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Energy and water transitions in Colorado and beyond

January 15, 2020 Issue No. 27

<https://mountaintownnews.net>

Pumped-storage hydro plan for Yampa Valley filed with fed agency

by Allen Best

Conceptual work has begun on a pumped-storage hydro project along the Yampa River five miles east of Craig. The project was conceived to provide electricity to assist Colorado utilities in balancing the intermittency of wind and solar generation as they advance toward 100% renewable portfolios during the coming decade.

In pumped-storage hydro, water is released from a higher reservoir to produce electricity when needed most. The water in the lower reservoir is then pumped uphill to the higher reservoir when electricity has become more readily available.

Colorado has two existing pumped-storage hydro projects. [Cabin Creek Generating Station](#), between Georgetown and Guanella Pass, harnesses a 1,200-foot vertical drop to produce up to 324 megawatts of electricity. Completed in 1967 and operated by Xcel Energy, it serves as effectively a giant battery with a four-hour

life, the same as a humongous bank of Tesla batteries.

Near Leadville, at Twin Lakes, the Mt. Elbert pumped storage hydro plant can produce up to 200 megawatts. Operated by the U.S. Bureau of Reclamation, that pumped-storage hydro was completed in 1981.

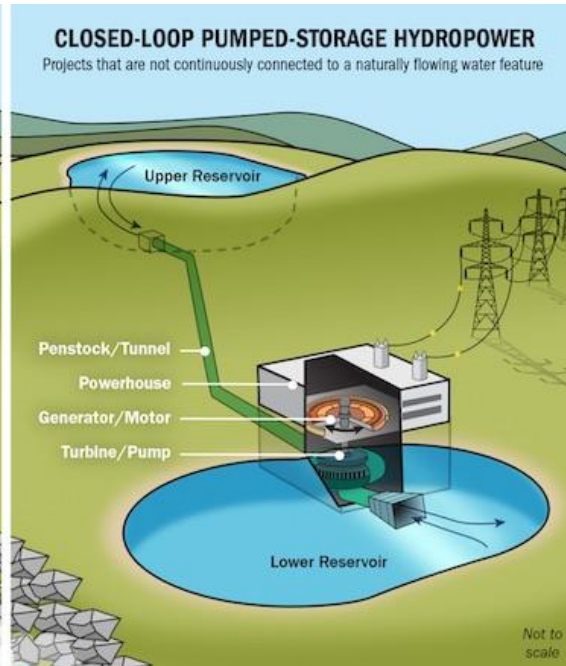
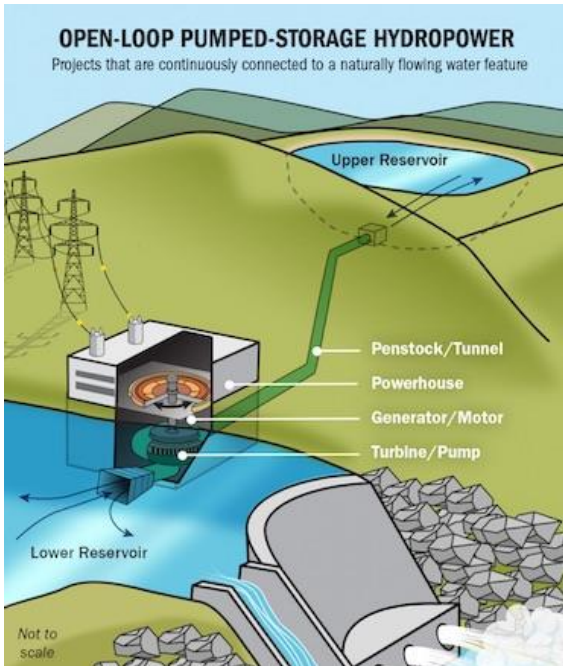
Near Craig, the project—it's really no more than an idea—would use three turbines to produce 600 megawatts, nearly as much as Colorado's largest coal-fired power plant. The idea submitted to the

Company hopes to use transmission from Craig and Hayden to help integrate renewable generation in Colorado

Federal Energy Regulatory Commission on Aug. 20 calls for two relatively small reservoirs of storage capacity of 4,800 acre-feet each connected via a tunnel and conduit, with a total drop of 1,450 vertical feet. This compares with a 1,200 drop at Cabin Creek.

The lower reservoir would not be on the Yampa River, nor would it require a constant infusion of water. Rather, it operates in a closed loop. Only water lost to evaporation would have to be replaced. In an open loop hydro system, water is drawn directly from a river to be pumped uphill.

Matthew Shapiro, the applicant, says the preliminary permit awarded by FERC in



November for the Craig-Hayden project is best described as a placeholder for a future license application. He hopes to begin producing electricity toward the end of this decade, just as several utilities in Colorado aim to achieve 100% renewable generation. [See Nov. 24 notice in the Federal Register.](#)

Creating pumped-storage hydro, he says, requires considerable patience but also capital. One project in Wyoming that Shapiro's company proposes has an estimated cost of \$1.8 billion.

The United States has not had a new pumped-storage project since 1993. The Craig-Hayden project is the only FERC filing for Colorado.

Despite its jumbled geography and abundant water, the Centennial State actually is a difficult place for new pumped hydro projects, says Shapiro. The right kind of topography, with enough vertical drop over a short distance but not too much is needed, but also proximity to transmission and low environmental sensitivity.

"It's a significant challenge. Finding the combination of factors is not easy," Shapiro says. "But that is what a good pumped-

storage developer does during the site-screening process."

The Craig site checks all the boxes. Private land is easier to develop than public land, says Shapiro, and it has that. Transmission lines export the electricity in three directions and to several states, but especially to east of the Continental Divide in Colorado. The Hayden and Craig coal-fired stations together have 1,724 megawatts of generating capacity, the most of any area of Colorado.

