

**Written Testimony of Heidi VanGenderen
Chief Sustainability Officer, University of Colorado Boulder**

**For Field Hearing on: Colorado’s Roadmap for Clean Energy Action: Lessons from State
and Local Leaders**

Good morning Chair Castor, Ranking Member Graves, Congressman Neguse, and other distinguished members of the Committee. Thank you for the opportunity to testify at today’s field hearing, and welcome to Colorado.

My name is Heidi VanGenderen. I am a third generation Colorado native and I currently serve as the first Chief Sustainability Officer at the University of Colorado Boulder. I have worked for over three decades in the public, private, non-profit, and academic sectors to advance the technologies, policies, deployment and financing of low-carbon strategies.

My comments today represent the views stemming from my professional background in energy and sustainability policy, and do not represent the official positions of the University of Colorado Boulder.

Colorado is a wonderful state in so many ways. It sports immense natural beauty and natural resources, particularly in the energy realm. It is a western state where people pride themselves on individualism, but pitch in readily in community. It is a state that prides itself on health and well-being. It is a state whose people have strong political opinions and party registration is about evenly split between Republicans, Democrats and Independents. It is a home rule state where individual communities wield tremendous influence and voters aren’t afraid to step up to the ballot box through initiative. And it is a state where public institutions like the University of Colorado help lead through education, research, convening power, and operational example. I will elaborate in the following.

Colorado is a state that is blessed with abundant energy resources – we are literally an “all of the above” state that is “richly endowed” with both fossil and renewable resources.¹

Several important facts about Colorado’s energy economy:²

- Colorado’s crude oil production has quadrupled since 2010, and the state holds about 4% of total U.S. crude reserves.
- Colorado is the fifth-largest natural gas-producing state, and 11 of the nation’s 100 biggest natural gas fields are located in the state.
- Colorado is the top coalbed methane-producing state, and has nearly one-fourth of U.S. economically recoverable coalbed methane reserves.
- Electricity from renewable sources has more than doubled since 2010 to almost 25% of Colorado’s net generation in 2017, led by increased wind power from the state’s nearly 2,000 turbines.
- Although coal production in Colorado has declined 64% since 2005, over half of Colorado’s electricity still comes from coal-fired power plants, and annual coal

¹ <https://www.eia.gov/state/analysis.php?sid=CO>

² Ibid.

production in the state increased for the first time in six years in 2017, as foreign demand for U.S. coal rose.

Colorado's economy overall ranks agriculture, manufacturing, mining and tourism as its four top contributors. Mining represents 4.8 percent out output and 1.2 percent of jobs. It is further estimated that each job in oil and gas extraction supports an additional 4.2 indirect and induced jobs which amplifies the effects of Colorado's fossil fuel economy.³

There is no free lunch for any source of energy, but Colorado also knows first-hand the human health effects that come, particularly, from the extraction and use of fossil fuels. Last year, there were 280 days of recorded unhealthy air quality in the state, particularly along the Front Range where two-thirds of the state's population resides. The national average is 227 days.

As one example, a new University of Colorado Anschutz study finds that mothers living near more intense oil and gas development have a 40 to 70 percent higher chance of having children with congenital heart defects.⁴

Health can and should be one of the primary drivers in our collective recognition of the need (and inevitability) of transitioning to a genuinely low-carbon economy. The health of people, the health of ecological systems, and the health of all living beings should be squarely in our sights as we continue to consider and take steps to move forward from primary reliance on fossil fuels

Renewable energy in Colorado is quite a story, as it is now in many states across the country. Providing new electric generation that reduces the energy sector's impact on public health and the environment and diversifying the state's electricity portfolio, thereby increasing the resiliency of the electrical grid are two strong components of Colorado's expanding renewable energy economy.

Jobs are another important part of the equation in Colorado's diversification of its energy economy. While Colorado is far from one of the most populous states in the country with a statewide population of only 5.7 million, our state now ranks 7th in the U.S. in terms of renewable energy jobs. Approximately 17,000 workers now work in renewable energy with the solar industry employing nearly 8,000 people and the wind industry employing more than 7,000. One sector that is likely to increase quickly is in the electric vehicle (EV) space, which already employed about 3,000 people as of 2018.⁵ Overall, the state has 57,591 people working in clean energy industries.⁶

Energy efficiency, as we are all aware, is one of the most critical elements in the path to ensuring a low-carbon economy. As noted, the energy we don't use is the cleanest, least

³ <https://www.cobizmag.com/Articles/The-economist-Whats-the-most-important-industry-in-Colorado/>

⁴ <https://www.cpr.org/2019/07/19/cu-anschutz-study-suggests-link-between-oil-and-gas-developments-and-child-heart-defects/>

See also: <https://www.thedenverchannel.com/news/local-news/cu-study-finds-people-living-near-oil-and-gas-may-be-at-higher-risk-of-cancer>

<https://www.cuanschutztoday.org/those-living-near-oil-and-gas-facilities-may-be-at-higher-risk-of-cancer-and-other-diseases/>

⁵ <https://www.cobizmag.com/Articles/The-economist-Whats-the-most-important-industry-in-Colorado/>

⁶ <https://www.solarreviews.com/news/colorado-7th-us-renewable-energy-jobs-061418/>

carbon intensive and least expensive of all sources. The majority of clean energy jobs in Colorado are in energy efficiency, which employs 32,036 workers. Nationally that accounts for 1.4 percent of all the energy efficiency workers in the US.⁷

Policy Matters

Energy has been a prominent and storied part of Colorado history. That history begins in earnest with the Pikes' Peak Gold Rush in 1858 that brought unprecedented numbers of people into the region. That influx, in turn "led to powerful social, economic, and political changes that brought about the creation of Colorado Territory in 1861, culminating in the admittance of Colorado to the Union in 1876."⁸

A more recent story begins with a brown bag lunch convened nearly twenty years ago at the University of Colorado Denver that brought together business, non-profit, and academic sector energy representatives to explore the most effective policies that could help advance Colorado's energy economy. The top option identified was a renewable energy standards that was then, quite swiftly, declared to be "politically unviable" by many of those assembled.

Although introduced in three legislative sessions, the legislature did not pass a renewable energy standard. Instead, in 2004, Colorado became the first state to pass a citizen-initiated renewable energy standard (Amendment 37 that resulted in a mandate to the state's two investor-owned utilities to produce 3% renewably based electricity by 2007 and 10% renewably based electricity by 2015.

Xcel Energy serves roughly 78% of Colorado and had begun exploration, before the passage of Amendment 37, of wind power. Spurred by the RPS, Xcel stepped up its efforts and completed construction of the 44 turbine, 25.3 Ponnequin wind farm on the Colorado/Wyoming border. That wind farm enabled the family that owned that ranch land to both remain on their property, and provided them critical income at a time when they would have otherwise had to vacate a failing ranch. Cattle and the turbines co-exist to this day and represent a critical element of Colorado's renewable energy economy – namely, rejuvenation of Colorado's rural economy through renewable energy. You have heard more about that story from Cary Weiner who testified earlier.

Xcel Energy found its wind investments to be tremendously viable and discovered that they were on track to meet the renewable energy standard well ahead of schedule. The utility then came to visit former Governor Bill Ritter when he was elected in 2006 to not only discontinue its opposition to the renewable energy standard, but to ask the Governor's support for doubling the standard. That standard has been strengthened three times since 2004 and today is at 30% by 2020, with 3% from distributed resources.

Today, Xcel Energy is the number one wind producing utility in the country. Xcel recently came before Colorado's Public Utilities Commission with its Clean Energy Plan to reach 80% carbon free electricity by 2030 and to produce 100% carbon free electricity by 2050. That plan was codified in the state's 2019 legislative session in SB 236, signed into law by Governor Polis, which also included cooperative utilities in the mix with a 20% renewable requirement by 2030.

⁷ Ibid.

⁸ <https://www.historycolorado.org/mining-industry-colorado>

Partnering with utilities, rather than combatting them, represents a new kind of politics that can supersede destructive partisanship and result in mutually beneficial policies and plans that advance economically beneficial, healthful, low-carbon strategies.

As Governor Polis noted in his testimony, thirteen bills relating to strengthening Colorado's energy policies came to his desk for signature. SB 236, noted above, addressed another critical component of Colorado's evolving energy economy – namely, the many workers in the fossil fuel industries. While oil and natural gas workers have increased, along with Colorado's production, coal workers do not face the same story with the closure of several coal plants across the state.

In recognition of the state's transition away from fossil-based electricity generation, SB 236 also allows utilities to pursue securitization (i.e., using low-cost bonds) to refinance power plants so as to retire them early and also requires the PUC to consider workforce transition issues for individuals and communities that have relied on jobs in the coal sector. The thoughtful and active retraining of workers is a role in which all societal institutions can and should participate: government, the private sector and educational institutions primary among these.

Optimal energy policy is truly bipartisan and transpartisan. It is policy that recognizes its role in providing technology neutral platforms that can unleash the best of human capacity and enterprise. It is policy that recognizes the inevitability of a changing energy economy while recognizing the unprecedented prosperity that has been brought through reliance on finite fossil fuels. It is policy that can help bring continued prosperity to communities everywhere through support of diversifying our fuel portfolio, lowering our carbon footprint, and protecting human health. It is policy that recognizes the optimal roles of government as a partner in needed public-private partnerships that can invest the capital required for this energy transition: as a purchaser in that new energy economy; and as a regulator to ensure that all energy enterprise is conducted in sufficiently transparent and ethical ways.

Over the last decade or more, energy policies have been enacted in the United States more at the local, state and regional levels in the absence of significant action at the federal level. While this is a global challenge, that is and will be practically addressed at a very local level, recognition of the now globally-connected energy economy is also an opportunity for rejuvenated, bipartisan effort in Congress, as well as continued policy enactment, as appropriate at the state and local levels.

Research Also Matters

Research for all aspects of climate change and the energy transition is an extraordinarily important investment as we seek to provide lawmakers accurate science-based evidence on which to base policies, programs and investments that can make a sufficient difference.

The University of Colorado Boulder became an inaugural member of the University Climate Change Coalition (UC3) which now boasts 20 top-tier Research-1 (R-1) universities from Canada, the U.S. and Mexico. UC3 members are committed to leveraging institutional strengths to foster a robust exchange of best practices and lessons learned in pursuit of accelerating local climate solutions that reduce greenhouse gas emissions and build community resilience.

CU Boulder Chancellor Phil DiStefano just attended a UC3 Summit hosted by the University of British Columbia in Vancouver where he was able to engage in transnational conversations about how to combine research endeavors across universities so that critical research dollars are used as efficiently as possible while leveraging the respective strengths and expertise of the collaborating universities.

Roughly 74% of CU Boulder's research funding comes from the federal government. The importance of adequate support of leading edge research cannot be underestimated if we are to successfully address one of the greatest challenges, and opportunities ever faced. While we cannot rely on technology development in the applied research space as the sole solution to this challenge, there is some remarkable work underway at our university, and others.

Two among many examples in the applied space include:

- Renewable and Sustainable Energy Institute (RASEI): A team of CU Boulder, the National Institute of Standards (NIST) and the National Oceanic and Atmospheric Administration (NOAA) researchers led by CU's Dr. Greg Rieker has developed a long-range methane leak detection system based on CU's Nobel Prize winning frequency comb laser, which also resulted from a collaboration between CU Boulder and NIST. The system is capable of scanning several square miles in just a few minutes, paving the way to improving both safety and efficiency. The team formed a Colorado-based commercial spin-out company to transition the technology to market.
<https://www.colorado.edu/mechanical/2017/01/26/cu-boulder-team-track-methane-leaks-usinglasers>
- Chemical & Biological Engineering: Prashant Nagpal's research has "developed nanobio-hybrid organisms capable of using airborne carbon dioxide and nitrogen to produce a variety of plastics and fuels, a promising first step toward low-cost carbon sequestration and eco-friendly manufacturing for chemicals. By using light-activated quantum dots to fire particular enzymes within microbial cells, the researchers were able to create "living factories" that eat harmful CO₂ and convert it into useful products such as biodegradable plastic, gasoline, ammonia and biodiesel."
<https://www.colorado.edu/today/2019/06/11/these-nano-bugs-eat-co2-and-make-eco-friendly-fuel>

