

“Feasibility Study for Wind Energy Development in Appalachian Ohio”

Presented by
Carole Womeldorf, Ph.D.
Ohio University, Athens, OH

Appalachian Regional Commission
Annual Meeting, October 27, 2009

Outline

- Existing Wind Maps for Ohio
- Summary of Proposed Feasibility Study
- Benefits of Feasibility Study for SE Ohio
 - Detailed specific knowledge to support Wind Energy development in SE Ohio.
 - ...and improved weather forecasting, air pollution transport predictions, and improved wind maps of region and beyond.

Existing Wind Maps for Ohio

- A Wind Map is designed to tell you the *wind speed* or *wind energy* across a region.
- But as with everything, a wind maps' *accuracy* and *relevance* are subject to limited resources...

Choices when making a wind map –

They all require resources: Time + \$\$

– Domain Size

- USA? Ohio? or Athens/Meigs/Vinton Counties...

– Resolution of terrain & resource

- Coarse to High Resolution

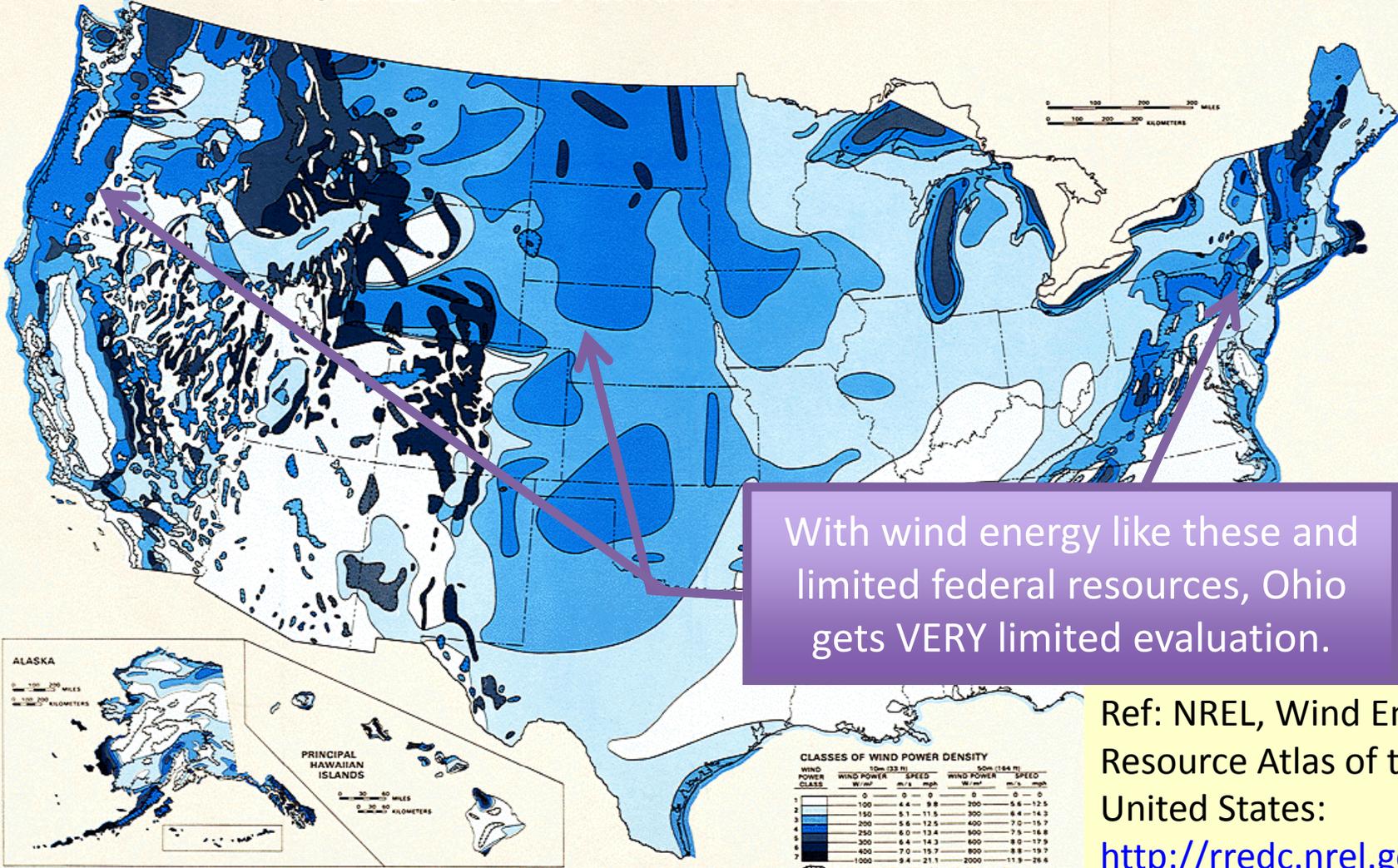
– Target Audience & Technology

- Residential? Farm? Commercial? Industrial? Utility ?

– Wind Classes, hub height, and *data*.

USA Domain Size (1986)

UNITED STATES ANNUAL AVERAGE WIND POWER



