350 NEW MEXICO ♦ AMIGOS BRAVOS ♦ CENTER FOR BIOLOGICAL DIVERSITY ♦ CENTER FOR CIVIC POLICY ♦ CITIZENS CARING FOR THE FUTURE ♦ CLIMATE ADVOCATES VOCES UNIDAS ♦ COALITION FOR CLEAN AFFORDABLE ENERGY ♦ CONSERVATION VOTERS NEW MEXICO ♦ DINÉ CITIZENS AGAINST RUINING OUR ENVIRONMENT ♦ DREAMS IN ACTION ♦ HEALTH ACTION NEW MEXICO ♦ NATURAL RESOURCES DEFENSE COUNCIL ♦ NATIVE AMERICAN VOTERS ALLIANCE EDUCATION PROJECT ♦ NEW MEXICO ENVIRONMENTAL LAW CENTER ♦ NEW MEXICO NATIVE VOTE ♦ NEW MEXICO SPORTSMEN ♦ OLÉ – ORGANIZERS IN THE LAND OF ENCHANTMENT ♦ NEW MEXICO VOICES FOR CHILDREN ♦ PARTNERSHIP FOR RESPONSIBLE BUSINESS ♦ PROGRESSNOW NEW MEXICO ♦ RIO GRANDE INDIVISIBLE NEW MEXICO ♦ ROCKY MOUNTAIN FARMERS UNION ♦ SAN JUAN CITIZENS ALLIANCE ♦ SANTA FE GREEN CHAMBER OF COMMERCE ♦ SIERRA CLUB – RIO GRANDE CHAPTER ♦ SOUTHWEST ENERGY EFFICIENCY PROJECT ♦ TÓ NIZHÓNÍ ANÍ ♦ WESTERN ENVIRONMENTAL LAW CENTER ♦ WESTERN LEADERS NETWORK ♦ WILDEARTH GUARDIANS

October 5, 2021

The Honorable Michelle Lujan Grisham
Governor of the State of New Mexico

Commissioner Stephanie Garcia Richard
New Mexico State Land Office

Senator Martin Heinrich
United States Senate

Majority Leader Peter Wirth
New Mexico Senate

Senator Ben Ray Luján
United States Senate

President Pro Tempore Mimi Stewart
New Mexico Senate

Representative Teresa Leger Fernández
United States House of Representatives

Speaker Brian Egolf
New Mexico House of Representatives

Representative Melanie Stansbury
United States House of Representatives

RE: NEW MEXICO HYDROGEN POLICY

Dear Governor Lujan Grisham, Senator Heinrich, Senator Luján, Representative Leger Fernández, Representative Stansbury, Commissioner Garcia Richard, Majority Leader Wirth, President Pro Tempore Stewart, and Speaker Egolf:

The undersigned organizations are grateful for your collective leadership to address the urgency of the climate crisis. This year, the United States has witnessed brutal heat waves, raging wildfires, and catastrophic floods. These events underscore the imperative for New Mexico to expeditiously move forward with a just and equitable energy transition away from

fossil fuels and towards renewable energy — a transition that sets the foundation for a thriving, resilient future for all of the state's people and communities and its natural heritage.

We write to express our unified concern that a "hydrogen hub," in particular one based on fossil hydrogen (i.e., from natural gas), will prove a counterproductive distraction from urgently needed climate action. In New Mexico, we need statutory carbon emissions limits, methane emissions standards, transportation emissions standards, state investment to power a transition to 100% electric vehicles, and support for New Mexican families who are making their homes more safe, resilient, and efficient. It is in this way that we can transition to a climate-resilient 21st-century renewable energy economy that provides stability for workers and families. We do not need a distraction that serves to further entrench fossil fuel interests and perpetuate volatile boom-bust oil and gas cycles.

Below, we channel our concern through seven guiding principles to help you determine whether and how a targeted and climate-driven deployment of hydrogen may serve as an element of New Mexico's energy transition. These principles recognize the critical distinction between fossil hydrogen derived from natural gas and green hydrogen derived from water and powered by 100% renewable energy. Distilled to their essence:

1. New Mexico must <u>first</u> put in place a comprehensive, durable, and enforceable climate policy framework <u>before</u> assessing whether hydrogen should be an element of the state's climate and energy transition.

