

DIRECTION

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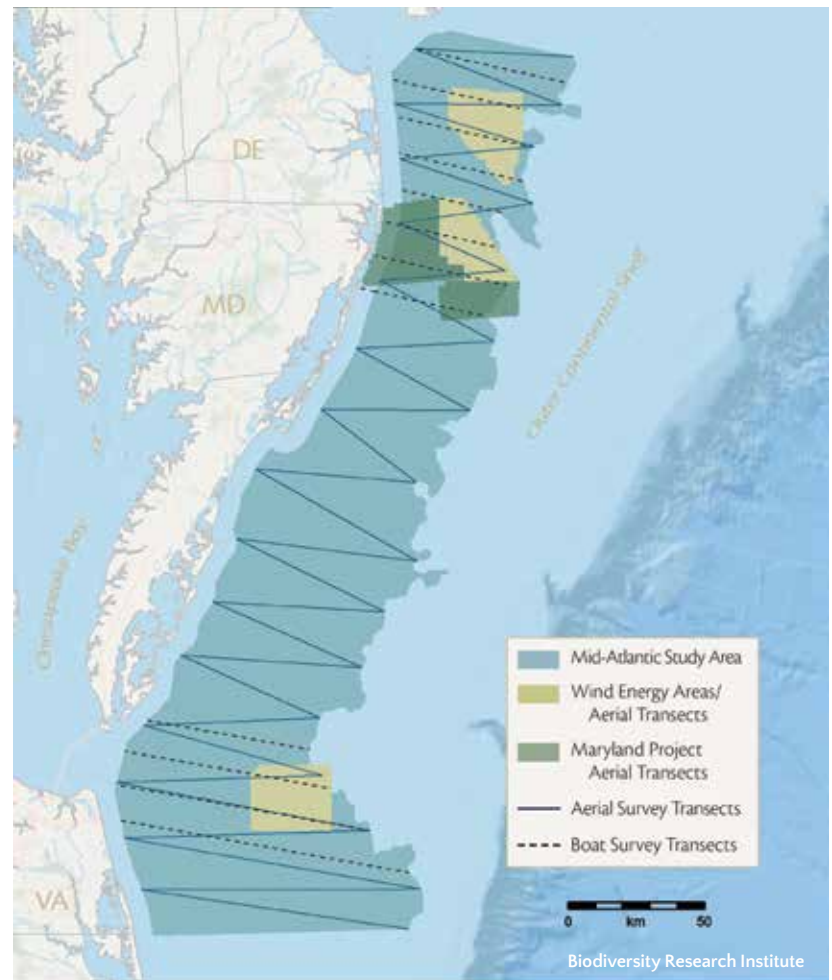
INNOVATIVE STUDY HELPS OFFSHORE WIND DEVELOPERS PROTECT WILDLIFE

Thanks to a first-of-its-kind in-depth study of wildlife distribution and movements, the nation's Eastern Seaboard is better prepared now more than ever for offshore wind energy. Funded by the Energy Department and several partners, the collaborative Mid-Atlantic Baseline Studies Project helps improve the understanding of many birds and aquatic animals that live in the Mid-Atlantic and how they interact with their marine environment, promoting more sustainable offshore wind development.

Prepared by the Biodiversity Research Institute (BRI), the study provides two years of high-quality baseline data to wind energy regulators, developers, and other stakeholders, which BRI gathered through a mix of methods, including boat and aerial surveys, filling critical information gaps on species distribution and behavior of seabirds, marine mammals, sea turtles, and other species. This extensive study covers more than 7,000 square miles of ocean waters along the Virginia, Maryland, and Delaware coastline where a number of offshore wind projects are moving forward.

