

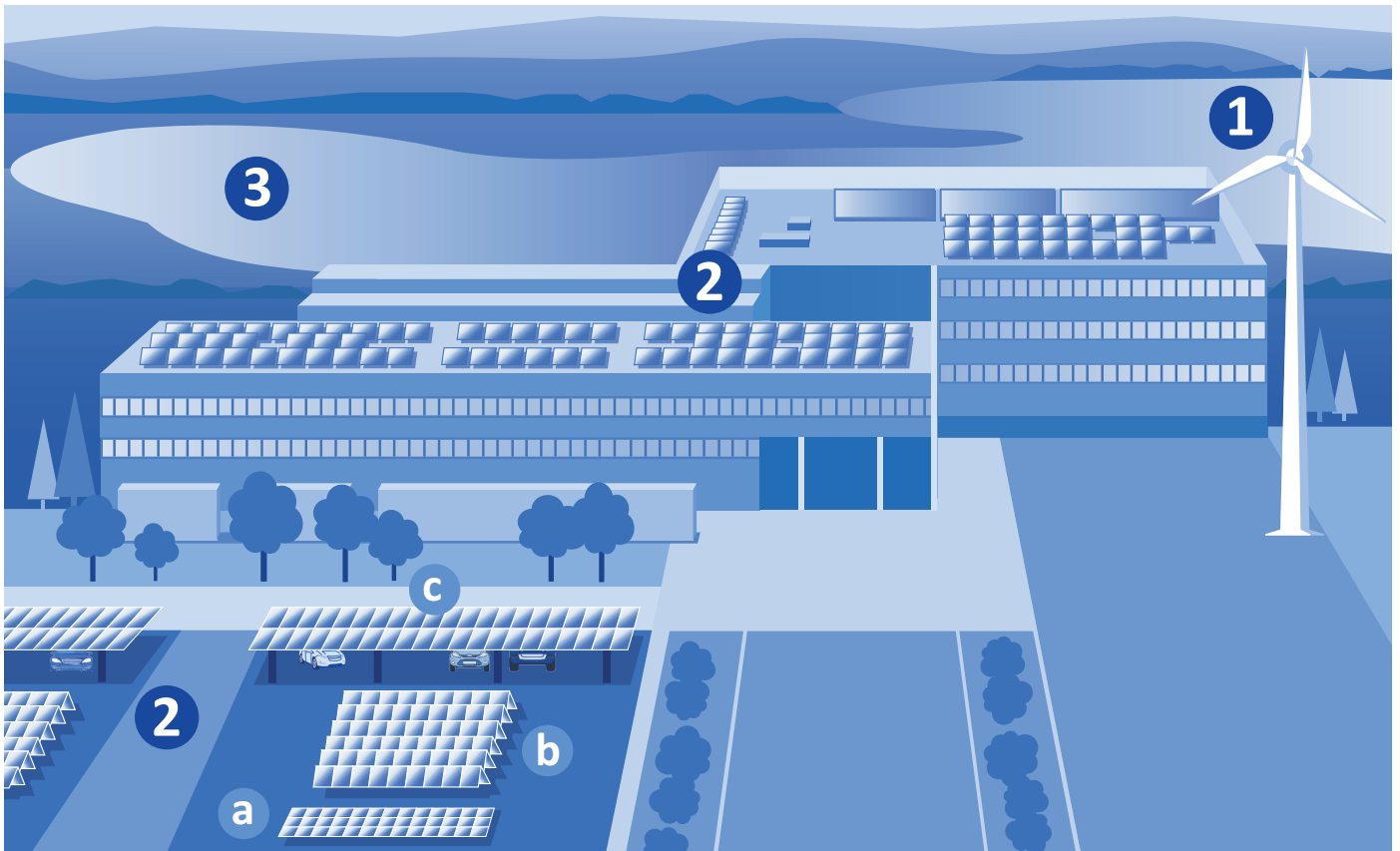


Great River Energy's headquarters site

In 2006, Great River Energy built one of the most sustainable buildings in the world as part of our promise to practice and promote energy conservation. But we didn't stop there. In 2014, Great River Energy voluntarily added a 250-kW solar array to its existing on-site renewable energy portfolio. Combined, the renewable energy output provides up to 20 percent of the building's annual power usage.

Here's a look at the renewable energy systems that help power Great River Energy's Leadership in Energy and Environmental Design (LEED) Platinum and ENERGY STAR certified building.

- 1 WIND TURBINE.** The 166-foot tall, 200-kW wind turbine is half the height of a typical commercial turbine. The turbine requires minimum winds of 9 miles per hour, and will shut down when winds exceed 35 miles per hour. The turbine produces approximately 5 percent of the building's annual energy needs.
- 2 PHOTOVOLTAIC PANELS.** The original 72-kW solar photovoltaic panel array included rooftop panels and five solar trees. At the time of installation, this was the largest solar array in Minnesota, providing approximately 3 percent of the building's annual power usage.



In 2014, Great River Energy added an additional 250-kW solar array. This array uses three different types of solar panels and electrical systems to collect and convert electricity. In addition to providing renewable energy for the building, the array is a solar energy research and development site that will help Great River Energy learn how solar energy installations can be integrated into cooperative systems.

- a** The two groups of panels along the boulevard are made by Sharp. These conventional panels produce a combined 50-kW of solar energy.
- b** The center three panels are made by tenKsolar, based in Bloomington, Minn. The unique feature of the reflectors provides up to 20 percent more energy production. These panels are expected to produce 100-kW of renewable energy.
- c** Solar parking canopies made by Suniva help Great River Energy meet its goal of 250-kW without disturbing the topography. The canopies also provide shading and protection to vehicles that park underneath.

Inverters that convert the solar energy from direct current to alternating current will also be tested as part of this project. Three different inverter manufacturers will be tested for their performance, with one inverter type for each panel manufacturer and corresponding voltage.

Like excess wind power, any excess solar energy is placed on the electric grid.

- 3** **GEOTHERMAL TRANSFER SYSTEM.** A state-of-the art geothermal transfer system, in combination with heat pumps and displacement ventilation, heats and cools the building. The system uses the bed of Arbor Lake as its heating and cooling source because water provides great conductivity and stable temperatures.

Arbor Lake is approximately 30 to 40 feet deep at its lowest point. Because light does not penetrate below 20 feet, the bottom of the lake is between 39 degrees Fahrenheit in the winter and up to 55 degrees in the summer.

A nontoxic, biodegradable fluid is pumped through 36 miles of piping, exchanging heat with the lake. Heat from the building is extracted during the summer and heat from the lake is absorbed during the winter.

Member cooperative solar projects

Great River Energy worked with its cooperatives to install an additional 400-kW of renewable energy across Minnesota.

In addition to generating renewable energy, the 20-kW solar arrays are helping to provide information on how distributed generation solar facilities can be integrated into cooperative systems.

Site identification, material procurement and design took place throughout 2014 and construction began in mid-2014. All facilities were in service by winter 2015.



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