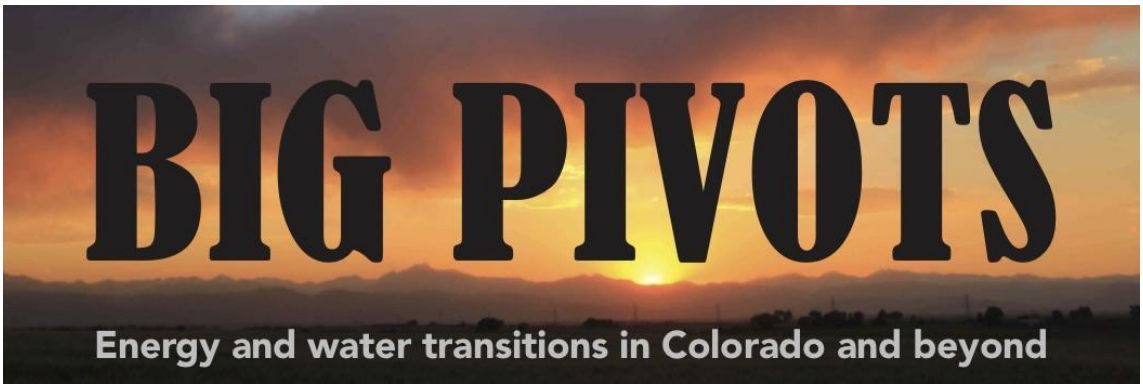

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Colorado may go where no others have with global warming filter

by Allen Best

In 2019, Colorado legislators passed an impressive suite of laws that boldly staked out ambitions to dramatically decarbonize the state's economy.

Now, the hard work is underway. In this year's session, legislators have introduced dozens of bills that collectively seek to define the pathways for achieving this towering task. Closing down coal plants will not be enough. Every single component of the state's economy produces greenhouse gas emissions.

HB21-1303 proposes to steer state dollars in roads and buildings to materials and designs with lower global warming potential

HB 21-1303, a bill introduced in early May, seeks to use the state government's purchasing power to nudge architects and contractors to make greenhouse gas emissions a calculation in selection of building materials. The state has spent $54 billion in the last decade on buildings.

This bill would apply this additional criterion to new buildings created with state funds. It was approved by the Colorado House Energy and Environmental Committee on an 8-5 party line vote on May 20 and the House Appropriations Committee the next day on a similar party-line vote. In both cases, the Democratic majorities prevailed.

California has adopted legislation to use state spending to begin steering the building market toward so-called green materials. Six states, including Colorado, have or will have similar bills under consideration this year.

Colorado's bill takes a step beyond that of California or other states in that it would also require the Colorado Department of Transportation to begin using the filter of greenhouse gas emissions of concrete and asphalt when choosing road materials.

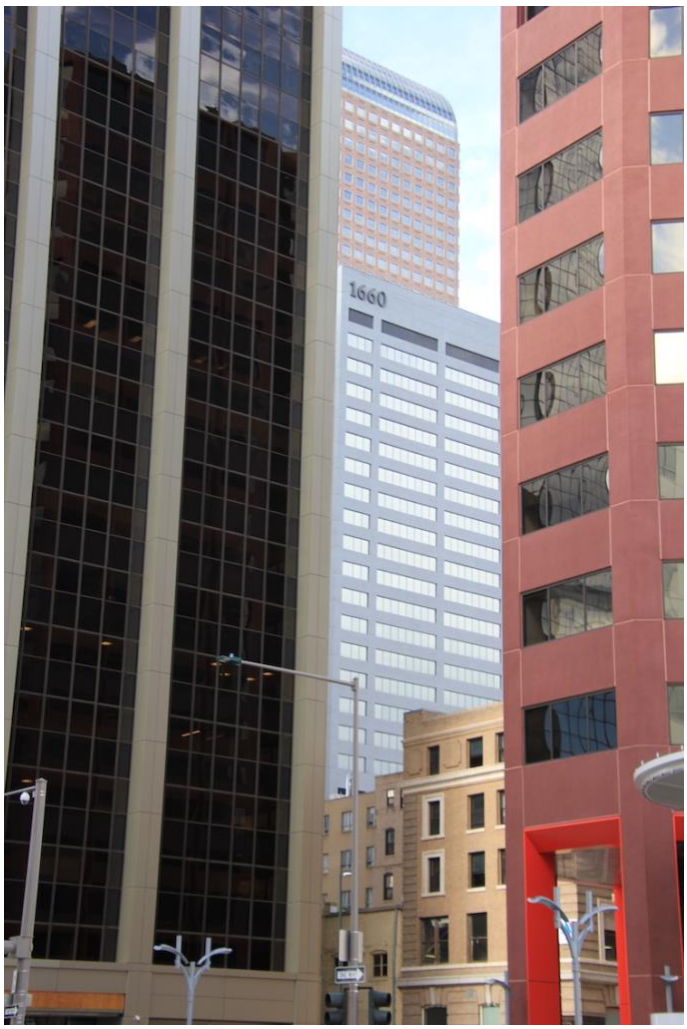
This would be a huge step for Colorado, says a bill co-sponsor, Rep. Tracey Bernett, a Democrat from Boulder. "It's very

comprehensive, what we want to do with this," she says of the bill.

The Polis administration supports the bill. "We think this is an important strategy for achieving the state's carbon reduction goals," said Will Toor, director of the Colorado Energy Office at the May 20 hearing. C-DOT also testified on behalf of the bill, as did several industry groups.

State Sen. Chris Hansen, a Democrat from Denver, submitted a similar bill in last year's covid-shortened session, but it did not have the same scope. He is a co-sponsor of this year's bill, as is State Rep. Barbara McLachlan, a Democrat from Durango.

Because of the fossil fuels typically used to produce steel and the emissions associated with concrete and cement, building materials themselves have a large carbon footprint. Too, there is carbon associated with the transport of materials. All would have to be calculated and used in the choice of building materials and specific product.



