



KINGDOM COMMUNITY WIND

Green Mountain Power partnered with Vermont Electric Coop to build 21 wind turbines in Lowell, VT as a new source of renewable energy. After 5 years of planning and 18 months of construction, the project began generating electricity in November, 2012.

To learn more about how a wind turbine works, visit this online resource from the Department of Energy <http://energy.gov/eere/wind/inside-wind-turbine-0>

About the Turbines

1. *What's the make and model of these turbines?* VESTAS V112 3 MW
2. *How much energy is made by KCW?* About 180,000 MWh per year, enough to power 24,000 homes
3. *How much CO₂ is displaced by KCW?* About 75,000 tons each year
4. *Where were the turbines manufactured?* The towers and blades: Colorado. The nacelle: Denmark
5. *How tall are these wind turbines?* The tower is 273 feet tall. From the ground to the blade tip is 443 feet.
6. *How much does a turbine weigh?* About 500 tons
7. *What are the towers made of?* Steel. The walls are approximately 2 inches thick
8. *What is the diameter of the tower at the base?* Approximately 12 feet
9. *How long are the blades and how much do they weigh?* 170 feet. About 15 tons each
10. *What are the blades made of?* Carbon fiber skeleton with a fiberglass cover
11. *Are there elevators inside the towers?* There are ladders and two-person lifts
12. *How are the tower sections joined together?* They are bolted together on the insides of the towers
13. *Why is the tower door so high off of the ground?* The space below the door contains electrical switch gear. For safety, specifically to avoid arc-flash, personnel in the tower are physically separated from this switchgear.
14. *What is the life span of the turbines?* They have a 25 year warrantee. With care, we expect them to have a longer useful life.
15. *What's the elevation of the turbines?* At the base, the turbines range from 2,174 feet above sea level (T3) to 2,601 ft above sea level (T 10)

Turbine Operations

16. *How fast do the blades spin?* The blades rotate at up to 14 RPM. At 14 RPM, the outside tip travels at 170 MPH
17. *At what wind speed do the turbines start to turn?* About 8 MPH
18. *At what wind speed do you reach the maximum power generation of 3 MW per turbine?* About 29 MPH
19. *At what wind speed do you have to shut down the turbines?* About 55 MPH
20. *Do the towers sway in the wind?* The tower is intentionally flexible and sways as much as 10 feet at the top.
21. *What happens when there's lightning?* Personnel leave the mountain top; the towers are designed to handle lightning strikes, and they continue to operate.
22. *Do the turbines have lights?* Yes – the FAA requires lights. KCW has 8 red LED lights that blink slowly and do not create glare, similar to the ones atop communications towers. We have received FAA approval to use a radar system that allows the lights to stay off unless aircraft are in the area, and are currently working with vendors to get a system installed at KCW.

Protecting the Environment

23. *What animals live around the turbines?* Black bear, white-tailed deer, moose, turkey, coyote, fox, ruffed grouse, snowshoe hare, red squirrel, and a variety of songbirds, other small mammals, and amphibians.
24. *How much land was impacted by construction?* About 135 acres. Since construction, 45 acres have been re-vegetated using native plants and mulch produced from the project itself. This re-vegetation is visible on the side slopes of the roads and turbine pads.
25. *How many mitigation acres did GMP secure?* About 2,800 acres of critical habitat have been preserved to offset land disturbed by the project.
26. *How will the development affect water quality and the environment?* We worked closely with the Vermont Agency of Natural Resources to ensure the smallest possible impact on water quality and the environment during construction and operations due to the increase in impermeable surfaces (roads and turbine pads). This includes hydrology, water chemistry, and aquatic biota, specifically fish and aquatic insects. We conduct extensive monitoring under ANR supervision to ensure compliance. Recent tests demonstrate the health of nearby waterways is the same or better than prior to construction.
27. *What are you doing to protect bats?* The operation of the turbines is regulated based on the atmospheric conditions that affect the behavior of bats, include the season, time of day, wind speed, and temperature. To date, no endangered birds or bats have been killed. It is interesting to note that each year about 33,000 birds are killed by wind turbines in North America; in that same period, up to one billion birds die flying into buildings or windows, and a half billion birds are killed by cats. Source: www.sibleyguides.com and US Fish and Wildlife Service.
28. *What are the painted rocks?* They guide the wildlife team in making a complete search for dead birds and bats.
29. *How loud are the turbines?* The noise standard for KCW is no more than 45 dBA outside the nearest residence--roughly the sound level of a quiet library. The two nearest homes to this project are 0.7 miles and 0.9 miles. Continuous acoustic monitoring of KCW took place throughout one full year in 2016, during that period of time KCW did not exceed the set thresholds.

Financial Facts and Construction

30. *How much did the project cost?* About \$168 million
31. *How much does the power generated cost?* Levelized over a 25-year period, between 9 and 10 cents per kWh
32. *How many people work at KCW now?* six full-time employees
33. *What is the payment to the town of Lowell?* The project pays Lowell \$535,000 annually, increasing by \$32,500 every 5 years, for 25 years.
34. *Will the surrounding towns receive money?* GMP has established a Good Neighbor Fund of approximately \$180,000 annually for Westfield, Albany, Craftsbury, Irasburg, and Eden for the first 10 years of the project.
35. *How much will the State Education Fund receive?* More than \$500,000 annually for the life of the project.
36. *How many people worked on the project?* Over 200. More than 100 Vermont firms were involved in various phases of the project. At the height of construction, more than 150 Vermonters were working on the mountain.
37. *How far from the Route 100 are the turbines?* About 1 to 2 miles, depending on the turbine
38. *How long is the crane path from T1 to T21?* About 3.8 miles
39. *How much concrete is in the turbine pad?* About 90 cubic yards. Other applications of the V112 require 500 cubic yards of concrete per turbine pad. Our amount is significantly less because we quickly hit bedrock.
40. *How deep do the tower bolts and anchor rods go?* Tower bolts: about 12 feet. Anchor Rods: about 40 feet
41. *Where did the blade in front of the O&M building come from?* It was damaged during construction and was never installed on a wind turbine.
42. *Is there a decommissioning plan?* Yes. Funds are held in reserve for this, and there are strict standards for removing the towers and returning the mountain to a more natural state.