

Social License for Wyoming's Energy Future: A Replication Study

JESSICA WESTERN, SELENA GERACE, AND WILL BENKELMAN

SEPTEMBER 2023



In Collaboration with the University of Wyoming Ruckelshaus Institute, the Plains CO₂ Reduction Partnership (PCOR), and the Intermountain West Energy Sustainability and Transitions (I-WEST) Project

Social License for Wyoming's Energy Future: A Replication Study

By Jessica Western, Ph.D. | Research Associate, University of Wyoming Ruckelshaus Institute and Principal, Big Goose Creek Resolutions;

Selena Gerace | Associate Research Scientist, University of Wyoming School of Energy Resources;

Will Benkelman | Graduate Research Assistant, University of Wyoming Haub School of Environmental Resources

A publication of the University of Wyoming School of Energy Resources
June 2023

Acknowledgements:

Our gratitude to the Plains CO₂ Reduction (PCOR) Partnership (DOE Award #DE-FE0013838) and the Intermountain West Energy Sustainability and Transitions (I-WEST) Project (DOE Award #LANL-AE-388-361) which provided funding for this project.



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Ruckelshaus Institute

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EXECUTIVE SUMMARY

This study explores the perspectives, values, needs, and concerns of Wyoming residents in relation to energy in Wyoming. It is a replication of a 2020 study published as *“Social License for Wyoming’s Energy Future: What Do Residents Want?”*. Both studies were motivated by a desire to understand what Wyoming residents want in relation to energy and why. This replication provides an update and comparison to the 2020 study and allows us to track how Wyoming residents’ perspectives about energy have evolved over time. We have framed our analysis through the lens of the ‘social license to operate’ as a way to understand the types of energy Wyoming residents approve of and accept.

The study was initiated and partially funded by the *University of Wyoming School of Energy Resources*. Funding was also provided by two U.S. Department of Energy projects: the *Plains CO₂ Reduction (PCOR) Partnership*, and the *Intermountain West Energy Sustainability and Transitions (I-WEST) Project*. The lead social scientist for this study, Jessica Western, is a Research Associate and Adjunct Professor at the *University of Wyoming’s Haub School of Environment and Natural Resources*. Selena Gerace is a Research Scientist at the *University of Wyoming School of Energy Resources* and Will Benkelman is a graduate student at the *Haub School of Environment and Natural Resources*.

We conducted this study in two parts. First, in the fall of 2022, we conducted a survey of Wyoming residents designed to assess opinions about energy related activities in the state and provide insights into their desires for Wyoming’s energy future. Second, we conducted a Q-study at the end of 2022 and in early 2023, which consisted of a series of interviews with 22 Wyoming residents who actively work on energy related issues in the state. These interviewees also completed a sorting exercise to rank agreement or disagreement with statements about energy in Wyoming. The Q-study methodology is a way of identifying the major discourses on a topic within a community.

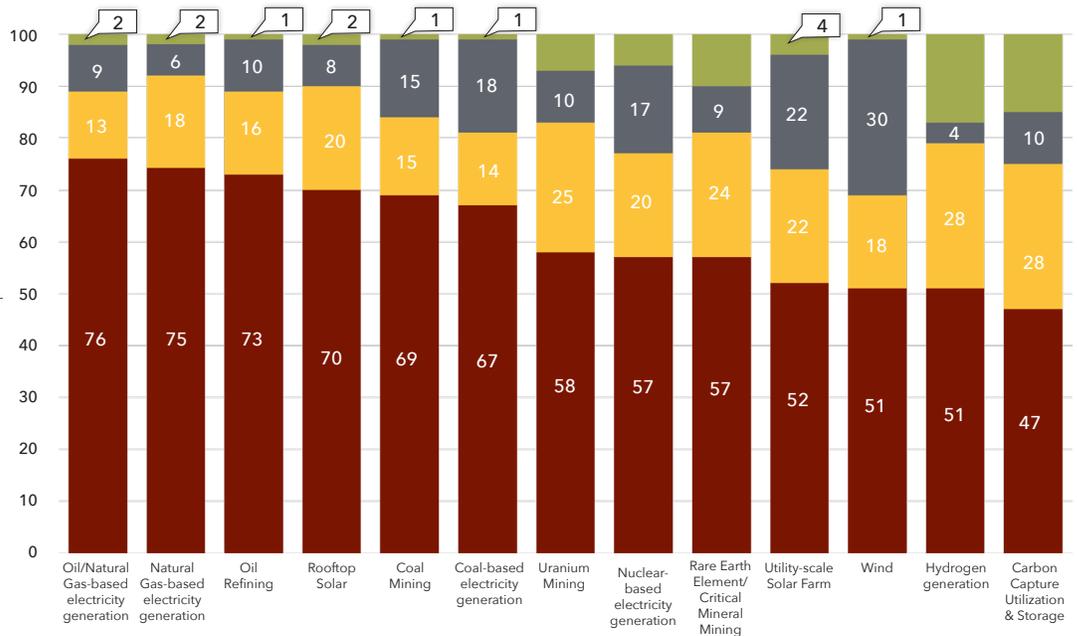
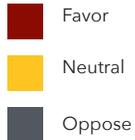
The 2022 survey results found that 76% of Wyoming residents favor oil and natural gas-based electricity generation, 73% favor oil refining, and 70% favor rooftop solar. Coal mining and coal-based electricity generation were also shown to have strong support, with 69% and 67%, respectively. Uranium mining was favored by 58% of residents and nuclear-based electricity generation was favored by 57%. Wind and utility scale solar received the most opposition, with 30% and 22%, respectively. Emerging energy types, such as rare earth elements/critical minerals (RER/CM), hydrogen, and CCUS, were all notable in the high levels of residents reporting that they are either neutral or not sure about them (38%, 45%, and 43%, respectively).

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The 2022 survey results found that 76% of Wyoming residents favor oil and natural gas-based electricity generation, 73% favor oil refining, and 70% favor rooftop solar.



The following is a list of energy related activities that are either being done or could be done in Wyoming. How much do you favor or oppose each one in the future?



Totals do not add up to 100 due to averaging and categories reported.

When comparing these results to the 2019 survey, several trends emerged. It is clear that conventional fossil energy types (coal, oil, and natural gas) still received the most support. Solar energy also received high levels of support on both surveys. Wind received considerably less support (51% in 2022 compared to 65.5% in 2019), while uranium mining, nuclear-based electricity generation, CCUS, and REE/CM all received considerably more support in 2022, with fewer people reporting being neutral or not sure. All of these industries have become more prominent in the Wyoming energy discourse over recent years as they have made tangible traction in the state. For example, Wyoming obtained Class VI primacy for permitting geologic storage injection wells, Rare Element Resources' critical mineral mining and processing project (the *Bear Lodge Project* in northeastern Wyoming) has advanced, and the TerraPower small modular reactor was sited in Kemmerer. This suggests that as residents have learned about and gained experience with emerging technologies, their support for them has increased.



It is clear that conventional fossil energy types (coal, oil, and natural gas) still received the most support.

Results of the Q-study identified three major themes that exemplify and explain discourses in Wyoming about energy. While the survey illuminates the levels of social license that currently exist in Wyoming, the themes identified in the Q-study and the commonalities between these themes explains the reasons for these levels of social license.

The three identified themes from this study are:

Theme 1: *Climate change either is or is not an existential threat.* (Note: This theme was unique in that there was a divergence in views about climate change that caused strong, but opposing, correlations about climate change beliefs. Both views were captured in this theme.)

Theme 2: *An all-of-the-above energy strategy is most effective in increasing resilience in Wyoming.*

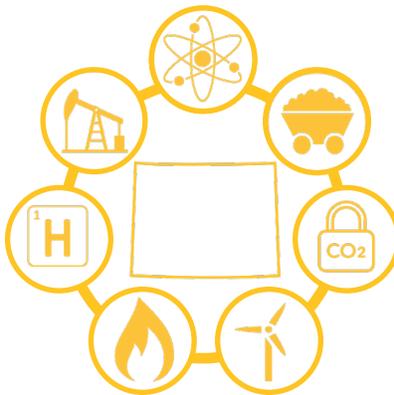
Theme 3: *Economics and communities are priorities.*



CLIMATE CHANGE THEME

Majority of respondents believe climate change is occurring

Diverging views about causes of climate change being human caused or natural



ALL-OF-THE-ABOVE ENERGY THEME

Belief that decisions on energy type should be made based on economic considerations

Important for Wyoming to be an energy leader

Energy development should align with values



ECONOMICS AND COMMUNITIES THEME

Emphasis on communities a top priority

Economics are a major priority

Motivated by fear of losing jobs and social services if fossil energy declines further

Major Findings from the 2022/2023 Survey and Q-Study:

After analyzing the results of the 2022 survey and the Q-study, we looked at the combined findings to determine what they could reveal about the social license for energy in Wyoming. The combination of these findings highlights several salient and compelling points about the energy discourse in Wyoming, and what Wyoming residents need and feel concerned about. These include:

- 1. More information about emerging and expanding energy industries:** Wyoming residents generally support the state's "all-of-the-above" energy strategy. However, they also have big questions about emerging energy types and what they will mean—including what they will mean to them personally, to their communities, to the environment, and to the state economy. Of particular note from the survey results are the high levels of "I don't know" and "Neutral" responses in regard to many emerging and expanding energy types (such as CCUS, hydrogen, nuclear, etc.). This, in and of itself, is an important response as it indicates the lack of general understanding and need for information. The need for more readily available and understandable information was also highlighted in the results from the survey questions about energy information sources and accessibility. The majority of respondents either did not answer these questions or reported that they did not believe enough information was available. Q-study participants also spoke about the importance of ensuring information and education about energy topics is available. Many participants saw the provision of meaningful information as critical to supporting communities to become resilient in the face of industry change.
- 2. Communities as a top priority:** Q-study participants in all themes expressed strong concern regarding the fate of Wyoming's energy communities at risk of losing jobs and social services if fossil energy industries decline further. Generally, there was enthusiasm, even relief, that at least for Kemmerer there may be solutions (the TerraPower small modular reactor demonstration project) providing jobs, tax revenue and the continuation of the social services the community needs. Other communities do not have such strong possibilities yet and renewable energy is not considered to be a viable option to fully replace jobs or support communities. Q-study participants want communities to be a top priority in making energy-related decisions and want to ensure communities are supported in having employment and revenue sources.
- 3. Consensus on existence of climate change, divided on cause:** Data from both the survey and the Q-study indicate that the majority of respondents believe climate change is occurring. However, there are some differences in beliefs about whether it is primarily caused by humans. In the survey, more than 50% of respondents don't believe climate change is caused by humans and less than 40% do believe it's mostly caused by humans. While most Q-study participants believe humans are mostly responsible for climate change, some Q-study participants in Theme IB do not. These participants, however, do believe human activity was at least partially responsible for climate change.

- 4. The importance of landscapes and wildlife:** In the Q-study and the survey, participants and respondents indicated a strong desire to prioritize the landscapes and wildlife which are unique to Wyoming when making energy related decisions. This priority is evident in survey respondents' top reasons for valuing Wyoming, four of which are connected to landscape and wildlife: recreation, aesthetics, biological diversity, and spirituality (the definition of the 'spirituality' value "...places for which I feel reverence and respect for nature..."). The importance of landscape and wildlife was also evident in Q-study responses about responsible development and siting, and concerns about the environment.
- 5. A desire to make decisions about the energy mix based on economics:** Q-study participants in all themes expressed a desire for decision making about the energy mix to be based on economic considerations. However, there were variations in what this means to different respondents. Some believed there should be fewer regulations that determined 'winners' and 'losers' for energy industries and decisions should be made based on market forces determining costs and revenue. Other participants believed in a demand-driven approach to making decisions about Wyoming's energy mix, by developing the types of energy that are demanded by customers. Still others believe decisions should be made based on what would provide the greatest economic benefits to communities in the form of jobs and tax revenue. Related to this desire for economic-based decision making, was an acknowledgement among many Q-study participants that Wyoming is not in control of what types of energy are demanded. Participants recognized the complicated and powerful forces outside Wyoming that are driving demand for energy resources. While some accepted that demand is largely outside of Wyoming's control, others expressed frustration about it.
- 6. A role for policy-makers:** Q-study participants in all themes and many survey respondents focused on the role they would like state leadership and policy-makers to play in energy planning and decision-making. In open-ended survey questions, eleven respondents provided comments expressing a desire for the Legislature to provide incentives to new companies using emerging technologies e.g. "A carbon fee and dividend policy that is revenue neutral seems like a good way to influence those incentives". Most of the statements reflected a desire for the Legislature to "think out of the box" and not give preference to coal, oil and gas over renewable energy resources. The four themes in the Q-study also reflected these sentiments. In Theme 1B, participants wanted policy makers to craft policies that "keep coal on the table", "build capacity to mine, convert and enrich uranium for nuclear fuel", and "tax solar and wind". The three other themes also discussed changes in taxes, but in the context of "providing a solid energy policy that includes Wyoming revenue structure" that includes, e.g., value-added tax and "a leveling of the playing field by not taxing wind and solar energy types". In these three themes we also found a desire that policy makers were more informed about energy dynamics and used that information to make policies that "don't pick winners and losers". This is tied to the point participants made regarding markets: "I want free markets to dictate energy types".

Implications from both Studies: Considerations for Social License

We conducted both the 2020 and 2023 studies to understand Wyoming residents' perceptions of energy. And, at the center of both is the concept of social license. By illuminating what Wyoming residents want, need, value, and are concerned about, these two studies provide important insights into the social license for energy in Wyoming.

- 1. Importance of continuing to be an energy leader:** Wyoming has a long history as an energy producing state. For many respondents, that history is ingrained in the Wyoming conscience. Energy industries have provided meaningful livelihoods for generations of residents, energy industries have generated the tax revenue that provides social services, and many residents feel pride that Wyoming has literally provided much of the energy that powers the nation. Wyoming's role as a leader in coal, oil, and natural gas has had a profound impact on the culture of Wyoming and many residents want Wyoming to continue to be a leader in these and emerging energy industries. Survey results show that fossil fuels continue to enjoy strong support in Wyoming, with support for coal and oil increasing from 2019 to 2022 and support for natural gas staying at the same level. Support for nuclear electricity generation and CCUS have also increased and support for solar has stayed the same. Q-study results also indicate a desire for Wyoming to continue to be an energy leader. While participants in each of the themes differ some on what kinds of energy to focus on, all believe that Wyoming has an important role to play, whether that is in continuing to produce conventional fossil resources, expand into emerging decarbonized energy types, or a mix of all-of-the-above. These results indicate that while there may be many differences among Wyoming residents about the types of energy they give social license to, there is strong social license for energy overall in Wyoming.
- 2. An opportunity for education and engagement:** As in 2019, the 2022 survey indicates a strong need for more information and educated related to energy. This is especially true about expanding and emerging energy industries. Q-study participants in 2023, far more so than in 2020, also stressed the importance of education for the public so that they can meaningfully engage in decisions about energy and to have self-determination in shaping their future relationship to energy. They expressed an understanding that for communities to be successful in navigating transition, it is important for them have more knowledge about different types, including how they will impact their communities, what potential trade-offs will be, and what role they'll play in providing jobs and revenue. For communities to do this, adequate education and engagement will be vital. Education and engagement are also key for obtaining social license.



- 3. Energy development in alignment with values:** The qualities that Wyoming residents value the most about Wyoming all focused on communities, landscapes, and wildlife. These values were expressed in the way that preferences for different energy types were expressed. Q-study participants in all themes had different preferences for different types of energy (as did survey respondents). However, many of these participants brought up the importance of *how* and *where* energy is developed not just the type of energy. The social license they gave for energy development was often conditional on where it was sited, how it would support communities, and how it would impact wildlife and landscapes. For example, participants raised the importance of siting energy activities in areas where development already existed to minimize any additional energy footprint. Participants also spoke about the importance of how siting would affect migration routes for wildlife, community and residents' quality of life, hunting opportunities, and scenic beauty. Considering ways of developing energy that are in alignment with Wyoming resident's values can also play a role in building social license.
- 4. Desire for more state-level planning and policy:** Survey respondents and Q-study participants in both the 2020 study and the 2023 study expressed the strong desire for more state-level planning and policy development related to energy in Wyoming. The State of Wyoming is already actively involved in energy issues and policy. And in the three years between the two studies, state-level leadership has done much to plan for Wyoming's energy future and develop the policy framework to support it. For example, the Wyoming Energy Authority developed a state-wide "all-of-the-above" energy strategy to guide the state's approach to energy, Governor Mark Gordon set of the goal of Wyoming achieving net-zero carbon emissions, and Wyoming attained primacy for permitting Class VI injection wells for permanent storage of CO₂. The results from this study indicate that Wyoming residents want more of this type of proactive planning and leadership related to energy and want to be engaged in state-level planning. Residents are thinking critically about the role of economics, policy, education, and communities in forming Wyoming's energy future. They want deliberate and well-thought-out decision making and they want to be engaged in the process. To build social license, this engagement can be valuable. The engaged public has the knowledge needed to be included in decision-making, to process complicated issues, and to give social license for the plans and policies that are developed.



