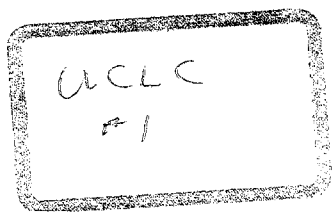
ILLINOIS
GROUP

Siting, Zoning & Taxing of Wind Farms in Illinois Conference 2012

New Technology Impact on Health & Safety Issues

Kevin Parzyck
Invenergy

February 8, 2012 – 3:15 PM



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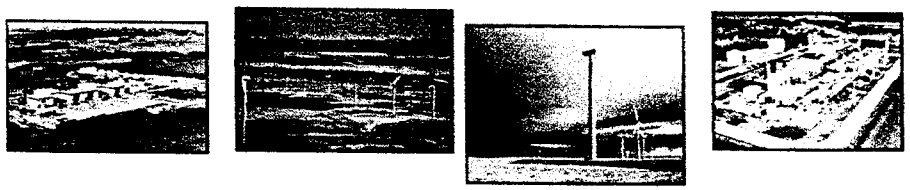
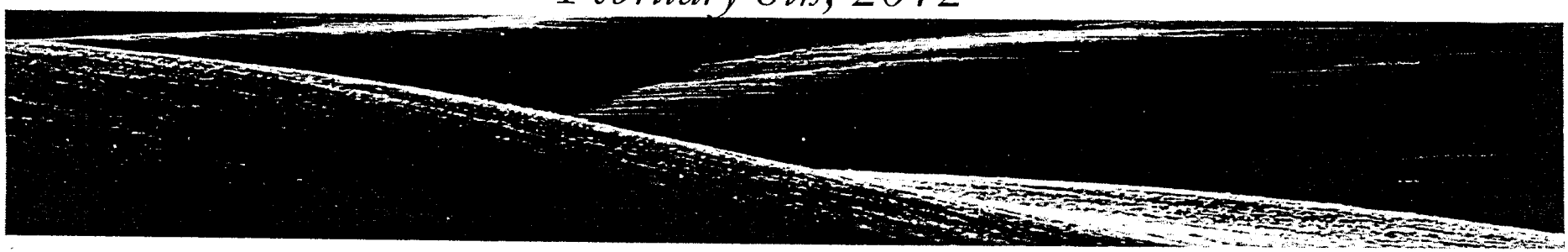
IWWG Siting, Zoning & Taxation Conference