With wind energy like these and limited federal resources, Ohio gets VERY limited evaluation.

Ref: NREL, Wind Energy Resource Atlas of the United States:
<http://rredc.nrel.gov/wind/pubs/atlas>

Vector Thematic Data

Layer Name	Description (Hyperlinked To Metadata)	Size	
oh_county	Ohio Counties	1.1 Mb	
oh_zip	Ohio Zip Codes	1.5 Mb	
oh_place	Ohio Places (polygon)	763 Kb	
oh_schdist	Ohio School Districts	632 Kb	
ath_precinct	Voting Precincts	86 Kb	
ath_twp	Township Boundaries	1 Kb	
ath_sec	Section Boundaries	35 Kb	
ath_tract	Census Tract Boundaries	29 Kb	
ath_blkgrp	Census Block Group Boundaries	45 Kb	
ath_blk	Census Block Boundaries	611 Kb	
ath_flood	FEMA Floodzones	624 Kb	
ath_hypso_25ft	Countywide 25 ft Contour Lines	100 Mb	
variable	Countywide 5 ft Contour Lines	5-12 Mb	
ath_soils	Soil Mapping Units	33.7 Mb	
ath_hyd_line	Streams	0.8 Mb	<input type="button" value="View"/>
ath_hyd_poly	Water Bodies	774 Kb	<input type="button" value="View"/>
ath_rds	E911 Roads	667 Kb	<input type="button" value="View"/>
ath_address	E911 House Address	794 Kb	<input type="button" value="View"/>
athens_parcel	Countywide Parcels (last update 7/01/08)	8.5 Mb	<input type="button" value="View"/>
athensluf	Landuse/Landcover	35.7 Mb	<input type="button" value="View"/>