Buildings have much embodied carbon in their materials, particularly concrete and steel. *Photo/Allen Best*

The bill, "Concerning Measures to Limit the Global Warming Potential for Certain Materials Used in Public Projects," would have the Colorado Department of Personnel & Administration establish what the bill calls a" maximum acceptable global warming potential" for each category of eligible materials used in certain public projects under its purview. When projects go out to bid, this maximum would be included.

The Colorado Department of Transportation has a similar process in front of it, but with a little more breathing room as state engineers calculate what would be best.

Think of this as being akin to the social cost of carbon, a metric now being used by the Colorado Public Utilities Commission in evaluating electric resource plans submitted by utilities. That social cost adds the long-term costs of resource choices into the decision-making matrix.

House committee members heard abundant testimony in support – including from road builders and unions, along with several architects. They said that materials with lower global warming potential are already available and being used.

Why, if the free market is moving in this direction already, will a state law be needed?

"I think the bill has merit to the extent that the more we pay attention to this, the more likely we are to get favorable outcomes," said Paul Hutton, a principal at Cuningham, a national design firm with an office in Denver's LoDo neighborhood.

"We are just raising the bar and holding company and design firms and contractors accountable," he said. "If we don't make this an explicit measure, we're not likely to make progress as rapidly as if we say this is something that matters."

Global warming potential of materials has become a consideration for Hutton's firm in just the last few years, and it isn't for all design firms even now, he said.

A new building on the University of Denver campus uses timber in lieu of traditional steel and concrete. Construction photo top/SA+R; completed building photo above/Wayne Armstrong

Thinking about buildings and their materials in light of the carbon footprint of materials plays out in different ways. One example is the timber building at the University of Denver, designed by Cuningham and project partner architect, Lake Flato. It eliminates the typical steel and concrete components in vertical architecture. Wood can be used with adequate structural integrity to heights of 17 floors, he says.

"Timber has a far lower embodied carbon than either concrete or steel," says Hutton. "That's a trend we're starting to see in Denver and across the country."

Another example comes from rural Colorado. At Blanca, a town at the foot of the eponymously named 14,000-foot peak in the San Luis Valley, a new school is being completed. Sierra Grande School will not burn propane for heating, as was the case with the former school. Instead, the building will be warmed via underground pipes that extract the constant heat of the Earth.

The design begins with the maximum insulation of the building envelope. The ceiling's R-value, a measure of insulation, is 65, and that in the walls is 49. Both are double the typical high R-values in building insulation.

But in insulation, there's another consideration. What is the carbon footprint of the material? Hutton explains that insulation is plastic based and hence derived from petroleum. Different processes used for manufacturing, however, have varying emissions of greenhouse gases. Figuring out the specific insulation and the amount to use is something that a building designer must consider when calculating its global warming potential.

Even when concrete is used, there are variations. A story by the BBC earlier this month explained that we use more concrete than any other substance, except for water.

Cement is a bonding agent used to create concrete along with water, sand, and gravel. Essentially, it's a glue, and it typically constitutes 10% to 15% of concrete. The critical agent in concrete is lime. It is obtained by heating calcium carbonate, usually limestone. High temperatures are needed, 1,450 degrees C (2,642 degrees F, or roughly enough to melt stainless steel).

This process yields calcium oxide, the critical agent in cement. From the rock it also unleashes carbon dioxide—and this is a big deal. Cement accounts for about 8% of the carbon dioxide we emit into the atmosphere globally. Aviation produces about 2.5% of emissions.

In this process, fossil fuels produce 40% of the carbon footprint of cement and the carbon dioxide released from the limestone 60%.

Techniques have been developed to reduce the carbon dioxide emissions associated with cement production. The BBC story details several of them. They include using substitute materials such as ash that can displace part of the cement without reducing strength. Another approach, if more expensive, involves using a different binding agent that does not produce emissions. A third approach, carbon capture, involves a 200-foot-long metal tube.

Colorado has two cement plants, one at Lyons and the other at Florence. The Florence plant, operated by LafargeHolcim, an international company, has developed a cement that it says has fewer emissions of carbon dioxide.

The lower-carbon product, OneCem, was used by C-DOT in 2008 in reconstruction of U.S. 287, the highway that extends diagonally across Colorado from Springfield to Limon and also from Denver to the Wyoming border. The product was also used in building Interstate 25 south of Denver. Altogether, says LafargeHolcim, the product has been used on 600 lane miles of concrete paving in Colorado.

The Colorado Decarbonization Roadmap also mentions the company's cement plant at Florence in a section on carbon capture, use, and sequestration. The company is said in the report to be giving "serious consideration" to employing carbon capture technology—perhaps as described above. The technology has proven too burdensome for widespread use in burning of coal for electrical production.

Just how many buildings might this impact in any given year? Perhaps a few fewer than you might think. State universities, for example, have dozens and dozens and dozens of buildings. But relatively few get constructed using state funds.

This bill proposes a nudge, not a shove.

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To decarbonize grid, keep the nukes, say 2 Colorado researchers

Two Colorado researchers on renewable energy have a recommendation that might surprise some who embrace goals of 100% renewable or, at least, emission-free electricity.

Keep the existing nuclear reactors on line as long as possible, say Charles Kutscher, a fellow at the Renewable and Sustainable Energy Institute at the University of Colorado Boulder, and Jeffrey Logan, the associate director of the institute.

Writing in The Hill, the two Coloradans say that creating an emissions-free electric grid in the United States won't be easy. 2020 was a record year for new U.S. wind and solar electricity capacity additions, but to achieve a carbon-free grid by 2035, annual installations of solar and wind must double or triple.

They also urge wringing as much efficiency out of transportation, buildings, and industrial sectors, hence lessening the amount of electricity that will be needed. But they also say it's important to keep the existing nuclear fleet operating for as long as it's safe to do so.

They note that many analysts see a clear path to achieving 80 to 90% renewable electricity grid.

"Addressing that last 10 to 20% will also likely require long-term storage as well as grid modernization including improved market design."

But if there are challenges and difficulties, they say, mostly it's a matter of doing.

