has designated both the Baltimore/Washington metropolitan area and the Delmarva Peninsula as "Critical Congestion Areas," where transmission lines are overcrowded and nearing inadequacy.[35]

Maryland exacerbated the problem by allowing investments in energy efficiency to stagnate for nearly a decade after the deregulation of the electricity market.[36] Only in the past two years has the state taken action to restart efforts to save energy. Finally, as Maryland begins to implement laws such as the Regional Greenhouse Gas Initiative and the Healthy Air Act, it is likely that some existing power plants will scale back power production, or retire altogether – further narrowing the gap between available electricity supply and demand.[37]

"We cannot, cannot stand idly by and wait for market forces or the electricity good fairy to come in and solve this problem for us. We know that there's no new generation coming online. We have to do something about this now or the rolling brownouts and blackouts will happen."

– Governor Martin O'Malley to the Maryland Association of Counties, August 16, 2008[40]

To maintain system reliability, Maryland must either reduce demand for electricity, and/or increase electricity supply by adding power lines or additional power plants. Maryland is beginning to take action on both these fronts. The EmPOWER Maryland initiative will help improve energy efficiency.[38] At the same time, Governor O'Malley and the Public Utilities Commission have ordered utilities to acquire new, local electricity generation resources to ensure the reliability of the electricity system.[39]

Importing More Electricity Would Require Transmission Line Construction

Several transmission and distribution utilities have proposed building high-voltage power lines to transmit electricity into and through Maryland – enabling more power to be imported into the region from out-of-state power plants, and thus improving the reliability of the electricity system.

Currently proposed lines include:[41]

- A power line proposed by American Electric Power and Allegheny Energy that would start in southwestern Pennsylvania, enter West Virginia and end near Kemptown and the Montgomery County border in Maryland;
- A power line proposed by Dominion Virginia Power that would travel through Loudoun and Prince William Counties in Northern Virginia; and
- A power line proposed by Pepco Holdings, that would stretch 230 miles from Northern Virginia, through Maryland (and potentially under the Chesapeake Bay), to Delaware, ending in southern New Jersey.

Major new transmission line proposals carry notable risks. For example, without adequate policy safeguards, the lines could enable more power to be imported into Maryland from fossil-fired power plants, increasing Maryland's contribution to global warming. Additionally, importing more fossil-fired power could expose Marylanders to price escalation as a result of future global warming regulations or as a result of volatility in the price of fuel.

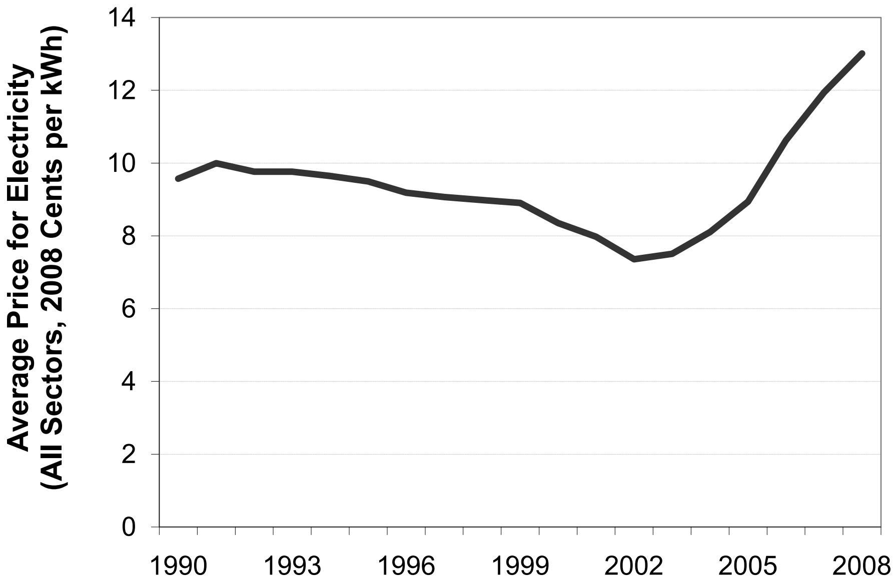
Major power lines also face substantial political hurdles, including objections over cost and impact on local landowners. The transmission lines will also take many years to construct, and construction may not begin in a timely manner. For example, Allegheny Energy intended to begin construction on its power line project by the fourth quarter of 2008.[42] As of the publication of this report, the project has not yet achieved regulatory approval and is at least nine months behind schedule.

Maryland Consumers Are Paying More for Electricity

Finally, Marylanders are paying more to power their homes and businesses. In the past seven years, electricity prices have jumped by more than 75 percent, even after adjusting for inflation.[43] (See Figure 2.) Rates paid by Baltimore Gas & Electric customers have climbed 85 percent since deregulation passed in 1999.[44] And millions of dollars are leaving the state to pay for fuel imports, draining our local economy.[45]

When Maryland leaders were debating whether to restructure the electricity market in late 1998, advocates of

Figure 2: Electricity Rates Have Increased Dramatically Since 2002[47]



Electricity rates in Maryland have spiked significantly since 2002, even after adjusting for inflation.

deregulation promised that increased competition would deliver lower rates. In fact, the opposite occurred. Following the removal of rate caps in 2006, the price of electricity more than doubled, increasing retail electricity bills by as much as 72 percent, or $743 a year.[46]

Maryland's limited ability to import power contributes to the rising cost of electricity. During periods of peak demand, the state must rely upon higher-priced local sources of power.[48] Many power plants designed to serve peak demand run on natural gas or petroleum, which are particularly vulnerable to price spikes cause by disruptions in supply or increases in demand.[49]

Offshore Wind Energy Can Help Maryland Take Control of its Energy Destiny

To take control of its energy destiny, Maryland needs to build a 21st century electricity system. This system should provide a solid and reliable supply of electricity, at a stable and predictable price, produced locally and without emissions of global warming pollution.

Looking at potential energy resources that might be able to deliver such a transformative change to Maryland's electricity system, the wind blowing along Maryland's coast presents a golden opportunity.

> "The wind potential off the coasts of the lower 48 states actually exceeds our entire U.S. electricity demand."
>
> – Ken Salazar, U.S. Secretary of the Interior, 2 April 2009[50]

Offshore wind energy can help to secure Maryland's energy future. Offshore wind energy is capable of providing large amounts of pollution-free electricity – greater than every Mid-Atlantic state currently consumes. Moreover, strong offshore wind resources are located close to where the electricity would be used, reducing the challenge of transmitting electricity from distant resources. Finally, wind power can provide electricity at a constant price, providing a hedge against volatile fossil fuel prices – and protecting consumers against any cost increases that could arise from inevitable limits on global warming pollution.

