

The Wind Energy Technologies Office (WETO) invests in early-stage energy research and development (R&D) for U.S. land-based, offshore, and distributed wind power generation to lower wind energy costs, increase capacity, accelerate reliable safe energy production, mitigate market barriers, address environmental and human use considerations, and promote U.S. manufacturing innovation.

Economic Highlights

WETO innovations stimulate the U.S. economy, job growth, and competitiveness.

- WETO technology R&D investments create opportunities for cost-competitive land-based and offshore wind energy across America and for U.S. growth in the global wind market.
- Wind energy supports over 100,000 jobs nationally, including at 500 manufacturing facilities in 43 states.
- In 2016, \$13.8 billion was invested in 8.2 gigawatts (GW) of new U.S. wind power.
- Wind turbine technician is the fastest growing job in the U.S., increasing twice as fast as the next largest job category.

WETO R&D products strengthen U.S. energy security and resilience.

- With 82 GW of utility-scale wind energy deployed across 41 U.S. states and territories in 2016, wind energy is the fourth-largest source of U.S. generating capacity, behind natural gas, coal, and nuclear.
- Wind currently provides nearly 6% of U.S. electricity – enough to power more than 20 million U.S. households.
- In 14 states, wind provides more than 10% of in-state generation; in four states, wind energy exceeds 25% of generation.
- Wind energy represents 30% of all new installed U.S. generation capacity from 2012 to 2016.

WETO supports a diverse mix of stable power generation and strengthens domestic manufacturing and infrastructure.

- Seventy percent of U.S. wind energy development is in rural, low-income counties—\$175 million of \$245 million in 2016 land lease payments went to these counties.
- Innovations in taller wind towers and blades can facilitate more wind generation in lower wind speed areas, such as the southeastern United States. With innovation, experts predict wind energy costs could fall another 24%-30% by 2030.

FY 2018 Priorities

Resource Characterization and Technology R&D

- Atmosphere to Electrons (A2e) – Focus on optimizing performance and improving reliability of next-generation wind plants. Activities include atmospheric coupling research, complex terrain resource characterization, wind-turbine wake-steering control, high-fidelity wind-plant wake modeling using U.S. Department of Energy high performance computing (HPC), and integrated system design.
- National Laboratory Facilities – The National Wind Technology Center and Scaled Wind Farm Technology Facilities will conduct A2e verification and validation experiments and component reliability testing.
- Technology Innovation – R&D and testing (RD&T) on controls, sensors, algorithms, materials, and low-specific power rotor design and manufacturing for tall wind applications, to lower costs and improve reliability and performance.

Mitigate Market Barriers

- Grid Integration and System Reliability – WETO R&D will focus on essential grid reliability services for wind systems and forecasting tools, as well as impact evaluations on large shares of wind energy in electricity markets to ensure that wholesale market design adequately compensates all participants for service.
- Wind/Radar Research and Testing – WETO will perform design and evaluation of technology solutions, algorithms and tool development to address wind/radar challenges in partnership with the Departments of Defense, Transportation, Homeland Security, and Commerce.

Modeling and Analysis

- WETO will focus on potential impacts of innovations in offshore wind substructures, operations strategies, and wind plant technologies developed through A2e.

FY 2018 Budget Request

Budget Authority (Dollars in Thousands)	FY 2018 Request
Technology RD&T and Resource Characterization (Land, Offshore, and Distributed)	26,693
Mitigate Market Barriers	3,822
Modeling and Analysis	1,185
Total, Wind Energy Technologies	31,700

WETO supports wind as a sustainable domestic power source that presently employs more than 100,000 Americans, enables a robust turbine component manufacturing sector, and has expansive potential for delivering affordable, reliable power across the nation.

Major Accomplishments and Goals

WETO public-private partnerships leverage investments in basic R&D and accelerate technology adoption.

- Through innovations and a robust wind market, over 80% of towers and 50%-70% of blades and hubs installed in the U.S. in 2015 were made in America.
- DOE initiatives have led to multiple successfully commercialized, produced, and installed wind energy innovations.
- From 1976 to 2008, WETO ranked first in wind energy patents and citations linked to commercial power from wind, with WETO-sponsored R&D resulting in 112 patents.
- WETO research and industry innovation led to a 90% drop in the unsubsidized cost of wind from 1980 to 2016.

WETO helps the wind industry and its stakeholders overcome core challenges to industry growth.

- Investment in U.S. technology R&D and prototype demonstration of land-based and offshore wind systems, speeds U.S. project deployments and refines U.S. manufacturing technologies.
- R&D in complex wind aerodynamics, advanced component development, wind plant reliability improvement, and distributed wind applications directly reduces energy costs.
- Multi-year R&D aimed at overcoming wildlife challenges, turbine effects on radar, and grid operations planning has facilitated widespread wind deployment.
- Cost targets are \$0.149/kilowatt-hour (kWh) for offshore wind and \$0.052/kWh for land-based wind energy by 2020, and \$0.093/kWh for offshore wind and \$0.031/kWh for land-based wind by 2030.

Success Stories

WETO-sponsored R&D has resulted in significant U.S. wind industry innovation and cost reductions

DOE National Laboratories and federal wind test centers have enabled cost-effective development and validation of innovative wind technologies for four decades. WETO-funded R&D from 2002 to 2008 included a focus on strategic use of carbon composite in predominately fiberglass wind turbines blades.

Carbon incorporated into the blade structure increases strength, stiffness, and reduces weight; incorporation of off-axis carbon composite produced passive bend-twist-coupled load alleviation; and carbon composite coupled with the geometrically efficient flat-back airfoil produced a 22% lighter blade. As a result of this DOE-sponsored research, carbon fiber blades have become 15% to 20% of the global blade market over the past few years, with carbon composite use expected to grow in coming years as turbine and blade sizes continue to grow.



DOE-designed carbon-fiber hybrid blade for passive load

WETO-funded activities focus on reducing market and infrastructure barriers to wind deployment

Large-scale renewable energy grid integration studies indicate that high penetration of renewable energy is possible without compromising the reliable operation of the U.S. electricity grid.

DOE supported several high-renewable penetration grid integration studies, including the Western Wind and Solar Integration Study and the Eastern Renewable Generation Integration Study, showing that the U.S. electric system is operable with roughly 30% annual variable generation from wind and solar power in the regional and national scenarios examined to date.

- Several states already have high amounts of in-state wind generation, including Iowa (38% in 2016), South Dakota (30% in 2016), and Kansas (30% in 2016).
- Regional transmission organizations (RTOs) are conducting more detailed integration studies. The U.S. Southwest Power Pool, an RTO covering 14 states, published two studies finding the region has the potential to serve 75% of its load with wind. In February 2017, the Southwest Power Pool set a record for instantaneous wind-penetration of 52%, becoming the first RTO in North America to serve more than 50% of its load at a given time with wind energy.

