INTRODUCTION TO WIND ENERGY
Outline

• How is wind created?
• Where is the wind?
• How do we measure the wind?
• How does a wind turbine work?
• What are the sizes of turbines?
• What size turbine goes where?
• How do you site a turbine?
• How much energy can we get?
• What are the pros and cons?
How is wind created?

- Temperatures vary according to the amount of sun it gets.
- Uneven heating of the Earth's atmosphere and surface.
- Balance between warm and cool air is constantly changing, creating wind.
Where is the Wind?
Where is the Wind?
How do we measure wind?

- Meteorological tower
- Anemometer
- Wind vane or sock
- Data logger
- Data chip
How is electricity generated?

- **Needed:**
  - Conductor – loop of wire
  - Magnetic field – electromagnets
- **Conductor moves within the magnetic field**
  - Conductor rotates through a magnetic field
  - Magnets move back and forth through a looped wire
How does a wind turbine work?

- **Kinetic energy** of wind transformed into rotational energy to turn the motor’s axel.
- Components:
  - Tower
  - Nacelle
  - Rotor - hub and blades

Drawing of the rotor and blades of a wind turbine, courtesy of ESN
What are the sizes of turbines?
What size turbine goes where?
What size turbine goes where?

<table>
<thead>
<tr>
<th>Wind Class</th>
<th>Potential for Wind Development</th>
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| Class 1 or 2 | • Marginal for onsite  
               | • Unsuitable to marginal for community-scale            
               | • Unsuitable for utility-scale                         |
| Class 3      | • Appropriate for onsite  
               | • Marginal to appropriate for community-scale          
               | • Generally unsuitable for utility-scale               |
| Class 4      | • Appropriate for onsite or community-scale            
               | • Marginal for utility-scale                           |
| Class 5+     | • Appropriate for all scales                           |
How do you site a turbine?

• Wind resource
• Current land use
• Environmental impacts
• Government regulations
• Cost of wind farm
• Economic payback
• Community opinion – aesthetics
• Noise and flicker issues
• Transmission lines
• Spacing of turbines
• Much, much more!

Mountaineer Wind Energy Center, WV
www.communityenergy.com
How much energy can we get?

Data measured and compiled by USDA-ARS Research Lab, Bushland, TX
What are the pros and cons?

- Oil independence
- Locally produced (jobs)
- No air pollution (or CO2)
- Uses no water
- Renewable
- Lower cost

**BUT...**
- Bird and bat issues
- Aesthetic issues
- Intermittency

Wind is not the ONLY solution