

U.S. DEPARTMENT OF  
**ENERGY**

Office of  
**ENERGY EFFICIENCY &  
RENEWABLE ENERGY**

# Wind Energy Technologies Office Overview

## Systems Integration Focus

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# Wind Office Guiding Principles



Wind energy will play an essential role in realizing the Biden Administration's vision of a decarbonized energy future. Meeting these ambitious goals will require robust, continued investments in research, development, and deployment (RD&D) while promoting energy equity and environmental justice.

## Accelerating Wind Energy Deployment to meet Decarbonization Goals

- 100% grid decarbonization by 2035 could require more than 1,000 GW of wind.
- Current average annual installation rates would need to increase up to 10x to reach these levels of deployment.
- Administration goals of 30 GW offshore wind by 2030, 15 GW of floating offshore wind by 2035.

## U.S. Economic Benefits

- Hundreds of thousands of good-paying jobs with the opportunity to bargain collectively
- U.S. manufacturing and supply chain opportunities
- U.S. leadership in global clean energy market.

## Realize Energy and Environmental Benefits for the Nation

- Realize 100% carbon-free electricity by 2035
- Improved environmental quality, public health, and economic justice
- Enable a reliable, resilient, cyber-secure grid, capable of operating with large-scale additions of renewable energy
- The combined health, climate, and grid benefits of wind energy is valued at over \$115/MWh.

# State of Wind Industry and Future Opportunities

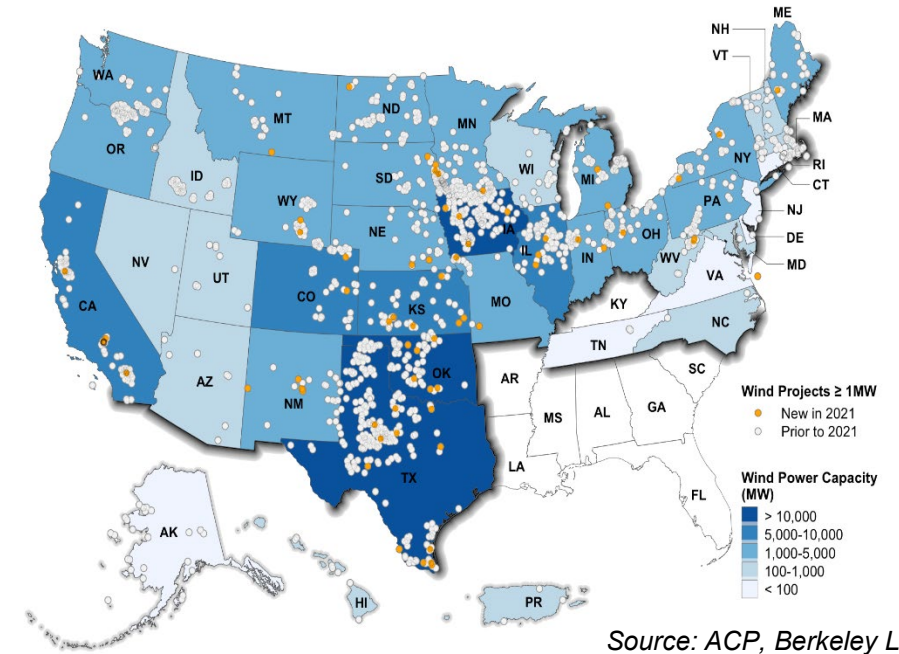
## Land-based Wind Continues to Grow

- 141.3 gigawatts (GW) of total installed as of Jan 2023
- Wind now provides more than 10% of electricity nationwide
- 120,000 Americans now working in the wind industry.
- U.S. has potential for 1,400 GW of distributed wind energy capacity—half of the nation's current annual electricity consumption.
- Massive expansion required to achieve decarbonization goals

