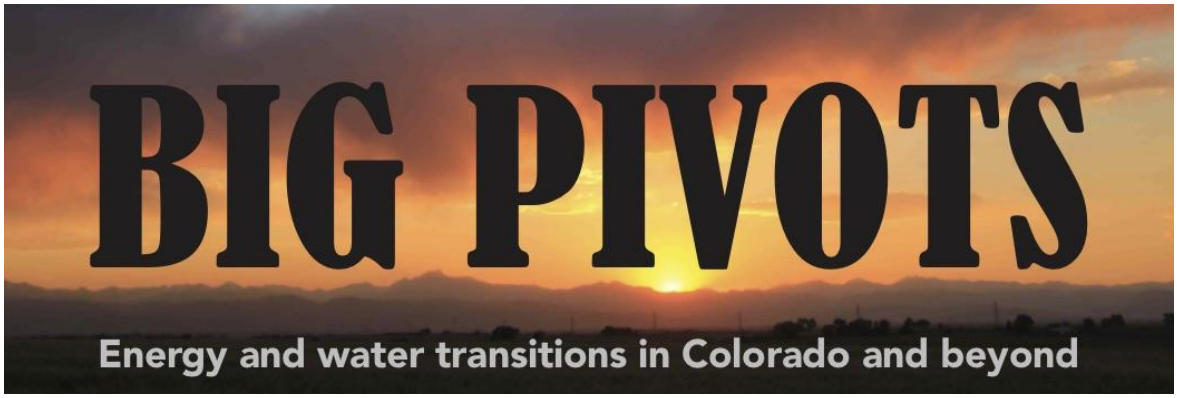


March 18, 2021 Issue No. 33
https://mountaintownnews.net

Steven Chu's grim yet hopeful view of a planet certain to get warm & wackier

by Allen Best

Where to start with Steve Chu? That he was a secretary of energy in the Obama administration for four years? That he won a share of the Nobel prize in physics in 1997?

That he delivered the most interesting, frightening but at times funny lecture about climate change that I have heard?

That Zoomed lecture occurred on March 4 at the Getches-Wilkinson Center for Natural Resources, Energy, and the Environment, a program within the law school at the University of Colorado-Boulder. This report starts with his parting comments.

"Time is running out," he said. "The real scary stuff is the stuff we have seen in the last decade, the violent weather, the forest fires, the droughts. I thought that they were 30 to 50 years in the future, but they're here now."

The evening's moderator was ready to wish everyone well and thank Dr. Chu, when he had one last thought.

"You can't give up hope, because if you give up hope you can say you no longer care about your children and your grandchildren," he said.

Which begs the question. What hope do we have?

We have very little hope of stabilizing the changing climate to avert what Chu described as some very, very bad turbulence. Most of the atmospheric concentrations of carbon dioxide that have been occurring since the start of the industrial era in the 1750s have actually been added in the last 65 years. We're now at 415 parts per million and will almost certainly hit 500 ppm and likely 550 ppm.

About 15 years ago, scientists were saying they expected the climate wobbling to begin at about 450 ppm. Turns out they were too conservative by far.

Chu was detailed but brief in laying out the scientific evidence. To find the concentrations of carbon dioxide we have today, he said, you have to go back 3 to 5 million years, to a time when the intensity of the sun was about the same. The Earth's temperature then was 2 degrees warmer and the sea level was 10 to 20 meters higher.

That takes us back to the emissions locked into the system now, some of which are unlikely to be manifested for another century.

"In order to stay below 2 degrees, something has to happen," he said. "The carbon emissions for everything in the world have to go below zero. I'll say it again. It has to be below zero. That's not just the carbon from power plants. It's everything."

Now it's my turn to say it again. Think zero carbon, then think about a way to actually suck carbon dioxide out of the atmosphere. That's not something we've actually mastered yet, not in any way that is practical. We've figured out how to have astronauts flying untethered to a space ship. But we haven't figured out the technology that will spare us the rising heat that will in turn cause intensifying droughts in some places on the planet—likely including the Colorado River Basin—and far more flooding elsewhere, seawater rising along the coasts and into our most populous cities.

Steven Chu

We've become hyperfocused on the carbon emissions from coal-fired power plants and, to a lesser extent, natural gas. Several times Chu suggested it's time to think more broadly, especially with agriculture.

"What is the greatest emitter of carbon dioxide? It's not electrical generation," he said. "It's agriculture use and forestry, at least 28%, according to the IPCC summary report."

Our hunger for animal protein has led us to a dangerous place. We create cattle that live 8 to 14 months, he said, pigs 22 to 26 weeks (during which time they grow to be 280 pounds), and broiler chickens in 40 days. And there are the breast-heavy turkeys, bred for their white meat, which most of us in the United States (myself included) favor.

This does produce methane. "If beef and dairy cattle were a country, the carbon dioxide emission would be more than any country except China and the United States." This, of course, takes a huge commitment of land, to feed the animals we eat.

As for renewable energy, it's all fine, but to get beyond 80% of our electrical generation it needs to be supplemented by storage.

Pumped-storage hydro provides 96% of the world's energy storage around the world (and nearly 100% in Colorado). The global storage totals 2 gigabytes, but needs to be about 10,000 gigabytes.

Batteries will help. Chu predicted prices will drop three-fold in the future, "but they need to go down another three-fold to achieve what we need," he said.

I hope this story has informed, but it's just a peek. The 128-minute video can be seen HERE.

Before you go, let me suggest you stick around on the video toward the end, where he talks about why we have to make a go of it on this planet. He describes the limits of existing technology for space travel. You think driving across Wyoming or Nevada takes time. He said covering just one-tenth of the Milky Way Galaxy would require 2.6 million years.

Instead, we need to redefine "wealth," he said. "Right now wealth is defined by gross domestic product, which is defined by how much stuff you can make and use." The world cannot sustain the population of 11 billion people projected for century's end if that population aspires to the American definition of wealth.

Chu suggested something called the human development index, one that better equates wealth with quality of life.

"This is our home, and we have to take care of this one, because that's all we have," he said. And hence, of dire necessity, the hope.

West Grand School District's electric bus was unveiled today in Kremmling. Photo/ Chris Michalowski, Mountain Parks Electric

Colorado's first electric school buses roll out in very different districts

In an odd way, Boulder and Kremmling have a common bond. The school districts headquartered in the two places are the first in Colorado to have electric school buses.

First was the electric bus for the Boulder Valley School District, which rolled out in early March. The bus for the West Grand School District arrived in Kremmling on Wednesday afternoon and will be placed in service in early April.

Many more will be following across Colorado, as state aid has been approved for 14 buses. The grant program taps Colorado's $67.5 million share of the Volkswagen settlement.

