

## What Mineral Products & Metals Are Needed To Make Wind Turbines?



- **Aggregates and Crushed Stone (for concrete):** Mined in the United States.
- **Bauxite (aluminum):** Mined in Australia, China, Brazil, India, Guinea, Jamaica, Russia, Venezuela, Suriname, Kazakhstan, Guyana and Greece.
- **Clay and Shale (for cement):** Mined in United States.
- **Coal (by-product coke is used to make steel):** Coal is mined world-wide, and constitutes 45% of the generation of U.S. electricity.
- **Cobalt (magnets):** Mined in Congo-Kinshasa, Canada, Zambia, Russia, Australia, China, Cuba, Morocco, New Caledonia and Brazil.
- **Copper (wiring):** Mined in Chile, United States, Peru, China, Australia, Russia, Indonesia, Canada, Zambia, Poland and Mexico.
- **Gypsum (for cement):** Mined in China, United States, Iran, Spain, Thailand, Japan, Canada, Italy, France, Australia, Turkey, India, Russia, Saudi Arabia, Brazil, Egypt, Germany, United Kingdom, Algeria, Poland, Argentina and Austria.
- **Iron ore (steel):** Mined in China, Brazil, Australia, India, Russia, Ukraine, United States, South Africa, Iran, Canada, Sweden, Kazakhstan, Venezuela and Mexico.
- **Limestone (for cement):** Mined in United States.
- **Molybdenum (alloy in steel):** Mined in China, United States, Chile, Peru, Mexico, Canada, Armenia, Iran, Russia and Mongolia.
- **Rare Earth Oxides (magnets; batteries):** Mined in China, India and Brazil.
- **Zinc (galvanizing):** Mined in China, Peru, Australia, United States, Canada, India, Kazakhstan, Ireland and Mexico.
- **Silica Sand (for cement):** Mined in United States, Italy, Germany, United Kingdom, Australia, France, Spain, Japan, Poland, Hungary, South Africa, Mexico, Austria, Iran, Republic of Korea, Slovakia, Canada, Belgium, India, Bulgaria, Norway, Chile, Gambia, Turkey and Czech Republic.

### INTERESTING FACTS

- The foundation may contain over a thousand tons of concrete and rebar. Dimensions are often between 30-50 ft. across and 6-30 ft. deep.
- The average tower height is 229 ft. 8 in. Shafts are sometimes driven down farther to help anchor it. The platform is critical to stabilizing the immense weight of the turbine assembly.
- Depending on the model, industrial wind turbines can weigh between 164-334 tons, or more.
- 5,000 commercial-scale wind turbines were installed in 2008.
- Like old fashioned windmills, today's wind turbines use blades to collect the kinetic energy of the wind. The wind flows over the blades creating lift, like the effect on airplane wings, which causes them to turn. The blades are connected to a drive shaft that turns an electric generator to produce electricity.
- When the wind isn't blowing, other types of power plants must be used to make electricity.
- Wind turbines also use neodymium, boron and iron magnets in their construction and operation.
- The U.S. possesses the largest non-China rare earth resource in the world at the Mt. Pass Mine in California.



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