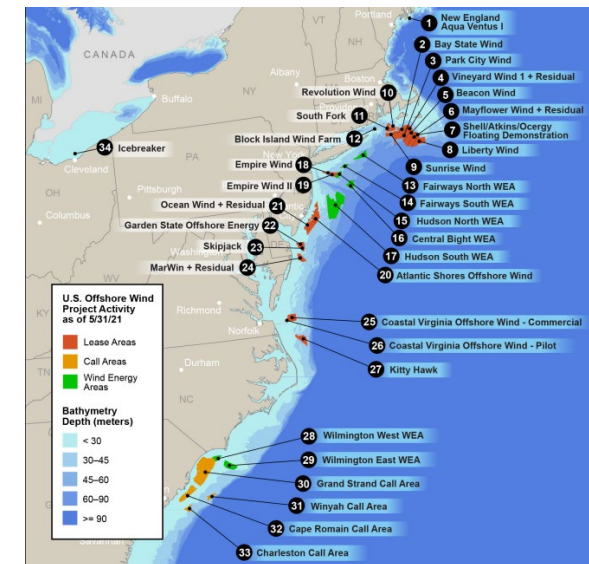
## Offshore Wind is Accelerating, Representing a Huge Opportunity

- More than 40 GW of offshore wind now in the project pipeline
- BOEM planning 5 new lease sales by 2025
- Achieving 30 GW by 2030 goal would mean:
  - Enough clean power for 10 million homes
  - 44,000 jobs in offshore wind, another 33,000 in communities.
  - \$12 billion in capital investment and at least \$500 million in port upgrades
- Floating offshore wind essential to regional decarbonization, represents U.S. global leadership opportunity.