CU Boulder is home to some of the most renowned climate research in the world, and was recently ranked number one in the world for geosciences. Nested in a constellation of federal labs (several of which I understand you visited during your trip to Colorado), that research includes:

- The Institute of Arctic and Alpine Research (INSTAAR): Tania Schoennagel analyzes the increase in wildfires in the American West over the past 30 years. Her work projects how climate change will affect the trend in coming decades, particularly with regard to the wildland/urban interface. In Congress and elsewhere, she advocates for policies that promote adaptive resilience in response to changing fire regimes.
<https://www.colorado.edu/today/2017/04/17/new-era-western-wildfire-demands-new-waysprotecting-people-ecosystems>

- INSTAAR: One of the most cited researchers in the geosciences, James White was among the first to document the astonishing speed and magnitude of past climate change seen in ice cores. By showing that climate change in natural systems tends to happen abruptly over decades, White's work has contributed greatly to our understanding of the potential consequences of climate change within our lifetimes. <https://news.nationalgeographic.com/news/2013/12/131203-abrupt-climate-change-scienceearly-warning-report/>
- Cooperative Institute for Research in Environmental Sciences (CIRES) and INSTAAR. CIRES is a partnership between the National Oceanic and Atmospheric Administration (NOAA) and CU Boulder. More than two dozen CIRES and INSTAAR researchers are at the heart of NOAA's global monitoring program, which continually tracks and studies levels of greenhouse gases in the atmosphere. Those measurements of gases, including those known to cause greenhouse warming and others involved in depletion of Earth's protective ozone layer, are the foundation of the world's understanding of past, current, and future climate change. (Carbon Cycle Greenhouse Gases group)
- CIRES: Lisa Dilling and other researchers in the CIRES-based Western Water Assessment seek to understand how climate change and variability affect water and other resources in the Intermountain West. The WWA team is working with water managers and lawmakers to understand how cities plan for and respond to natural hazards and climate change, exploring what kind of snowpack data can best inform water managers making decisions about water allocation and use, and working with ranchers to help navigate matters like drought and insurance.
- CIRES: CIRES scientists are among the most well-known experts in the world on Earth's changing frozen realms – the cryosphere. Led by CIRES Director Waleed Abdalati, an expert in remote sensing of Greenland's dynamic and melting ice, CIRES scientists track changes in Arctic sea ice, study permafrost evolution, conduct field work from the South Pole to the North Pole, and much more. The CIRES-based National Snow and Ice Data Center tracks changes in Earth's frozen realms to better understand our future: from measurements of sea-ice extent in the Arctic and sea-ice forecasting for the Navy, to discovering the climate impacts of melting permafrost.

CU's engineering, environmental design, geosciences and business programs, supported by the work of centers and institutes such as the Center for Science Technology Policy Research (CSTPR) and those noted above are also cultivating the workforce of the near-future who will literally help design, engineer, build and operate the low-carbon economy.

Students are prepared, in part, to do so through participating in our campus as a living laboratory. This refers to integrating research and education into our daily operations and creating a fertile ground for innovation and entrepreneurship by bringing together our researchers, industry partners, and venture capital with the goal of taking applied research quickly to commercialization. A brilliant and potentially breakthrough concept like Prashant Nagpal's as one example, has to be demonstrated through pilot scale deployment to prove their merit and ultimately their efficacy in the marketplace. What better place than university campuses, and the communities in which they reside, to provide that testing ground?

The imperative is clear. The work underway is remarkable and hopeful. The respective and collective roles of each sector and institution you are hearing from in the course of the work of this Select Committee are also clear. The very fact of your work through this Select Committee is an indication that congress not only recognizes the imperative, but is looking for paths to support the good work at the local, state, and regional levels across this country, and across the world. We in Colorado applaud you, and thank you.

Again, thank you Chair Castor, Ranking Member Graves, Congressman Neguse, and members of the committee, for the opportunity to testify today. I look forward to the discussion and to answering any questions you may have.