SURVEYING THE MID-ATLANTIC

The study was conducted from 2012 to 2014 in Outer Continental Shelf waters off the Mid-Atlantic coast using several new technologies and methods to monitor and analyze wildlife distribution patterns. The results provide a new tool to help regulators, resource managers, researchers, and developers minimize



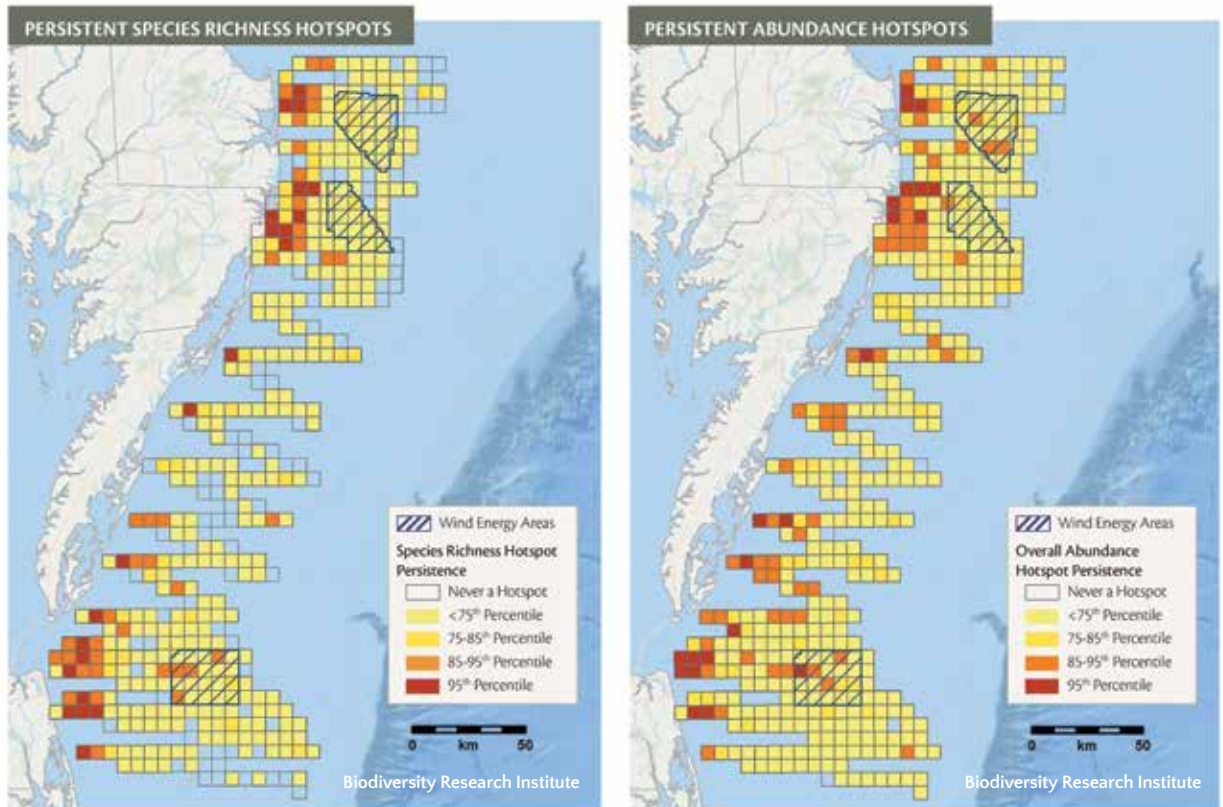
The study areas for the Mid-Atlantic Baseline Studies and Maryland projects with WEAs and boat and aerial survey transects. Fine scale aerial transects (20-percent coverage) were carried out within the WEAs and the Maryland project area.

issues during offshore wind siting and permitting processes, as well as informing natural resource management and conservation efforts.

Boat-based surveys are typically used to monitor marine wildlife because boats can travel slowly enough to allow researchers to record detailed data on species of

interest. This includes behavioral data, such as feeding frenzies of dolphins and seabirds preying on fish.

On the other hand, high-resolution digital video aerial surveys are a newer method for collecting data on marine animals. This study was the first to use this method on a broad scale in the United States.