Kevin Parzyck – Vice President of Development

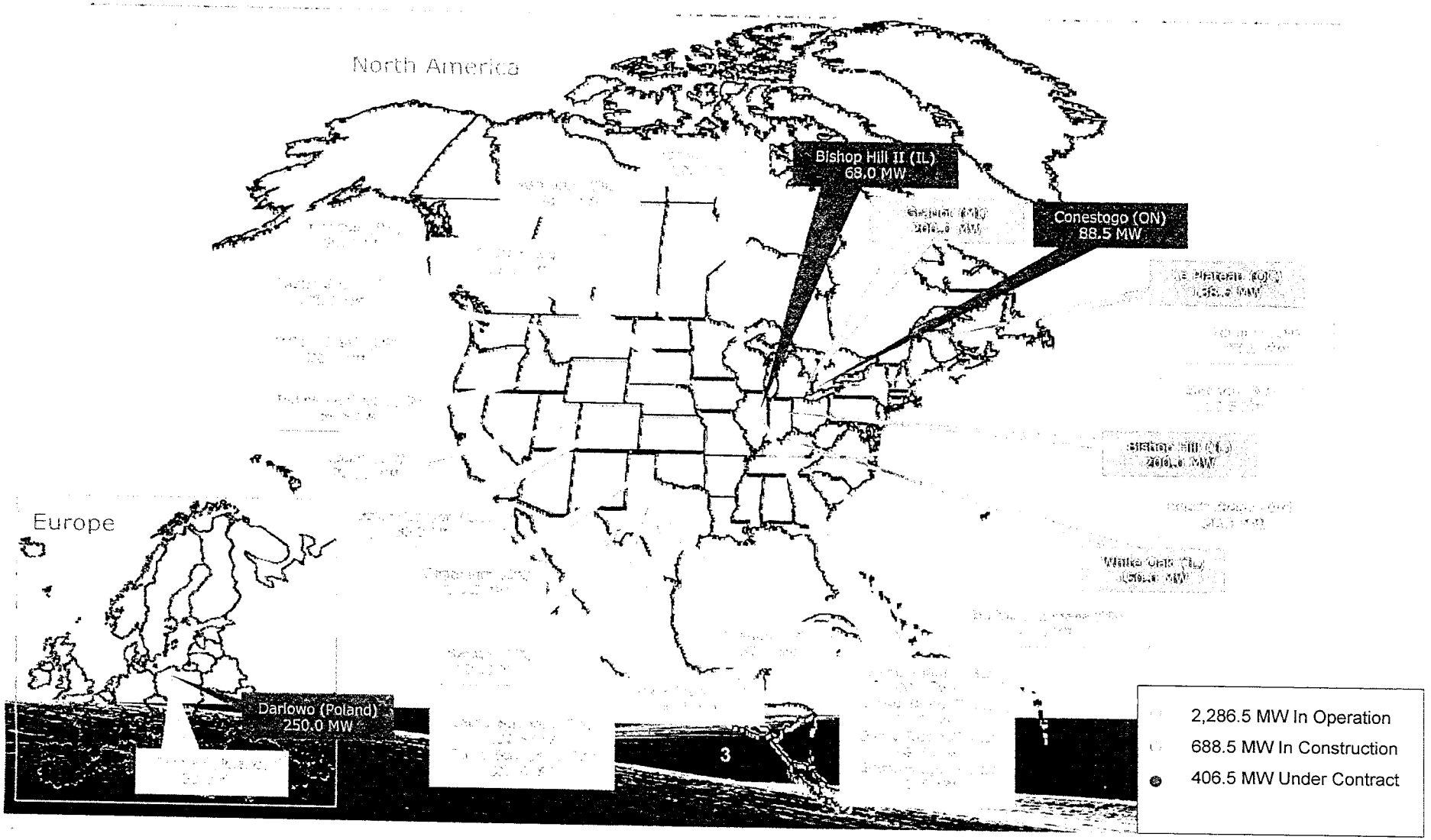
February 8th, 2012



Who is Invenergy?