2. Equity and justice must shape and underpin hydrogen policy decisions.

3. Hydrogen must neither divert from nor delay New Mexico's transition to a renewable energy future.

4. Hydrogen must avoid adverse climate, environmental, public health, and community impacts.

5. Policy-makers must rigorously scrutinize the financial and economic prospects of hydrogen as a climate and energy transition tool, in particular fossil hydrogen which, given negative market expectations, risks wasted capital and stranded assets.

6. New Mexico must provide a clear-eyed assessment of water availability, efficiency challenges, and constrained end-use markets for renewables-powered green hydrogen.

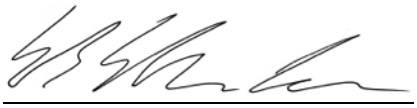
7. New Mexico must carefully consider hydrogen transport and storage safety challenges and risks.

These principles are grounded in our view that New Mexico's political leadership must not go down a narrow, risky, and harmful hydrogen path encouraged by the intensive lobbying and public relations efforts of fossil fuel interests. Instead, we strongly encourage you to inspire

a shared effort to diversify our economy, address the climate crisis, deliver on equity and justice, and protect land, water, people, and communities impacted by the destructive legacy of decades of oil and gas production in New Mexico.

We welcome further conversation.

Sincerely,



Erik Schlenker-Goodrich
Executive Director
Western Environmental Law Center

Thomas Solomon
Co-Coordinator
350 New Mexico

Rachel Conn
Deputy Director
Amigos Bravos

Kayley Shoup
Community Organizer
Citizens Caring for the Future

Taylor McKinnon
Senior Campaigner
Center for Biological Diversity

James Povijua
Policy Director
Center for Civic Policy

Kurt Gutjahr
Executive Director
Climate Advocates Voces Unidas

Cara Lynch
Attorney
Coalition for Clean Affordable Energy

Ben Shelton
Political & Policy Director
Conservation Voters New Mexico

Mario Atencio
Director
Diné CARE

Aline Castelan
Political Advisor
Dreams in Action

Barbara Webber
Executive Director
Health Action New Mexico

Noah Long
Western Director, Climate and Clean Energy
Natural Resources Defense Council

Ahtza D. Chavez
Executive Director
NAVA Education Project

Virginia Necochea
Executive Director
New Mexico Environmental Law Center

Ahtza D. Chavez
Executive Director
New Mexico Native Vote

Oscar Simpson
State Chair
New Mexico Sportsmen

James Jimenez
Executive Director
New Mexico Voices for Children

Erica Gallegos
Policy Director
OLÉ – Organizers in the Land of Enchantment

Alexandra Merlino
Executive Director
Partnership for Responsible Business

Lucas Herndon
Energy & Policy Director
ProgressNow New Mexico

Oscar Simpson
Public Lands Chair
Rio Grande Indivisible NM

Bill Midcap
Senior Policy Advisor
Rocky Mountain Farmers Union

Glenn Shiffbauer
Executive Director
Santa Fe Green Chamber of Commerce

Camilla Feibelman
Director
Sierra Club – Rio Grande Chapter

Mike Eisenfeld
Energy & Climate Program Manager
San Juan Citizens Alliance

Tammy Fiebelkorn
New Mexico Representative
Southwest Energy Efficiency Project

Jessica Keetso
Organizer
Tó Nizhóní Aní

Gwen Lachelt
Executive Director
Western Leaders Network

Jeremy Nichols
Climate & Energy Program Director
WildEarth Guardians

Cc: The Honorable Debra Haaland, Secretary, U.S. Department of the Interior

The Honorable Jennifer Granholm, Secretary, U.S. Department of Energy

Administrator Michael Regan, U.S. Environmental Protection Agency

The Honorable Gina McCarthy, National Climate Advisor, The White House

Secretary James Kenney, New Mexico Environment Department

Secretary Sarah Cottrell Propst, New Mexico Energy, Minerals, and Natural Resources Department

David Kieve, Director of Public Engagement, Council on Environmental Quality

SEVEN GUIDING PRINCIPLES TO EVALUATE WHETHER TO INTEGRATE HYDROGEN INTO NEW MEXICO'S CLIMATE AND ENERGY TRANSITION

October 5, 2021

1. NEW MEXICO MUST FIRST PUT IN PLACE A COMPREHENSIVE, DURABLE, AND ENFORCEABLE CLIMATE POLICY FRAMEWORK BEFORE ASSESSING WHETHER HYDROGEN SHOULD BE AN ELEMENT OF THE STATE'S CLIMATE AND ENERGY TRANSITION.