State-of-the-art video aerial surveys were conducted from small twin-engine planes at an altitude of 2,000 feet, which is much higher than traditional visual aerial surveys flown at altitudes of roughly 200-600 feet. Flying at this higher altitude is safer for flight crews and less disruptive to the animals being counted. The aircraft had four belly-mounted cameras with a 200-meter-wide range of data collection.

Tracking techniques, such as attaching satellite transmitters to individual birds, also give researchers detailed information on the day-to-day movements and habitat use of wildlife. In this part of the study, the Energy Department contributed to two larger ongoing studies tracking marine birds, including red-throated loons, northern gannets, and surf scoters. Satellite telemetry was also used to study movements of peregrine falcons offshore.

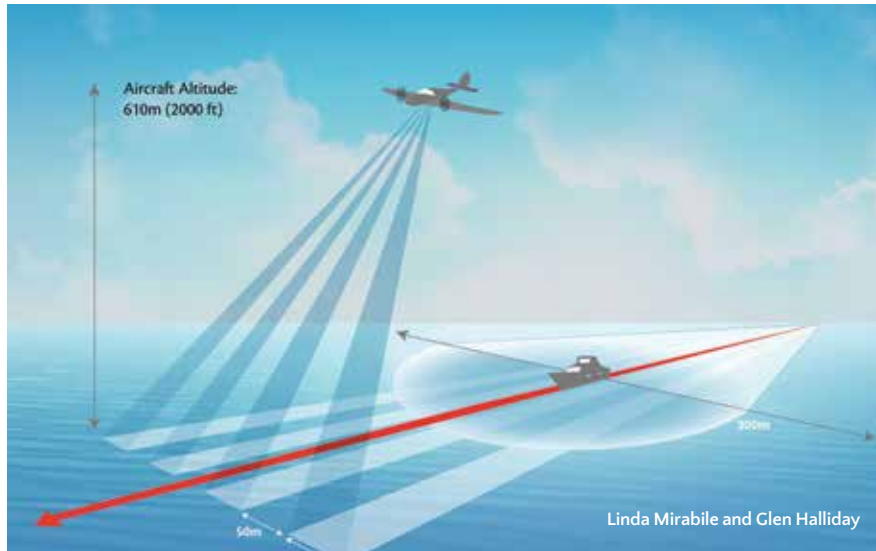
Additionally, weather surveillance radar was used in the study to identify offshore wildlife migration pathways and timing. These radar systems can detect precipitation as well as the movements of birds, bats, and insects. Innovations developed during this study allowed for targeted exclusion of weather phenomena. This improved the sample size of available data and allowed for examination of migratory activity even during rainy and snowy nights. Finally, detectors on boats were used to record wildlife sounds at night to monitor animal activity offshore.

MIX OF TECHNOLOGIES

By using a wide range of technologies and methods, the study developed a more complete picture of wildlife populations in the Mid-Atlantic study region. Combining the unique strengths of boat-based and

high-resolution digital video aerial surveys alongside satellite-based tracking resulted in a more comprehensive understanding of wildlife patterns across the region. For example, survey data allowed for population-level analyses of abundance and distributions that were not possible with tracking alone. Similarly, satellite tracking provided data on broad-scale movements of individual birds, including nocturnal locations, which were missing from survey data.

This research builds on the Wind Program's work to remove barriers to wind power deployment and increase public understanding of wind power technologies by addressing siting and environmental issues. As a model for future studies, the results will be used to make environmental management decisions by a variety of stakeholders including



government agencies, developers, environmental consultants, and nonprofits.

For more information on research and development work in this subject area, go to www.energy.gov/eere/wind and click on the Wind Program's Environmental Impacts and Siting of Wind Projects page under the Research & Development tab. Also, for more information about BRI's Wildlife and Renewable Energy Program, go to www.briloon.org/mabs. ↪

— Source: DOE

This diagram shows the fields of view available during boat surveys and digital video aerial surveys.

WHAT AMERICA'S FIRST OFFSHORE WIND FARM REVEALS ABOUT GE'S ALSTOM DEAL

Block Island is a teardrop-shaped piece of land some 13 miles off the coast of Rhode Island. It's best known for its beaches, wind-swept bluffs, and summer vacation homes. But a new attraction is quickly rising 3 miles off its southeastern shore.