Water is also needed. The two coal-burning stations together own 15,000 acre-feet from the Yampa River, far more than the 5,000 acre-feet needed for this project. The plants will close between 2025 and 2030.

Finally, a pumped-storage hydro project needs customers. Shapiro reports seeing a promising market within Colorado. Two utilities—Platte River Power Authority, a co-owner of the Craig plant, and Holy Cross Energy—both have adopted goals of 100% renewables by 2030. Xcel Energy, the primary owner of the Hayden units and a part owner at Craig, has a 100% emissions-free goal for 2050.

All analyses of attaining high levels of renewables in electricity supplies have focused on three crucial pillars:

One, demand needs to be recontoured to better take advantage of when renewables are abundant, such as linking warming of hot water to times of abundant electricity.

Second, energy supplies in Colorado need to be better connected with a broader geographic area, either to the west or possibly to the Great Plains and conceivably in both directions, thus allowing greater ability to take advantage of renewable energy. The sun might not be shining everywhere, but the wind is always blowing somewhere. There is actually some predictability to this, if you get large enough terrain.

And third, there needs to be storage. The Craig-Hayden idea envisions six-hour storage, compared to the four-hour value of lithium-ion batteries. So-called green hydrogen, which uses renewable electricity to create hydrogen from water, can deliver 50 to 100 hours of storage, but the technology and economics lag. “I think there is going to be a mix, particularly over the next 20 to 30 years before I think green hydrogen really matures,” says Shapiro. “We will see a mix of storage types. I don’t think we are going to do 100% renewable energy without additional advanced energy storage technology.”

Utilities have been closely watching developments. Duane Highley, chief executive of Tri-State Generation and Transmission, operator of the three units at Craig, said on an October webinar that his

utility sees no need to make decisions about energy storage until 2024 and does not actually need it until 2029-2030. The three units at Craig will be shut down between 2025 and 2030. The two Hayden units operated by Xcel are to be shut down in 2027 and 2028.

A 2019 report by Synapse Energy Economics that was commissioned by the Colorado Energy Office spoke to the need for advanced energy storage as Colorado decarbonizes its electricity.

Storage can provide frequency regulation, voltage support, energy arbitrage and deferral of transmission and distribution infrastructure investment,” says the report, [“The Future of Energy Storage in Colorado: Opportunities, Barriers, Analysis, and Policy Recommendations.”](#)

“Although pumped hydro is currently the most prevalent type of energy storage in the United States, traditional battery storage technologies (primarily lithium-ion) have experienced rapid market growth within the last few years. As costs continue to decline in the coming decade, flow batteries are also expected to become common in large-scale storage applications.”

Pumped-storage hydro does not figure prominently in the analysis by Synapse. However, the consultant did find need for public policy that serves to encourage the market for storage in Colorado.

“Though lithium-ion battery costs are projected to decline in the coming years, there is debate about whether they are expected to become cost-competitive with

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traditional generators prior to the late 2020s without supportive policy mechanisms.”

In removing two coal-burning units at the Comanche station near Pueblo, Xcel Energy is adding 275 megawatts of battery energy storage. On a vastly different scale, United Power began using a 4-megawatt battery storage in late 2018.

In viewing the Craig project, Shapiro hopes to time completion to the closure of the coal plants. These projects require patience.

Shapiro already has already demonstrated great patience. In a life with many twists and turns since his upbringing in the New York City borough of Brooklyn, Shapiro by 1991 was on the Blackfeet Indian Reservation in Montana. In a paper titled [E Pluribus Unum](#), Shapiro describes himself as a “creator, an entrepreneur, a public philosopher, a conscious citizen, a writer, and a father.”

In that paper, he says he was motivated to help the Blackfeet and, in that outlook, he began to wonder whether the steady winds of the Montana reservation could be harnessed to benefit the tribe. He quickly grasped the limits of renewable generation.

“Upon my return to New York, I immersed myself in the study of energy storage as a means of helping wind energy compete with conventional energy resources,” he explained. There were then 40 pumped-storage hydro projects in the United States among well more than 100 around the world.

Since then, in 1993, just one additional project pumped-storage hydro has been built in the United States. Many gas-fired plants were built, however, to address the need for peaking power.

About 2009, though, Shapiro noticed a shift.

“Renewable energy was surging, the interest in storage was starting to pick up, and more and more utilities were mentioning pump-storage in their resource

plans,” he explained in a telephone interview. “So partners and I formed GridFlex to identify the best new sites in the country.”

His partners now include David Gillespie, who served a stint with Duke Energy as vice president of business development, and John Spilman, the general counsel, who has provided services to Vestas Americas, among others. Shapiro is the chief executive.

Utilities have shown much greater interest in the last two years after solar prices tumbled and, in response to consumers, many embraced 100% carbon-free goals. But the time was not lost. “We spent a lot of those years honing our knowledge about how to make the business case,” he said in a recent phone interview. “And we built relationships with equipment vendors and environmental consulting firms and others needed to move ideas into projects.”

Shapiro’s company, [Gridflex](#), now in partnership with another company called [rPlus Energies](#), a developer of utility-scale wind and solar, has filed with the FERC for seven sites: two in Nevada and one each in California, Colorado, New Mexico, Oregon, Washington and Wyoming.

Most, like the Craig site, are placeholders in the FERC process. Two, in Wyoming and Nevada, have moved to a second step with FERC, the pre-application stage.

In Wyoming, Shapiro last summer outlined a plan to use Seminoe Reservoir in conjunction with a new reservoir on federal Bureau of Land Management property for a capacity of 700 megawatts, somewhat larger than the Craig-Hayden proposal. The Rawlins

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Times reported that officials in Carbon County declined to endorse the project but were OK with the application with FERC proceeding. Cost of that project has been estimated at \$1.8 billion

In Nevada, progress came earlier with the White Pine project getting press attention in Ely in 2014. But it has moved little further along than the Colorado project.

