U.S. DEPARTMENT OF ENERGY

Office of ENERGY EFFICIENCY & RENEWABLE ENERGY

Distributed Wind for Federal Agencies

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June 23, 2022

FEMP Federal Energy Management Program

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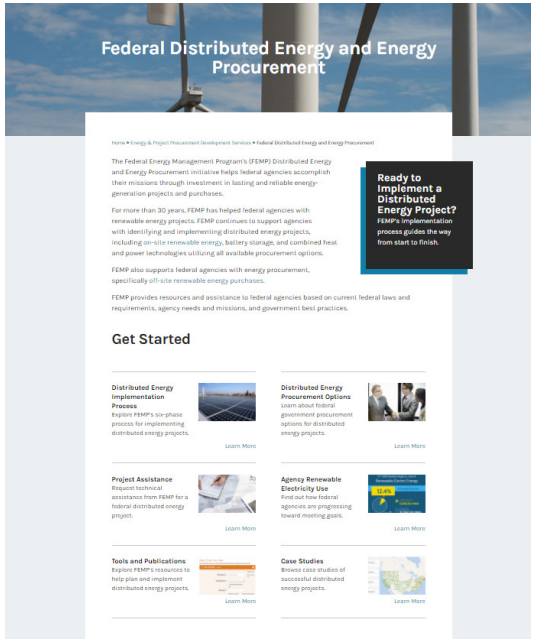
Webinar Logistics

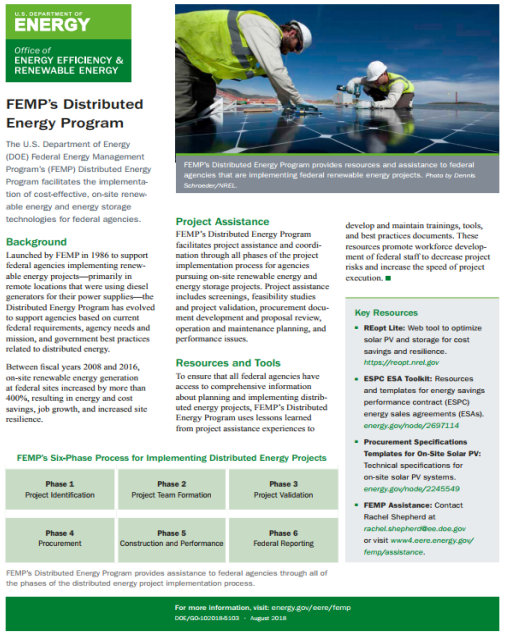
- Call in for the best audio connection!
- Please ensure your phone/computer is muted throughout the webinar
- Logistical issues: wbdg@nibs.org
- Don't hesitate to ask questions!
  - Send questions to all panelists in the Q&A window
  - Feel free to contact us through the FEMP Technical Assistance for Distributed Energy Projects (https://www7.eere.energy.gov/femp/assistance/node/add/application-combined)

FEMP's Distributed Energy Program

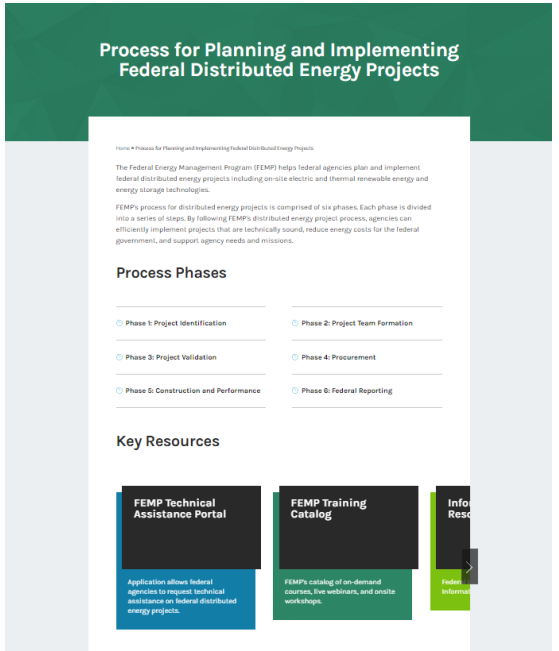
FEMP's Distributed Energy (DE) Program facilitates the implementation of cost-effective on-site renewable energy, energy storage, and combined heat and power technologies for federal agencies.



[FEMP's Distributed Energy Program Website]



[FEMP's Distributed Energy Program Factsheet]



[FEMP's Distributed Energy Implementation Process Website]

Agenda

- Learning Objectives
- Distributed Wind Definition
- Wind Resource Assessment Tools
- Resources and Tools
- FEMP Resources and Q&A

Learning Objectives

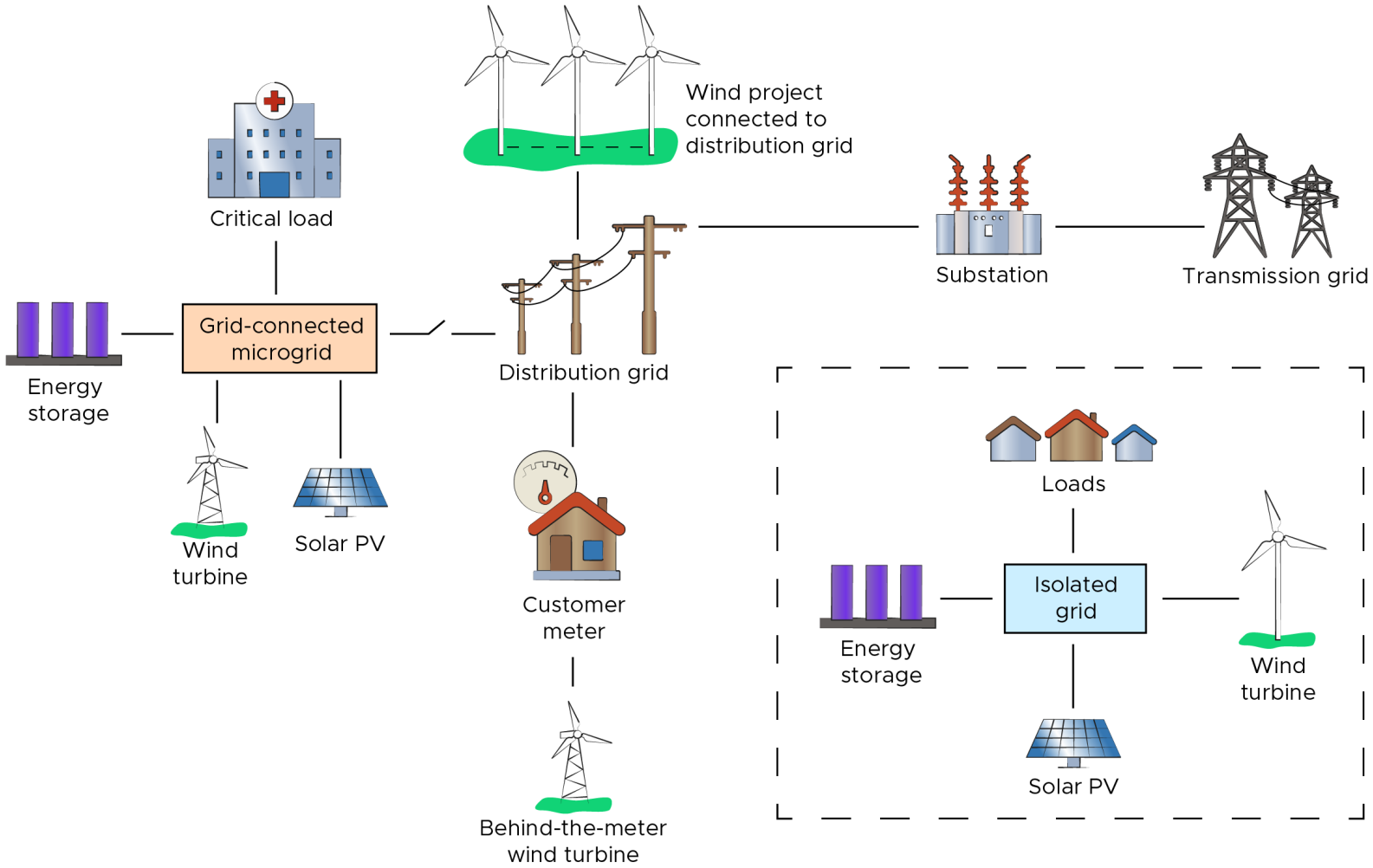
- After completing this training, you will be able to do the following:
  - Define and describe distributed wind
  - Use publicly available wind resource assessment screening tools
  - Locate other distributed wind tools and resources

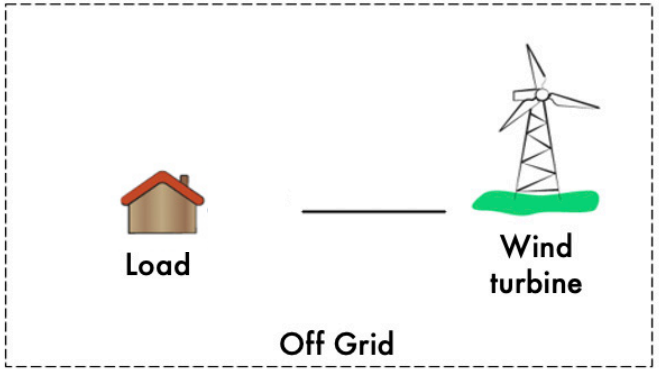
Quiz Question

What is Distributed Wind?

Image Source: Aegis Renewable Energy

Distributed Wind is Wind as a Distributed Energy Resource

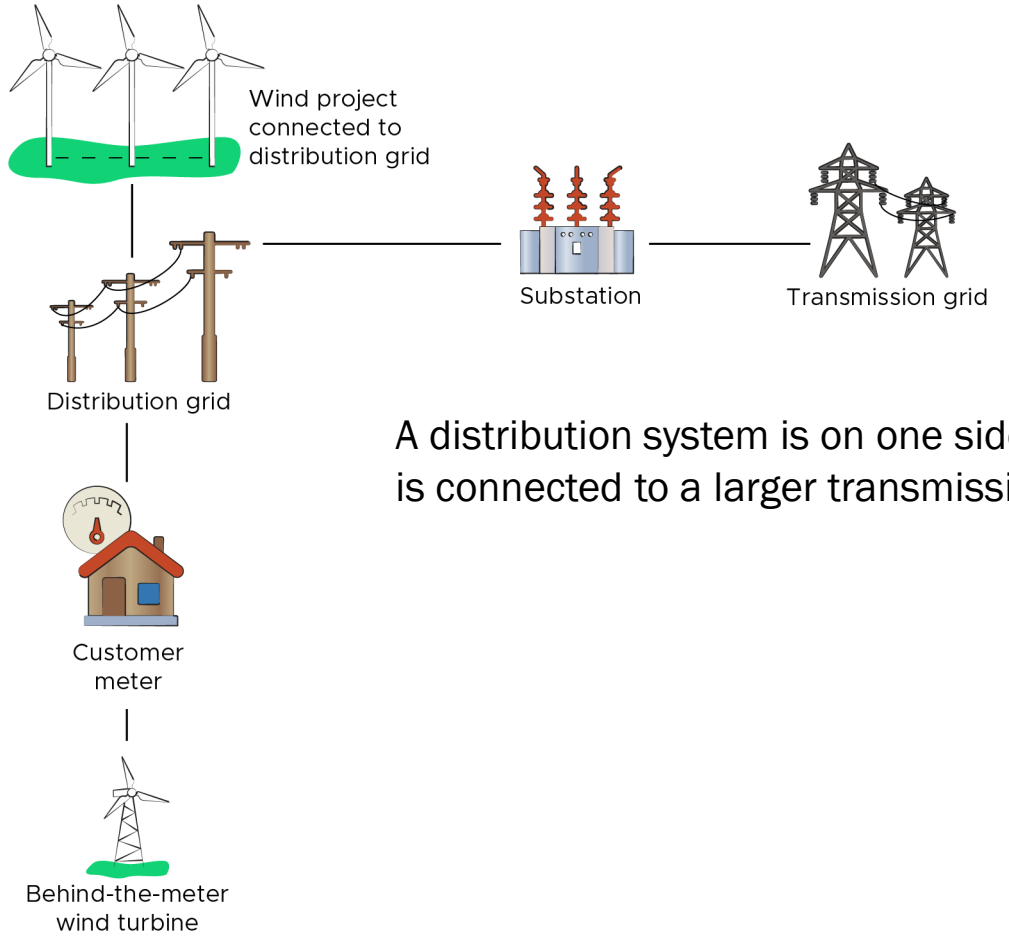




Distributed wind energy can serve both <u>onsite</u> and <u>local</u> energy needs in a variety of applications.