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"Although some observers have called for a massive R&D effort to develop innovative solutions to the climate crisis, the truth is that we already have the technologies we need to solve most of the problem, and our chief focus must be on enabling and deploying them."

What new NREL study says about achieving 100% renewable grids

While we might all like a definitive answer on what it will take to achieve an emission-free grid, a new study produced by 17 researchers at the National Renewable Energy Laboratory and the Office of Energy Efficiency and Renewable Energy, both federal labs, offers a more squishy answer.

The study carefully works through the challenges, identifying three key ones:

1) the short-term variability problem, which has largely been solved;

2) the diurnal mismatch problem, which is partially solved, so further research is needed; and

3) the seasonal problem remains largely unsolved although some pathways have been proposed. Additional research is also needed.

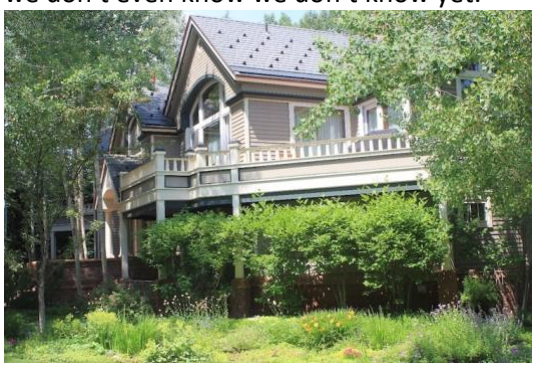
Locally, yes, deep, deep penetration is possible, but getting close to achieving 100% renewables at a national scale for all hours of the year—well, there are significant unanswered questions.

"There is no simple answer to how far we can increase renewable deployment before costs rise dramatically or reliability becomes compromised," said Paul Denholm, the principal energy analyst at NREL and lead author of the paper that was published in Joule, an energy journal.

"As far as the last few percent' of the path to 100%, there is no consensus on a clear cost-effective pathway to address

both the Balance Challenge and the Inverter Challenge at the national scale," he said in a statement distributed by NREL.

"Studies have found no specific technical threshold at which the grid 'breaks,' and we can't just extrapolate from previous cost analyses because, when it comes to the future, there are many non-linearities and unknown unknowns—things we don't even know we don't know yet."



Aspen wants to pick up the pace on squeezing emissions from buildings

Elected officials in Aspen have agreed they want to move forward more briskly to reduce greenhouse gas emissions caused by the building sector.

The Aspen Times reported that city council members at a work session agreed on the need for a more aggressive building code for Aspen to meet the goal of its Climate Action Plan. That plan seeks to reduction emissions 80% by 2050.

A city inventory found that buildings cause 58% of emissions in Aspen.

Past efforts have caused a decline in building emissions. For example, natural gas emissions declined 3% between 2004 and 2017, despite significant construction. That is also true nationally.

The idea pitched to city council members is to require more rigorous efficiency, so that code requirements cannot be met simply by adding more solar panels.

But the discussion also includes the lifecycle emissions of buildings. This would include consideration of the emissions generated during the harvesting, manufacture and transport of building materials—and then the emissions produced when the building materials end up in the landfill.

Council members, reported the Times, said they want the city to up its game in curtailing construction and demolition waste.

No timeline has been established, but the code will move ahead of the most aggressive national codes. Pitkin County similarly adopted regulations in 2020 that advanced requirements.

Pueblo County resident worries about possible solar heat island effect

Pueblo County has among the most sunshine of any place in Colorado. It ranks at 7 or 8 on a scale of 10 in the national matrix, says the developer of a 300-megawatt solar farm being developed by Lightsource BP to supply Evraz, the steel mill.

But is there too much of a good thing?

That was the question posed by a resident of Lakeside Manor Estates, a housing subdivision of 70 properties located south of Pueblo. The first big solar farm was adjacent to the Comanche power plant, and at the time of development was the largest east of the Rocky Mountains. Then came the Evraz project and another called Bighorn Solar.

Now comes the Pronghorn Solar Park, which is proposed to have 150 megawatts spread across 800 acres adjacent to the housing development.

The Pueblo Chieftain reports fears of what 74-year-old Alan Gasscock describes as a "solar oven."

"I am a proponent of solar. In fact, I have solar panels on my property. But this is a massive array," Glasscock said. Solar panels will be built to a maximum of 15 feet high.

At a public hearing, Glasscock voiced concerns about what he said would be the 130 to 140 degrees of heat radiating from the panels.

A representative of Leeward Renewable Energy, the project developer, discounted the worry about a heat island effect outside of the project's border. Kevin Adelman said the thin solar modules dissipate the heat quickly and a vegetative border of trees and shrubs will further shield residents from dissipating heat. Glasscock was unpersuaded, citing the high-water requirements needed in Pueblo County's hot, arid environment.

Delta-Montrose reports improved bottom line after 2020 switch

Kit Carson Electric left Tri-State Generation and Transmission in 2016 and has never looked back. Now, Delta-Montrose Electric reports the same story.

The electrical cooperative reported last week that the 2020 adjusted net operating margins exceeded $4.3 million, more than double those in 2019 and the best since 2014.

Power supply costs decreased by more than $2.7 million compared to 2019. The cooperative purchased roughly the same amount of electricity in both years.

Tri-State supplied the wholesale power in all of 2019 and the first half of 2020. In the latter half of 2020, Delta-Montrose got its electricity from Guzman Energy, the same Denver-based wholesale provider that began supplying Kit Carson in 2016.

As it did with Kit Carson, Guzman has started helping Delta-Montrose expand its local electrical generating capacity, primarily solar.

Is there a story beyond this story—perhaps something else that explains the improved financial picture of Delta-Montrose? Possibly.

But the real story here is one that cannot yet be reported. What will the managers and directors of the cooperatives in western Nebraska and elsewhere who are evaluating their options—including exiting from Tri-State—think of this latest news?

Tri-State recently lowered its wholesale power costs to member cooperatives by 2%.

Facebook data center shows why New Mexico needs to continue its renewable energy policy

Whatever problems Mark Zuckerberg may have in sorting out Facebook's role as an arbiter of public information, it has been a catalyst for strong economic development in New Mexico. That's the gist of an article by two op/ed contributors in the Albuquerque Journal.