Any investment in hydrogen must be considered in the context of New Mexico's responsibility to develop and implement a policy framework that ensures the state does its fair share to reduce greenhouse gas emissions such that global warming is constrained to 1.5°C/2.7°F. New Mexico's policy framework must be comprehensive (i.e., cover all economic sectors), durable (i.e., codified into state law to best withstand political shifts), and enforceable (i.e., the compliance of public and private-sector actors must be assured).

Such a framework is an essential predicate to assess whether and how hydrogen should be folded into New Mexico's energy transition. Yet this framework does not yet exist in New Mexico. Without such a framework, there is a serious risk that even well-informed efforts on hydrogen will fail to address our state's emissions reduction and economic transition needs, and will eat up critical time as we race towards a precipice of climate disaster.

Governor Lujan Grisham does seek "to achieve a statewide reduction in greenhouse gas emissions of at least 45% by 2030 as compared to 2005." Exec. Or. 2019-003 (Jan. 29, 2019). However, the Governor's commitment is not codified in statute and her executive order can be revoked, just as most of the climate policy efforts of Governor Richardson were undone by Governor Martinez.

Further, the Governor's October 2020 climate strategy report found that current and pending state GHG-reduction policies will not achieve these targets, explaining that "reaching these ambitious targets will require significant change beyond the bold steps we are already taking."[1] While we are cognizant of the potential availability of federal resources for hydrogen, it is the imperative for climate action, not the supply of federal funding, that must take precedence and drive climate action.

As a core principle, New Mexico must therefore establish a comprehensive, durable, and enforceable climate policy framework as a condition precedent to assessing whether hydrogen can be integrated into New Mexico's climate action and energy transition. Absent that

[1] New Mexico Interagency Climate Task Force, New Mexico Climate Strategy at 8 (Oct. 2020). Available at: https://www.climateaction.state.nm.us/documents/reports/NMClimateChangeReport_2020.pdf.

framework, hydrogen risks obscuring and undermining, not contributing to, New Mexico's climate and energy transition.

2. EQUITY AND JUSTICE MUST SHAPE AND UNDERPIN HYDROGEN DECISIONS.

New Mexico's state leadership and administration should adopt equity and justice principles that center our state's people and communities — especially people of color, women, tribal communities, immigrants, low or no-income earners, rural communities, and communities now dependent on or impacted by extractive industries. For too long, these communities have been overburdened by systemic environmental and socioeconomic inequities. These systemic inequities propagate systemic injustices that adversely impact health, economic prosperity, access to clean air and water, and the opportunity and ability to fully engage in our state's political discourse.

Any consideration of hydrogen must therefore prioritize equity and justice. The state should adopt principles that: (a) engage overly burdened communities; (b) reduce health and environmental impacts on such communities; (c) respect tribal sovereignty; (d) consider and advance equitable economic transition; and (e) ensure accountability and transparency.

Fossil hydrogen, like any new market for fossil fuels, risks perpetuating, rather than remedying, systemic inequities and injustices. Therefore, adoption and development of equity and justice principles is essential.

3. HYDROGEN MUST NEITHER DIVERT FROM NOR DELAY NEW MEXICO'S TRANSITION TO A RENEWABLE ENERGY FUTURE.

New Mexico's highest climate priority should be centered on investments in proven and readily available renewable energy generation, battery storage, electrification (including building heating and transportation), energy efficiency, and transmission technologies. These known, tested and cost-effective technologies will prove the backbone of New Mexico's clean energy economy, not hydrogen. Even the most optimistic estimates of the use of hydrogen find that it is poised to play a markedly smaller role than other climate solutions in the future energy economy.