In Arizona, other developers have several proposals for even larger pumped-storage hydro projects. One using water from Lake Powell proposes to use the transmission built for the Navajo Power plant now being demolished. It has a price tag of \$3.6 billion.

About the Craig-Hayden site, Shapiro declined to identify whether his company has agreements with landowners and other specific elements of what will be needed. He said he has begun outreach to utilities.

Holy Cross Energy might be one such utility. Its service territory includes Vail and Aspen but also Rifle, which is within 100 miles of the pumped-storage hydro, connected by a major transmission line. In its resource plan posted in 2020, Holy Cross specifically mentioned pumped-storage hydro as one option for being able to attain its goal of 100% renewable generation by 2030.

Jonah Levine, who wrote a master's thesis about pumped-storage hydro in 2007, now works in the realm of biomass for Louisville, Colo.-based [Lignetics](#).

"The evolving story is not of wind vs. biomass or even traditional resources vs. renewables," he says. "The real question is how do we deploy these things together in the most efficient and effective ways? I don't see that story enough. What is the best utilization of the resources to our society?"

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Denver's Alliance Center now linked with electric car batteries

At Denver's Alliance Center, it will soon now possible to keep the lights on by tapping the battery of an electric car.

A bi-directional charger will be set up before the end of March in the small parking lot outside the 40,000-square-foot building, a red-brick structure originally built in 1908 and retrofitted with modern sustainability standards.

Boulder recently set up a Fermata bi-charger outside its North Broadway Recreation Center. In an experiment, the city wanted to figure out how much it could use the electricity from the car battery instead of the electricity delivered by Xcel. This matters during times of peak use, such as in late afternoon, when [rates spike, reflecting increased demand. See story posted Dec. 8.](#)

Because peak demands can still be met with electricity generated by natural gas peaker plants, there is a climate change component, too. Shaving the peak of demand reduces reliance on fossil fuels.

The Alliance Center is now home to many of Colorado's conservation organizations. The Fermata Energy V2B System allows the building to draw on the energy of the car battery when it's useful to do so, and the building's electricity can in turn charge the car battery.



Gunnison County Electric at 1% local generation but aiming to get to 7%

CRESTED BUTTE, Colo. – At least in part, it took a Swedish lass crossing the Atlantic Ocean to move the needle in Crested Butte.

In 2008, Crested Butte adopted a resolution affirming climate change action. And then it did essentially nothing. It wasn't for lack of good intentions. But there was no plan, no clear idea of how to move forward. Crested Butte was not alone in this fumbling.

Change is happening now. Some of that is in transportation. The town has two electric motorcycles for use by municipal employees and is getting an electric SUV for police use. It will be a Tesla. If electrification of medium-and heavy-duty vehicles lags, the town intends to get an electric dump truck, when they become available.

Electricity for these vehicles is getting cleaned up, too. Crested Butte gets electricity from Gunnison County Electric, a co-operative that is among 42 that together compose Tri-State Generation & Transmission.

Taylor Park Reservoir lies 36 miles from Crested Butte and the same distance to Gunnison.

Tri-State will close three of the big coal-burning units in Colorado from 2025 to 2030. It has agreed more broadly to reduce carbon emissions in the electricity it delivers within Colorado 80% by 2030 as compared to 2005 levels. This will require the wholesale provider to crimp the carbon it imports into Colorado from coal plants in Wyoming and Arizona.

In addition, Tri-State has loosened restrictions on how much Gunnison County and other member co-ops can generate. The original policy allowed a maximum of 5% local generation. Gunnison County even now is well below 1%. A new policy adopted in late 2019 allows member co-ops to achieve up to 2% or two megawatts of generation, whichever is less. For Gunnison County, that's 2%. That gives the co-op a maximum of 7%.

In December, Gunnison County Electric completed a 101-kilowatt community solar array on the shop building at the headquarters near Gunnison.

Next comes a solar farm—if the details get worked out—on the edge of Crested Butte. The town is providing three or four acres and has agreed conceptually to the idea of purchasing the renewable energy attributes from the solar installation, enough for the 20 buildings and other pieces of infrastructure that the municipality owns. This includes the town hall, of course, but by far the largest is the wastewater treatment plant. The town will be paying a premium of \$20,000 annually.

Key to the town's commitment, says Crested Butte Mayor Jim Schmidt, is the understanding of "additionality." There will be clear evidence that the money being spent has produced something tangible. It's at home, not a wind farm in Iowa or a solar farm in Arizona.

This is very different from the philosophy of Vail Resorts, now the owner and operator of the Crested Butte Ski Area, which happens to be the largest consumer of electricity in the Gunnison Valley. It famously sealed a pact on a wind farm being completed in eastern Nebraska that produces enough electricity, on a net basis, for all of the ski and resort company's many operations across the country. It doesn't actually get the electricity, but it does get the renewable attributes. See 2015 story, [The murkiness of voluntary RECs.](#)

The Crested Butte site is imperfect. But all sites in the Gunnison-Crested Butte area fell short. This particular site has more serious snow-loading and it gets in the shadows earlier in the afternoon than other locations. Other sites, however, had other problems, including infringement into habitat of the Gunnison sage grouse, an endangered species.

Gunnison County Electric will also add to its local generation as the result of the addition of a turbine at Taylor Park Dam. The dam is located in the western folds of the Sawatch Range near Crested Butte.

The idea of harnessing the power of falling water has been talked about for at least 20 years. Many dams have been so retrofitted in recent years: Pueblo, Granby, and Ridgway, among others. See 2015 story, [Putting the electric harness on old dams](#)

The Montrose-based Uncompahgre Valley Waters Users Association will take the lead on filing with the U.S. Bureau of Reclamation for installation of an electric turbine on the dam. The plan is to be able to realize 200 kilowatts of production. A maximum of 3 megawatts would be possible, but that would require new transmission.

The power from the dam will provide steady baseload generation. Those involved, including Gunnison County Electric, hope to get the project finished in 2022.