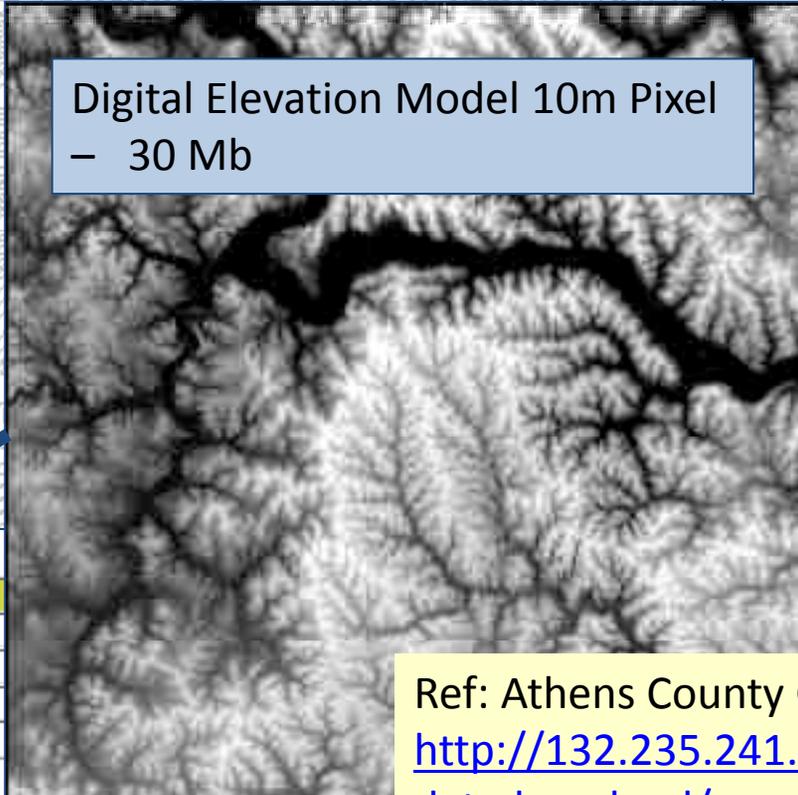
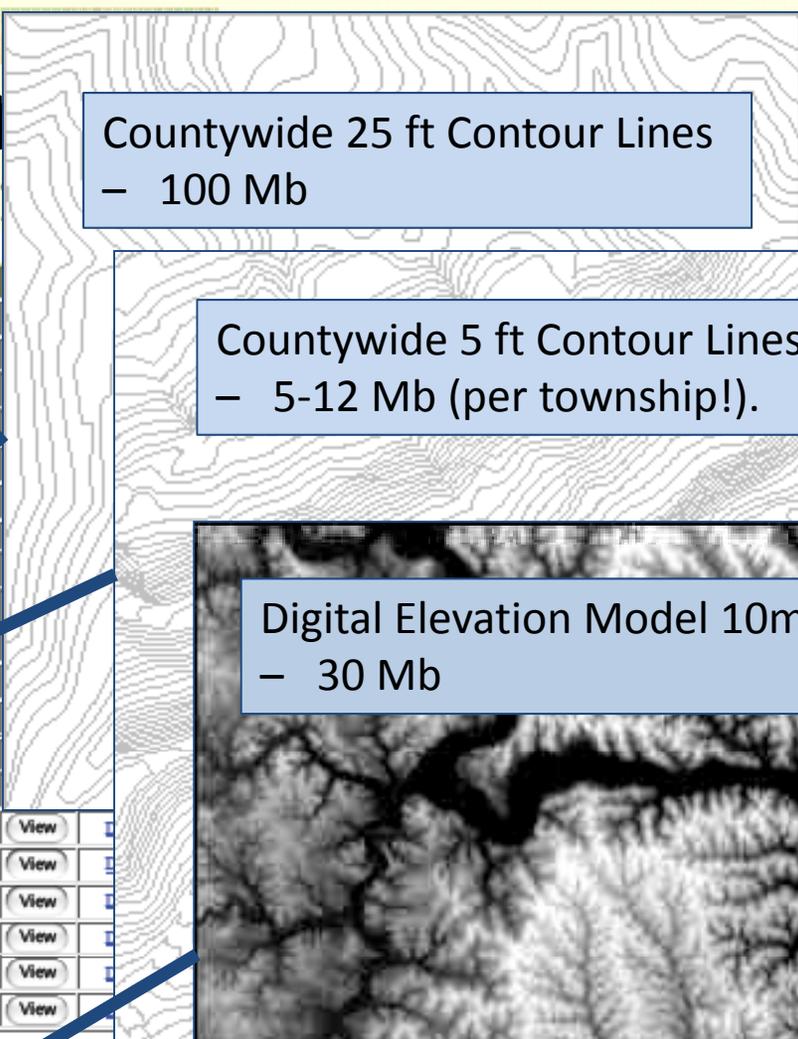
Raster Thematic Data

Layer Name	Description (Hyperlinked To Metadata)	Size	View	Download
ath10m_dem	Digital Elevation Model 10m Pixel	30 Mb	<input type="button" value="View"/>	<input type="button" value="Download"/>
ath_hluc	Landuse/Landcover-National Landcover Dataset 30m	695 Kb	<input type="button" value="View"/>	<input type="button" value="Download"/>
variable	Georeferenced 7.5 Minute USGS Quadrangle Maps	~7-10Mb	<input type="button" value="View"/>	<input type="button" value="Download"/>
variable	Digital Ortho Photographs - 1ft pixel - 2002	~4-8 MB	<input type="button" value="View"/>	<input type="button" value="Download"/>

Countywide 25 ft Contour Lines
- 100 Mb

Countywide 5 ft Contour Lines
- 5-12 Mb (per township!).