There, in the choppy Atlantic surf, a company called Deepwater Wind started building what will be America's first offshore wind farm. The farm will have five wind turbines, each rising to twice the height of the Statue of Liberty. When completed in late 2016, they will generate a combined 30 MW of electricity — enough to supply 17,000 homes — and turn Block Island into the most powerful coastal enclave in the northeast.

But there's more to the project. It is also the physical example of GE's future following its acquisition of Alstom's power and grid business, which closed earlier in November.

The Block Island farm brings together Alstom's massive Haliade turbines, whose blade tips will



The massive Haliade turbine has a rotor diameter of 150 meters. It can generate 6 MW.

tower 600 feet above the water, and GE's innovative gearless permanent magnet generators that can produce 6 MW of power. The combination has the potential to transform the renewables business both in the U.S. and abroad.

Until now, Europe has been the hub of wind innovation, according to Bryan Martin, head of U.S. private equity at the financial firm D.E. Shaw. The company is financing the \$290 million Deepwater farm, and Martin said he believes that bringing Alstom's wind turbines and GE's power generation technology under one roof will change the wind industry's competitive landscape.

"We're very excited about GE's acquisition of Alstom's power businesses," Martin said. "GE and Alstom getting together creates the first real competitor to Siemens for offshore wind farms in Europe."

The rotor of each Haliade turbine is nearly one-and-a-half times the length of a football field, or 150 meters. All that torque spins GE's 6-MW direct drive permanent magnet generator. The design allowed GE engineers to eliminate the gearbox, reduce the number of moving parts, cut the need for maintenance, and lower the operating cost.

The generator weighs 150 tons and sits 100 meters in the air. It's split into three separate electrical circuits.



Deepwater Wind

Deepwater Wind has already started building America's first offshore wind farm.

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WoWE 2015 Rudd Mayer Fellows
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WoWE Lunch and Q&A with Andrea Jung
*Just before WINDPOWER 2015 WoWE partnered
with GE to host a special lunch with Andrea Jung,
CEO of Grameen America, former CEO of Avon,
and member of the GE Board of Directors*

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GE Energy





The new farm will rise 3 miles off the coast of Block Island.



The Haliade machine is now part of GE's offshore wind portfolio.

Even if two circuits go offline, the turbine can still produce 2 MW of electricity on the remaining circuit. Low maintenance and redundancy are hugely important, especially for

offshore installations where treacherous waters and high wind can delay a repair trip for days or weeks. According to Jeffrey Grybowski, chief executive of Deepwater, the

farm will power all of Block Island, which currently relies on expensive diesel fuel. The farm will also lower carbon emissions by an estimated 40,000 tons annually — the equivalent of taking more than 150,000 cars off the road. It could also help cut electricity bills for Block Island residents by up to 40 percent.

“Offshore wind can power much of the U.S. East Coast, not least in the Northeast, where the wind is strong and we need energy,” Grybowski said. “And we can employ lots of people doing it.”

The Block Island farm will be the first offshore wind farm in the U.S. But the potential for U.S. offshore wind energy is massive — over 4,000 GW, which amounts to more than four times the nation's annual electricity production, according to the U.S. Department of Energy. President Obama's Clean Power Plan has also increased interest in onshore and offshore wind energy, presenting a new opportunity for industry.

So far, a total of 47,000 onshore turbines have been installed in the U.S. wind market where GE is a major player. The Alstom power and grid acquisition now gives it a stronger offshore offering and one of the broadest and deepest renewables portfolios in the industry. The combined businesses will also have expanded project expertise and financing for power projects.

“Today, offshore wind is a small market with big potential, and the Block Island project sits at the leading edge of innovation,” said Anders Soe Jensen, CEO of GE's offshore wind unit. “We're proud that GE will again be making energy history with the first American offshore wind farm.”