Why now for these projects? Mike McBride, chief executive of the co-op, calls it an alignment of the stars. "We've wanted to do it for many years.

Crucial to the solar project at Crested Butte, in particular, was the community desire and support for reduction of greenhouse gas emissions. There have been various community goals set and engagement, not only by local governments, but also individual citizens.

"There's a story here, how much difference individuals and communities can make when they're willing to step up and make it happen."

The Taylor Park project again was a matter of time, gaining agreement among partners that it was worth pursuing. But again, he sees a desire for local generation being part of that underlying support.

In Crested Butte, Schmidt points to the power of an individual far removed in motivating local people. He says the powerful message delivered two years ago to the United Nations by the Swedish girl, Greta Thunberg. That, he says, was the turning point.

Ackermann: government regulation has a legitimate and noble public purpose

DENVER – In bidding farewell to the Colorado Public Utilities Commission last week, Jeff Ackermann heard kind words and then spoke from the heart.

Regulation should not be viewed as a bad word, he said. It's good work, necessary work, and at times very taxing work, and it is on behalf of the public.

Ackermann had chaired the 3-member PUC since 2017 but was not reappointed by Gov. Jared Polis.



Jeff Ackermann

Meghan Gilman, the newest commissioner, said that she had not actually met Ackermann in person since she became a commissioner last March. John Gavin, who lives outside Paonia, introduced his cat, Tulip, who he said had been wanting to join their weekly meetings since March.

Bryan Hannegan, the chief executive of Holy Cross Energy, offered words of commendation from what he called "co-op nation." He called out Ackermann's role in advancing work on distribution network planning, a wonkish but ultimately very important piece of creating the grid of the future. "I think that is a great foundation for the future of our state," he said.

Ackermann said he gained a much deeper appreciation of the work of a PUC chairman in the last four years, but also

offered a message to PUC staff members who were never answerable directly to the PUC commissioners but nonetheless have a role in regulating public utilities from railroads to telecoms to electrical and gas utilities. Their work, he wanted them to know, was honorable. They were doing the bidding of the public.

Ackermann described it as a sense of calling, this work of regulation. It offers neither great financial compensation nor high prestige, but it is of public benefit.

Not all see it that way. He pointed to a trajectory that began in 1986 when President Ronald Reagan famously said he believed the nine most terrifying words in the English language are: "I'm from the government, and I'm here to help."

That has led to the framing of the idea that "government is the enemy of the public, and regulation is the worst part of government," said Ackermann. "This has led to a time in which it "can be difficult to one's political ambitions to acknowledge regulation."

The issues of water, clean air, and electrical generation are so complex that it's impossible for any one person to bring the expertise to the table necessary to bear witness for the public benefit. "We need to remember that regulation has a legitimate and I would say noble purpose."

Even as Ackermann spoke on Jan. 6, a mob had gathered outside the Capitol in Washington D.C. and had begun to invade the building itself, many bent on destruction. Soon, a police officer was being killed, a lectern was being carted off, and self-congratulatory selfies were being taken.

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Why efficiency has become a big part of energy in Colorado during 21st century

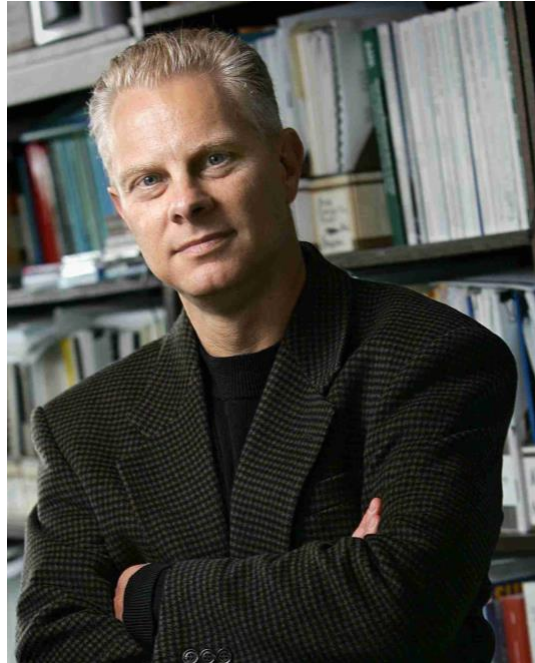
by Allen Best

Howard Geller would never be found marching to close a coal-fired coal plant. He's an activist with a carefully defined mission, but street protest is not his style. To see his handiwork you must dive deep into the filings of state utility commissions, go to legislative hearings, perhaps follow around a few of his 7 employees in Colorado and 6 in other states where the Southwest Energy Efficiency Project operates to understand how Geller has shaped the energy pivot of the last 20 years.

Two decades after he moved to Colorado and founded SWEPP, Geller is moving on into the world of consulting, leaving his office and position as executive director to Elise Jones, who will simultaneously end her second of two terms as a commissioner in Boulder County. "Twenty years is about the right amount of time," he said last Friday.

In 2001, when Geller moved from Washington D.C. to Boulder, utilities in Colorado and other southwestern states devoted little effort to energy efficiency. Major electrical utilities in the Southwestern states then spent \$20 million to help their customers save energy and reduce their bills. Today, the amount has increased almost 20-fold. Those same utilities in recent years have been spending \$350 million to \$400 million to promote energy efficiency.

"Comprehensive energy efficiency programs are now standard for utilities," he says. The utilities "realize their customers like these programs. They realize that saving energy is the least costly way of providing



energy, of saving kilowatt-hours. It's a cost-effective resource," he says, a line he has likely used thousands of times in the last 40 years.

In 1981, Geller had moved to Washington D.C. hoping to land a job with an environmental organization. He had a new master's degree from Princeton in mechanical engineering, and his master's advisor alerted him to a new organization called American Council for Energy Efficiency Economy that had funding for a Washington office. Would Geller like to be that first employee? "That sounded great," he remembers.