Construction of six data center buildings at Los Lunas, south of Albuquerque, has driven more than $1 billion in investment and led to development of renewable energy projects in six New Mexico counties considered economically distressed and will support 300 jobs once complete," say Kenneth Eichwald, a commissioner in Sandoval County, and Kirstin Keller, executive director of the Middle Rio Grande Economic Development Association.

"Facebook's commitment to powering its operations with renewable energy, coupled with New Mexico's low cost of renewable energy, have encouraged Facebook to potentially expand operations in New Mexico," they write.

Headwaters River Journey is part science, part history and a lot of message.
Photos/Allen Best

Telling the story of what was lost as a result of our thirsty cities

by Allen Best

Gathered around the campfire one evening during a rafting trip many years ago, the conversation was about classroom education of river guides. I remember it well almost 40 years later because I cracked a joke that got a round of laughter.

To make the educational experience complete, I said, somebody should throw a pail of cold water over those assembled to make it like a real river trip.

That memory was provoked by a recent visit to the Headwaters River Journey, a water-focused exhibit-slash-museum that occupies the ground floor of the Headwaters Center in Winter Park. It doesn't leave you shivering like you just fell into a cold mountain stream. It does intend for visitors to gain an appreciation for mountain water and the consequences of its loss, in the case of the Fraser Valley to the benefit of metropolitan Denver.

Colorado has 25 ditches, tunnels, and other conveyances that ferry water over

One component allows a literal hands-on demonstration of depletion of Jim Creek, one of the sources of metropolitan Denver's water, as levels rise in Moffat Tunnel pipeline. ***Photo/Headwaters Center***

and through the Continental Divide, from the Western Slope where 80% of water originates, mostly in the form of snow, to the Front Range cities and the farms beyond, where 85% of Coloradans live. No place has been dewatered so severely as the Fraser Valley, where Winter Park is located.

Diversions that began in 1936 have resulted in 60% of the water from the Fraser Valley being diverted to metropolitan Denver. That percentage will increase to more than 80% if a long-contemplated project by Denver Water gets realized.

Headwaters River Journey seeks to deliver an appreciation for the natural environment of the Fraser and other mountain valleys and the cost to these ecosystems. It does so with an abundance of hands-on experiences.

The hands-on learning is literal in an exhibit about Denver Water's diversion from Jim Creek. The creek originates on the flanks of James Peak, across from the Winter Park ski area, meandering through a glacial-carved valley to a confluence with the Fraser River. Or, what's left of the creek.

The exhibit has you lay hands on an operating wheel that is used to raise or lower a headgate at a diversion point. As you crank the red wheel, as if to divert water into a diversion ditch, a screen on the left shows water levels in the creek dropping. More cranks yet reveal cobbles, a creek nearly without its water. A panel on the right shows corresponding water levels rising in the water pipe in the Moffat Tunnel used by Denver to deliver water to South Boulder Creek, just one relatively minor hump away from Denver's suburbs.

This was not news to me. I once lived in that valley, proudly wearing a "Dam the Denver Water Board" (as the water agency was formerly called) bumper sticker on my car. Now, I live on the receiving end of that water, in the Denver suburb of Arvada. Here, 78% of water for

this city/suburb of 120,000 people comes through the Moffat Tunnel from Jim Creek and myriad other creeks in the Fraser Valley. More yet comes from the adjacent but far more remote Williams Fork Valley, two more tunnels away.

The plumbing before the water arrives at my garden hose is vast, complex, and expensive. The legal system for administration of Colorado's water may be more byzantine yet.

Headwaters doesn't dive deep on the history, legal system, or the plumbing. It's more like a chapter in Colorado Water 101. It is geared to someone who knows relatively little about water.

Still, someone like myself, who has written about Colorado water off and on for more than 40 years, the exhibits can fill in gaps. One of my gaps is biology. One exhibit showed the life stages of stoneflies, an important component of the aquatic ecosystem. Through an interactive exhibit, I swam along a river bottom somewhat like a trout might, looking for food.

Another interactive experience allowed me to flap my arms as if a condor, flying over the geography from Berthoud Pass northward to Longs Peak and west along the Rabbit Ears Range. If a museum can be this much fun for an older guy, I wonder what it would be like to be a 10-year-old.

My companion, Cathy, was most touched by two exhibits that triggered her memories of living for almost 30 years in a very small mountain town in a house above the confluence of a creek and river.

One was a line of the life to be found along a mountain creek, from the bugs to the four-legged critters. She says it was a lovely reminder of "all the friends that I miss" now that she lives, sometimes with regret, a citified life.

The other was a wall-sized video immersion at the beginning of the exhibit that shows the changing of the seasons from one vantage point of a mountain slope. As the snow fell, there was a whoosh of chilled air. As the snow melted, there was the sound of water drops falling.

The exhibit is the creation of Bob and Suzanne Fanch, owners for the last 20 years of the 6,000-acre Devil's Thumb Ranch, which is 7 or 8 miles down the valley —and, perhaps not incidentally, just below some of Denver Water's diversions on Ranch Creek. It's one of the nation's most high-end cross-country ski destinations.

Kirk Klancke, a neighbor of the Fanches on Ranch Creek and an active member of Trout Unlimited and other water-related causes, describes himself as a technical advisor.

The Fanches, he explains, got the bug for interactive exhibits after visiting a museum in Iceland. "What a great educational tool, and the Fanches have always been interested in the future of the Fraser River," he says.

The vision was distilled by Suzanne, he says, in a discussion. She took the message from a Trout Unlimited movie about the plight of the river that was called "Tapped Out." A Boulder couple, Chip and Jill Isenhart, who have a company called ECOS

Communications, designed the exhibits.

