Goshen North Site Visit

Idaho Falls, Idaho
May 18-20, 2009

RIDGELINE ENERGY VEOLIA

- Ridgeline started in 2000
- Developed 65 MW Wolverine Creek Wind Farm E of Idaho Falls. Power Purchase Agreement with **Pacificorp/Rocky Mountain Power**
- Built 125 GNII Summer 2010. 50% joint venture with BP Wind. Power Purchase Agreement with **Southern California Edison.**
- Rockland Wind Farm: 80 MW PURPA project south of American Falls. Power Purchase Agreement with **Idaho Power** presently under consideration at Idaho Public Utilities
- 200 MW project South of Laramie – likely next project to see construction
- Now Ridgeline is wholly owned by Veolia Environmental
- Headquartered in Seattle with Offices in Boise, Portland, Idaho Falls, Spokane and Albany, NY.

Pingree Middle School Field trip to Wolverine Creek Wind Farm

When and where does the wind blow?

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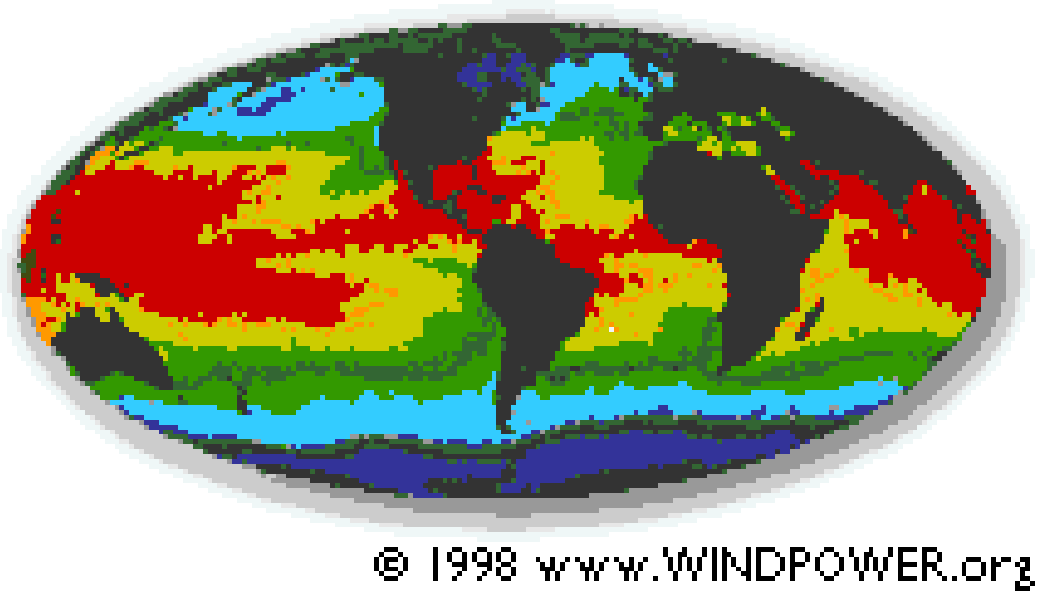
- All renewable energy(except tidal and geothermal power), and even the energy in fossil fuels, ultimately comes from the sun.
- The sun emits 386 billion billion megawatts of energy.
- 174 billion megawatts of that energy reaches the earth's surface
- About 1 to 2 per cent of that energy is converted into wind.
- That is about 50 to 100 times more than the energy converted into biomass by all plants on earth.