Residents are thinking critically about the role of economics, policy, education, and communities in forming Wyoming's energy future.

INTRODUCTION

This report details the results of a study on Wyoming residents' perceptions about energy—their thoughts, values, needs, and concerns. The study is a replication of, and comparison to, the study we conducted in 2019 and 2020 and published as *“Social License for Wyoming’s Energy Future: What Do Residents Want?”*ⁱ Both studies were motivated by a desire to understand Wyoming residents' preferences related to energy production and resources and the reasons for these preferences. Wyoming's bond to energy is especially strong as an energy producing, exporting, and innovating state. Energy funds our schools and health care systems, it sustains our local and state governments, it provides jobs for our residents, and is the nucleus around which many of our towns were built.

Wyoming’s Relationship with Energy

Wyoming's history as an energy producing state dates back to 1863 when the first recorded oil sale occurred along the Oregon Trail.ⁱⁱ Just a few years later, commercial coal mining was ushered into Wyoming with the arrival of the Union Pacific Railroad in 1867, which relied on coal to fuel its steam-powered engines.ⁱⁱⁱ Two decades later, in 1884, the first drilled oil well (the Mike Murphy #1) began producing in the Wind River Basin.^{iv} Natural gas production began not long after in the early 1900s.^v More than 120 years later, Wyoming continues to extract, refine, and process fossil resources, generate fossil-based electricity, and transport both. Today, the state is a leader in fossil energy extraction—it is the number one coal producing state in the U.S., the 8th oil producing state, and the 10th natural gas producing state.^{vi} Wyoming produces nearly 12 times more energy than it consumes and is the second largest net energy exporting state in the U.S. (after Texas). Moreover, Wyoming's economy is the second most energy intensive among states (after Louisiana).^{vii}

While coal, oil, and natural gas have been the most long-standing energy industries in the state, Wyoming's energy portfolio includes many other energy industries as well. For example, Wyoming has been a leading state in uranium mining, producing a total of more than a quarter of a billion pounds of yellowcake since commercial uranium mining began in the 1950s.^{viii} While domestic production of uranium has decreased significantly since its peak in the 1980s^{ix}, Wyoming still has the largest known reserves of uranium in the US.^x In more recent years, wind energy development has expanded significantly in Wyoming. Currently, there are 3,000 megawatts of installed wind powered-generating capacity and another 830 megawatts are scheduled to come online in 2024. There are several other large wind projects in development, such as the Chokecherry-Sierra Madre project in southeastern Wyoming, which will generate an additional 3,000 megawatts.^{xi} Wind now accounts for 22% of Wyoming's total installed electricity generation capacity.^{xii}

While Wyoming has been a significant producer of energy for decades, it has been plagued by *boom-and-bust* cycles—characterized by periods of high demand for energy resources which causes industries to expand quickly (the *“boom”*), followed by sharp drop-offs in demand which causes the industries to decline significantly (the *“bust”*). Coalbed methane is a notable example, having a boom in the mid-2000s, reaching its peak in 2008 at more than 580 million thousand-cubic-feet (MCFs), before it began a steady decline in the early 2010s. In 2022, production of coalbed methane in Wyoming had decreased to just 69 million MCFs.^{xiii}

Likewise, coal, oil, and natural gas have gone through significant boom and bust cycles. In recent years, there have been steep declines in production due to changing market demand for energy resources. Coal production in Wyoming reached its peak at more than 450 million short tons in 2008 and was down to 244 million short tons in 2022 (see Figure 1).^{xiv} Natural gas production has declined from more than 2.5 billion MCFs in 2009 to less than 1.3 billion MCFs in 2022 (see Figure 2).^{xv} Oil production has followed a somewhat different trajectory in Wyoming as it hasn't seen the steep decline that coal and natural gas have in recent years. Production reached a low of 51 million barrels in 2009, but increased to more than 90 million in 2022 (see Figure 3).

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The decrease in production of fossil resources in Wyoming has caused a corresponding decline in the number of jobs that fossil energy industries provide.”

The decrease in production of fossil resources in Wyoming has caused a corresponding decline in the number of jobs that fossil energy industries provide. The number of people employed in coal mining in Wyoming has decreased from more than 7,054 in 2009 to less than 4,400 in 2021. The number of people employed in oil and gas extraction has decreased by more than half from a high of 4,542 in 2014, to 2,213 people in 2021.^{xvi}

Wyoming Coal Production 1978-2022

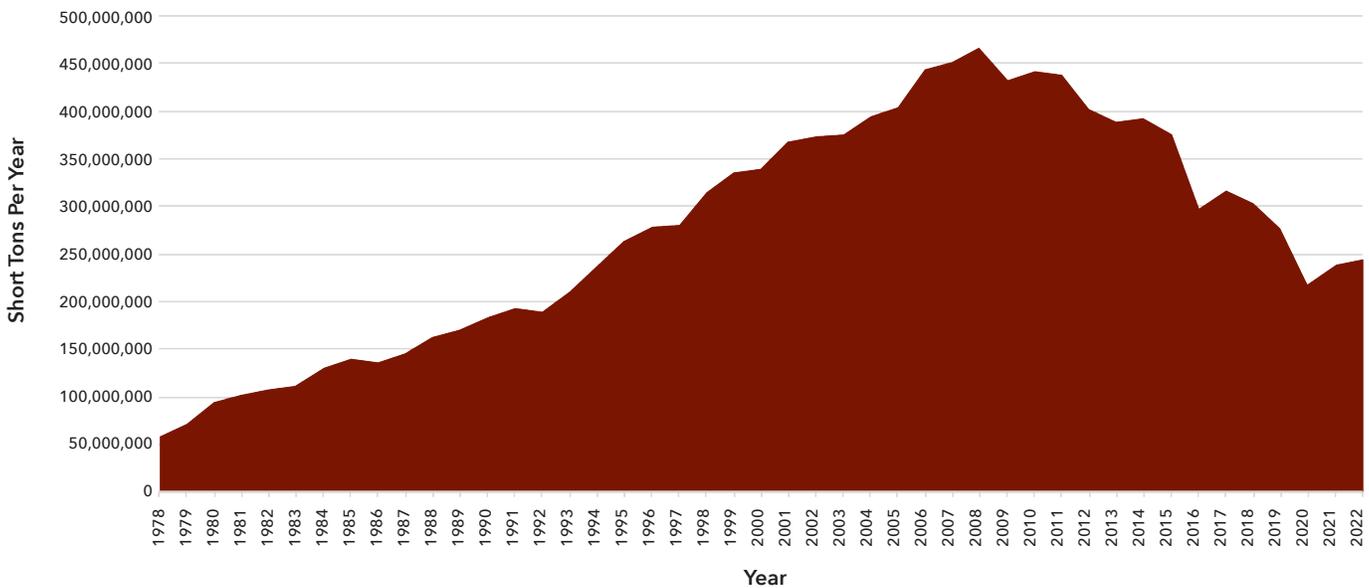


Figure 1: Wyoming Coal Production 1978-2022

Wyoming Natural Gas Production 1978-2022

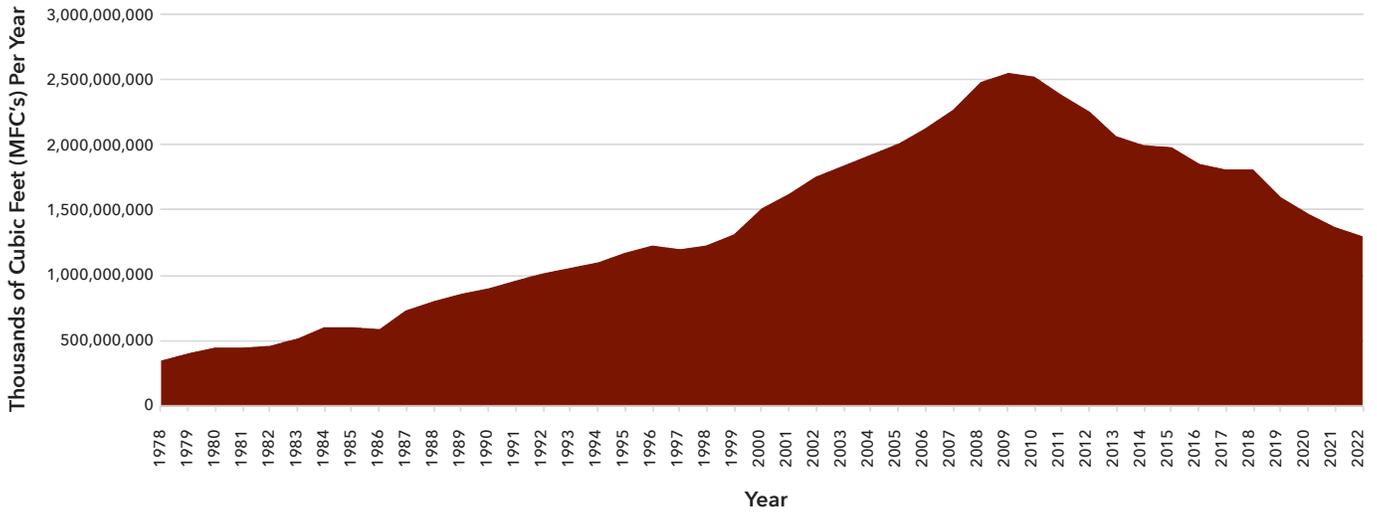


Figure 2: Wyoming Natural Gas Production 1978-2022

Wyoming Oil Production 1978-2022

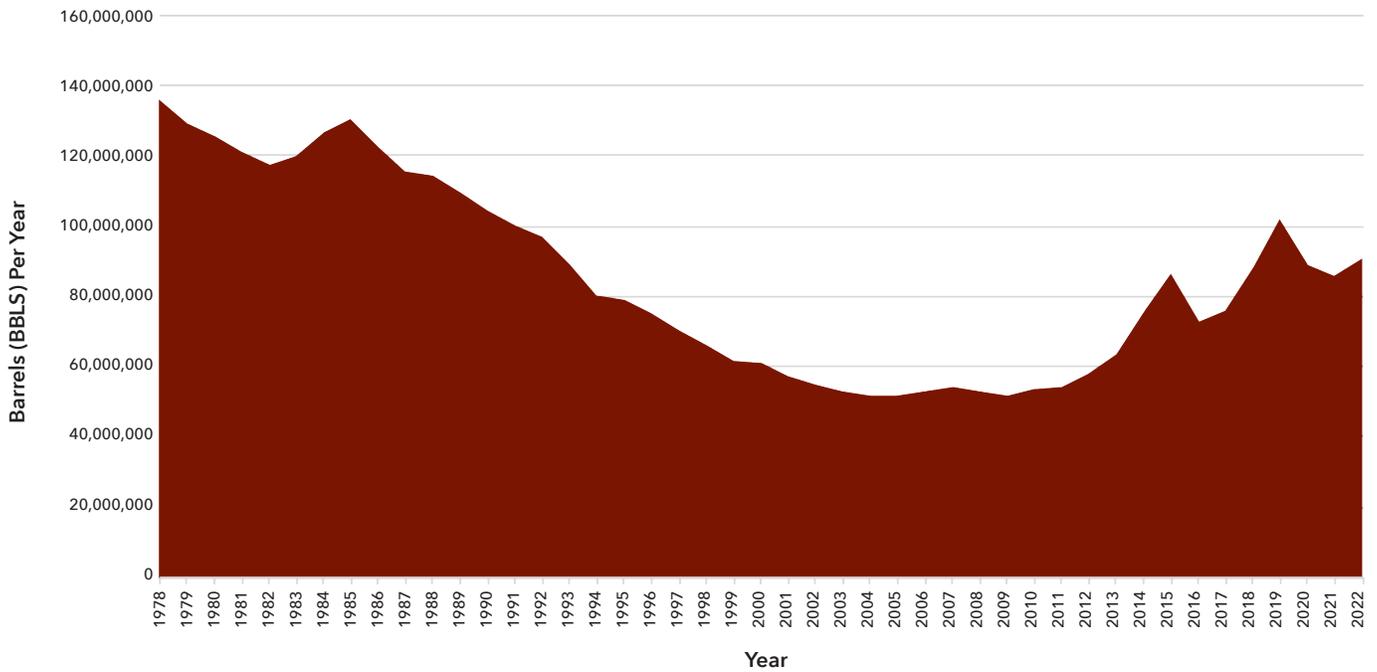


Figure 3: Wyoming Oil Production 1978-2022

Wyoming's Focus on Diversification and Innovation

In recent years and in response to changes in energy markets, Wyoming has focused on diversification and innovation of its energy industries and technologies. In 2021, Wyoming's Governor, Mark Gordon, set Wyoming's sights on achieving net-zero carbon emissions, a goal he pledged Wyoming could meet while keeping its fossil industries alive.^{xvii} The Wyoming Energy Authority is the state agency in charge of coordinating energy activities and their mission is to advocate for, facilitate, and advance the Wyoming energy economy. They developed an energy strategy that focuses on an "all-of-the-above" approach to energy development in the state, including conventional fossil resources, as well as emerging technologies such as carbon capture, utilization and storage (CCUS), hydrogen, nuclear, geothermal, and rare earth elements.^{xviii}

This focus on supporting innovation in emerging and expanding energy industries follows the example Wyoming has been setting for well over a decade in supporting the development of a CCUS industry. The Wyoming Legislature has developed a robust legal and regulatory framework for CCUS by passing a suite of statutes starting in 2008. In 2020, Wyoming attained primacy over the permitting and regulation of Class VI injection wells, which are used to inject CO₂ for permanent geologic storage.^{xix} In addition to its support for CCUS, Wyoming has also worked to develop a nuclear energy industry. In 2021, Kemmerer was selected by TerraPower as the site for its small modular reactor demonstration project.^{xx}

The Original Study and Reasons for a Replication

Since the initial study was completed in 2020, many dynamics have shifted globally, nationally, and locally which have deeply resonated through energy markets and communities.

Much of the 2020 Social License study was conducted during the global COVID-19 pandemic, which caused massive upheaval to global markets, societal norms, and daily practices. As a result, the study captured the perspectives of a state in the midst of great uncertainty. Arguably no corner of society was left unchanged by the pandemic, and energy was no exception. Changes in people's daily activities due to lockdown measures caused disruptions in transportation, trade, and economic activity which led to dramatic decreases in energy demand and use. While oil prices plunged into negative numbers^{xxi}, energy consumption in the U.S. decreased 7% below 2019 levels.^{xxii} This brought much economic turmoil to energy industries, including job losses and bankruptcy filings.^{xxiii, xxiv, xxv}

The impacts of the pandemic continue to ripple through energy industries and have been further complicated by other disruptive events nationally and internationally. Energy markets began to recover in 2021 and prices steeply increased due to rapid economic recovery post-pandemic^{xxvi}, but were shocked again when Russia invaded Ukraine in early 2022. Caused first by Russia withholding gas supplies and then by sanctions against Russia by the U.S. and the EU, oil and gas supplies decreased and prices spiked—natural gas to its highest price ever, and oil to its highest price since 2008—leading to a global energy crisis.^{xxvii}

Also in 2021, an extreme winter storm (Storm Uri) hit a large portion of the U.S. bringing unprecedented low temperatures, snow, and ice which lead to widespread power outages in Texas and left more than 10 million people without electricity. A stunned nation watched as residents in Texas (one of the biggest energy producing states in the country) were left without heat, water,

medical services, and other services which require electricity.^{xxviii} All of these events have caused the U.S. to grapple with our relationship to electricity, and to reconsider our energy security and independence, and the resilience of our electricity systems.^{xxix, xxx, xxxi, xxxii}

As a country and as a state, our relationship to energy is likely to be further shaped by the unprecedented federal funding for clean energy development and infrastructure in the last two years. Both the Infrastructure Investment and Jobs Act passed in November of 2021, and the Inflation Reduction Act, passed in August of 2022, appropriate billions of dollars for tax incentives, grants, and loans for climate change-related energy investments and research development and demonstration projects.^{xxxiii, xxxiv} In order to be funded, these projects are required to include a Community Benefits Plan that demonstrates how they will: (1) benefit communities by providing workforce development and education opportunities, (2) prioritize community outreach and engagement, (3) ensure environmental justice, and (4) promote diversity, equity, inclusion and accessibility. Projects are expected to partner with communities, align with their priorities and needs, and ensure that benefits are flowing to them.^{xxxv, xxxvi, xxxvii}

The Importance of Social License

The analysis in this study is framed through the lens of the ‘social license to operate’, as was the 2020 report. A social license to operate (SLO) *is a society’s or community’s ongoing approval and broad acceptance for a company’s project or operations.*^{xxxviii} While SLO represents a kind of agreement between a community and a company (the community agrees to allow and/or participate in a company’s operations), it is an informal agreement, voluntarily given, and is not legally binding or officially given. You know you have a SLO if you are able to conduct operations without objection.^{xxxix, xl}

In industries such as mining, oil and gas, and other natural resources, the importance of obtaining an SLO has become increasingly recognized in the last two decades. If a community does not accept or give approval for a project, there may be protests, costly delays, campaigning against the project, legal action in opposition, or lobbying government officials to have permits retracted. As such, not obtaining a SLO from a host community can be costly in terms of time, money, reputation, and legitimacy. It is also a powerful tool to evaluate how much buy-in communities have for a project and for them to feel a sense of ownership.