Distributed Wind is Connected at the Distribution Level

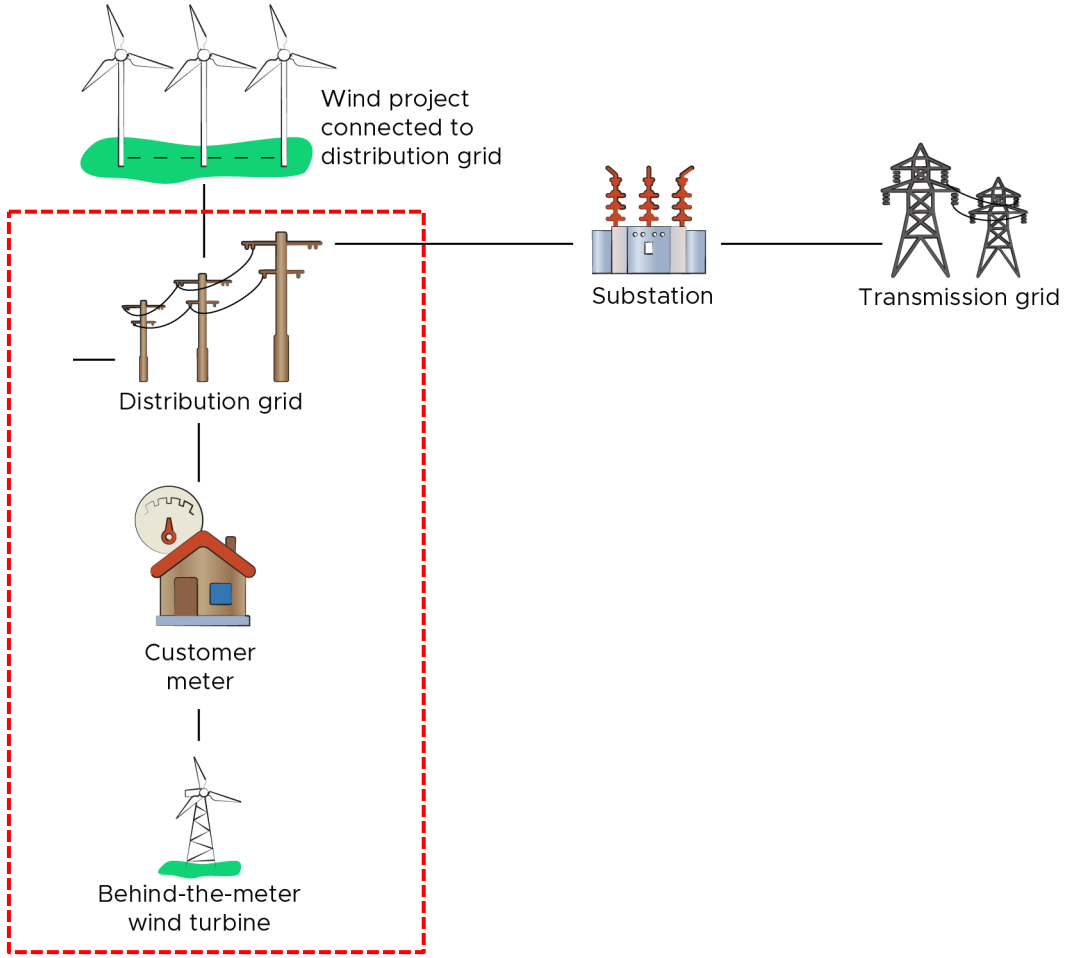
A distributed wind energy project is connected at the distribution level of an electricity delivery system.



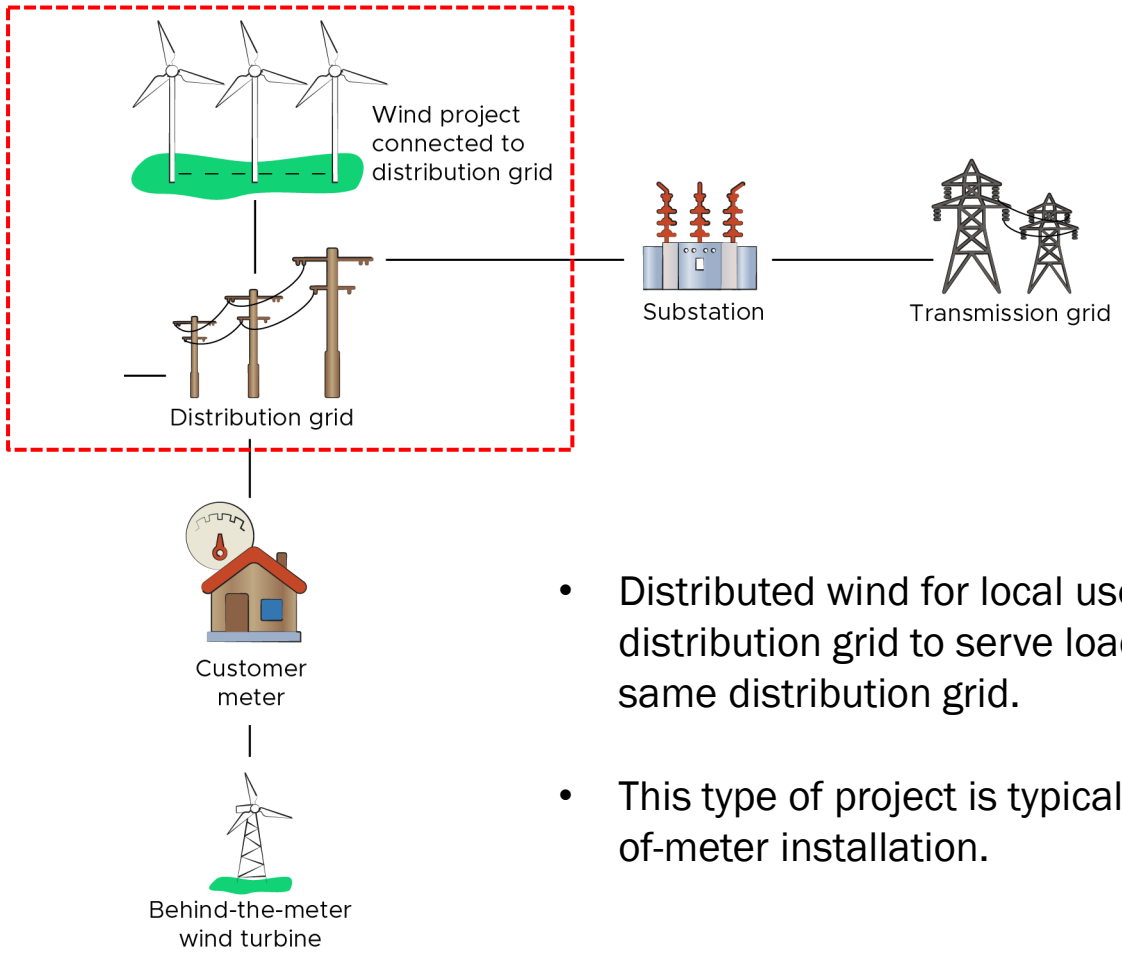
A distribution system is on one side of a substation that is connected to a larger transmission system.

Distributed Wind is Behind the Meter

- The majority of distributed wind projects for onsite consumption are behind-the-meter installations
- Behind-the-meter means the turbine is connected to the local distribution grid behind the customer's utility meter and may provide excess generation back to the grid through net-metering or other billing mechanisms
- Net metering is the policy that provides financial compensation to customers who send excess generation from their distributed energy resources back to the grid.



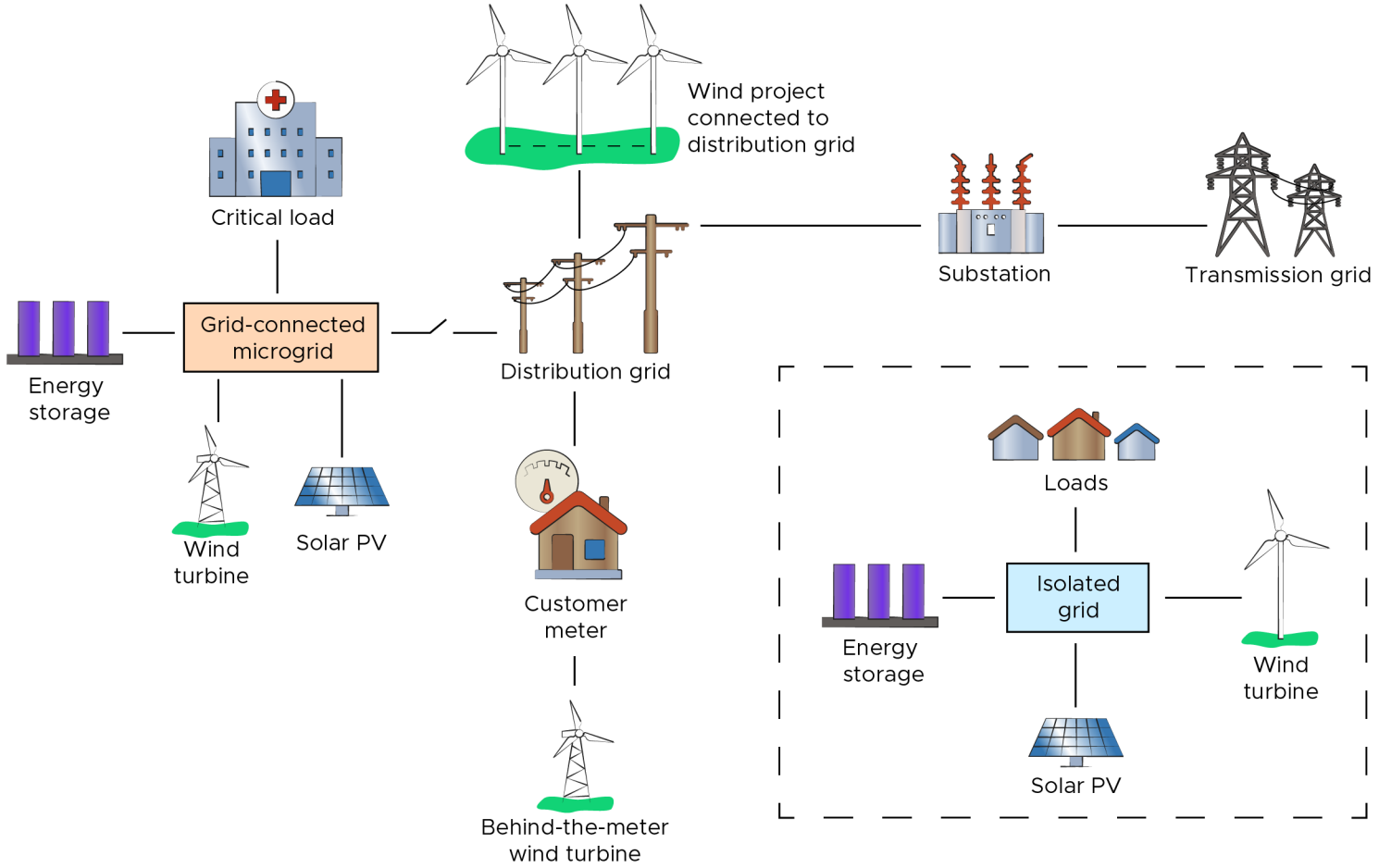
Distributed Wind is Front of the Meter



- Distributed wind for local use is connected to the distribution grid to serve loads interconnected to the same distribution grid.
- This type of project is typically referred to as a front-of-meter installation.