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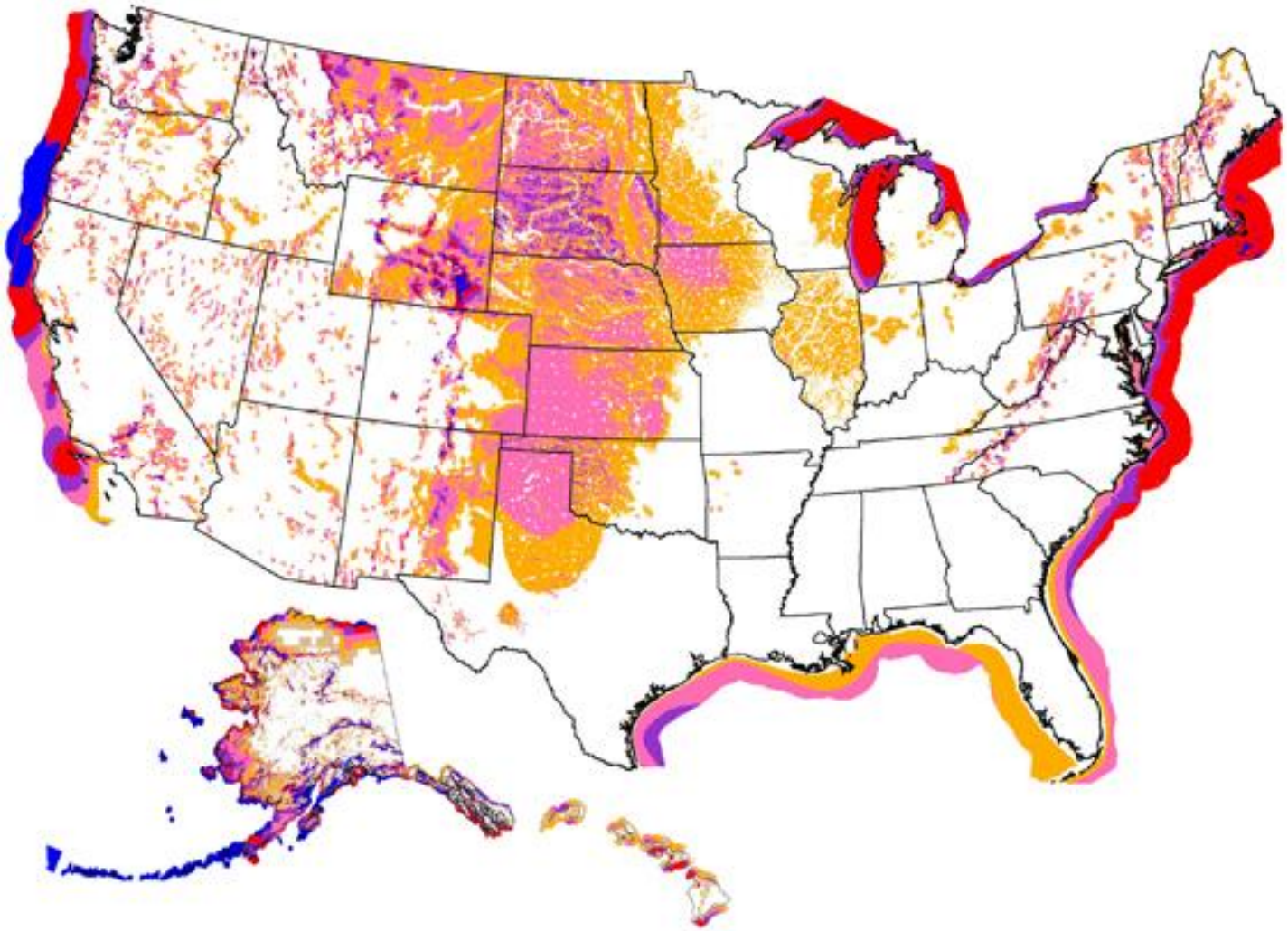

