

# 2024 Distributed Wind Energy Summit

## Deciding on Distributed Wind



# 2024 Distributed Wind Energy Summit

## Mapping Opportunity

September 19, 2024

**Dr. Caleb Phillips**

Senior Scientist, Data Analysis & Visualization, NREL



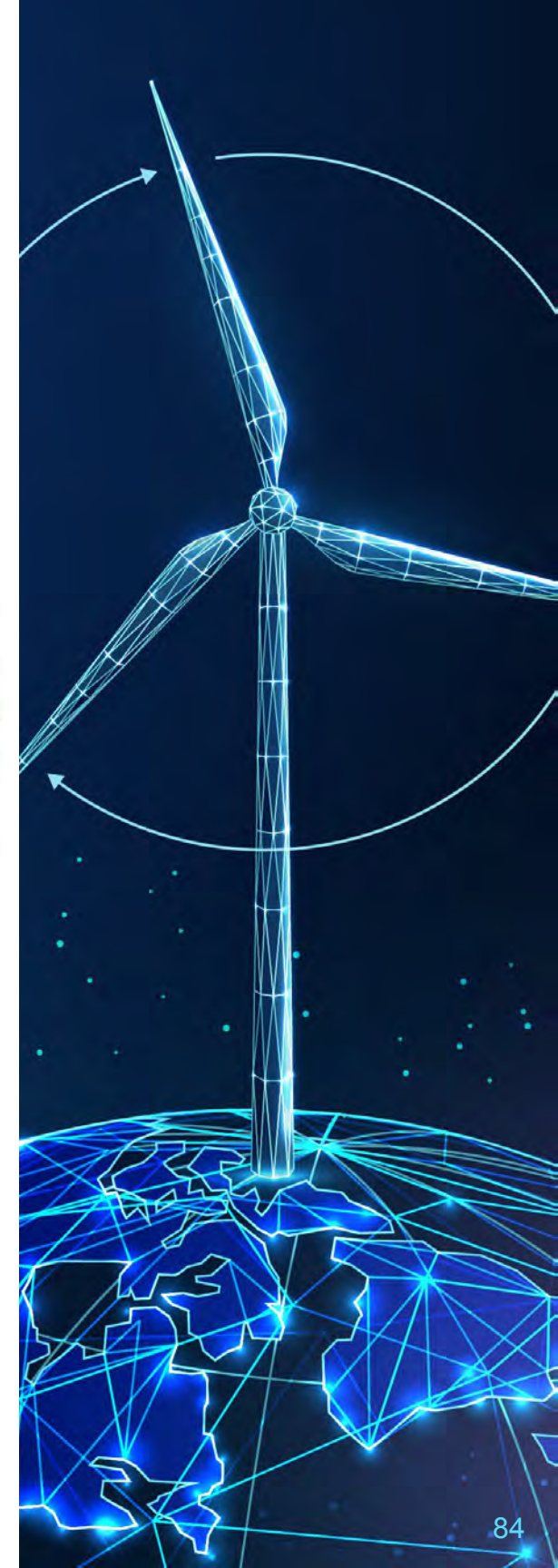
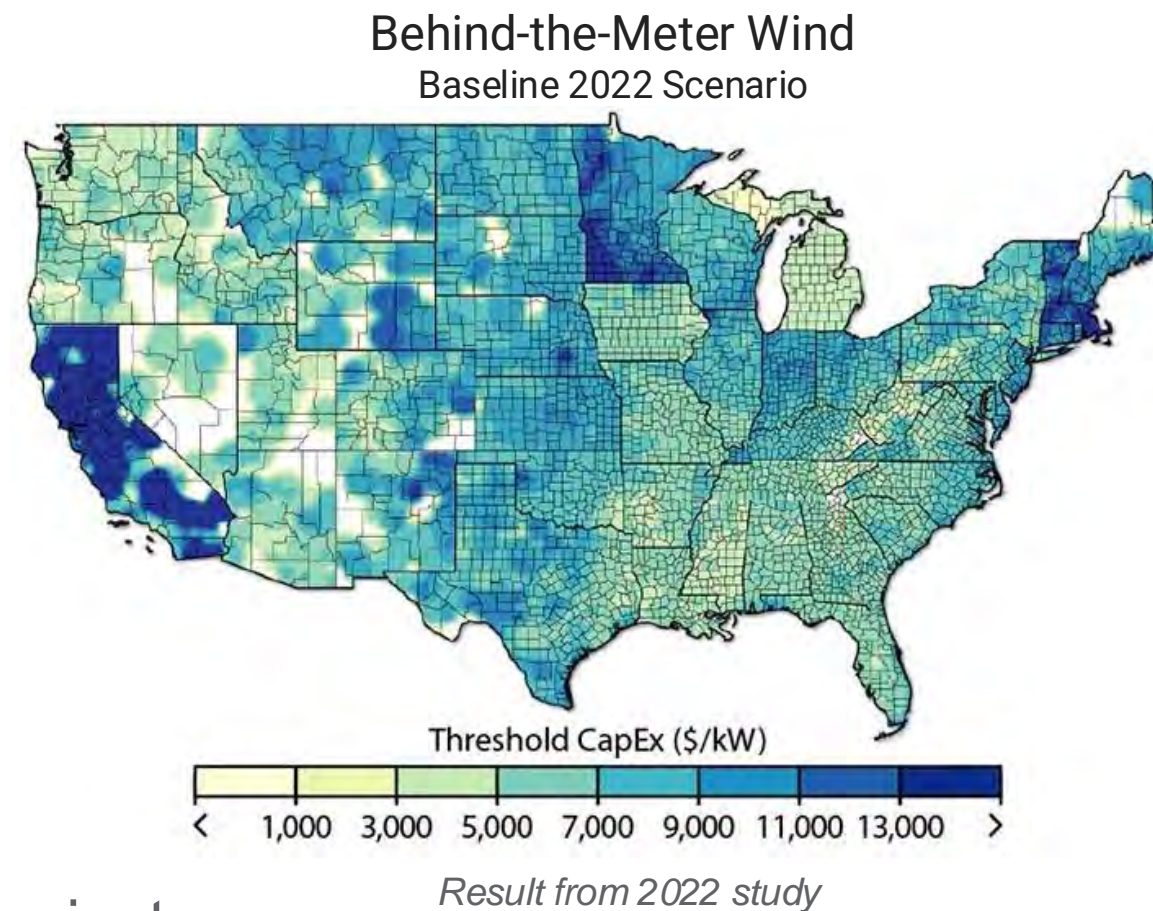


