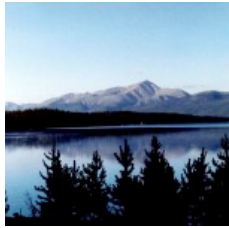


Water Surge

Hydropower, once shunned because of environmental concerns, is making a comeback



By STEPHANIE SIMON – LEADVILLE, Colo.—The giant pipes wheeze and rumble, the whoosh of water coursing through them as noisy as a freeway. The Mount Elbert hydropower plant high in the Rocky Mountains isn't much to look at—or listen to. But to true believers, it's a road map to a greener future.

Larissa Bender, Bureau of Reclamation

The Mount Elbert plant (center) in Colorado uses pumped storage to generate electricity. Using wind power or cheap electricity from the grid overnight, it pumps water from the lake in the foreground through underground pipes to the reservoir above the plant. At times of high demand, it runs the water back down through the plant and its turbines to make electricity. Hydropower, shunned just a few years ago as an environmental scourge, is experiencing a remarkable resurgence in the U.S. Dams are still viewed warily; in fact, Congress is considering dismantling four hydroelectric dams blamed for depleting salmon in the Klamath River basin in southern Oregon and northern California.

But engineers and entrepreneurs are pressing an alternative view of hydropower that doesn't involve new dams. They argue that plenty of efficient, economical energy can be wrung from other water [resources](#), including ocean waves, free-flowing rivers, irrigation ditches—even the effluent discharged from wastewater treatment facilities. There's a surge of interest, too, in adding small power plants to dams built years ago for flood control or navigation—as well as in turning reservoirs into battery packs of sorts, releasing energy when the grid needs it most.

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Globally, hydropower provides 16% of electricity, slightly more than nuclear power and closing in on natural gas, according to the London-based International Hydropower Association.

In the U.S., by contrast, hydropower now provides about 7% of electricity generation. All other renewable sources combined account for about 3%.

Even without building large dams, expanding efforts to draw power from water could add 40,000 megawatts to the grid by 2025, says the Electric Power Research Institute, a nonprofit research firm in Palo Alto, Calif. That's the equivalent of putting at least two dozen new nuclear power plants online.

Pouring It On

Such estimates are stirring action. The U.S. Department of Energy spent nothing on hydropower research as recently as 2007 but allocated \$50 million this year. The Federal Energy Regulatory Commission issued 50 preliminary permits for small hydro projects last year, up from 15 in 2007. At least two dozen states have mandated that utilities draw more power from renewable sources—and many include small hydropower as an option, along with wind and solar. Colorado Gov. Bill Ritter recently announced an agreement between his state and the federal government that will streamline the permitting process for developing small hydropower projects in Colorado.

The Department of Energy estimates a new hydro project in 2016 would generate power at a cost of \$120 per megawatt-hour. By contrast, the cost per megawatt-hour would be \$150 at a wind farm going online that year and

nearly \$400 at a photovoltaic solar array. (Those figures don't take into account various tax incentives meant to offset the cost of renewable energy, especially wind and solar.) Hydro also has technical advantages over other renewables. Daily water flow in many areas is far more predictable than wind or sunshine. It's relatively easy to store the energy pent up in water so it can be released when the grid needs it most. And certain types of hydro plants can rev up from low power to full capacity within seconds.

"There remains tremendous untapped potential in North America," says Don Erpenbeck, a vice president at MWH, a global hydropower construction and engineering firm in Broomfield, Colo. "After decades of delay, we are starting to realize that potential." But Mr. Erpenbeck adds that years-long waits for federal permits and high capital costs make hydropower a tough sell to some utilities and investors. Maximizing water energy in the U.S., he says, "is going to take some guts."

Countries such as Brazil and China remain committed to large hydroelectric dams and are forging ahead with big projects. Yet they are also looking at smaller solutions favored by environmentalists. The International Hydropower Association estimates that North America has developed nearly 70% of its available hydropower resources and Europe 75%. But the group sees huge potential in South America, Asia and especially Africa, where just 7% of resources have been developed.

Dam Smart

In the U.S., one strategy gaining popularity is to add power plants to some of the 80,000 existing dams that don't have hydroelectric capacity. Technological advances like turbines that are gentler on fish and oxygen-injection systems that help balance aquatic ecosystems have won favor even among some environmental groups. In one such project, American Municipal Power Inc. is spending \$2 billion to add power plants to three dams on the Ohio River and invest in additional hydropower elsewhere. The utility's CEO, Marc Gerken, says the new hydropower will cost more initially than coal or natural gas. But after the construction costs are paid off in 30 years, the utility will enjoy cheap power for several decades because the fuel—the rushing river—is essentially free and the plant is designed to run without much maintenance for 60 or 70 years. AMP, based in Columbus, Ohio, is a nonprofit corporation owned and operated by municipal utilities in the six states the company serves.

Other technologies are more speculative. A much-ballyhooed experiment that involved suspending a turbine from a barge in the Mississippi River didn't prove to be worth expanding. The turbine is generating power, but Hydro Green Energy LLC, the Houston-based start-up that developed the device, says it has moved on to more promising ventures. "It's still a power-producing, money-making device," but the economics don't support expansion, says Vice President Mark Stover. Several companies are experimenting with "low-head" turbines that can pull energy from relatively small volumes of water dropping as little as five feet over natural or man-made falls. One such project, launched by Natel Energy Inc. of Alameda, Calif., uses low-head technology to extract energy from an Arizona irrigation canal. Federal scientists say some of these approaches look promising but need more study. "With these new technologies, nobody knows what their environmental impacts might be," says Doug Hall, who manages the water-energy program at the Department of Energy's Idaho National Laboratory.

Pump Action

A less-experimental technology, dating back more than a century, is also gaining currency as a means to store energy and back up the grid: pumped storage, the system used by the Mount Elbert hydro plant outside Denver. The plant, sitting on the jewel-like Twin Lakes and managed by the Bureau of Reclamation, plays a key role in keeping lights on and air conditioners humming across the West.

At night, when demand on the power grid is low, the Mount Elbert plant sucks water from the lakes, sometimes using wind power to pump that water up into a reservoir above the plant. The reservoir acts as a liquid battery—a huge pool of potential energy. As the day warms up and the grid shows signs of strain, workers begin to release the water down a 470-foot drop, through devices that turn the pent-up energy into usable electricity. The water eventually pours back into the lakes, where it can be recycled into power again the next evening. Pumped storage is quite popular abroad; China has 2,200 projects under construction, and India and Ukraine aren't far behind. An

analysis by MWH shows that countries as varied as Romania, Thailand, Switzerland, South Africa and Italy are also moving heavily into pumped-storage construction. The U.S. has lagged, but federal authorities saw a surge in permit applications in 2008 and again so far this year.

“No new dams are being built,” says Dave Sabo, a senior adviser with the Bureau of Reclamation. But just about every other approach to hydropower, he says, is being studied and tested intensively. Says Mr. Sabo, “All this stuff is in play right now—pretty heavily.” Ms. Simon is a staff reporter in The Wall Street Journal’s Dallas bureau. She can be reached at stephanie.simon@wsj.com.