SOURCE: US DOE Wind Powering America

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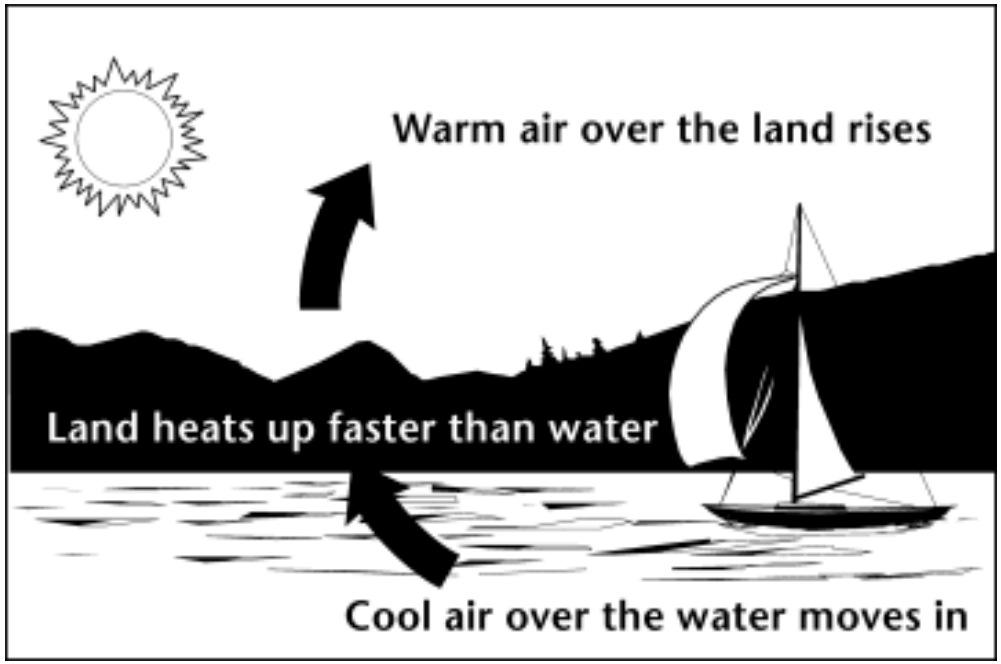
- During the day, the air above the land heats up more quickly than the air over water. The warm air over the land expands and rises, and the heavier, cooler air rushes in to take its place, creating winds. At night, the winds are reversed because the air cools more rapidly over land than over water.
- In the same way, the large atmospheric winds that circle the earth are created because the land near the earth's equator is heated more by the sun than the land near the North and South Poles



Source:
US DOE

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How do turbines generate power?

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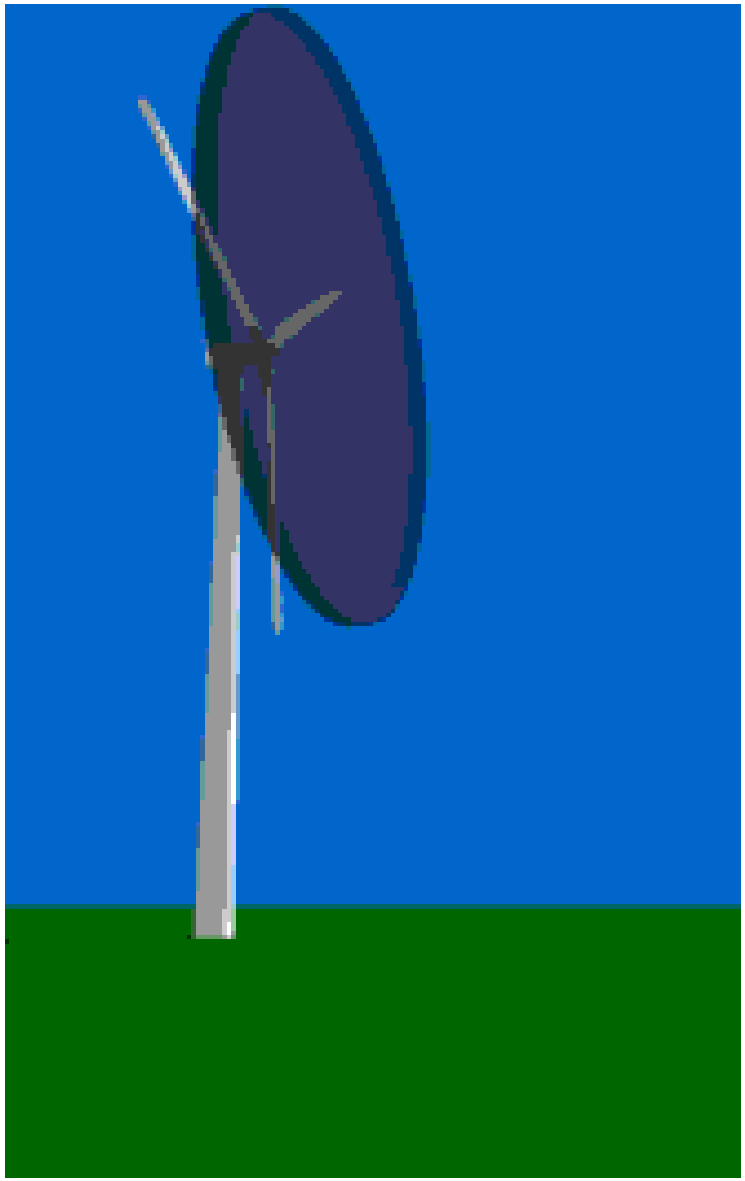