# The Distributed Wind Energy Futures Study

What is the US opportunity for distributed wind now through 2035?

**Key Innovation:** An **every-single-parcel** assessment of land use, wind resource, and siting. We assess each parcel's technical and economic viability, policy financing and incentives, and performance improvement pathways to 2035.

This is a long running NREL-led project with prior studies in 2012, 2016 and 2022.





## Example: Parcel Sampling & System Sizing

- For every parcel in the continental US (~155 million parcels):
  - **Find largest possible wind turbine system (see below)**



1. Example of a parcel in Southwestern Utah.



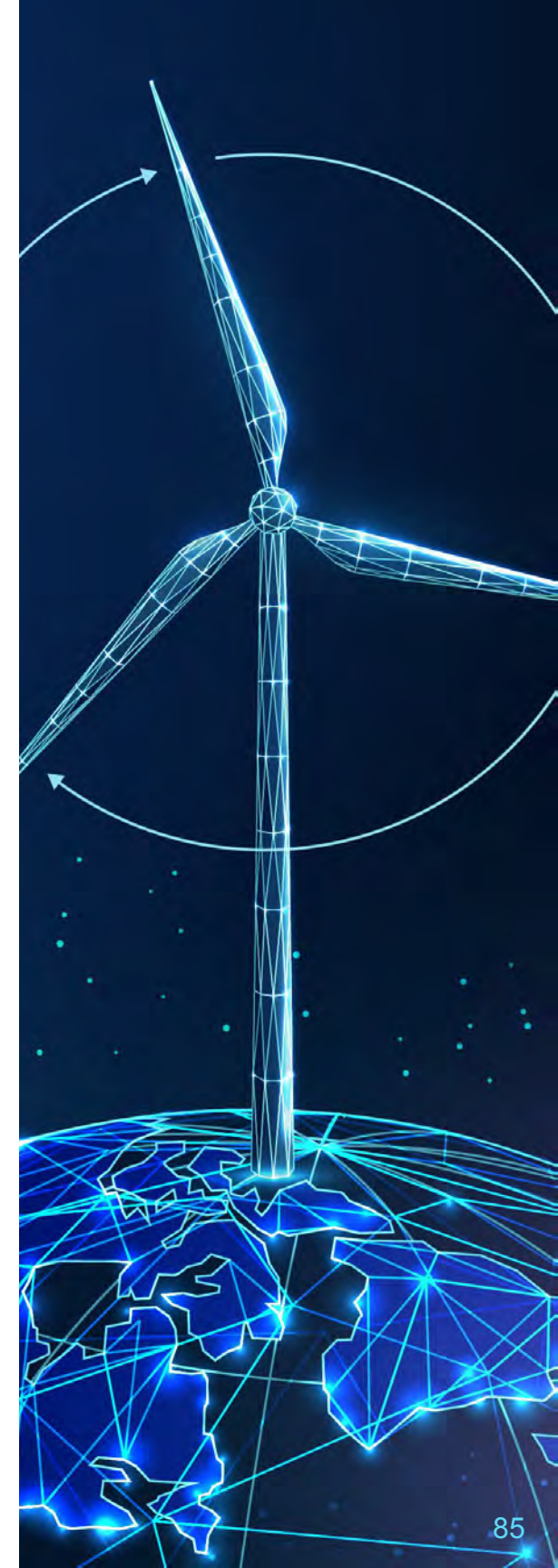
2. Remove building geometries from parcel.



3. Remove exclusions: Slope > 20%, federal lands, water, forests, etc.



4. Biggest circle in remaining polygon determines maximum turbine size.



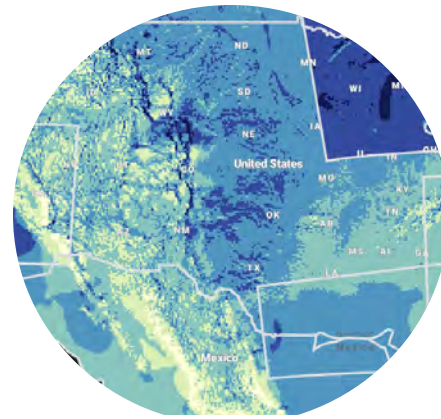


## Example: Wind Resource & Model Turbine

- For every parcel in the continental US (~155 million parcels):
  - Find largest possible wind turbine system
  - **Estimate potential power and energy generation**