As for these first two districts, they're very different. Boulder Valley has 30,000, West Grand 408 students drawn from Kremmling and outlying routes up the various valleys: the Muddy, Troublesome, Williams Fork, and Blue, as well as along the Colorado River to Parshall

Darrin M. Peppard, the superintendent of schools at West Grand, credits activism by both Mountain Parks Electric, the local electrical cooperative, and the Boulder school district.

"We were notified by Mountain Parks Electric about the Volkswagen settlement funds grant. We weren't entirely sure—an electric bus, our high altitude, the cold temperature. How is that really going to function?"

What sold West Grand was a trip to Boulder. The school district there had arranged to have an electric bus hauled from a school district in North Dakota. "It was a cold, cold, snowy day in Boulder—which was perfect," says Peppard. "They fired up the bus, and the cabin temperature warmed much more rapidly than a diesel bus would in December."

Making the electric bus even more attractive was the cost: nothing. West Grand got a grant for $301,000 from the state program. Mountain Parks Electric contributed $70,000 and Tri-State Generation and Transmission, the wholesale supplier for Mountain Parks, added $50,000. This includes the cost of the bus but also the electrical infrastructure at the bus barn for charging.

Chris Michalowski, the power use advisor at Mountain Parks, says the co-op's capital funds—unclaimed credits of members who died or have left—were tapped to fund the bus. But the bus fits in with a broader goal of Mountain Parks to encourage transportation electrification.

"This is a great way to do that. It's highly visible, easily recognizable, on the road twice a day," he says. And that influence of the electric bus will encourage the parents of the bus riders to buy electric.

West Grand has changed little since the 1970s when this writer lived there. It is ranch country, but the largest employer is the molybdenum mill near the head of the Williams Fork Valley.

This new 78-passenger electric bus will have a route that runs 20 to 25 miles twice a day "up" the Blue River Valley, not quite to Green Mountain Reservoir.

The buses officially have a range of 120 miles. That said, when it was driven to Kremmling on Wednesday it was charged in Golden and again in Frisco.

Community reaction has been one of intrigue, Peppard says. "Is it going to work? Is it going to be OK? People are eagerly anticipating answers to those questions, and we are confident that it will be great."

He expects the first surprise to be when people board the bus. "It's extremely quiet."

In Boulder County, the school district will study operation of its electric bus with an eye on cost savings. The district has 255 buses

Charging in a Grand way

Fast-charging stations are being rapidly added to Grand County., Fraser added one in December, Grand Lake will do so this summer, and Granby has been recipient of a DC fast-charging grant.

Kremmling also has a Tesla fast-charging station, as does the Devil's Thumb guest ranch.

ALT Fuels Colorado has been delivering grants for several years for electric and other vehicles that replace diesel vehicles 2009 or older. To be eligible, there must be a one-to-one trade-out.

The Vail Valley Foundation also was given $209,000 for an electric shuttle bus at the same time. Other school districts were given money for propane-burning buses.

Arriving as governor in January 2019, Jared Polis shifted funding, steering all Colorado's $67.5 million share of the Volkswagen settlement into electric and renewable natural gas.

For example, both Waste Management and Western Disposal Services got grants for garbage trucks that will burn renewable natural gas, the latter from a sewage treatment plant in Boulder.

Grants have also been approved for electric buses: Steamboat Springs, Denver, Aspen (Country Day), and Durango. Aurora Public Schools have gotten funding for 7.

The city of Fort Collins has also received funding for an electric bus.

Matt Goble, program coordinator for ALT Fuels Colorado, says there's a significant lag time between when a bus is ordered and when it is delivered. "Right now, there is a 6 to 8 month best-scenario," he says.

Durango's award may be unique in that the school district is partnering with La Plata Electric to do bus-to-grid charging. (A story coming in another issue of Big Pivots).

See full list of ALT Fuels Colorado award recipients here.

Battery storage next for Hayden coal plant?

How will Xcel Energy repurpose the Hayden coal plant in northwestern Colorado after power generation there ends in 2028?

Xcel Energy, the operator and primary owner, has assured locals that the plant will be repurposed, offering a continued tax base for the school district. But what exactly?

Alice Jackson, the president of Xcel Energy-Colorado, hinted at some possibilities in an interview with the Steamboat Pilot recently.

"Whether it's battery storage that can be installed there or other innovative technology currently being explored—there's a number of different opportunities that we're exploring right now."

In a preview of its plans to be submitted by March 31 to the Colorado Public Utilities Commission, Xcel said it plans to add 400 megawatts of battery storage to its system, but did not specify where. It already has 275 megawatts of battery storage being assembled or planned near Pueblo and in Adams County.

Might one of those innovative technologies be green hydrogen?

A key thing to remember about the plant at Hayden, as well as the Craig plants roughly 15 miles to the west, is that they have transmission lines extending south and east. It only makes sense to use those transmission lines.

In a webinar in October, Tri-State 's chief executive, Duane Highley, said his utility has made no decision about storage, nor does it need to until about 2024.

On that same webinar, State Sen. Chris Hansen, the state's geekiest energy legislator, suggested a future for green hydrogen. Green hydrogen is made from water, and the power plant already has water rights associated with the combustion of coal. However, as Hansen later noted, green hydrogen is in the early stage of development and still very expensive. However, if costs and other issues are worked out, it could provide utilities a way to "store" the renewable energy for weeks or even months. That remains a fundamental conundrum for Xcel and other utilities in Colorado, who have plentiful wind through much of winter and spring but not so much in summer.

Xcel has 68 employees at the plant. In Pueblo, where it is scheduled to close two coal units in 2022 and 2025, it has committed to working with employees and their union, the International Brotherhood of Electrical Workers, on a transition plan. The same is true at Hayden. That includes training opportunities to work in renewable or other energy sectors.

"We can't just transfer the impacted workers to another power plant anymore," said Rich Meisinger, business manager of the BIEW Local 111, at a press conference in February. "I think the company and union are working more closely than they ever have to secure opportunities for good union jobs in Colorado."

Those renewable jobs are unlikely to be found in the Yampa Valley, whose wind and solar utility-scale resources fall short of those found elsewhere in Colorado.

Wind in northwest Colorado is not nearly as consistent as that of eastern Colorado, where Xcel—and also Tri-State and other utilities—plan major wind and solar development (and $1.7 billion in transmission lines to support that new generation). Solar also lags some other areas of Colorado.

Moffat County objects to Biden 30% plan for lands

Moffat County commissioners have registered their opposition to President Joe Biden's plan to conserve 30% of the nation's land and water by 2030 as part the broader effort to address climate change.