As Wyoming faces considerable changes in energy demands and focuses on diversification and innovation, it is vital we understand what energy types and activities for which Wyoming residents give a SLO. This report explores how the social license for energy has changed over the last three years. It sheds light on the energy technologies that already have broad SLO in Wyoming, the energy technologies that do not, and the opportunities that exist to build SLO for emerging low-carbon industries.

This report illuminates and informs an understanding of Wyoming residents--what their values are, what their preferences for, beliefs, and attitudes about energy are, what they want for their communities and their futures, and how all of these have changed in the last three years.

By replicating the study conducted in 2019 and 2020, we can see how Wyoming residents’ preferences, beliefs, attitudes, and values have changed in response to changes in national and international energy demand, and how the discourse about energy in Wyoming has evolved in response to new energy projects and technologies entering the Wyoming landscape.

THE 2022 SURVEY

Survey Methods

We conducted two surveys using a similar methodology—one completed in 2019 and one in 2022. In this section, we explain the methods used for both surveys. Detailed results from the 2022 survey are described below. To read the 2019 results, please see www.uwyo.edu/haub/ruckelshaus-institute. Both survey instruments were developed in collaboration with the *University of Wyoming's School of Energy Resources (SER)* and the *Ruckelshaus Institute (RI)*. Both were designed to assess Wyoming residents' opinions about energy related activities in the state and provide insights into what residents want for Wyoming's energy future. Once developed, the survey instruments were reviewed by researchers in SER and RI. The 2022 survey was also reviewed by the PCOR Partnership. When finalized, the survey instruments were provided to the Wyoming Survey and Analysis Center (WYSAC) where they were programmed for online survey administration and formatted into a multi-page scannable form.

The sampling population for both surveys included all Wyoming households with mailable addresses in the Delivery Sequence File maintained by the USPS. Probability samples for 2022 of 3,100 such addresses were drawn from that file. The samples were purchased from the Marketing Systems Group, a leading national vendor specializing in the generation of scientific samples.

For both surveys, potential respondents were contacted via USPS invitation letter and survey packet and then given the option to complete the survey online or by using a paper version of the questionnaire sent in the mail.

First, the households selected in the sampling frame were mailed a letter inviting them to complete the survey online in October 2019 and June 2022. The letter provided the URL address of the survey and a unique access code. In an effort to secure a roughly equal gender split of the final sample, a quasi-random in-house selection of respondent was introduced, using the next birthday method: *"To ensure a representative survey sample, we ask that the adult (18 years of age or older) in your household with the next birthday completes the survey."*

After about two weeks, all households who had not responded with completed surveys online were mailed a paper copy of the survey. The mailing included a cover/reminder letter and a postage paid return envelope. After another three weeks, all households that had not responded with completed surveys, were mailed a reminder letter. Finally, a replacement paper copy of the questionnaire was mailed to all households that had not responded with completed surveys by that time. All mailings were sent First Class mail using physical stamps. Data collection was closed in January 2020 for the first survey, August 2022 for the second.



In the course of data collection for both projects, the completed paper copies of the survey received in the mail were scanned into a database. At close of data collection, the datasets compiled within the two data collection platforms were exported into SPSS software and checked for consistency, missing data, etc., and then merged into a single dataset ready for analysis. This report has been peer-reviewed by leaders representing different interests to ensure veracity and neutrality.

Response Rate and Data Analysis

For the 2022 survey, a total of 357 completed surveys were received by close of data collection, resulting in a response rate of 14% (response rates between 5 and 30% are considered good). Of those, 158 were completed online and the remaining 199 were obtained via paper copies. This random sample yielded a margin of error of +/- 5.18 percentage points ($p < .05$). The sampling frames for both surveys were random and reflect a natural distribution of survey data that closely matches the population in the state (see Table 2).

Table 1: Random-sampled survey responses by county

County	2019 %	2022 %	Actual Pop. July 2019
Albany	7.0	9.1	6.7%
Big Horn	2.4	1.2	2.0%
Campbell	6.6	6.3	8.0%
Carbon	3.0	1.1	2.6%
Converse	1.0	2.0	2.4%
Crook	1.8	.9	1.3%
Fremont	6.2	6.6	6.8%
Goshen	2.4	1.4	2.3%
Hot Springs	1.2	1.1	0.8%
Johnson	1.6	1.7	1.5%
Laramie	17.4	19.2	17.2%
Lincoln	3.6	2.3	3.4%
Natrona	12.6	11.8	13.8%
Niobrara	0.6	0	0.4%
Park	5.4	7.7	5.0%
Platte	2.2	2.1	1.5%
Sheridan	6.0	6.8	5.3%
Sublette	2.2	.6	1.7%

Sweetwater	7.0	4.3	7.3%
Teton	3.2	1.1	4.1%
Uinta	2.8	1.4	3.5%
Washakie	1.8	1.2	1.3%
Weston	0.8	0	1.2%
	100.0%	100%	100.0%
<i>Info not provided</i>	5.6	9.8	

Survey Respondent Demographics

As part of the survey, we asked respondents for information about themselves, including their age, gender, level of education, and political affiliation so we could explore whether these factors influence their attitudes and beliefs. This information helps us understand what factors influence levels of social license for different energy activities.

The gender distribution of 2022 survey respondents was almost evenly split between men and women and was very similar to the 2020 census data. However, when comparing other demographic characteristics of the 2022 survey respondents to the 2020 census data, there are some clear differences that need to be considered. The percentage of respondents who are older than fifty in this sample is much larger than in the census data. Additionally, the percentage of respondents who have attained a bachelor's degree or higher is also considerably higher.

Table 2: 2022 Survey participant demographic information compared to 2020 census data

Survey participant demographic information		Wyoming 2022 Survey	2020 Census Data
Age	18 - 50 Years	53.9%	52.2%
	Older than 50 Years	46.1%	25.1%
Gender	Women	48.9%	49.7%
	Men	50.6%	50.3%
Education	High School Diploma or Higher	99.7%	93.6%
	Bachelor's Degree or Higher	54.5%	29.2%
Political Affiliation	Democrat	15.1	No Census Data*
	Independent/Other	29.7	No Census Data*
	Republican	55.3	No Census Data*

* The U.S. Census Bureau does not collect data on political affiliation. However, in 2022, the percentage of Wyoming registered voters in political parties were: Democrat (16.32%), Republican (69.88%), Constitutionalist (0.27%), Libertarian (0.93%), Unaffiliated (12.59%), and Other (0.01%).^{xli}

Survey Results

The 2022 survey was designed to capture the expanded breadth of the Wyoming energy landscape. To do this, we expanded the scope of topics from those we asked about in the 2019 survey. This expanded scope meant that not all of the results are directly comparable to the 2019 survey. However, two of the most salient and relevant results are comparable: (1) Wyoming residents' support and opposition for energy activities; and (2) what residents value the most about Wyoming. These comparisons are discussed below (as well as a broader comparison of the two surveys in Section IV). Also, in the section below, are the results of the additional, more in-depth questions about energy topics, including emerging and expanding energy technologies. Additionally, we analyzed demographic characteristics (like gender, age, and political affiliation) to determine their association with different levels of support or opposition for energy activities.

Wyoming Residents' Support and Opposition to Energy Industries and Activities

The survey asked Wyoming residents how much they favor or oppose different energy activities in Wyoming. Their responses demonstrate that favorability for conventional energy types remains high. As seen in Figure 4 below, more than 70% of residents favor oil and natural gas-based electricity generation and oil refining, and almost as many residents also favor electricity generated through rooftop solar. Coal mining and coal-based electricity generation were also shown to have strong support, with 69% and 67% of residents, respectively, favoring them. Wind and utility scale solar received the most opposition, with 30% and 22% of residents, respectively, opposing them. Emerging energy types, such as rare earth elements/critical minerals (REE/CM), hydrogen, and CCUS were all notable in the high levels of residents reporting that they are either neutral or not sure about them.

Percentages of 2022 survey respondents who support or oppose types of energy industries and activities in Wyoming

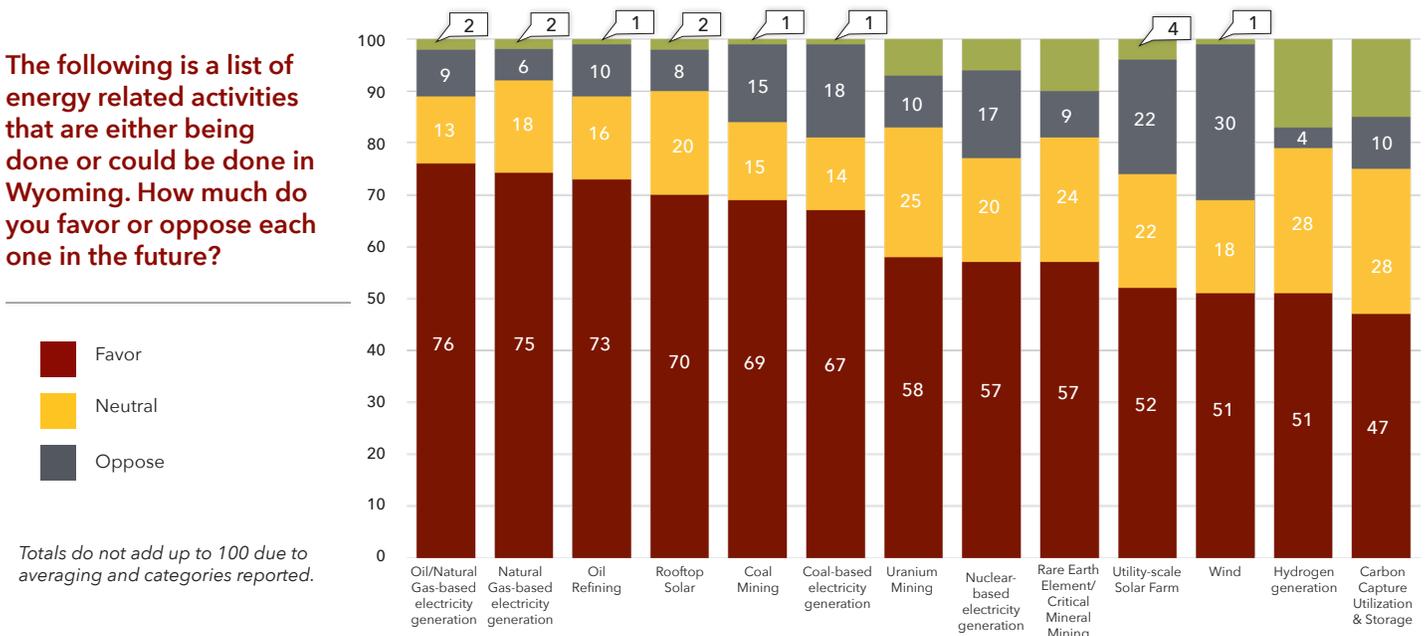


Figure 4: Percentages of 2022 survey respondents who support or oppose types of energy industries and activities in Wyoming

When comparing these results to the 2019 survey (see Figure 5 below), several trends emerged. It is clear that conventional fossil energy types (coal, oil, and natural gas) still received the most support. Solar energy also received high levels of support on both surveys. Wind received considerably less support (51% in 2022 compared to 65.5% in 2019), while uranium mining, nuclear-based electricity generation, CCUS, REE/CM all received considerably more support in 2022, with fewer people reporting being neutral or not sure. All of these industries have become more prominent in the Wyoming energy discourse over recent years as they have made tangible traction in the state. For example, the TerraPower small modular reactor was sited in Kemmerer, Wyoming obtained Class VI primacy for permitting geologic storage injection wells, and Rare Element Resources' critical mineral mining and processing project (the *Bear Lodge Project* in northeastern Wyoming) has advanced. This suggests that as residents have learned about and gained experience with emerging technologies, their support for them has increased. (Additional analysis of the differences between the 2019 and 2022 survey are discussed in more detail in section iv: *What Wyoming Residents Value about Wyoming* and section E: *Analyzing the 2022 Survey Results: Who Believes What?*)



Percentages of 2019 survey respondents who support or oppose types of energy industries and activities in Wyoming

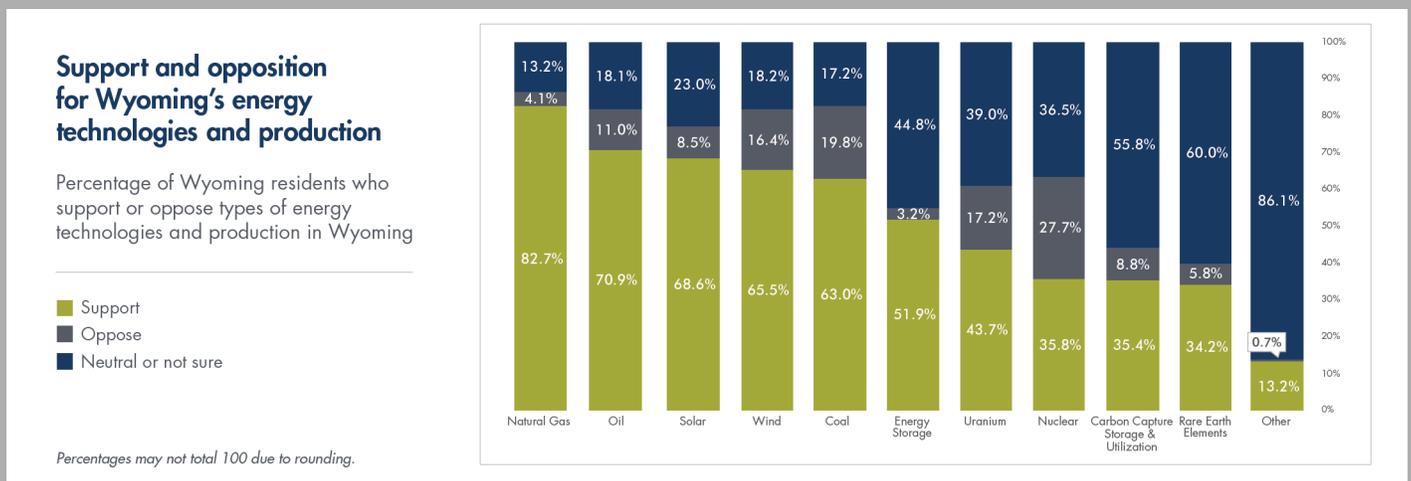


Figure 5: Percentages of 2019 survey respondents who support or oppose types of energy industries and activities in Wyoming



All of these industries have become more prominent in the Wyoming energy discourse over recent years as they have made tangible traction in the state.

Wyoming Residents' Preferences and Reasons for Supporting CCUS and other Emerging Energy Activities

We asked several questions of Wyoming residents about their preferences and reasons for supporting or opposing energy activities that are emerging and expanding, but with which most residents have less first-hand experience.

CO₂ CAPTURE AND STORAGE

When asked about their preferences regarding different ways of capturing and storing CO₂, residents supported *materials production* and *point source capture*, followed by *enhanced oil recovery*. Results indicate ambivalence and potential lack of knowledge toward *direct air capture* and *permanent geologic storage*, with large numbers of residents reporting that they are neutral or not sure about them. *Permanent geologic storage of carbon produced out of state* received the most opposition, with 43% of residents saying they would oppose it. (See Figure 6.)