This was the first year of the presidency of Ronald Reagan, who famously had the solar panels installed by the prior White House occupant removed. But in 1987, Reagan signed into law the National Appliance Energy Conservation Act. The law significantly elevated the federal presence in ensuring uniformity of minimum levels of refrigerators, clothes dryers, and other household appliances.

Geller had a role in shaping the law. In a 1996 paper published in a journal called [Energy and Buildings](#), he said the regulations

were projected to displace the need for 31 large (500 megawatt) baseload power plants by 2000. Today, Geller calls it the most important legislation yet in advancing energy efficiency other than the adoption of the so-called [CAFE](#) (Corporate Average Fuel Economy) efficiency standards for automobiles in 1975 and updated several times then.

A self-described workaholic, Geller in 2001 was tiring of Washington and wanted an improved quality of life for himself and his young family. Looking across the nation, he saw the Southwest as lagging. Abundant low-sulfur coal yielded relatively cheap electricity. Saving energy had seemed less imperative. And there was also the 20th century mindset that the way to prosperity was through production, not efficiency.

With the help and funding sources of Law and Water Fund of the Rockies, now called Western Resource Advocates, and that organization's Bruce Driver and John Nielson, he started SWEEP. Boulder was, and is, the headquarters.

From the start, SWEEP has differed from other major environmental organizations in its narrow focus on energy efficiency. SWEEP makes the argument to both utilities and state regulators that energy efficiency can work for both the customers and the utility. Xcel Energy, an investor-owned utility, can recover the money invested in these programs through rates on customers, just as it would if building a new power plant. Customers still get lower bills. "We have made energy efficiency a win-win for customers and utilities," says Geller.

"Xcel is now spending more than \$100 million a year saving customers electricity and natural gas with programs for low-income households, other households, small businesses, larger businesses and very large

businesses," he says. "There are programs for every customer."

Colorado, he reports, has moved up to 11th place among the states in the annual ranking by American Council for Energy Efficiency Economy. Nevada was the most improved in that 2020 ranking and New Mexico has moved up a lot. He credits Salt River Project, the utility serving the Phoenix area and a part-owner of coal-fired power

plants in northwestern Colorado, with being an outstanding utility.

"It's not a good idea to waste energy, whether it's fossil-based energy or renewables," he says.

Like Amory Lovins, who co-founded the Rocky Mountain Institute in 1983, the career of Geller was strongly influenced by the Arab oil embargo of 1973. The scarcity of oil produced new attention to energy ecosystems, the links between energy and the environment, and the alternatives.

Then an undergraduate student at Clarke University, a liberal-arts institution in Worcester, Mass., Geller co-majored in physics and what is now called environmental studies. Then, for his master's thesis at Princeton, he modeled community energy systems, looking at technical performance as well as their environmental and economic performances.

Geller has a global outlook. He spent 16 months in India after receiving his master's degree in what he describes as his personal Peace Corp-type experience, working with a very inspiring individual on technologies for rural areas. A few years later, he was given a fellowship in Brazil. Learning Portuguese, he earned a doctorate in energy policy from the University of Sao Paulo while helping start Brazil's National Electricity Conservation Program.

While in Brazil, Geller met a woman who became his wife. In choosing to relocate to Boulder, activities such as snowboarding and

track and the quality of education available at the Boulder High School contributed to their choice.

Reviewing his career, Geller admits to occasional discouragement but insists that he generally remains optimistic. “We have made a lot of progress,” he says. He cites the 130 laws that SWEEP has helped pass in Southwestern states.

“Clearly the politics matter. We have opportunities at times, and lack of opportunities at other times, depending upon the political environment. The Trump administration has been a disaster for the clean energy transition, but we need to make up for that during the next few years. Colorado was a backward state (when I got here) but things really got rolling in a big way under Gov. (Bill) Ritter. New Mexico and Arizona now have progressive governors and great things are happening in those states.”

Geller says SWEEP has studiously avoided blue-state, red-state deal dichotomies. His organization works with Republicans as well as Democrats—and has accomplished much in Arizona during a time when it has had a Republican governor, Doug Dulce. At the same time, it has had almost no presence in Wyoming.

Benefits of energy efficiency vary depending upon the locale. In some places, it’s the jobs, in other places the climate, and, in Salt Lake City, which often becomes shrouded during winter months under an inverted cloud of toxins caused by emissions from cars and buildings, there’s a different message yet.

Colorado stands apart, now noted nationally for its ambitions and accomplishments in the clean energy transition.

“It’s not a traditional left-wing kind of state,” concedes Geller. “It’s not a California or a Vermont or a Massachusetts that is expected to be in the front. Colorado not long ago had Republican senators and governors, then it moved to purple and has

now become moderately blue. But Colorado had and still has a lot of fossil fuel production, a lot oil and natural gas production and some coal production,” he points out.

Now, Colorado has begun to demonstrate that transition can be done rapidly and cost effectively while still tending to needs of economically disadvantaged communities, he says. More than a coastal state, Colorado can provide an example for other interior states.

Coal plants are now being rapidly retired, he says, but energy efficiency will remain very important in helping facilitate high levels of renewables. The essential task is to contour or shape demand to better match supplies of renewables. This can be done through such things as smart thermostats and grid-connected hot-water heaters. He hopes senators from the Southwestern states—perhaps Michael Bennet or John Hickenlooper of Colorado or Mitt Romney from Utah – will champion the case for an expanded federal role in this new frontier of energy efficiency.

If his life has been pushing for incremental change, Geller is like so many others in seeing the need for a brisker movement. “We can’t solve all our problems in one fell swoop in 2021,” he says. “But we can’t delay. We really need to move in the next 5 years.”

Big task for Elise Jones will be to redefine efficiency programs for new times

For Elise Jones, who will become executive director of the Southwest Energy Efficiency Project in late January, one fundamental challenge will be to help design programs that recognize changing needs of the 2020s.

