THE BIG WET BATTERY

A new energy project along Highway 294 near tiny Martinsdale could help fill the gaps in Montana's grid without boosting emissions

BY EVE BYRON

PHOTOGRAPHY BY THOMAS LEE

WHEN TALKING ABOUT A CLEAN ENERGY REVOLUTION THAT might take root on a grass-covered butte in the middle of Montana, Carl Borgquist bounces like an electron between the conference table and a whiteboard in his office at Absaroka Energy in Bozeman.

With the focus of a U.S. Navy judge advocate (a prior profession) and the meticulous calculations of an estate planner (another former occupation), Borgquist diagrams how the proposed "Gordon Butte Closed Loop Pumped Storage Hydro Facility" near Martinsdale will help fill gaps in the energy grid. After percolating for seven years, the project finally received its 50-year license in December from the Federal Energy Regulatory Commission (FERC)—a huge step that allows Absaroka to build and operate the facility.

The closed hydro loop seems complicated, yet is deceptively simple. It's basically a big battery, but one that stores energy in the form of water. Making it work requires the building and filling of two reservoirs—one atop Gordon Butte, about 1,025 feet above the second reservoir. Between the two ponds stretches a buried concrete and steel-lined hydraulic tunnel, called a penstock, which has a buried powerhouse at its base. Inside the powerhouse are hydroelectric turbines, which power a generator.

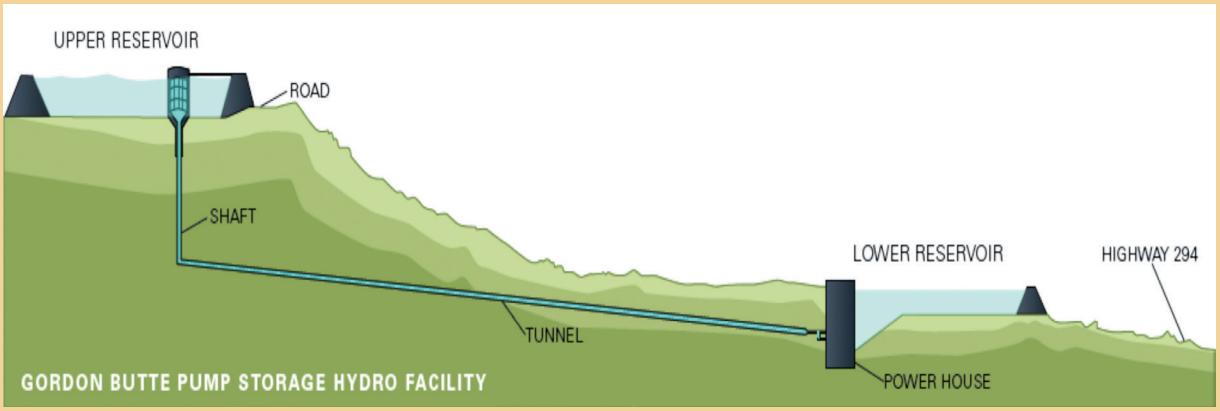
When the grid needs juice, gravity pulls water from the upper reservoir to the powerhouse, which generates electricity, then discharges the water into the lower reservoir. When the grid has ample electricity, and the price of it drops, water is pumped back to the upper reservoir, storing energy for later.

"Pump storage is recognized around the world as the cheapest and most reliable integration tool out there," Borgquist says. But it won't work just anywhere. "For an economically feasible site, we need the upper and a lower reservoir to sit relatively close to one another, because the penstock that connects them is very expensive to build."

The boyish 54-year-old, clad in Carhartts and a brown sweater, turns to a laptop on the conference table, pulls up a graphic that shows peaks and valleys of energy use in 24-hour increments, and then reverts to the whiteboard and resumes drawing, outlining how Gordon Butte can respond to those peaks and valleys.

At Gordon Butte, managers anticipate generating electricity during the day, when demand is higher, as is the cost of electricity. They'll do most of the refilling of the upper reservoir at night, buying energy for the pumps when there's less demand for energy and electricity is cheaper.