For more information, go to www.gereports.com. ↵

— Source: GE Reports

INVENERGY STARTS COMMERCIAL OPERATION OF BEECH RIDGE ENERGY STORAGE PROJECT IN WEST VIRGINIA



Invenergy LLC recently announced the start of commercial operations of its 31.5-MW Beech Ridge Energy Storage project in Rupert, West Virginia.

The project is located in Greenbrier County, approximately 60 miles southeast of Charleston at Invenergy's Beech Ridge Energy Center, and complements the facility's existing 100.5 MW of wind energy. Beech Ridge Energy Storage provides fast-response regulation service to the PJM market and brings Invenergy's total operating storage capacity to more than 64.5 MW.

"The start of operations for Beech Ridge further underscores our commitment to finding innovative storage solutions to meet our customers' needs," said Kris Zadlo, senior vice president of regulatory affairs, storage, and transmission at Invenergy. "We are continuing to expand our storage project portfolio as we believe this revolutionary technology plays a vital role in the future of renewable energy."

An industry leader in energy storage, Invenergy also has a 31.5-MW storage project at its Grand Ridge Energy Center

in LaSalle County, Illinois. Earlier this month, that facility received the Energy Storage North America's (ESNA) 2015 Innovation Award for Centralized Storage. ESNA is the largest and most influential gathering of policy, technology, and market leaders in energy storage, and the conference's Innovation Awards recognize excellence in installed energy storage projects across three categories: centralized storage, distributed storage, and mobility.

Invenergy's Grand Ridge Storage Facility was also recently named a finalist for Best Renewable Project by Power Engineering and Renewable Energy World magazines.

Both the Beech Ridge Energy Storage and Grand Ridge Energy Storage facilities are utilizing BYD America's containerized energy storage system.

In all, Invenergy has more than 100 MW of energy storage projects in operation, in construction, and in development in the United States, making it one of the largest energy storage companies in the world. ↪

— Source: *Invenergy*

GRAND OPENING OF PATTERN ENERGY'S 200-MW LOGAN'S GAP WIND FACILITY IN TEXAS



Pattern Energy Group Inc. (Pattern Energy) recently held a Grand Opening ceremony to dedicate its new 200-MW Logan's Gap Wind facility in Comanche County, Texas. Now operating at full capacity, Logan's Gap Wind will create enough clean energy to power 50,000 homes in Texas each year, according to average annual residential energy use data from the U.S. Energy Information Administration.

"Presently, the majority of the revenue collected by Comanche County comes by way of ad valorem taxes," said Sherman Sides, Comanche County Commissioner Precinct 3. "The Logan's Gap Wind facility will increase the county's tax base dramatically as well as provide needed additional revenue for the county throughout the next 25 years."

"We should all be proud that Logan's Gap Wind was built using American-made turbines while creating hundreds of local jobs," said Mike Garland, CEO of Pattern Energy. "Construction spending injected more than \$5 million into the local economy, and, going forward, our Community Benefits Program will support local organizations, including the Comanche Youth Council. The facility will now harness the wind of Comanche County to produce clean energy for Walmart, one of America's leading companies."

Walmart has a 10-year power purchase agreement to acquire 58 percent of the expected output from the facility. Seventeen percent of the expected output will be sold under a 13-year fixed price agreement with a A-/Baa2-rated financial institution. The remaining 25 percent of expected output will be sold at ERCOT spot market prices.

"Walmart has a goal to be supplied by 100-percent renewable energy, and sourcing from wind energy projects like the Logan's Gap Wind Facility is a core component in the mix," said Mark Vanderhelm, vice president of energy for Walmart. "The energy we'll procure from this facility represents nearly one-fifth of the U.S. portion of our goal to source seven billion kilowatt hours of renewable energy by 2020. That's a significant leap forward on our renewable energy journey."

Logan's Gap Wind utilizes 87 Siemens 2.3-MW wind turbines with a total capacity of 200 MW.