Wind power projects across the United States

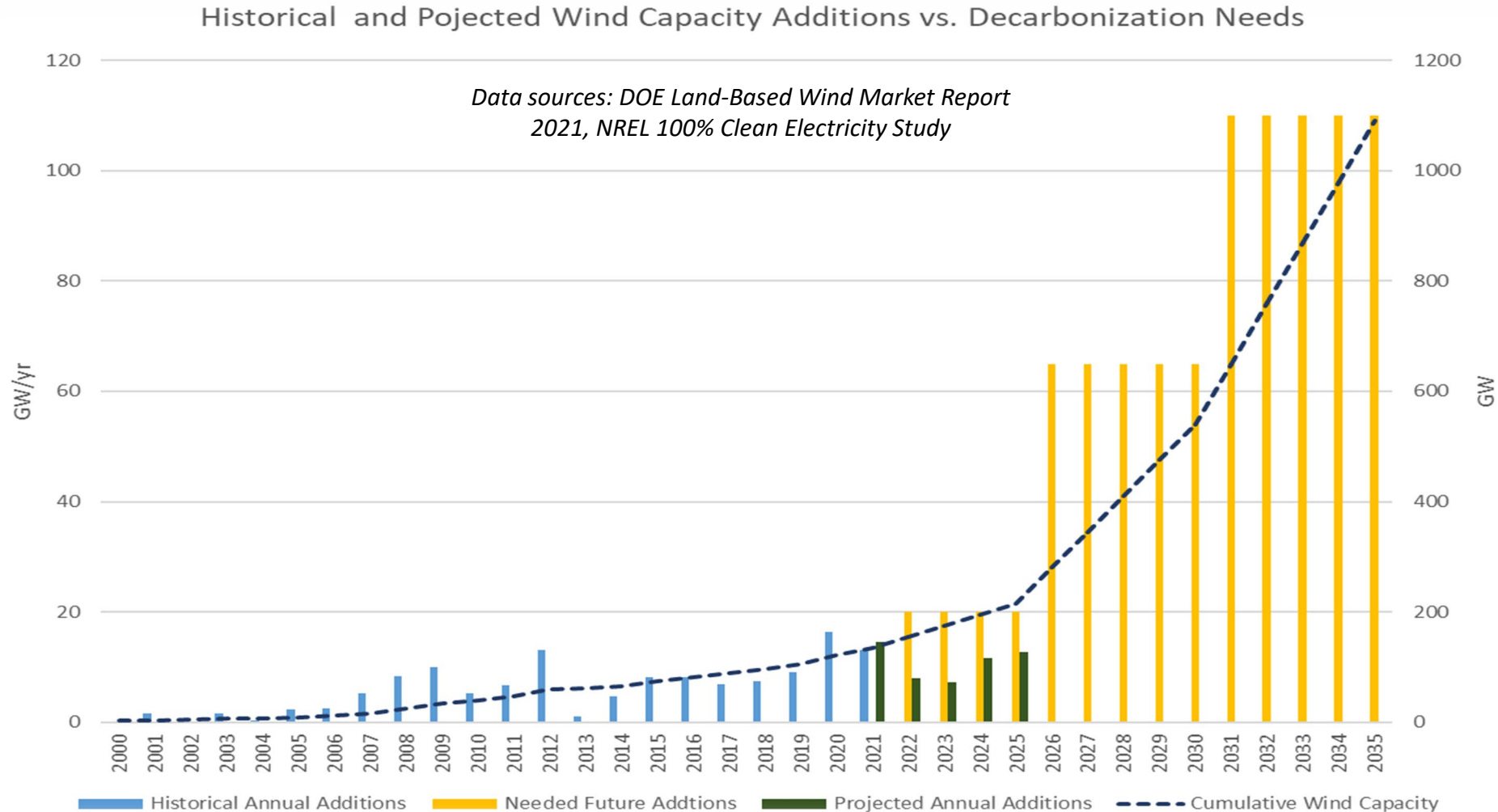


Source: ACP, Berkeley Lab



U.S. Atlantic Coast Offshore Wind Energy Pipeline and Call Areas

# Current Deployment Falls Far Short of Need



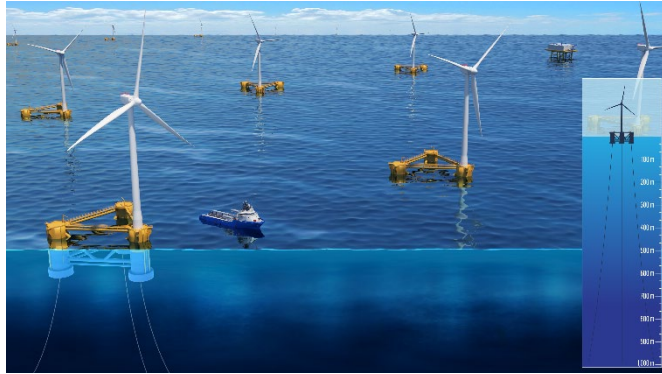
**New wind installations between 775 and 1,375 GW are required to achieve 2035 grid decarbonization; current and projected wind deployment falls far short due to policy, siting, and cost**

# WETO Strategic Focus

**Meeting the Biden Administration's goals will require increased investment in wind energy research, development, demonstration and deployment to:**

1. Reduce the cost of wind energy for all wind applications
2. Enable the integration of up to 50% wind energy or more into the U.S. grid, including integrated systems with other energy and storage technologies, and the electrification of U.S. industry, transportation and building.
3. Reduce impacts on the environment and affected communities and facilitate responsible development and delivery of wind energy resources.





# WETO R&D Programs

## Subprograms

Offshore Wind

Land-based Wind

Distributed Wind

Systems Integration

Data, Modeling, and Analysis

## Top Line Priorities

Aggressive Cost Reduction

Scaling and Light-Weighting

Environmental and Siting Solutions

Transmission Access, Grid Reliability, Hybrid Systems, and Cybersecurity

# Systems Integration Overview



# Systems Integration

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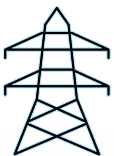
## Challenges and Opportunities

- Complexity in transmission planning and permitting hinders large-scale wind deployment
- Increased wind (>30% in some states) requires grid flexibility, reliability support, storage, and hybrid systems integration
- Wind growth can offer an array of grid services from wind sources
- Wind hybrid systems have great potential but underdeveloped.
- Digitization increases risk of cyberattack

## Goals

- Expand access to wind resources through transmission upgrades
- Enable cost-effective, reliable, resilient, and secure grid operation with large-scale wind deployment
- Enable wind deployment through hybridization with other technologies
- Align with other crosscutting R&D initiatives and facilities





# Systems Integration

## Key Activities

### **Transmission Adequacy and Access**

Improved interconnection process, transmission analysis, and transmission technology innovation

### **Grid Reliability and Resilience**

Wind control for grid services, grid monitoring and control, grid stability analysis with increasing IBRs

### **Wind Hybrid Systems**

Design, control, and configure wind hybrid systems for grid and for decarbonized industry

