

## In-river generator may give Bush power alternative

**RUBY: Device shows promise for remote riverfront villages.**

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A technology almost as simple as a Yukon River fishwheel could one day power the laptop computers and microwave ovens of Alaska's river people. In Ruby it's beginning to do just that.

Last summer, the Western Alaska village on the banks of the Yukon became the first community in America to tap into the power of an in-stream hydrokinetic generator, a submersible turbine that looks a bit like a tipped-over fish wheel.

In-stream power also gets called "low-impact hydro" and "hydro without the dam." By any name, it may be an idea whose time has finally come.

A 100-kilowatt turbine about 20 times larger than Ruby's is scheduled to be installed later this year in the Upper Yukon River village of Eagle, where it's expected to power all the homes in town from breakup to freezeup.

That could eventually provide a fuel-free alternative to Eagle's present practice of burning about 80,000 gallons of increasingly costly diesel fuel each year to generate electricity.

In-stream hydro is no longer just a quirky, renewable energy concept, Ruby project director Brian Hirsch said Tuesday, displaying a slide-show image of four generators now in production during a workshop on the subject at the 2009 Alaska Forum on the Environment under way in Anchorage.

"Every one of these devices that you see up there are not just an artist's rendering anymore but actually a device that is made of steel and now producing electricity," Hirsch said.

Admittedly not a whole lot so far. Unlike increasingly popular wind farms and geothermal power plants, in-stream hydro is still a costly technology in its infancy, with lots of unanswered questions. Especially in Alaska.

Can the turbines floating on the surface of the Yukon withstand bombardment by the huge logs that regularly drift downstream? Will the Yukon's notoriously silty water damage their intricate mechanism? Or might the turbines cause problems of their own, disrupting river navigation or posing a threat to migrating fish?

The Ruby generator, a mere 5-kilowatt turbine capable of powering only two households, was an experiment. After one month of operation last summer, Hirsch can report that it works.

"But there's a lot to improve," he said.

On the plus side, in-stream hydro is a simple, highly portable technology that can be up and running in a matter of weeks and might be ideal for remote riverbank communities.

The Ruby project, sponsored by the Yukon River Inter-Tribal Watershed Council (Hirsch serves as the council's energy program manager), was partly assembled in Fairbanks, then barged downstream from Nenana. Its price tag was \$65,000.

That included the cost of the turbine itself, manufactured by a Canadian firm, as well as the cost of a pontoon boat to float it, gear to anchor it, a debris boom to protect it and underwater transmission cables to connect the generator to Ruby's power grid.

Ruby was selected as a test case partly because diesel-generated power there is so expensive, and partly because its residents enthusiastically supported the project, Hirsch said. Ruby also satisfied some technical requirements.

In-stream turbines ideally get placed in the part of a river where the current is strongest. That's usually on the surface near the middle, where the river is deepest. But placing it in the middle of a river increases the length of the transmission lines required and possibly creates navigational hazards. Ruby proved ideal because the fastest, deepest current was close to shore.

To protect the turbine from floating driftwood, the construction team fashioned a simple A-frame prow out of two logs. That was only halfway successful, Hirsch said. It diverted everything that floated on the surface. But some debris on the Yukon floats beneath the surface, and it accumulated on the vessel's anchor chain. Eventually all the snagged flotsam began to shield the turbine from the current and lowered its electrical output.

"It's a challenge, and it's something we're working on," Hirsch said.

The larger in-stream hydro turbine waiting to be installed in Eagle this summer may offer an answer to that problem. It'll come equipped with a heavy, metal sieve-like prow that will extend deep into the river, deflecting subsurface debris.

Underwritten by a \$1.6 million grant from the Denali Commission, the Eagle project was proposed and advanced by the Alaska Power & Telephone Co., a Washington-state-based utility that provides Eagle residents with electricity. The company chipped in some seed money of its own.

But it's still "really expensive" per kilowatt to put a hydrokinetic generator in the water when you compare the new technology with more mass-produced renewables like wind power, said Benjamin Beste, an AP&T engineer who also addressed the forum.

Even so, Beste thinks in-stream hydro is a viable summer source of power for Eagle, as well as other small, isolated river communities in Alaska. He doesn't think the turbines could avoid damage in winter or spring, when break-up occurs. Like Ruby, the in-stream hydro operators in Eagle plan to remove their turbines from the river each fall.

And its effect on migrating salmon? "The fishery impact is not really well known yet," Beste said.

What is known is that adult salmon that migrate upstream favor the slowest current in the river, rather than the fastest, where in-stream turbines are typically placed, said Gwen Holdman, director of the Alaska Center for Energy and Power at the University of Alaska Fairbanks.

So adult salmon might be OK, as well as the fishing vessels that pursue them. But juvenile salmon migrating downstream to sea as smolts prefer the faster current to expedite their journey, and they represent a potential concern, Holdman said.

The university's energy center plans to study such issues if and when a 50-kilowatt in-stream generator is installed this summer as planned in the Tanana River at Nenana.

And Ruby might receive another turbine -- a 25-kilowatt generator large enough to satisfy about half the village's summer energy needs -- if a renewable energy appropriation previously approved by the Alaska Legislature survives the current session.

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