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Wind energy is a factor of three things

- **Air Density**
  - Dense air packs more power
    - Lower Temperatures
    - Lower Humidity
- **Rotor Area**
  - Bigger Area, More Power
    - Double the Rotor Diameter
    - get 4X the power
- **Wind Speed**
  - Exponential increases in energy
  - Doubling the wind cubes power
    - $2^3 = 2x2x2 = 8$
    - Double the wind speed get 8X the power
- **Double Rotor Area & Wind Speed**
  - Increase energy output by 32 times!!! (4x8=32)

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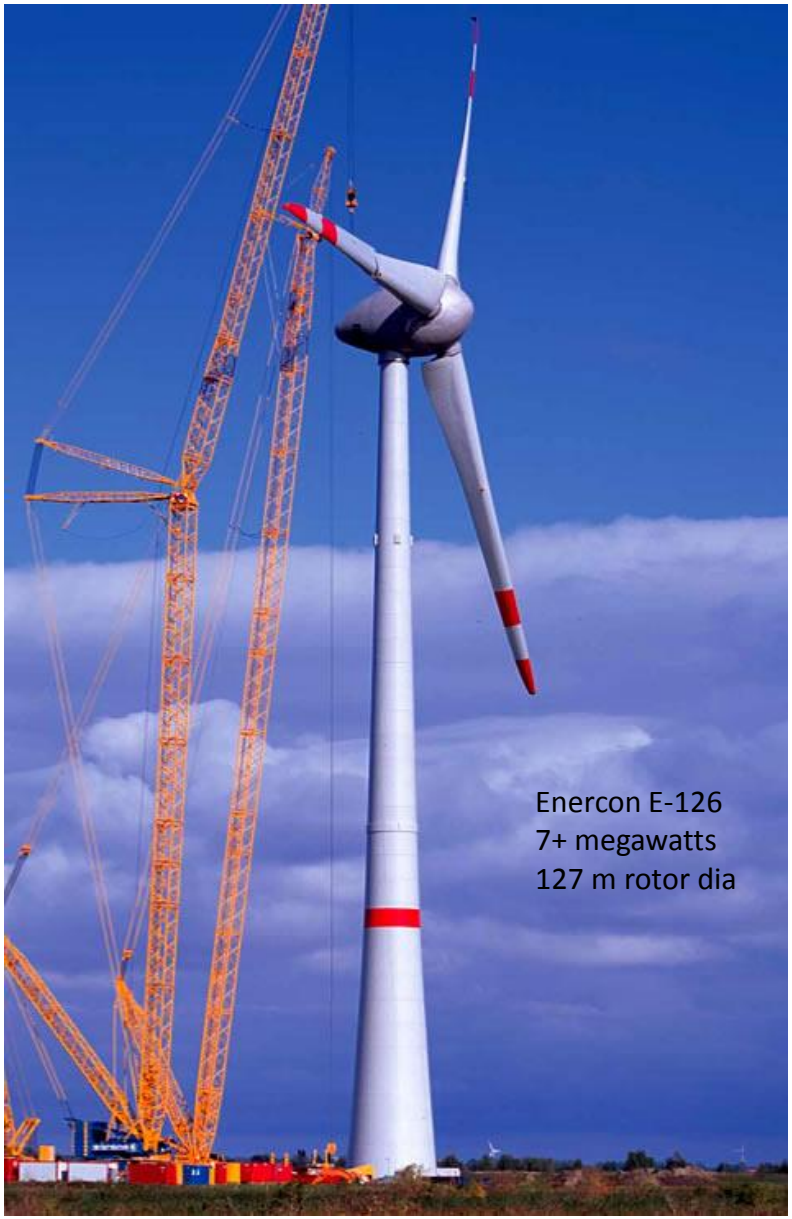