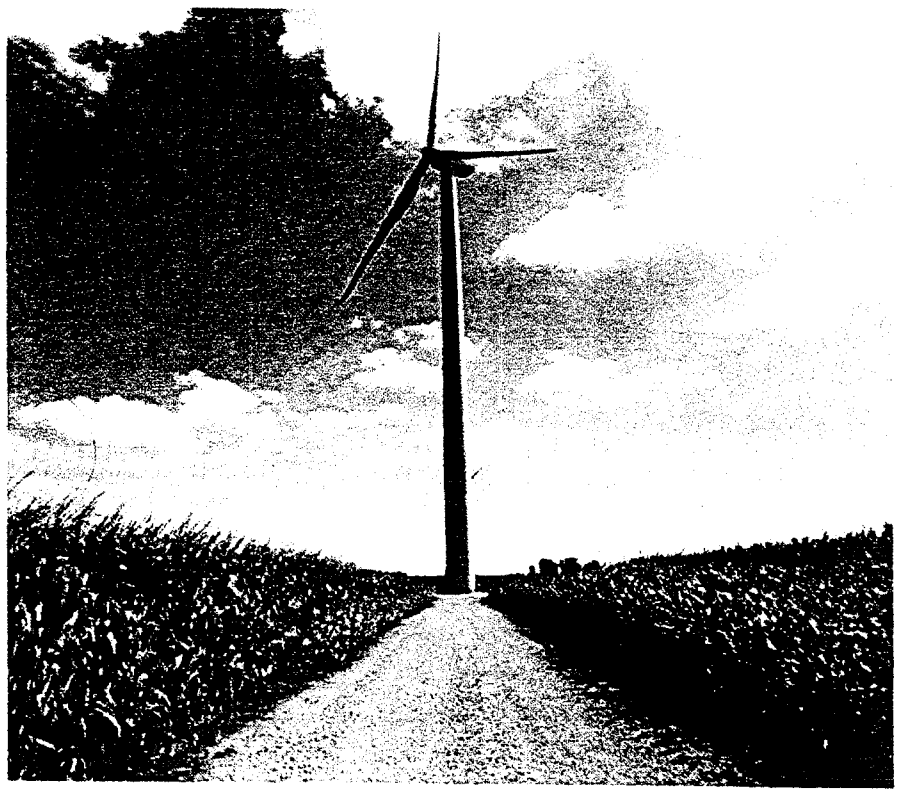
- Developer, Owner and Operator of large scale Wind & Natural Gas energy generation projects headquartered in Chicago with development offices in Denver, CO and Rockville, MD
- One of the 'top 10' wind energy developers in North America based on constructed projects over the last several years.
- Largest "independent" wind energy developer in the United States – "independent" meaning unassociated with a large corporate parent.
- Completed over 2,200 MW of wind projects with more than 1,000 MW in construction or under contract.

Invenergy Wind Projects



Invenergy – Illinois Wind Projects

- Grand Ridge – LaSalle County
- White Oak – McLean County
- Bishop Hill – Henry County
- California Ridge – Vermillion & Champaign Counties



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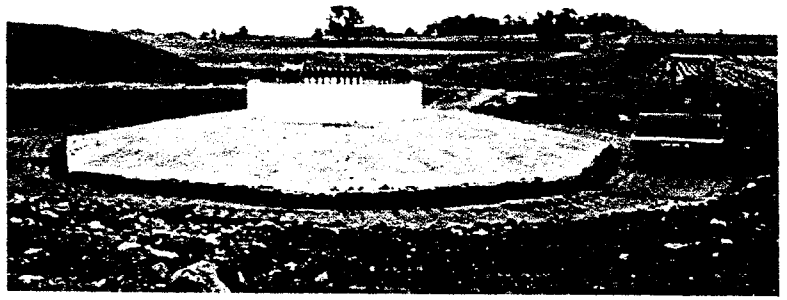
Wind Projects – Zoning Process

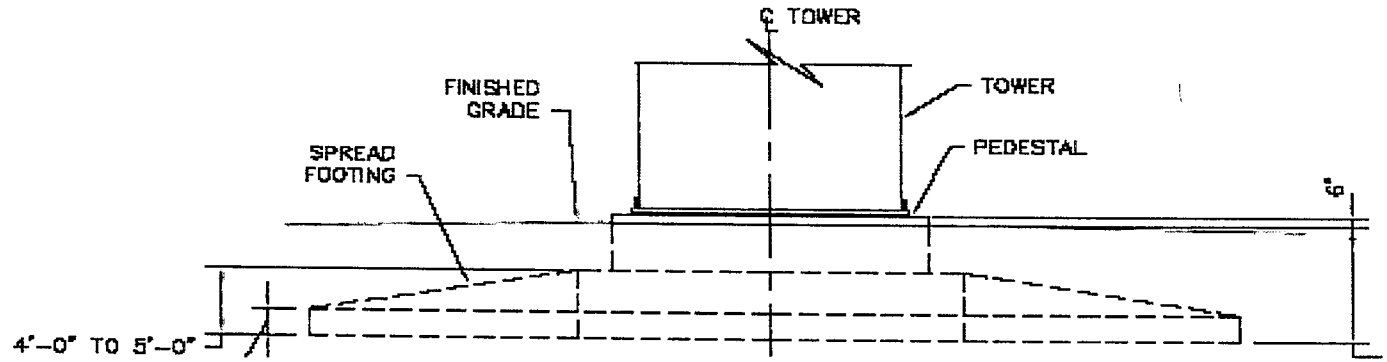
- Zoning Approvals for Layout & Infrastructure:
  - Turbines – size/type , number & layout
  - Access Roads – driveway locations
  - Underground Collection System – power & data
  - Collection Substation
  - Tie Line to transmission grid
  - Transmission Grid Substation
  - O&M Building
- Design Infrastructure for Long-Term Efficiency

