

Pilot Project Will Demo Micro Hydropower

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Laying the groundwork for hydropower developers has traditionally been the sole domain of Mother Nature, who alone has provided sources of water flowing downhill for human engineers to tap. Now, man-made water supply systems can provide a source of hydropower too.

Aquarion Water Company, one of the 10 largest investor-owned water utilities in the U.S., and alternative energy company Rentricity, Inc., are launching a pilot program to tap excess force inside water pipes using technology designed by New York-based Rentricity. The water provider will install Rentricity's Flow-to-Wire systems on pressure reduction valves (PRVs), which are used to relieve excess water pressure delivered to customers at elevations lower than the water source. Flow-to-Wire harnesses the dissipated pressure and converts it to electricity.

The concept has potential for application in any location where excess water pressure must be relieved from downhill flow between source and end use, including irrigation systems. It also has application for untapped fluid and steam flows in various industrial processes. Global environmental firm Golder Associates is supporting the pilot.

This program represents the first application of the Rentricity device in a public water supply system. The idea is to keep relieving excess pressure while providing a new source of clean, renewable energy and revenue for utilities. The power can be delivered to consumers through connection with the electric utility grid, or it can be used to offset existing demand by the water utility. A single Rentricity device is expected to produce enough power to meet the energy needs of 20 to 100 average homes, thereby reducing the electrical load traveling into the area on heavily stressed transmission lines. Aquarion subsidiaries serve 211,000 homes and businesses in Connecticut, New York, Massachusetts and New Hampshire.

The nine-month pilot program will involve the installation of Flow-to-Wire systems at several locations in southwest Connecticut. The process consists of a mini hydro turbine-generator, sensors that will provide real-time system performance data to improve operational efficiencies, processors, electronic controls, and communications equipment. Flow-to-Wire will use proven, off-the-shelf components both at the turbine level and the interconnection to the grid. Rentricity also sees the opportunity to create some unique valves that improve the efficiency of the system, since pressure and flow regulation are integral to the process.

The concept often referred to as low head hydro energy recovery has been around for a long time, but no business model existed for it, says Rentricity President Frank Zammataro. "A few installations using this concept were deployed near Albany, New York and in Pennsylvania in the mid-70s when there were strong tax incentives to do this type of thing," he says. "But a typical installation at that time (50 kW) cost between \$250,000 and \$300,000."

A lot has changed since then. "We have better manufacturing on the turbine side and we have the growing acceptance of distributed generation interconnection by electric utilities," says Zammataro.

"We now have standards being established by utilities to facilitate this type of distributed generation."

He says a typical installation would be a 50 kW unit operating at 70% capacity (in essence a 35 kW unit) costing \$55,000 to \$60,000 completely installed. He says the payback period is about two years in New England. The Connecticut utility commission has declared the process a Class 1 renewable technology, allowing it to bring an additional premium for the electricity it produces above the wholesale rate.

As with wind availability, excess pressure in PRVs ebbs and flows. Zammataro notes, however, that it is more predictable and controllable than wind. "The key thing is maintaining flow and pressure in an installation and targeting peak flows when electricity pricing is at the highest rate in a given 24/7 period. For example, at our pilot site, at the lowest point in the dead of winter, we have no less than 1 million gallons a day going through the turbine. But on a typical summer day, there will be as much as 4 million gallons going through the system, when electricity pricing is high."

Among the areas to be investigated during the pilot are the modifications to vaults needed to optimize the process, including sizing turbines to take maximum advantage of both high flow and low flow periods. "We have talked about designing the vaults where we can easily pull out a large unit in the winter and install a smaller unit that is much more energy efficient, then swap it back for the spring and summer time," says Zammataro.

There will be multiple installations in a given system with a typical potential for megawatts of power. "We believe there are between 20 and 40 potential installations in Aquarion's system that would amount to anywhere from 2 to 5 MW of energy recovery," he says. "Nationwide we believe there are 3,000 or more addressable sites just in water distribution. That includes inter-reservoir transfer points that might be flowing 75 million gallons per day during the spring and summer months. These larger installations are worth considering as part of an overall system-wide economic cost/benefit review since they would require a much bigger retrofit project and turbine." The addition of irrigation sites increases potential applications dramatically.

"Certainly, our focus will be on surface water systems located in fairly mountainous parts of the country. Worldwide we believe that number to be about 25,000 sites. In aggregate, there could be hundreds of megawatts of power by installing these systems. And we believe this is a conservative figure."

Zammataro believes the U.S. Department of Energy will be looking at micro-hydro applications in the 2005 timeline, replacing to some degree initiatives in large hydro projects. "We think this form of energy recovery will become more popular as a form of making clean energy and also stabilizing power situations in many areas," he says. Rentricity is exploring additional sites in Pennsylvania, New York and New Jersey.