How the closed hyro loop would work



An artist's rendering at top shows the two reservoirs in relation to each other. The pools of water are connected by a penstock, and turbines power a generator. Gravity pulls water down to the lower reservoir when the electrical grid needs energy. At times of low usage, water can be stored above, where the reservoir essentially acts as a battery. Unlike wind and solar energy, which have gaps, the hydro loop can be responsive to demand, whatever the weather.

SOURCE: Absaroka Energy

"At about 2200 hours (10 p.m.) everybody is going to bed and we don't need the same amount of generation," he says. "Though we can respond instantly to requirements in the grid, at night we will bias the operation toward storing energy. At 0600 hours (6 a.m.) when everyone turns on their lights, makes their coffee, we will shift and mostly run the operation on the energy generation side."

Part of the draw of the system is that it's sensitive enough to respond rapidly to other energy-generating operations. If the water is flowing down through the penstock, but the wind picks up and there's no need for the hydro-generated electricity, the facility can leave the water in the upper reservoir—in essence, storing the energy. Borgquist said the plant can switch in seconds between generating energy and storing it.

Wind and solar are popular alternative, non-consumptive electricity-generating sources; but sometimes the wind doesn't blow and the sun doesn't shine, which causes gaps in electricity generation. A closed-loop hydro plant can fill in the gaps between high demand and low supply. That's "the holy grail" for energy development, notes Anne Hedges with the Montana Environmental Information Center. And because it's gravity-fed, it creates no emissions.

She is thrilled to hear that FERC issued the permit, and said that while nothing is perfect, "Ultimately, we'll have many more problems if we can't get ahead of carbon pollution. This is larger than Colstrip Unit 1. It's a big facility that can turn on a dime during the peaks and valleys of energy production. We're really excited about it."

The four Colstrip units are coal-fired electricity generators owned primarily by Puget Sound Energy in Bellevue, Washington. As part of a legal agreement, Puget Sound will close Colstrip units 1 and 2 by 2022. Combined, units 1 and 2 generate about 600 megawatts of electricity; a single megawatt of electricity can power about 1,000 homes. In comparison, the Gordon Butte project would generate about 400 megawatts, which could power an estimated 400,000 homes.

Absaroka Energy will lease property on the Galt family's 71 Ranch near the north end of the Crazy Mountains in Meagher County for the project. Borgquist became interested in renewable energy after helping Errol Galt

Carl Borgquist stands near power lines that connect the coal plants in Colstrip with power grids in the Pacific Northwest. Borgquist is spearheading a project to help the companies regulate power flow.

One of the drawbacks of wind power, generated by turbine farms like this one, is the gaps in availability when the wind isn't blowing. The Martinsdale project would help moderate that.

PHOTO COURTESY OF ABSAROKA ENERGY

Tiny Martinsdale (population: 64, as of 2010) has seen more prosperous days. It can't supply the 350 or so workers needed to construct the Gordon Butte project, so Absaroka Energy anticipates busing workers in from larger communities.

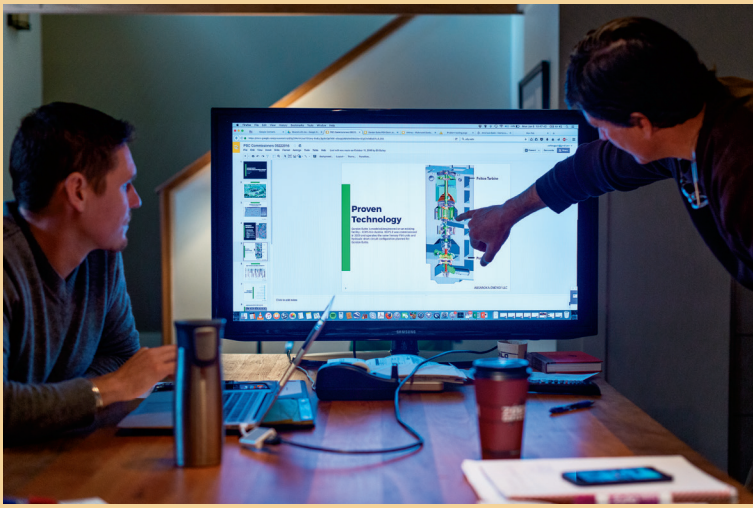
with his six-turbine wind farm and realizing the ranch was an ideal site geographically: it had a water source from Cottonwood Creek, and it's only 5½ miles north of a 500-kilovolt transmission line that is a major link between Colstrip and West Coast customers.