Renewable energy offers immediate, proven, and publicly supported climate solutions. Renewable energy, since it does not involve the extraction or combustion of fossil fuels, does not emit greenhouse gases. This is unlike the fossil hydrogen lifecycle, which emits greenhouse gas emissions even assuming strict methane safeguards and carbon capture. In this context, renewable energy offers a far more certain, lower risk climate solution, rather than a distraction. Fossil hydrogen may, if deployed with strict emissions limits upstream and in production, have some benefits relative to the carbon- and methane-intensive status quo, but not when compared to the renewable energy system we must attain in the coming decades.

With abundant wind and solar resources, the state should therefore boost New Mexico's role in the regional marketplace by further investing in renewables, accelerating our 100% clean energy requirement to 2035, and supporting appropriate transmission line development and a competitive tax structure that empowers New Mexico to serve markets across the Western U.S. Hydrogen must neither divert from nor delay political, regulatory, or financial attention and resources and needed investments in these lower risk, higher return climate solutions.

4. HYDROGEN MUST AVOID ADVERSE CLIMATE, ENVIRONMENTAL, PUBLIC HEALTH, AND COMMUNITY IMPACTS.

The pursuit of fossil hydrogen presents a range of serious climate, environmental, public health, and community risks. These risks underpin the following principles.

First, and as with our admonition that hydrogen not distract from our transition to renewable energy, hydrogen must not obstruct New Mexico's transition from fossil fuels. We remind you that the International Energy Agency (IEA) warned earlier this year that, "to bring global energy-related carbon dioxide emissions to net zero by 2050 and give the world an even chance of limiting the global temperature rise to 1.5°C," we cannot approve any "new oil and gas fields" and must initiate "a sharp decline in fossil fuel demand."[2] This warning is shared by a separate analysis finding that, to avoid 1.5 Celsius of warming, global fossil fuel production must decline by roughly 6% per year between 2020 and 2030.[3] Fossil hydrogen is incompatible with these findings.

Yet large-scale fossil hydrogen risks incentivizing new oil and gas fields or, at the least, perpetuating aging and pollution-intensive oil and gas fields in New Mexico. In the aggregate, New Mexico is already burdened with 60,000 oil and gas wells and well over 7,000 additional approved but not-yet-completed wells, as well as a spider web of roads, pipelines, compressor stations, and other oil and gas infrastructure.

This infrastructure is of great concern to the climate, but also New Mexico's inestimable landscapes. In the Greater Chaco region, fossil hydrogen would exacerbate immense stress on the region's ecological and cultural values as well as perpetuate inequities and injustices caused to its people and communities.[4] It is also of great concern in the Permian Basin, where oil and gas infrastructure — including nearly 200 abandoned oil and gas wells — has encroached on Carlsbad Caverns National Park and is the source of vast pollution that risks harm to communities. Indeed, tens of thousands of vulnerable New Mexicans live near oil and gas wells, including more than 10,000 children under the age of 5 who live within one-half mile of an oil

[2] International Energy Agency, Net Zero by 205: A Roadmap for the Global Energy Sector at 21 (May 2021). Available at: https://www.iea.org/reports/net-zero-by-2050.

[3] SEI, IISD, ODI, E3G, and UNEP, The Production Gap Report: 2020 Special Report (2021), http://productiongap.org/2020report.

[4] New Mexico Oil Conservation Division, Well Statistics (updated January 28, 2021), https://www.emnrd.nm.gov/wp-content/uploads/sites/6/OCDWellStatistics2020.xlsx.

and gas well.[5] A managed transition toward a diverse, stable, just, and equitable economy that supports people and communities and protects land and water, and away from our dependence on the volatile and harmful boom bust cycle of oil and gas, is critical.

Second, hydrogen implicates a range of significant and additional climate, environmental, health, technological, and economic risks, including:

- **Uncertainty Surrounding Carbon capture and Sequestration (CCS).** Production of fossil hydrogen, either through steam methane reforming (SMR) or autothermal reforming (ATR), requires very high levels of carbon capture (alongside near-zero levels of methane emissions, addressed below) to qualify as "low carbon" which, importantly, is not "zero carbon." Regardless, this introduces technology challenges and uncertainties. It also demands a build-out of capital-intensive carbon dioxide pipelines and storage infrastructure. Such sequestration must, at the least, be permanent, statutorily required, and highly effective. Of note, fossil hydrogen could lose low-carbon status and become stranded should CCS technologies fail to deliver on performance goals. Further, whether carbon capture and sequestration infrastructure is appropriate demands a process to address equity and justice issues before decisions are made.