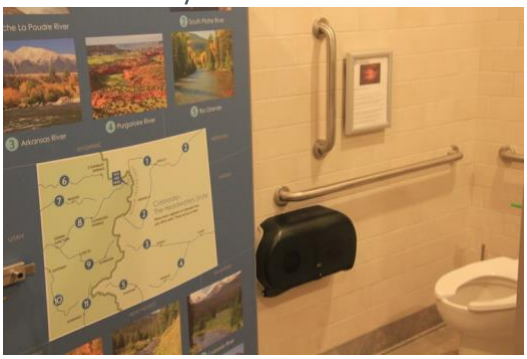
"We are natural history and environmental storytellers, and our team of content experts and designers has been doing this for more than 30 years in Colorado," says Chip Isenhart.

"Our passion is partnering with mission-driven clients like the Fanches, and they have done an amazing job creating a world-class exhibit in Grand County."

Isenhart says the primary task in creating the exhibit was to connect the dots between the Fraser River and the Front Range residential water use. To do this, he and his team needed to see the story through the eyes of the locals.

"We would go out on the river with Kirk Klancke, and folks from CPW, and meet frustrated anglers due to fishing closures at 1 p.m. due to river temperatures being so high from the lack of water," says Isenhart. "And at the same time we also got to work closely with Front Range water interests to make sure our story was balanced. That was very, very important to ECOS and the Fanches and Trout Unlimited, as this issue is beyond complicated. It's actually fairly easy to paint a picture that's more sensational than accurate."

Once ECOS had the essentials of the story figured out, they set out to create a variety of fun, changeable, and—they hoped—memorable interactive experiences to tell that story.



One of my memories is of the bathroom stall. No opportunity for educational storytelling was missed.

The take-home message of Headwaters River Journey is about personal responsibility.

"It's taking the knowledge you've learned and actually making a difference using that knowledge and being a participant, rather than a spectator," says Klancke. "That is what this museum is designed to do."

The ideal audience would be somebody who lives in metropolitan Denver, a beneficiary of the exported water, or more broadly somebody from the Front Range. As such, it might better be located in Golden, for example, or even along the Platte River near downtown Denver. It was located in Winter Park, at least in part, because the municipality provided the 6 acres of land. Plus, there is an additional benefit. Immediately outside the backdoor of the exhibit is an illustration of beavers, willows and a braided mountain river.

> "It's actually fairly easy to paint a picture that's more sensational than accurate."
>
> **Chip Isenhart**
> ***ECOS Communications***

But Isenhart says the exhibit can have value for remote learning, especially for classrooms along the Front Range. "That's hopefully one of the next steps," he reports.

I had intended to visit the exhibit in March 2020, on the way back to Denver after a trip to Craig. I was a bit late, and hence the curtain of covid descended the next week. My trip was delayed by 13 months.

It was worth the wait, though. Headwaters Journey exceeded my expectations. And I'd go back again for a refresher.

See Headwaters River Journey for hours and location.

Can natural gas be eased from the built environment instead of shoved?

Story/photos by Allen Best

In squeezing natural gas from the built environment, Colorado is unlikely to adopt hard mandates, as have been enacted by local governments in California and a few other states. But can Colorado figure out a gentler approach that achieves the same results?

Members of the Colorado Public Utilities Commission didn't get any simple instructions along the lines of "just-add-water" during a meeting on May 20 with experts from the Environmental Defense Fund and the Regulatory Assistance Project, two national organizations engaged in the transition from natural gas.

"I am sorry I am not giving you a simple answer," they were told at one point by Meghan Anderson of the Washington state-based Regulatory Assistance Project. "There are lot of things coming together."

That was in response to a question from Commissioner John Gavan. He had alluded to SB21-200, the bill submitted by Sen. Faith Winter and others that would give the state's Air Quality Control Commission more authority to achieve greenhouse gas reductions through new regulations.

Environmental groups have insisted that Colorado needs to move more rapidly in wringing out greenhouse gas emissions from the state's economy. A 2019 law specified targets of 50% by 2030 and 90% by mid-century.

Gov. Jared Polis has vowed to veto the bill if it lands on his desk. Despite running on a platform of 100% renewables, Polis argues for an approach that is not seen as heavy handed regulation. He's not against prodding the market, as was evident in a legislative hearing on the same day as the PUC meeting. Will Toor, the director of the state energy office, testified in support of a bill that would steer state funding toward building materials with lower carbon emissions embedded in their production or extraction.

"We have this raging battle going on in Colorado on that issue, do we do it through mandates or market forces?" Gavan said at the PUC session. "What do you see from around the country and the world?"

Colorado most certainly needs both mandates and market forces, Christie Hicks, the lead counsel for energy markets and utility regulation with the Environmental

Defense Fund, said in response to the question by Gavan. She emphasized the importance of transparency and accountability in a stakeholder processes with utilities and others.

In Washington state, demand for natural gas has actually dropped, the result of improved energy efficiency, more stringent building codes, and deliberate efforts to displace fossil fuels in buildings with electricity.

Colorado's largest gas-distribution utility, Xcel Energy, said in a PUC filing that it expects a 1% annual growth in demand for natural gas for building use. Xcel, in a November position paper titled "Transitioning Natural Gas for a Low-Carbon Future," also argued against too aggressively transitioning from natural gas to electricity, even though it will sell more electricity.

For Colorado to meet its decarbonization targets, it must shut down coal plants and aggressively electrify transportation. More difficult yet will be the weaning of buildings from their dependence on natural gas—and, in some places, propane—for space heating, warming of water and appliances such as kitchen stoves.

The PUC commissioners were told that natural gas combustion in buildings causes 10% of total U.S. greenhouse gas emissions.

Eric Blank, the PUC chairman, asked the same question in a different way. Even before joining the PUC, he has been talking about the 40,000 to 50,000 housing units being built each year in Colorado along with perhaps 5,000 to 10,000 commercial units, virtually all with natural gas hookups.

Even beyond what the PUC can do, he asked, do you have any advice about what Colorado can do as we begin shifting toward all-electric, particularly with deployment of incentives?

Colorado very definitely is not California, he said, a reference to the natural gas bans in new construction by local governments in California, led by Berkeley beginning in 2019.

"It's just not how Colorado operates," said Blank.