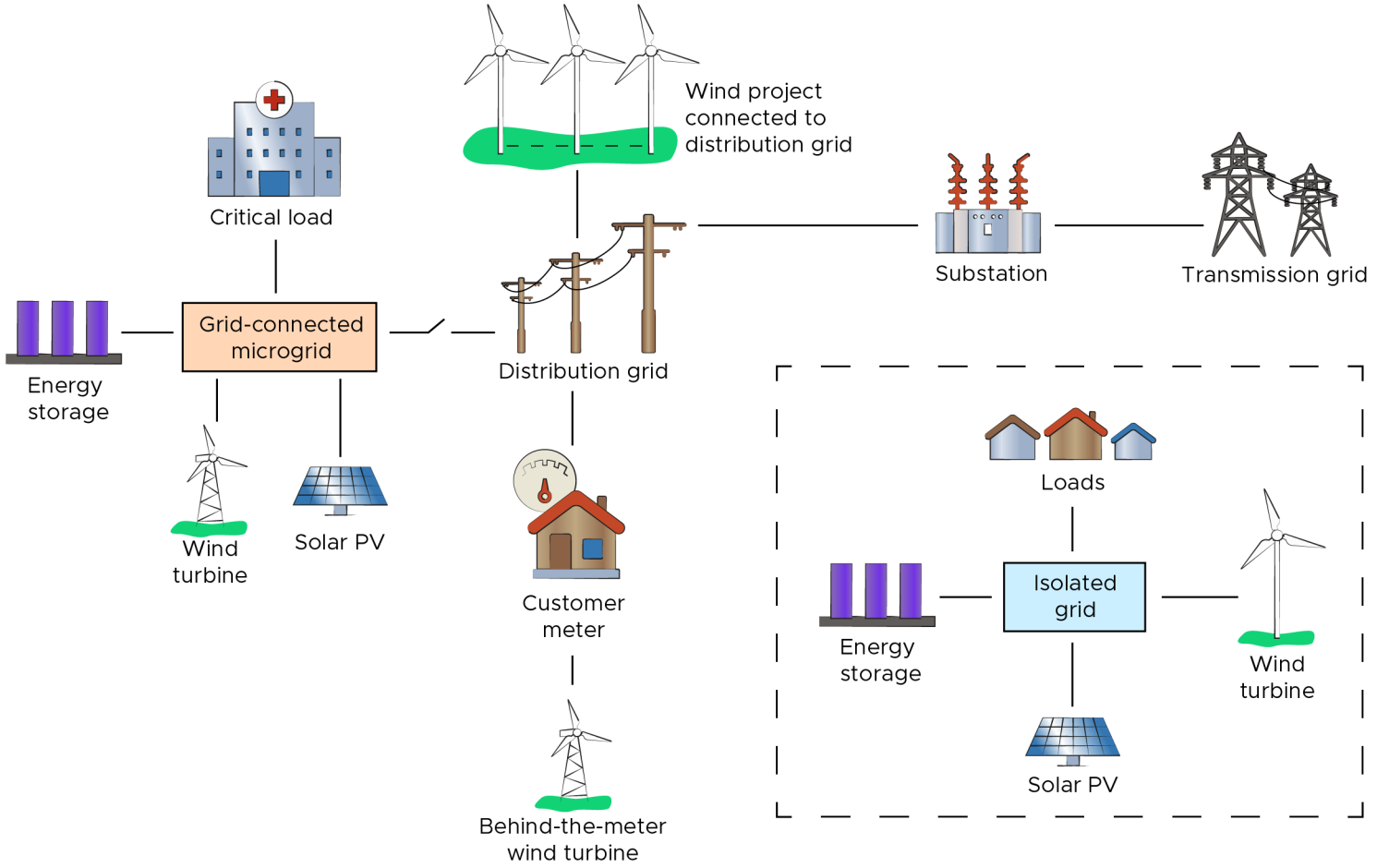
Distributed Wind is in Microgrids and Isolated Grids

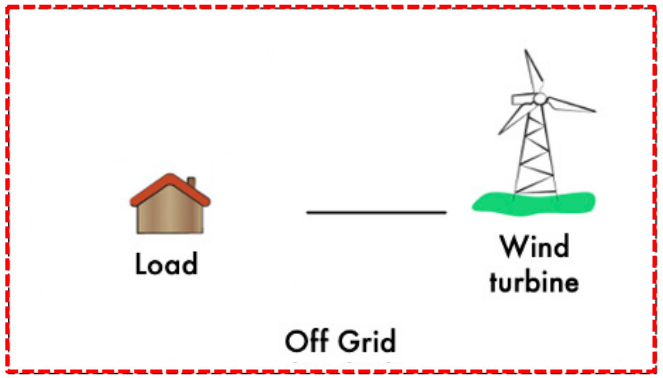
Distributed wind can also be part of a grid-connected microgrids....



....and isolated grids, such as for a remote village not connected to any other grid system. A wind turbine can be deployed as a front-of-the-meter distributed energy resource in an isolated grid.

Distributed Wind is Off Grid





- A wind turbine can also be off-grid in a remote location for on-site energy needs.
- This is still considered distributed wind, but it is not connected to the local distribution grid.
- We differentiate off grid from isolated grid.

Distributed Wind Examples

Distributed wind installations can range from a less-than-1-kW off-grid wind turbine powering telecommunications equipment....

...to a 15-kW wind turbine at a small farm (center photo) or a 100-kW wind turbine at a university campus (right photo).

Distributed Wind Examples

Distributed wind can also be several multimegawatt wind turbines owned by a local community or the local electricity distribution utility.

Government customers can use distributed wind. A government customer can be federal, state, county, city, and tribal.

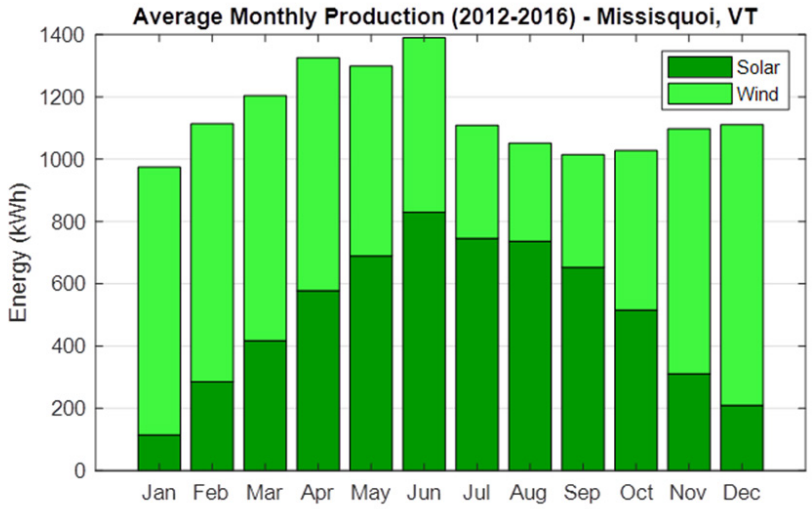
Federal Agency Examples

Image Source: Bergey WindPower

U.S. Fish & Wildlife Service:

Missisquoi National Wildlife Refuge, Vermont

- 10-kW small wind turbine installed in 2006
- Connected to the utility grid to allow net metering
- The refuge also has a 15-kW solar PV array that complements the wind generation on a monthly basis
- The wind and solar generation provide about 30% of the refuge's energy needs



Data courtesy of Ken Sturm, Missisquoi National Wildlife Refuge Manager

Federal Agency Examples

National Nuclear Security Administration

Pantex Renewable Energy Project, Texas

- **11.5 MW** - five 2.3 MW Siemens wind turbines
- Financed with an Energy Savings Performance Contract

U.S. Air Force

Joint Base Cape Cod, Massachusetts

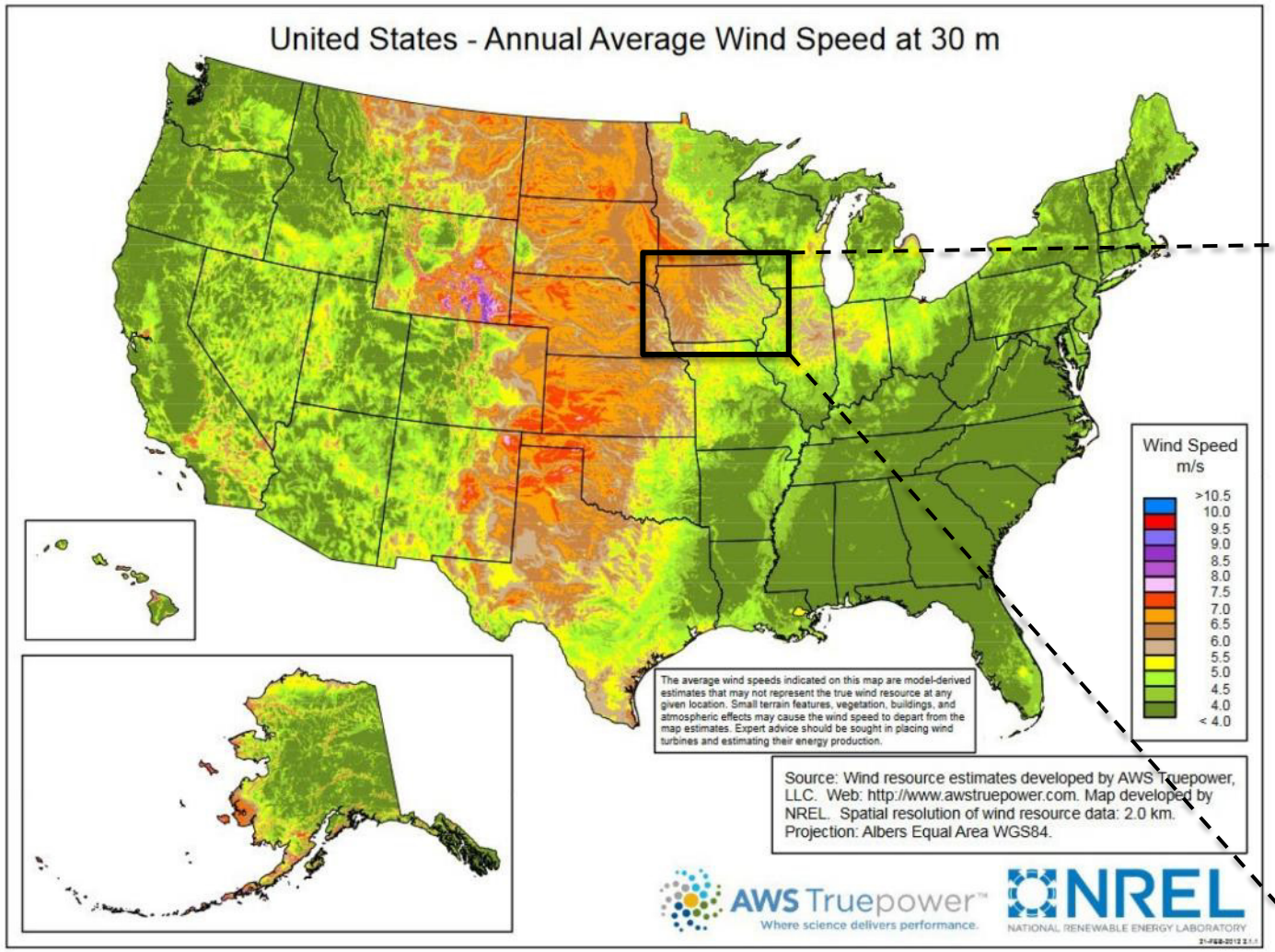
- **7.86 MW** - two 1.5 MW GE wind turbines, two 1.68 GE MW turbines, and one 1.5 MW Fuhrlander turbine
- Procured through appropriated funds