Digital Elevation Model 10m Pixel
- 30 Mb



Ref: Athens County GIS
<http://132.235.241.242/datadownload/>

Ohio's Wind Map in 1986

CLASS 1 –

VERY LOW WINDS



Figure 1: Ohio's average annual wind power potential at 50 m, as predicted in 1986, declaring Classes 1 and 2, less than 6.4 m/s, across the whole state, except just south of Lake Erie.²

LOW WINDS – BUT *HIGH* UNCERTAINTY

SE Ohio Factors
Supporting High
Uncertainty

- Sparse data
- ✓ Complex terrain
- Meteorological Uncertainty

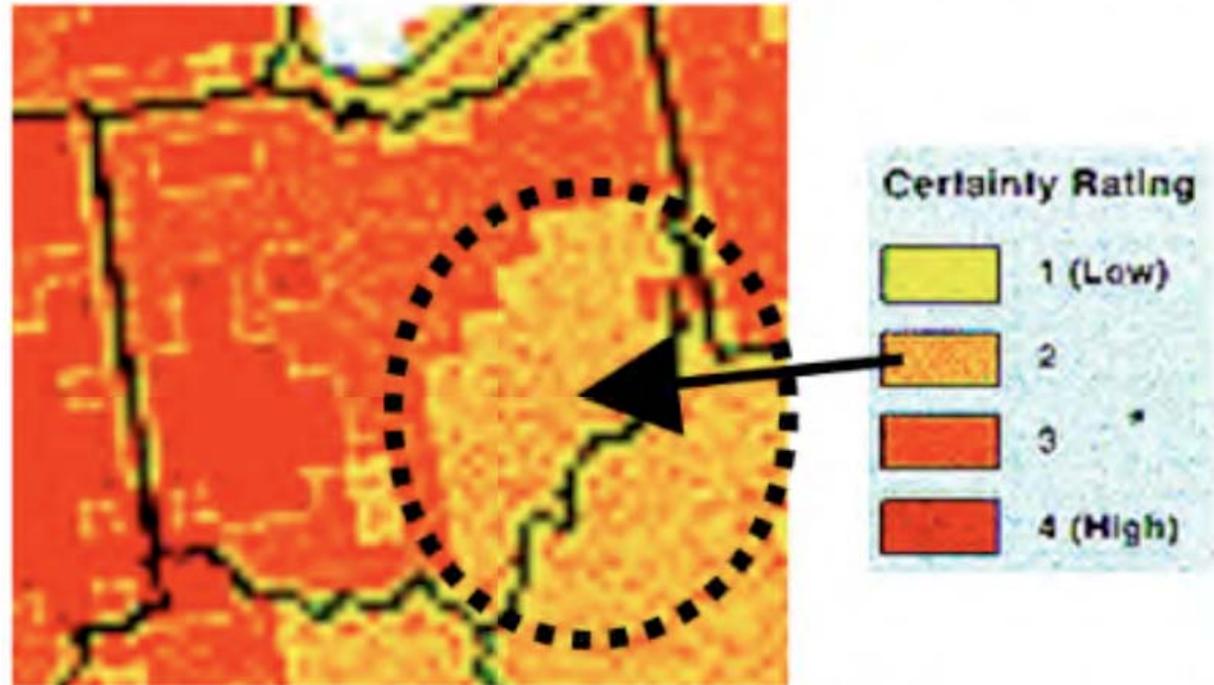


Figure 2: A Certainty Rating of 2 (more uncertain than 50% of the mapped data) for the wind power assessment in Appalachian Ohio, in Figure 1, from the 1986 Wind Atlas.²

Ohio's Wind Map in 2004

Good news! – with new data & model, more winds found.

But with no new data – predictions of very low winds in SE persist. High uncertainty also persists.