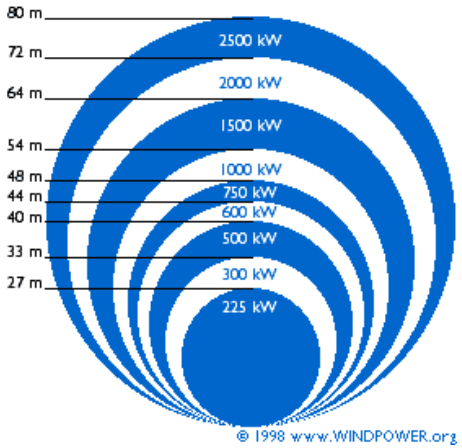

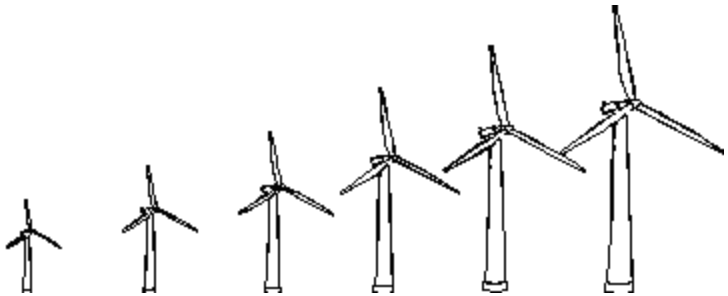

Year	1981	1990	1995	2000	2004	2008
Rotor	10m	27m	36m	47m	72m	127m
kW	25	225	450	660	2,000	7,000+
mWhr	45	550	1,280	2,377	5,800	20,000

61 meter blades: 200 feet; 11 ton rotor section; 6 ton tip

- Clipper Liberty 2.5 mW:
  - 104 Ton Nacelle
  - Housing 22 ft x 17 ft
- Vestas V-90 1.8 mW
  - 148 ft blades
  - 75 ton nacelle
  - 40 ton blade assembly
- GE 1.5 mW (70m rotor d)
  - 116 foot blade
  - 56 ton nacelle
  - 36 ton blade assembly
- Gamesa G87
  - 143 foot blades
  - 72 ton nacelle
  - 42 ton blade assembly