Wind Resource Assessment Screening Tools

- Free wind resource maps
- Purchased assessment reports

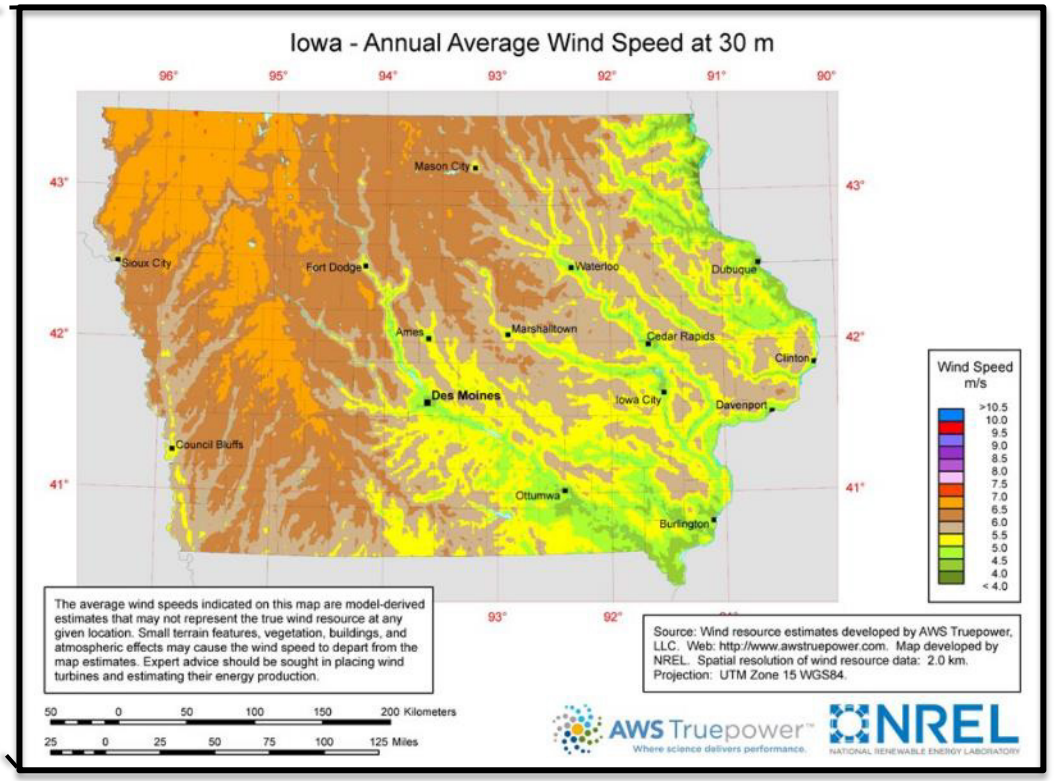
Image Source: Aegis Renewable Energy

Free Wind Resource Maps: WINDExchange



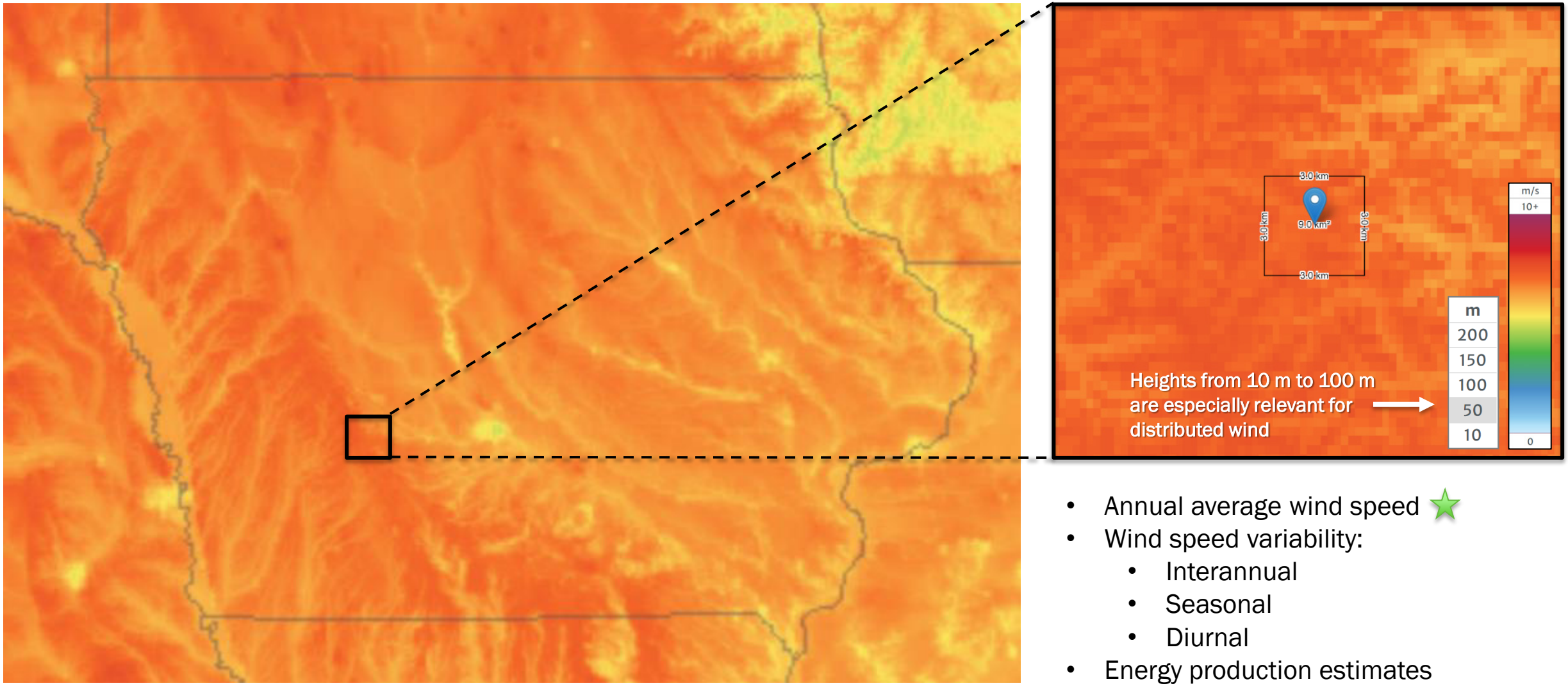
Minimum suitable annual average wind speed:

- At least 4.5 m/s at 30 m above ground level for small wind turbines
- At least 6.5 m/s at 80 m above ground level for large wind turbines



https://windexchange.energy.gov/maps-data

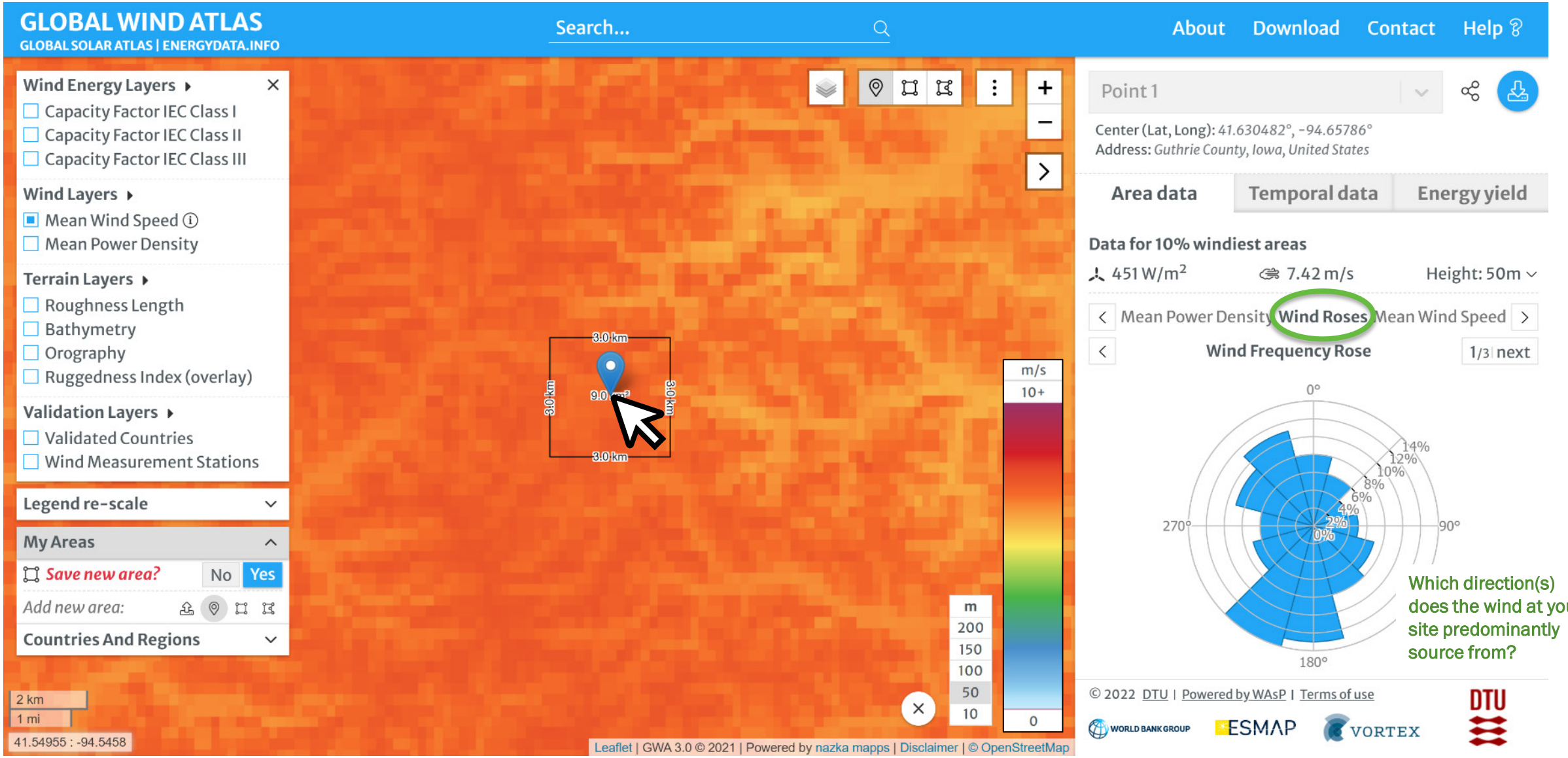
Free Wind Resource Maps: Global Wind Atlas



- Annual average wind speed ★
- Wind speed variability:
  - Interannual
  - Seasonal
  - Diurnal
- Energy production estimates
- Wind direction in a wind rose