The Craig Daily Press reports that the resolution cited the fact that the top 10 taxpayers in Moffat County make up 62% of the county's assessed valuation, and all of those top 10 depend directly upon federal lands or the resources under the surface. Too, the commissioners pointed to the amount of land in the county already off-limits to development. They include 339,036 acres of wilderness study areas and lands with wilderness character; 150,000 acres in the Dinosaur National Monument; and the 14,000 acres of the U. S. Fish and Wildlife Refuge, plus tens of thousands of acres in state wildlife areas, plus land in private conservation easements.

What to make of this talk of carbon-tax support?

The top lobbying arm of the oil and gas industry, has been edging closer to endorsing a carbon tax.

The Washington Post reports that a paper being weighed by a policy committee of the American Petroleum Institute would back a carbon tax as an alternative to federal regulation and policies aimed at slowing climate change.

What to make of this? Not much, many analysts and lawmakers tell the Washington Post. They say Congress is highly unlikely to adopt a carbon tax—allowing the trade group to appear to support climate action while risking little.

A tax of $40/ton, a favored starting point for many policy makers, would translate into 36 cents per gallon of gasoline.

Consolidation continues in Colorado's oil-and-gas sector

Chevron Corp. continues to consolidate its holdings in Colorado with a deal to acquire all the outstanding stock of Noble Midstream Partners, a major industry player in northern Colorado's oil-and-gas fields.

The Boulder Daily Camera says that the Houston-based Noble Energy was acquired by Chevron last fall for $5 billion, the first major acquisition in the oil and-gas industry after the pandemic-induced price collapse in early 2020.

Noble Midstream was originally set up as a partner to Noble Energy to transfer and store oil and gas produced in Northern Colorado to refineries in Oklahoma. It also operated in the Permian Basin of Texas.

The Yampa River near Steamboat Springs in 2012. Photo/John Russel, Steamboat Pilot

A warming climate leads to a paradigm shift on the Yampa

by Allen Best

In 2018, Erin Light did something that had never before been done on the Yampa River downstream from Steamboat Springs. She placed a call.

As district water engineer, Light was responsible for administering Colorado's complex matrix of water rights. Rights are ranked by date and volume, from earliest decreed and hence most senior to most recent and hence junior. A senior water-rights holder on the Yampa River at Lily Park, near the entrance to Dinosaur National Monument, had called to say he was not getting the water decreed to that property for irrigation of the hay meadows.

The call she placed that summer lasted 21 days, causing the most junior of users upstream to cease diversions until that senior right was met. Then came another hot and dry summer in 2020, and she placed another call, this one lasting 9 days. It was a paradigm shift for the Yampa, a river that through the 20th century always had had enough water for anybody who wanted to dip a straw into it.

If foreign to the Yampa River, such calls have long been commonplace on Colorado rivers. The premise is water scarcity, the idea that there just isn't enough water for all who want it, at least all the time.

Colorado's hierarchy of seniors and juniors, older and younger, is commonly traced to the development of irrigation agriculture in the Poudre Valley between Fort Collins and Greeley. The Greeley irrigators were first, but then came new irrigators upstream near Fort Collins. In a drought year, their new diversions had an

effect on what was available downstream. Within a decade, soon after Colorado became a state, the first calls were placed on that river.

It took little time for scarcity to be understood on all of Colorado's rivers east of the Continental Divide. Scarcity was slower to be understood on the Western Slope, where there was more water and, even in the days of feverish gold- and silver-mining, fewer people. Yet over the decades, the Colorado and other rivers came to be fully appropriated.

The Yampa, though, stood alone among major rivers in Colorado in its relative plentitude. It routinely delivered water to all who wanted it. Even its reservoirs, modest in size, came relatively late in the 20th century, to help moderate flows.

The Yampa's relative isolation played a role in this. It's two mountain ranges distant from the Front Range, two significant fences to hop for Front Range cities and Great Plains farmers.

Climate also played a role. You can't grow corn in the Yampa Valley with any reliability. You can grow hay, but the geography makes even that problematic.

Snow drapes a house in Craig and an angler casts in the Yampa River at Steamboat Springs, both in early March 2020. ***Photos/Allen Best***

A gaging station in the Yampa River near Maybell has documented 1.5 million acre-feet a century ago to 1.1 million acre-feet now, with one recent year showing only 500,000 acre-feet. *Photos/Allen Best*

Now that climate is shifting. Not enough to grow corn but enough to cause the Yampa to be marginally less robust and, as the 21st century has shown in 2018 and 2020, but also in other years before that, unable to deliver.

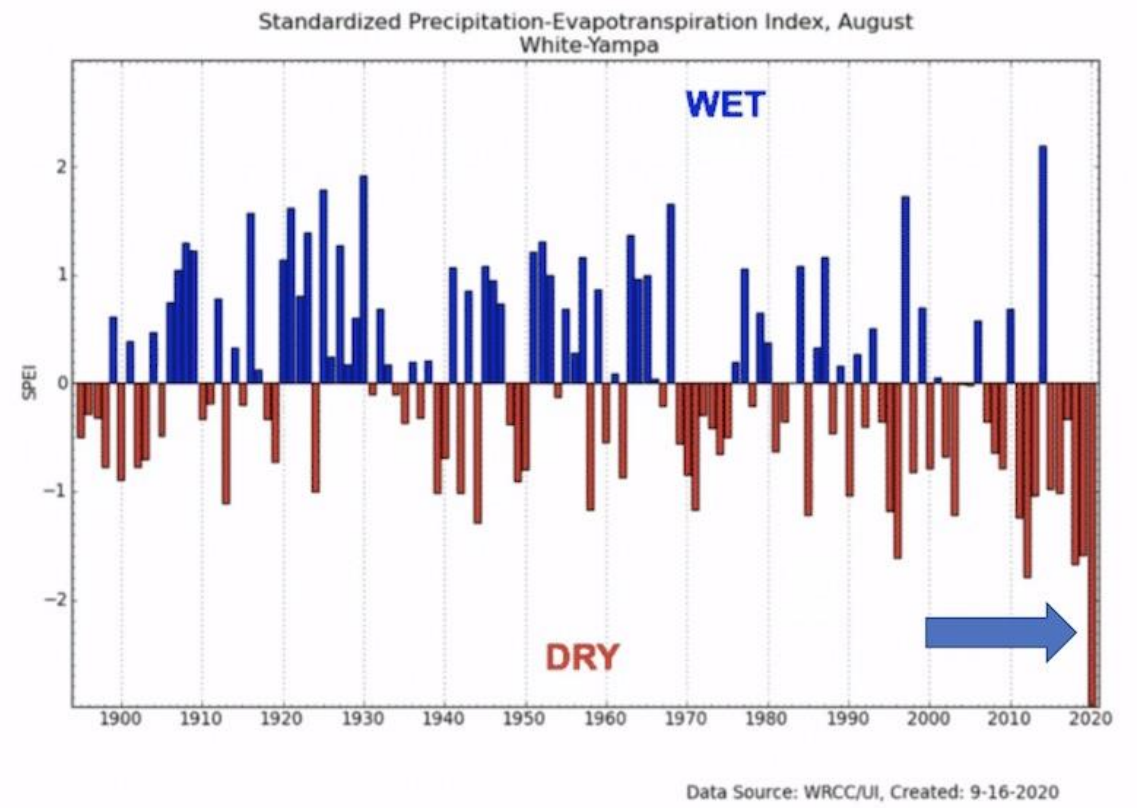
This has led to Light recommending that the Yampa be designated as "over-appropriated." It's a legal phrase that suggests something more odious than is actually the case. It sounds like the theater has been oversold and some people will be escorted from their seats to stand outside.