Those deeply engaged in utility planning and the regulatory process say if demand-side management programs stay the same, they will risk falling behind in the rapid changes during the coming decade of beneficial

electrification applied to transportation and buildings.

A Boulder County commissioner for the past 8 years, Jones in late January will replace Howard Geller, who founded SWEEP in 2002. He will remain with SWEEP through February and has plans to become a consultant.

Prior to elective office, Jones was executive director of the Colorado Environmental Coalition, the predecessor to Conservation Colorado, for 13 years.

She is also a member of the Colorado Air Quality Control Commission, with a term ending in January 2022. It has become one of the most important appointee boards in Colorado, given responsibility by 2019 legislation for creating policies that will result in dramatic and swift decarbonization of Colorado's economy.

In addition, Jones serves on a variety of other boards, commissions, and committees.

"Elise is a highly regarded and passionate clean energy and sustainability advocate, as well as an accomplished nonprofit leader," said Bruce Ray, chair of the board of directors for SWEEP.

New Mexico struggles with role of oil and gas as it aims for carbon reduction goal

The [Santa Fe Reporter](#) tells of the pickle that New Mexico is in. Like Colorado, it's stretching to achieve deep carbon reductions. But how does it do so when so



Elise Jones

much of its living comes from drilling for natural gas and oil?

The executive order signed by Gov. Michelle Lujan Grisham in 2019 mirrors that of carbon reductions adopted by Colorado at almost exactly the same time: 45% emissions below 2005 levels by 2030 and 100% renewables by 2045.

A recent progress report by the governor's Climate Change Task Force found that hewing to the current path the state will get only halfway there.

The story says oil and gas produces 53% of the state's total emissions, the single biggest sector. Transportation comes in second at 14%. Electrical generation is third at 11%. In Colorado, transportation leads.

New Mexico has two big fields of production for hydrocarbons. A portion of the Permian Basin lies in eastern New Mexico, and then there's the San Juan Basin, which laps over into Colorado.

This differs from Colorado, where transportation now leads; oil and gas comes in only third.

Noah Long, who directs the Natural Resources Defense Council's Climate and Energy Program, says oil and gas sectors' emission must be reduced more rapidly than had been understood. "It also means that every other sector in the state—whether it's buildings, the electric generation sector or transportation and industry—will also have to increase or accelerate its decarbonization if we have any chance of meeting science-based targets."

On paper, a new proposed regulatory framework would go far in curbing methane emissions. But where will the money come from to implement the regulation?

And there's another, much bigger problem for New Mexico. Oil and gas revenues account for nearly 40% of the state's budget. "The state's heavy dependency on oil and gas money has for decades left legislators and governors alike reluctant to cross the industry," the Santa Fe Reporter notes.

[See Power Struggle: New Mexico's emissions reduction goals focus on energy but need to move on oil and gas](#)

350.org says role of methane dramatically understated in Colorado carbon roadmap

350 Colorado released a report this week that insists that the oil and gas sector produces 70% of Colorado's greenhouse gas emissions, compared to the state's estimation of just 17.3%.

"If Colorado truly wants to lead in global efforts to solve the climate crisis, our state must begin with an honest and accurate accounting of Colorado's actual GHG emissions resulting from the oil and gas sector and use that to guide policy decisions for attainment of our state's GH emission reduction goals," said Micah Parkin, executive director of 350 Colorado.

The 350 report criticized the draft Colorado Roadmap that was released in late September 2020 as relying on an outdated assumption that understates the power of the heat-trapping effect in the short term of the short-lived gas. It also says that researchers from Cornell University have shown the current methane leakage rates reported by industry are unrealistically low.

The report relies on the work of Cornell's Robert Howarth, author of "Methane and Climate Change."

[The report can be found here.](#)

Last summer, in adopting new methodologies for establishing a baseline for greenhouse gas emissions, officials with the state's Air Quality Control Division acknowledged that Colorado has had a weak baseline of emissions, especially from the oil and gas sector. New aerial observations from both airplanes and satellites that use



sophisticated technology can now better measure emissions.

However, 350 Colorado also points to projections in the draft roadmap that production in Colorado of oil will increase 86% and natural gas 41% by 2030. If correct, that will shoot emissions sky-high, says Parkin.

Colorado now has two of nation's three hydrogen electrolyzers

A hydrogen fuel station is now operating at Colorado State University's Powerhouse Campus along the Poudre River.

The station contains an electrolyzer that will convert electricity into hydrogen and oxygen. It also has a compressor that can compress the hydrogen for storage in tanks. The equipment had been in Washington D.C. in a demonstration project.

With this station, Colorado has two of the three electrolyzers in the country. An electrolyzer is also set up at the National Renewable Energy Laboratory in Golden. The third is in California.

Bryan Willson, the executive director of CSU's Energy Institute, told the Fort Collins Coloradan he expects hydrogen-fuel technology to expand into trucks, buses, locomotives, and possibly even large cargo ships. Amazon, he noted, already uses hydrogen to power forklifts at one of its warehouses near Denver.

"Hydrogen fuel cells are a big component of being able to reduce the environmental impact of transportation," Willson explained. Renewable energy can be used to create the hydrogen from water. So, as Platte River Power Authority continues to clean up its power supply, the hydrogen produced at the Fort Collins plant will also become cleaner.

Tom Bradley, who leads CSU's Department of System Engineering, told the Coloradan that hydrogen will play a big role in future transportation.

"Hydrogen fuel cells are a big component of being able to reduce the



environmental impact of transportation," he said. "Hydrogen is taken from an energy storage tank and combined with oxygen from the air, and the product of that is water and water vapor, so sometimes you'll see a fuel cell car will drip some water out of its plastic tailpipe," he said.

"But there's no carbon dioxide, no air pollution, no ozone depletion or anything like that."