- **Carbon and Methane Emissions.** The greenhouse gas intensity of fossil hydrogen depends on permanent, verified carbon capture (exceeding 90% efficiency) at the production facility as well as enforceable and verifiable control of methane emissions in upstream sources to near-zero levels. Any failure or leakage on either end can have outsized climate impacts and undermine the climate benefits of hydrogen. While Oil Conservation Division waste rules and Environment Department ozone rules will prove helpful, they are not a substitute for policies that directly reduce carbon and methane emissions in accord with state greenhouse gas emission reduction targets. Indeed, the state's own modeling of future greenhouse gas reductions from policy action for its annual climate report assumes methane pollution reductions ranging from 30% to 90%.[6] This presents a wide range of outcomes where considerable methane emissions continue unabated. Moreover, peer-reviewed research already finds far higher levels of methane pollution from oil and gas production than government agencies have previously estimated.[7] For example, Zhang *et al*. (2020) found total oil and gas-related emissions in the Permian Basin of 3.7% of regional gas production.[8] An additional peer-reviewed study

[5] Environmental Defense Fund, New Mexico Oil and Gas Data Map, https://www.edf.org/nm-oil-gas/map/ (last visited September 22, 2021).

[6] New Mexico Greenhouse Gas Emissions Inventory and Forecast, Center for the New Energy Economy, Colorado State University, p. 26. Available at https://cnee.colostate.edu/repowering-western-economy/.

[7] Alvarez et. al., "Assessment of methane emissions from the U.S. oil and gas supply chain", Science, available at https://www.science.org/doi/abs/10.1126/science.aar7204 and Robertson et. al., "New Mexico Permian Basin Measured Well Pad Methane Emissions Are a Factor of 5-9 Times Higher Than U.S. EPA Estimates", Environmental Science and Technology, available at https://pubs.acs.org/doi/10.1021/acs.est.0c02927.

[8] Zhang et. Al., "Quantifying methane emissions from the largest oil-producing region in the United States from space", ScienceAdvances, available at https://www.science.org/doi/10.1126/sciadv.aaz5120?ftag=YHF4eb9d17.

of fossil hydrogen concluded that "there really is no role for blue hydrogen in a carbon-free future" because of the largely unavoidable climate pollution that would accompany it.[9]

For political leaders committed to science-based policymaking, these climate risks should give great pause. Locking in any additional near-term and highly potent methane emissions hinders the world's ability to avoid catastrophic climate consequences.[10]

- **Public health impacts.** Oil and gas development, production, and processing – which produces the natural gas required for fossil hydrogen – can be a significant source of health-damaging air pollutant emissions, including volatile organic compounds (VOCs), many of which are hazardous air pollutants (HAPs) known to cause cancer and other serious health effects.[11] A commonly detected HAP near upstream oil and gas facilities is benzene, a known human carcinogen[12] for which there is *no* safe level of exposure.[13] Benzene is also associated with other human health impacts, including neurological damage, birth defects, and hearing loss.[14] Benzene and other HAPs can be emitted during gas well stimulation and completion, gas production and processing, as a product of combustion, and from storage tanks and impoundments.[15] These emissions pose adverse health risks and impacts to workers and communities near gas facilities.

  Oil and gas production, as well as downstream hydrogen combustion, also emits nitrogen oxides. Nitrogen oxides and volatile organic compounds react in the presence of sunlight to form ground-level ozone, also known as smog. Both short-term and chronic exposure to ozone can cause adverse human health risks and effects. Children are at greatest risk from ozone exposure because their lungs are still developing and they are more likely to

[9] Howarth R. Jacobson M. (2021). How Green is Blue Hydrogen? *Energy Science and Engineering*. Available at https://onlinelibrary.wiley.com/doi/full/10.1002/ese3.956.

[10] Intergovernmental Panel on Climate Change, *Climate Change 2021: the Physical Science Basis*, (2021). Available at: https://www.ipcc.ch/report/ar6/wg1/#SPM.