Over-appropriated doesn't mean that. It does have implications for those wanting to drill large-capacity wells along the river. They must show the ability to deliver augmentation water, which is commonly purchased from an upstream reservoir. Most of Colorado's rivers long ago were designated as over-appropriated.

In my reporting for a story commissioned by Aspen Journalism, which can be seen here and has more of the detail of interest to a local audience, I talked several times with Light. She chose her words carefully. She didn't talk about climate change, only the direct evidence, the water years of 2018 and 2020. But there were other bad years, too, including 2012 and also 2002.

Light wasn't the district engineer in 2002, and only recently did the downstream irrigator near Dinosaur explain why he hadn't demanded his water that summer and fall. He just didn't have the heart to cause so much pain upstream in that year of scorching temperatures, forest fires, and meager winter snows eviscerated by spring winds.

Perhaps the most compelling evidence from Light were these statistics, drawn from the U.S. Geological Survey gaging station at Maybell, located along the Yampa River (and Highway 40), between Craig and Dinosaur National Monument. A century ago, the



gauging station recorded an average annual 1.5 million acre-feet. That has declined to 1.1 million in the 21st century. And, of course, some years are worse, including one year in the last decade of 500,000 acre-feet.

At a recent meeting of the Colorado Air Quality Control Commission, a representative of Boulder County mentioned drought caused by climate change in support of regulations to control methane emissions. One of the AQCC commissioners, Randy Ahrens, of Broomfield, wanted to know why, if the ski areas could talk about what wonderful record-breaking snows we had, we could still be in drought.

In that question I think I heard some skepticism, perhaps a wondering whether enviros were just a little too chicken-littlish. It was a legitimate question, though.

I saw the answer during my three trips to the Yampa Valley in 2020. In early March I visited Steamboat and then Craig, seeing evidence of a big snow year, reminiscent of the winter and spring I had spent there in 1979. I got skilled that winter at chaining up my Ford Pinto in the dark during a snowstorm while crossing Rabbit Ears Pass.

But those heavy snows I saw in March 2020 soon disappeared in a warm, dry spring.

Kelly Romero-Heaney, the water resources manager for Steamboat Springs, laid it out for me. The snow-water equivalent—a measure of the snowpack—showed 116% of median on March 1. It was down to 69% by June 1.

Then came summer, hot and dry, a record in both categories during August against 130 years of measurements.

That heat and lack of precipitation, Romero-Heaney told me, drove a measure called the SPEI, or Standardized Precipitation Evapotranspiration Index. “The combination of heat and lack of precipitation drove an SPEI figure that far exceeded drought years, such as 2002, 2012, and 2018,” she said.

Last August, when I returned again to explore the Little Snake River, it felt like an

oven. Stopping for a sandwich in Steamboat on the return to the Front Range, it felt Denver hot. That afternoon I continued eastward across Cameron Pass then drove past Long Draw Reservoir and toward the headwaters of the Colorado River. A week later, it was afire.

That Cameron Peak Fire was still in advancing in early October when we returned to Craig a third time. It was a smoky time there—and everywhere.

On that October trip I drove up the Elk River northwest of Steamboat Springs to see Jay Fetcher. His ranch a few miles from Steamboat Lake had been his parents' ranch when they arrived from Philadelphia in 1949 and he was a toddler. His parents had kept a record through their years of when the last snow disappeared from the meadow. His father died just a few years ago, a legend in Steamboat and beyond, partly because he was a co-founder of the ski area, but also because of his work in water.

Jay Fetcher at his ranch along the Elk River northwest of Steamboat Springs in the hay meadow where he, and before that, his parents have carefully tracked the last disappearance of snowbanks each spring.

Jay has continued the work of his parents, charting the withering of the winter snowpack. And the chart he gave me showed a clear progression toward earlier springs, particularly during the 21st century. There' still great variability, but now more so. The "snow off meadow" date arrives an average one day earlier every five years. That means longer summers.

The story here is that last year was emblematic of what has been happening in the Yampa River. There's no longer enough water for everybody who wants it all the time. It's not because of additional new diversions, although there are some. But that does not tell the story. The longer, hotter summers may cause ranchers to divert more water to irrigate. That could be part of the story.

The largest story is of the warming weather, the shifting climate.

Light has submitted her proposal for over-appropriation to her boss, Kevin Rein, the state water engineer. In an interview, he had also chosen his words about climate change carefully. Approving this, he said, would not be a prediction of a climate to come, only a recognition that the hydrological balance has shifted.

Fair enough. But there's the weight of evidence, almost crushing, that climate change has started playing a heavy hand in the Colorado River. There are the studies by Udall, et al, that point to the "hot drought" as the story, with roughly half the recorded declines due to temperature and not precipitation. There are, of course, the enduring images of the bathtub ring at Lake Mead. And there are the models that predict much more warmth is yet to come.

Climate change is not just the future. It's here, it's now. And from all available evidence, the climate scientists were too conservative in their predictions.

A no-hoper, this bill still triggered some interesting talking points

State pre-emption of local natural gas bans rejected by committee

by Allen Best

Berkeley was first in what is fast shaping up as a national battle about natural gas. In January 2019 it passed a law that crimped use of natural gas in new buildings. Since then, 42 municipalities in California have changed their building codes to make natural gas use impossible or difficult in new buildings. Seattle and a few others cities elsewhere in the country have adopted restrictions, too.

Arizona and 3 other states were quick to push back. Last year they adopted prohibitions on local bans. This year similar legislation has been introduced in 12 states, including Colorado.

At least for now, though, Colorado will be more like California than Arizona. A Colorado legislative committee on March 3 killed a proposal that would have prohibited such local actions

The 7-5 party-line vote—Democrats opposed the proposed restriction on local authority and Republicans favored it—provided a preview of coming debates as Colorado seeks to move forward on economy-wide decarbonization goals specified by a 2019 law.

The primary talking points in the Colorado House Energy & Environment Committee were about individual choice vs. local control.

Consumers should have the right to burn natural gas and propane, said the bill's sponsor, Rep. Dan Woog, a Republican from Erie. "I contend this is about choice and giving everyone in Colorado a choice," he said of his bill, HB21-1034, "Consumer Right To Use Natural Gas Or Propane."