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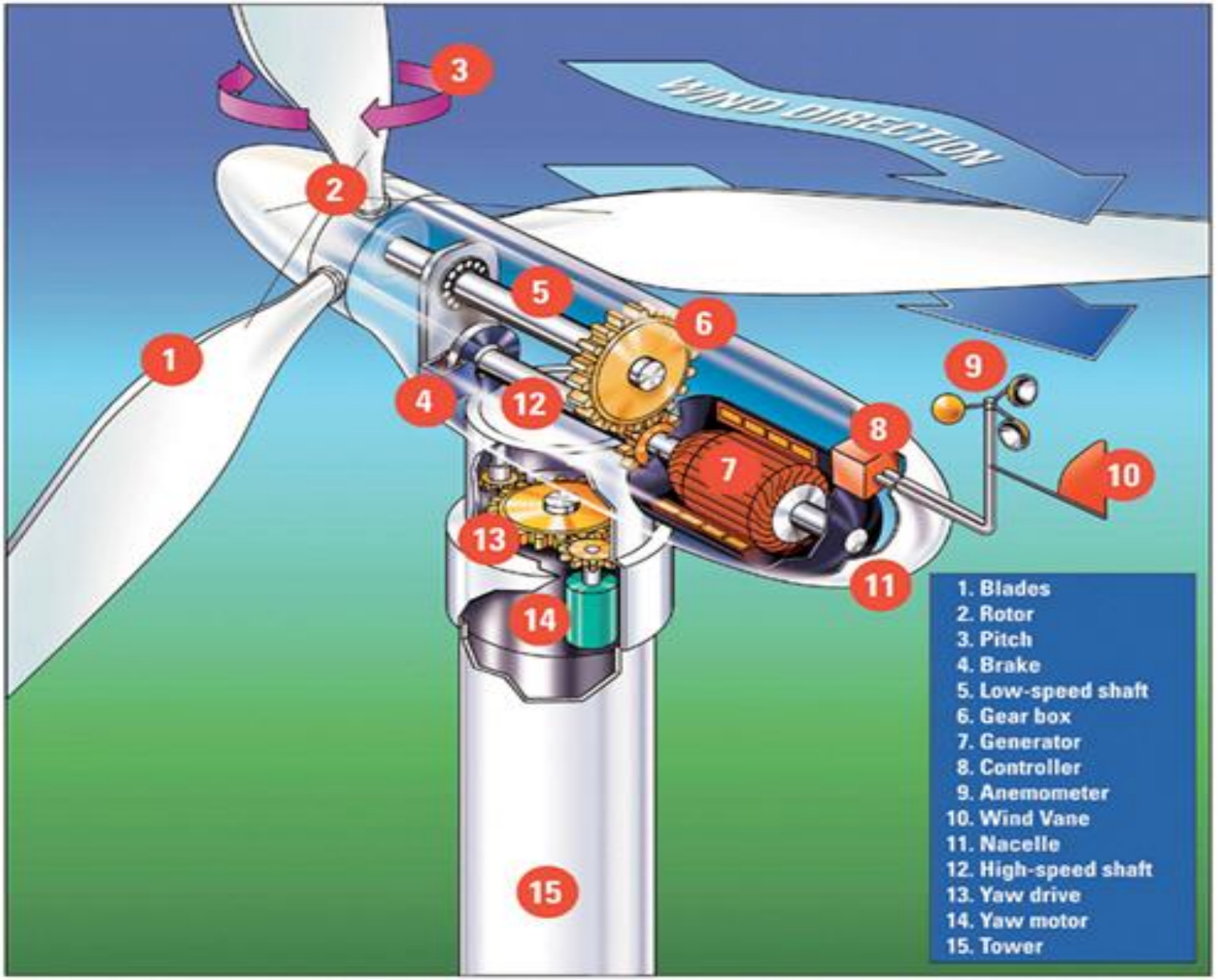