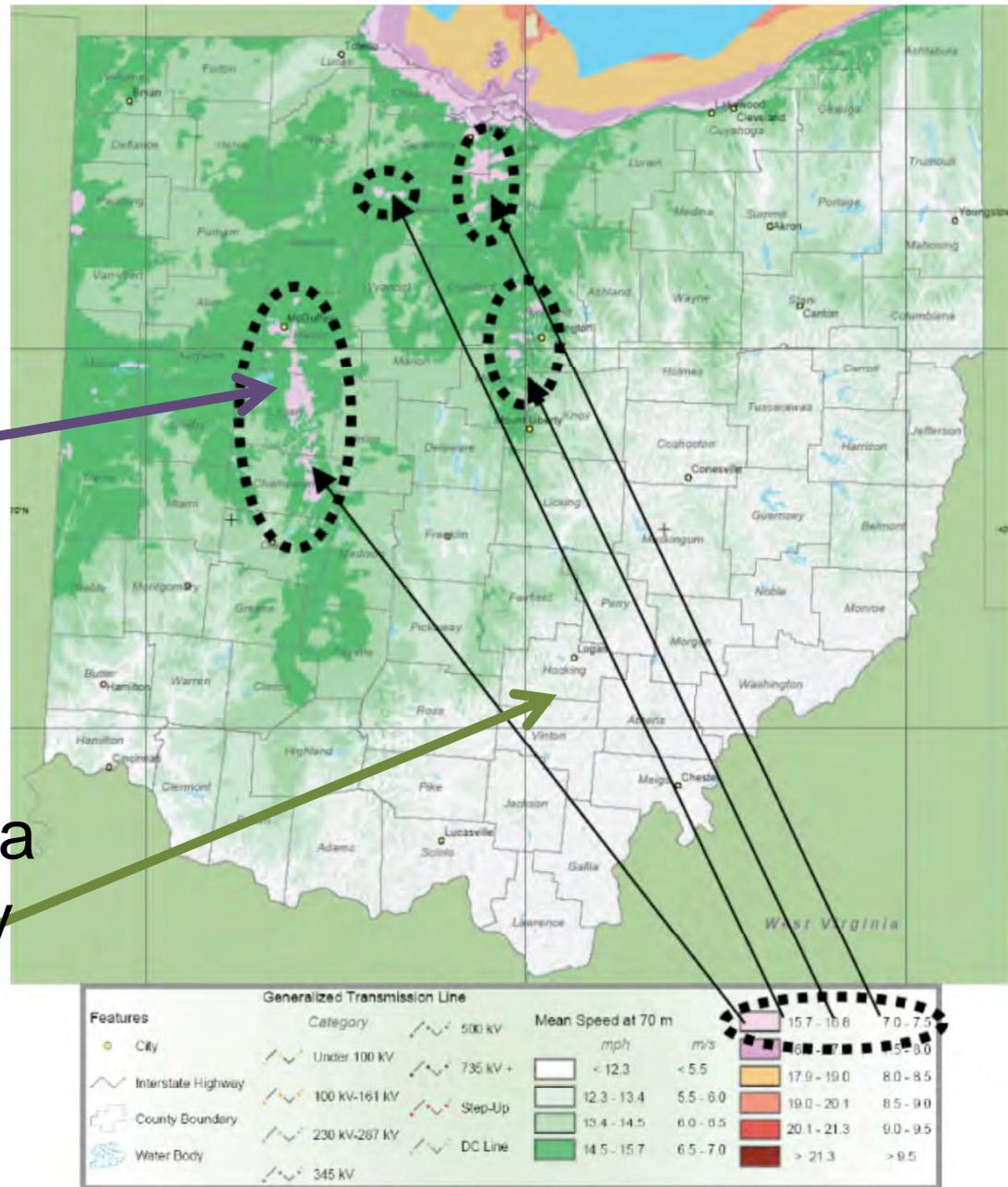


Figure 3: 2004 Wind Resource of Ohio: Mean Annual Wind Speed at 70 m.³