Education will be foundational, answered Natalie Karas, also of the Environmental Defense Fund. She pointed to a website-based planning device created by a utility in New York that can instantly spit out the emissions associated with fuel decisions.

And can the natural gas lines be repurposed, say to hydrogen? "We have a 50- or 60-year gas system, and to keep that system safe requires hundreds of millions of dollars of ongoing investment in coming months and years," Blank pointed out. "Is there any clean energy value in those assets going forward in terms of using it for hydrogen or other clean energy molecules?"

Blank got an indirect answer. "It's all about meeting end uses," said Megan Anderson of the Regulatory Assistance Project. The question, she said, is whether it's good idea to make upgrades or are there better ways to meet customer needs.

PUC Commissioner Megan Gilman, who assembled the session, asked a central question about motivations and accountability. Current models used in Colorado and elsewhere reward investor-owned utilities with returns based on investments they make in energy generation and distribution. That gives utilities incentives to make investments that don't necessarily align with climate goals. "That's a fundamental problem," she said.

Hicks said the best example of using regulation to achieve broad societal goals can be found in the electric sector, where states have been nudging utilities firmly to

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abandon coal-fired generation in favor of those that cause less pollution.

One technique is called performance-based ratemaking. Rates the privately-owned utilities are allowed to charge customers depend upon utilities achieving social goals. In this case, the allowed utility revenues would be tied to reductions of greenhouse gas emissions.

Hicks also urged a wholistic view of energy systems, seeing natural gas along with electric—which, in a way, is exactly what the Xcel position document issued in November urged.

The EDF's Karas talked about the need for "rigorous analysis" of "every new piece of gas infrastructure being put into the ground. The experts all talked about the importance of planning.

Also explored during the session was the question that Blank described as the "economic rock." In short, how does this transition from natural gas in buildings occur across all economic sectors, not just among the well-heeled or, for that matter, not just in new homes and buildings?

The Xcel paper in November also drew attention to this problem. The scenario is what if only those of most modest means, unable to retrofit their homes, are left holding the bag of the stranded asset and hence required to pay much higher cost.

If there are no easy answers, the best equity will be borne of both well-crafted process and policy, the commissioners were told.

In wrapping up the meeting, the commissioners agreed there's no urgency in making decisions about 2050. They have at least a month. By late June, new laws being considered by state legislators now may alter the agenda of the PUC.

Laws passed by the Colorado General Assembly will frame how this transition occurs. Several bills in the hopper address this in various ways.

One bill, for example, seeks to redefine the metrics used for determining the effectiveness of demand-side programs. Taking a longer view, as HB21-1238 proposes to do by deploying the social cost of carbon, would result in more energy efficiency programs driving down the consumption of natural gas. The bill is sponsored by Rep. Tracey Bernett and Sen. Chris Hansen.

Another bill, SB21-246, nicknamed the "clean heat bill, would address the transition more directly. Sponsored by Senate Majority Leader Steve Fenberg and others, it would have the PUC establish targets for investor-owned utilities to promote beneficial electrification, i.e. displacement of fossil fuels by electricity derived from renewable resources.

For PowerPoint and other documents from last week's meeting, go here.

Many candidates for Holy Cross board — but why is that?

Ten candidates for 3 positions

by Allen Best

Three open seats this year on the Holy Cross Energy Board of Directors have drawn 10 candidates. By standards of electrical cooperatives, including Glenwood Springs-based Holy Cross, that's a bumper crop. Just a few years ago, candidates often ran unopposed.

Why so many candidates?

No deep unhappiness has surfaced. Electrical rates have remained stable and outages are few. Candidates' statements suggest no more than modest skepticism about the current path of Holy Cross, Colorado's third largest among the state's 22 electrical cooperatives.

Directors of Holy Cross last year adopted a goal of 100% renewable electrical generation by 2030, the most ambitious goal of a major utility in Colorado. The closest is the 100% goal of Platte River Power Authority, a consortium of four cities along the northern Front Range, which is confident it can hit 90% but says the 100% goal is contingent upon a variety of conditions.

Holy Cross has also drawn attention in the last several years because of its innovations. It has begun creating the infrastructure that will allow relatively rapid adoption of electric vehicles by its 44,000 members (56,000 meters) in its service territory in the Vail, Aspen, and Rifle areas. It is tinkering with demand-side management programs that allow power uses to be matched more smoothly with renewable generation. It has begun the work of creating microgrids, such as will allow continued electrical supplies in the case of disruptions such as caused by wildfires.

Climate change is the background issue for this drive to decarbonize electricity and expanded use of that electricity into market sectors, most notably transportation and buildings, now dominated by fossil fuels. "We live in a really beautiful place, and people want to protect it," says Jenna Weatthered, vice president for communications at Holy Cross.

Matt Scherr, an Eagle County commissioner, sees in the turnout of candidates "a much broader understanding of how critical our energy supply is to climate, prosperity, and daily life (hello, Texas) and also what a leader our local utility is in the nation in regards to reliable, inexpensive, renewable energy."

Another reason for the strong turnout of candidates may be the influence of Adam Palmer, a board member of Holy Cross from 2012 until his death in a January avalanche. Personally popular and known for his perpetual smile, Palmer also sat on the Eagle Board of Trustees. The election earlier this spring to fill his vacant place on that board likewise drew a large number of candidates, possibly driven by a desire to carry on his work.

The larger number of candidates may be part of a cycle. Last year's election drew 8 candidates to vie for 2 positions. The year before that there were 6 people competing for 2 seats. However, elections from 2013 to 2016 were uncontested, says Weatherred. But 9 candidates competed for 2 spots in the 2011 election.

What may most distinguish Holy Cross among Colorado's 22 electrical cooperatives is the number of candidates. But having contested elections is not uncommon, says Kent Singer, director of the Colorado Rural Electric Association. He estimates that half

of the cooperatives have at least one contested election each year.

But in another way, Holy Cross is entirely normal. All customers of Holy Cross, as with all coops, are also members and can vote for directors. Relatively few people, almost never more than 10%, exercise that right.