Preferences for ways for capture and store CO₂

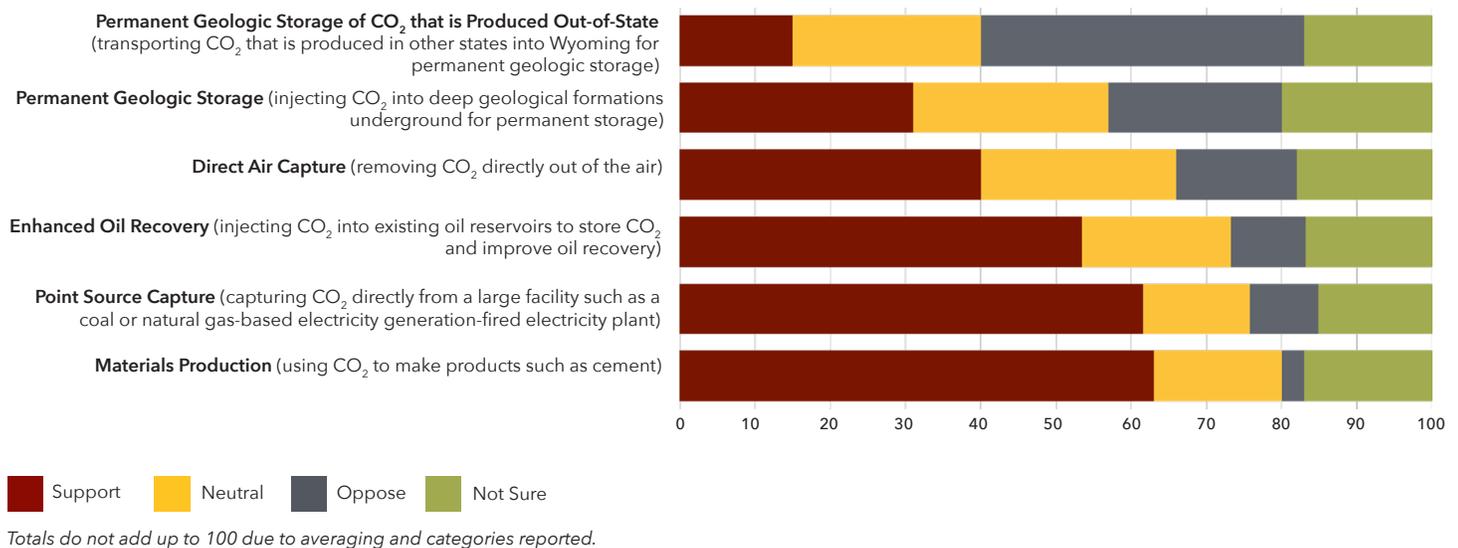


Figure 6: Preferences for ways for capture and store CO₂

GEOLOGIC STORAGE OF CO₂

When asked specifically about geologic storage, more than 40% of residents reported that they believe it will *allow Wyoming to produce reliable, low-carbon energy from fossil resources and should be one of many low-carbon industries that Wyoming develops* (see Figure 7). Respondents were divided on their other beliefs about geologic storage with many saying they were neutral or not sure, including on whether *geologic storage of CO₂ would support the continued use of fossil resources, and therefore contribute to climate change*.

Beliefs regarding permanent geologic storage of CO₂

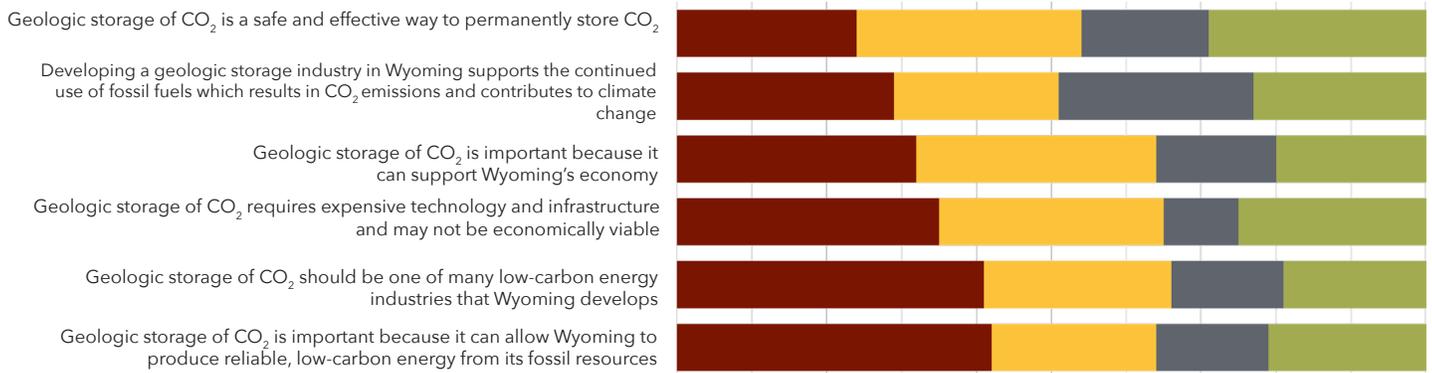
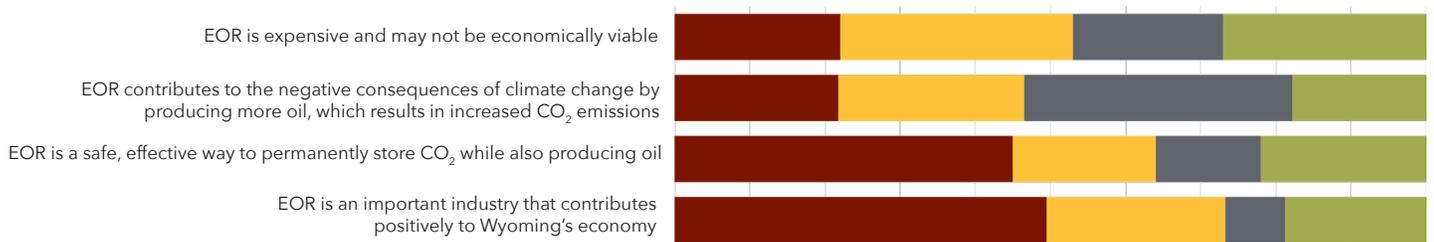


Figure 7: Beliefs regarding permanent geologic storage of CO₂

ENHANCED OIL RECOVERY WITH CO₂

Enhanced oil recovery (EOR) has been conducted in Wyoming for decades, so residents have more familiarity with it than the other emerging technologies included in the survey. However, many residents still reported being neutral or not sure when asked about specific beliefs about EOR. Overall, beliefs about EOR were relatively positive with 50% of residents reporting that EOR contributes positively to Wyoming's economy, and 45% reporting that it is a safe and effective way to permanently store CO₂ while also producing oil. Moreover, 36% of Wyoming residents disagreed that EOR contributes to climate change. (See Figure 8.)

Beliefs regarding the use of enhanced oil recovery for captured CO₂



■ Agree
 ■ Neutral
 ■ Disagree
 ■ Not Sure

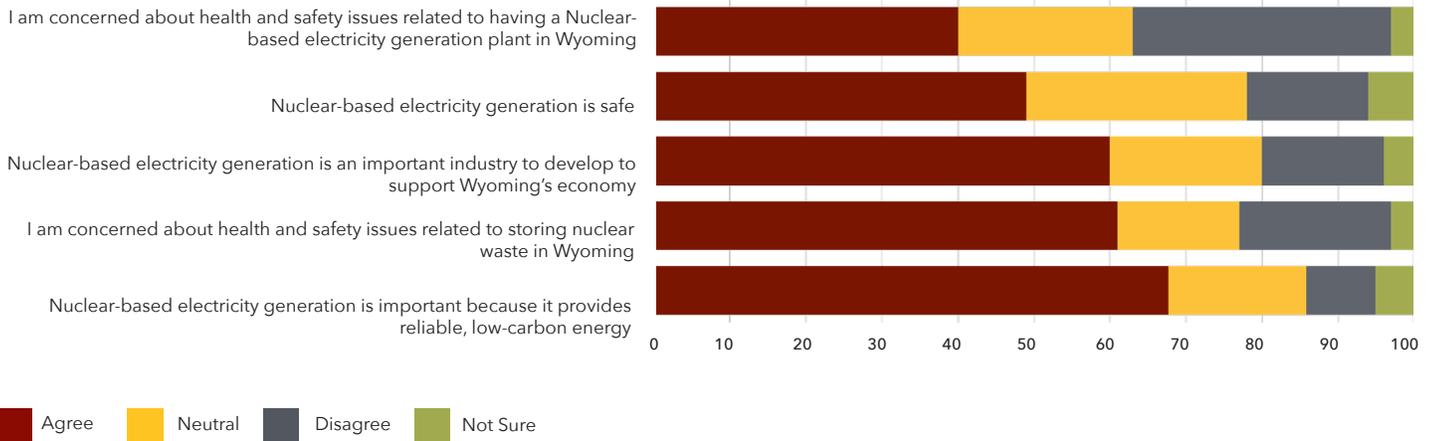
Totals do not add up to 100 due to averaging and categories reported.

Figure 8: Beliefs regarding the use of enhanced oil recovery for captured CO₂

NUCLEAR ENERGY

We asked respondents about their level of agreement with a number of statements about the pros and cons that are commonly discussed in the discourse about nuclear energy. Their responses reflect support for nuclear-based electricity generation with 67% agreeing that it is important because it provides reliable, low-carbon energy and 60% agreeing that it is important for Wyoming's economy. However, responses also reflect a high level of concern regarding nuclear waste, with 61% agreeing that they had health and safety concerns related to the storage of nuclear waste. (See Figure 9.)

Beliefs regarding nuclear energy



Totals do not add up to 100 due to averaging and categories reported.

Figure 9: Beliefs regarding nuclear energy



HYDROGEN

When we asked survey respondents about their support for different types of hydrogen separation technologies, most respondents, more than 40%, reported they simply “don’t know” enough about hydrogen separation to choose which they support. Additionally, far more respondents reported they would support some type of hydrogen separation that minimizes CO₂ emissions (either from fossil fuels in conjunction with CCUS, or using renewable energy sources, or both) then without CO₂ emissions being minimized. (See Figure 10.)

Opinions regarding hydrogen separation

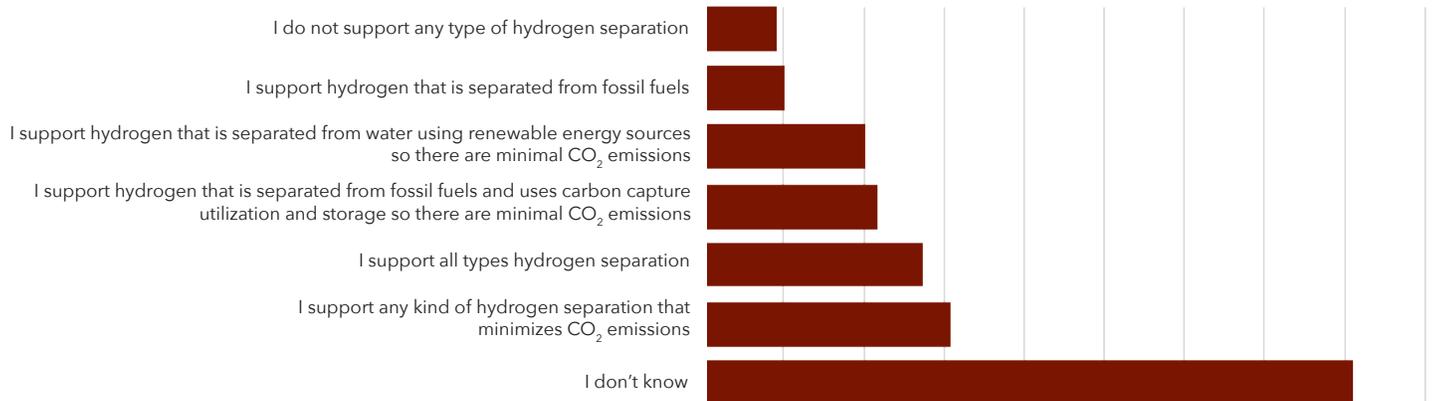


Figure 10: Opinions regarding hydrogen separation

Where Wyoming Residents Get Their Energy Information

One of the main conclusions of the 2020 report was the need for more opportunities for the public to learn about different energy types and the related trade-offs. To better understand how to provide these opportunities, we asked respondents in the 2022 survey where they access energy-related information (see Table 3). Respondents could choose as many sources as they wanted. Nearly half of the respondents (48%) indicated they receive information from local and state newspapers (print or digital), and 45% said they receive information from friends and family. Nearly a third of respondents (32%) said they receive information from the radio, 30% from social media, and 27% from national or international newspapers (print or digital).



Table 3: Where do survey respondents get most of their information about energy industries, markets, and technologies?

Source	Percent
Local TV	23
Network TV	25
Cable TV	23
Local or State Newspapers (print or digital)	48
National or International newspapers	27
Radio	32
Social Media	30
YouTube	15
Friends/family	45
Scholarly articles	28
WEA	18
UW	17
Other	15

We also asked Wyoming residents if they think the available information about energy is adequate. Broadly speaking, the answer was “no” with 42% of respondents indicating there was not enough readily accessible and understandable information about energy. A third of participants said it depends on the type of energy industry, market, and technology, and only 20% said “yes” there is enough.

Table 4: Do survey respondents think there is enough readily accessible and understandable information about energy industries, markets, and technologies?

	Frequency
Yes.	14
Generally, yes.	57
It depends on the type of energy industry, market, and technology.	102
Generally, no.	93
No.	59
I don't know because I don't seek out information about energy industries, markets, and technologies.	30
Total	354
Missing	3
Total	357

What Wyoming Residents Value about Wyoming

In social psychology, the science that informed the design of this survey, people’s values influence their beliefs and attitudes. We used the same methodology in 2022 that we used in 2019 to explore why respondents value Wyoming, which included 13 difference values they could choose between. To explore the intensity with which these values were held, we asked them to divide a fictional 100 dollars between the values.

Results for how 2022 survey respondents ranked these values is shown in Figure 11 below. The top five values to which the highest percentage of participants reported as being important are:

- Recreation:** I value Wyoming because it provides places for my favorite outdoor recreation activities.
- Aesthetics:** I value Wyoming because I enjoy the scenery, sights, sounds and smells, etc.
- Community:** I value Wyoming because it is the location of my community and I wish to preserve that community and its health, security, and welfare.
- Biodiversity:** I value Wyoming because it provides places with a variety of fish, wildlife, plant life, etc.
- Spiritual:** I value Wyoming because it has sacred religious, or spiritually special place to me or because it contains places for which I feel reverence and respect for nature.