[11] *See, e.g.*, Roy, A. A., Adams, P. J., & Robinson, A. L. (2014). Air pollutant emissions from the development, production, and processing of Marcellus Shale natural gas. *Journal of the Air & Waste Management Association*, *64*(1), 19–37. https://doi.org/10.1080/10962247.2013.826151; Garcia-Gonzales, D. A., Shonkoff, S. B. C., Hays, J., & Jerrett, M. (2019). Hazardous Air Pollutants Associated with Upstream Oil and Natural Gas Development: A Critical Synthesis of Current Peer-Reviewed Literature. *Annual Review of Public Health*, *40*(1), 283–304. https://doi.org/10.1146/annurev-publhealth-040218-043715 [Hereinafter Garcia-Gonzales et al, 2019].

[12] US EPA (United States Environmental Protection Agency). (2016). *Benzene: Hazard Summary*. https://www.epa.gov/sites/default/files/2016-09/documents/benzene.pdf; IARC (International Agency for Research on Cancer). (2018). *Benzene: IARC Monographs on the Evaluation of Carcinogenic Risks to Humans* (Vol. 120). https://publications.iarc.fr/Book-And-Report-Series/Iarc-Monographs-On-The-Identification-Of-Carcinogenic-Hazards-To-Humans/Benzene-2018.

[13] WHO (World Health Organization) (Ed.). (2000). *Air quality guidelines for Europe* (2nd ed). World Health Organization, Regional Office for Europe.

[14] Garcia-Gonzales *et al*. (2019), *supra* Note 8, at 293.

[15] *Id* at 289-290; Figure 2.

> be active outdoors when ozone levels are high.[16] Outdoor workers, such as oil and gas workers, are also at greater risk due to heightened exposure.[17] Ozone exposure can inflame and damage the airways, make the lungs more susceptible to infection, aggravate existing lung disease, and increase the frequency or severity of asthma attacks.[18] Chronic exposure to ground-level ozone is associated with premature mortality.[19]

These risks are intended as illustrative, rather than exhaustive, of the problems associated with fossil hydrogen and must be thoughtfully and transparently avoided if the state desires to integrate hydrogen as an energy transition tool.

5. NEW MEXICO MUST RIGOROUSLY SCRUTINIZE THE FINANCIAL AND ECONOMIC PROSPECTS OF HYDROGEN AS A CLIMATE AND ENERGY TRANSITION TOOL.

Fundamentally, the state must act as a prudent investor and evaluate whether hydrogen can serve as a long-term tool to strengthen and diversify our economy. Yet investing scarce financial and administrative resources in fossil hydrogen is a very risky bet, with ripple consequences, if that bet fails, to New Mexico workers and their families. Any framework for evaluating whether to integrate hydrogen into New Mexico's energy transition must avoid these risks, both to the state and to our workers who ultimately seek long-term stability.

While near-term federal subsidies for fossil hydrogen may be tempting, the long-term market prospects for fossil hydrogen are dim. This undercuts the notion that fossil hydrogen can serve as a durable jobs creator for New Mexico. According to a recent market analysis by Bloomberg New Energy Finance (BNEF):

> 'Blue' hydrogen production facilities — those that use fossil fuels with carbon capture and storage (CCS) — may be cost-competitive for only a limited period of time.
>
> **While blue hydrogen is cheaper today than 'green' hydrogen made from solar or wind electricity, the situation should reverse by 2030.**

[16] US EPA (United States Environmental Protection Agency) (2021, May 5). *Health Effects of Ozone Pollution* https://www.epa.gov/ground-level-ozone-pollution/health-effects-ozone-pollution.
[17] *Id.*
[18] *Id.*
[19] Seltzer, K. M., Shindell, D. T., & Malley, C. S. (2018). Measurement-based assessment of health burdens from long-term ozone exposure in the United States, Europe, and China. *Environmental Research Letters*, *13*(10), 104018. https://doi.org/10.1088/1748-9326/aae29d.