Maryland's Offshore Wind Resources are Immense

Winds blowing above the ocean are typically stronger and more consistent than winds over land, and thus are well-suited for power generation.[51]

Offshore wind resources are, by any measure, immense. The U.S. Department of the Interior estimates that wind energy resources off the coast of the continental United States could more than supply the country's entire demand for electricity.[52] Moreover, the largest concentration of resources in shallow ocean waters, accessible with current technology, is located along the Atlantic coast.[53]

In 2007, a group of researchers from the University of Delaware and Stanford University estimated the wind energy resources available in the Mid-Atlantic Bight (a region from Cape Cod, MA to Cape Hatteras, NC), out to an ocean depth of 100 meters. (See Figure 3.) The group excluded from consideration areas inappropriate for development, including bird flyways, shipping lanes, and visual space for major tourist beaches. The researchers found that wind energy resources in this region could supply all of the electricity needs for every coastal state from Massachusetts to North Carolina – while also replacing all of the gasoline used in motor vehicles, and all of the fuel oil and natural gas used for heating and industry – with energy to spare.[54] (Achieving such a high wind energy penetration would likely require the use of an energy storage system – such as a network of batteries in plug-in hybrid or electric vehicles.) In comparison, the oil and gas resources in federal waters along the Mid-Atlantic Bight amount to only one-tenth of the wind energy potential of the same region – and the oil and gas would be gone in about 20 years.[55]

With today's technology, wind turbines can be installed in ocean waters up to a depth of about 30 meters. In shallow depth areas in the Mid-Atlantic Bight (at an ocean depth of 20 meters or less), 60 GW of power could be installed. That's enough to meet more than one-third of the region's need for electricity.[58]

Maryland's wind energy resources offshore far exceed its land-based resources.

Figure 3: Ocean Depths in the Mid-Atlantic Bight[56]

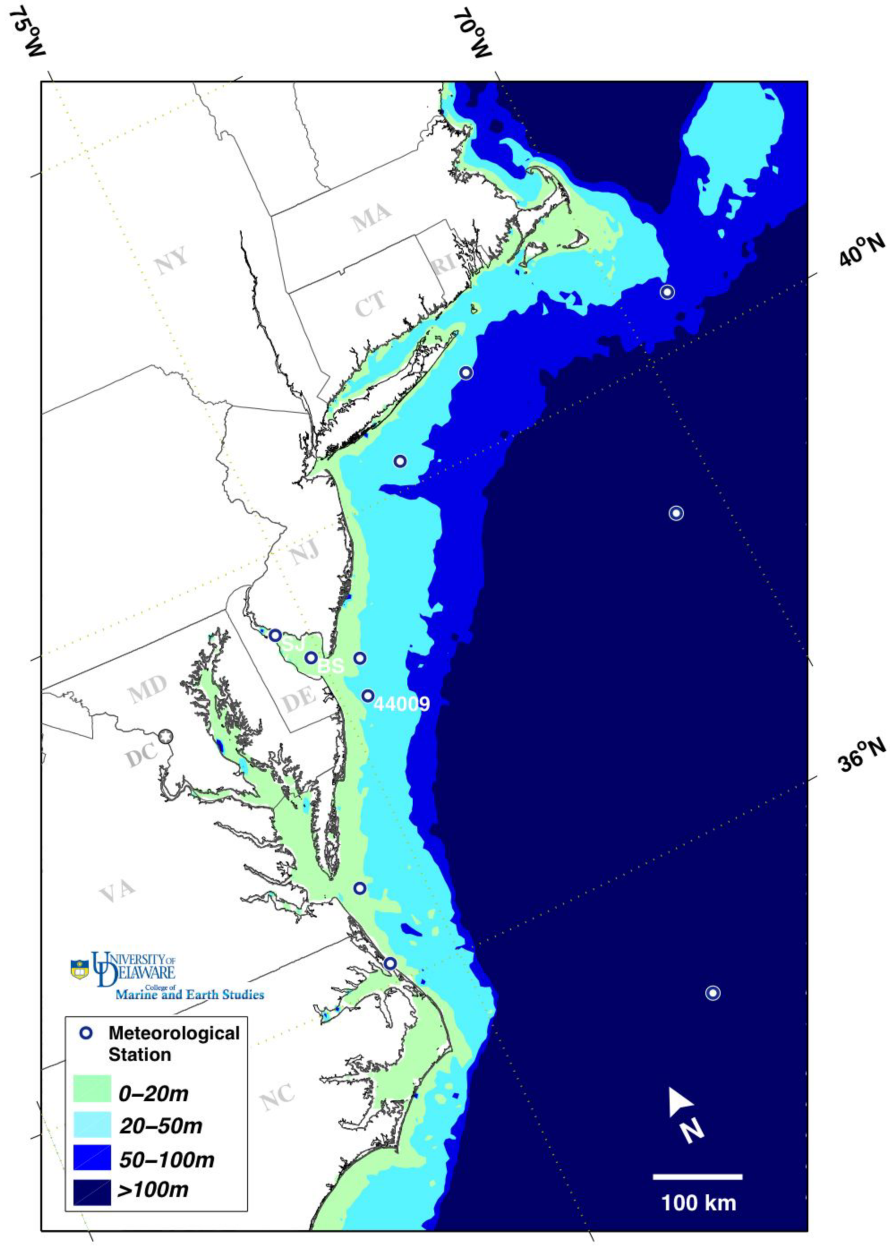
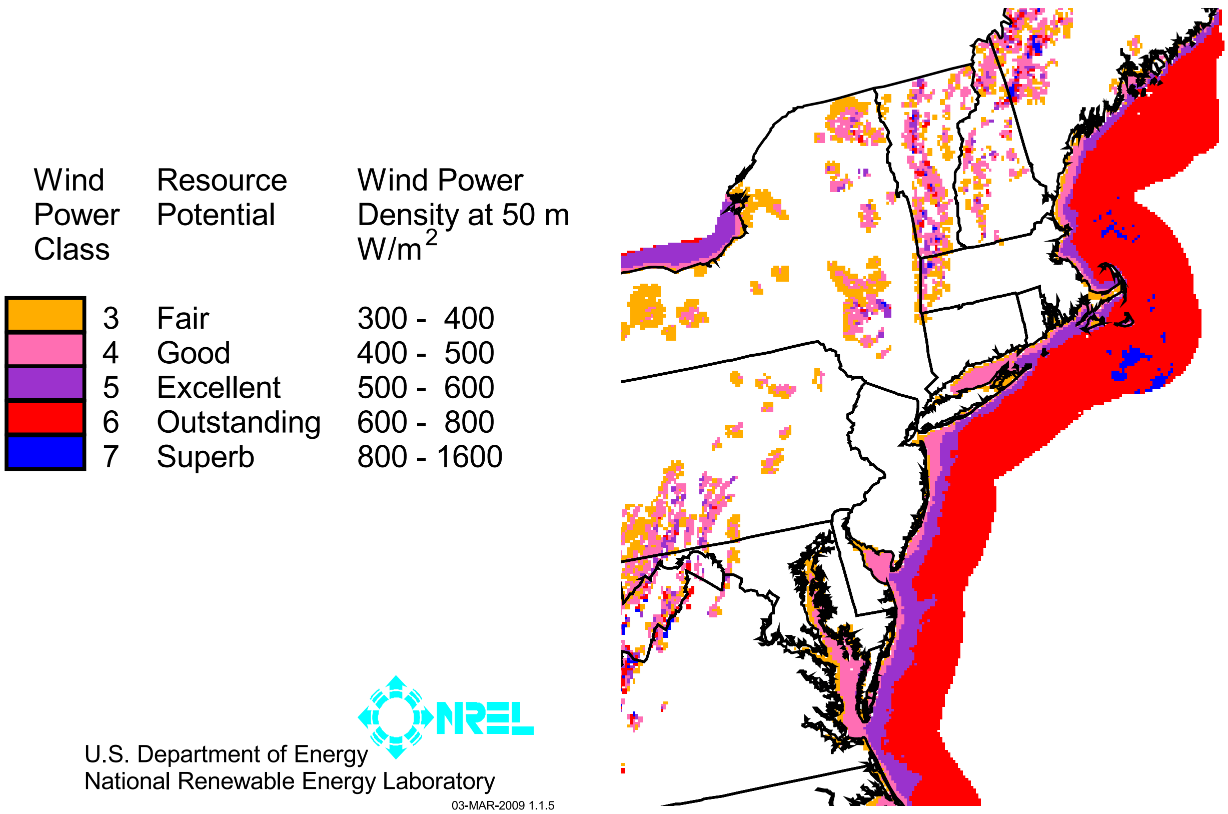