Turbine Foundations

Spread Footer Foundations

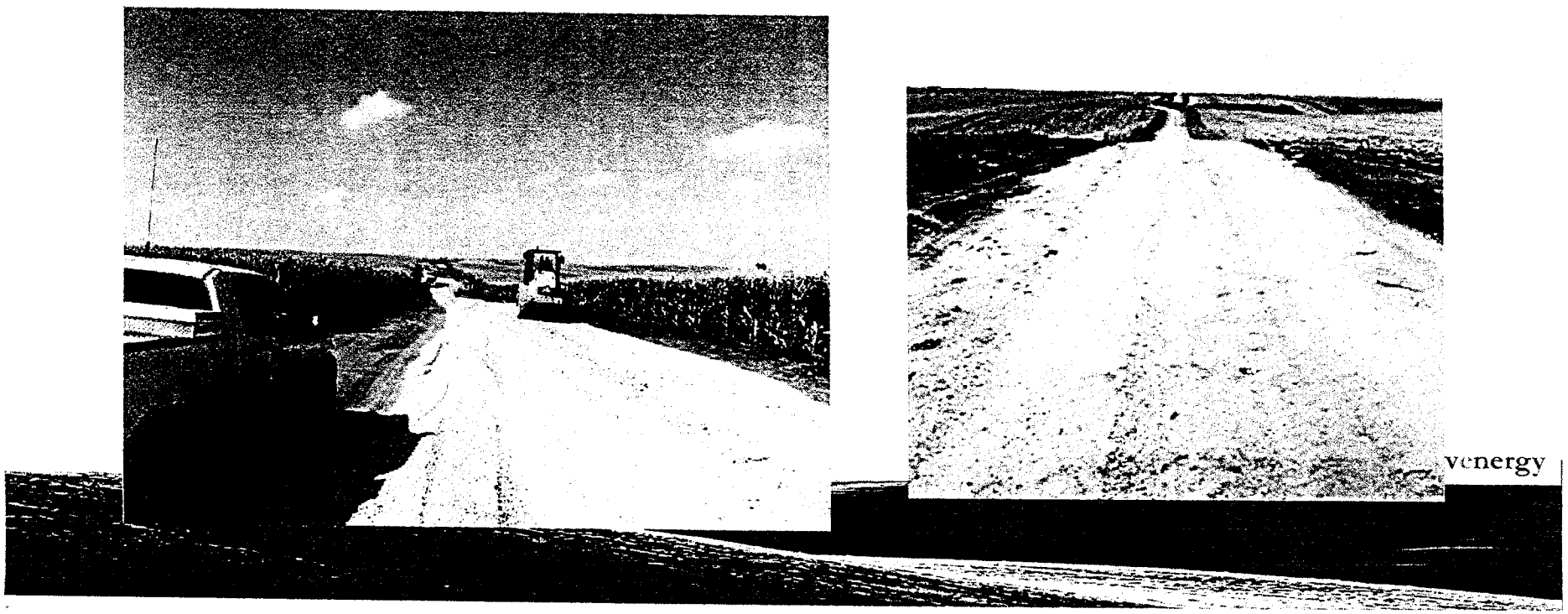
- Diameter: 50 feet (typical)
- Max Depth: 10 feet (typical)
- Depth of soil cover: over 3 feet
- Minimizes any impact to field disruptions