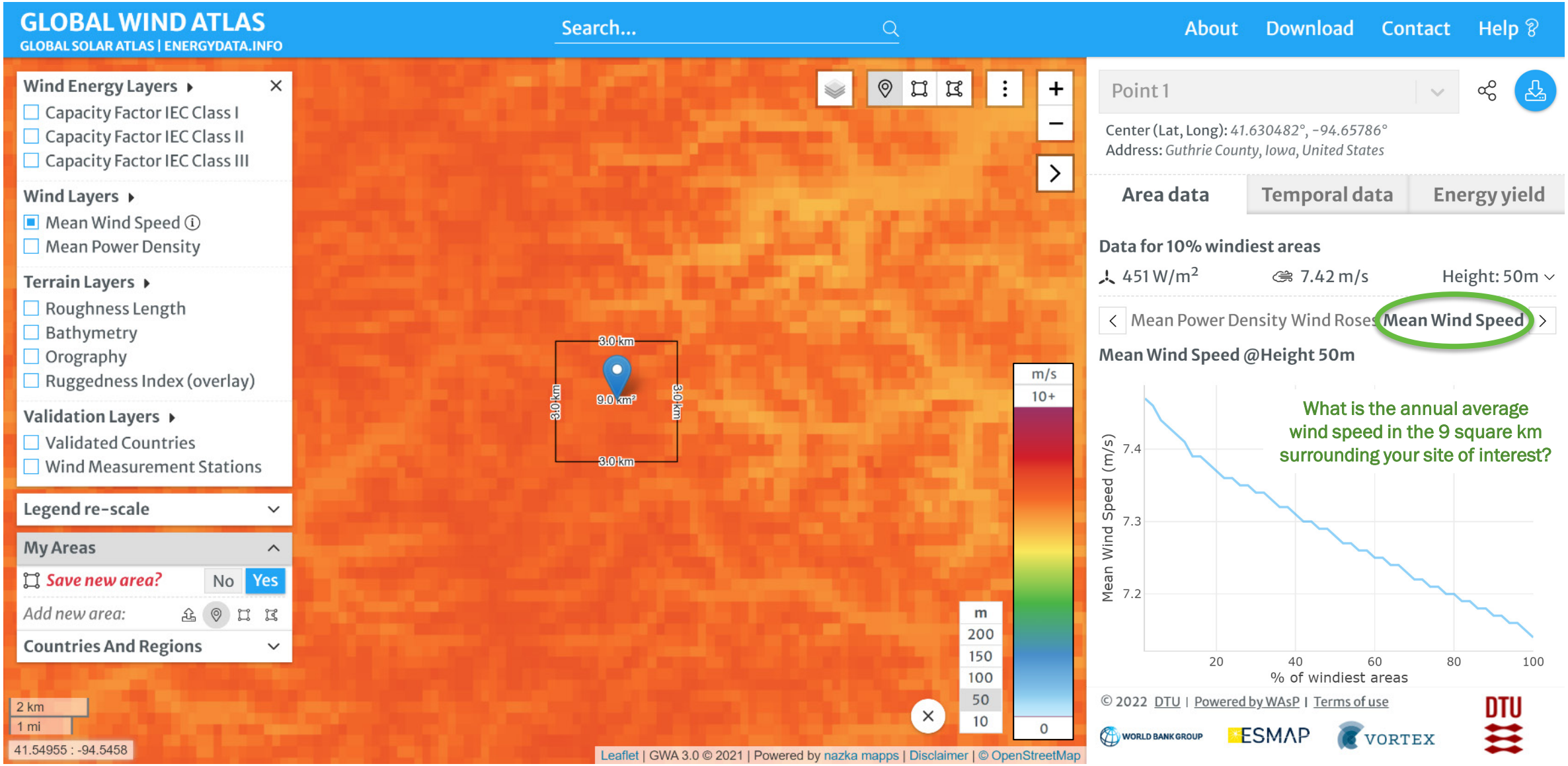
https://globalwindatlas.info/

Free Wind Resource Maps: Global Wind Atlas

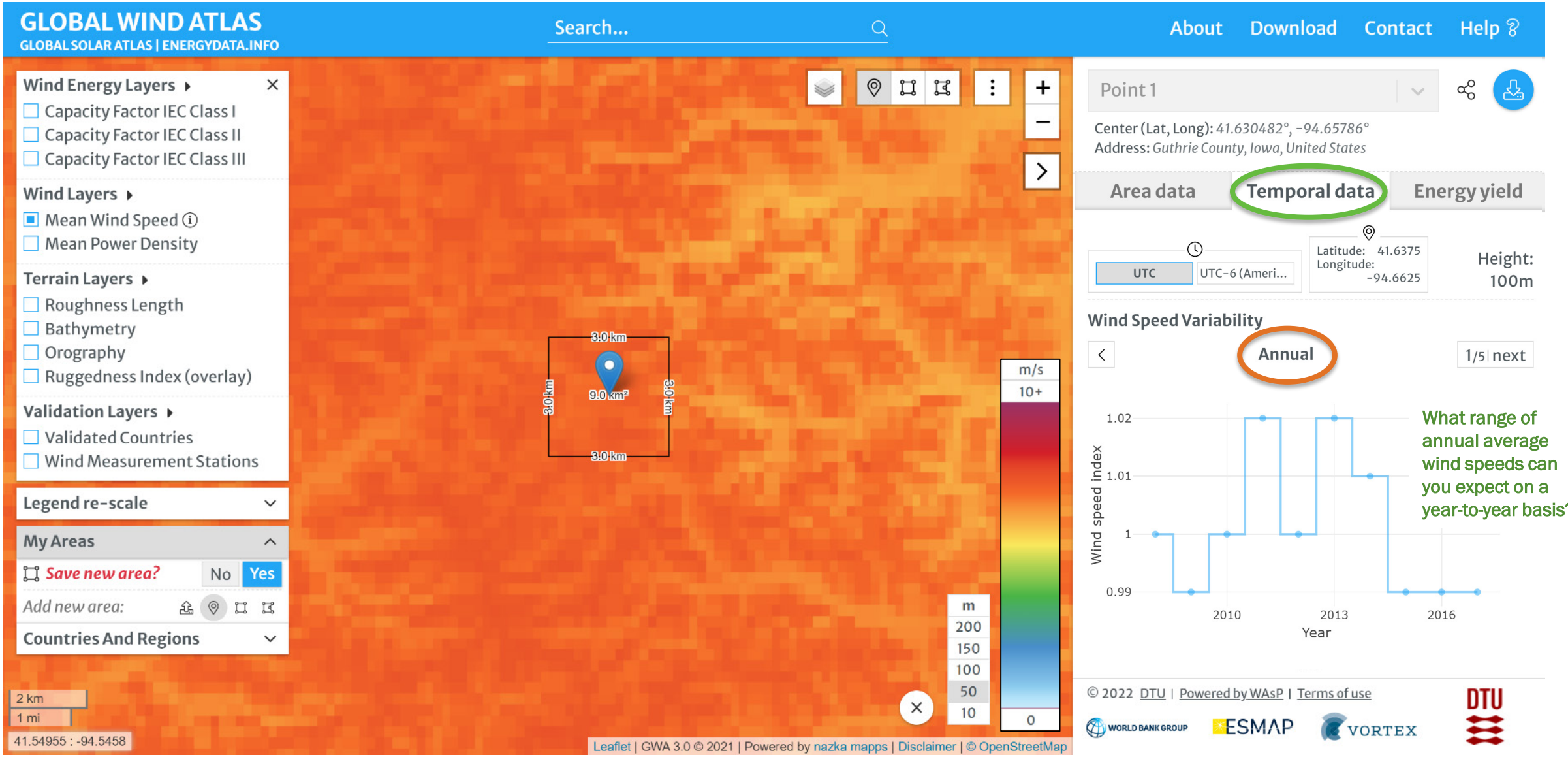


Which direction(s) does the wind at your site predominantly source from?

Free Wind Resource Maps: Global Wind Atlas



Free Wind Resource Maps: Global Wind Atlas



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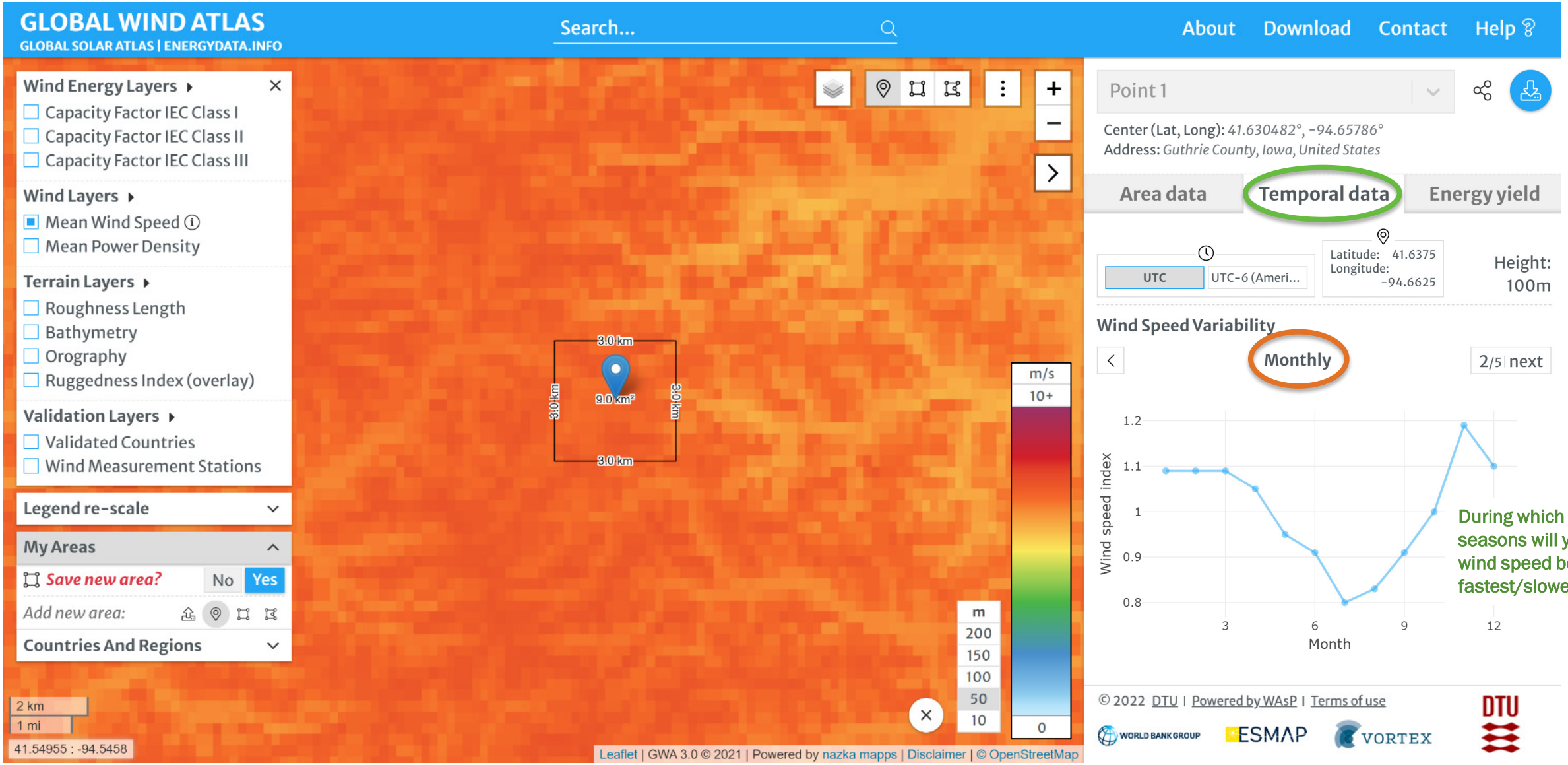