> **BloombergNEF expects renewable hydrogen to be cheaper by 2030 in all modeled countries, even those with cheap gas (such as the U.S.) and those with pricey renewable power (such as Japan and South Korea)**.[20]

Consequently, BNEF's lead hydrogen analyst warned that:

> Companies currently banking on producing **hydrogen from fossil fuels with CCS will have at most ten years** before they feel the pinch ... Eventually those assets will be undercut, like what is happening with coal in the power sector today.[21]

Other market observers are also cautious about the long-term prospects for fossil hydrogen. Energy industry consultant ICF found that while "[fossil] hydrogen is a favorable near-term option for low-carbon hydrogen production[,] as electrolyzer technology becomes better-established and usage of renewable energy increases over the next 10-20 years, green hydrogen production will likely become dominant."[22]

In other words, not only is fossil hydrogen risky from an emissions perspective, it creates significant financial risk for the state, and could amplify, rather than reduce, our already excessive dependence on oil and gas. According to market analysts, fossil hydrogen is not the bridge to renewable energy that its proponents claim; it is a dead end. Moreover, fossil hydrogen paired with carbon-capture technology and green hydrogen require markedly different technology and infrastructure (e.g., carbon and natural gas pipelines for fossil hydrogen; renewables and transmission lines for green) and will likely come from different production sites. Pipeline, carbon capture, and carbon storage infrastructure required for fossil hydrogen is also capital-intensive and typically involves long-lived assets that would need to be in use for long periods of time (20, 30, 40 years). Given fossil hydrogen's dim long-term prospects, this is a problem.

At bottom, as the transition to renewable energy accelerates, the political and economic appetite for fossil hydrogen is likely to wane, stranding fossil-based assets, wasting the state's time and energy, and undercutting the stability New Mexico workers deserve and need. As a recent article noted, "if [fossil] hydrogen doesn't pan out, we might be wishing we could go

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[20] "Green" hydrogen to outcompete "blue" everywhere by 2030", Bloomberg New Energy Finance, May 5, 2021. Emphasis added. Available at https://about.bnef.com/blog/green-hydrogen-to-outcompete-blue-everywhere-by-2030/.

[21] David Iaconangelo, *Hydrogen with CCS faces same fate as coal — report*, Energywire, April 8, 2021. Emphasis added. Available at https://subscriber.politicopro.com/article/eenews/1063729469.

[22] Nima Simon, Mike McCurdy, P.E., and Heidi Larson, P.E., *Examining the current and future economics of hydrogen energy*, ICF Consulting, August 13, 2021. Available at https://www.icf.com/insights/energy/economics-hydrogen-energy.

back in time and think a bit harder about investing in that technology now."[23] Accordingly, it is critical that New Mexico avoid risky bets incongruent with its duty to take prudent policy action in the public interest.

6. NEW MEXICO MUST PROVIDE A CLEAR-EYED ASSESSMENT OF WATER AVAILABILITY, EFFICIENCY CHALLENGES, AND CONSTRAINED END-USE MARKETS FOR GREEN HYDROGEN.

Green hydrogen offers not only climate benefits relative to fossil hydrogen, but also economic and financial benefits. Critically, green hydrogen production holds the potential for continued cost reductions, as the costs of electrolyzers and renewable electricity are projected to decline owing to increased deployment and virtual learning effects. In contrast, steam methane reforming, the technology underpinning fossil hydrogen production, is a mature technology and therefore offers much less potential for further cost reductions. Fossil hydrogen also faces volatile natural gas prices, a risk heightened by future climate regulations. Therefore, from an economic and financial perspective, exploring the potential for green hydrogen in concert with the state's renewable energy buildout strikes us as a more prudent course than placing risky political, financial, and economic bets on fossil hydrogen.

That said, while renewables powered, water-derived hydrogen presents significant advantages to fossil hydrogen, it must be carefully investigated as well given New Mexico's arid climate.

First, water-derived hydrogen must be fully produced with renewable energy to have carbon benefits; "[b]ecause electrolysis is so energy-intensive, hydrogen made with grid-average electricity is even more carbon intensive than hydrogen made from [steam-methane reforming] of natural gas."[24]

Second, we must fully evaluate whether New Mexico has sufficient water supplies to scale up renewable energy-powered water-derived hydrogen production to a level where it can prove a significant element of our climate and energy transition. This concern must be evaluated and addressed by policymakers. While the water required for electrolysis and cooling systems is less than that required for fossil fuel activities, large-scale and indiscriminate green hydrogen production could strain New Mexico's limited and dwindling water supplies — water supplies essential to the long-term resilience of communities as the state warms.