2022 Survey results for what Wyoming residents value about Wyoming

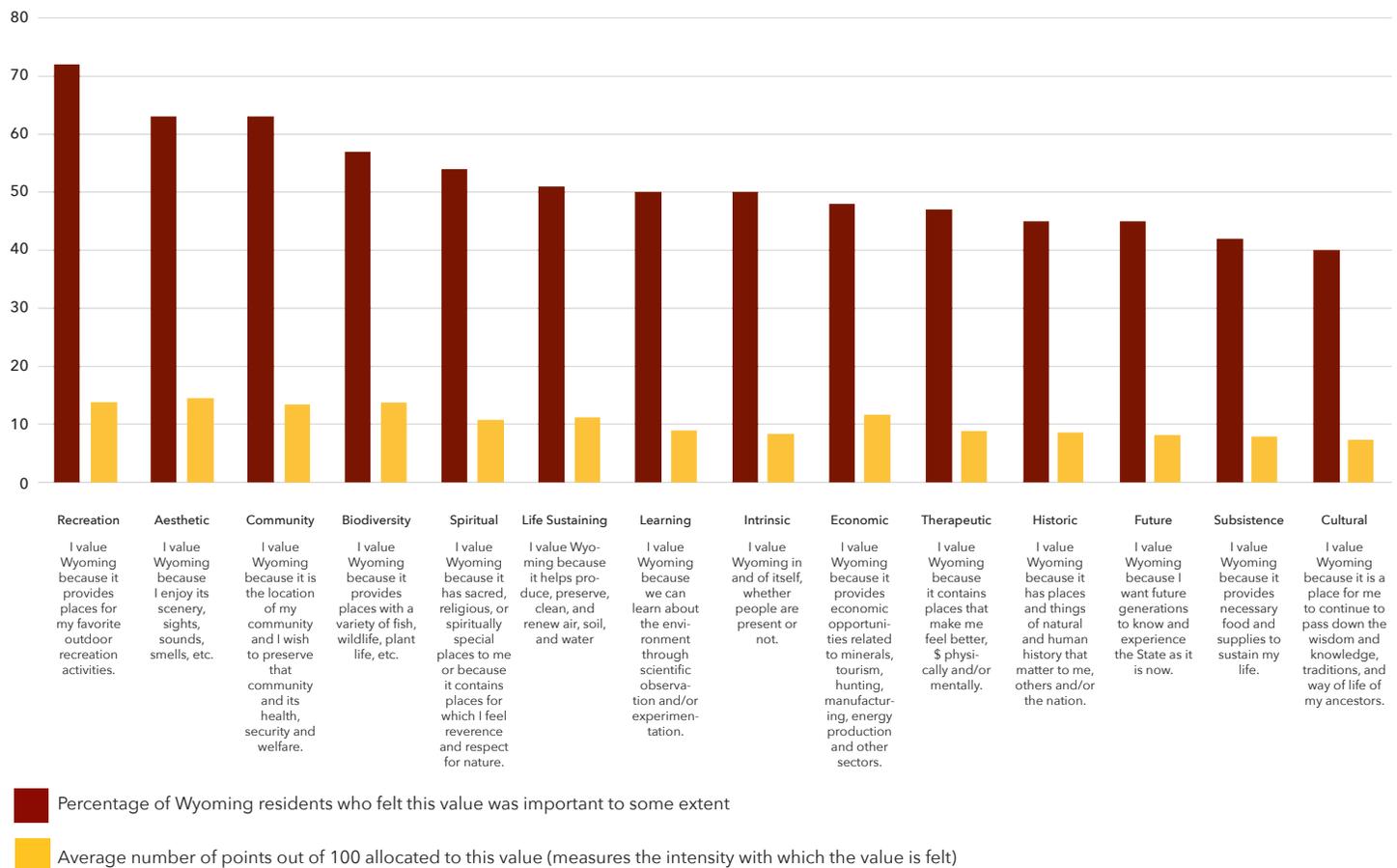


Figure 11: 2022 Survey results for what Wyoming residents value about Wyoming

These results were very similar to the 2019 survey results for what residents' value about Wyoming (see Figure 12). While the order and percentages different slightly, the only major difference was that *economic value* was only valued by 48% of participants in 2022 as opposed to almost 60% in 2019 and spiritual value was valued by 54% of participants in 2022 and less than 32% in 2019.²



2019 Survey results for what Wyoming residents value about Wyoming

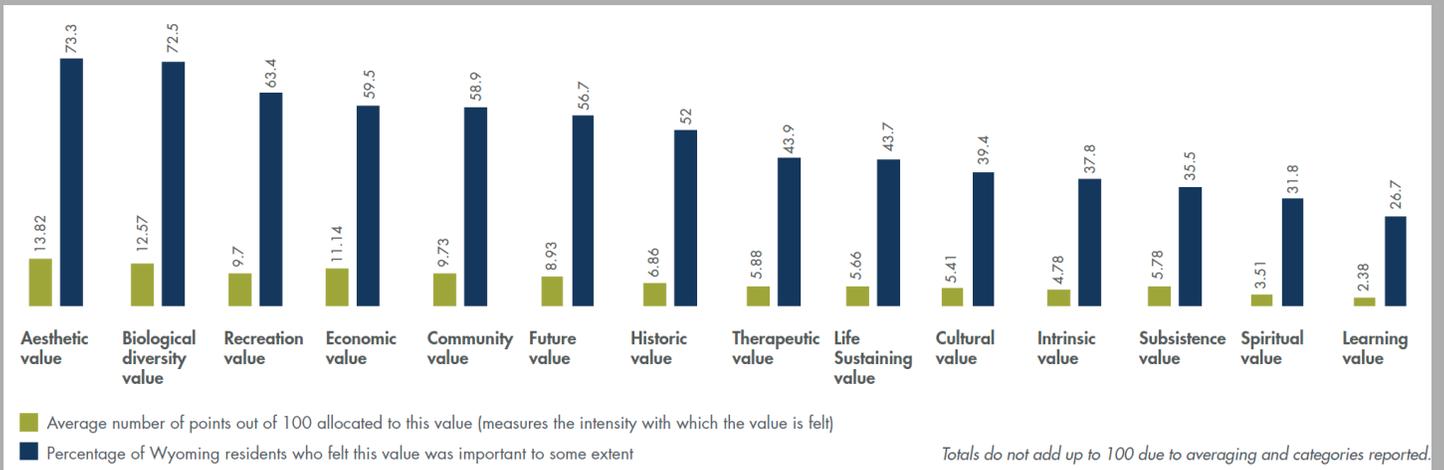


Figure 12: 2019 Survey results for what Wyoming residents value about Wyoming

Wyoming Residents' Beliefs about Climate Change

In 2022, we asked respondents to choose one of the four statements in Table 5 below that best represented their opinion about climate change. A resounding 90% of respondents reported they believe climate change is happening. While more than 50% don't believe it's caused by humans and less than 40% do believe it's caused by humans, very few respondents (6.3%) don't believe climate change is happening at all.

Table 5: 2022 survey respondents' opinions about climate change.

Which of the following statements best describes your opinion about climate change?		
	Frequency	%
I don't think climate change is happening.	22	6.3
I have no idea whether climate change is happening or not.	13	3.7
I think climate change is happening, but it is caused by natural fluctuations in Earth's temperatures that are not caused by humans.	175	50.3
I think climate change is happening and I think it is largely caused by humans.	138	39.7
Total	348	

Analyzing the 2022 Survey Results: Who Believes What?

In considering the results of the 2022 survey, we conducted additional analysis into which sub-sections of the population give social license to which types of energy activities. To do this, we analyzed the results by the demographic information collected from participants, including gender, political affiliation, level of education, years living in Wyoming, and age. Additionally, we analyzed the data based on beliefs about climate change and values. These analyses shed light on the variation that is present in Wyoming communities, the commonalities and differences in preferences between people with different life experiences, beliefs, and values. A summary of these results is provided here and the full statistical results can be seen in *Appendix B*.

Table 6: Summary of correlations based on gender, political affiliation, education, years in Wyoming, age, climate change beliefs, and values.

Gender

Women are less supportive and more uncertain than men about conventional energy types including all types of fossil-based electricity generation and uranium mining.

Likewise, women are also less supportive and more uncertain than men about emerging energy activities including nuclear-based energy generation, CCUS, REE/CM, and hydrogen.

Half the number of women compared to men, believe there is an adequate amount of information about energy available. Additionally, more women than men indicated they don't know if there's enough information available "because they didn't seek out this type of information".

Political Affiliation

Respondents who identify as politically conservative are more supportive of fossil-based electricity generation, while respondents who identify as politically liberal are more supportive of wind and solar energy activities.

Respondents' attitudes toward newer technologies were not related to political affiliation.

Respondents who identify as Republicans tend to support permanent geological storage and EOR more than those who identify as Democrats.

Respondents who identify as Republicans prefer to get information about energy from local TV, cable TV, Wyoming newspapers, radio, and social media. Respondents who identify as Democrats had a lower response rate to this question, but indicated a preference for local TV, network TV, and international newspapers. Of the respondents who identify as being Independent, their preferences were distributed relatively evenly between all sources, with local TV being the least preferred.

Education

Respondents with lower levels of education indicated more uncertainty regarding emerging and expanding energy types.

We detected a significant difference in preferences for energy information sources related to education. Respondents with a 4-year college degree or high level of education prefer international information sources significantly more.

Years in Wyoming

Residents who have lived longer in Wyoming, favored fossil fuel energy types significantly more than those who have not lived in the State as long. No differences were detected for emerging and expanding energy types based on length of time living in Wyoming.

Age

Older respondents support uranium mining and REE/CMs more.

Younger respondents supported solar technologies more.

Age made the most difference in relation to preferred energy information sources. The cut-off age for these differences appears to be residents under or above 60 years of age. Those younger than 60 favor social media the most for energy information, where those older favor more traditional sources of information such as newspapers and television. Television appears to be used very little used by younger respondents.

Climate change beliefs

There is a clear correlation between climate change beliefs and conventional and more established energy types: those who do not believe climate change is human caused support oil, gas, and coal related activities more; those who do believe climate change is human caused support renewable energy types.

Regarding emerging/expanding technologies, including nuclear energy, there was no significant difference detected based on climate change beliefs.

The values that have the most significant correlations with preference for energy types are *cultural*, and *life sustaining*. Respondents who tend to rank cultural and life sustaining values higher, also ranked wind, utility-scale solar farms, and rooftop solar higher.

Correlations with emerging and expanding energy types

We first explored correlations with emerging and expanding technologies (i.e. carbon capture, utilization and storage, nuclear energy, rare earth elements and hydrogen generation) and demographic characteristics. When considering gender, men are generally more supportive of these energy types, and women are less supportive and less certain. Climate change beliefs do not have a clear motivational relationship with these emerging energy types, other than in relation to CCUS: respondents who believe climate change is human caused are less likely to support CCUS. (See Table B1 in Appendix B.)

When considering correlations between values and emerging energy types, we found few significant relationships and none for nuclear energy. This may be related to the high number of “neutral” and “I don’t know” responses received about residents’ support and opposition to emerging energy types. There was a significant positive correlation between a high ranking for economic value and support for CCUS and hydrogen generation. For REE/CMs there were many significant negative correlations with values. Respondents who ranked community, historic, learning, life-sustaining, recreation, spiritual, and therapeutic values highly, support REE/CMs less. (See Table B2 in Appendix B.)

Correlations with conventional and more established energy types

When exploring correlations between conventional and more established energy types and demographic characteristics, we found several that were significant. In general: (1) women are less supportive and more uncertain of conventional and more established energy types, (2) more conservative respondents support conventional activities more, and (3) more liberal respondents support wind and solar activities more. Respondents with lower levels of education indicated more uncertainty regarding these energy types. Older respondents support uranium mining more and younger respondents support solar technologies more. There was also a significant relationship between conventional energy types and climate change beliefs: participants who believe climate change is human caused support wind and solar more, and participants who do not think climate change is human caused support conventional energy more. (See Table B3 in Appendix B.)

Eleven of the fourteen values we asked respondents about had correlations with levels of support and opposition for conventional and more established energy types. Table 7, below, shows the values that have the most significant correlations with conventional and more established energy types. Positive numbers indicate a positive correlation between the value and the energy type; negative numbers indicate a negative correlation. As seen in the data in Table 7, respondents who ranked the Life Sustaining value higher support wind and solar more. (See Table B4 in the Appendix for all correlations between values and these energy types.)

Table 7: Correlations between values and conventional and more established energy types

Conventional and more established energy types						
Values related to Wyoming	Wind	Coal-based Electricity	Uranium Mining	Oil and Natural gas-based electricity generation and drilling	Utility-scale solar farm	Rooftop solar
Cultural			.175, p = .040	-.213, p = .011	.185, p = .046	.264, p = .004
Life Sustaining	.184, p = .018	-.185, p = .017	-.166, p = .033	-.198, p = .011	.198, p = .011	.166, p = .034

Showing correlations that are significant (p<.05).

Correlations with EOR and Permanent Geologic Storage

The results indicate significant differences between how EOR is perceived based on gender, political affiliation, income, years living in Wyoming, age, and climate change beliefs. Republicans, men, and respondents who do not believe climate change is human caused, had high levels of agreement with statements in support of EOR. There was a significant correlation between agreement with the statement “EOR is expensive and may not be economically viable” and participants who identify as Democrats. (See Table B5 in Appendix B.)

Correlations were also found between permanent geological storage perceptions and political affiliation (Republicans tended to support geologic storage more) and gender (men tended to support geologic storage more). (See Table B6 in Appendix B.)

Correlations with energy information sources

The last set of relationships we explored were those between demographic characteristics and where respondents access energy information. A large percentage of respondents did not answer this survey question, which may indicate either ambivalence about energy information or a lack of knowledge about where to get it. Of the respondents who answered this question, there was a significant correlation with gender (men reported getting more information from national, international, and Wyoming-based newspapers than women) and level of education (respondents with a 4-year college degree or higher reported getting more information from newspapers). (See Table B7 in Appendix B for frequency numbers.)

Table 8: Correlations between demographic characteristics and information sources

		Survey Respondents %	Local TV %	Network TV %	Cable TV %	Wyoming Newspapers %	(Inter)national newspapers %	Radio %	Social Media %	Family/friends %
Politics	Democrat	16	23	25	13	17	22	19	18	10
	Independent	24	11	25	22	20	28	22	17	20
	Republican	60	69	57	64	63	50	59	65	70
Gender	Men	58	56	59	60	56	65	60	51	51
	Women	41	44	41	40	43	34	39	48	48
Education	< 4 Year college degree	45	50	44	48	43	28	45	48	52
	4-year college degree +	54	50	55	51	56	71	54	50	48
Age	< 60	39	24	34	21	35	45	38	56	43
	>60	59	74	65	75	63	54	62	44	56
Missing			73	75	71	49	73	66	77	59

When we asked respondents if there are adequate amounts of energy-related information available, we found no significant differences related to level of education, political affiliation, or climate change beliefs. However, we did find significant differences related to gender: 26% of men believe there is an adequate amount of information compared to 13% of women. Approximately the same percentages of men and women said it depended on the type of energy industry (26% for both). More women (43%) than men (40%) believe there isn't enough information, and considerably more women (13%) than men (6%) indicated they don't know because they don't seek out this type of information. (See Table B8 in Appendix B.)



When we asked respondents if there are adequate amounts of energy-related information available, we found no significant differences related to level of education, political affiliation, or climate change beliefs.

COMPARISON BETWEEN 2019 AND 2022 SURVEY RESULTS

One of the main goals in conducting the replication of the 2019 survey was to understand how support and opposition to different types of energy are changing over time. Table 9 below summarizes the differences in levels of support between the 2019 and 2022 survey results. It compares the mean level of support reported in each survey (ranging from strongly agree/favor (1) to strongly disagree/oppose (5)) to demonstrate how attitudes for each energy type have changed.

On average, the amount that respondents favor almost all types of energy increased significantly between the 2019 and 2022, with the exception of wind energy for which favor decreased. We did not find a significant difference between 2019 and 2022 in relation to levels of support for natural gas or rooftop solar.

Table 9: Comparison between support and opposition for energy types between 2019 and 2022 survey results

Attitudes regarding Types of Energy			
How strongly do you favor or oppose each of these energy related activities?	Year Survey	Mean	Interpretation
Wind energy	2019	2.21	Less Support
	2022	2.68	
Coal	2019	2.32	More support
	2022	2.12	
Oil	2019	2.06	More support
	2022	1.85	
Natural Gas	2019	1.73	No Difference
	2022	1.86	
Rooftop solar	2019	2.01	No Difference
	2022	2.09	
Nuclear-based electricity generation	2019	2.91	More support
	2022	2.37	

Carbon capture utilization and storage	2019	2.61	More support
	2022	2.47	
Rare earth elements / critical minerals mining	2019	2.58	More support
	2022	2.28	
Means reflect Strong Agreement/Favor (1) to Strong Disagreement/Opposition (5) All differences significant p=.05 value			

When comparing results from 2019 and 2022 for support for or opposition to different energy types, statements supporting wind energy received less support between 2019 and 2022, but also statements opposing wind energy received less opposition (see *Table C2 in Appendix C*). The one opposition statement respondents generally disagreed with was that wind impacted recreational activities. (See *Table C1 in Appendix C*.)

Respondents' levels of support or opposition to oil and gas have also shifted between 2019 and 2022. Although on average respondents agreed less with supportive statements about oil and gas in 2022, there was also considerably more disagreement with opposition statements (see *Table C3 in Appendix C*).

Likewise, statements in support of coal received a little less agreement in 2022 than in 2019, and statements opposing coal received considerably more disagreement (see *Table C4 in Appendix C*).

Aesthetic, biological diversity, economic, and historic values (which were the highest ranking values in 2019) all remained at approximately the same level from 2019 to 2022. All other values increased in average amount of dollars that respondents allocated to them in 2022 (see *Table 10 below*).