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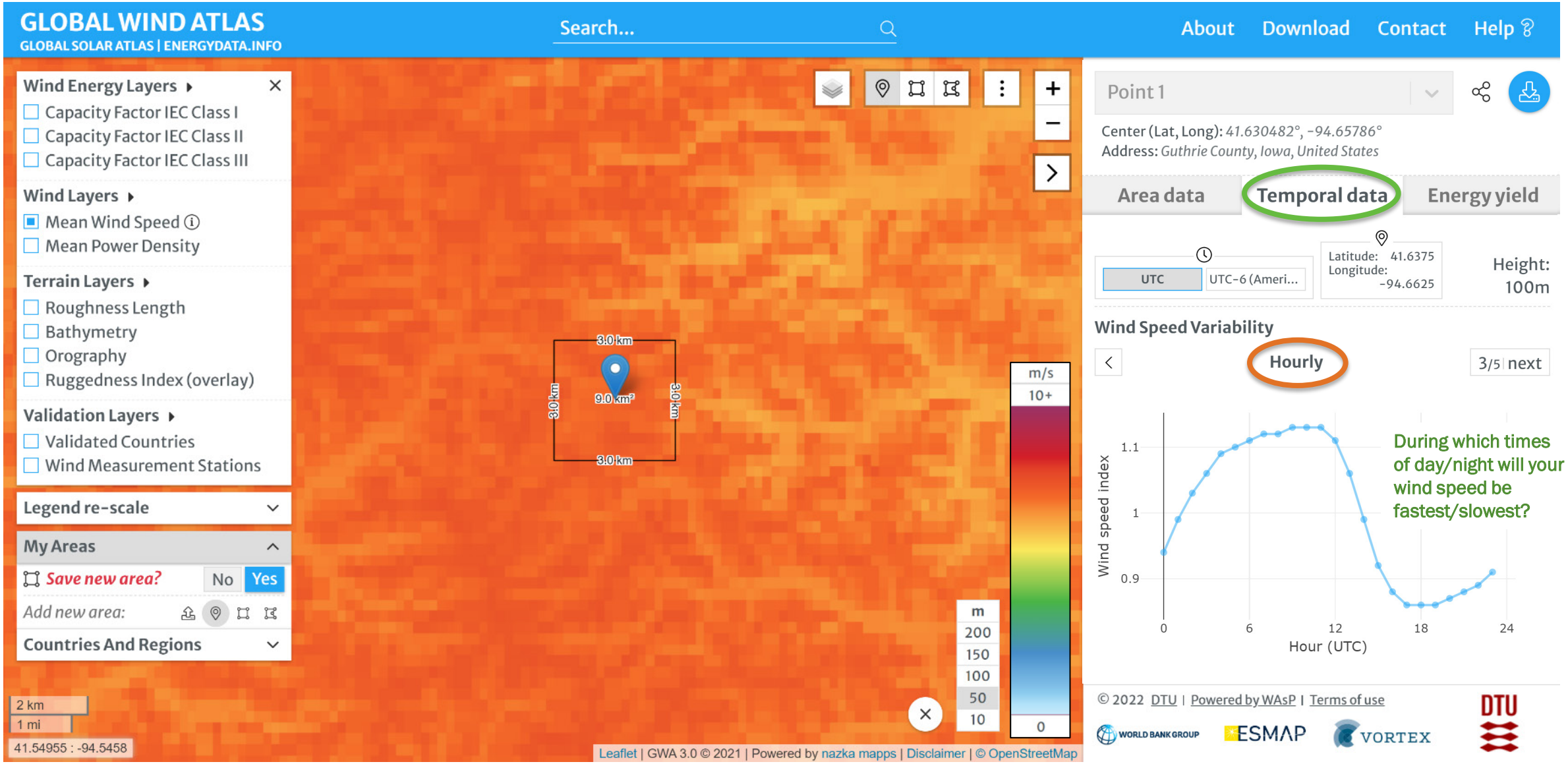

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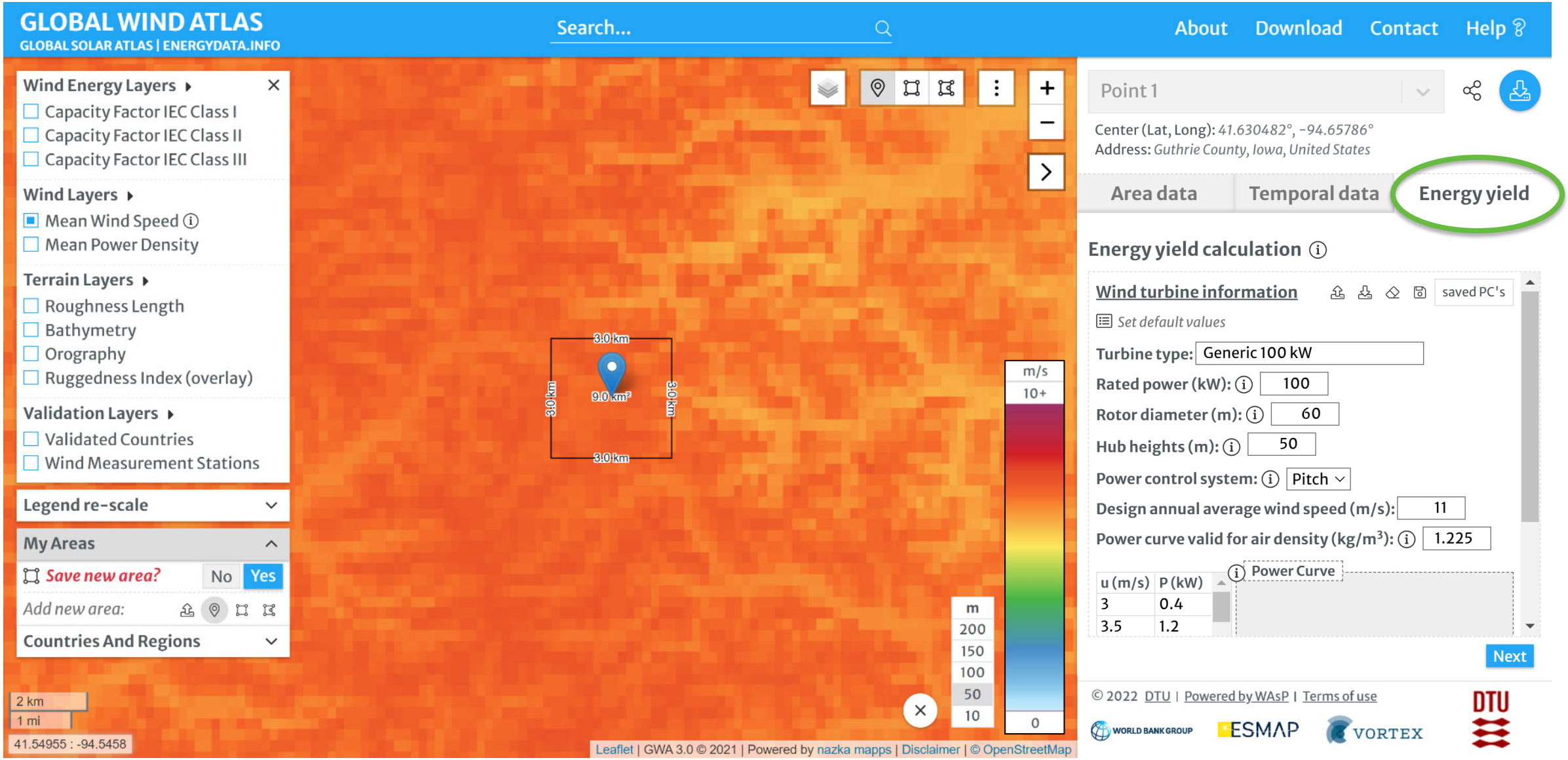

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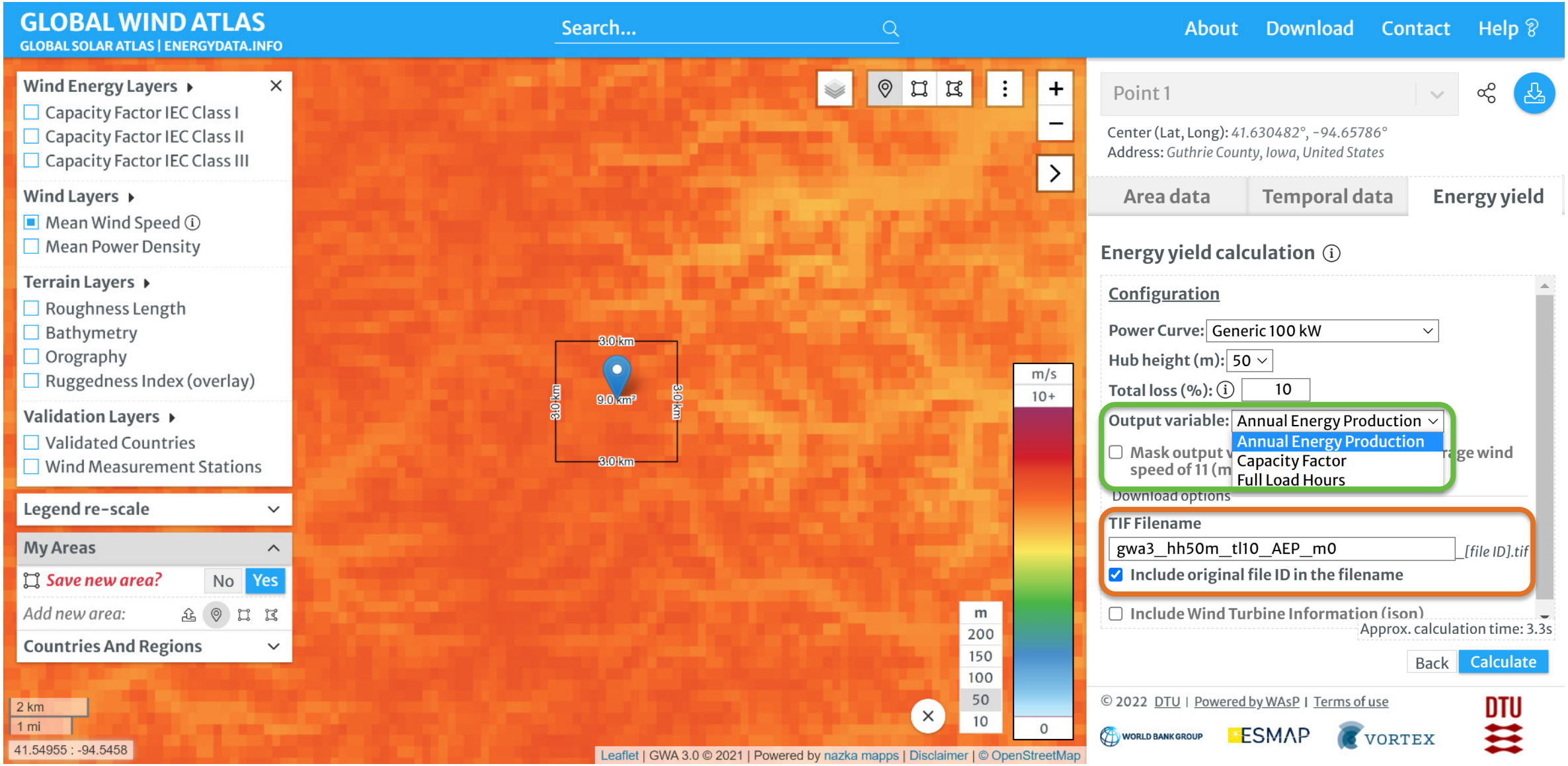


Fee-Based Wind Site Assessment

Industry consultants perform wind site assessments for clients

- Assessments range from reports for a single site, turbine, and hub height to annual subscriptions with unlimited combinations of sites, turbines, and hub heights
- Cost range: $100s to $1000s

Services include:

- Wind resource assessment
- Seasonal, diurnal, and interannual wind speed variability
- Wind roses
- Energy production estimates
- Sound and shadow flicker analysis
- GIS maps
- Site optimization recommendations

Image Source: Eocycle Technologies Inc.