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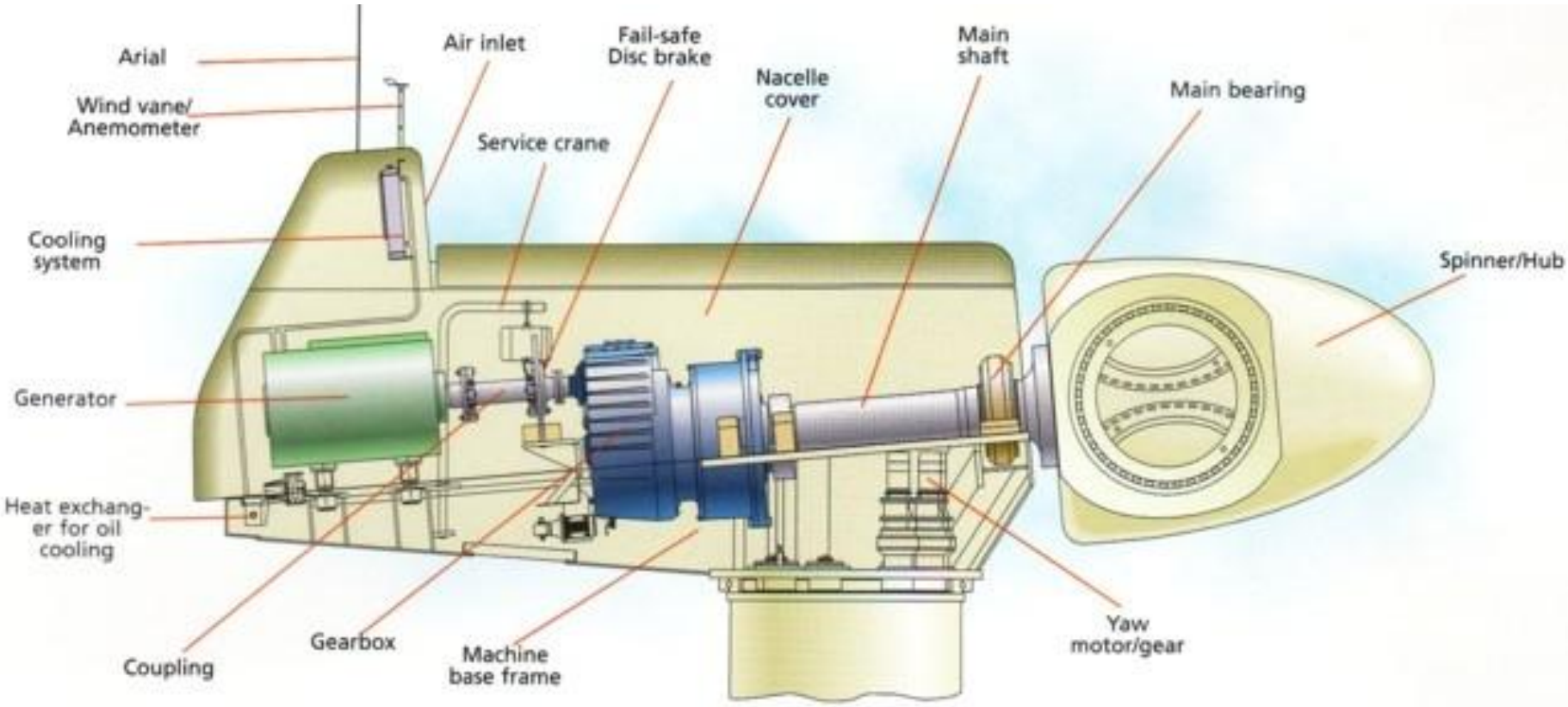
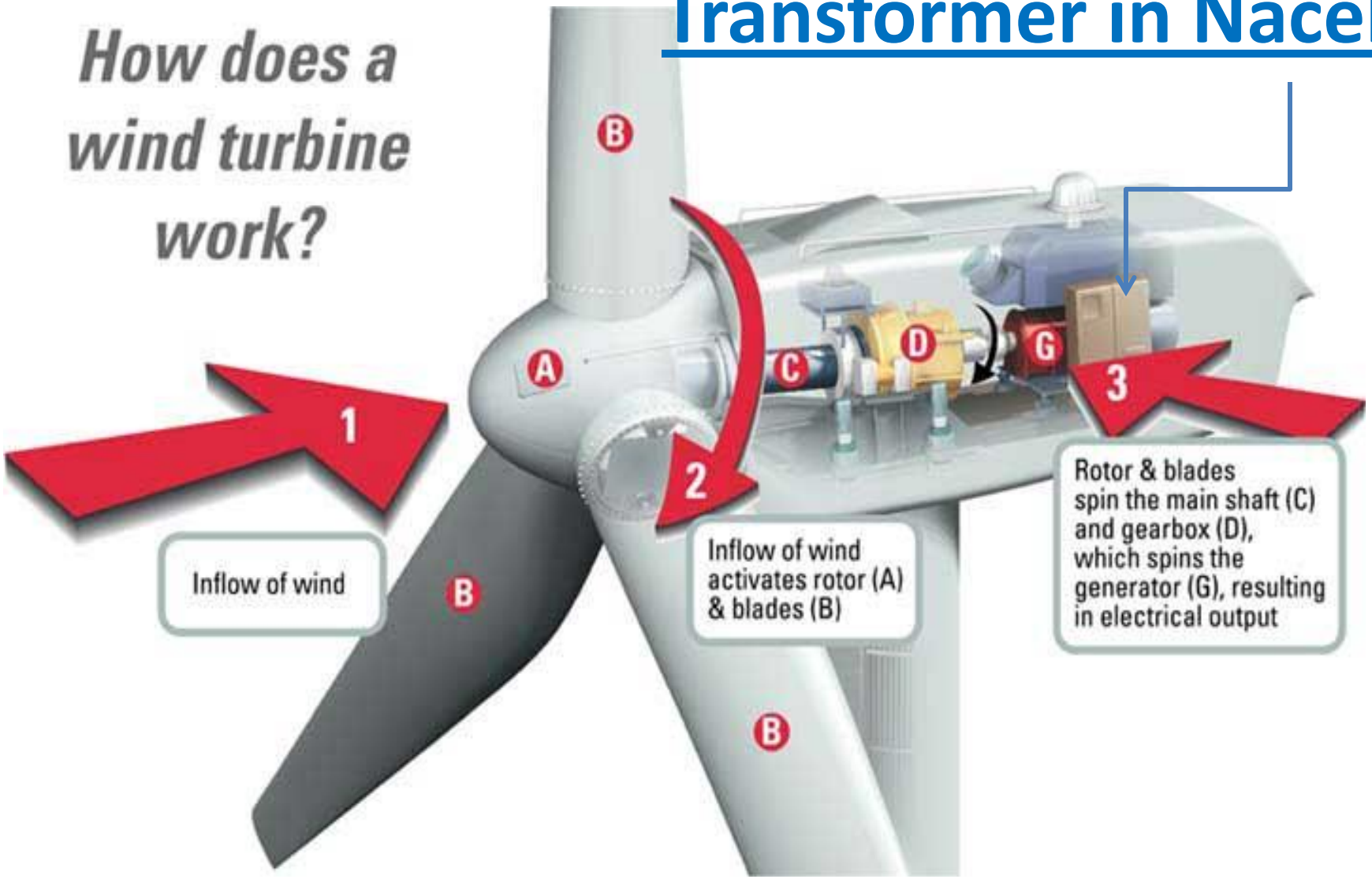
Yaw and Pitch Motors