Access Roads

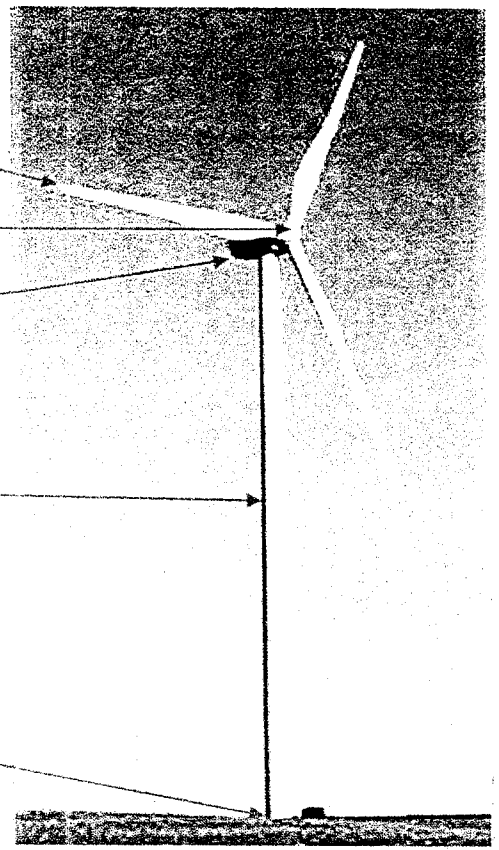
- Permanent Road
  - Stabilized Soil with Gravel Surface
  - 16' wide



Underground Collection System

Wind Turbine

- Blades (Rotor)
- Hub (Rotor)
- Nacelle
- Tower
- Foundation



Long-Term Operation

- Developers need to amortize large up-front costs over life of project
  - Long-term easements
  - Long-term Power Purchase Agreement (PPA)
- Efficient installed infrastructure is key to long-term profitability
- Most of the project's infrastructure is never upgraded (foundations, collection lines, etc.)
- Primary upgrades are associate with turbine rotor & nacelle components

Long-Term Operation

- Two Primary Objectives for Operating Facilities
  - Maximize Production – generate more power
  - Maximize Reliability – keep facility up & running
- Revenue directly related to Megawatts-Hours of power sold to utilities
- Financial Model is based upon historical data regarding the power output and reliability of the wind turbines
- Technological advances can improve upon historical predictions

Maximize Production

- Physical Rotor Improvements – may require SUP revisions
  - Blade replacement – modify rotor-swept area
  - Blade Tip Extensions – modify rotor-swept area
  - Improved Rotor Aerodynamics – blade tip winglets, full blade replacement
- Physical Upgrades inside Nacelle – likely not require SUP revision
  - Gear Box upgrades/replacement
  - Generator upgrades/replacement
- Advanced Load Controls – IT systems

Improve Reliability

- Minor Component Replacement
  - Pitch Motors
  - Yaw Motors
  - Bearings
- Controls Upgrades – IT Systems
  - Maximize turbine configuration for wind conditions
  - Monitor component conditions
- Regular Maintenance Programs
  - Lubrication & testing
  - Component replacement plan

Zoning Implications

- Tower Heights
  - Taller towers correlates to "better wind" & greater turbine power production
  - Increasing tower heights may affect compliance with some setback requirements
- Larger Rotors / Longer Blades
  - Larger rotors correlates to greater turbine power production as it "catches more wind"
  - Larger rotors raises the "tip height" and may affect compliance with some setback requirements
- Improved power production improves financials

Conclusion

- Install an efficient project infrastructure up front for optimal long-term performance
- Utilize technology upgrades to improve power generation of units
- Utilize technology & maintenance programs to improve reliability of the system
- An efficient & well-maintained facility will be a contributing long-term member of the community

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