Distributed Wind Tools and Resources

(1) FEMP's online, on-demand training: Selecting, Implementing, and Funding Distributed Wind Systems in Federal Facilities

(2) Rural Area Distributed Wind Integration Network Development (RADWIND) project

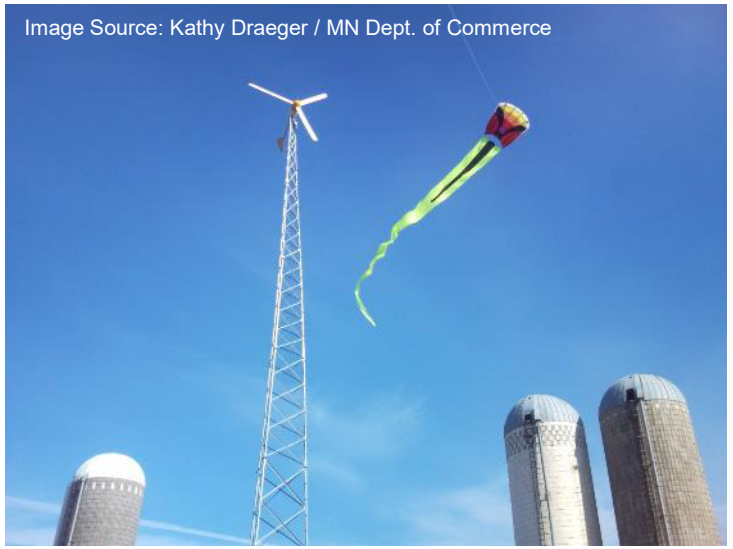
(3) U.S. DOE Wind Energy Technologies Office (WETO)

(4) FEMP Resources and Technical Assistance

Image Source: Aegis Renewable Energy

Selecting, Implementing, and Funding Distributed Wind Systems in Federal Facilities

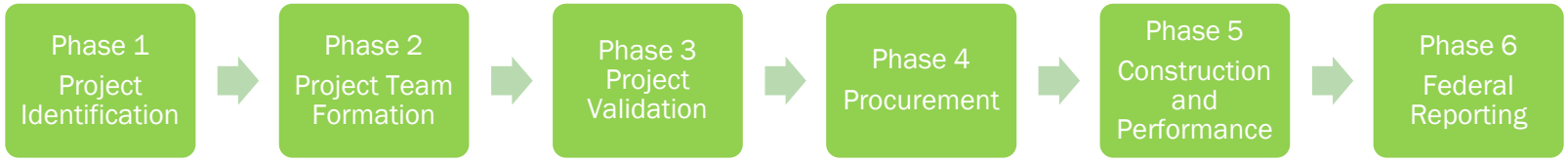
- An on-demand, online, module-based webinar training ★
- Available on the Whole Building Design Guide page for FEMP Courses: https://www.wbdg.org/continuing-education/femp-courses/fempodw037
- Estimated duration is 2 hours
- Completion of quiz earns 0.3 continuing education units



Selecting, Implementing, and Funding Distributed Wind Systems in Federal Facilities

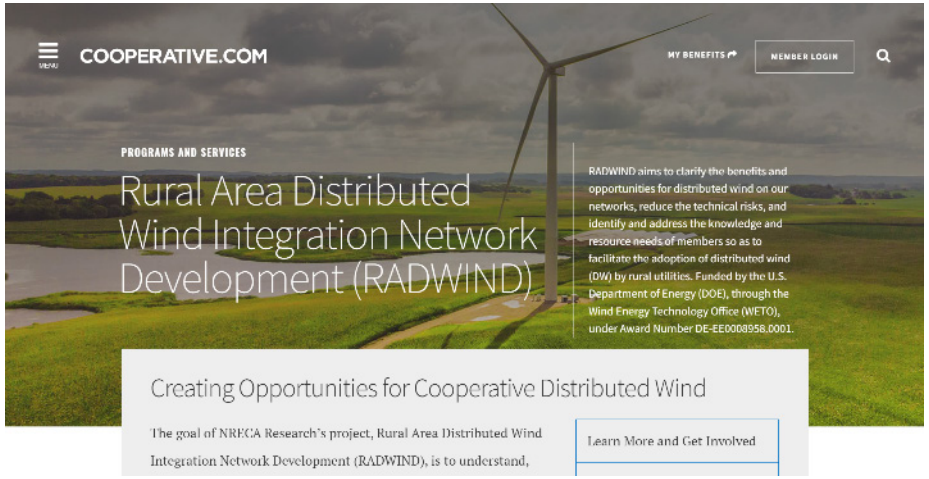
- **The training is divided into modules:**
  - Module 1: Introduction to Distributed Wind Systems
  - Module 2: Initial Cost Effectiveness Screening
  - Module 3: Wind Resource Assessment
  - Module 4: Technical, Economic, and Siting Considerations
  - Module 5: Evaluating Project Financing Options
  - Module 6: Wind Energy Myths and Marketing Claim Red Flags
  - Module 7: Operations and Maintenance

- **The modules are designed to follow FEMP's Process for Planning and Implementing Federal Distributed Energy Projects**



Rural Area Distributed Wind Integration Network Development (RADWIND)

- RADWIND is a National Rural Electric Cooperative Association (NRECA) project funded by the US DOE WETO to address the market, technical, and perceived barriers to wind deployment in rural electric cooperative service territories
- Case studies and other reports are available on the RADWIND webpage: https://www.cooperative.com/programs-services/bts/radwind/Pages/default.aspx



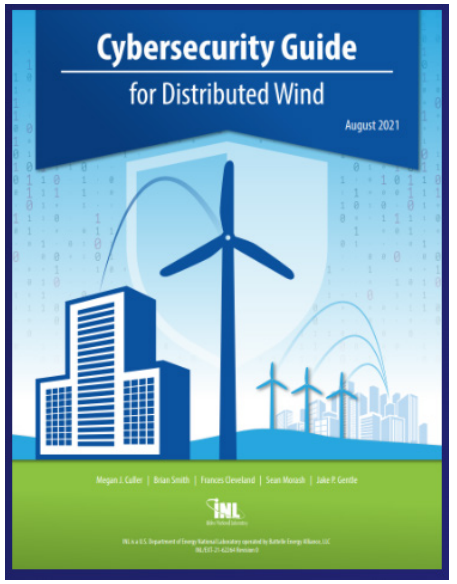
Rural Area Distributed Wind Integration Network Development (RADWIND)

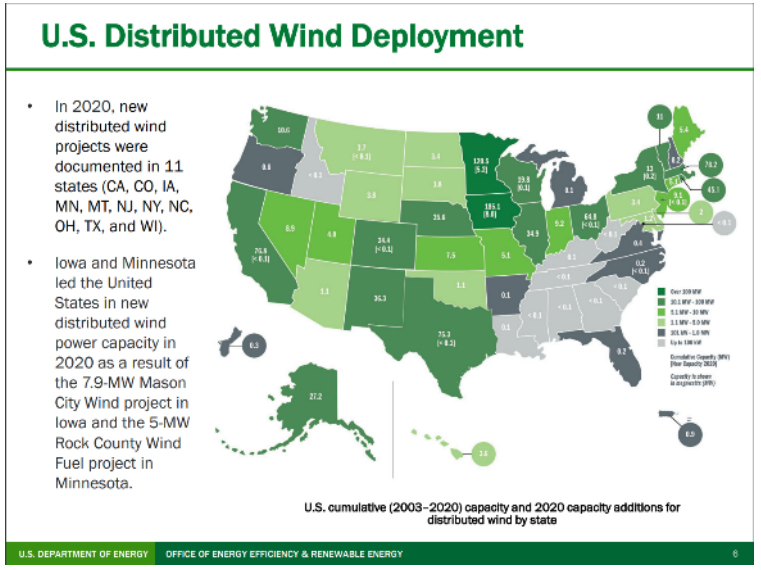
- While RADWIND's primary audience is rural electric cooperatives, lessons learned in the case studies may be applicable to federal sites.
- Also, if a federal agency is served by a rural electric cooperative, the agency and cooperative could use the RADWIND distributed wind project planning resources when working together.


Image Source: Charles Newcomb

U.S. DOE Wind Energy Technologies Office (WETO)

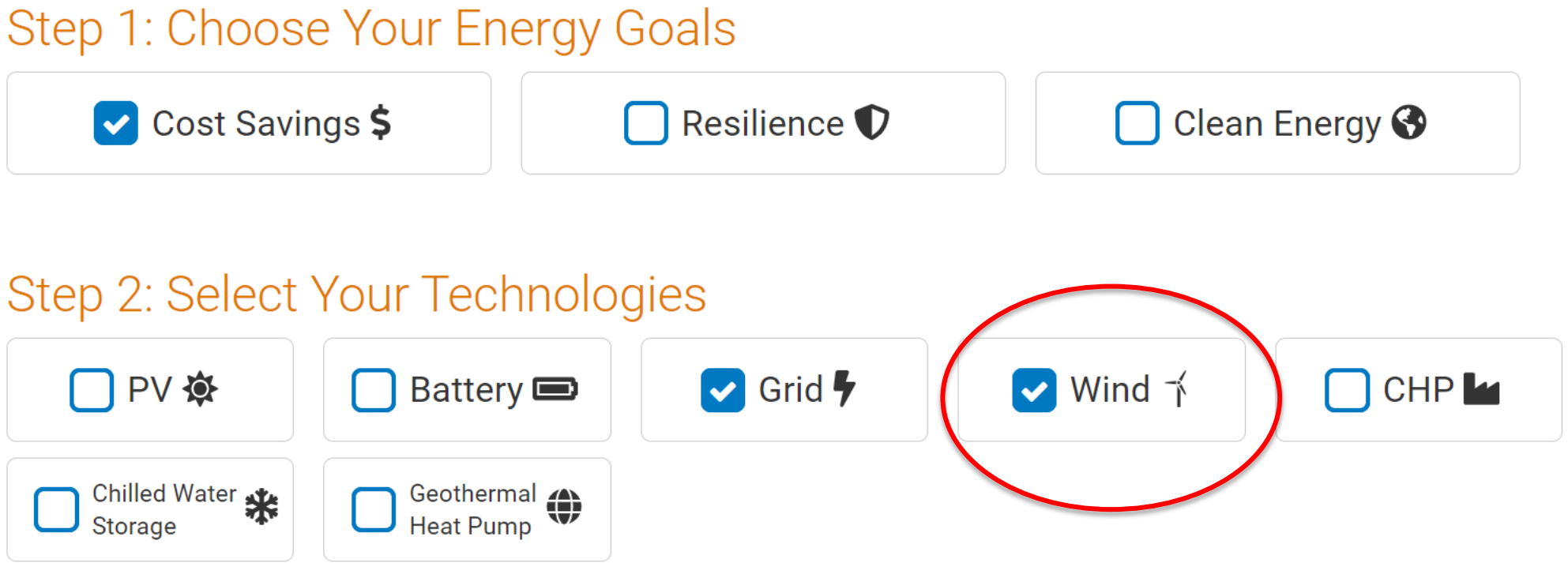
- Federal agencies may be interested in the resources from WETO's Distributed Wind Research Program available at https://www.energy.gov/eere/wind/distributed-wind
- Examples
  - Cybersecurity Guide for Distributed Wind from Idaho National Laboratory
  - Market data and market potential analysis





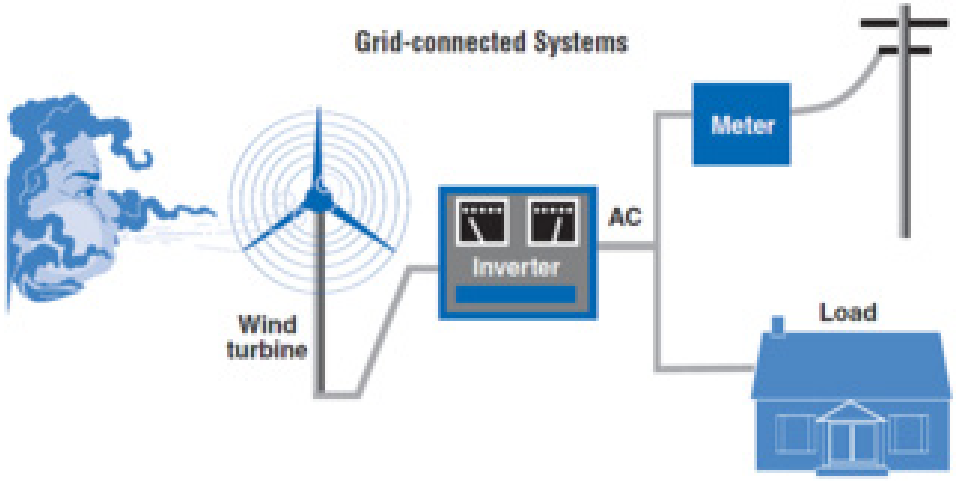
FEMP Resources: REopt Tool

- The REopt Tool optimizes generation, storage, and controllable loads to maximize the value of integrated distributed energy systems for buildings, campuses, and microgrids.
- It includes wind as a generation technology option.



