

## **Frequently Asked Questions**

### **What is wind power?**

Electricity that is generated directly from the wind as it blows across and turns the blades of a wind turbine. Below is an explanation of how a wind turbine works. Wind power is available to you if you are a customer of a SMMPA member utility. The advantages to using wind are many, but the biggest benefit is the extremely clean nature of this type of generation. Wind is renewable and produces no emissions or by-products.

### **Where are the SMMPA-owned wind turbines located?**

The Agency currently owns six Vestas wind turbines - two 950 kW wind turbines, two 1650 kW wind turbines located in member community Fairmont and two 1650 kW wind turbines located in member community Redwood Falls. By installing turbines in member communities, SMMPA can feed wind power directly into its distribution system and avoid the cost and scheduling of using a transmission grid.

### **How big are SMMPA's wind turbines?**

For our 950 kW turbines, each 30-foot deep foundation required 850,000 pounds (lbs) of concrete. The 15-foot diameter tubular steel tower measures 231-feet tall and weighs 98 tons. Hub height is 237 feet and ground to blade tip measures 326 feet, taller than the statue of liberty. On top of the tower rests a 24 ton nacelle, the main body of the turbine that contains a gearbox and generator. The rotor, made up of the hub and three 87-foot long blades, is 179 feet in diameter and weighs 16.5 tons. For our 1650 kW turbines, each 32-foot deep foundation required 907,000 lbs of concrete. The tower itself measures 229-feet tall and weighs 233,000 lbs. Made of tubular steel, it is 15 feet in diameter at the base and tapers to 6 feet at the top. The height of the rotor hub is 237 feet and ground to blade tip measures 364 feet. On top of the tower rests the 102,000 lb nacelle, the main body of the turbine that contains the gearbox and generator. The rotor, made up of the hub and three 131-foot long blades, is 269 feet in diameter and weighs 43,000 lbs. The rotor sweeps an area of 56,844 square feet - 8800 more square feet than a football field. The blade tips move at 138 miles per hour. Each wood/epoxy blade weighs 15,000 lbs and can pitch up to 90 degrees to capture more power from the wind. The 300 ton capacity crane used to construct the turbines weighs 896,000 lbs. It took fifteen semi trucks to bring the crane to the site and three days to assemble it.

### **How much power do SMMPA's wind turbines generate?**

The turbines are each rated at 950 kW and 1650 kW respectively. This refers to the "nameplate capacity," which is what the turbine could produce in ideal conditions. On an average annual basis, we expect each 950 kW turbine to produce around 2,700,000 kWh or enough electricity to power approximately 375 homes. Each 1650 kW turbine, being larger and more efficient than a 950 kW turbine, will produce around double that amount.

### **Is the power generated by SMMPA's wind turbines variable by season?**

Because winter months are windier than summer months and cold air is denser than warm air, turbine blades push harder and turn faster to generate more electricity in the winter.

### **What components comprise the wind farm?**

The major components of the wind plant are the turbine-blade-tower units, a substation and transmission lines. Here are some details on each:

- The basic components of the wind machines include a tubular steel tower, turbine generator located at the top of the tower, housing for the turbine (called the nacelle), three fiberglass blades, and electronic equipment that monitors and controls the machines.
- The generators are 950 kW and 1650 kW alternating current induction generators that produce power at 600 volts. The turbines are linked by an underground wiring system that carries the power from the turbines to the wind farm's substation.
- The wind farm's substation takes the power generated by the wind turbines and transforms it to a higher voltage for the distribution system. The substation also ensures that the wind turbine power is delivered at standard, consistent voltage and frequency levels

### **How do SMMPA's wind turbines work?**

Wind blowing through the turbine blades rotates the rotor much like a child's pinwheel. A gearbox inside the nacelle transfers this mechanical power to the generator, which converts it to electrical power. As wind direction changes, the machine rotates into the wind on its axis. This is called the "yaw" control. The turbine has a weather station and computer control system that provides real-time information on wind speed and direction. With this information, the computer controls the machine so it always captures the maximum amount of energy from the wind. This ongoing monitoring and adjustment is known as "chasing the wind."

### **Why is wind power so appealing?**

A number of traits make wind generation an attractive option, but most compelling is its low environmental impact. Wind is abundant, especially in southwestern Minnesota, and inexhaustible. It is also a renewable resource that creates no emissions or by-products. Adding to the appeal is the substantial reduction in cost to produce this clean power - from approximately 40 cents/kWh in 1979 to 2-5 cents/kWh today.

### **Is there anything negative about wind generation?**

In the past, one environmental issue concerning wind generation has focused on the impact turbine towers and blades may have upon birds, primarily raptors such as eagles, falcons and hawks. New turbines, like the one used for wind power, are designed with bird safety in mind. All of the following measures work together so there is very little, if any, impact upon birds:

- Machines are larger and therefore generate more power. This means that fewer machines are required today than were in the past.
- Blades are built bigger and designed to spin slowly (15 to 22 rpm), making it easier for birds to see and avoid them.
- Machines are placed away from edges or bluffs, keeping them off the flight pattern of migratory birds.
- Blades are painted with a reflective coating to make them highly visible to birds.

Most importantly, machines and their towers do not offer birds tempting places to perch. The wind power turbine uses a tubular tower to support its blades and nacelle rather than the older lattice-style tower. Access ladders are placed inside the tower and all power lines connecting the wind machine to the substation are below ground. The nacelle top is smooth and does not provide a roosting place. In the past, most bird injuries occurred as birds roosting on the old-style lattice towers spotted prey on the ground and glided into the path of the rotating blades.

**What is a concrete example of how choosing wind power can help the environment?**

Currently, electricity in Minnesota and surrounding states is supplied primarily from large coal-burning power plants, natural gas-fueled turbines and nuclear power. When a wind turbine is added to the interconnected electric transmission system, the need for these other generators diminishes. That is, when a wind turbine is producing power, a fossil fuel-burning plant will be scaled back and burn less fossil fuel. Generating 100 kWh of wind power each month for one year has the same environmental impact as planting a half-acre of trees or not driving a car 2400 miles. Generating 600 kWh of wind power each month for one year is similar to removing one car off the road for that year.

**Where does SMMPA currently get its power?**

Currently 12% of the energy SMMPA supplies to its 18 municipally-owned member utilities comes from renewable and carbon-free sources. The majority of SMMPA's energy is produced at the Sherburne County Generating Station Unit 3 (Sherco 3). SMMPA owns 41% of the 884 MW coal-fired generator. Sherco 3 is a pulverized-coal steam unit that burns western coal with a sulfur content of less than 1%. Nearly 30% of unit 3's construction budget was for pollution control equipment. It has a state-of-the-art air quality control system that removes over 70% of the sulfur dioxide and over 90% of the particulate matter. The boiler is equipped with the best available control technology that minimizes the formation of nitrous oxides. SMMPA also has, through contracts with its members, fossil fueled steam plants, natural gas-fueled combustion turbines and diesel plants