Critically, 76% of the state remains in drought, with 19% of the state, including the vast majority of San Juan County, in "extreme" drought.[25] Last year, virtually the entire state (99.79%) was in

[23] "Fossil Fuel Companies Say Hydrogen Made From Natural Gas Is a Climate Solution But the Tech May Not Be Very Green," Time Magazine (Sept. 22, 2021), https://time.com/6098910/blue-hydrogen-emissions/.
[24] Earthjustice Hydrogen Report at 13.
[25] U.S. Drought Monitor, https://droughtmonitor.unl.edu/CurrentMap/StateDroughtMonitor.aspx?NM (last visited Sept. 9, 2021).

drought, including 32% in "extreme" drought, and the long-term forecasts are sobering.[26] In real-life terms, even "moderate" drought requires farmers and ranchers to supplement livestock with feed and water, while "extreme" drought creates "extreme" fire danger, decreases irrigation allotments, and induces forest and vegetation death. Notably, in March, the New Mexico State Engineer temporarily closed portions of groundwater basins in southeastern New Mexico because of concern over the hydrologic impacts of many pending water use applications.[27] Put simply, New Mexico is aridifying because of the climate crisis, calling into question the viability of indiscriminate investments in any water intensive industry. Hydrogen production that is not accompanied by reductions in fossil fuel production, and it's associated water demands, would place further demand on limited and dwindling water supplies — demand that implicates important equity and justice considerations.

Furthermore, current forecasts envision the most effective use of hydrogen in niche sectors within a 100% renewable economy, where the direct use of electricity faces technical hurdles, such as the production of fertilizer, off-road transport like aviation and maritime shipping, and steelmaking. It may also have a limited role in providing storage and capacity for electric utilities. However, direct electrification with renewable energy is vastly more efficient and cost-effective than hydrogen as a replacement fuel for end uses, such as cars and buildings, that now use hydrocarbon fuels. While there may well be a role for zero carbon hydrogen, it will likely be a small player compared to renewable energy and other, more efficient, energy storage technologies that may offer bigger markets, and more certain returns, for New Mexico investment.

7. NEW MEXICO MUST CAREFULLY CONSIDER HYDROGEN TRANSPORT AND STORAGE CHALLENGES.

Hydrogen transport and storage offer another challenge that warrants serious reflection. Hydrogen is corrosive and can embrittle natural gas pipelines that were not built to handle high shares of hydrogen. Blending hydrogen into existing natural gas pipelines presents potential leakage, health and safety risks to people and communities proximate to those pipelines. Where hydrogen is not blended, hydrogen producers would require new, dedicated, and capital-intensive pipelines or other infrastructure to transport hydrogen from production centers to end-use markets. Regardless, the need for long-lived hydrogen pipelines and other transport infrastructure should therefore be carefully investigated to avoid asset stranding should a hydrogen market not pan out. It should also be guided by the assessment of hydrogen market potential noted above to ensure that investments are aligned with a long-term and secure climate vision and a needed, planned phase-out of fossil fuel production

[26] *Id.*

[27] New Mexico Office of the State Engineer, https://www.ose.state.nm.us/ProgramSupport/News/2021/PRESS%20RELEASE%20CAPITAN%20etc%203%2025%2021.pdf.

Consistent with the equity and justice principles we outline above, hydrogen pipeline and other infrastructure projects should be subject to the buy-in and meaningful participation of local communities impacted by said projects. This suggests the potential to convert or replace existing fossil fuel infrastructure with renewable hydrogen infrastructure to avoid new impacts, even as existing infrastructure locations should be evaluated to gauge whether they were appropriately located in the first place to avoid impacts to people, communities, cultural resources, and the environment. Further, the prospect of hydrogen pipeline and other infrastructure projects requires an assessment of impacts, proper planning and siting to avoid impacts, and rigorous regulatory standards governing the risk of hydrogen leakage.

All of these issues demand careful and comprehensive consideration and appropriate safeguards in the specific context of New Mexico's climate future and transition from fossil fuels. To date, however, we have not seen any assessments evidencing such careful, deliberative, and comprehensive consideration.

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