FEMP Distributed Energy Interconnection Checklist

- The Distributed Energy Interconnection Checklist provides federal site managers with a series of tasks and questions to ask their utility.
- The checklist items are applicable to most types and sizes of distributed energy.



FEMP Technical Assistance

FEMP Technical Assistance for Distributed Energy Projects

- Make request at FEMP's Assistance Request Portal: https://www7.eere.energy.gov/femp/assistance/de-assistance
- Services
  - Screening Assistance
  - Feasibility Study Assistance
  - Interconnection/Grid Integration Assistance
  - High-Performance Green Building Construction/Renovation Assistance
  - Large- and Utility-Scale Project Planning Assistance
  - Acquisition Strategy Assistance
  - Request for Proposal Development/Proposal Review Assistance
  - Contract Assistance
  - Design Review Assistance
  - Construction Assistance
  - Acceptance Testing and Commissioning Assistance
  - Operations and Maintenance and Measurement and Verification Assistance
  - Performance Issues Assistance

FEMP Technical Assistance: USDA-ARS Example

- **Feasibility Screening for USDA-ARS Bushland, Texas site**
  - Estimated wind resource at the site and energy production, levelized cost of energy (LCOE), and Energy Savings Performance Contract (ESPC) Energy Sales Agreement (ESA) prices for a range of small wind turbine sizes
  - While the site has an excellent wind resource, small wind would not be cost-competitive
    - The site's blended electricity cost is $0.07/kWh and its marginal rate is $0.02/kWh
    - Modeled LCOE and ESPC-ESA rates were in the $0.10 to $0.17 per kWh range

Image Source: https://clipartart.com/categories/smart-meter-clipart.html

FEMP Technical Assistance: DEARNG Example

- **Evaluation of distributed wind resource, performance, costs, and land availability at select Delaware Army National Guard (DEARNG) sites**
  - Analysis considered:
    - Wind resource and performance of four wind turbines (ranging from 15 – 1,700 kW in size)
    - Cost-effectiveness compared to the site's energy charge
    - Local siting limitations and land availability
    - Policy environment (e.g., availability of net metering)

Site	Wind Resource	Tariff/ Energy Charge	Site/Land Availability
Bethany Beach Training Site			
Dagboro Readiness Center			
Georgetown Readiness Center			
Smyrna Readiness Center			
FMS #4 (Main meter)			
Cheswold Readiness Center			
Pigman Readiness Center			
Scannell Readiness Center			
Wilmington Readiness Center			
River Road Training Site			
Newark Reserve Center			
Biden HQ, Duncan RC, AASF			
Stern RC, 198th RC, FMS #1			

Legend

Good	*Ok*	*Not Good*	*Unknown*

Learning Objectives: Revisit

- Let's revisit the learning objectives:
  - Define and describe distributed wind
  - Use publicly available wind resource assessment screening tools
  - Locate other distributed wind tools and resources

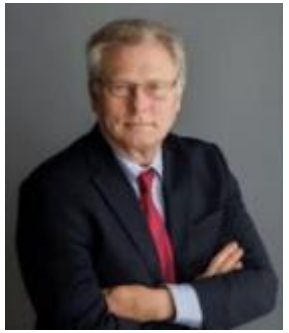
Taking the First Step

Talk to the FEMP Federal Project Executive (FPE) in your region for assistance.

energy.gov/eere/femp/energy-savings-performance-contract-federal-project-executives-0

Northeast Region

Tom Hattery
Northeast Region
202-256-5986
thomas.hattery@ee.doe.gov



Southeast Region

Doug Culbreth
Southeast Region
919-870-0051
culbrethcd@ornl.gov

Western Region

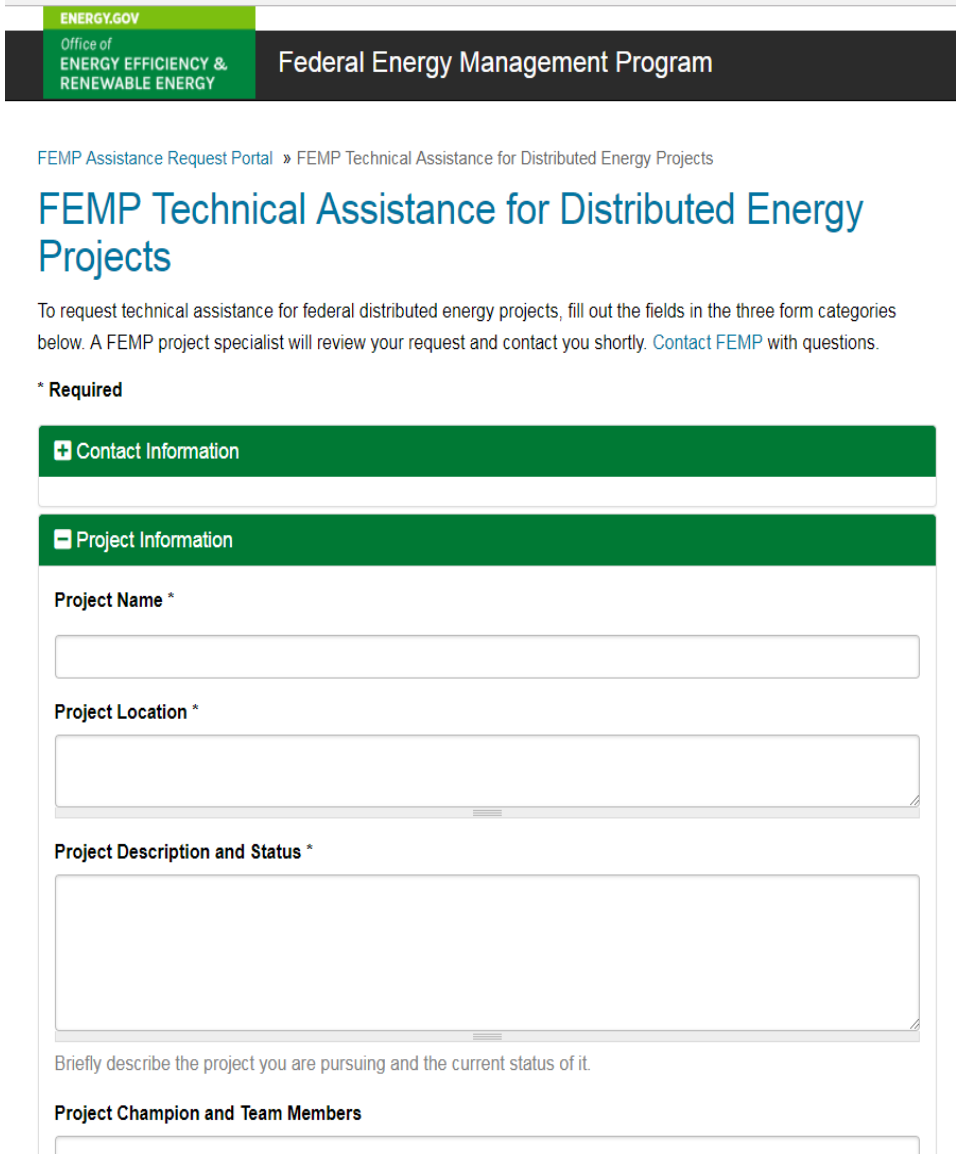
Scott Wolf
Western Region
360-866-9163
wolfsc@ornl.gov

FEMP Support

- Project guidance and discussions with Federal Project Executives (FPEs)
- Technical assistance provided by DOE National Labs
- Tailored training for agencies
- Strategic Partnership Meetings

FEMP Assistance Request Portal

Submit questions or requests for support through the (*https://www7.eere.energy.gov/femp/assistance/*)



Questions?

IACET Credit for Webinar

WBDG WHOLE BUILDING DESIGN GUIDE a program of the National Institute of Building Sciences

ACCREDITED IACET PROVIDER

The National Institute of Building Sciences' (NIBS) Whole Building Design Guide (WBDG) hosts the FEMP training program's learning management system (LMS).

The WBDG LMS:

- Allows for taking multiple trainings from multiple organizations through one platform.
- Houses the assessments and evaluations for all accredited courses.
- Allows you to:
  - Track all of your trainings in one place.
  - Download your training certificates of completion.
- Eases the CEU-achievement process.

Visit the WBDG at www.wbdg.org to view courses and create an account

IACET Credit for Webinar

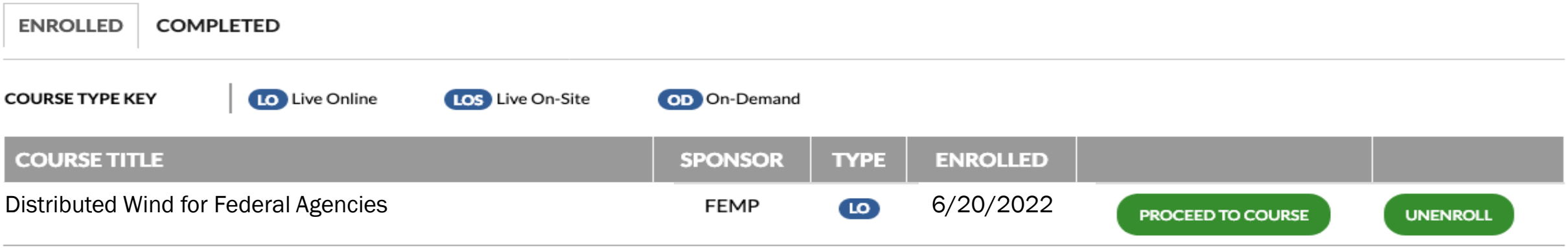
To receive IACET-Certified CEUs, attendees must:

- Attend the training in full (no exceptions).
  - If you are sharing a web connection during the training, you must send an e-mail to Elena Meehan (elena.meehan@ee.doe.gov) and indicate who was on the connection and who showed as connected (will reflect in the WebEx roster).
- Complete an assessment demonstrating knowledge of course learning objectives and an evaluation **within six weeks of the training**. A minimum of 80% correct answers are required for the assessment.

To access the webinar assessment and evaluation, visit:

https://www.wbdg.org/continuing-education/femp-courses/femplw06232022

If you have a WBDG account and enrolled previously, simply log in and click the *Continuing Education* tab on the user account page. Click *Proceed to Course* next to the course title.



Glossary

- **Behind-the-meter**: A distributed energy resource is behind the meter if it is connected to the distribution system behind the customer's utility meter to offset all or some of the on-site energy needs. Behind-the-meter distributed energy resources may provide excess generation back to the grid through net-metering or other billing mechanisms.
- **Distributed energy resources**: Technologies deployed on the distribution grid that generate or provide electric capacity at or near where it will be used (i.e., close to load). Examples of distributed energy resources include utility- or customer-sited technologies such as wind turbines, solar photovoltaic arrays, and battery storage.
- **Front-of-the-meter**: A distributed energy resource is front of the meter if it is connected to the utility side of all customer meters on the distribution system, typically to serve loads interconnected to the same distribution grid.
- **Geographic Information System (GIS):** A computer system that creates, manages, analyzes, and maps all types of data.
- **Isolated grid**: An electrical grid system that is not connected to a larger grid system, such as for a remote village, and typically utilizes front-of-meter distributed energy resources for local use.
- **Levelized cost of energy (LCOE):** An LCOE represents the present value of all anticipated project costs (installed and O&M) over the project's anticipated lifetime energy production. LCOE allows for the comparison of different technologies of unequal life spans, sizes, and initial capital costs. LCOE is calculated by dividing a project's lifetime costs by its energy production and is expressed in $/kWh or ¢/kWh.
- **Microgrid**: A group of interconnected loads and distributed energy resources within defined electrical boundaries that can operate in either a connected or disconnected (islanded) mode from the local distribution grid.
- **Net metering**: A billing mechanism that provides financial compensation for customers who send excess generation from their distributed energy resources back to the grid.
- **Off-grid**: A distributed energy resources is off grid if it is not connected to any distribution grid.
- **Wind rose**: A diagram showing the relative frequency of wind directions at a particular location over a specified time period.