Table 10: Comparison between what survey respondents value about Wyoming in 2019 and 2022 survey results

	Year Survey	Average \$ allocated	Interpretation
Aesthetic value	2019	13.5	
	2022	13	Same
Biological diversity value	2019	12	
	2022	12	Same
Cultural value	2019	5.6	
	2022	7.9	Increase
Community value	2019	9.7	
	2022	12.5	Increase
Economic value	2019	11.0	
	2022	10.9	Same
Future value	2019	8.9	
	2022	8.5	Same
Historic value	2019	7.0	
	2022	8.8	Increase
Intrinsic value	2019	5.1	
	2022	8.5	Increase
Learning value	2019	2.8	
	2022	8.9	Increase
Life sustaining value	2019	5.9	
	2022	10.7	Increase
Recreation value	2019	9.7	
	2022	12.9	Increase
Spiritual value	2019	3.9	
	2022	10.4	Increase
Subsistence value	2019	6.0	
	2022	8.2	Increase
Therapeutic value	2019	6.1	
	2022	8.8	Increase

All differences significant $p=.05$

THE Q-STUDY: AN IN-DEPTH ANALYSIS OF THE ENERGY DISCOURSE IN WYOMING

Following the survey described above, we began the second part of our research—a Q-study which involved a series of interviews with 22 individuals who represented the diversity of interests in Wyoming related to energy issues. Below is a short description of the Q-study methodology and a more detailed description can be found in Appendix D.

Q-Study Methods

Q-studies are conducted using Q-methodology to explain how participants view trade-offs in a particular situation. Q-methodology is an interview-based social science protocol that identifies the main themes in a discourse (in this case, the discourse around conventional, expanding, and emerging energy activities in Wyoming) using statistically valid, quantitative data. It also provides quantitative data to explain the themes. In this Q-study, participants ranked a series of 36 statements about energy in Wyoming from -5 (Strongly Disagree) to 5 (Strongly Agree). These statements all reflected perspectives that were expressed in the 2022 survey by Wyoming residents. Following the ranking exercise, participants were interviewed regarding the reasons why they ranked statements in order to explore each participants’ reasoning. The 22 interviews were conducted during October 2022 through January 2023. Each interview took 45 minutes, on average.

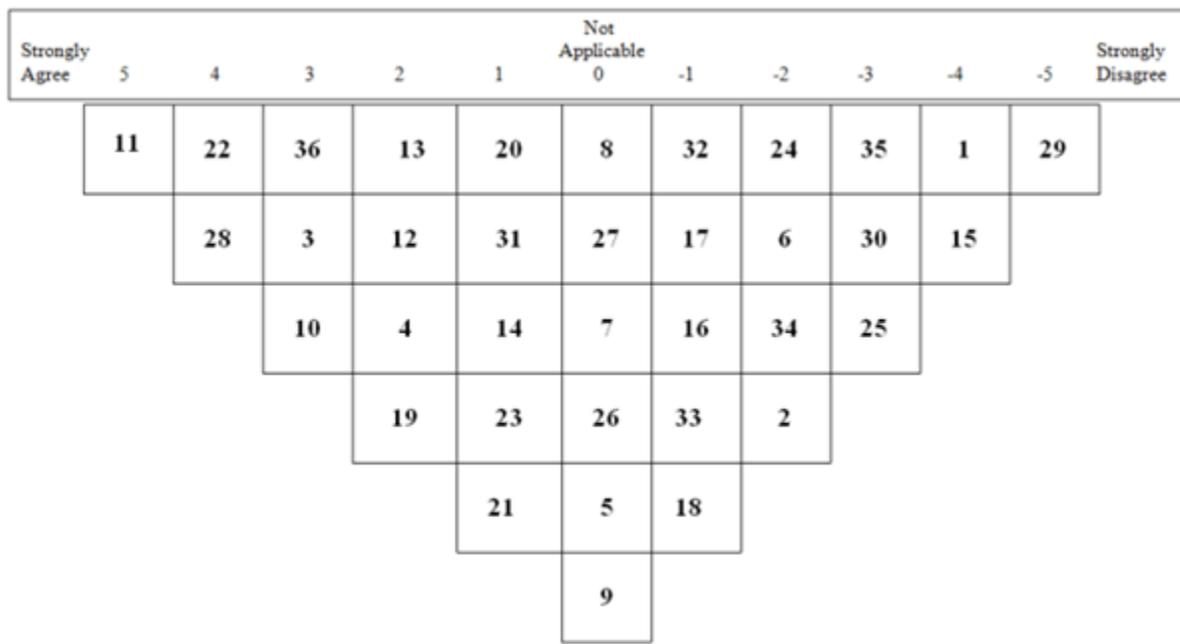


Figure 13: Diagram of Q-sort exercise showing grid on which participants must place 36 statements. This figure represents an example of how a participant’s Q-sort might look after completion. Each number correlates to a different statement. The Q-sort reflects where the participant ranked each statement.

The Q-methodology results highlight the dominant perspectives stakeholders hold regarding energy activities and their trade-offs for Wyoming. It is a methodology for identifying and illuminating the range of subjectivity in a discourse and the reasons for the varieties of subjectivities within that range.

Table 11: Q-study participant professional fields and gender

Professional Field	Participants	Gender	Participants
Industry	5	Male	18
Government	5	Female	4
Agriculture	1		
Conservation	7		
University	3		
Utility	1		

The quantitative data was used to identify the main themes in the discourse about energy in Wyoming. The 22 completed Q-sorts from the participants were loaded into PQMethod software, which uses principal components analysis to generate factors, or themes. The themes are derived from the numerical placement of the statements in each Q-sort on the continuum from -5 (strongly disagree) to 5 (strongly agree). Each theme resulting from PQMethod software is formed by a group of statements that correlate with each other. Resulting themes are also significantly different from each other.

The qualitative data from the interviews was used to understand and explain the themes identified from the quantitative data. Interviews were analyzed based on the perspectives that most strongly characterize each theme. As a whole, Q-methodology reflects the internal deliberation a person goes through on any subject and captures the internal subjectivity of the participant and the context in which their deliberation takes place.

Q-Study Results

Three distinct themes resulted from Q-study. Each theme highlights different perspectives of what participants' value most and what their greatest concerns are. We also found there are some perspectives in the Wyoming energy discourse that all three themes have in common. The three themes we identified are:

- **Theme 1:** characterized by the belief that *climate change either is or is not an existential threat*. (Note: This theme was unique in that there were many participants that have absolutely divergent views about climate change causing strong, but opposing, correlations in how they sorted the statements. The statistical analysis we conducted to identify themes picked up this correlation and both types of narratives were captured in this theme.)

- **Theme 2:** characterized by the belief that an all-of-the-above energy strategy would be most effective in increasing resilience in Wyoming
- **Theme 3:** characterized by the belief in the importance of prioritizing economics and communities above all else.

Tables 12 and 13 below provide more details about the three themes. Table 12 provides a summary of the major characteristics and perspectives of each of the themes. Table 13 show how each of the 36 statements were ranked in each of the three themes.

Table 12: Characteristics of the three identified themes in Wyoming’s energy discourse

Theme	1A	1B	2	3
Theme Characteristics	Climate Change is an Existential Threat and Renewable Energy Types are preferred	Climate Change is Not an Existential Threat and conventional energy types preferred	All of the Above for Resilience	Economics and Community
Motivations	Urgent need to address climate change. Need to decrease fossil fuel use is also urgent.	Opposition to climate change narratives, which are really about politics and markets.	Concern for communities and desire for community and state resiliency first, climate change second.	Supporting Wyoming’s economy will support Wyoming’s communities.
Climate Change Approach	Fossil fuels contribute to climate change, threatening all life globally.	Acknowledge climate change as a factor, humans contribute but there are also natural dynamics.	Coupled: desire to be practical and balanced by providing jobs and revenue while being in alignment with climate goals and demands.	Climate change is a fact, the science is to be trusted, but it’s not all the US’s fault or burden.
Economic Approach	Need seismic shift in how Wyoming’s economy functions. Desire to address tax structures and investments and use federal funding to support communities.	Make as much money and jobs as you can and stop worrying about climate change.		Let the free market dictate the energy portfolio, not Wyoming or regulators.
Environmental Approach	Discussed as being subject to climate change.	Participants make a distinction between pollution, which they oppose, and carbon.	Natural landscape and environment are important; don’t want to lose what we value most.	Natural landscape and environment important: don’t want to lose what we value most.

Thoughts Regarding Communities	New energy types may offer opportunities for communities. Safeguards and a plan needed to be created to support communities through transition. Need pro-active legislature.	No mentions.	Need tools to be self-determined. Need pro-active legislature. Aggressively provide information regarding energy and trade-offs.	Proactive actions urgently needed for communities. Need pro-active legislature.
Most preferred energy strategies	Renewable energy, development of batteries.	Continue fossil fuels because they are reliable. Carbon storage will allow continuation of coal. Also interested in nuclear energy.	Resource ambivalent but emphasis on decarbonized energy coupled with CO ₂ storage important.	Nuclear energy, carbon capture and storage to support conventional energy types and address climate change concerns.
Other thoughts regarding energy types	Interested in carbon storage techniques.	Although renewables are part of the picture, they are considered unreliable and require rare earth minerals from China.	Interested in nuclear energy	Generally support an all of the above approach.
Recommendations	Take advantage of federal dollars to support communities through change. More public engagement needed	None	Need smoother transition timeline. Need public engagement.	Don't pick winners and losers—make demand-based decisions. Site energy near existing energy. Need public engagement
Desires	Wyoming needs to untie its identity to fossil fuels which holds it back.	To have other states acknowledge Wyoming's role as conventional energy supplier.	Facilitative regulatory environment.	Education on energy types and related trade-offs are critical.

Overarching perspective	Climate change is the biggest motivator. The resulting changes in markets are an opportunity to be maximized.	Wyoming is an energy state that is successful at supplying coal, oil and gas.	As long as energy type or technology enhances Wyoming's resilience, it's all good.	Make decisions about Wyoming's energy mix based on customer demand to support Wyoming.
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While the survey illuminates the levels of social license that currently exist in Wyoming, the themes identified in the Q-study and the commonalities between these themes explains the reasons for these levels of social license. It is important to note that, while participants in this Q-study may be aligned strongly with one theme, the same participant may also agree with many of the perspectives of another theme. For example, a participant may statistically correlate strongly with Theme 1 due to his or her perspective on climate change, however, that participant may also align closely with Theme 2's perspectives regarding communities. Humans are often multi-dimensional and this methodology brings that out.

Table 13: Ranking of each statement for each of the three themes from 5 (most strongly agree with) to -5 (most strongly disagree with)

#	Statement	Theme 1: Climate Change is/is not an Existential Threat	Theme 2: All-of-the-Above for Resiliency	Theme 3: Economics and Community
1	More investment needs to be made in batteries or other storage electric/ energy options.	2	1	2
2	We should drill for oil and dig for coal and use them until they are gone. While also developing nuke and wind and solar.	-3	-1	1
3	The whole "climate change is real" bit is just another scare tactic.	-4	-5	-3
4	Climate change is a major concern for me in the growth of energy in Wyoming.	4	0	-1
5	I do not disagree that climate change is occurring. However, I do not agree that humans are responsible for that change.	-4	-3	0

6	CO ₂ storage is something that will have to be done to mitigate climate change.	1	3	-2
7	If CO ₂ storage is feasible, affordable, profitable and creates jobs, go for it.	0	2	2
8	CO ₂ storage should be done as long as the health and safety of Wyoming residents and wildlife are made top priority.	-1	4	1
9	When doing CO ₂ storage, how can anyone know for certain that CO ₂ will stay underground, not leak out and cause pollution of ground water or other problems?	0	-4	0
10	CO ₂ storage just really seems to be an excuse to prop up existing extractive industries.	1	-3	-2
11	Coal increases CO ₂ Emissions and increases climate change.	5	1	-2
12	I support coal as an energy source if clean-burning coal-fired electricity generation technology is used.	-3	2	-1
13	Coal mining should continue until clean energy options become more widely available.	-5	0	2
14	Wyoming has great fossil fuel resources that should be used both for the betterment of Wyomingites, but also the good of America.	-2	3	3
15	We need to explore the use of fossil fuels that are efficient and affordable so we can be energy independent.	-3	1	1
16	We need to do all of the above when it comes to energy.	-1	4	5
17	Whatever is done for energy, it needs to support education, communities, and be done respecting the environment.	1	5	4

18	I think we generally put too much emphasis on how much money we can make right now from energy in WY, and not enough emphasis on how to do it sustainably.	1	-1	0
19	Wyoming needs to vigorously develop the capability to be a leader in emerging energy industries.	0	2	3
20	No nuclear! Not safe!	0	-4	-5
21	Go Nuclear!	-1	4	1
22	We should decrease our use of oil and gas to reduce climate change.	4	-2	0
23	Oil and gas development negatively impacts people with noise and dust.	1	-1	-4
24	Oil and gas development and use in Wyoming keeps us from having to buy from other countries and being dependent on them.	-1	0	2
25	Oil and gas are established, dependable and are Wyoming's economy's life blood.	-1	2	0
26	Fossil fuels have a limited future in the world economy. It's past time to invest in alternatives to fossil fuels.	3	-3	-3
27	Wyoming is situated to become a leader in alternative energy production and technological development but is held back by a state mentality that keeps looking back to the "golden days" of the 1900s.	2	-2	4
28	Wyoming needs to develop more opportunities for installing solar panels on houses.	3	-1	0
29	I oppose utility scale solar farms because we have no way to dispose of expired panels that are considered toxic.	-2	-1	-3
30	I oppose utility scale solar farms because they need too much land.	-2	0	-2
31	I support utility scale solar farms as long as they are sited prudently.	3	1	3

32	Utility scale solar farms help alleviate climate change.	2	0	-1
33	I oppose wind energy because it is too heavily subsidized.	-2	-2	-4
34	I do not approve of how we dispose of wind turbine blades. We tear up the earth to bury them and they are also hazardous material.	-1	-2	-1
35	Wind energy development is unsightly.	0	0	1
36	I support wind energy to decrease climate change.	2	1	0

Themes regarding Social License and Energy in Wyoming

Described below are each of the three themes in detail, expanding on the key perspectives they are characterized by:

Theme 1: Climate Change Is or Is Not an Existential Threat

Theme 1 is unique in that it captures two divergent points of view. Participants who are represented in Theme 1 were largely motivated by whether or not they believe climate change to be an existential threat. Many participants in this theme ranked statements according to their belief that climate change is indeed a great threat to the continued existence of life on earth (*we labeled this perspective Theme 1A*). There were also many who ranked statements expressing exactly the opposite belief—that climate change is definitely not a dire threat (*we labeled this perspective Theme 1B*). Each of these sub-themes is described separately below.



Theme 1A: Climate Change Is an Existential Threat

Scientific consensus on climate change

Participants in Theme 1A believe there is a scientific consensus that fossil fuels contribute to climate change which in turn forms a threat to all life on the planet. One participant said, *“If we keep burning fossil fuels, we won’t have a livable future for anyone that’s my age or younger.”* As a result of this belief, participants considered the need to decrease fossil fuel use to be urgent. Another participant said, *“Priority number one is rapidly decreasing the amount of coal fired electric generation that’s going on in the state. Priority number two is going to be reducing other forms of fossil fuel production and consumption.”*

Be a leader in renewable and low-carbon energy alternatives

Participants in this theme express support for and interest in renewable energy and low-carbon alternatives, including batteries, wind, and solar. Recognizing both the challenge and the importance of transitioning to these forms of energy, one participant said, *“I’m in favor of a very*

active transition to a clean energy economy, I fully recognize it's a big lift, that there's a lot that needs to change, it's expensive, it's going to be, you know, a huge effort on the part of, you know, a big slice of society in Wyoming. But I do favor that change." Other participants expressed their belief in the importance of Wyoming being a leader in alternative energy development for economic reasons, saying *"I support wind energy because it's the least cost power choice for utilities and it brings our rates down."*

This support for low-carbon energy was conditional on it being developed responsibly. One participant stressed the importance by saying, *"We have an abundance of land, we have an abundance of solar. We have a fair abundance of certain critical minerals and metals. And how do we model developing those in a responsible manner?"*

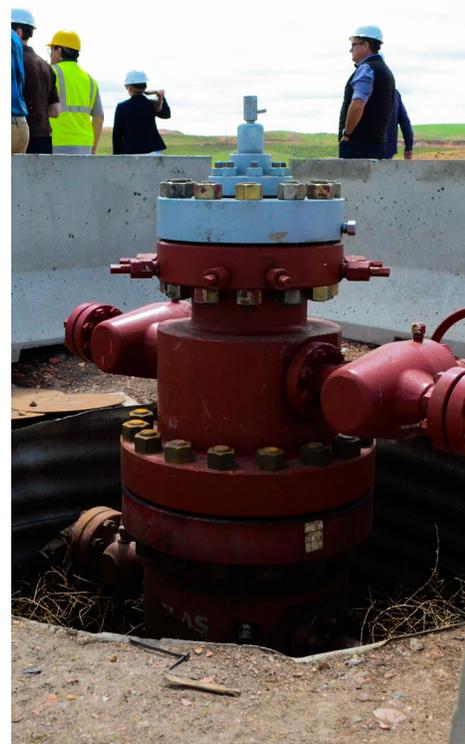
Concerns about CCUS

Concern and skepticism were expressed about CCUS in this theme. Participants said they had doubts about geologic storage of CO₂ because they do not believe it to be economically beneficial or feasible. One participant said the CCUS was a way of *"propping up extracting industries"*. Another argument made against CCUS was in relation to its water use. One participant said the impact of CCUS on water quality and quantity (similar to that of oil and gas and nuclear) was another reason they support wind and solar by saying, *"Carbon capture has water issues, oil and gas has water issues, nuclear definitely has water issues. Wind and solar do not have water issues."* Some participants in the theme did express a level of openness to CO₂ storage as a climate change mitigation technique, but there was significant skepticism expressed about it overall.