1. Example of a parcel in Southwestern Utah.



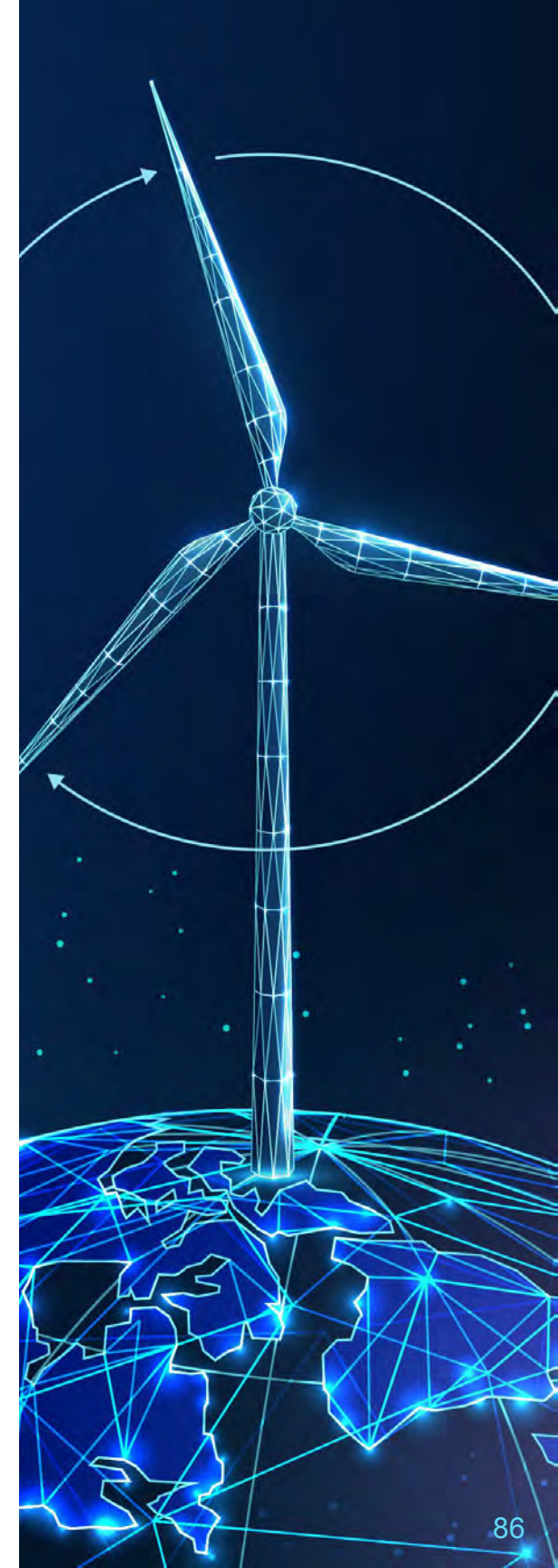
2. Use NREL's WIND Toolkit Dataset



3. Extract hourly average windspeed and direction



4. Using turbine power curve, estimate generation



## Example: Valuation Framework and Costs

- For every parcel in the continental US (~155 million parcels):
  - Find largest possible wind turbine system
  - Estimate potential power and energy generation
  - **Apply valuation framework, calculate cost**