[See also CSU press release.](#)



GRAND COUNTY ON CHRISTMAS DAY: The most startling statistic from the East Troublesome Fire is that it raced more than 100,000 acres in a day's time. Those familiar with fire say this will happen again in Colorado and likely soon. Where you live? Look for an in-depth story in coming weeks in **Big Pivots**.



Chris Clack's case for massive investment in new transmission

by Allen Best

Chris Clack made a key point in a presentation sponsored by the Denver Museum of Nature & Science called "The Future of Energy: Transmission."

If renewables locally can be understood as variable and intermittent, that is not at all the case on a regional or larger scale.

"The global heat engine runs constantly, driving wind and cloud patterns. The process is very well understood," he said, describing solar irradiance and the distance between the Earth and the sun.

"Therefore, variability is a local effect."

If you're reading *Big Pivots*, you likely understand where this is going. The background question is how can Colorado, New Mexico and other states achieve their

dramatic economy-wide decarbonization goals?

Electricity is the key. It will be used to replace fossil fuels in transportation, home and hot water heating and, over time, perhaps other sectors of the economy, too. Colorado has a goal of 90% carbon reduction by 2050. That's economy-wide.

So how do we reinvent the electrical grid to achieve those goals?

Clack, the principal at Boulder-based Vibrant Clean Energy, described the need to reinvent the grid. The distribution grid was originally built simply to absorb power from centralized power plants. It worked. "It's very complicated, but without this system, we would not have the kind of society we have in the United States or elsewhere," he said.

Now, that system has to be reinvented. "We would like it to happen in 20 years, but realistically it will be 35 years," he said.

Long-distance transmission will be a big piece of that. "It makes a lot of things easier," Clack explained. It allows the grid to

be decarbonized, thus allowing the decarbonization of buildings and transportation. Even as energy efficiency improves, this will result in need for more electricity, not less. All these things can be achieved with improved long-distance transmission. The additional benefit is that it will reduce the need to curtail renewables, such as when there is too much supply, and storage can actually be increased.

None of this is particularly a new insight, and Clack pointed to several among the many studies of recent years, including an MIT study that had been issued the day before in the journal called Joule.

Vibrant Clean Energy also expects to issue another study out in January, called Zero by Fifty, or ZBF. Clack—we could call him Dr. Clack, as of course, he has a doctorate—pointed to the need for high-voltage direct-current lines. All this will require considerable investment. That investment will be repaid by 2035 to 2040.

Clack flipped that same coin: Not building a high-voltage direct current grid adds \$1 trillion in energy costs to the nation’s economy by 2050.

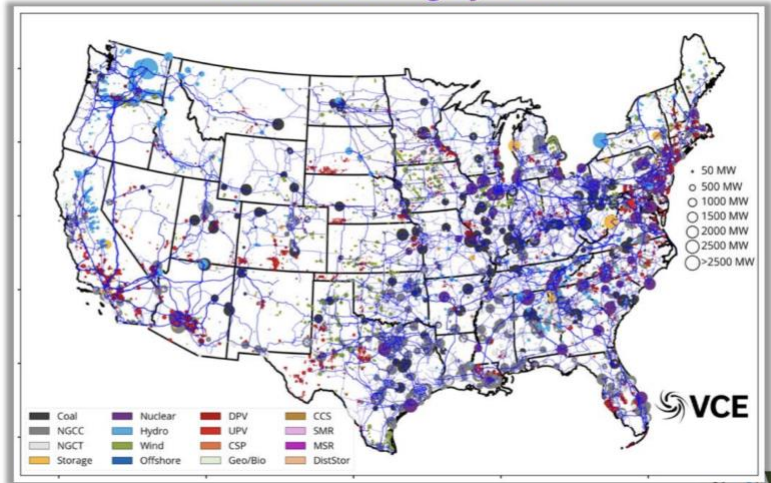
With this, Clack showed slides of the added renewables his company’s study envisions. He actually sees need for less additional renewable generation with improved transmission. But the increase he and his team project is still striking. See the comparison in these two slides at right.

In the Q&A, Clack was asked about the idea of running transmission underground, along railroad lines, perhaps, similar to fiber-optic lines in the 1990s and beyond. The

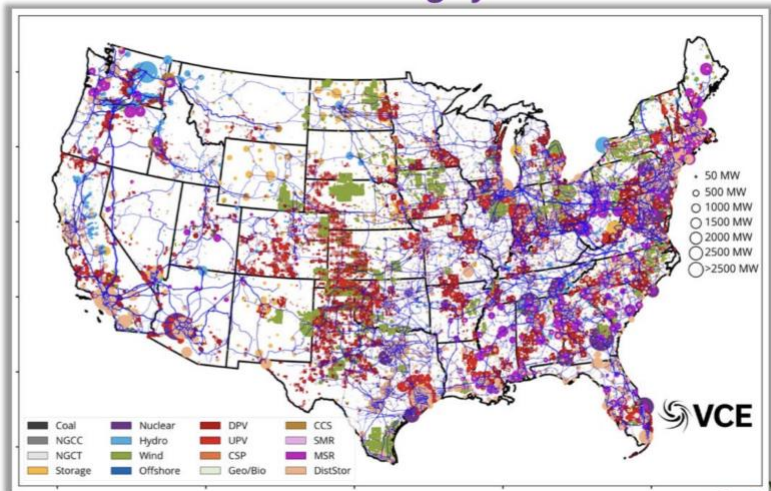
same idea was discussed at a recent information meeting about transmission put together by John Gavan at the Colorado Public Utilities Commission.

There were a few concerns about

Resource Siting by 2020



Resource Siting by 2050



security, he said but in general “it could work.”

What about the inevitable inter-state need for transmission and the lack of coherent federal policy?

There needs to be a blueprint and also a federal backstop for this new infrastructure, he said, as there was with the federal highway system.