Need for lifestyle changes and policy changes

Participants in Theme 1A believe an important factor contributing to climate change is lifestyle and that people have the agency to make daily changes to lessen these impacts. They advocated for lifestyle changes to mitigate climate change such as increasing household energy efficiency, decreasing consumption, and increasing awareness of energy and resource use. One participant said, *"Some part of the conversation should be about what our practices are, how do we live our lives, and what kinds of energy efficiency measures or changes in behavior can we adopt."*

Participants also advocated for policy changes at a state-level, stating their belief that climate change necessitates seismic shifts in the way Wyoming and the country operates. A participant explained this by saying, *"It's going to take reshaping our tax structure, it's going to take rethinking what our economic output is and making investments. Right now, Wyoming's pretty slow to the table with a lot of like big federal funds, because of normative cultural beliefs that are keeping us from actually re-imagining our economy. And yeah, the technology is available, and we're missing the opportunity to make money off of it, unfortunately."*



Need to think globally

Some participants in this theme expressed their belief in importance of thinking about climate change on a global-scale. Related to this was the belief that the United States has a responsibility to the rest of the world to decarbonize the energy sector. This perspective was expressed by one participant by saying, *“There is a portion of the world that has played a much bigger part that bears a bigger piece of the responsibility and hadn’t contributed to climate change. And our country, as a whole, has contributed an outsized share, and Wyoming as a state has contributed an outsized share of the U.S. contributions too. So, we should also be the ones that are leading the charge back in the other direction.”*

Not in control of demand

There was a strong recognition among participants in this theme that Wyoming is not in control of the demand for decarbonized energy and cannot change it. Theme 1A participants believed Wyoming should accept this and become a provider of the decarbonized energy that is in demand. Participants thought Wyoming’s approach to energy would inevitably have to change due to external demands and a sense of frustration was expressed about the continuation of conventional energy industries. One participant said that Wyoming needs to *“untie its identity from fossil fuels -- holding on to coal is holding us back”*.

Focus on communities

While concern about climate change was the number one priority for participants in this theme, it was not the only priority. Simultaneously, there was a recognition of the importance of taking care of the communities that would be impacted by this transition. One participant said, *“Before I look for any of those phasing out or decline in that use and extraction, [we need to] build out the safeguards and build out the platform for an energy transition for the people and the communities and the state revenues that would be impacted.”*

Theme 1B: Climate Change Is Not an Existential Threat

Climate change is not a threat or caused by humans

Participants in Theme 1B believe climate change is not an existential threat, nor solely driven by humans. Participants consider climate change to be a natural process that has gone through cycles of fluctuation throughout history. Moreover, participants expressed the belief that the climate change narrative is about politics and marketing, rather than being a real threat to humans and the environment. As one participant said, *“One of the issues that I have with climate change is that I believe it’s happening, but I don’t think it’s an existential crisis. It is very much a political and market issue right now.”*

Another participant said they prefer not to use the term climate change because it has political connotations that they don’t think reflect the reality of the current climate situation. They said, *“The term climate change is such a divisive, political term. It’s a term I try to stay away from, frankly. I talk about climate variance, or I try to use a different word. I’ve seen in my lifetime, significant changes not just in recent years, but throughout my life. Most of those have been cyclical, not necessarily always in one direction. I’m not a denier that some of the things we do as humans can have some impact, but I like to stay away from that term because it’s so fraught. I just try and say let’s look at what’s really happening, and not try and put it into political context.”*

Participants in this theme not only believe that climate change is being used for political purposes, but also believe that there are negative consequences to the way climate change has been widely accepted. They expressed the conviction that climate change mitigation, on top of being unnecessary, is having a negative effect on Wyoming's economy because it has decreased demand for fossil resources.

Skeptical about renewable energy

Theme 1B participants expressed skepticism about renewable energy, including wind and solar. One reason for this skepticism is that the energy they produce is intermittent and they are not dispatchable sources of electricity, meaning they can't adjust the power they supply to the electrical grid on demand the way a thermal power plant can. One participant articulated the concerns with the intermittent nature of wind and solar by saying, *"I don't care about the source of energy, it just has to be dispatchable. That's the problem with renewable energy, wind and solar, it's variable and we don't have control over it. If we need more wind, it doesn't matter. You can't get it. It's whatever it is. And so that's a problem for the grid. It's all about the cost of electricity."*

Another concern participants in this theme have with renewables is that they require rare earth elements and there are potential environmental concerns with how those are extracted and processed. This is especially true since most of them are currently mined and processed in China which does not have strong environmental regulations. One participant said, *"Solar and wind are good ideas. But honestly, I think in the long run, they do more harm to the environment than coal and oil and natural gas have ever done. They take a lot of rare earth elements. Where earth elements are mined in China, and other places of the world where mining is not clean, it's not safe, it's not environmentally friendly."*

Further concerns expressed about wind and solar included that they can't provide enough energy to meet baseload demand, so they cannot be a replacement for all fossil fuels and that they rely on batteries (for energy storage) and that technology is too expensive. Likewise, participants said that roof-top solar would be more costly and is inefficient. However, some participants in the theme expressed some openness to renewables if they are sited properly, landowners are justly compensated, and if tax policy was developed to ensure that they contribute economically to the state. One participant said about wind and solar, *"They need to be taxed, we need to find a way to tax them appropriately. So that they can contribute to the state's revenue base."*

The need for reliable, dispatchable energy

As indicated above, participants in this theme believe we need to continue utilizing fossil resources because we need a reliable, dispatchable energy source. One participant expressed why fossil fuels would continue to be important in society by saying, *"I don't think we're going to get away from coal, oil, natural gas or nuclear anytime soon. I don't think solar or wind are ever going to carry the burden. As long as people want to charge their cars, and charge their phone and have power come on, when they hit flip a switch, energy is going to be important."*

Participants also felt a sense of injustice that coal is often condemned in the dialogue about climate change, but we still rely on it as a source of energy. One participant's comments highlighted this point of view clearly: *"Coal is neither good nor bad. It is a fossil fuel that can be utilized to create energy. But at the same time people are complaining about coal because it's evil, they have their phones that are powered by coal, they drive their cars that are powered by coal. You know, electric cars, honestly, I think are gonna be the salvation of coal. We don't have the electrical infrastructure to support it, if everybody drove electric cars."*

The importance of continuing to utilize our fossil energy infrastructure was also mentioned. Participants in this theme were in favor of retrofitting coal-fired power plants to natural-gas or using technologies like CCUS to decarbonize them. As one participant said, *“As opposed to phasing out our coal-fired plants, retrofit them to be used in another manner. Like I know that Jim Bridger is looking at converting to natural gas on a couple of those plants. I think those type of things as well as just using the technology and making it affordable for companies to use the technology that reduces the CO₂ emissions.”*

Indeed, one participant in Theme 1B pointed out that from the perspective of some coal communities, it’s not clear that coal is in decline at all. In fact, demand for coal has increased in recent years, leading to increased workforce demands. So, for people working in those industries, it doesn’t appear that an energy transition is underway. *“We’ve seen a tremendous uptick in the last couple of years in demand. Our coal stock piles, for utilities that are still using coal, are at their lowest level since the 70s. And so, the demand is very high. When you talk to those guys up in Gillette, we could probably use another 200 coal miners right now to meet the demand. They don’t see a transition right now. They’re not seeing themselves as a coal community, in need of federal resources to transition to something else.”*

Nuclear energy was also considered a favorable option because it also has the capacity to produce dispatchable electricity and is more reliable than renewable resources. Additionally, nuclear energy was viewed as favorable because Wyoming has such vast reserves of uranium which could be further developed.

Pride in Wyoming as an energy state

Participants in this theme expressed pride in Wyoming as an energy producing state that has supplied energy to the country for generations. Simultaneously, they expressed frustration about dialogue at the national-level about decarbonizing and moving away from fossil fuels. One participant expressed their concerns that other states don’t value the energy resources Wyoming has provided to the country and how necessary these resources are for our current infrastructure. Another participant said, *“People have taken us for granted and now they don’t like us because we provided that energy they needed but now they think we’ve destroyed the nation because they think it’s dirty. Well, it’s not. I think that at some point in the future, people will be begging for our energy.”*

Participants also expressed pride in Wyoming as a place to live, in particular about the communities, the small towns, and the way that the small population makes people feel connected to each other. However, along with this pride for Wyoming as a supplier of coal, oil, and gas was a concern that people outside Wyoming don’t care about the people in Wyoming. One participant said, *“As a state, we are a fantastic place to live and grow and raise your family. We’re a marvelous state. It’s a small town with long roads. Everybody’s connected. But when you take a step outside this state, we’re irrelevant.”*

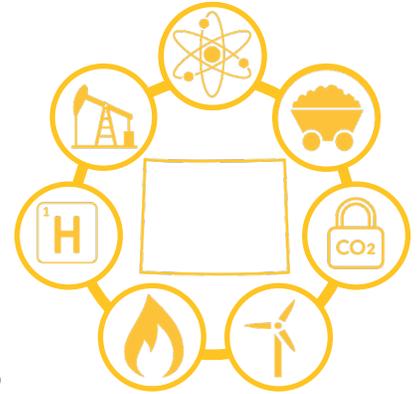
Focus on economics

Ultimately, participants in this theme want to see decisions made based on a fair assessment of the economic trade-offs associated with different types of energy, not based on climate change. *“Make as much money as you can, create as many jobs and increase quality of life for everybody, whatever it takes, and stop worrying about climate change.”*

Theme 2: All-of-the-Above for Resilience

Balancing community and environment as top priorities

Participants in this theme are motivated by concerns for communities and by a belief in the importance of a “just transition” (meaning a transition done in a way that is as fair and inclusive as possible). They consider education to be key so that people can understand the tradeoffs of different types of energy. They are also motivated by a belief in the importance of taking care of the natural environment. To some extent, participants in Theme 2 are driven by concerns about climate change, but not to the extent as participants in Theme 1. In this theme, there is an acceptance of the existence of climate change and a strong belief in the related scientific evidence. However, they do not see themselves as crusaders for climate change. One participant expressed their belief in the importance of not ignoring the needs of communities in an attempt to mitigate climate change by saying, “Don’t sell out that which we value the most in the name of the energy transition”.



Resource ambivalent

Theme 2 participants did not make arguments in favor or against particular types of energy. Instead, they argued in favor of creating balance and for engaging in practical deliberation over what will provide jobs and revenue while also being in alignment with climate goals and demands. For example, one participant expressed the belief in the importance of being “resource ambivalent”, meaning not being biased toward a specific type of energy resource, but rather being open to a wide variety of energy industries based on how they can support Wyoming and its communities. This participant said that what was important was not the type of resources but the services they provide: “The thing that we value isn’t coal, the things we value are those robust social services and quality of life. And so, I always feel like we should be coming back to how do our energy choices meet those needs and preserve those values.”

Communities and the importance of resiliency and self-determination

Participants in this theme reiterated the importance of resilience for Wyoming communities. To gain economic and social resilience in Wyoming, these participants believe in diversifying the economy, encouraging the development of clean energy to create jobs, and providing workforce retaining opportunities for people transitioning into new industries. Participants were in favor of moving away from fossil energy but also in opportunities to decarbonize fossil industries (e.g. CCUS, EOR, and blue hydrogen) if they makes sense based on economics, infrastructure considerations, and community desire. This openness to a wide variety of energy types and solutions was reflected in one participant’s comment that the first step in gaining resilience is to be more open to change, “I think we need to listen more; I think we need to be more open—open to changes that will, rather than encouraging stability in our current industries, encouraged resilience across Wyoming of economy.”

Moreover, Theme 2 participants believe that in order to increase resilience for Wyoming communities, the communities themselves must be empowered to be the decision-makers. One participant phrased this as the importance for communities to have “self-determination” around what their future look like. This participant spoke about a national obligation to the energy-

producing communities in Wyoming that have been negatively impacted economically by the regulatory landscape that has driven demand away from fossil-based energy, saying: *“We’ve made a political decision to transition, not necessarily a transition that’s being driven by cheaper alternatives, or new technology, but by political and social choice around climate, that is the political landscape in which the decisions are being made. This gives rise to a greater obligation to these communities for the way that they’ve contributed to the economy up to this point, and also the fact that we’ve kind of reached a consensus as a majority to make big changes that are going to negatively affect them and reduce their welfare.”*

All-of-the-above

Participants in this theme truly supported an all-of-the-above approach to energy in Wyoming as a means of supporting the state, supporting communities, and taking care of the environment. There was a firm commitment to the importance of guaranteeing safe, reliable, affordable energy, and to do this, participants in this theme believe Wyoming needs to be open to all types of energy.

The continued use of fossil fuels was supported particularly if it was decarbonized using CCUS. Participants believe that regardless of alternative energy development, for the time being fossil fuels will continue to be necessary and relevant. Renewable energy was also supported, including wind and solar. Even hydropower was called out as a potentially valuable and underutilized energy source in the state.

Participants were also positive regarding nuclear energy, with some participants considering it to be a potential gap filler when transitioning from fossil fuels to renewables. Participants thought nuclear would be advantageous because it could provide electricity to back-up wind and solar (which would address their intermittent nature) and it does not emit CO₂.

Theme 2 participants believe that producing the energy our society needs, supporting our communities, and reducing environmental impacts requires this all-of-the-above approach and that it must be driven by the people of Wyoming. Other things considered to be important to participants in this theme include a smoother transition timeline, aggressively educating Wyomingites about energy, and support for the most efficient technologies, especially nuclear energy. To do this, participants believe a regulatory environment that *“doesn’t set up road blocks”* will be paramount.



Theme 3: Economics and Community

Climate change is not the driving motivator

While participants in Theme 3 believe that climate change is happening and that it's important, they also believe that the causes of climate change are complex and not all attributed to human activity. Similar to participants in Theme 1B, they do not believe that fossil fuels are the sole cause of climate change, but rather that there are natural cycles and fluctuations which are also contributing to the Earth's changing climate. Also, participants believe that the U.S. alone cannot be burdened in the fight against climate change, it needs to be a global effort.



Open for business

Participants in Theme 3 focus on the importance of Wyoming's economy as a means to support its communities. They believe that to strengthen Wyoming's economy, Wyoming needs to be completely open for business--there needs to be a clear understanding of the markets, how they work, and how Wyoming can meet market demand. One participant said, *"We need to attract companies. We're competing not just on a state level, we're competing on a world level for these companies to want to come in, they want to locate where there's tax incentives, where there's a levelized playing field where they know the rules to play in the sandbox. And that's important to them, because they can locate these facilities anywhere."*

Participants also expressed a desire for fewer regulations dictating which types of energy are developed. They were concerned about how regulations have the effect of picking winners and losers instead of letting markets choose. One participant said they'd prefer a more free-market approach, *"I want the free market dictate it and not for us to pick winners and losers."*

Communities are the priority

Taking care of Wyoming communities is the top priority for participants in Theme 3. Participants expressed their conviction that it is imperative that we are *"proactive to take care of our communities"*. Theme 3 participants believe that the realities many communities in Wyoming face are dire and we have an urgent need to take care of them. This is an interesting parallel but opposing belief to Theme 1A's belief that climate change is dire and we have an urgent need to address it. One participant in Theme 3 said about the urgent need to support communities, *"We need to be proactive to fill that void [left by the decline in coal industries], both for energy that we need as a nation, and also for those jobs for folks that are doing that work right now."*

For participants in this theme, part of taking care of communities means providing meaningful energy education which they consider to be lacking, and which they believe hurts Wyoming. Additionally, participants were very concerned about fossil industry job losses, believing that those livelihoods will not be replaced by renewable energy jobs. Participants believe these job losses in turn negatively impact communities and force young people to leave Wyoming to find jobs.