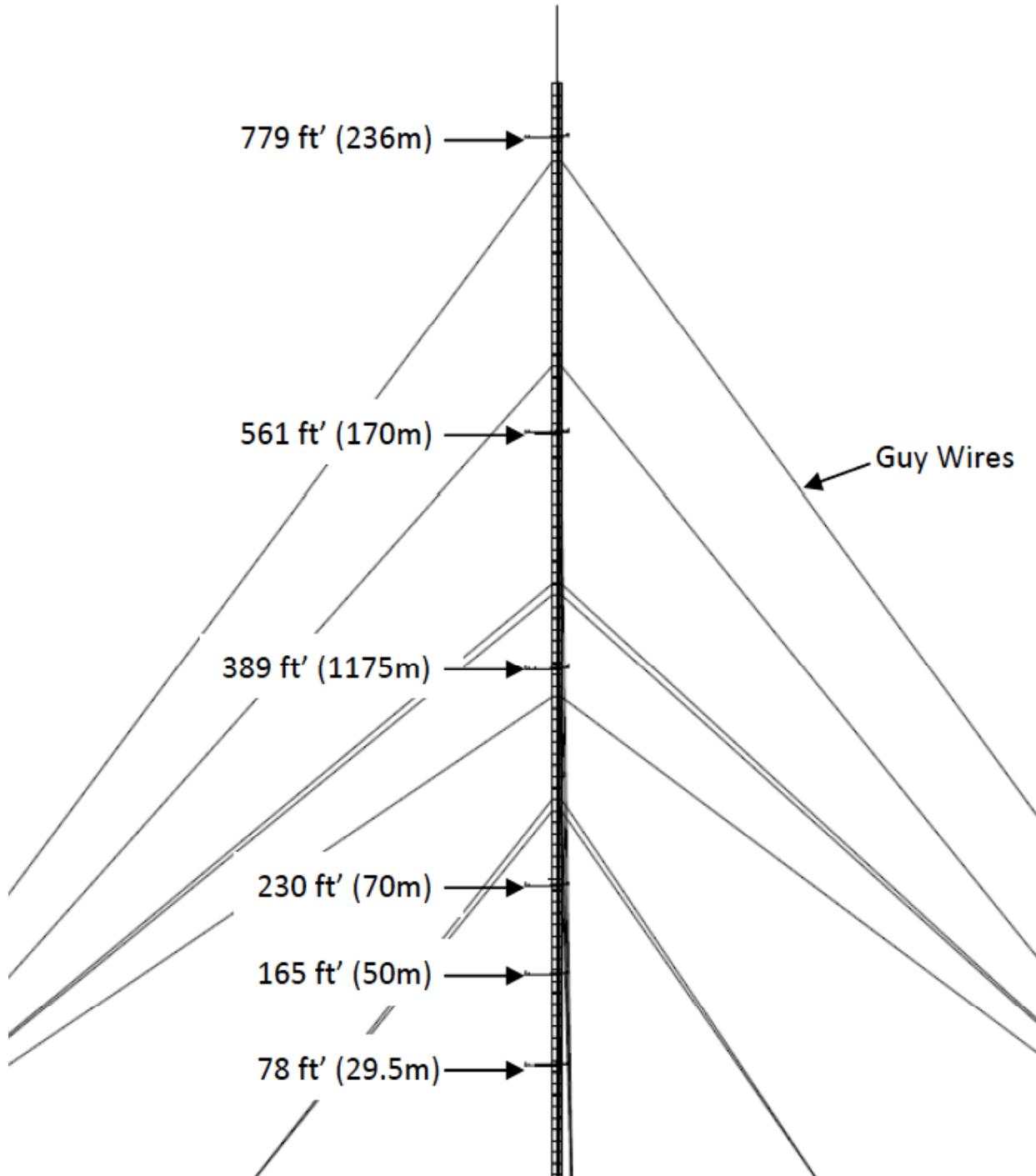
So what will we find
for Appalachian Ohio
in 2011?