Yet like every big dream—this could be the largest capital works project in Montana in decades—it has hurdles to overcome. Perhaps the largest is the estimated $900 million to $950 million construction cost. The funds could be generated either by selling the project to another entity before it's built, now that it's permitted, or signing contracts for the electrical capacity up front to cover the construction costs. "It's about offering a very capable, cost-effective tool to the Northwest regional utilities that have responsibilities to keep the grid healthy," Borgquist said.

Puget Sound Energy previously said it would look at viable alternatives to Colstrip that include wind, natural gas or solar power, but didn't mention hydropower. Another potential power purchaser closer to home is Northwestern Energy, Montana's largest supplier and a company that already owns and operates a range of wind, hydro, natural gas and coal-fired facilities, producing electricity for more than 421,000 customers every day. Historically, Northwestern has been cool toward Gordon Butte; in its 2015 electricity procurement plan, Northwestern concluded that building additional natural gas-fired generation plants had the lowest cost and the least risk for addressing future capacity and flexibility needs. Yet Northwestern may be warming up to the Gordon Butte project.

"What we need is a cost-effective, flexible source of energy that we can depend on to be available when we need it to maintain reliability

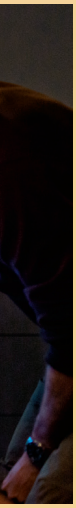
Project quick facts



during those times that aren't considered normal, such as extended extreme hot or cold spells," said Claudia Rapkoch, a Northwestern spokesperson. "We recently issued a request for proposals for this type of resource and it's not limited to any particular type of generation, so it would be a way for this project to be formally evaluated under our resource planning guidelines for sustained capacity."

Montana Fish, Wildlife and Parks voiced concerns early on that the project would harm the Cottonwood Creek fishery, which already is dewatered at times when irrigators pull water from the stream. But Clint Smith, a fisheries biologist with FWP, said the agency is comfortable with Absaroka Energy's proposal to take water from the stream to fill the reservoirs only when it's available. About 4,000 acre-feet needs to be diverted from the creek, but the Gordon Butte project will need up to two years to complete the fill. Their plan calls for taking 50 cubic feet per second (cfs) for about 40 days during the peak water flows in the spring, before irrigation starts. Once the initial reservoir is full, Gordon Butte anticipates losing about 500 acre-feet annually to evaporation or seepage, which will take about five days of continuously diverting 50 cfs to refill the reservoirs.

"We call [Cottonwood Creek] a losing stream [it loses water as it flows downstream] so when the project was proposed we thought the water potentially wasn't available," Smith said.



- Gordon Butte will produce 400 megawatts of energy for up to 8.5 hours at full capacity, taking 10 hours to fully recharge. One megawatt can provide energy for about 1,000 homes.
- Each reservoir will measure about 4,000 feet by 1,000 feet, with depths between 50 and 75 feet. The reservoirs can store 4,070 acre feet of water each.
- About 350 construction workers will construct the facility during a three-year period. Afterward, the project will employ about 20 to 24 people.

At left, Eli Bailey and Carl Borgquist explain the Gordon Butte closed hydro loop project at the Absaroka Energy offices in Bozeman. The cost of the project is estimated at $900 million to $950 million.

"It's about offering a very capable, cost-effective tool to the Northwest regional utilities that have responsibilities to keep the grid healthy."

"Then they went through the water rights process and we're comfortable with this now. The stipulation is, should water flows not be available to go to the Gordon Butte project, they have to turn off their ditch."

Since Martindale's population was listed as 64 residents in the 2010 census, finding the estimated 350 employees for the three-year construction project also was an issue early on. Borgquist doesn't anticipate building temporary man camps or other housing; instead, he expects the company will bus in the workers each day from larger communities.

The project is endorsed by Montana U.S. senators Jon Tester and Steve Daines as well as Governor Steve Bullock, who said it represents Montana taking a leadership role in defining the nation's energy future. "This state-of-the-art facility provides an incredible opportunity to preserve our natural legacy while creating jobs where they are needed most," Bullock said.