Woog said the bill was a response to Denver's consideration of requiring new buildings be all electric. He and supporters see Denver's efforts as most assuredly the camel's nose under the tent.

"This is not hypothetical," said Dianna Orf, representing the Associated Governments of Northwest Colorado. She said she had been in meetings where state officials have talked about moving people away from natural gas. "We fear that someday in the future we will see a ban on natural gas for our home use," she said.

Others described the proposed law as a solution in search of a problem. Rep. Edie Hooton, a Democrat from Boulder, said she works with many environmental groups, and she's not aware of plans to begin pushing natural gas bans.

Primary talking points in Colorado House Energy & Environment Committee were individual choice vs. local control

The truth lies somewhere in the middle. Denver remains the lone jurisdiction in Colorado with an active proposal to crimp the expansion of natural gas and propane in new buildings. Despite the fears expressed by Orf and others, not even Denver proposes to force its removal from existing buildings. Instead, the proposal to be reviewed by the Denver City Council later this year would apply to homes in 2024 and other buildings in 2027. It would not apply to existing buildings.

Boulder already has a building code that effectively creates a ban on natural gas in

larger homes. The maximum energy use per square foot of new residential construction of 3,000 square feet or larger leaves no room for gas. Boulder County has a similar program.

For Colorado and many of the towns and cities within the state to achieve their climate goals, they must necessarily address the emissions caused by buildings. This includes natural gas that is commonly burned to warm air and water, also in some cases for cooking.

Colorado's plan is to largely remove emissions from electricity while accelerating electrification of transportation. Removing emissions from the built environment was recognized as the more difficult challenge in the Colorado Greenhouse Gas Pollution Reduction Roadmap that was released on Jan. 14.

At the committee hearing, much was made of all-electric heating in the past. "It was a nightmare," said Rep. Perry Will, a Republican from New Castle, of living in an all-electric house in the 1990s.

The technology has changed completely in the last 25 years. If Xcel Energy, the state's largest utility, remains skeptical that the technology is ready for prime time in Colorado, many others, including Rocky Mountain Institute, argued that houses and water can be warmed in most parts of Colorado without natural gas.

Geos, a multi-family complex in Arvada, has no natural gas connections. Basalt Vista, an affordable housing project in the Roaring Fork Valley, also has no natural gas. They use air-source heat pumps, a fast-improving technology pushed by a company called Mitsubishi. The air-source heat pumps work to -14 Fahrenheit.

Having the technology is one thing. Having technicians familiar with it is another matter. Widespread re-training will be needed for this paradigm shift.

Once a building is built with natural gas, the retrofit is indeed expensive. Colorado had been building about 40,000 houses a year, nearly all of them with natural gas space and hot-water heaters. About three-quarters of Colorado's 1.5 million houses have natural gas.

A 2020 study commissioned by the Colorado Energy Office found substantial opportunities to reduce greenhouse gas emissions in the built environment. Policies could result in nearly 200,000 homes having electric heat pumps by 2030, the report found. The roadmap released in January said it's not just a matter of technology. Financing programs will be needed. (See pages 75-75 of the roadmap.)

Dan Woog

Legislation introduced this year will tackle at least some of this. One of the bills supported by the administration of Gov. Jared Polis would institute more rigorous energy efficiency in homes to cut demand for natural gas.

Another piece of legislation would require Xcel Energy and Black Hills Energy, the state's two investor-owned electrical utilities, to file plans with the PUC to support beneficial electrification in buildings. This would be similar to what was required of Xcel and Black Hills for transportation electrification. The idea is of incentives but softly pressing down the carbon intensity of the building sector.

At the committee hearing, ban-on-ban proponents also talked frequently about loss of jobs if demand for fossil fuels is suppressed. Scott Prestidge, representing the Colorado Oil and Gas Association, talked about Colorado's front-of-class regulations that seek to minimize emissions during extraction and delivering of natural gas.

The most curious argument at the hearing was Woog's statement that banning new natural gas infrastructure in one jurisdiction would cause higher prices for natural gas in other jurisdictions

Woog didn't explain his reasoning, but it does mirror one of the talking points of a paper issued in early November by Xcel. The report examined the difficulty of rapidly electrifying buildings. One of the perceived challenges is that those with higher incomes will be able to afford to electrify and shut off their natural gas, leaving lower-income residents served by the same line to pay the higher costs for upkeep of the infrastructure.

That, however, is a very different circumstance than a ban on natural gas in new buildings in Denver having an effect in, say, Weld County.

Such local pre-emption legislation has followed a very similar pattern, according to a National Public Radio report in February. Gas utilities, with help from industry trade groups, have successfully lobbied lawmakers over the past year to introduce similar "preemption" legislation in 12 mostly Republican-controlled state legislatures, NPR said, citing work by the Natural Resources Defense Council.

The Washington Post also reported on the controversy. "Logically the natural gas industry does not want to see its business end, so it's doing what it can to keep natural gas in the utility grid mix," said Marta Schantz, senior vice president of the Urban Land Institute's Greenprint Center for Building Performance. "But long term, if cities are serious about their climate goals, electric buildings are inevitable."

In Massachusetts, State Rep. Tommy Vitolo, warned of the costs of delay. "If we install a furnace or burner in a building in 2022, will we have to take it out before the end of its useful life in order to meet emissions?" he told the Post. The important comparison is now gas vs. electric, but gas plus the costs of heat pumps 15 years from now. In other words, he wants to get it right the first time.

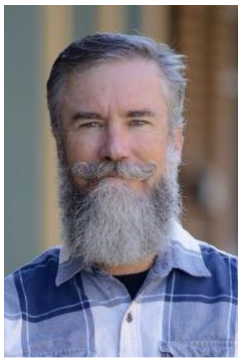
At the committee hearing at the Colorado Capitol, representatives of many cities testified in opposition to Woog's bill, all emphasizing local control.

> "We need every single tool available to us to address our building stock."
>
> **Jamie Harkins**
> ***Lafayette, mayor***

What's right for Arvada is not necessarily what's right for Boulder or some other jurisdiction, said Arvada City Councilwoman Lauren Simpson.

In an effort organized by Colorado Communities for Climate Action, representatives from Fort Collins to Salida also talked about air quality impacts, including inside homes and in communities more generally, as well as atmospheric pollution by greenhouse gases.

"I know what my community needs," said Katherine Goff, of the Northglenn City Council. The "proposal would hamstring our abilities" to reduce greenhouse gas emissions by replacing gas with electricity once electricity has been decarbonized, she said.



P.T. Wood

"We need every single tool available to us to address our building stock," said Lafayette Mayor Jamie Harkins, after describing the city's climate change goals. But there was a secondary reason, that to make buildings healthier. A growing body of research has shown deleterious effects of combustion of natural gas inside buildings.

From Salida came similar sentiments. "We take climate change very, very seriously in our community here in the mountains," said Mayor P.T. Wood. "We are feeling the effects of climate change at this moment," going on to describe a "dry, hot winter."

If Salida isn't yet ready to follow in the footsteps of Berkeley and other California cities that have put the kibosh on use of natural gas in new buildings, Salida wants to retain that authority. The bill, said Wood, "would cut away at the ability of local communities to make their own decisions. These decisions should be made locally and not in Denver."

In a sense, the arguments were flip-flopped from the usual, when representatives of fossil fuel counties have traditionally championed local control over state authority and decried decisions made in Denver. Before votes were cast, Hooton, the legislator from Boulder, wryly noted the shift. "We're for local control until we're not," she said.

Hooton went on to say she was discouraged by the "climate change denialism" she heard among fellow committee members in their questioning of bill opponents. That was met with a sharp response from Rep. Andres Pico, a Republican from Colorado Springs. "That is an insult," he said. "I will not take it."

Pico had declared that there is "no climate emergency." Where the Salida mayor saw the forest fire on nearby Methodist Mountain several years ago as the result of a warming climate, Pico described it as a natural phenomenon. Ditto for the 21st century drought.

If the climate is warming, it's almost entirely natural, Pico declared.

Pico's assertions regarding drought contradict what is fast becoming established science about Colorado's largest and most water-plentiful watershed, the Colorado River. Extended droughts have been documented for the last 2,000 years, but the current drought looks different, what one climate scientist calls a "hot drought," with precipitation declines corresponding closely to rising warmth produced by accumulating greenhouse gas emissions.

The natural gas industry paints itself as the clean-burning fuel, and compared to coal, it is. But there has been sharp debate about whether unintended emissions of methane – the primary constituent of natural gas – in the supply chain actually make natural gas worse than coal in its global warming potential.

Jan Rose, a representative of the Colorado Coalition for a Livable Climate, a coalition of 28 groups, cited methane emissions from natural gas pipelines, which she said leak like sieves.

A new aerial study found that gas pipelines represent the second largest source of methane leaks. And a 2020 study by the Environmental Defense Fund found that 3.7% of natural gas produced in the Permian Basin of Texas and New Mexico leaked. Because of the strong heat-trapping proclivity of methane, 27 times as great as carbon dioxide when measured over a century, that loss negated any benefits of natural gas combustion over coal, the study found.

Colorado has been engaged in tightening regulations to preclude such emissions from the Wattenberg and other gas-producing fields.

The sharpest contrast during the hearing came when Christiaan Van Woudenberg, a trustee in Erie, as elected

officials in statutory-rule municipalities are called, testified that Woog's bill represented "another attempt to prop up a dying industry." Until recently, Woog was also on the Erie Town Board.

In the voting, Rep. Mike Weissman, a Democrat from Aurora, mixed personal experience with broad musings. He said he lives in a house built in the '70s where natural gas provides everything: space heat, hot water, and cooking. Building new, he said he'd make different choices based on economics of the rapidly improving technology but also on the moral obligations to change. He cited evidence of accumulating greenhouse gas emissions, now up to 415 parts per million as compared to 280 ppm at the start of the industrial revolution.

And Weissman suggested that towns and cities should be the laboratories of innovation in Colorado, just as states were in the mind of the famed jurist Louis Brandeis.

This local-preemption bill was effectively dead on arrival but it will return. Expect, too, to see sharpened talking points, perhaps even this year as legislators take up more practical measures, including the proposal to require Xcel and Black Hills to undertake beneficial electrification plans.

Aspen adopts resolution on divestment of investments

Aspen's city government continues to move along its effort to divest from fossil fuels from its $3.1 million in investment.

The council agreed in early February to divest $3.1 million from Berkshire Hathaway when the bonds mature in August because of the company's bad environmental score rating.

Now, it has adopted a resolution that guides the city's investments. The new provision says the city "will adopt the environmental scoring metric from E.S.G. (Environmental, Social and Governance) scores provided by the City's financial adviser, to help guide decision-making in this area. "For new investment opportunities, the City shall not invest in corporate offerings that have an environmental score below the midpoint of the scoring scale."

What does this mean in practice?

The Aspen Times reports a rapidly shifting investment geography. For example, the city has $2.90 million invested in Wells Fargo, a major investor in fossil fuels production. But the company the very week of Aspen's decision announced its intentions to have net-zero financed emissions by 2050 and align its investment practices with goals outlined in the Paris Climate Change Agreement.

Why Colorado is unlikely to have Texas-sized outages

Dan Harms, vice president of grid solutions for La Plata Electric Association, says the Valentine's Day mess in the Lone Star State likely wouldn't happen in Colorado for two reasons.

First, Colorado is part of a larger grid that covers 14 states and the provinces of British Columbia and Alberta. Texas has its own grid. That greater geographic diversity would help Colorado, he wrote in the Durango Herald. And second, Colorado's system already uses freeze-protection devices, unlike most of Texas.

Xcel's $1.7 billion plan for new transmission in Eastern Colorado

by Allen Best

Xcel Energy-Colorado and other utilities propose to build 560 miles of additional 345-kilovolt transmission lines across eastern Colorado in the coming decade to get the wind and other resources they need as they close coal plants and meet expanding demand to displace fossil fuels in transportation and buildings.

The $1.7 billion investment would access 5,500 megawatts of new wind and solar power and energy storage for Xcel. Xcel is calling it Colorado's Power Pathway.

Xcel hopes to get the first segment in service by 2025 and other segments completed in 2026 and 2027—an herculean task, given the slow pace customary to getting approval for transmission before construction actually begins.

Partnering with Xcel are Colorado's other major electrical utilities: Tri-State Generation & Transmission, Colorado Springs Utilities, Platte River Power Authority, and Black Hills Energy. But Holy Cross Energy, another utility, will also be affected, as it relies upon Xcel's transmission for delivery to the Aspen-Glenwood Springs-Vail areas.

"Investments in our transmission systems increase grid capacity, strengthen reliability, help us continue our clean energy transition and provide the best possible service for our customers and local communities," said Alice Jackson, president, Xcel Energy-Colorado. "This new transmission line will support our vision to reduce carbon emissions and deliver 100% carbon-free energy by 2050 and will result in much-needed economic and generation development in the region."

Tri-State's participation is contingent on completion of an agreement being worked on. But the agreement in strong enough conceptually that Duane Highley, Tri-State's chief executive, offered a statement that echoed that of Jackson, but with one small difference. The project would drive investment "in rural communities we serve," he said. Most of the area of eastern Colorado is served by cooperatives who are members of Tri-State.

In his new book, "How to Avoid Climate Disaster," Bill Gates likens transmission zones to freeways and distribution lines to local roads and streets.

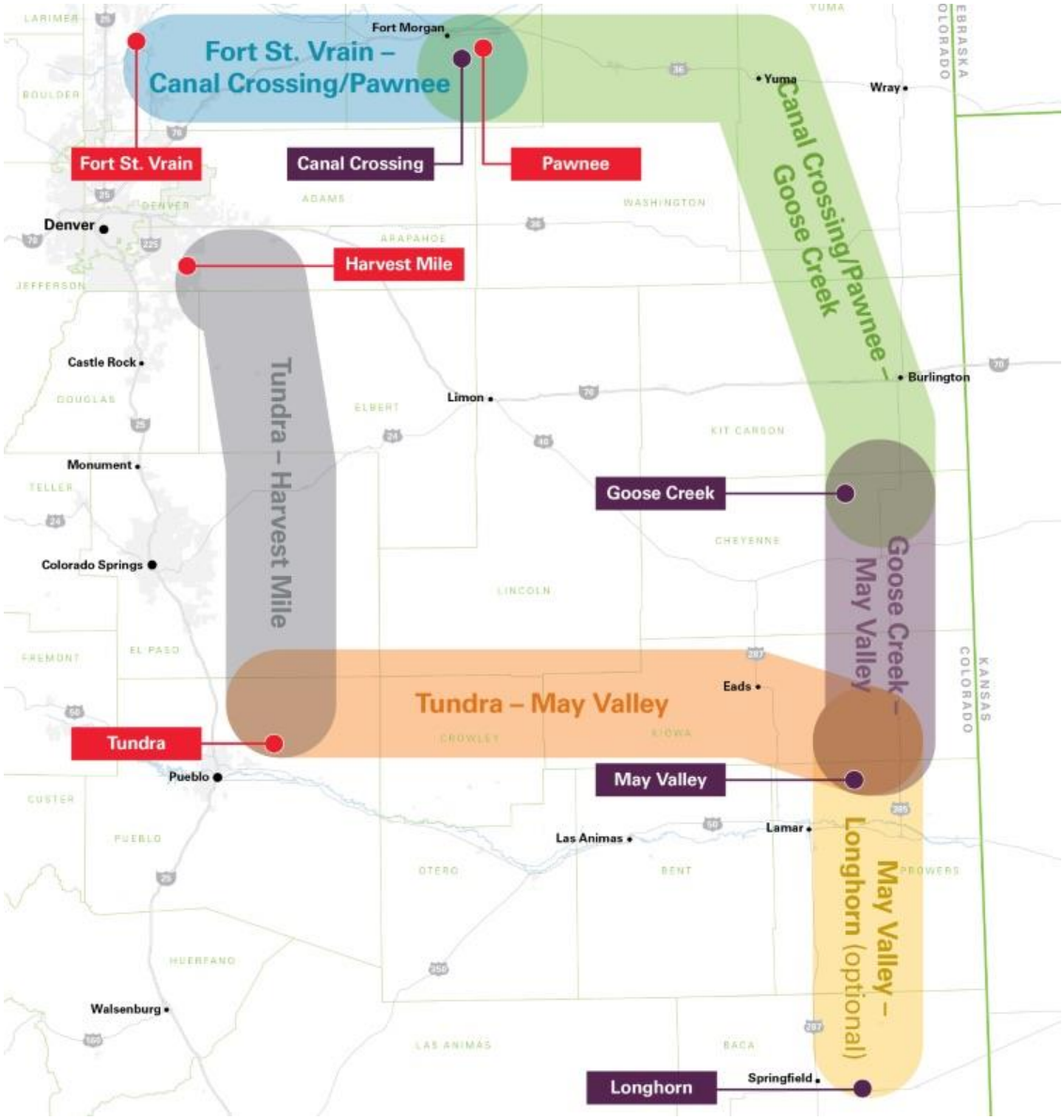
The plan envisions five segments that collectively sort of create a box in eastern Colorado. One leg would connect from Fort St. Vrain, the gas-powered plant near Greeley, eastward to a new substation near Fort Morgan. This would roughly parallel U.S. Highway 34.

From Fort Morgan and Brush and the Pawnee power plant, which Xcel wants to convert from coal generation to natural gas by 2028, another line would continue eastward to Yuma and then veer south to Burlington and Xcel's new wind farm at Cheyenne Ridge.

A third segment would continue south along the Kansas border to the vicinity of Lamar. From the Lamar area a fourth leg would then continue north of U.S. Highway 50 and the Arkansas River to the Tundra switching station northeast of Pueblo. The final leg would link Tundra with the Harvest Mile Substation, located southeast of Aurora.

Xcel also identifies a potential transmission line from the Lamar area south to Walsh, which may have Colorado's very best sustained wind resource. The extension would cost $250 million. See story, "Windy enough in Dust Bowl land."

The project would yield three new substations, expansion of four existing



substations, including one previously planned but not yet in service.

Xcel has filed an application with the Colorado Public Utilities Commission for a certificate of public convenience and necessity. Local land-use approvals will also be required.

The release from Xcel made no mention of a major transmission bill introduced in the Colorado Legislature by Sen. Chris Hansen and Rep. Alex Valdez, both Democrats from Denver, and Sen. Don Coram, a Republican from Montrose. SB21-72 seeks to enable Colorado to meet its clean energy goals by creating a new agency, the Colorado electric transmission authority, with the authority to issue revenue bonds and responsibility to identify and establish transmission corridors within Colorado and coordinate with other entities to establish transmission corridors that connect to out-of-state transmission.

Xcel opposes the bill, as does Black Hills Energy. Tri-State and several independent cooperatives, Holy Cross and Intermountain Rural Electric, support it. The bill passed the Senate Transportation and Energy Committee this week on a 5-1 vote.

Will Comanche be the last coal plant standing in Colo.?

by Allen Best

Coal to feed the roaring blast furnaces of Pueblo's steel mill was being mined a century ago at dozens of hamlets in the foothills of Colorado's Sangre de Cristo Range. Little remains today of those camps near Trinidad nor of the mine works at Crested Butte, Lafayette, and other one-time coal-mining towns.

We're now in the midst of an even greater change. Get your photos quick. The smokestacks of the giant coal-burning plants that have generated most of our electricity during the last 50 years will soon start falling.

We've had energy transitions before. This one is more urgent and more sweeping.

What will be Colorado's last standing coal plant? It's an open question. Xcel Energy, Colorado's largest utility, wants it to be Comanche 3. It operates and is majority owner of the plant, along with Intermountain Rural Electric Association and Holy Cross Energy. In late March Xcel will submit plans to state regulators to keep the plant burning coal until 2040.

All other coal plants in Colorado will close by 2030, according to current plans. Colorado's energy transition is—well, the metaphor of picking up steam doesn't work as well as it used to. The state had a combined 4,412 megawatts of electrical generating capacity by coal in December 2018.

Since then, Platte River Power Authority, Tri-State Generation and Transmission, Colorado Springs Utilities, and Xcel have all committed to closing plants by 2030. That leaves just one coal plant, 750 megawatts of Comanche 3, and Xcel wants to use just a

third of the generating capacity beyond 2030.

One question mark was Pawnee, Xcel's coal plant near Brush. Xcel wants to retrofit it to burn natural gas, as it did previously with Cherokee, the big plant north of downtown Denver. Xcel in late February also announced it wants to add 5,500 megawatts of new wind from Colorado's eastern plains, but also storage and solar farms. This new farm-to-market network is to be knitted together by $1.7 billion investment in new transmission lines.

We've had energy transitions before. Diesel replaced coal in powering locomotives in only two decades. This transition is more urgent and more sweeping, from fossil fuels altogether. It's partly driven by economics. Wind and solar prices plunged 80% and 90%, and utilities have learned to effectively and reliably integrate more and more renewables. Now, coal has become the expensive fuel.

Adding urgency are the larger and fiercer wildfires, the deepening droughts, and other evidence of the disruptive and costly impacts of climate instability caused by our failure to tame our atmospheric pollution.

Look to Pueblo for the most vivid example of this big pivot in energy. The steel mill ceased burning coal directly in the 20th century. Two huge coal-burning plants, Comanche 1 and 2, were constructed near the steel plant, part of a spree of new coal plants across Colorado from 1965 to 1984. Now, those two units near Pueblo will grow cold beginning in 2022 and 2025.

Most remarkable is how the Evraz steel mill will be powered. Construction has started on a solar farm covering 1,500 acres, an area almost five times the size of Denver's City Park. The solar farm will have a generating capacity of 240 megawatts to produce ribbons of continuous rail from recycled steel. Coal will almost entirely be absent from the process.

Comanche 3, though, will still stand in the background of the steel mill. It's had a troubled life. Since 2010, when it was completed, the $865 million plant has been down an average 91.5 days a year, including most of 2020. Last year the Colorado Public Utilities Commission decided the future of Comanche 3 was subject to investigation. The most damning statistic from that heavily-redacted report filed on Monday is that when approved by the PUC in 2004, the plant was forecast to deliver electricity at $45.70 per megawatt hour. The cost through 2020 was instead $66.25.

Xcel defends Comanche 3 as an efficient plant but also one that provides Pueblo jobs and Pueblo County taxes. Too, it may provide reliable electricity when winds cease and darkness falls—as long as it's not down for repairs. There's also this small fact: $633 million of Comanche 3's value as of 2020 had not been depreciated. There are decades of payments left to be made. Will the PUC require Xcel ratepayers to continue paying off this debt? Or might a complicated financial device called securitization allow Xcel to exit the plant sooner?

Comanche may also be a place holder. So many questions remain about how to completely decarbonize electricity even as demand for it grows to replace fossil fuels in transportation and buildings. If a lemon, Comanche 3 may still be Colorado's last standing coal plant. But with this one exception, the end of the era of coal-fired power plants is clearly on the horizon, at least in Colorado.

Can Colorado become exemplar of transition in energy for other interior states?

Colorado still has a carbon-heavy economy as of 2021, but with a legislative mandate to achieve deep reductions by 2030. Will the state be an exemplar for that decarbonization?

Eric Blank, the chairman of the Colorado Public Utilities Commission as of January, made the case that Colorado can be that national model, at least among interior states. One reason is its size.

"The fact that it's a small pond," he said at an event sponsored by the Getches-Wilkinson Center at the University of Colorado-Boulder. He went on to talk about mathematical game theory, the frequent switching in a small group that creates a "very large motivation to work together well."

Going back to the 1990s, he said, those working in energy in Colorado were "really collegial and worked together." Imagine instead working in real estate development in New York City and "never having to work with the same person twice." The actions in that case would be very difficult. In Colorado, you can't get away with being a bad actor. "I think it's a strength."

An Ivy League-trained lawyer, Blank's first posting in Colorado was with Western Resource Advocates before he went into the private sector, first as a wind developer and then as a solar developer.

"We really have a chance to be a role model for the rest of the country," he said. "This doesn't need to be some red vs. blue tribal warfare, like everything at the national level," he said. "We have an opportunity to do it smart, do it fair, do it in a different way that is a model for everybody."

The PUC primarily regulates investor-owned utilities, both gas and electric, but also the generation of wholesale electric provider Tri-State Generation & Transmission. In that capacity, it is overseeing a giant component of Colorado's decarbonization strategy, which is to largely decarbonize electricity by 2030 and then apply electricity to replace fossil fuels in other components of the economy.

For example, the PUC has overseen the transportation electrification plan of Xcel Energy, and it is now doing so for Black Hills Energy. Both were required by a 2019 state law.

To a lesser extent, the PUC has some oversight about natural gas and propane use in buildings. That role could expand, depending upon legislation that may emerge from the Legislature this session.

Decarbonization of electrification is proving relatively fast and easy because, said Blank, renewables have become cheaper than coal, in particular.

Eric Blank

"As a general rule, the economics of wind, solar and storage are now cheaper than operating costs of many of the coal plants," he said. "There are opportunities to cost-effectively move forward that generally work for customers. Our challenges tend to be more how to protect communities that have been disproportionately impacted by (the transition) that is equitable, just and fair."

Also working to Colorado's advantage, said Blank, is a "really robust and integrated stakeholder group that is interested in our processes and our work and creates a real richness and diversity in thinking. It's a real strength."

Not least, Colorado has relatively rich renewable resources. It ranks not at the top for either wind or solar, but "depending

upon how you define it, the top 10 or 15 among the states." And, it's not just one resource. "The combination is very compelling."

At the outset. Blank talked about Colorado's weaknesses. He mentioned the size of state agencies, dwarfed by those in California. And then there's Colorado's location in the electrical grid, in the Western interconnection but on the edge of the Eastern interconnection, which acts something like a wall. And there are not good connections north and south. As such, Colorado is something of an island.

Xcel-Boulder agreement still awaiting OK by PUC

You don't think there's interest in energy matters in Boulder?

The Daily Camera reports that the municipal government formed an energy partnership advisory panel to oversee from the city's perspective the joint agreement budding with Xcel Energy after voters approved a 20-year franchise agreement last November.

The panel has 15 slots, and 70 people applied.

The Daily Camera notes that the franchise agreement speaks to the need for joint movement between utility and municipality on distribution planning, advocating for climate policy, and moving toward 100% renewable generation, among other subject areas.

The franchise has yet to be approved by the Colorado PUC, postponing more substantive work.