Figure 4: Mid-Atlantic Coastal Wind Energy Resources at a Height of 50 meters[57]



(See Figure 4.) Strong winds blow over shallow ocean waters along the entire Atlantic coast. Moreover, Maryland's offshore wind energy resources are relatively close to where the electricity will be used – minimizing the amount of energy that would be lost during transmission.[59]

Offshore Wind Technology is Ready

Offshore wind energy technology is ready to be deployed now.

Nearly two decades have passed since the commissioning of the first offshore wind park off the coast of Denmark in 1991.[60] Today, offshore wind energy is growing in importance as a source of electricity worldwide. Offshore wind farms are already operating in dozens of locations along the European coast.

Many communities are recognizing that offshore wind resources provide huge potential for electricity generation near power-hungry cities, simplifying the delivery of renewable, pollution-free power to where it will be used. Moreover, placing wind turbines in the ocean often reduces potential issues with noise or aesthetic impacts on nearby communities, especially for densely populated areas with limited on-land wind resources.[61]

Current technology makes shallow water the most cost-effective location for offshore wind turbines, and new technologies are being developed to take advantage of wind in deeper waters. The technology overlap between the wind industry and experience gained through the construction of offshore oil drilling platforms promises to make wider areas of the ocean available for wind energy development at increasingly reasonable costs.

A foundation for an offshore wind turbine, with construction equipment in the background. The technology for building foundations on the sea floor derives from the offshore oil and gas extraction industry. Photo: MT Højgaard[70]

Offshore Wind Combines Technology From the Wind Energy and Oil & Gas Industries

Nationwide, land-based wind power is rapidly becoming an important part of the electric system. In 2008, wind turbines accounted for more than 40 percent of all electric generating capacity added to the grid, a greater share of new capacity than any other type of generation except perhaps natural gas-fired power plants.[62]

The past decades have seen dramatic advances in the technology of wind turbines, enabling turbines to generate more power at lower cost. The cost of wind power projects has been cut by about two thirds over the past two and a half decades, and technological advances have made it possible to build turbines that are more efficient at generating electricity from the wind.[63]

Offshore wind energy technology has benefited from advances in turbine design. Just like a land-based wind farm, offshore wind turbines harness the energy in the wind with giant blades attached to a generator, mounted on a steel tower reaching 80 meters or higher above sea level. However, offshore wind turbines are larger – and capable of generating more electricity – than their land-based counterparts. The newest offshore wind turbine designs are capable of generating as much as 5 megawatts (MW) of electricity per unit during high winds.[64]

Offshore wind turbines are becoming larger to minimize infrastructure costs, while maximizing the amount of electricity that can be generated over a given area of ocean.[65] Transporting large wind turbine components is easier over water than over land, where bends in roads and rail lines limit the size of blades and tower sections. However, barges can move much larger objects over open water, facilitating the construction of ever larger wind turbines. The Global Wind Energy Council anticipates that within 5 to 10 years, offshore wind turbines as large as 8 MW will be developed.[66]

Offshore wind energy also benefits from the experience of the offshore oil and gas drilling industry. Offshore wind turbine towers are mounted on an underwater foundation, using technology developed for offshore oil and gas drilling platforms. In shallow waters, tower

The Middelgrunden offshore wind farm in Denmark, commissioned in 2000, has been generating electricity for nearly a decade.
Photo: Siemens[75]

foundations can be driven directly into the seafloor. To reach deeper waters, researchers are designing floating platforms upon which to mount wind turbines.[67] Current technology has allowed offshore wind turbine installation in waters as deep as 45 meters.[68] Within a decade, experts expect waters as deep as 150 meters to become accessible to offshore wind development through adaptation of floating platform technology from deep water oil and gas drilling platforms.[69]'

Offshore Wind Plays a Growing Role in the European Electricity System

There are at least 19 operational wind farms off the shores of European countries, including Ireland, Scotland, England, Denmark, the Netherlands, France, Belgium, Denmark, Germany and Sweden.[71] Total operational offshore wind capacity in Europe is greater than 1,600 MW – enough to meet the electricity needs of approximately half a million households.[72] On the order of seven more offshore facilities are scheduled for construction during 2008-2009.[73]

The European Wind Energy Association anticipates that Europe will have somewhere between 20 and 40 GW of operational offshore wind energy generation capacity by 2020, and as much as 150 GW by 2030.[74]

Offshore Wind Can Become Increasingly Important in the United States

While no company has yet to begin construction on an offshore wind energy facility in the United States, many projects are in the development pipeline. As of April 2009, more than 2,000 megawatts of offshore wind projects were proposed – primarily along the Atlantic coast and in the Great Lakes.[76]

The U.S. Department of Energy, in its plan to reach 20 percent of the U.S. electricity supply from wind power by 2030, anticipates 50 GW of offshore wind developed in the U.S. by 2030.[77]

Offshore Wind Can Help Reduce Maryland's Contribution to Global Warming

Wind turbines deployed offshore could deliver large amounts of pollution-free electricity – reducing Maryland's contribution to global warming and improving public health.

Compared to traditional coal- and natural gas-fired power plants, offshore wind power has effectively zero emissions. Taking into account fossil fuels used to build a wind farm, wind energy emits 11-37 grams of carbon dioxide per kWh over its full life cycle.[78] In comparison, new coal-fired power plants emit more than 700 grams of carbon dioxide per kWh, and natural gas-fired combined cycle plants produce close to 400 grams per kWh.[79] (See Figure 5.)

By replacing fossil fuels for electricity generation on Maryland's electricity grid, one large offshore wind farm (600 MW) could prevent more than 2 million metric tons of global warming pollution per year.[81] That is equivalent to 4 percent of Maryland's global warming pollution from electricity consumption, or the equivalent of eliminating pollution from nearly 1 in 10 vehicles on Maryland roads.[82]

Offshore Wind Can Improve Electric System Reliability and Stabilize Costs

In order to improve the reliability of its electric system and prevent the possibility of rolling blackouts, Maryland needs to increase available electricity generation capacity and/or reduce demand for electricity. Through the EmPOWER Maryland initiative, the state is taking action to improve the efficiency of electricity use. Installing an offshore wind facility would help improve the reliability of the electric system by providing local generation capacity.

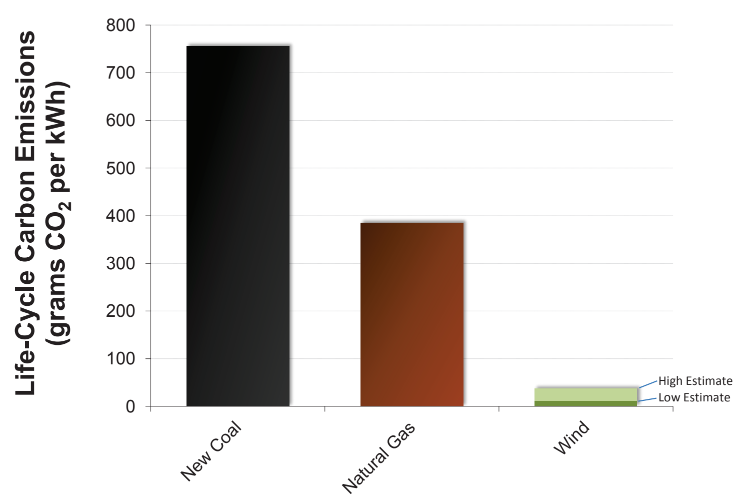
Wind energy offers the additional advantage of price stability. Because most of the cost is for building and installing the wind turbine – and the "fuel" is free – the price of wind power does not fluctuate over time. As a result, an offshore wind farm could help insulate Maryland ratepayers from volatile fossil fuel prices and from cost increases that could result from inevitable regulation of global warming pollution.

Improving Reliability

Electric system reliability depends on having enough generation resources available to meet demand for electricity at any given time. Offshore wind can contribute to the reliability of Maryland's electricity supply by providing access to a predictable and local energy resource, and by providing many small generation units linked together, where a mechanical failure at any individual turbine would have little to no impact on the overall function of the electricity system.

Governor O'Malley and the Public Utilities Commission have ordered utilities to acquire electricity generation resources to ensure the reliability of the electricity system.[92] An offshore wind energy facility would qualify. Moreover, analysis by the Maryland PIRG Foundation indicates that an offshore wind farm, coupled with the state's substantial efforts at reducing peak demand through energy

Figure 5: Wind Power Produces Far Less Global Warming Pollution than Coal- or Gas-Fired Power[80]



Offshore Wind Can Reduce Health-Threatening Pollution

Offshore wind can help clean Maryland's air and improve public health. By displacing dirtier power sources, offshore wind can help prevent emissions of pollutants that form soot and smog, two serious public health threats.

For every megawatt-hour of electricity generated, the average Maryland power plant emits 12.2 pounds of soot-forming sulfur dioxide and 2.8 pounds of smog-forming nitrogen oxides.[83] Upwind power plants, some of which supply power to Maryland, also contribute significant amounts of pollution. Partially because of this pollution, Maryland has a history of violating health-based air quality standards.[84]

Sulfur dioxide emissions from coal-fired power plants form fine soot particles in the atmosphere. When inhaled, these particles become lodged deep in the lungs where they cause a variety of health problems, including asthma, bronchitis, lung cancer and heart attacks.[85] Soot pollution from power plants is responsible for significant harm to public health in Maryland.[86]

Fossil-fueled power plants also emit nitrogen dioxide, one of the primary ingredients in smog. Smog makes lung tissues more sensitive to allergens and less able to ward off infections.[87] It scars airway tissues.[88] Children exposed to smog develop lungs with less flexibility and capacity than normal. During high smog days, otherwise healthy people who exercise can't breathe normally.[89] Over time, smog exposure can lead to asthma, bronchitis, emphysema and other respiratory problems.[90]

Based on the emissions of non-baseload power plants in the regional electricity system in 2005, a large offshore wind farm (600 MW) could prevent in the range of 7 million pounds of smog-forming nitrogen oxide emissions and more than 25 million pounds of soot-forming sulfur dioxide emissions per year.[91]

efficiency and with local solar energy generation required under the state's renewable electricity standard, would likely help the state maintain a reliable electricity system through 2025.[93]

Offshore wind can be built close enough to power-hungry cities to avoid the need for long, expensive, and politically unpopular transmission lines. Upgrades will have to be made to the transmission infrastructure in Maryland to accommodate new offshore wind turbines.[94] However, the infrastructure required will likely be far less than for importing on-land wind power from as far away as the Great Plains. Potential points of interconnection for an offshore wind farm include Ocean City, MD; Indian River, DE, or possibly Calvert Cliffs, MD.[95]

Wind energy is a predictable resource. While the wind doesn't blow with equal strength at all times, winds can be forecast with more than 80 percent accuracy a day in advance, allowing grid operators to plan ahead and ensure that enough capacity is available to keep the lights on.[96] PJM, the regional electric grid operator, currently assigns new wind projects an initial "capacity credit" of 20 percent, meaning that 10 MW of wind power capacity offsets 2 MW of fossil fuel capacity for reliability planning purposes.[97] PJM then updates this initial capacity credit for each individual wind farm based on actual operating experience, taking a rolling 3-year average of the power supplied by the facility during the hours of 3 p.m. to 7 p.m. from June 1 to August 31.[98] Offshore wind projects, often in areas with winds that tend to blow more consistently, can have capacity credits as high as 40 percent.[99]

Offshore wind can further increase the reliability of the electric system if several wind farms are built in different locations, and are coupled with other resources across the electricity grid. With a diverse and geographically dispersed portfolio of resources, the need for backup sources of power to maintain reliability declines. For example, according to a study by the Rocky Mountain Institute, an optimized mix of wind and solar resources at as few as six locations can reduce variability in the system by more than half.[100]

Additionally, since an offshore wind farm is made up of many individual turbines, the likelihood of a mechanical failure interrupting electricity generation from the whole facility is greatly minimized. While a refueling or repair outage at a large power plant, amply demonstrated by the history of reliability problems at the Calvert Cliffs nuclear facility, can remove a huge block of capacity from the grid for days, weeks, or even years, a problem at an individual turbine would have a relatively small impact on the overall availability of power from an entire offshore wind farm.[101]

The experiences of nations like Denmark, Germany and Spain – which obtain significant shares of their overall electricity generation from wind power – demonstrate that it is possible to shift 20 percent or more of the nation's power generation to wind without adverse affects on the reliability of the electricity system. In early 2006, a group of the nation's largest utility companies found that at wind penetration levels of up to 20 percent, "system stability in response to a major plant or line outage can actually be improved by the addition of wind generation"; the cost of integrating wind energy into a typical utility system is affordable; and wind energy does not require backup generation.[102] And a recent study undertaken in Minnesota found that utilities can obtain up to one-quarter of their electricity from wind without harming grid reliability, and with only minor costs for absorbing the intermittent power.[103] Some wind industry analysts have even suggested that it is possible to have up to 40 percent wind power as part of a smoothly functioning electricity grid.[104]

In order to effectively integrate an offshore wind farm into the electricity system, grid operators must continue accurately planning to ensure that a temporary reduction in production from any one resource does not disrupt the operation of the grid.

Stabilizing Costs

Wind energy offers the advantage of price stability. Because most of the cost is for building and installing the wind turbine – and the "fuel" is free – the price of wind power does not fluctuate over time.

The capital cost for an offshore wind farm is currently more than double an onshore facility.[105] Building underwater foundations and support structures to mount the turbine tower upon adds additional expenses compared to on-land facilities.

However, this additional cost is balanced out in part by the fact that offshore winds are typically stronger and more consistent than over land – making offshore facilities more effective at generating electricity. Moreover, substantial offshore wind resources are located closer to where the electricity will be consumed, reducing the need for expensive long-distance transmission line construction. These factors can enable offshore wind to provide electricity at a competitive price within Maryland's electricity market.

For example, Delmarva Power signed a contract in June 2008 with a developer planning a wind farm off the coast of Delaware. Under this contract, Delmarva agreed to pay 11.7 cents per kWh for 200 MW worth of power from this facility, subject to an annual adjustment of 2.5 percent, less than the recent rate of inflation.[106] The Delaware Public Service Commission determined that the small price premium this potentially represented was a bargain-rate insurance policy compared to the state's recent experience with unpredictably skyrocketing electricity rates.[107]

The real value in offshore wind comes from the fact that the price is certain and predictable for decades in advance. Wind power can provide a hedge against price spikes in the cost of fossil fuels. It can also hedge against cost increases that are likely to affect fossil-fueled power plants as global warming pollution limits come into effect.

The Hedge Value of Wind Power

Whenever wind is available, the highest-cost natural gas generators producing power at the time are turned down, or turned off. Since wind has no fuel cost, once wind turbines are installed, consumers can know exactly how much wind will cost for the life of the turbines. For example, the Interwest Energy Alliance estimates that Coloradans will save more than $250 million over the next two decades because of the wind farms installed in the local electricity grid as of summer 2006.[108] Similarly, clean energy also provides a hedge against spikes in the price of coal. For example, the price of Illinois Basin coal more than doubled from August 2007 to August 2008, and many other kinds of coal have reached historically high prices in the last year.[109]

Offshore wind can also reduce overall demand for natural gas and reduce natural gas prices. As a result, people and industries that depend on natural gas will have slightly smaller bills than without natural gas conservation efforts. These savings can then be reinvested in other parts of the economy, rather than spent on high-priced fuel imported from out of state. This additional spending creates jobs throughout the economy.

Recent studies estimate that for every 1 percent reduction in national natural gas demand, natural gas prices fall by 0.8 percent to 2 percent below forecast levels.[110] Modeling the impacts of a hypothetical national renewable energy standard and energy efficiency effort in effect starting in 2003, the Lawrence Berkeley National Laboratory found natural gas bill savings with an estimated net present value as high as $73 billion through 2020.[111]

Wind Energy Can Reduce Costs for Residential Electric Consumers

Under Maryland's electricity system, utilities provide "standard offer service" to residential customers at market prices, procuring resources by signing contracts with wholesale electricity suppliers. The goal of this process is to provide consumers with the lowest-cost service over the long term, with the least risk of unexpected cost increases.[112]

According to an analysis carried out for the Maryland Office of People's Counsel, utilities can reduce the overall cost of residential service – and minimize the risk of unexpected cost increases – by incorporating a diverse range of clean energy resources, including energy efficiency and wind power.[113]

Offshore Wind Costs Less than Nuclear Power and Coal with Carbon Capture

Offshore wind can help Maryland ratepayers prepare for a future in which global warming pollution from power plants is limited by law.

