WSR-88D KILX Wind Farm Update

March 6, 2010
Wind Farms

• Wind farms are being promoted at all levels of government as a partial alternative to fossil fuel-based energy production.

• It is likely that many more wind farms will appear on the landscape of Illinois
  – Flat Terrain
  – Relatively High and Steady Wind Speeds
  – Nearby Customer Base

• The wind farm industry is extremely competitive and they can be somewhat hesitant to share information on proposed sites.
Wind Farm Potential – United States

This map shows the annual average wind power estimates at a height of 50 meters. It is a combination of high resolution and low resolution datasets produced by NREL and other organizations. The data was screened to eliminate areas unlikely to be developed onshore due to land use or environmental issues. In many states, the wind resource on this map is visually enhanced to better show the distribution on ridge crests and other features.

Wind Power Classification

- **Wind Power Potential**
  - Fair: 300 - 400 W/m²
  - Good: 400 - 600 W/m²
  - Excellent: 500 - 800 W/m²
  - Outstanding: 600 - 900 W/m²
  - Super: 800 - 1200 W/m²

- **Wind Power Density at 50 m**
  - 6.0 - 7.0 m/s
  - 7.0 - 7.5 m/s
  - 7.5 - 8.0 m/s
  - 8.0 - 8.5 m/s
  - 8.5 - 9.0 m/s

- **Wind Speed at 50 m**
  - 14.3 - 15.7 m/s
  - 15.7 - 16.8 m/s
  - 16.8 - 17.9 m/s
  - 17.9 - 19.7 m/s
  - 19.7 - 24.8 m/s

- Wind speeds are based on a Weibull k value of 2.0

U.S. Department of Energy
National Renewable Energy Laboratory
Wind Farm Potential - Illinois
Illinois Wind Farms

Current & Under Construction
July 2009

Wind Farm Status
- Existing Wind Farm
- Existing Single Turbine
- Under Construction

Source: IREA
Data Current: July 2009
www.Illinoiswind.org
KILX Proximity Farms

- Twin Grove I+II
- Railsplitter
- Spring Creek (Proposed)
Potential Impacts (Generic)

Based on their investigation and experience, the WSR-88D Radar Operations Center has identified the following impacts wind farms can have on WSR-88D data and forecast/warning operations:

- False or anomalously large radar-estimated precipitation amounts due to reflection from towers/turbines;
- False low radar-estimated precipitation amounts due to radar beam blockage;
- False echoes downrange from wind farms;
- Anomalously large reflectivity values due to reflection from towers/turbines;
- False storm identification due to reflection from towers/turbines;
- Incorrect velocity values due to turbine interference;
- Incorrect wind velocity profiles; and
- Potential blockage of low-level tornado/severe weather signatures due to blockage from towers/turbines.
Why do Wind Farms have a Significant Impact on Radar?

Example of Wind Farm Impact on Shallow Ground Fog.
Railsplitter Wind Farm

• When Fully Operating:
  – 67 Turbines
  – Distance Range 8.7 nm – 14.4 nm
  – 18 Degrees of Azimuth Directly Impacted
  – Built at a cost of $200 M.
  – Provide power to 30,000 customers
Potential Impacts (Specific)

• No two wind farms have the same effect. The effect depends on distance, topography, height, orientation, size, and atmospheric conditions

• What we do know:
  – The towers and blades are in the direct path of the 0.5 degree and 0.9 degree scan.
  – During certain conditions, the farm will likely be in the beam path as high as 1.5 degrees as well.
Sugar Creek Wind Farm (Proposed)

• When Fully Operational:
  – 114 Turbines
  – Distance Range 6.7 nm – 13.8 nm
  – 25 Degrees of Azimuth Directly Impacted
  – Built at a cost of ????.
  – Provide power to 70,000 customers

• Additional Impacts:
  – Likely to have Anomalous Spikes as far as 18 nm Downstream at 0.5 and 0.9 Degrees
Sugar Creek Wind Farm (Proposed)

- Developmental and Operational Partners have been willing to consider mitigation options.
- Learning from one another.
- Discussed turning “off” the farm during hazardous weather.
- Next meeting we are scheduled to demonstrate how we utilize the information.
Potential Impacts

– Wind turbine contamination will cause the radar’s precipitation estimation algorithms to generate false and anomalously large rainfall/snowfall/icing accumulation estimates over the facility.

– Wind turbine contamination of the Doppler velocity data in the area of the wind farm will degrade the performance of the Velocity Dealiasing Algorithm and may cause the Tornado Detection Algorithm and/or Mesocyclone Detection Algorithm to miss detections or generate false alarms in the vicinity of the facility.

– Composite Reflectivity products will have anomalously large values near the wind energy facility; the Storm Tracking algorithm may falsely identify storms or provide incorrect storm track forecasts in the vicinity of the facility.

– A “shadowing” effect will occur down radial of the farm for an unknown distance.
Holder Tornado Approaching Twin Grove Wind Farms

Photos by Mark Sefried
We Need to Keep in Mind

– When a thunderstorm or winter storm moves over the wind turbine clutter, the storm characteristics could be masked or potentially misinterpreted, particularly in the vicinity of the facility and potentially downrange of the facility.
– Situations of turbine clutter contaminating the Doppler velocity data in the area of the turbine clutter area and possibly downrange, creating false signatures, could disrupt situational awareness particularly during hazardous/severe weather events.
– If weather develops (particularly thunderstorms) over the wind turbine clutter area, they may be difficult to initially detect.
– False precipitation estimates could negatively impact ability to warn for flooding.

• It is unknown how far downrange from the wind energy facility the wind turbine clutter, partial blockage, and shadow effects will impact the radar data and may change from event to event.
What We Are Doing

• NWS will keep in mind the location of the wind turbines (e.g. Radar Overlays and Impact Examples) and adjust our awareness accordingly (See “We Need to Keep in Mind”).
• Document Impacts so our Radar Operations Center can effectively report on future sites.
• Participate in development of training.
• Participate in research (Oklahoma Univ.).
What We Can NOT do

• NOAA has no regulatory power. Only FAA and DOD must be consulted.
• There are criminal penalties for “grassroots” lobbying by government employees.
Looking Ahead...

- Discussions will continue with wind energy companies to share concerns and understandings.
- Still hope that Dual-Polarization upgrade to radar may provide some help.
- Oklahoma University is working under a DOE grant to look at algorithm development for radar mitigation
- In the Meantime...more turbines!
Other Impacts?

UFO HITS WIND TURBINE
4am prang at 300ft

MISSING BLADE RIDDLE