"Logan's Gap represents the latest chapter in Texas' wind energy success story and provides an outstanding example of how wind power can be used to help companies meet their energy needs," said Jacob Andersen, CEO of Siemens Wind Power Americas. "Through our factories in Iowa and

Kansas, Siemens has made a long-term commitment to the growth of wind power in America. We're pleased to partner with Pattern Energy on a project that symbolizes our energy future, and Siemens' wind service technicians will help ensure that the turbines at Logan's Gap continue to operate reliably and efficiently."

As part of its commitment to the communities where it operates, Pattern Energy created the Logan's Gap Wind Community Benefits Program to support causes within the greater Comanche County community. Over the next five years, Logan's Gap Wind will contribute \$100,000 to the Logan's Gap Wind Community Benefits Program, which will support the following local organizations that each provide a unique and critical service to the community of Comanche County:

- The Comanche County Agency on Aging
- The Salvation Army Food Assistance Program
- The Park Enhancement Group of Comanche

- The Comanche Youth Council

Construction of the wind power facility created hundreds of jobs. An average of 250 workers were on site during construction with up to 550 workers on site during peak activity. There are 12 full-time permanent workers to operate and maintain the facility.

Each year, the Logan's Gap Wind facility will avoid the emission of 780,000 metric tons of carbon dioxide — equal to taking 153,000 cars off the roads — and conserves enough water to meet the needs of more than 9,000 Texans each year, according to statistics from the U.S. Energy Information Administration and The University of Texas.

Located in ERCOT's North Zone, the Logan's Gap Wind facility connects to Oncor's 138kV Comanche-Zephyr line, which crosses the facility site and supplies power to the Dallas-Fort Worth area.

For more information, go to www.patternenergy.com. ↪

— Source: Pattern Energy

EQUINIX SIGNS POWER PURCHASE AGREEMENTS THAT BRING ITS NORTH AMERICAN DATA CENTERS TO 100-PERCENT RENEWABLE ENERGY

Equinix, Inc., a global interconnection and data center company, recently announced that it has signed power purchase agreements (PPA) with an affiliate of NextEra Energy Resources LLC and with Invenergy LLC to purchase wind energy in Oklahoma and Texas, respectively, which will cover all Equinix data centers throughout North America. These agreements will provide a combined 225 MW of capacity, bringing Equinix's total renewable energy coverage in North America to 100 percent by the end of 2016 and nearly doubling its global renewable energy from 43 percent to 82 percent. Both projects will be fully deployed by the end of 2016.

The agreement with a NextEra Energy Resources affiliate includes the purchase of wind energy from the Rush Springs Renewable Generation Facility located in Grady and Stephens counties in Oklahoma. The agreement will provide 125 MW of capacity, resulting in approximately 556,000

MWhs of clean and renewable energy generated annually in Oklahoma and delivered into the Southwest Power Pool (SPP) regional electricity grid.

"NextEra Energy Resources is pleased to be working with Equinix on this project to help them meet their sustainability goals," said John DiDonato, vice president of wind development at NextEra Energy Resources. "In addition to helping Equinix, this project will bring significant economic benefits to Stephens and Grady counties."

The agreement with Invenergy includes the purchase of wind energy from the Wake Wind Energy Facility located in Floyd and Crosby counties in Texas. This agreement will provide 100 MW of capacity, resulting in approximately 457,000 MWhs of clean and renewable energy generated annually in Texas and delivered into the Electric Reliability Council of Texas (ERCOT) regional electricity grid.

"As corporations like Equinix look for ways to reduce their emissions and improve their sustainability goals, Invenergy is committed to providing long-term clean energy to help them achieve those goals," said Craig Gordon, vice president of sales and marketing at Invenergy.

"As a global data center leader, we truly understand the importance of operating our business in an environmentally sustainable way," said Karl Strohmeyer, president of Equinix Americas. "These projects are two significant milestones toward our commitment of reaching 100-percent renewable power across all of our data centers across the globe and further solidify Equinix's position as a leader in data center sustainability."

For more information, go to www.equinix.com. ↪

— Source: Equinix