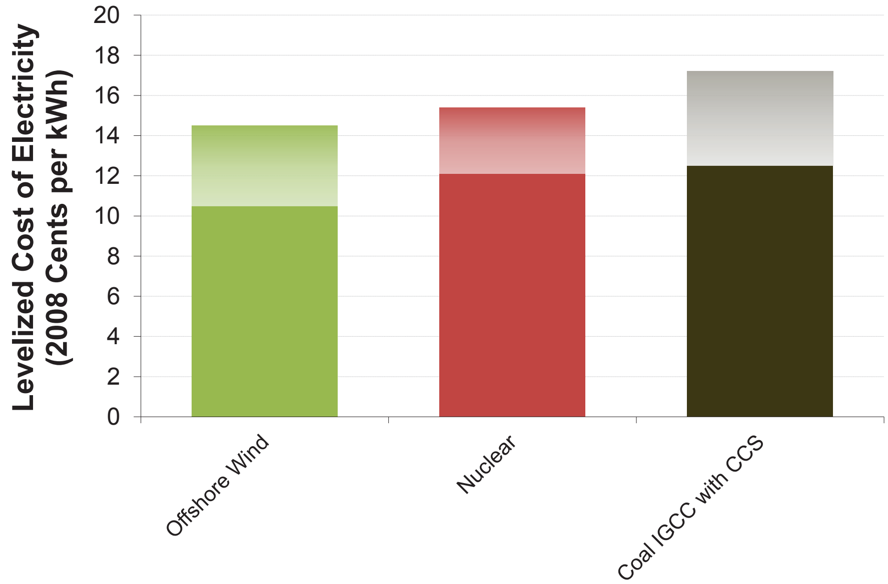
Because offshore wind power is effectively pollution-free, it will not be affected by policies that increase the cost of emitting carbon dioxide pollution. In contrast, the coal- and gas-fired power plants that currently supply much of Maryland's electricity will likely face additional costs, or possible replacement by low-carbon electricity sources.

Besides energy efficiency, the most cost-effective resource, on-shore wind power is among the most cost-effective low-carbon electricity sources.[114] However, Maryland's capacity for on-shore wind power is limited – in part because of transmission bottlenecks between the state and the best wind resources.

Offshore wind power could prove more accessible. Offshore wind would be more cost-effective than building a new nuclear power plant, and more cost-effective than a new coal-fired power plant with technology to capture the carbon emissions and bury them deep in the ground. (See Figure 6.)

Moreover, as the U.S. wind industry gains experience with offshore wind turbine manufacturing and installation, economies of scale are likely to improve, potentially making offshore wind an even more cost-effective choice.

Figure 6: Comparing the Cost of Offshore Wind with Nuclear Power and Coal with Carbon Capture[115]



This figure compares estimated costs of electricity generation from different low-carbon generation technologies, levelized (or averaged) over the lifetime of the technology to enable a meaningful comparison. The gradient portion of each bar represents the possible range of costs, which varies with the type of technology used, the quality of the natural resource, and also the precision of cost estimates. Each bar includes estimated transmission interconnection costs, but not distribution costs. The cost estimates for nuclear and coal were produced for the California Public Utilities Commission, while cost estimates for wind energy were generated by the United States Department of Energy. (IGCC with CCS stands for integrated gasification combined cycle with carbon capture and sequestration, a potential method of producing effectively low carbon electricity from coal.)

Other States are Moving to Capture Offshore Wind Resources

All states along the Eastern Seaboard share an interest in reducing global warming pollution while ensuring a reliable, affordable supply of electricity. Many of Maryland's neighboring states to the northeast are choosing to accomplish those objectives by building offshore wind farms.

Delaware, New Jersey and Rhode Island are currently leading the charge. In June 2008, Delmarva Power signed a contract to purchase 200 MW of power from an offshore wind farm to be built off the coast of Delaware by Bluewater Wind Delaware, LLC.[116] The facility should begin operation around 2012.[117] New Jersey regulators are facilitating the construction of an even larger facility to be located near the southern Jersey Shore.[118] And Governor Carcieri in Rhode Island is working with Deepwater Wind to build an offshore wind farm capable of providing 15 percent of the state's electricity.[119]

Delaware

Like Maryland, Delaware restructured its electricity market earlier this decade, promising that competition between utilities would deliver cheaper power. And just as in Maryland, that outcome did not materialize. As rate caps mandated under deregulation came off in 2006, customers of Delmarva Power faced a 59 percent rate increase.[121]

Working to prevent further cost increases, state leaders passed a law requiring Delaware to generate more of its own electricity in-state. Energy companies responded with several proposals for traditional coal- or natural gas-fired power plants. However, a new company called Bluewater Wind put forward a different plan: building a large wind farm along the Atlantic coast.[122]

Bluewater entrepreneurs had recognized that the winds off the coast of Delaware were well-suited for power generation, blowing steadily during the day, when demand for electricity is often high.[123] They also were able to offer a promise of stably-priced electricity for 25 years – something that no traditional power plant running on fossil fuels could match.

After several years of debate and negotiation, Delaware chose to become one of the first states to build an offshore wind farm, rather than one of the last states to build a coal plant. In June 2008, Delmarva Power signed a contract to purchase 200 megawatts (MW) of power from the wind farm to be built by Bluewater Wind.[124] The agreement will secure enough clean energy to power 60,000 Delaware households.[125] Delaware Electric Municipal Corporation has also agreed to purchase 17 MW of capacity for its nine municipal members.[126]

Staff of the Public Service Commission found that the new wind farm could provide electricity to customers of Delmarva Power for an average of less than $1 per month more than under a reference case scenario describing anticipated costs for natural gas, and costs for complying with expected limits on global warming pollution.[127] However, in the event that fuel costs or the cost of emitting global warming pollution increase – which the commission found likely – offshore wind could provide net savings approaching $1 per month.[128]

Bluewater Wind plans to put the wind farm – which could eventually reach 600 MW in size –approximately 12.5 miles off the coast of Rehoboth Beach.[129] Overall, the wind farm project will create 500 jobs during construction and 80 to 100 operation and maintenance jobs for the life of the farm. Bluewater also plans to locate a regional hub for offshore wind development and maintenance in Delaware, bringing additional economic benefits.[130]

> "The Europeans see offshore wind turbines as sentinels protecting them from energy domination by foreign powers. When you put that against a few winter days of seeing turbines on the beach as you walk your dog, I think that's a very easy trade-off."
>
> – Peter Mandelstam, founder of Bluewater Wind, speaking to Mark Svenvold for the *New York Times*, September 2008.[120]

The contract will help Delmarva Power meet Delaware's renewable electricity standard, requiring that 20 percent of electricity sales derive from renewable sources by 2019.[131] Offshore wind power is widely supported by the public and by elected officials, all of whom value its ability to reduce dependence on fossil fuels and prevent global warming pollution – and especially its ability to provide power at a stable and predictable price.[132]

After legislative approval of the offshore wind farm, Governor Ruth Ann Minner commented, "I am cautiously optimistic that this agreement will be the first step toward making the First State a leader in cutting-edge energy alternatives."[133]

New Jersey

Like many states on the Eastern Seaboard, New Jersey is faced with a complex and intertwined series of energy problems. The electricity system is aging, with several large power plants

"We want to create this generation's race to the moon – but this time, a race to the sea, to harness this potential wind source off of our coasts, and bring economic development, environmental benefits, and new, green jobs to the Garden State."