The economic benefits of nuclear

Nuclear energy was strongly favored by participants in Theme 3 because they believe it will provide many economic benefits to Wyoming. Participants were particularly enthusiastic about the TerraPower small modular reactor that has been sited in Kemmerer because it will provide an economic lifeline for a community that is on the brink of losing many jobs when the Naughton Power Plant retires. Nuclear energy is viewed as a new industry that will replace those jobs and an option for using the existing infrastructure there. One participant said, *“I am super excited about this nuclear option in Kemmerer. For Kemmerer, if they’d lost that coal plant, that entire community and county really would have been economically devastated. So, it’s a way to use the existing transmission, existing workforce, existing land, all of it. It’s really exciting and I think those projects are important to Wyoming.”*

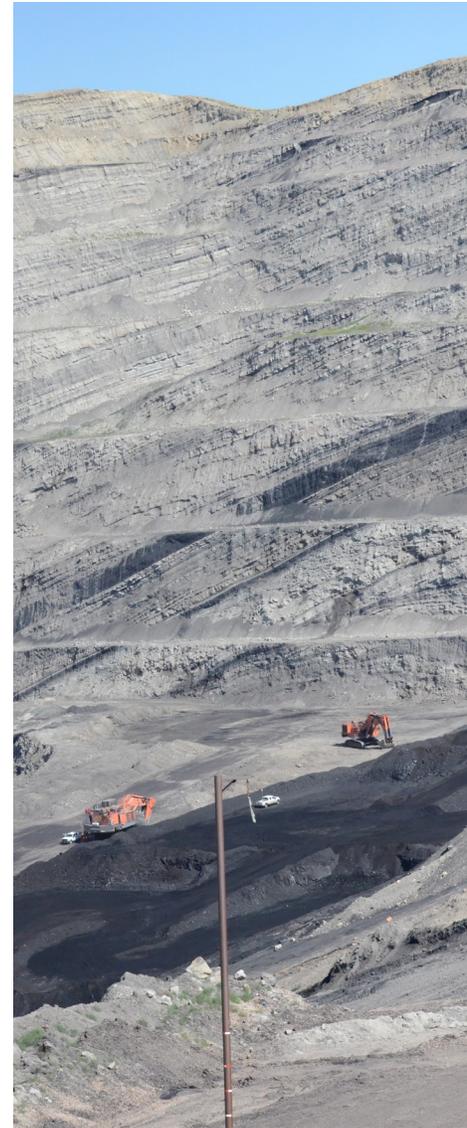
Support for CCUS and support for coal

Theme 3 participants were in favor of CCUS and expressed regret that Wyoming hasn’t taken a more proactive approach sooner to developing CCUS industries in order to preserve more of the coal industry. Similar to the sentiment expressed in Theme 1B, participants in Theme 3 also recognize the important role that coal has had in Wyoming historically and believe there is still an important role for it in the future. One participant said of the importance of coal and its role in supporting the coal industry, *“We should have started this carbon capture conversation much earlier. We didn’t start really getting serious about it until the coal market was already declining, which we should have anticipated that better and better ready with that technology at the time, so that we wouldn’t have lost so many coal plants around the country that are supplied by Wyoming coal.”*

Wyoming as an energy leader

Participants in this theme expressed a strong sense of identity with Wyoming’s culture as an energy producing state and with Wyoming as an energy leader. They believe that Wyoming’s role as a leader in energy will be important for the future of the state and that we should continue to invest in it: *“I view Wyoming as a leader in energy historically, and I think we need to continue to be. We have to be investing in these emerging technologies and emerging industries. And I feel like Wyoming really is trying to find its way and lead on every kind of energy resource there is. I feel really excited and believe that’s important to the future of our state. Well, I think we are in and above all, all the above sort of energy mix right now.”*

This desire for Wyoming to be a technological leader in energy was expansive and included all types of energy technologies, including CCUS, wind, and solar—so long as they are developed in the right way. Participants in Theme 3 expressed openness to many different types of energy in Wyoming but emphasized the importance of ‘logical’ development that took into account the existing infrastructure and communities. This is similar to the position expressed by participants in Theme 2 who want a practical, all-of-the-above approach to energy in Wyoming.



The problem with the speed of the energy transition

The problematic nature of the energy transition was raised many times by participants in Theme 3. In particular, the speed at which the energy transition is expected to happen was considered both unrealistic and not in alignment with the best interests of communities. One participant referred to the early retirements of coal-fired power plants as ‘economic devastation’. This participant also spoke the tremendous challenge Wyoming faces as increasingly more policies (federally and in other states) are put into place to encourage the transition away from fossil fuels as quickly as possible: *“I think Wyoming’s under a great deal of pressure. A lot of us are just running as fast as we can possibly run to get something to work.”*

Additionally, many participants in this theme emphasized the challenges of replacing the jobs that will be lost as fossil energy industries decline in the state. While not theoretically opposed to renewables, participants pointed out that renewable industries simple won’t provide the same number of jobs that coal-fired power plants and coal mines do, leaving many Wyoming residents in energy communities without economic opportunities or ways to make a living. One participant expressed their concern over this job imbalance by saying, *“Here’s the problem. In coal-fired power plants, you probably have 500 to 1000 workers working there. You have 500 or 1000 people working at a coal mine. So you’re talking about 2000 people. In order to build a decent sized wind farm, you’re probably talking about 400 or 500 people working on it for a year or two years. And once that construction is done, there’s going to be 50 full time jobs. So by taking coal and replacing it, there’s actually less jobs in the industry. That’s a major problem. We have to build a heck of a lot of solar farms and wind farms to be able to hire 2000 workers”*

Commonalities among All Themes

As noted above, while each theme was unique in the perspectives it represents, there were also perspectives that all themes had in common. These represent the perspectives that are most prevalent in Wyoming and the topics on which there is the most common ground among Wyoming residents. Table 14 shows the statements in the Q-sort that had the most agreement among themes.

“

In particular, the speed at which the energy transition is expected to happen was considered both unrealistic and not in alignment with the best interests of communities.

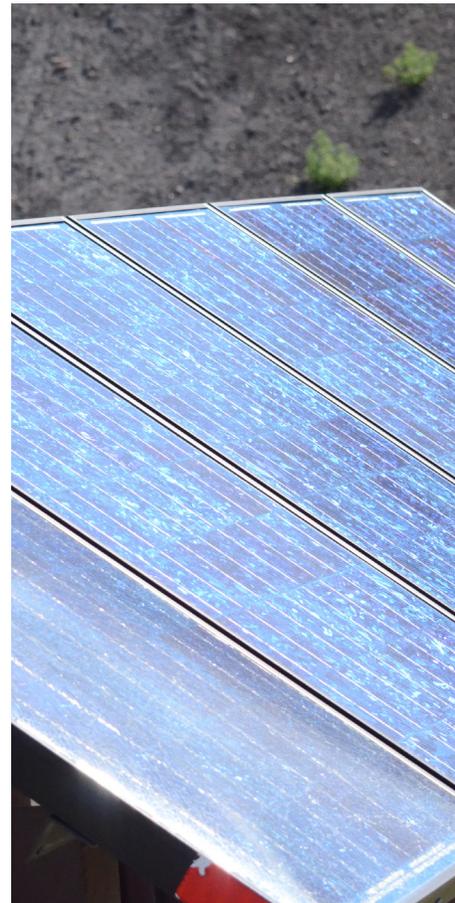


Table 14: Ranking of each statement for each of the three themes from 5 (most strongly agree with) to -5 (most strongly disagree with)

Consensus Statements	Theme 1: Climate Change is/ is not an Existential Threat	Theme 2: All-of-the-Above for Resiliency	Theme 3: Economics and Community
1. More investment needs to be made in batteries or other storage electric/ energy options.	2	1	2
1. The whole “climate change is real” bit is just another scare tactic.	-4	-5	-3
29. I oppose utility scale solar farms because we have no way to dispose of expired panels that are considered toxic.	-2	-1	-3
33. I oppose wind energy because it is too heavily subsidized.	-2	-2	-4
34. I do not approve of how we dispose of wind turbine blades. We tear up the earth to bury them and they are also hazardous material.	-1	-2	-1
35. Wind energy development is unsightly.	0	0	-1
36. I support wind energy to decrease climate change.	2	1	0

The commonalities in rankings of these statements highlight three points of consensus. First, there is general (though not overwhelming) support for batteries and other energy storage technologies. Second there is support for (or neutrality about) wind energy and respondents disagree, or do not rate as important, statements that oppose wind energy. The third consensus point indicates that participants in Theme 1A, Theme 2, and Theme 3 on average strongly disagree with the assertion that climate change is a ‘scare tactic’. Theme 1B participants are not in consensus with this belief (when rankings for this statement are broken down between the two sub-themes, the average score for Theme 1A is close to -5 (disagreement) and the average score for Theme 1B is close to 1 (slight agreement)). The perspective highlighted by the high level of consensus on this statement was also reflected in our 2022 survey result.



DISCUSSION OF MAJOR FINDINGS FROM THE 2022/2023 SURVEY AND Q-STUDY

After analyzing the results of the 2022 survey and the Q-study, we looked at the combined findings to determine what they could reveal about the social license for energy in Wyoming. The combination of these findings highlights several salient and compelling points about the energy discourse in Wyoming, and what Wyoming residents need and feel concerned about. These include:

- **More information about emerging and expanding energy industries:** Wyoming residents generally support the state’s “all-of-the-above” energy strategy. However, they also have big questions about emerging energy types and what they will mean—including what they will mean to them personally, to their communities, to the environment, and to the state economy. Of particular note from the survey results are the high levels of “*I don’t know*” and “*Neutral*” responses in regard to many emerging and expanding energy types (such as CCUS, hydrogen, nuclear, etc.). The need for more information in Wyoming is also a factor that has emerged in a recent report in relation to other states.^{xiii} This, in and of itself, is an important response as it indicates the lack of general understanding and need for information. The need for more readily available and understandable information was also highlighted in the results from the survey questions about energy information sources and accessibility. The majority of respondents either did not answer these questions or reported that they did not believe enough information was available. Q-study participants also spoke about the importance of ensuring information and education about energy topics is available. Many participants saw the provision of meaningful information as critical to supporting communities to become resilient in the face of industry change.
- **Communities as a top priority:** Q-study participants in all themes expressed strong concern regarding the fate of Wyoming’s energy communities at risk of losing jobs and social services if fossil energy industries decline further. Generally, there was enthusiasm, even relief, that at least for Kemmerer there may be solutions (the TerraPower small modular reactor demonstration project) providing jobs, tax revenue and the continuation of the social services the community needs. Other communities do not have such strong possibilities yet and renewable energy is not considered to be a viable option to fully replace jobs or support communities. Q-study participants want communities to be a top priority in making energy-related decisions and want to ensure communities are supported in having employment and revenue sources.
- **Consensus on existence of climate change, divided on cause:** Data from both the survey and the Q-study indicate that the majority of respondents believe climate change is occurring. However, there are some differences in beliefs about whether it is primarily caused by humans. In the survey, more than 50% of respondents don’t believe climate change is caused by humans and less than 40% do believe it’s mostly caused by humans. While most Q-study participants believe humans are mostly responsible for climate change, some Q-study participants in Theme IB do not. These participants, however, do believe human activity was at least partially responsible for climate change.

- **The importance of landscapes and wildlife:** In the Q-study and the survey, participants and respondents indicated a strong desire to prioritize the landscapes and wildlife which are unique to Wyoming when making energy related decisions. This priority is evident in survey respondents' top reasons for valuing Wyoming, four of which are connected to landscape and wildlife: recreation, aesthetics, biological diversity, and spirituality (the definition of the 'spirituality' value "...places for which I feel reverence and respect for nature..."). The importance of landscape and wildlife was also evident in Q-study responses about responsible development and siting, and concerns about the environment.
- **A desire to make decisions about the energy mix based on economics:** Q-study participants in all themes expressed a desire for decision making about the energy mix to be based on economic considerations. However, there were variations in what this means to different respondents. Some believed there should be fewer regulations that determined 'winners' and 'losers' for energy industries and decisions should be made based on market forces determining costs and revenue. Other participants believed in a demand-driven approach to making decisions about Wyoming's energy mix, by developing the types of energy that are demanded by customers. Still others believe decisions should be made based on what would provide the greatest economic benefits to communities in the form of jobs and tax revenue. Related to this desire for economic-based decision making, was an acknowledgement among many Q-study participants that Wyoming is not in control of what types of energy are demanded. Participants recognized the complicated and powerful forces outside Wyoming that are driving demand for energy resources. While some accepted that demand is largely outside of Wyoming's control, others expressed frustration about it.
- **A role for policy-makers:** Q-study participants in all themes and many survey respondents focused on the role they would like state leadership and policy-makers to play in energy planning and decision-making. In open-ended survey questions, eleven respondents provided comments expressing a desire for the Legislature to provide incentives to new companies using emerging technologies e.g. "A carbon fee and dividend policy that is revenue neutral seems like a good way to influence those incentives". Most of the statements reflected a desire for the Legislature to "think out of the box" and not give preference to coal, oil and gas over renewable energy resources. The four themes in the Q-study also reflected these sentiments. In Theme 1B, participants wanted policy makers to craft policies that "keep coal on the table", "build capacity to mine, convert and enrich uranium for nuclear fuel", and "tax solar and wind". The three other themes also discussed changes in taxes, but in the context of "providing a solid energy policy that includes Wyoming revenue structure" that includes, e.g., value-added tax and "a leveling of the playing field by not taxing wind and solar energy types". In these three themes we also found a desire that policy makers were more informed about energy dynamics and used that information to make policies that "don't pick winners and losers". This is tied to the point participants made regarding markets: "I want free markets to dictate energy types".



IMPLICATIONS FROM BOTH STUDIES: CONSIDERATIONS FOR SOCIAL LICENSE

We conducted both the 2020 and 2023 studies to understand Wyoming residents' perceptions of energy. And, at the center of both is the concept of social license. By illuminating what Wyoming residents want, need, value, and are concerned about, these two studies provide important insights into the social license for energy in Wyoming.

- 1. Importance of continuing to be an energy leader:** Wyoming has a long history as an energy producing state. For many respondents, that history is ingrained in the Wyoming conscience. Energy industries have provided meaningful livelihoods for generations of residents, energy industries have generated the tax revenue that provides social services, and many residents feel pride that Wyoming has literally provided much of the energy that powers the nation. Wyoming's role as a leader in coal, oil, and natural gas has had a profound impact on the culture of Wyoming and many residents want Wyoming to continue to be a leader in these and emerging energy industries. Survey results show that fossil fuels continue to enjoy strong support in Wyoming, with support for coal and oil increasing from 2019 to 2022 and support for natural gas staying at the same level. Support for nuclear electricity generation and CCUS have also increased and support for solar has stayed the same. Q-study results also indicate a desire for Wyoming to continue to be an energy leader. While participants in each of the themes differ some on what kinds of energy to focus on, all believe that Wyoming has an important role to play, whether that is in continuing to produce conventional fossil resources, expand into emerging decarbonized energy types, or a mix of all-of-the-above. These results indicate that while there may be many differences among Wyoming residents about the types of energy they give social license to, there is strong social license for energy overall in Wyoming.
- 2. An opportunity for education and engagement:** As in 2019, the 2022 survey indicates a strong need for more information and education related to energy. This is especially true about expanding and emerging energy industries. Q-study participants in 2023, far more so than in 2020, also stressed the importance of education for the public so that they can meaningfully engage in decisions about energy and to have self-determination in shaping their future relationship to energy. They expressed an understanding that for communities to be successful in navigating transition, it is important for them to have more knowledge about different types, including how they will impact their communities, what potential trade-offs will be, and what role they'll play in providing jobs and revenue. For communities to do this, adequate education and engagement will be vital. Education and engagement are also key for obtaining social license.
- 3. Energy development in alignment with values:** The qualities that Wyoming residents value the most about Wyoming all focused on communities, landscapes, and wildlife. