BIG PIVOTS

Energy and water transitions in Colorado and beyond

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From record hot to maybe record cold! What's up with that pivot?

by Allen Best

Snow during September along Colorado's northern Front Range hasn't been that unusual if you go back a century or more, nor is it unusual to have wide temperature swings.

But the temperature swing predicted this week will be notable for its extremes. And the snow will be on the early side, too.

In the Denver area, the high temperature over the Labor Day Weekend is forecast to be 98°. By Tuesday, it will be snowing and with a low of 30° or maybe less.

Bye-bye bean harvest.

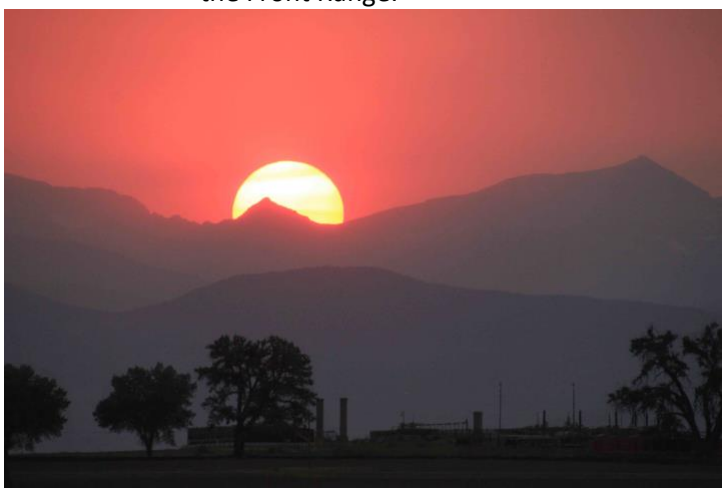
Matt Kelsch, a hydrometeorologist with the National Center for Atmospheric Research in Boulder, says September snow is not that uncommon in the Denver-Boulder area.

"If you look at records for the 20th century about once every four years there's measurable snow in September, sometimes a big one. It's not that unusual," he says. In the last 20 years, though, that has happened only once.

Even in the 20th century, September snows were likely to be later in the month. Snow on Sept. 8 shows up only once in the record.

Temperature extremes have also occurred before. "In 1993, we had a high of 90 on the afternoon 12th and the morning of the 13th we had an inch of snow and 33° at 7 a.m.," he said.

This week's predicted temperature plunge will not be faster, it will be more extreme: from the high 90s to below along the Front Range.



West of the Continental Divide temperature swings will be as great, or greater. The Weather Channel predicts a high of 93° F in Craig followed by a swoop to 17°. At Vail, the swing is from 80° to 24°. Granby was predicted to a high of 82° over the weekend followed by a low of 14° on Tuesday. Talk about free fall!

"There's a very real chance that we set or tie record highs on Sunday or Monday and then set or tie a record low on Wednesday, says the National Weather Service office at Grand Junction on its website. "Hang on for the ride!"

Southeastern Colorado expects to be a on a roller coaster, too. Lamar is predicted to hit 105° on Sunday and 33° on Tuesday.

Is this greater extreme a reflection of the warming and changing climate?

Yes and no, Kelsch says. He reminds his interlocutor of the distinction between weather and climate, the latter being the long-term weather patterns. Or, as is often said, climate is what you expect and weather is what you get.

In the long term and big picture, more record highs have been accumulating than record lows. "This is a good example of how we're seeing more of the extremes, sometimes in proximity to each other."

What clearly stands out in an inspection of the records for the last 30 years in Boulder, where Kelsch maintains a weather observation station, is a shifted pattern in precipitation. July and August have become drier, but February, March, and April have become wetter.

This year fit in with that pattern. It also fits in with trends around the world. Climate change theory forecasts longer, more intense droughts but, in places, greater spurts of precipitation.

This shift along the foot of the Front Range sets up a greater risk of wildfire. The increased late winter—and spring precipitation results in growth of more grasses, which in turn is followed by a higher, drier summer.

The hot temperatures this weekend will heighten the fire risk. "The only good news is that if a fire does start, it won't have long to live," Kelsch observes.

From Tevas to SmartWool, air conditioners to furnaces, it's going to be a big pivot.

You can see Matt Kelsch's weather blog here.

What is Gov. Polis thinking as he makes appointments (or does not make them)?

Colorado Gov. Jared Polis probably likes his eggs scrambled. Taking office in 2018, Polis showed that he was unafraid of mixing things up.

Consider Kate Greenberg, his ag commissioner, who not many years ago, fresh out of college, was wading into the bed of the water-less Colorado River to work on restoration. Her predecessors for at least decades had all been men of a certain age who were "producers," i.e. had large farms.

Or for that matter, Shoshanna Lew, the first-ever female to lead the state's transportation department.

So why didn't he reappoint Auden Schendler, the self-described climate hawk from the Roaring Fork Valley, to another term on the Colorado Air Quality Control Commission?

Auden Schendler

The commission is Colorado's lead agency in taking the giant steps necessary to decarbonize the economy as specified by a 2019 law. The goal is 50% fewer emissions by 2030, and this simply cannot be achieved only by closing coal plants.

Schendler this year, in concert with two commissioners from Boulder County, Elise Jones and Jana Milford, had made the case repeatedly for more aggressive actions. Was he too aggressive?

That was among the questions dangled after Polis did not reappoint Schendler to the commission after just one term. He also did not appoint Dr. Anthony Gerber, a pulmonologist at National Jewish Health, who had been on the commission for 6 years, or Peter Butler, a water expert from La Plata County, who had been absent at several recent meetings.

Polis offered no explanation for his reasoning, nor his choice of their replacements: Randy Ahrens, a former mayor of Broomfield; Gary Arnold, the business manager for Denver Pipefitters Local #208, and; Michael Ogletree, who works as the Air Quality Program manager for the City of Denver.

Polis did reappoint Chuck Grobe, a former Moffat County commissioner and, during his career, a transmission supervisor for Tri-State Generation & Transmission.

In an interview with Colorado Public Radio, Schendler said he suspected he was not reappointed because of his views on climate change. For evidence, he pointed to two of the three additions as being weighted toward fossil fuel interests.

Debate revs up in Boulder about Xcel agreement

Boulder voters in November will be asked whether they will approve a 20-year franchise agreement with Xcel Energy.

The Boulder Daily Camera explains that the agreement would specify that Boulder's electricity must be 100% carbon-free by 2030. The agreement would give the city six exit ramps from 2023 to 2036 if Xcel fails to hold up its end of the agreement.

The city has pursued the idea of creating its own municipal utility for a decade. Voters in 2010 approved $29 million for the effort; only $4 million remains.

Mayor Sam Weaver had led the charge for municipalization but defended the proposed deal as the best that could be gained by a city strapped for finances by covid effects.

Leslie Glustrom, perhaps the most vocal supporter of municipalization, suggested there are details that haven't been digested in the 100-page agreement that would cripple Boulder's energy autonomy.

A steadfast critic of Xcel, she continued that theme in her remarks: "When you're a monopoly, your job is to protect the monopoly," she said. "Xcel doesn't function like any other business in the marketplace."

Resource guide aims to help local communities

The Colorado Energy Office has released a web-based resource guide for local governments to help them identify high-impact, low-cost strategies to reduce greenhouse gas emissions and assist with long-term economic recovery.

The resource guide includes community spotlights that highlight some of the bold climate actions already being taken by communities across the state and identifies 5 high-impact actions communities can undertake immediately:

1) Pursue Energy Efficiency Through Energy Performance Contracting

2) Update Building Codes

3) Implement Smart Growth Principles

4) Adopt Electric Vehicles

5) Create a Climate Action Plan & Set Renewable Energy Goals

A shallow win for Tri-State in its tussle with two member co-ops

by Allen Best

Tri-State Generation and Transmission gained a victory in its dispute with two dissident member electrical cooperatives in Colorado last Friday, but it was a shallow win.

The Federal Energy Regulatory Commission ruled on Aug. 28 that it has exclusive jurisdiction over determining what constitutes fair and just exit charges to members who wish to leave before their contracts expire.

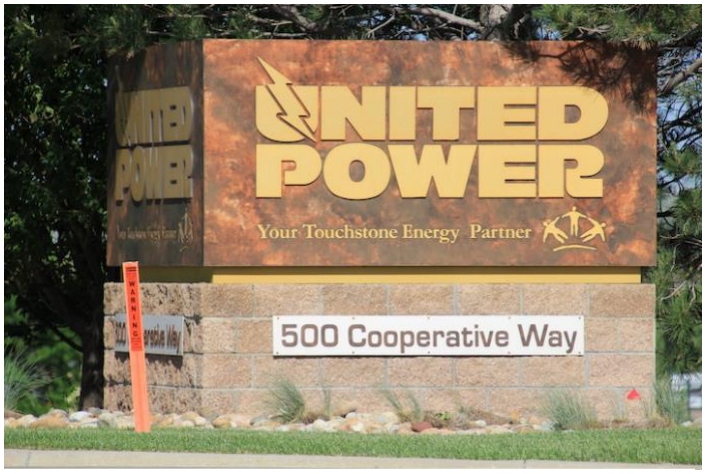
This is what Tri-State had asked. It seemingly moves to Washington D.C. the question of how much the two co-ops, Brighton-based United Power and Durango-based La Plata Electric, must pay to leave Tri-State before their all-requirements contracts expire in 2050.

But the premise for that exclusive jurisdiction was conditional upon what may happen in metropolitan Denver, both at the Colorado Public Utilities Commission and in a lawsuit filed in Adams County District Court. The legality of Tri-State admitting a new member, Mieco, the first non-utility member in its 67 years of existence, is being challenged in both places. Tri-State added Mieco in order to get FERC jurisdiction.

FERC commissioners said their decision was "based on the record before us and that any future Colorado PUC and state court rulings regarding the validity of Mieco's membership in Tri-State could be relevant to this determination."

"This is a monumental decision for our members and Tri-State and allows us all to move forward in our clean energy transition with much more certainty," said Duane Highley, the chief executive, in a release from Tri-State on Monday evening.

Highley said FERC jurisdiction makes Tri-State members in all four states equal with just one regulatory body. "At the FERC, each of our members, no matter in which state they are located, can participate fully, have a voice and be treated equally on wholesale contract and rate matters," Highley said in the release.



United Power serves 96,100 meters from the oil-and-gas fields north of Denver westward into the foothills. ***Photo/Allen Best***

But on this pivotal issue of exit fees, La Plata had a different takeaway Tuesday morning. "To FERC then, the question of the validity of Tri-State's non-utility member addition – the foundation of Tri-State's preemption play – remains before the Colorado PUC and awaits its ultimate decision," said La Plata in a statement.

In an interview Tuesday morning, Bryant Robbins, interim chief executive at United Power offered the same take-away. "The PUC still has total control of whether FERC gets involved or not," he said. "We don't

know whether the PUC will make that decision. It's totally within their purview."

This is a matter that may ultimately be decided in the courts.

Big bucks at stake

Big bucks are at stake – and perhaps the future viability of Tri-State. It has let two previous member co-ops go amid unhappiness about the speed and direction of Tri-State's shift from power generation heavily based on large coal-fired power plants to emerging utility models.

These two current dissidents together represent roughly 25% of electrical sales among Tri-State's remaining 42 members.

In a surprising admission contained in a filing with the Colorado PUC this summer, Tri-State argued that United and La Plata should have to pay a disproportionate fee relative to the previous exit fees to avoid Tri-State having to make a premature debt repayment "and potentially causing cascading defaults of all of Tri-State's debts."

Tri-State's darkened clouds can be seen in the credit ratings assigned by Wall Street analysts. Fitch Ratings in June downgraded Tri-State's long-term debt obligations of $2 billion to A-, from the previous A. Other analysts late last year had similarly down-graded the credit rating.

Tri-State reported $3.2 billion in long-term debt in its June SEC filing against almost $5.3 billion in assets.

The wholesale supplier long resisted changes, investing lightly in renewable energy and remaining devoted to centralized power generation, including coal plants. Only in January did Tri-State, under the direction of Highley, then the CEO for only 9 months—and under the gun from regulators in Colorado and New Mexico— announce plans to close its coal plants in those two states by 2030. It also retains part ownership of coal plants in Wyoming and Arizona.

Tri-State needs to hang onto these big members, the first and third largest, or at least get well reimbursed if they leave. Or, perhaps, Highley wants to buy time while he pivots Tri-State, the nation's third largest generation and transmission association.

United Power serves 96,100 meters in an arc of suburbs, oil fields, and farms north of Denver. La Plata has 45,500 meters in southwestern Colorado.

Both co-ops asked for exit numbers from Tri-State in 2019. Then, in December, they asked the Colorado Public Utilities Commission to intervene to ensure a fair and non-discriminatory methodology.

Tri-State plans to cease operating the three coal-burning units at Craig Station beginning in 2025 and wrapping up by 2030. ***Photo/Allen Best***

United by then had received what it calls a "bloated" figure "north of $1.2 billion." An administrative law judge heard nearly a week of testimony in May. The judge, Robert Garvey, in early July issued a recommendation to the PUC commissioners that United and La Plata generally supported. Under the formula he recommended, United would pay $234.8 million.

Central to the dispute between Tri-State and its dissident members was the wholesaler's so-called all-requirements contract. The contract allowed members to generate only 5% of their own electricity.

That wasn't nearly enough for Kit Carson Electric Cooperative of Taos, N.M., which in 2016 left Tri-State after paying a $37 million exit fee. Backed by Guzman Energy, a new wholesale power provider, it set out to develop local solar resources. It expects to meet peak daytime demands by 2022.

Delta-Montrose Electric of Montrose, Colo., had been arguing with Tri-State managers and fellow member co-ops since 2006, advocating a future with more distributed energy from local irrigation canals and other sources. It reached an agreement in July 2019 after a year and a half of sometimes bitter negotiations and left in July 2020 after paying $67.5 million.

United says it had tried to work within the existing structure of Tri-State. In 2018, it proposed to lead an effort to amend Tri-State's all-requirements restriction by creating a new class of membership, to allow more member flexibility. Now, says United, in filings with the PUC this summer, it was duped by Tri-State.

"Tri-State never disclosed that it simultaneously was secretly planning to use the bylaw amendment to try to destroy its exemption from FERC rate regulation," United said in the July 30 filing. It accuses Tri-State of duplicity, denying at the time of plans to seek a FERC exemption. Actions later showed that "Tri-State was constructing a Trojan horse" by admitting three new members that, unlike all others, do not distribute electricity.

Tri-State had been exempted under Section 201 of the Federal Power Act from jurisdiction by FERC. Adding three non-utility members ended that exemption. First came MIECO, a company that trades refined petroleum products and natural gas.

Then came Olson's Greenhouses of Colorado, a Fort Lupton greenhouse that is part of a regional Utah-based chain, and finally Ellgen Ranch Co. The latter has a business address at a 2,000-square-foot house in Craig. It's not clear the relationship with a Craig company called Ellgen Ranch Outfitters, which advertises guiding and outfitting services. A website, Buzzfile, estimates Ellgen Ranch Co. has two employees and revenue of $96,890.

Who has jurisdiction?

Tri-State participated in the PUC hearings in May but insisted that FERC had jurisdiction. It has explained it wants just one set of regulators, not regulators in each of the four states in which it operates. FERC is the "only regulatory body in a position to provide consistent regulation over a multi-jurisdictional wholesale generation and transmission utility such as Tri-State," says Tri-State.

Jack Johnston, chief executive of La Junta-based Southeast Colorado Power Association, an ally of Tri-State managers, agreed that "regulatory duplication" would create conflicts for Tri-State as "member-owners in the four states sought advantageous rulings from their home state regulators." With FERC jurisdiction, all member cooperatives – 6 in Nebraska, 17 in Colorado, 11 in New Mexico and 8 in Wyoming – would have equal access." In an Aug. 6 letter to the PUC, he called the criticism of Tri-State "overly harsh and misplaced."

The language in the filings with the PUC late July and early August was lively, as both sides took exception to the administrative law judge's recommendation—and took shots at one another as well.

"Once again, United Power has constructed a narrative from hyperbolic and misleading statements to cast Tri-State as a villain in United Power's yarn," said Tri-State Generation & Transmission in an Aug. 6 filing.

"Tri-State is used to pushing people around to get its way; when it does not, it

resorts to intimidation through overt and implicit threats," says a filing from the same day on behalf of United and La Plata.

If you detect something beyond business-as-usual in that language, another statement from the two-co-ops lays it out clearly: "Tri-State has a problem on its hands, with frustrated members and a competitive power supply market that offers better alternatives, without the bullying and gamesmanship that Tri-State deploys with shocking regularity."

The Colorado PUC has until Nov. 5 to issue a decision in this matter unless all parties agree to extend the case further. But then there will be the court cases. Tune in next month for *As the Grid Turns*.

Holy Cross on why it's different than California

by Bryan Hannegan

It's often been said that "as California goes, so goes the nation." As one of the first states in the country to embrace an aggressive clean energy goal, California's actions have inspired much of the rest of the nation (including our own state of Colorado) to act similarly.

As Holy Cross Energy continues our own transition towards a clean energy future, there is much we can learn from recent experiences in California, particularly with regards to making sure we have enough clean power supply at all times to keep the lights on at an affordable price for all consumers.

Earlier this month, during an unprecedented heatwave that baked most of the Western U.S., California's electric grid operator was forced to institute "rolling blackouts" when the supply of electricity was insufficient to meet the state's needs. Initial reports and news articles blamed these blackouts on California's reliance on variable wind and solar resources for its electricity needs.

While there were indeed errors in wind forecasting, there were several other factors that contributed to this shortage of power: extreme consumer demand, an unexpected outage of existing generators, and a lack of imports from neighboring states.

Given our Seventy70Thirty clean energy goals, I have been asked whether HCE will have similar challenges with the reliability of our service as we add more clean energy to our mix. I want to reassure you that HCE's clean energy goals will not impede our ability to provide reliable, safe, and affordable electricity throughout our territory.

Many of the lessons learned in California over the days following their rolling blackouts only confirmed the beliefs we already held about how we will achieve a clean energy future for our region. Whereas California relied heavily on out-of-state imports to meet its peak energy needs, our recent Request for Proposals focused on local renewable energy developments (including energy storage). These flexible resources will allow us to store excess energy when we have it and dispatch that energy when we need it the most.

Our voluntary Peak Time Payback program, which rewards our members when they reduce their energy usage during peak electricity demand periods, cut HCE's demand by 1% and freed up extra power supply to be moved into California during their time of need. We believe this demand response capability will only grow as our members increasingly adopt distributed energy resources like batteries and electric vehicles at their homes and workplaces.

These are but a couple of ways HCE is working to avoid having to sacrifice reliability and affordability for the sake of sustainability.

Bryan Hannegan is chief executive of Holy Cross Energy.

Must the path to 100% emissions-free electricity include natural gas?

by Allen Best

FORT COLLINS, Colo. – The unknowns with which electric resource planners plotting pathways toward 100% emissions-free energy must contend are those rare events, called "dark calms," such as occurred in northern Colorado one January day in 2018.

The wind didn't blow.

The sun didn't shine.

Batteries can tide over a utility in such events, but how extensive must be the batteries? And, for that, matter, how long can such dark calms last?

Platte River Power Authority looks to add gas backup in closing its Rawhide coal plant

A report to directors of Platte River Power Authority says insufficient data exist to predict the worst-case scenario for multiple years of dark calms. The North American Electric Reliability Corporation recommends allowing no more than a one-day outage in 10 years or 2.4 hours in one calendar year.

With much uncertainty still lying ahead, executives of the utility have recommended directors from the four member communities—Estes Park, Fort Collins, Longmont, and Loveland—have the utility focus on plans to purchase a gas-fired reciprocating internal combustion engine, or RICE, to replace the certainty now provided by the Rawhide power plant. Platte River has pledged to close the coal plant by 2030.

That alternative is among four under consideration for much of 2020. Directors are expected to make a final choice at a meeting on Sept. 24. But really, there are only two: 1) eliminate coal but add gas; and 2) forget about all fossil fuels in planning for 2030.

Directors in 2018 adopted a resource diversification policy while maintaining reliability, financially sustainability and, of course, environmental responsibility. But the three pillars depended upon 9 conditions ranging from participation in an organized regional market to advanced capabilities and use of active end-use management systems. Amid them was a premise of matured and battery storage performance and cost declines. You can read the policy here.

Is any utility not mulling the same questions?

Xcel Energy, in its famous announcement in December 2008, committed only to 80% emissions free reduction (compared to 2005 levels) by 2030. It also said carbon-free, but even at the time I understood that to be an equivocation to keep things simple. It means

only carbon-emissions free. Carbon is still on the table, if it can be done without atmospheric emissions, such as through sequestration technology.

There is tension between aspirations and current reality, between the need for change and the uncertainty about how fast technology but also economics can move in just the next 10 years.

In March, just before the curtain of covid fell, Platte River held meetings in three of its four communities, with the final one held via video teleconferencing. Colorado State University's Center for Public Deliberation provided students trained in small-group facilitation to probe what people thought about the four scenarios and why. The results were summarized in a June report.

The focus groups' report makes for unusually interesting reading, if you, like me, are just flat-out curious about how we negotiate the difficult path that climate scientists say will be necessary in the next 10 years.

It wasn't a scientific survey. Those who showed up—roughly 160—were very well educated, 89% with college degrees, most with advanced schooling, and relatively affluent: a third had incomes of over $100,000. And, of course, nearly three quarters were baby boomers or older.

Not surprisingly, there was scant support for maintaining the status quo, i.e. keeping Rawhide operating until 2036. The other extreme assumed rapid technological advances—but not enough to justify closing Rawhide by 2030.

The action was in the middle: zero coal (but the new natural gas plant) and the zero carbon.

There was also pushback from some that Platte River had been too cautious, that in fact the goal of 100% renewables could be achieved without negative impacts to cost and reliability. "In a sense, they rejected the tension between reliability and renewable energy and believed both could be achieved soon without any unnecessary sacrifice."

There were thoughts about batteries, questions whether Platte River was enlisting the local (and considerable) talent of northern Colorado. This report ran 20-some pages, so I'm teasing out the highlights. The report cites frequent tensions between the known and unknown, and the 100% goal in the middle.

As per the report, the middle ground seemed to lie in keeping a steady eye on the aspirations.

In the break-out discussions, some were OK with hitting 90% or 95% emission-free energy. Other were OK with the natural gas, hoping it would be used as little as possible—which is the intention. Many

The rise of reciprocating internal combustion engines and renewables

Reciprocating internal combustion engines, which are typically used for backup, standby, or emergency power, are now becoming increasingly popular for larger utility-scale power generation applications, especially in areas with high levels of electricity generation from intermittent sources such as wind and solar.

Reciprocating engines tend to be smaller than other types of natural gas-fired electricity generators and account for a relatively small share of power plants fueled by natural gas. As of November 2018, the capacity of the average reciprocating engine generator was 4 megawatts compared with 56 MW for natural gas combustion turbines and 166 MW for combined-cycle units.

Source: Energy Information Administration

made the argument that regardless of the 2018 promise, they wanted Platte River to work toward getting as close to 100% as was possible, and if it was 95% or 98% that would be OK—while leaving open the possibility that with technological advances, 100% could be reached sooner than 2030.

On Thursday, after the meeting of directors, there was pushback from some of the environmental advocates. Public comment time had been pruned, and the Sierra Club sent out a release that lamented the "major reversal" of the 2018 policy and noted that if this happens, it will be the only utility in Colorado with plans to build a new fossil fuel power plant for use beyond 2030.

Sue McFaddin, founder of SevenGenerations LLC (Fort Collins), predicted "costly, stranded assets" and said that Platte River "also needs to help Fort Collins improve our air quality (#19 most unhealthy city in the nation for ozone) by installing nitrous oxide controls or shutting down Rawhide earlier. We can't wait 10 years for good air quality."

GM hops into Colorado program for immediate tax credits for EVs

DENVER—Colorado consumers can get $4,000 income tax credits as the result of legislation approved in 2016. Now, as the result of a new deal with General Motors, they can get that money immediately upon purchase without waiting to file their tax returns.

GM joins Nissan in offering the convenience.

"$4,000 now is much better than $4,000 later. This should help accelerate electric vehicle sales," said Travis Madsen, transportation program manager for Southwest Energy Efficiency Project,

GM sells the Chevrolet Bolt EV in Colorado but has announced plans to deliver additional EVs to Colorado's market.

The deal is at least partly a result of a consensus agreement reached in July 2019 with auto manufacturers over zero-emission vehicle standards. The agreement created an incentive to produce greater model availability sooner, not later.

Madsen explained that Colorado both requires automakers to deliver electric vehicles to Colorado as a result of the consensus agreement and the subsequent rule-making by the Air Quality Control Commission and offers policies and tools to help automakers sell those cars.

"Colorado's tax credit is an important policy—and it is better than a lot of other states' tax rebates because it enables dealers to apply the rebate at point-of-sale (as GM and Nissan are taking advantage of)," he said.

Also important is the policy embodied in a law adopted in May 2019, SB19-077, which requires electric utilities to invest in transportation electrification. That will help build out all of the charging infrastructure people will need to access the benefits of driving electric.

"There's more, but those three policies together (ZEV, rebates and utility investment) are the main pillars of Colorado's electric vehicle strategy (at least for light-duty vehicles)," he said.

Colorado has a goal of having 940,000 light-duty EVs on the road by 2030 and spur electrification and perhaps other alternative fuels by medium- and heavy-duty vehicles.

Why Trump's team wants to maintain the electrical walls

While the Trump administration talks about a wall on the border with Mexico, there always have been electrical walls in the United States between the three largely independent electric grids.

Colorado and Kansas are on different electric grids, the western and eastern, the only portal between those two states being in southeastern Colorado, near Lamar.

A fascinating story on The Atlantic website tells of the Trump administration's efforts to discourage advanced thinking about how to better knit together the country electrically.

Researchers at the National Renewable Energy Laboratory had been at work in the Interconnections Seam Study. The work on Seams, as the study is known, was discussed at a conference in Kansas attended by a high-level official in the Department of Energy. Almost immediately, the alarm was raised, because the researchers had created a scenario that assumed a carbon tax.

See: How a Plan to Save the Power System Disappeared.

The story by Peter Fairley, a free-lance journalist from Vancouver Island, runs 3,500 words. I can't begin to summarize the politics. Fairley does a pretty good job of it:

"The Seams study demonstrated that stronger connections between the U.S. power system's massive eastern and western power grids would accelerate the growth of wind and solar energy—hugely reducing American reliance on coal, the fuel contributing the most to climate change, and saving consumers billions. It was an elegant solution to a complicated problem."

I heard one energy executive allude to the study this year, but when I went looking for it on the NREL website, I found nothing. And an NREL media relations person was of no real help. Now I know why.

— Allen Best

How fast and far can beneficial electrification take Colorado?

by Allen Best

Deep in a report about beneficial electrification that was commissioned by the Colorado Energy Office is an observation about the breadth and depth of change in energy now underway.

"Twenty years ago, utility-scale wind energy was just beginning to emerge. Today, it is a major source of electricity," points out the new report by GDS Associates, a consultancy.

"Similarly, only 10 years ago, the solar industry had only begun to mature, with major innovations and market adoptions, driving what is now an increasingly common source of electricity."

Those and other example "serve to indicate the importance of the combination of policies and programs to drive the market. None of the changes occurred overnight. Beneficial electrification can be expected to succeed with a similar path."

Beneficial electrification is defined by Colorado law as replacement of fossil fuel by electricity in transportation, buildings, and other sectors. These two reports look more narrowly at buildings and industrial uses.

Neither is a giant slice of the emissions pie in Colorado, but that's the point. For Colorado to achieve its deep decarbonization goals: 50% in the next decade and 90% by 2050, it must do more than close coal plants. Getting a million electric vehicles on the road won't be enough.

The report, "Beneficial Electrification in Colorado: Market Potential 2021-2030," lays out the opportunities but also the challenges, creating menu options for Colorado legislators, utilities, and other policy makers.

The Lawrence Berkeley National Laboratory finds that "nearly 100% of all energy use" in residential and commercial buildings can come from electricity. The study explores what is practical to expect in this displacement of fossil fuels in buildings for space heating, hot water, and cooking.

In theory, consumption of natural gas and propane in Colorado could be cut by nearly half in the next decade.

The study finds a more realistic goal of 6% reduction in natural gas consumption and just under 10% reduction in propane.

Study finds Colorado can realistically expect to reduce natural gas consumption 6% in next decade—with proper policy supports.

Conversion from natural gas does not always pencil out. Propane, however, is another matter. There's almost no gap between technical potential and economic potential. The difference lies in the higher price of propane, about $21 per million Btu as needed to operate a highly-efficient furnace as compared to $4 for natural gas.

Air-source heat pumps—the crucial technology in wringing heat from outside air—require electricity, presumably from primarily renewable sources. The technology had advanced greatly in the last decade, making it more suitable for colder weather climates. Just how cold? The report does not try to assess potential within Colorado, although as recently as September 2019, an Xcel Energy representative cautioned that the technology isn't quite there for mass adoption in Colorado. Anecdotally come reports of building electrification planned in

Colorado's emissions. ***Source:*** ***Roadmap Public Listening Session Presentation****, Colorado Energy Office.*

the Aspen area. That may not be the coldest area in Colorado, but it's colder than most.

(The companion report by the consultant identifies market barriers and potential solutions for building electrification. See synopsis on next page).

A high-electrification scenario would increase electrical consumption 2% by 2030 while resulting in approximately 3.5 million tons less of carbon dioxide equivalent emissions.

The same report also finds that electrifying the industrial sector will be more challenging than buildings. One study found that only 3.6% of the U.S. industrial sector has technical potential for electrification, a stark contrast to the near 100% technical potential in the building sector.

"Colorado has a diverse industrial sector, spanning companies associated with food processing, forestry, agriculture, paper products and wood products, and oil and gas, to name a few. Each of these industries has its own ways of utilizing fossil fuels in their processes," the report says. In some cases, solutions other than electrification may be needed to mitigate greenhouse gas emissions. These include renewable natural

gas or an electric-to-hydrogen solution that facilitates the use of combustion to achieve high temperatures.

Even so, the oil-and-gas sector stands as a good candidate for expanded electrification in compressor stations and pumps. Solar panels already are omnipresent at extraction sites in Colorado's Wattenberg field, but opportunities for expansion of electric use are ample, the report says.

Not everything pencils out equally, though, even in electrification of homes. The report goes into considerable detail about such things as cooking stoves and clothes dryers.

The Colorado Energy Office sees the push for electrification being a large element but one among several. A statement by the offices also identifies several other strategies for reducing emissions from the built environment as the state puts together its roadmap for achieving 2025 and 2030 carbon reduction goals.

Other elements include:

• building energy codes with even higher standards than what were required by legislation adopted in 2019;

• benchmarking requirements and performance standards for commercial buildings;

• expanded weatherization and energy efficiency programs;

• the use of lower-carbon renewable natural gas, such as from landfills and dairies; and

• replacement of fossil fuels with electricity generated by renewables.

The Colorado Energy Office says these actions together could reduce greenhouse gas emissions by 2.7 million tons in the coming decade—with electrification responsible for over a third of these reductions.

Go here to find the 112-page report.

How to overcome barriers to building electrification

In so many ways, electrifying buildings makes sense even without considering carbon reduction goals. What holds us back?

A companion report, "Beneficial Electrification in Colorado: Market Barriers and Policy Recommendations," identifies 10 market barriers and 8 possible solutions.

The first of the 10 market barriers is limited consumer awareness and demand. Colorado's residential and commercial building owners are mostly unfamiliar with heat pumps for space heating and water heating. If aware of them at all, they think they work in warmer climates, unaware of advances that now make them efficient to about -13 F.

Then there's gas cooking. It's viewed as superior by many to traditional electric stoves. Induction cooktops are still not perceived as a distinct cooking experience. Gas cooking can be unhealthy, because of the fugitive gas, although few people are aware of this drawback.

In short, there's a lot of education that needs to be done, and at several levels.

But then there are the houses like mine, which is 131 years old and wasn't exactly designed for heat pumps. (Market Barrier #5)

Utilities must be involved, but they have reservations. The consultants, GDS Associates, identified several perceived problems that the utilities want addressed. One barrier is a Public Utilities Commission rule that prohibits natural gas utilities from incorporating fuel switching away from natural gas in their energy efficiency programs. The consultants talked with five electric utilities, three of which also have natural gas service territories.

Another concern has to do with HB 19-1261, the driver of statewide

decarbonization efforts. What if promoting beneficial electrification causes the utilities to increase their emissions from generation of electricity? The utilities want to see protection.

The report recommends several actions to address these perceived risks: a clear rule from the PUC or perhaps legislation to enable PUC rule-making. The goal is the big picture, the reduction in emissions, and how to properly account for that.

The report also calls for the state government to electrify its own buildings, leading by example. It suggests Colorado legislators consider implementing legislation to develop beneficial electrification funds or goals for electric utilities and funding for state-sponsored programs.

"Beneficial electrification in buildings is unlikely to substantially increase its market share over the coming decade without considerable programmatic support. Other states have developed utility-sponsored programs to support the market with incentives, technical support, and related market development activities

The report also recommends workforce development initiatives to ensure that electrification becomes a part of technical training apprenticeships and professional licensures.

In this transition from gas to electricity in homes, one critical element will be ensuring equity. The worry is that low- and moderate-income households may end up burdened with covering a disproportionate share of stranded costs for a natural gas system for which others no longer have need. This in particular is a concern for rural Colorado.

A similar concern was raised by the Office of Consumer Counsel in a settlement agreement reached in June among Xcel, the Colorado Energy Office, and several others. In that settlement, the stakeholders agreed —if the PUC agrees—to have discussions to help wrangle through some of the issues about beneficial electrification for buildings during the next year.

The report also recommends that Colorado study closely what other states—most notably California, New York, Massachusetts, and Vermont—have already done to speed along beneficial electrification.

Reconciling the carbon impacts of air travel

by Allen Best

Stories about air travel to and from Aspen in recent days suggest growing recognition that the atmospheric pollution caused by air travel must be reckoned with.

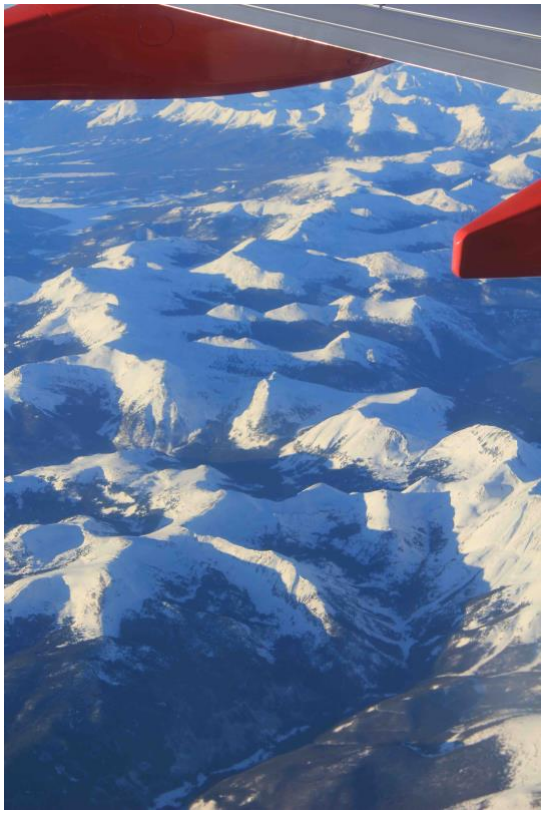
One story tells of a new company, AspenJet, that will use 88-passenger Embraer E-Jets retrofitted to accommodate just 30 people. It will fly non-stop routes from San Francisco, Florida, and other major hubs. The idea is to allow the experience of flying private but with the cost savings of pooling resources to get a plane. The 30-passenger limit is partly a nod to covid-19.

The advertorial—an advertisement dressed up as a news story—in The Aspen Times nodded at local concerns about the heavy carbon footprint of long-distance travel with repeated mentions of sustainability although without details of what that means. The closest to an explanation was mention of use of new biojet fuels.

Even before covid-19 arrived, aviation represented a relatively small part of total greenhouse gas emissions. But the sector has been growing rapidly. And while much distance can be covered rapidly, there's a tremendous carbon footprint.

I sorted through a lot of this in depth in a story found here: "The moral and technological quandary of aviation emissions." Fly or drive? It's not as simple as you might think. Flying in private jets, though, does put you at the extreme end of the carbon bench.

Aviation emissions represent a small slice of our total greenhouse emissions in the United States. But the sector has grown significantly. Unlike with cars and even



trucks, large, long-distance electrified planes look to be many years off.

As for biofuels, it's more tomorrow than today, according to a chapter in a 2019 book, "Sustainable Bioenergy." A July release out of Washington State University enthusiastically cites work of a biofuels researcher, but the operative phrase in the release is "could be."

A different story, in the Denver Post, revisits The Good Traveler program started at the San Diego International Airport in 2015. The idea is for travelers to pay a little more for carbon offsets, to be invested in projects that reduce carbon emissions put into the atmosphere elsewhere or suppress them altogether.

The Aspen-Pitkin County Airport joined the program this year, the only airport in Colorado so far. The Jackson Hole Airport joined in 2019. Payments in both cases go to the still-unplowed 15,000-acre May Ranch, which is located north of Lamar, an area of southeast Colorado that has been well-plowed in the last 140 years. The payments

from the airports and others will keep the land unplowed and more carbon in the soil.

I wrote about this in 2018 when I noticed that those attending the Telluride Bluegrass Festival were charged a small amount, depending upon the distance traveled. See: Carbon ranching and bluegrass in Colorado.

The program involving airports is administered by the Basalt- and Boulder-based Rocky Mountain Institute. Dave Mullaney, who specializes in industry and heavy transport for RMI, defended the offsets, calling it a "good, interim solution."

"Flying from here to San Francisco or Los Angeles, that's probably the most carbon-intensive two hours of your entire year," Mullaney told the Post. "It's a good thing to have on your mind that there are things you can do, even if you can't solve the problem by yourself or you don't have the perfect answer," he said. It is not, he said, the final solution.

Auden Schendler, the vice president of sustainability for the Aspen Skiing Co., dismissed the offset program as "window dressing."

"At a time when we need massive, international, systemic change, we are not so sure this is the right message," he said.