Summary of ARC Feasibility Study

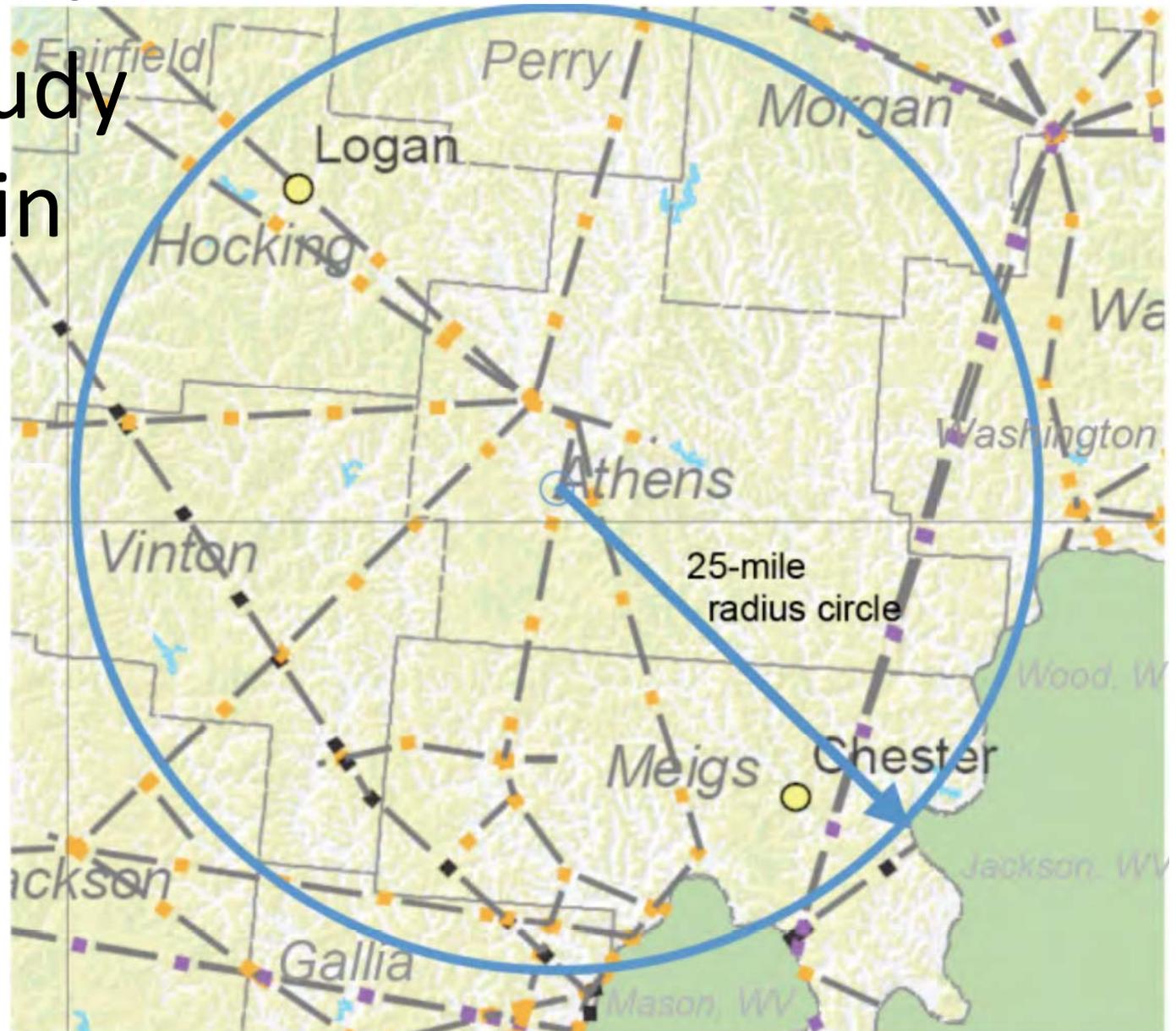
- Wind measurements taken on WOUB communications tower (*over 800 ft*)
- 2 years: 12 anemometers, directional vanes...
- Inputs to wind simulator software, (*designed for complex terrain: hills, ridges, etc.*) and
- Creation of new Wind Maps by and for SE Ohio.

WOUB TV- TOWER

Sensor
mounting
heights



Appalachian Ohio Study Domain



Benefits for Appalachian Ohio

- ***Quantify potential for Utility Scale and/or Community Scale Wind Energy Development***
- ***Customized wind maps of region***
- Improved Weather Forecasting
- Improved Air Pollution Transport
- Development of wind knowledge in students and community.

With gratitude to

- The Appalachian Regional Commission
- WOUB Center for Public Media
- Green Energy Ohio
- OHIO's Institute for Sustainable Energy and the Environment
- OHIO's Department of Mechanical Engineering
- OHIO's Consortium for Energy, Economics, and the Environment (CE3)
- National Renewable Energy Laboratory
- GE Energy