1. Example of a parcel in Southwestern Utah.



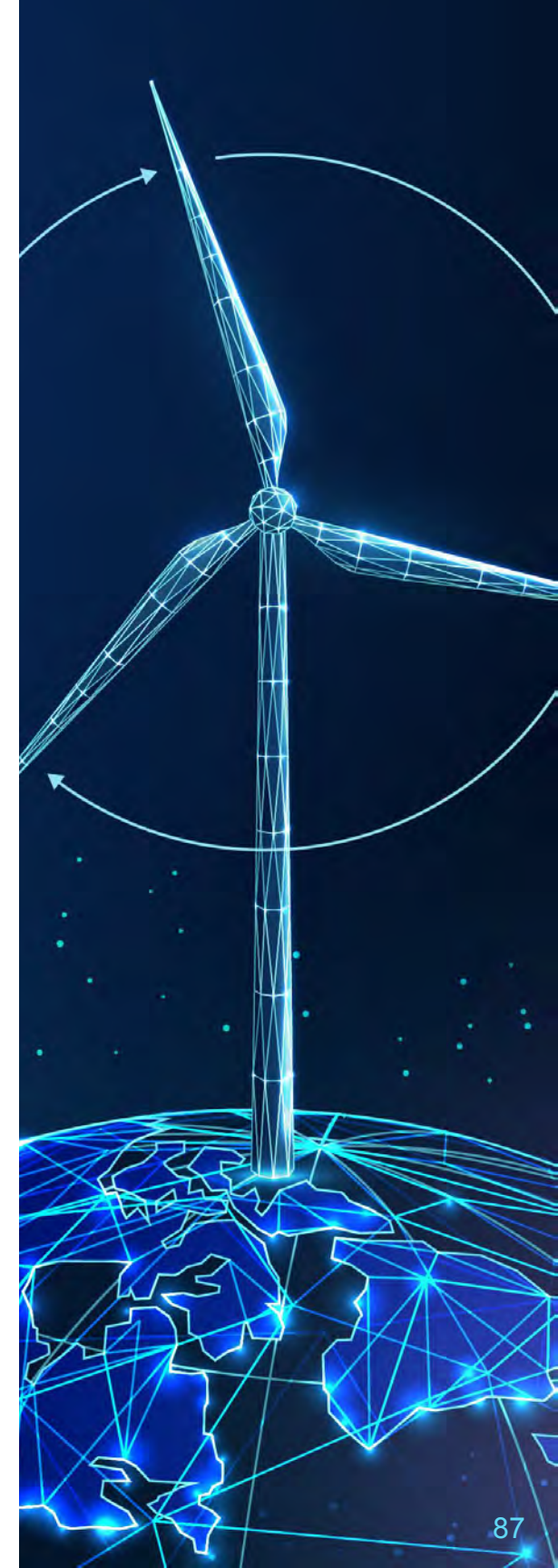
2. Wind resource and turbine model



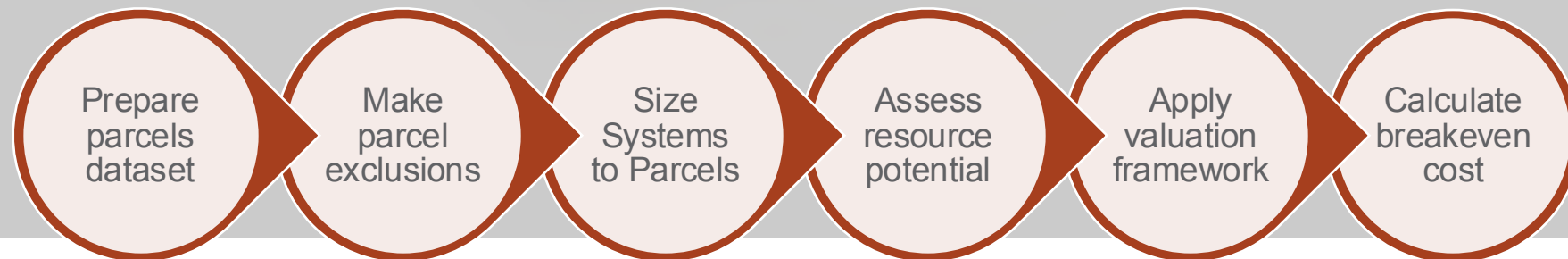
3. Cost of energy, building loads, and regulatory constraints