Carbon reduction that Colorado can crow about

by Allen Best

To announce his candidacy for governor of Colorado, Jared Polis in 2017 traveled to Solar Roast Coffee, a shop in downtown Pueblo that claims to offer the world's only commercial solar-powered coffee roaster.

That jibed well with the centerpiece of Polis's campaign, the goal of achieving 90% renewable energy in Colorado by 2040. It also helped that Pueblo had by then bucked its history as an industrial town built on the foundation of coal to proclaim a goal of 100% carbon-free energy, the first in Colorado.

Polis on Wednesday reported a major milestone. Electrical utilities that deliver 98% of electricity in Colorado have now committed to deep reductions in carbon by 2030. The utilities have agreed to clean energy plans that will get them to 80% reduction compared to 2005 levels.

In his latest video-shared press conference with a utility, Polis celebrated the ambitions of Black Hills Energy to file a plan in March 2022 with the steps to get it to the state's 80% goal.

In the meantime, Black Hills is now moving along toward the start of construction later this year of a 200-megawatt solar project in western Pueblo County. Completion of that solar project is expected by the end of 2023. Black Hills expects to achieve 70% reduction in greenhouse gas emissions by 2024.

See also:
[Blue and green in Pueblo](#)



Black Hills delivers both electricity and natural gas to nearly 290,000 customers in Colorado communities. The utility delivers electricity to Pueblo, Cañon City, and a mine at Victor. The utility was responsible for 3.5% of electrical sales in Colorado in 2018, according to the Colorado Energy Office. Xcel Energy was responsible for 52.5%.

Even before Polis took office in early 2019, Colorado utilities had announced several coal-plant closures. In the last year, those announcements have been a torrent. Tri-State Generation and Transmission in

January 2020 said it would close Craig Station by 2030. Colorado Springs Utilities in June said it would also close its last plant by 2030. Just this week Xcel announced

plans to retire its Hayden units in 2027 and 2028.

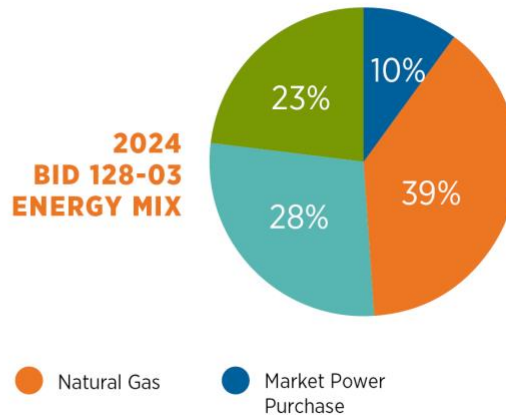
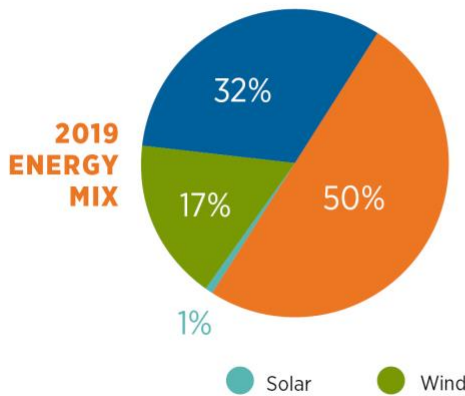
Platte River Power Authority in 2018 had announced it was getting out of coal by 2030 and posited a conditional goal of 100% renewable generation. Holy Cross Energy specified the same 100% goal in December, but without conditions.

"The reality is that the renewable energy future is here today," said Polis in crediting the plans by Black Hills.

"This race to the top is good," he added. "It's good for our state, economy. it's good for our air, it's good for climate, it's good for workers, it's good for ratepayers. It positions Colorado as a national leader in a swift transition to a clean energy economy."

Polis emphasized the job creation, interjecting several times to point out the

Polis crows about job creation as Black Hills Energy pledges 80% carbon reduction



250 jobs to be created in construction of the solar projects.

Then there’s what Polis called the moral imperative posed by climate change. Colorado in 2020 had the three largest wildfires in state history and an extreme drought nearly statewide in scale.”

Vance Crocker, manager of Black Hills operations in Colorado, pointed out that Black Hills closed its lone coal plant in Colorado in 2012. It replaced generation with natural gas. It has added 150 megawatts of wind generation. Next year, it will have a portfolio that delivers 51% renewable generation.

The solar project that is the centerpiece of what Black Hills calls its [“Renewable Advantage”](#) plan will save its customers \$66 million across a 15-year period, the utility says. The solar plan was filed with the Colorado Public Utilities Commission in June 2020. The broader plan will be filed in March 2021.

In adding solar and other renewables, Crocker said, Black Hills will be using its natural gas plants less and less but will continue to use them to ensure reliability. He also said that Black Hills has plans for more renewable natural gas, such as can be extracted from sewage treatment plants and dairies. He said Black Hills has several options in Colorado, although he did not specify them. He said the gas could be used both for electrical generation and sold

directly to consumers for home heating and other uses.

In May, a proposal to municipalize electrical operations in Pueblo was defeated handily after a campaign that produced a flurry of expensive campaign literature and advertisements against the proposal.

Tom Corlett was among those calling for municipalization. Viewing the plans of Black Hills, Corlett credits the utility with taking a good step forward with its decarbonization plans. But he wants Pueblo and Pueblo County, which both adopted decarbonization goals, to create mechanisms that deliver accountability. Pueblo County’s resolution calls for 100% renewable generation by 2035.

As an investor-owned utility, Black Hills will try to ensure 9% or more returns for its shareholders.

Crocker, the Black Hills executive, pointed out that Black Hills is in an area rich with renewable potential, both wind and solar. Its existing projects barely scratch the surface of what is possible given the breezy, sunshiny weather, he said. That wind is being harnessed with turbines manufactured in Pueblo at the Vestas factory. Pueblo, he added is becoming the renewable energy capital of Colorado.

See also: [Making steel with solar energy](#)