### **Wind Cybersecurity**

Resilient wind plants that detect and defend cyber-attacks

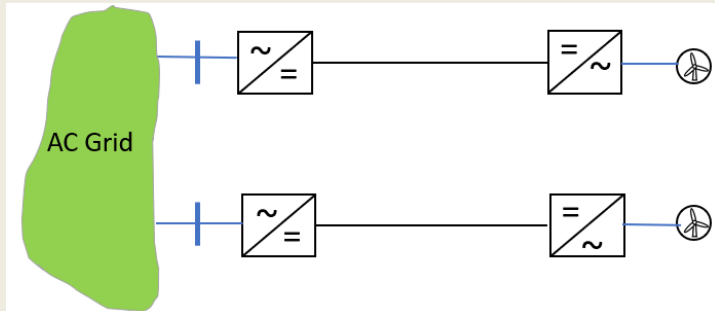
## Major Initiatives

- Atlantic and West Coast Offshore Wind Transmission Studies
- HVDC Standards
- Grid service demonstration and UNIFI consortium
- Wind Cybersecurity
- Wind-H2-Green Steel/Green Ammonia

# Offshore Wind Transmission

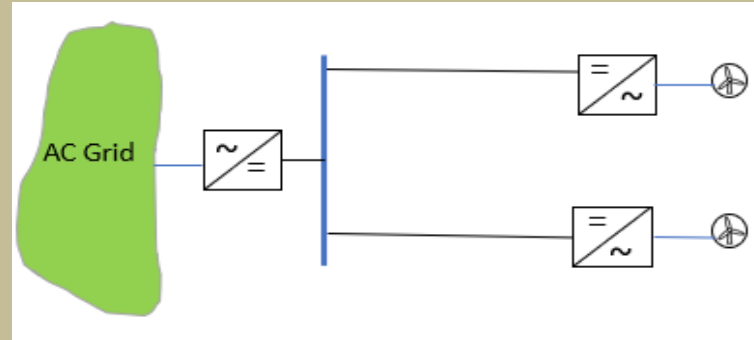
# Offshore High Voltage Direct Current (HVDC) Transmission Topologies

## Point to Point

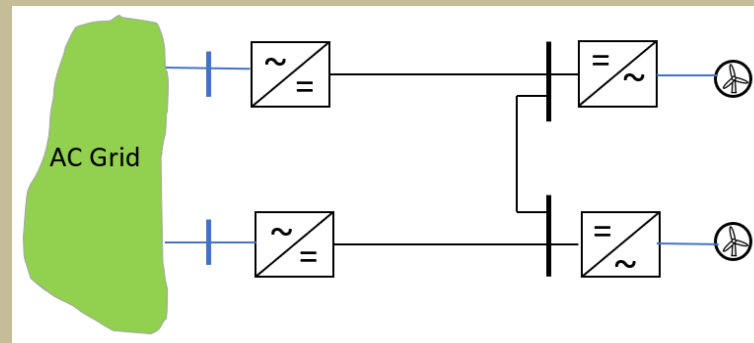


- Single vendor
- Mature technology

## Multi-terminal Network



- Fewer converters
- Requires interoperability



- Increased reliability
- Requires interoperability
- Requires DC breakers

# Offshore HVDC Transmission Initiatives at WETO

## Challenges and Opportunities for High Voltage Direct Current Workshop

- Collaboration with OE in 2022

## Funding Opportunity Announcement 2828

### Topic 1:

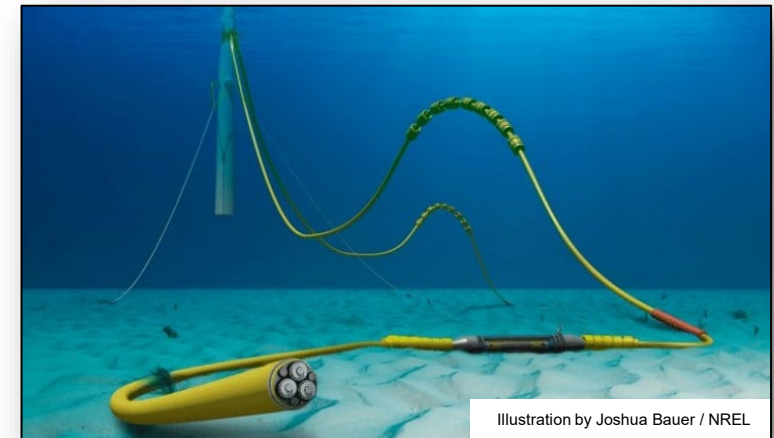
- a. HVDC Standards
- b. MTDC Controls & Functional Requirements
- c. Education & Workforce Development

## HVDC Moonshot Goal Initiative

- Collaboration with OE
- Directive from Congress in FY23 appropriations



HVDC Converter Substation



Static and Dynamic Subsea Cables

**Thank you!**  
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Source: NREL