4. Determine break-even cost and system cost viability

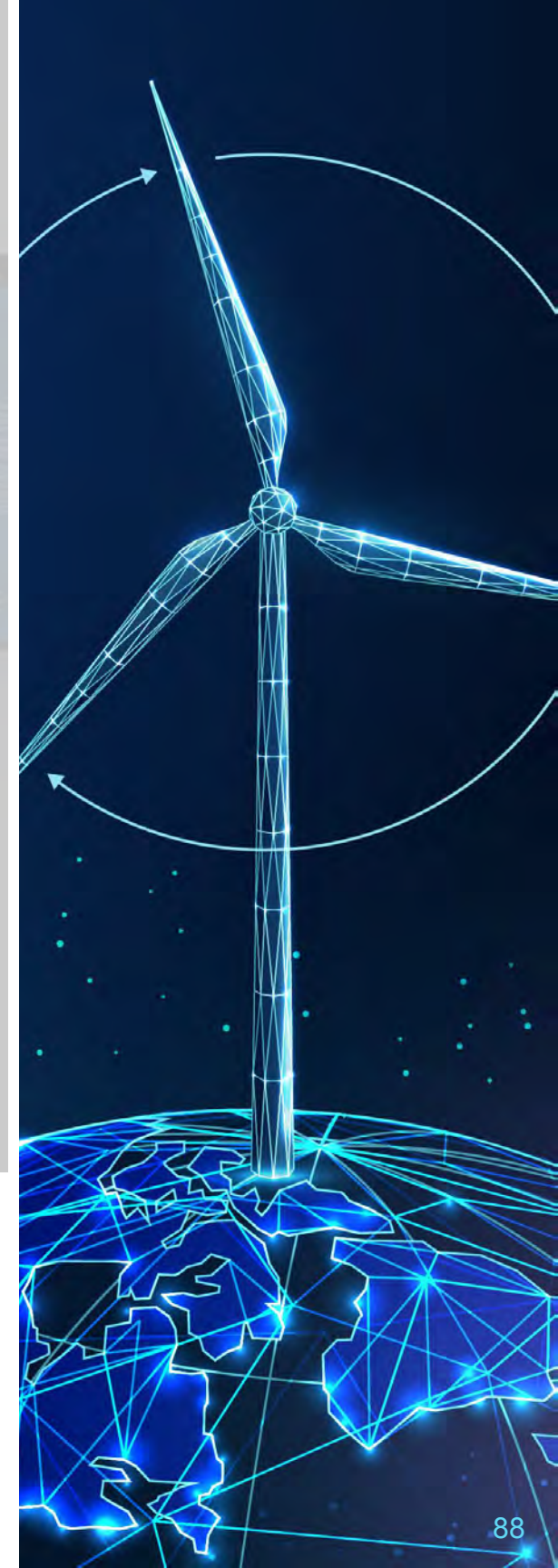




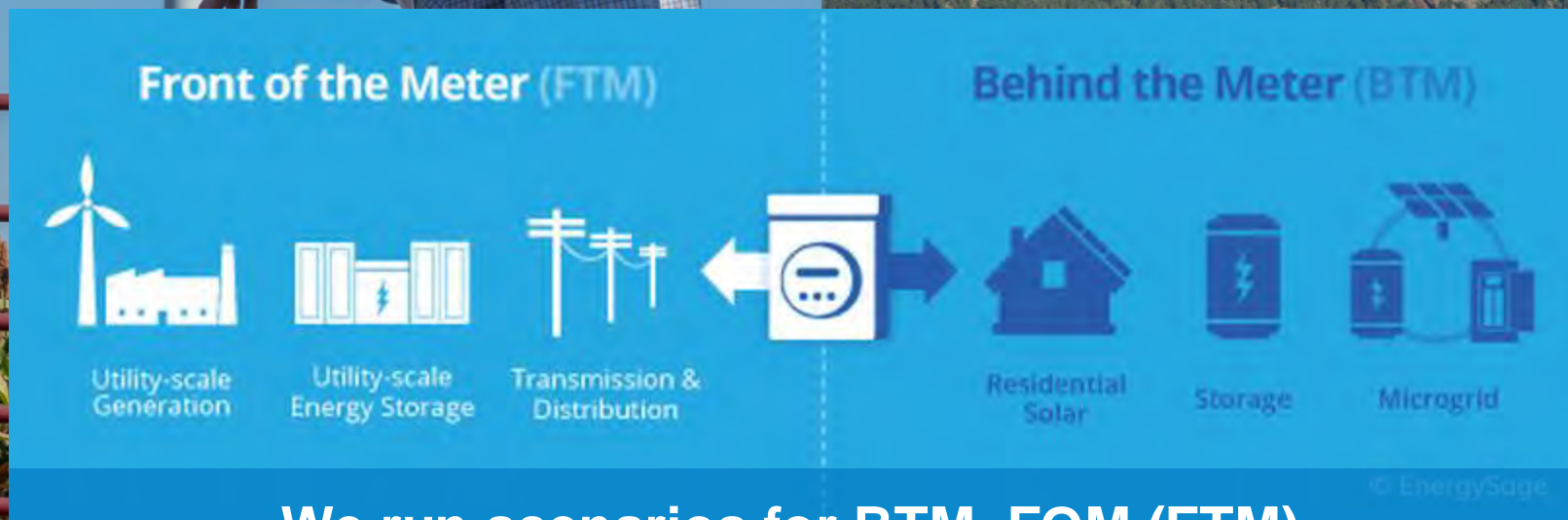


- Spatial trends
- Supply curves
- Compare results

While computationally costly, this workflow is performed in parallel on NREL's supercomputer Kestrel







We run scenarios for BTM, FOM (FTM),  
and combined for now through 2035



## Power

**Technical Potential**  
Generation (KW) if All Turbines Running  
at Nameplate Capacity



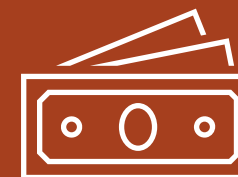
## Energy

**Annual Energy Productivity (AEP)**  
Energy Production (KWh), accounting for technology  
and wind resource



## Cost

**Breakeven Cost**  
Capital & O/M cost at which a turbine would pay for  
itself, in \$/kW




## Cost Viable




Technical  
Potential  
  
Annual Energy  
Productivity








ATMOSPHERE TO ELECTRONS  
U.S. DEPARTMENT OF ENERGY

Welcome, Caleb Phillips  Sign Out  

PROJECTS DATA PUBLICATIONS CODE METRICS FAQ 

Distributed Wind

Front-of-Meter Model Results

Summary Upload Permissions

Description

These files contains aggregations of key variables from the NREL Distributed Wind Futures Study using full parcel level data. These variables describe total technical and economic potential for distributed wind turbine deployment. Aggregations are available at the (1) county, (2) zipcode (zip code tabulation area or zcta), and (3) US Census block group level. Each scenario is coded with the scenario name (e.g., baseline) and year (e.g., 2022). The data are available as CSV or Geopackage.

Details

102 Views

123 External Downloads

SCENARIO MODE

Data Type

☒ Front-of-Meter

☐ Behind-the-Meter

Scenario 1 Year

☒ 2022

☐ 2035

Select a Variable

Breakeven Cost - Mean

Scenario 2 Year

☐ 2022

☒ 2035

Select a Variable

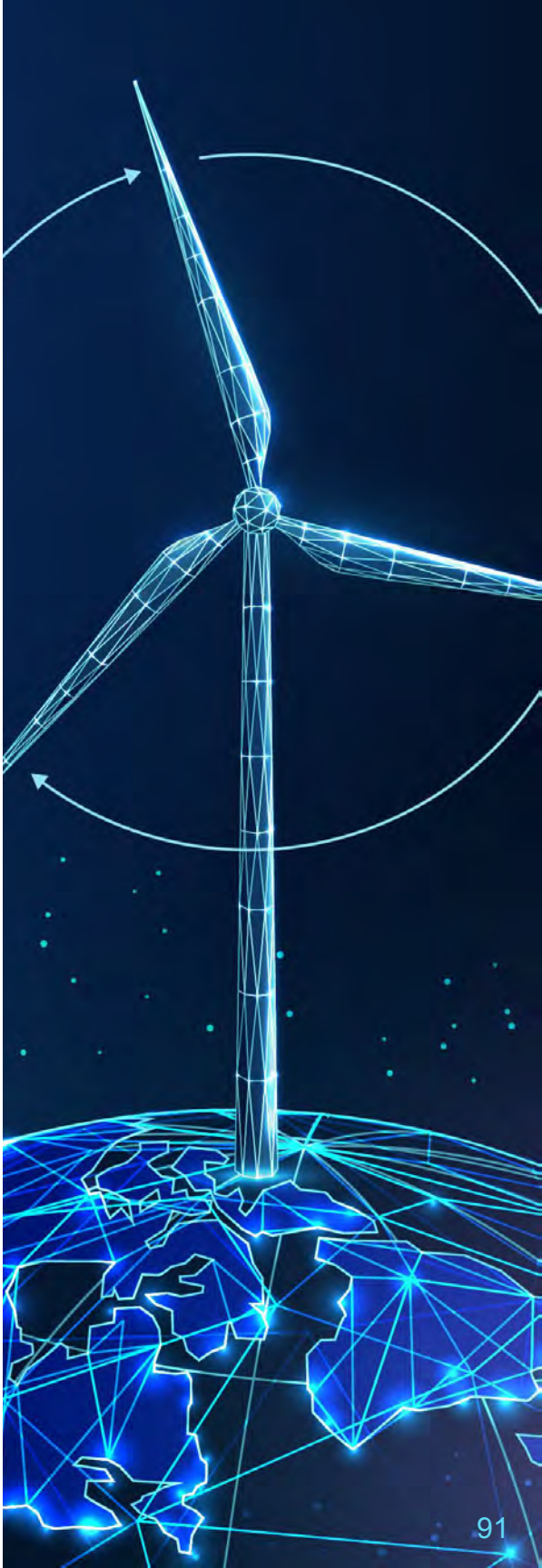
Breakeven Cost - Mean


Breakeven Cost - Mean (USD) | 2022


Breakeven Cost - Mean (USD) | 2035

A2E Wind  
Data Portal

DWEFS  
Scenario  
Visualizer





Find address or place 

Enter an address and click the behind-the-meter or front-of-meter tab to view average breakeven costs.