United Power, an electrical cooperative on the northern flanks of metropolitan Denver, has been contemplating an exit from its wholesale supplier, Tri-State Generation and Transmission. It's engaged in litigation against Tri-State and in defiance of Tri-State several years ago put in place battery storage, the first by a utility in Colorado. Even so, two contested elections this spring drew only 5,500 votes each from among the 97,000 members.

La Plata Electric, the cooperative based in Durango, is also considering an exit from Tri-State. Each of the 4 board seats is being contested this year. There are 8 candidates altogether.

In La Plata, disagreements are closer to the surface than those at Holy Cross or at United. They center around whether La Plata should buy out its contract with Tri-State to more aggressively develop local generation of electricity. The recent precedents are Delta-Montrose Electric in Colorado and Kit Carson Electric in New Mexico.

Tim Wheeler, the incumbent director from District 4, describes a vision for "community-led solutions and self-sufficiency." His challenger, John Purser, questions whether this is wise now that Tri-State has laid out plans to shift from coal to renewables. "There is no longer an environmental justification for leaving Tri-State," he says. La Plata distributes electricity well, he says, but he doubts whether it can generate it equally well.

San Miguel Power, another member of Tri-State, has asked what it would cost to get out of its existing contract with Tri-State, which expires in 2050. But only one election is being contested. Terry Rhoades, the incumbent from Ouray and Silverton, is being challenged by Rory Cowie, a hydrologist in Ouray involved in mining cleanup.

Holy Cross is among four cooperatives in Colorado that get no electricity from Tri-State. Instead, it has an agreement with Xcel Energy, although that agreement allows it to develop larger amounts of its own power, which it is doing. A big wind farm will be coming on line later this year in eastern Colorado, and work has begun on a solar farm near Glenwood Springs.

About 60% of Holy Cross members live in the Eagle Valley, from Vail to Glenwood Canyon. Four directors represent this Northern District, and one of them, Kristen Bertuglia, is seeking re-election to a 4-year term. If elected this would be her fourth term. Also up for grabs is the unexpired three years of the term of Palmer.

Bertuglia says she's not in the least bit insulted by having so many competing candidates. "I am inspired by it," she says. "I think people want to be part of what I have done and what the board has done and what the organization has done. That's why they're running."

But she also believes that the death of Palmer has been a motivating for at least some.

Bill Heicher, a resident of Eagle since 1972, says he sees Holy Cross as a well-run utility compared to many in the news and one that has become distinguished as an innovator. "They're way ahead of the curve on getting their energy supplied from renewables," he says. And, this is happening, he says, without frequent power outages that several decades ago were common.

"Holy Cross is much more prominent in community conversations about sustainability these days," says Kim Langmaid, a member of the Vail Town

Council and the founder of Walking Mountains Science Center in Avon. "Their reputation has shifted over the past 5 years, with their leading role moving toward 100% renewable energy, their leadership under CEO Bryan Hannegan, and all of their community partnerships."

She, too, points to the possible influence of the "death of my dear friend Adam Palmer and the inspiration he was for so many people in both the Eagle and Roaring Fork Valleys."

In the Southern District, from Aspen to Carbondale, three candidates are vying for one position. The incumbent, Robert Gardner, is among them.

Auden Schendler, from his post at the Aspen Skiing Co., has had his fingers in Holy Cross elections for many years, trying to promote candidates he believes will most aggressively support decarbonization of electricity. For example, he had encouraged Palmer to run. Not all his efforts—especially 10 to 20 years ago—were successful, though.

In this year's turnout of candidates, he sees a healthy sign and a reflection of the "growing success of our utility and the national importance of their clean energy goals."

Another constitutional scholar dubious of the Wyoming plan to target Colorado with lawsuits

The Associated Press has rounded up another constitutional scholar who takes a dim view of Wyoming's strategy to prop up its exports of coal and coal-generated electricity by suing other states, including Colorado.

Legislators appropriated $1.2 million in a law signed by Gov. Mark Gordon on April 6. In a story posted on April 1, Big Pivots identified the legislation as having a focus on Laramie River Station. The plant is partly owned by Tri-State Generation and Transmission. Tri-State has members in Wyoming and Nebraska, and power from that plant goes to both states, but most of the power from Tri-State's interest in that plant is exported into Colorado.

Robert Percival, an environmental law professor at the University of Maryland, sees Wyoming's case as being shaky.

"I don't think they have a legal leg to stand on," Percival told The Associated Press's Mead Gruver.

The Constitution's Commerce Clause prohibits states from barring goods and services based on their state of origin. States are free, however, to regulate or outright prohibit certain goods and services—coal and coal-fired electricity included—as long as they don't intentionally target other states, Percival said.

Washington may be another target of Wyoming's legal appropriation. Wyoming and Montana last year asked the Supreme Court to override a decision by Washington state to deny a permit to build a coal export dock on the Columbia River, to enable coal to be exported to Asia.

The Supreme Court hasn't said yet if it will hear the case, but Wyoming's new legal fund could help cover the cost of litigation, Michael Pearlman, spokesman for Wyoming's governor, told AP.

The coal litigation fund followed a 2020 bill that established a $1 million fund to promote Wyoming coal. Wyoming is paying a nonprofit, the Energy Policy Network, $250,000 a year from the fund to contest plans in other states to shut down coal-fired power.

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Normal has become a tiny bit warmer in Taos, and across the Southwest

Meteorologists talk about "average." What they mean is the average based on a 30-year record.

Every decade, this changes. The oldest decades gets cast aside, and the most recent decade added.

In this current recasting, average has shifted from 1980 to 2010 to the new time frame, 1990 to 2020, for calculating average. And that new average indicates more warming in the Taos area, as is true across the American Southwest.

The Taos Daily News explains that the average minimum temperature—the lowest temperature of the 24-hour period—for February increased 2 degrees Fahrenheit in the recalibration. Overall, the temperature in the Taos area increased 0.8 degrees.

If that doesn't seem like much, there seems to have been outsized influence of the warming in the Rio Grande Basin. The basin includes a portion of the San Juan Mountains in Colorado, where the river originates. Peak runoff is coming weeks earlier, a river guide tells the Taos News.