– New Jersey Governor Jon Corzine, October 6, 2008[135]

nearing the end of their intended lifetimes.[136] The state's main energy sources – coal, oil, natural gas and nuclear power – each have large problems, including environmental damage, rising and volatile fuel costs, public safety concerns and contribution to the serious threat of global warming.

In the face of these problems, officials in New Jersey needed to find new, affordable strategies to keep the lights on. The state launched an energy master plan process to determine the future shape of its electricity system.

"We need a new way to generate power, and offshore wind is essential to our future energy demands,"

– Jeanne Fox, President of the New Jersey Board of Public Utilities, quoted in the *Bergen Record*, September 2008[134]

Early drafts of the New Jersey's energy master plan identified offshore wind as the largest natural renewable energy resource available in the state. With a densely populated land area with little space available for onshore wind facilities, New Jersey realized that winds blowing over the ocean represented a massive energy source – with winds that tended to blow more reliably during times where electricity was in high demand.[137]

Initially, the state appeared to be planning to commit to constructing 1,000 MW of offshore wind power – a substantial amount. However, Governor Corzine's administration recognized that offshore wind could be exceptionally valuable as a hedge against future spikes in the price of fossil fuel and as a way to prevent health-damaging pollution and reduce global warming.[138] In October 2008, Governor Corzine announced that he was planning to triple the state's commitment to offshore wind power, aiming to build the first 1,000 MW by 2012, rising to 3,000 MW by 2020.[139] At this scale, offshore wind could supply 13 percent of New Jersey's annual electricity needs, or more.[140]

As a first step toward these goals, New Jersey officials chose Garden State Offshore Energy to develop a 350-megawatt offshore wind farm approximately 16 to 20 miles off the coast of Cape May and Atlantic counties.[141] The facility should be operational by 2013.[142]

In a more recent development, another wind company, Delsea Energy, has filed permit applications to construct a wind farm in shallow water of the Delaware Bay. The permits would allow Delsea Energy to begin studying their proposal to build over 100 wind turbines one to two miles offshore.[143] The company predicts that the farm would generate enough clean energy to fulfill 13 percent of the Governor's energy goals, and would provide power to 125,000 homes.[144]

New York

Political leaders and energy planners in New York recognize that the state needs to find new sources of electricity as a means of fighting global warming and stabilizing future energy costs. They are turning to offshore wind as one important – and local – resource to achieve those goals.

New York Governor David Paterson has established a Renewable Energy Task Force and created a "45 by 15" program, which calls for the state to meet 45 percent of its electrical needs through improved energy efficiency and renewable sources by 2015.[146] New York City Mayor Michael Bloomberg has also expressed support for constructing wind turbines on skyscrapers and offshore.[147]

In response, the Long Island Power Authority and Consolidated Edison announced plans to move forward with a major offshore wind farm project in 2009. The companies intend to solicit proposals by the end of the year to build the farm, which will be located approximately 13 miles off the Rockaway Peninsula.[148] The site could generate up to 700 MW of electricity, although initial plans call for the construction of 350 MW of turbines.[149] When completed, the facility will produce enough power to supply 250,000 homes.[150]

This wind farm project will bring many benefits to New York, ranging from job creation to better air quality. Commenting on the development of plans for the first offshore wind farm, Governor Paterson said: "By taking advantage of the natural resources that New York has to offer, we will position ourselves to be the national leader in renewable and alternative energy as our economy emerges from the current crisis."

The project will also finally provide clean power to New York City and Long Island. Transmission constraints have thus far limited the ability of these densely populated areas from obtaining clean, safe and infinitely available power from wind farms built in the northern part of the state. In contrast, the offshore wind farm will be located very close to the cities where the energy will be used.[151]

> "More than 100 years ago, a new statue standing tall in New York Harbor gave our nation its greatest symbol of freedom. In this century, that freedom is being undermined by dependence on foreign oil. So I think it would be a thing of beauty if, when Lady Liberty looks out on the horizon, she not only welcomes new immigrants, but lights their way with a torch powered by an ocean windfarm."
>
> – New York City Mayor Michael Bloomberg, speaking at the 2008 National Clean Energy Summit, August 19, 2008[145]

At a renewable energy conference in 2008, Mayor Bloomberg summed up his thoughts on clean energy by saying: "In New York, we don't think of alternative power as something that we just import from other parts of the nation. America's energy efficiency and energy security are our business, too." [152]

"This is much more than an energy project. This is about creating a new industry in Rhode Island; an industry that puts Rhode Island at the epicenter of the emerging alternative energy market. Deepwater Wind will help bring new economic activity, jobs and opportunity to Rhode Island."

– Rhode Island Governor Donald Carcieri, announcing the selection of Deepwater Wind to build the state's first offshore wind farm, September 25, 2008.[153]

Rhode Island

As part of a five-part plan to address rising energy costs, in 2006 Rhode Island Governor Donald Carcieri established a plan to generate 20 percent of the state's electricity supplies from clean energy resources.[154] "I think this is something we can achieve, and I'm going to pursue this aggressively," Governor Carcieri said at a news conference announcing the policy.[155]

The governor is particularly bullish on the potential for offshore wind power to transform Rhode Island's energy future. In a press release announcing a deal to build the state's first offshore wind farm, he said, "Of the many forms of renewable energy alternatives available, wind is the proven leader. Wind power is clean, green power that is not subject to variations and increases in fuel price."[156]

The governor solicited proposals from wind developers for the construction of an offshore wind facility large enough to supply 15 percent of Rhode Island's annual electricity needs. In September 2008, a selection committee settled on Deepwater Wind as the best choice for the job.[157] By late 2010, Deepwater expects to begin construction on five offshore wind turbines to provide power to the residents of Block Island.[158] Later, it expects to begin work on a much larger facility 15 to 20 miles from the coast.[159]

When complete, the wind farm will significantly improve environmental quality in Rhode Island. By displacing fossil fuels, the wind farm will prevent the emission of more than 22,000 tons of sulfur dioxide, 13,000 tons of nitrogen oxide, 425 pounds of mercury, and 17 million tons of global warming pollution over its 25-year lifetime.[160]