Learn more!

Behind-the-Meter Breakeven Costs

Front-of-Meter Breakeven Costs

Relative Breakeven Cost

Least Favorable

Most Favorable

Distributed Wind Explorer

Edmonton

Calgary

Vancouver

Seattle

San Francisco

Los Angeles

Denver

St. Louis

Chicago

Detroit

Toronto

Ottawa

Boston

New York

Philadelphia

Washington

Atlanta

Houston

Miami

Havana

Port-au-Prince

Monterrey

Guadalajara

Mexico City

DW  
Explorer

91



# 2024 Distributed Wind Energy Summit

## Distributed Wind Explorer

September 17, 2024

**Danielle Prezioso**

Socio-Technical Systems Engineer



PNNL-SA-203614





# Distributed Wind Explorer

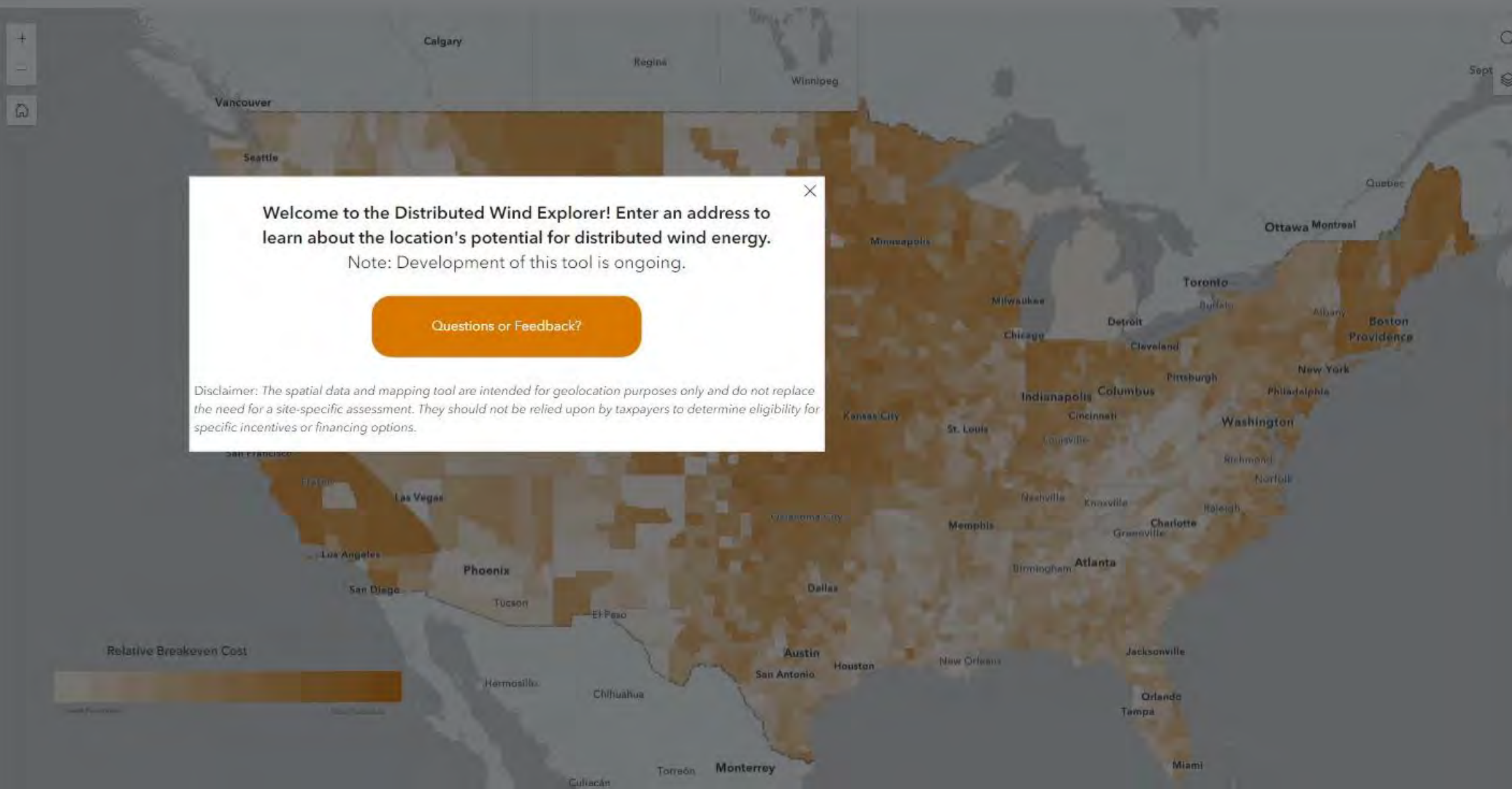


Behind-the-Meter Breakeven Costs

Front-of-Meter Breakeven Costs

Enter an address and click the behind-the-meter or front-of-meter tab to view average breakeven costs.

[Learn more!](#)



Welcome to the Distributed Wind Explorer! Enter an address to learn about the location's potential for distributed wind energy.