Buyers of Powder River coal get more picky about heating value

In the Powder River Basin of Wyoming and Montana, the shrinking continues of the once vast coal mining empire. What mine will be next to close?

WyoFile's Dustin Bleizeffer reports that new analysis suggests that buyers are getting more picky about the heating value of the coal they buy and there's a trend toward short-term contracts.

Powder River coal came on strong beginning in the 1970s and 1980s because of its low content of sulfur. This allowed power plants to burn it with less result of acid rain—and violating the Clean Air Act.

The downside was that the coal has less heating value than that produced in some other regions, with generally 8,400 to 8,800 Btus per ton.

New analysis by Dan Cohn, of the Sightline Institute, a research group based in Seattle, found that those mines with the coal of 8,400 Btu have fared more poorly as power plant operators have reduced their demand.

That reduced demand continued in 2020. Even without closing coal plants, utilities are operating them at lower capacities.

"The implications of that continuing decline are likely to hit Powder River mines differently, based on a number of factors—including the heating value," Cohn said in his report, "Planning for Coal Mine Closure in the Powder River Basin."

Montana's mine at Decker, a part of the Powder River Basin, closed in January. In February, Arch Resources said it is accelerating efforts to downsize operations at its Coal Creek and Black Thunder mines in preparation for closing. Coal Creek will likely ship its last trainload of coal this year.

All this is laid out in the example of the Scherer Power plant in Georgia. It's the largest coal plant in the nation with a generating capacity of 3,500 megawatts—more than double that of Colorado's two largest coal-burning complexes, Comanche at 1,635 megawatts and Craig at 1,283 megawatts.

In 2017, the Georgia plant purchased coal from six Powder River mines, the largest a contract for a 3.4 million tons. Last year, there were four contracts, the largest for 1.7 million tons.

"We've entered this sort of twilight phase in the Powder River Basin coal mining industry where it is no secret that some company will close their mine next," said Cohn.

Arch and Peabody Energy, the largest and best financed among producers in the Powder River, have both said they will eventually leave the Powder River.

The companies also operate Twenty Mile Mine, near Steamboat Springs.

For the Sightline Institute report, go here.

For the WyoFile story, see "Report: Coal's decline hits Powder River Basin mines differently."

More hope—and cash—for research into carbon capture technology

Hope continues that coal can remain a viable resource through improved technological innovation.

The U.S. Department of Energy in late April announced $99 million in grants to study technology that removes carbon from industrial exhaust and uses it for other purposes.

The federal agency gave $64 million of that to Membrane Technology and Research. The company is working at Wyoming's Integrated Test Center near Gillette.

Another $3 million federal grant shepherded through Congress by Wyoming representatives is to be used to support Wyoming-based research "focused on expanding and transforming the use of coal and coal-based resources to produce coal-based products, using carbon or rare earth element and critical minerals."

WyoFile took a hard look at the continued hope for what is sometimes called carbon capture and sequestration (or storage). Now it's also being called carbon capture utilization and storage.

The most telling comments came from Clark Williams-Derry, an energy finance analyst for the Institute for Energy Economics and Financial Analysis."… the technology is iffy and the subsidies aren't high enough to make most projects pencil out," he wrote in an e-mail to WyoFile.

The latest hope for carbon capture technology, at Petra Nova, a power plant in Texas, has ended badly. Others have also stumbled in the last decade. In the last 10 to 15 years, major investments in carbon capture at plants in Illinois and then Mississippi have been abandoned.

WyoFile reports new momentum. Congress has extended a tax credit seen as critical for carbon capture projects for another two years. And there's a push for expanded federal research.

Is it enough?

"I really do believe that there's a role for carbon capture, particularly in heavy industries (steelmaking, cement) that produce a lot of carbon as a process byproduct," Williams-Derry said. "However, real world progress on financially and technically viable carbon capture projects has been poor."

Colorado also sees a potential role for carbon capture in its energy future, as Will Toor, executive director of the Colorado Energy Office, pointed out in a presentation earlier this year.

In an upcoming issue of Big Pivots, look for a deeper study of the potential for carbon capture.

Solar and storage sector applauds decisions by the Colorado PUC

The solar and storage industry in Colorado registered what it called a success with a decision by the Colorado Public Utilities Commission.

The PUC decision will make it faster and easier to connect solar + storage systems to the grid, said the Colorado Solar and Storage Association in a statement released along with the national trade group, Solar Energy Industries Association.

The two groups had asked the PUC to reevaluate interconnection rules that had resulted in unnecessary confusion for solar + storage customers in Colorado. The PUC decision will help to drive deployment innovation and provide much needed transparency and predictability for customers and solar installers across Colorado.

The PUC decisions, among other things, will allow solar + storage customers to draw from their solar energy system or from the grid and empower them to use the stored energy whenever and however they want.

"The interconnection proceeding lasted over 2 years, and many stakeholders worked hard to modernize Colorado's electrical grid," said Mike Kruger, chief executive of the Colorado trade group. "We believe that the final result will ensure that customers have a clear path to installing more solar and energy storage, especially if the PUC approves incentives for deployment."

Solar had grown to 4% of Colorado's total electrical generation in 2020.

Colorado Newsline: Why is Garrison Kaufman still top air regulator in state?

Why does Garry Kaufman, Colorado's top air pollution regulation, still have a job, wondered Colorado Newsline.

"Coloradans might once have viewed the state as at least honest in trying to regulate polluters, even if it was often ineffective," said Newsline's Quentin Young, the editor, in a May 14 op/ed. "But its failures are so persistent, the matter is so critical, and the cause for distrust is so deep that new leadership is necessary. Garry Kaufman, the top official at the Colorado Air Pollution Control Division, can no longer effectively lead the agency and should be replaced."

Three whistle-blowers in a late March complaint alleged that "senior officials instructed employees to ignore modeling requirements mandated by the EPA under the federal Clean Air Act and, in at least one case, ordered a modeler to falsify data in order to ensure that no violations of air-quality standards were reported."