As a part of the deal, Deepwater pledged to establish a regional development office and a manufacturing facility for offshore wind turbines. The manufacturing facility will create 800 jobs that will pay annual wages amounting to $60 million.[161]

In a press release announcing the selection of Deepwater Wind, Michael Saul, Executive Director of the Rhode Island Economic Development Corporation at the time, explained the importance of the project. "We see this as a game changing solution to Rhode Island's energy future," he said. "… Deepwater Wind's presence in Rhode Island will be a catalyst to attract additional jobs in the renewable energy sector and position our state as a leader in renewable energy efforts."[162]

Massachusetts

Energy concerns have long been an issue in Massachusetts, a state that accounts for 45 percent of electricity consumption in New England.[164] In 1997, the state passed legislation restructuring the electricity market. To increase fuel diversity, protect consumers from price spikes, and reduce air pollution, this law included a requirement that utilities sell an increasing amount of electricity generated from wind, solar, biomass, and other renewable energy resources.[165]

Most of Massachusetts' renewable energy supplies have come from wind farms and biomass facilities located outside the state's borders. To meet future requirements, wind developers are pursuing several large projects in Maine, aiming to feed power to Massachusetts. However, the new projects would require the construction of new, expensive high-voltage power transmission lines. While these projects may ultimately go forward, state officials have disagreed over how to finance transmission line construction.[166]

However, Massachusetts Governor Deval Patrick understands that the state's greatest wind energy resources lie offshore. If these resources were utilized, they could deliver significant amounts of clean electricity, while helping to launch a new state industry. When running for office in October 2005, Patrick said, "… I'm convinced that the future of our economy is very much connected to the development of a vibrant industry in alternative and renewable energy."[167] And in January 2009, Governor Patrick announced a goal of building 2,000 MW of wind power in Massachusetts by the year 2020.[168]

The Cape Wind project – a plan to install 130 wind turbines off the coast of Cape Cod, in Nantucket Sound – could provide a significant boost toward the Governor's goal.[169] Cape Wind Associates, the developer, has been working to move the project forward since 2001. Patrick gave the project needed backing when he announced his support during his gubernatorial campaign.[170] However, wealthy property owners have effectively blocked the project to date.

Speaking to the *Boston Globe* about the project in October 2005, now-Governor Patrick said, "We need to get serious about the energy supply and cost issues that are facing us in this country and in this Commonwealth. … We can't keep saying we understand the problem of energy cost and supply and the problem of global warming and then refuse to act when we have an opportunity to do so."[171]

Despite the opposition, Cape Wind continues to move forward. In January 2009, the U.S. Interior Department gave the project a favorable environmental review.[172] If the federal government

> "With the growing interest in wind turbines we see in communities across the Commonwealth and the abundant wind resource we have off our coast, wind power is going to be a centerpiece of the clean energy economy we are creating for Massachusetts."
>
> – Massachusetts Governor Deval Patrick, announcing a goal of building 2,000 MW of wind in the state by 2020.[163]

grants the project a lease, and if several additional state and local permits are approved, the wind farm could be up and running by 2012 – barring any lawsuits that could be brought by Cape Cod landowners.[173]

Local groups opposing the wind farm are increasingly in the minority. A survey conducted in January 2008, after a positive draft environmental impact statement from the federal government, showed that 86 percent of Massachusetts citizens supported the project, including 74 percent of the residents on Cape Cod and nearby islands.[174]

Bolstered by this public support, a coalition of lawmakers from the Massachusetts House and Senate sent a letter to Interior Secretary Ken Salazar, writing, "Our coastline ...is vulnerable to rising sea levels and inundation that loom unless significant worldwide action is taken quickly to reduce greenhouse gas emissions. Cape Wind represents an example of the type of action that needs to be taken across the country and the world to responsibly confront the challenge of climate change."[175]

Virginia and North Carolina

Offshore wind projects have been proposed off the coasts of both Virginia and North Carolina as well. In Virginia, the Virginia Coastal Energy Research Consortium – a collection of scientists commissioned by the state's General Assembly in 2006 to research ocean energy opportunities – identified a site for nearly 200 turbines off Virginia beach.[176] The group concluded that the wind farm could spur more than 1,000 new jobs over three years.[177]

In North Carolina, the Outer Banks Ocean Energy Corporation envisions a hybrid offshore wind, ocean current and ocean wave power plant up to 25 miles offshore of the Tar Heel State.[178] The facility could provide 200 to 600 MW of generation capacity. The company's founder, Donald Evans, announced the project in September 2009, telling the *Charlotte Observer*, "Offshore wind is an inexhaustible, clean energy resource. It's been there since the Earth was here."

Maryland Should Harness Its Offshore Wind Energy Resources

To modernize its electricity system and take control of its energy destiny, Maryland should facilitate the construction of an offshore wind farm.

An offshore wind farm will help Maryland meet its goals for renewable energy procurement using a local resource, hence keeping more of its energy dollars in the local economy. At the same time, an offshore wind farm will help the state meet its goals for reducing emissions of global warming and health-threatening pollution. Finally, an offshore wind farm will help improve the stability and reliability of Maryland's electricity system, while insulating ratepayers from volatile fossil fuel prices, and any cost impacts of inevitable limits on global warming pollution.

In September 2009, the Maryland Energy Administration took the first steps toward enabling the construction of an offshore wind farm, potentially to be located off Ocean City.[179] The administration asked wind developers to submit ideas and launched a study of the economic and environmental impact of the project.[180]

However, much more remains to be done. To facilitate the construction of an offshore wind farm, Maryland's Public Utilities Commission should get involved and help to facilitate Maryland's transition to a 21st century electricity system.

Maryland should facilitate the construction of a large wind farm along its shores by 2014.

- Following the lead of state officials in Delaware, the Maryland Public Utilities Commission should solicit proposals for a wind farm to be built off of Maryland's coast.
- The PUC should then direct utilities to negotiate long-term power supply contracts with the wind developer, providing the kind of financial certainty necessary to obtain favorable financing.

Photo Credit: Siemens

The nation that leads the world in creating new energy sources will be the nation that leads the 21st-century global economy. … [T]he bulk of our efforts must focus on unleashing a new, clean-energy economy that will begin to reduce our dependence on foreign oil, will cut our carbon pollution by about 80 percent by 2050, and create millions of new jobs right here in America….

– President Barack Obama, speaking at the Trinity Structural Towers Manufacturing Plant in Newton, Iowa, April 22, 2009[181]

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