Note: Development of this tool is ongoing.

[Questions or Feedback?](#)

Disclaimer: The spatial data and mapping tool are intended for geolocation purposes only and do not replace the need for a site-specific assessment. They should not be relied upon by taxpayers to determine eligibility for specific incentives or financing options.



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## WindWatts

September 19, 2024

**Dr. Caleb Phillips**

Senior Scientist, Data Analysis & Visualization, NREL





WindWattsbeta

To start, click on the map or navigate to a specific location using "Address".

NREL

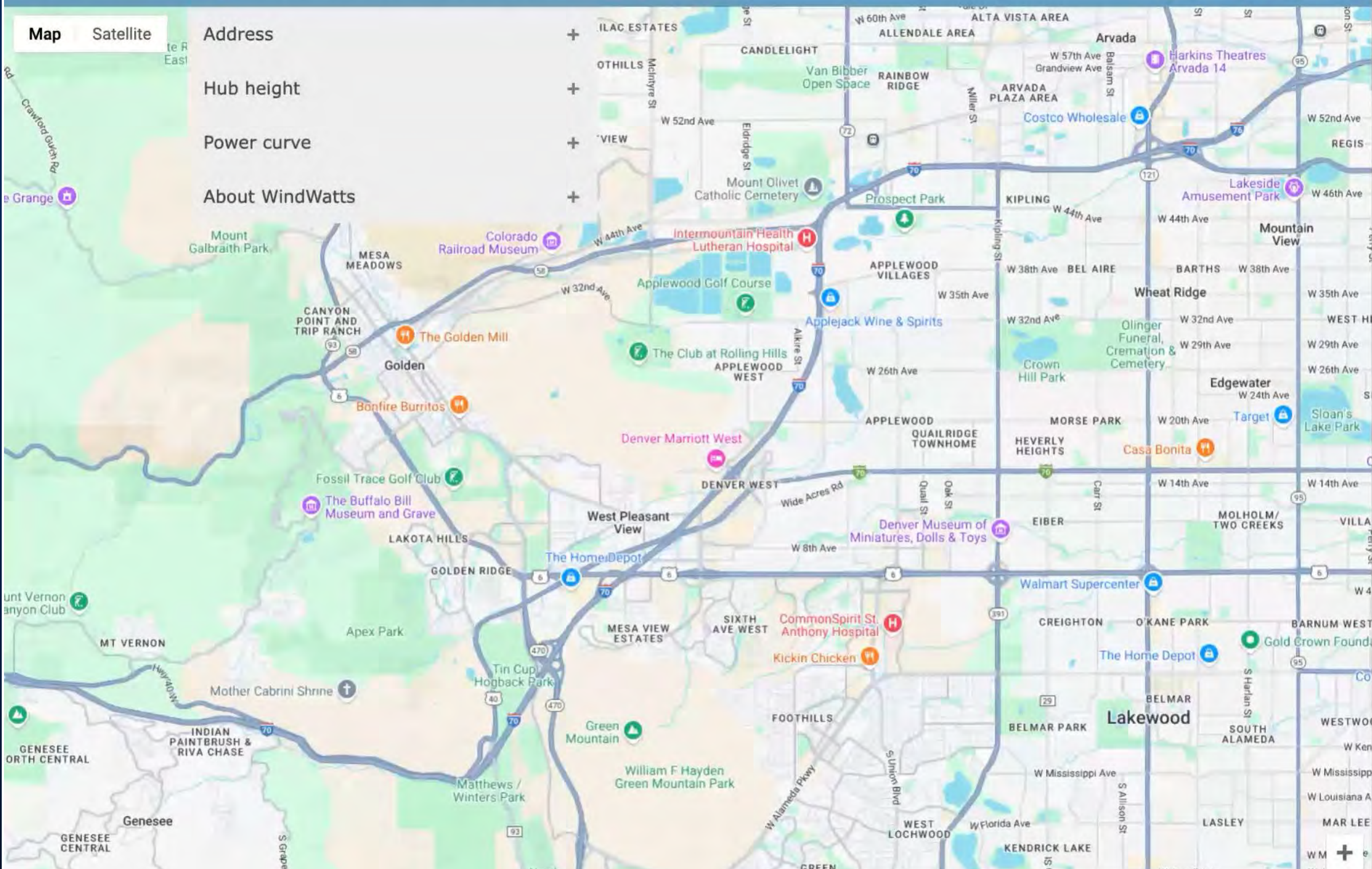