Inside a Wind Turbine



Source: Joe Rand The Kidwind Project
Joe@kidwind.org St Paul MN

Transformer in Nacelle



RIDGELINE ENERGY

Source: Joe Rand The Kidwind Project
Joe@kidwind.org St Paul MN

RIDGELINE ENERGY

SOURCE: Generation Energy, Inc.

Overview of the Construction Process

Typical sequence of wind farm construction

- Access Roads
- Concrete Batch Plant (if required)
- Public Road Improvements (if required)
- Turbine Foundations
- Electrical Collection System
- Wind Turbines
- Project Substation
- Operations and Maintenance Facility

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Source: Anna Giovanello, TTECI, Inc.

Install erosion and sediment controls

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Clear and Grade Road

Install required drainage (i.e. culverts)

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Install base materials (i.e. geo-fabric or Geo-Grid)

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Install and compact gravel road

Concrete Batch Plant (if required)

- Requires an air quality permit

Turbine Foundations, continued

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Turbine Foundations, continued

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Turbine Foundations, continued

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Turbine Foundations, continued

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Turbine Foundations

- Temporary turbine workspace typically 150 – 200 foot radius
- Permanent area of disturbance typically 50 foot radius

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Public Road Improvements

- Road and intersection widening
- Culvert and bridge replacement
- Reconstruction of previously existing roads
- Often requires road permits from DOT, County

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Heavy Loads 9 to11 Axles

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Electrical Collection System

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Electrical Collection System, continued

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Wind Turbine Erection

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Wind Turbine Erection, continued

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Mullen Crane, Soda Springs, ID Erecting Wind Towers East of Mountain Home March, 2008

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Wind Turbine Erection, continued

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Wind Turbine Erection, continued

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Wind Turbine Erection, continued

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Project Substation

- Be sure to install appropriate secondary containment in accordance with SPCC regulations

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Restoration and Reclamation

- Restore and reclaim

In accordance with Issued permits and agreements with various agencies (i.e. agricultural) and landowners

Source: Anna Giovanello, TTECI, Inc.

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