



Workers at the Kingsley Dam hydro plant remove parts that will be sent out for repair Oct. 19. (JACOB HANNAH/ Lincoln Journal Star)

**O** GALLALA -- Kingsley Hydro, the largest hydroelectric plant in Nebraska, looks like a mechanic's worst nightmare.

It's as if someone had gutted an old Chevy engine and left parts and tools scattered on the floor -- except some of these components and tools look like they came from the land of giants.

"This is the first time it's been torn down like this," said Devin Brundage, the electrical engineer in charge of dismantling the turbine-generator assembly that converts water flow into energy.

Built by the Central Nebraska Public Power and Irrigation District, Kingsley Hydro began operation 25 years ago. Except for routine inspections and periodic maintenance, it has never had a major overhaul -- until now. Like a

tired engine with lots of miles, the 50-megawatt plant needs some work, especially the turbine blades, which resemble a propeller on a ship or the world's biggest food processor.

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"The bronze bushings behind the six blades are getting worn down, causing the blades to sag," Brundage said.

Total cost of the renovation is estimated at nearly \$4 million.

Central employees have spent weeks painstakingly dismantling the plant.

It's a difficult job. The plant, which can electrify about 15,000 homes, operates on a simple principle but its inner workings are complex and machined to precise tolerances.

"The unit was in very good shape. Whoever did the installation in 1984 did a very good job," Brundage said.

When the dismantling was done, semitrailers hauled the elephant-size components to Voith Hydro, a hydro equipment rebuilding company in York, Pa. After reconditioning, the 10 to 15 pieces will be returned to Nebraska and re-installed in January.

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While it took about four weeks to take the turbine-generator apart, it will take about eight weeks to re-assemble it, Brundage said, because everything has to be plumbed and aligned properly to reduce any chance of damaging vibrations once the hydro starts up again. If everything goes according to plan, the re-start should occur around March 1.

Voith Hydro can trace its roots back to the company that installed Kingsley Hydro in 1984, Brundage said. "They still had all of the original drawings," he said, which made the job of dismantling the plant easier.

Kingsley Hydro should be good to go for another 25 years or more after the refurbishing is complete, said Brundage, noting that he was only 14 years old when the hydroelectric plant was built at the foot of Kingsley Dam, one of the largest earthen dams in the world.

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Kingsley Hydro was an afterthought. It was completed 43 years after Central finished the 3-mile-long Kingsley Dam on the North Platte River.

The Holdrege-based district saw a hydro plant as an opportunity to further utilize the water that was being stored in Lake McConaughy for irrigators downstream.

During the late 1970s, the nation was looking to add more hydropower generation as a way to reduce dependence on foreign oil -- a precursor to today's effort to create wind and other renewable energy resources.

At the direction of Congress, the U.S. Army Corps of Engineers screened more than 50,000 sites across the country. Four sites in Nebraska, including Lake McConaughy, had the most potential for building hydroelectric plants.

After much study and debate, Central and the Nebraska Public Power District signed a joint agreement. Central would build the project, and NPPD would buy the hydroelectric plant's total energy output, thereby paying for the construction, operation and maintenance.

Kingsley Hydro was finished six months ahead of schedule and \$14.2 million under its \$63 million budget.

Unlike some of Central's other hydro plants, it has no building above it. The turbine-generator assembly is under a concrete pad at the edge of Lake Ogallala, which was created when fill dirt was needed for Kingsley Dam.

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The hydro plant was dedicated in 1984. Virginia Smith, the late Third District congresswoman from Chappell and a vocal proponent of hydroelectric power, was among the dignitaries in attendance.

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Glen Bevard was at the dedication ceremony, too. He remembers that the parking lot and bleachers were full. And high school bands played during the ceremony, attended by about 300 people.

Bevard, now 60, has been the maintenance man at Kingsley Hydro since Day 1. He watched workers put in the turbine-generator assembly. Now, 25 years later, Bevard, as a crane operator, is helping pull everything out.

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His job is to lift the heavy pieces out of the gaping hole in the concrete slab that forms the cover for the plant. While he sits in a crane perch 35 feet above the opening, other Central employees work below to ensure that nothing is damaged during ascension.

"It's kinda sad seeing it all torn apart," Bevard said.

Twenty-five years ago, the workings of the hydroelectric plant weren't entirely clear to Bevard. He said he gained a better understanding as the years went by, but watching every piece come out has given him a more complete picture.

"Now everything makes more sense ... how it's put together ... and how it goes back in," Bevard said. "It's probably the neatest job anybody can have -- living at a lake and experiencing something like this."

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Flights of concrete steps lead to the scroll case, a huge donut-shaped space that is normally sealed by a thick steel door and that holds water from Lake McConaughy.

When the hydroelectric plant is in operation, water from the lake pours into the scroll case through a massive circular gate with unfathomable force.

Twenty wicket gates control the water. They can pass 6,000 cubic feet of water per second to the turbine blades, which spin a rotor made of up 40 electromagnets at 180 revolutions per minute.

"The magnets create a magnetic field as it (the magnets) crosses the stator windings," said Brundage, explaining how the hydroelectric plant can generate up to 50,000 horsepower. "That process then creates voltage and (electric) current."

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The rotor is 20 feet in diameter and weighs 135 tons. It is the largest piece of equipment in the hydroelectric plant. Brundage said it was so heavy that it couldn't be shipped in but had to be built on site in 1984.

Once the massive rotor was lifted out last month, workers erected a galvanized grain bin around it to protect it from bad weather, then sealed the cracks with caulk.

"We used one of the most common things found in Nebraska to protect the rotor," Brundage said, adding that once the rehabilitation work is finished the grain bin will be sold, most likely to a local farmer.