MapSatellite

Address

Hub height

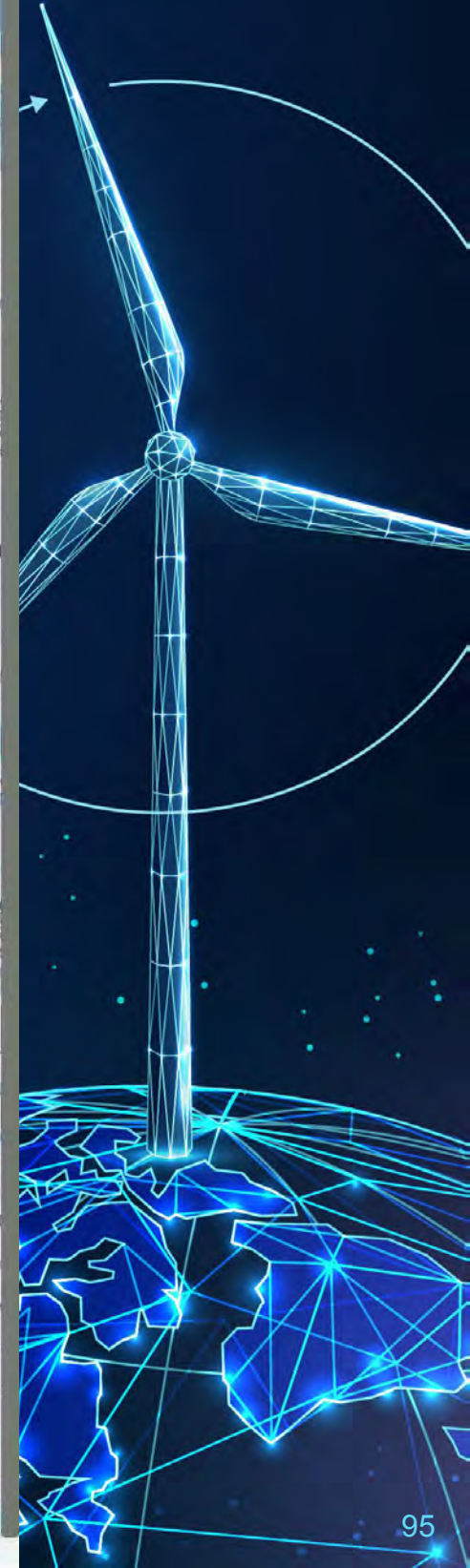
Power curve

About WindWatts



Google

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# 2024 Distributed Wind Energy Summit

## WINDVALT demonstration

September 17, 2024

**Sarah Barrows and Avinash Joshi**

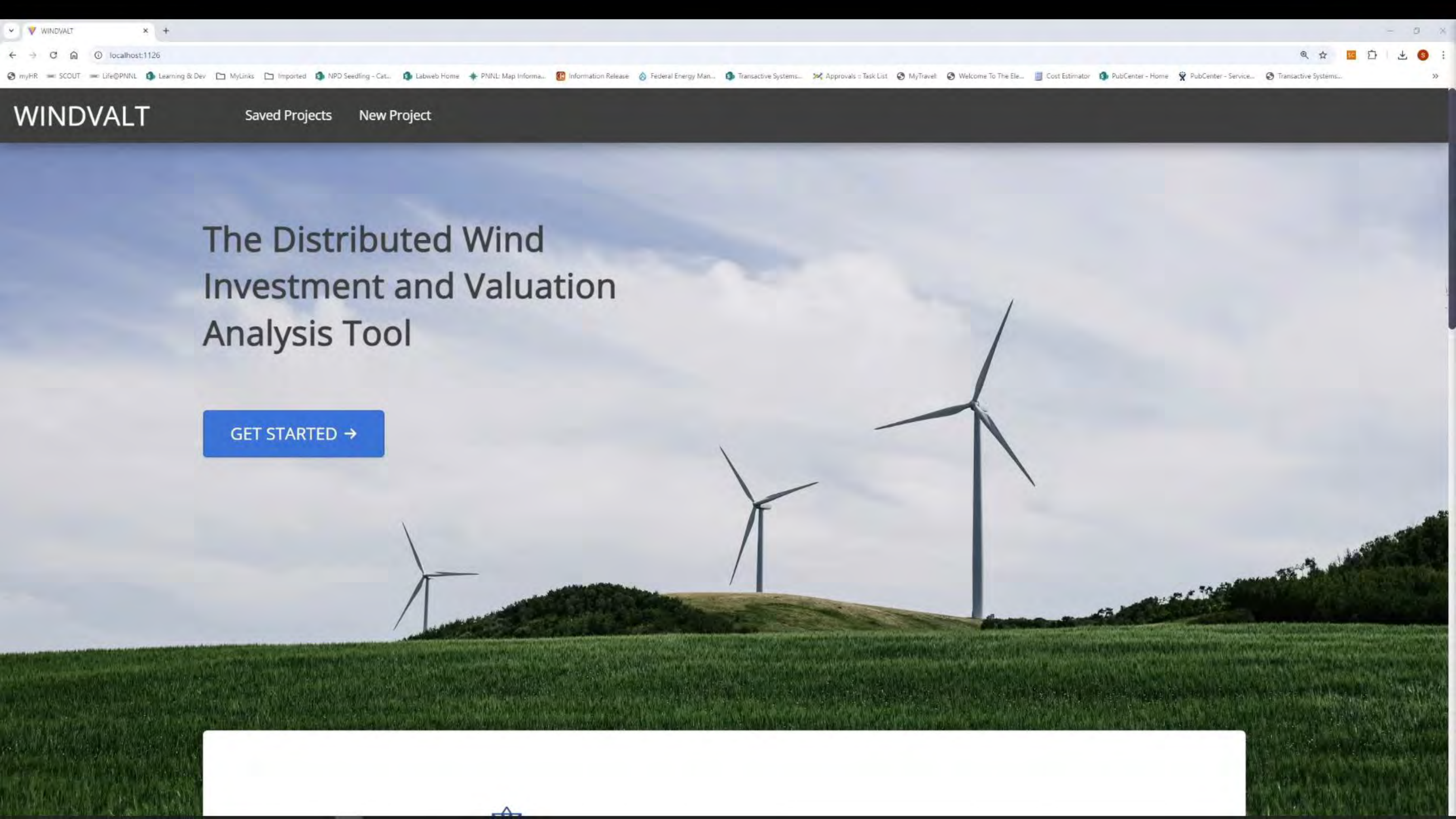
Pacific Northwest National Laboratory



PNNL-SA-203697







# The Distributed Wind Investment and Valuation Analysis Tool

GET STARTED →



## Want to be a **WINDVALT** test user?

Follow the link to sign up!

To contact the research team:

Sarah Barrows

[sarah.barrows@pnnl.gov](mailto:sarah.barrows@pnnl.gov)

