A turbine is deployed in the Mississippi River in Louisiana to capture hydrokinetic energy. *Photo courtesy of Free Flow Power*

(*GUEST OPINION*)

Water Power Surge

RIVER HYDROKINETIC GENERATION // BY PAUL JACOBSON

PROTECTING WILDLIFE HABITAT and migratory fish has much to do with the amount of interest in rivers as hydrokinetic waterpower resources. The limited power-generating potential and the use of immature technologies might be seen as impediments, yet many companies are showing a desire to at least dip their toes in the river water.

The Electric Power Research Institute recently completed a mapping and assessment of hydrokinetic resources in rivers of the continental United States. The assessment, part of an effort by the U.S. Department of Energy to characterize U.S. hydrokinetic waterpower resources including river, wave, tidal, ocean thermal, and ocean current, found that these undeveloped river resources could provide 3 percent of the nation's annual use of electricity.

The assessment analyzed 71,398 river segments across the 48 contiguous states and additional river segments in Alaska. It yielded a total theoretical resource estimate of nearly 1,400 terawatt-hours per year for the continental United States, which is equivalent to approximately 25 percent of annual U.S. electricity consumption.

River hydrokinetic generation produces electricity from the flow of water in rivers without the use of man-made structures to impound or divert water flow, as is the case with conventional hydropower. River impoundment or diversion in addition to habitat alteration and impaired movement of migratory fish are important environmental concerns constraining development of conventional hydropower. With hydrokinetic projects, many of these environmental impacts are reduced or eliminated. These environmental advantages are big reasons behind the interest in generation with alternative, relatively immature hydrokinetic technologies.

To date, six firms hold 55 Federal Energy Regulatory Commission preliminary permits for inland river hydrokinetic projects. Free Flow Power holds 38 of these preliminary permits with a combined, proposed capacity of 4,200 megawatts. All but one of these proposed projects are on the Mississippi River.

Northland Power Mississippi River holds 12 preliminary permits on the Mississippi River with a combined, proposed capacity of 809 megawatts. The Issaquena County Board of Supervisors holds one preliminary permit for a proposed, 5-megawatt project on the Mississippi River in the state of Mississippi.

Ecosponsible holds two preliminary permits totaling 2.5 megawatts for projects on the Niagara River in New York. Current Connections has a preliminary permit for a 20-megawatt project on the St. Clair River in Michigan, and Ocean Renewable Power Company (ORPC) holds a preliminary permit for a 300-kilowatt project on the Tanana River in Alaska.

Free Flow Power has an additional 18 preliminary permits on the Mississippi River pending with FERC. These 18 pending preliminary permits comprise 1,682 megawatts of proposed capacity.

It should be noted that a preliminary permit is simply an exclusive, limited-term franchise to prepare a license application for a given site, but it does not authorize site development. In some cases, preliminary permits have been surrendered by applicants or cancelled by FERC for lack of progress toward license application.

ORPC holds the only power purchase agreement for any type of hydrokinetic project – wave, tidal or river – in the United States. That power purchase agreement is supplied by ORPC's tidal energy project in Cobscook Bay, Maine. ORPC is adapting its tidal technology for use at its proposed hydrokinetic project on the Tanana River.

Despite the environmental advantages, hydrokinetic projects face a challenging environmental review process. Environmental review of waterpower projects and stakeholder expectations evolved in the context of existing conventional hydropower. Existing, conventional hydropower facilities undergoing relicensing have a reliable revenue stream and a 30- to 50-year environmental track record to fund and inform environmental review. For hydrokinetic projects, funding and empirical information about environmental impacts are scarce because the technology does not have a long history of performance data upon which to draw and the projects are not yet operational. If hydrokinetic generation is to achieve commercial success, environmental review standards and funding for project development must be brought into alignment.

There also are technical, environmental and economic constraints to converting river hydrokinetic potential into electricity. How much electricity might ultimately be generated with hydrokinetic technologies in U.S. rivers is a question that remains to be sorted out. Technical constraints, such as minimum rotor diameters, river cross sections during low-flow conditions, and conversion efficiencies limit the portion of the total 1,400 terawatt-hours per year theoretical resource that can produce electricity. EPRI's assessment estimated that the technically recoverable resource in the continental United States is 120 terawatt-hours per year, which represents approximately 3 percent of annual national consumption. The results show that the Lower Mississippi region contributes almost half (47.9 percent) of the technically recoverable resource estimate, Alaska 17.1 percent, the Pacific Northwest region 9.2 percent, and the Ohio region 5.7 percent. Collectively, these four regions comprise 80 percent of the technically recoverable hydrokinetic resource in the continental United States.

Practical constraints, such as access to load and conflicts with existing river uses, further limit the portion of the theoretically available resource that would likely ever be tapped by a robust hydrokinetic generation industry so that the practical resource remains an unknown, perhaps small, portion of the technically recoverable resource estimate. EPRI did not attempt to estimate the practical resource, but overall, the assessment shows that river hydrokinetic generation could be an important renewable energy option for the United States.

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NewsFlash

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The University of Maine is competing with other institutions to develop laser technology to measure wind speeds over the ocean to help site offshore wind generation.

The Maine project relies on buoy-based technology, according to the *Bangor Daily News*.

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