Wind 101

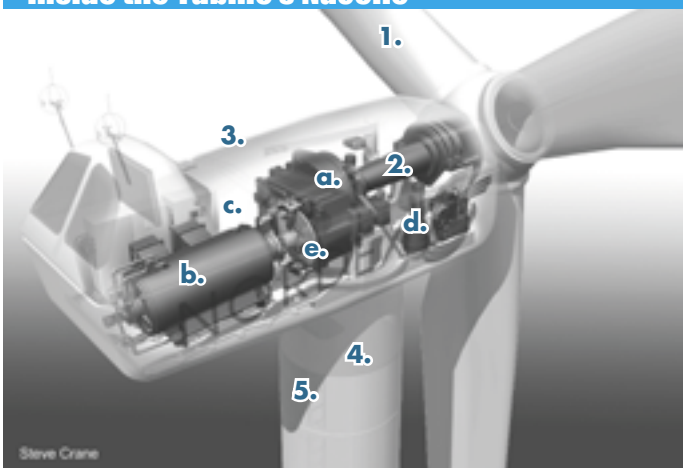
Gathering the wind

1. A computer automatically controls each turbine.
2. The computer turns the rotor to face into the world.

3. The rotor turns (depending on the type of wind turbine) at 11 to 20 rotations per minute (rpm). As the wind blows, the pitch of the rotor blade adjusts to suit changes in the wind speed. For safety purposes, the turbine shuts down automatically if the wind speed exceeds 56 miles per hour.
4. The blades drive the main shaft, which drives the generator through a gearbox to convert the mechanical power to electrical power.
5. The electricity is cabled down the tower, then through a series of transformers and underground distribution lines before entering the substation.

Source: FPL Energy

Inside the Tubine's Nacelle



1. Rotor blades capture the wind's energy, causing the shaft to rotate.
2. The shaft transfers the rotational energy into the generator.
3. The nacelle is the enclosure that holds:

a. The gearbox which increases the speed of the shaft between the rotor hub and generator.

b. The generator which takes the rotational energy of the shaft to generate electricity.

c. The electric control unit monitors the system and shuts down the turbine in case of malfunction.

d. The yaw controller moves the rotor to align with the wind direction.

e. Brakes stop the rotation of the shaft in case of power overload or system failure.

4. The tower supports the rotor and nacelle.
5. Electrical equipment carries electricity from the generator down through the tower and controls many safety elements of the turbine.

Sources: Nordex; www.howstuffworks.com

Photo by Steve Crane, Basin Electric Power Cooperative

Photo courtesy U.S. Army Corps of Engineers

Photo by Steve Crane, Basin Electric Power Cooperative

Electricity used by electric cooperatives in South Dakota and western Minnesota is generated primarily at three main sources: coal-fired power plants in North Dakota and Wyoming, hydroelectric dams on the Missouri River and wind turbines. Because wind is an intermittent resource – meaning it doesn't produce electricity all the time – it must be backed up by more consistent resources such as coal-fired plants. Additional electricity is generated at peaking plants and new heat recovery plants.

Large power lines carry the electricity to substations where the energy is stepped down to smaller transmission lines.

Photo by Steve Crane, Basin Electric Power Cooperative

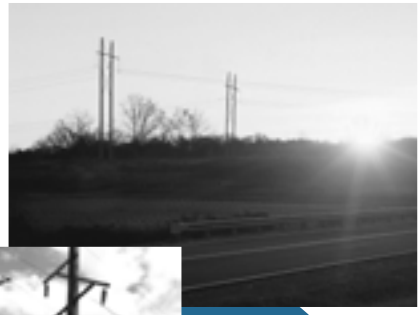


Photo by Tom Green, Northern Electric Cooperative

The smaller transmission lines, typically carrying 115-kilovolts and 69 kilovolts, are often referred to as H-structures and wishbone structures, denoting the shape of the poles. These lines carry electricity to local distribution substations where the electricity is further stepped down.

Photo by Tom Schoening, East River Electric Power Cooperative

Electricity is then taken from the generation source through large transmission power lines onto the electrical grid.

Photo by Brenda Kleinjan, SDREA

Electricity is then carried away from the local substations usually through three-phase power lines.

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Electricity is delivered to more than 110,000 homes and businesses served by local Touchstone Energy® Cooperatives in South Dakota and western Minnesota.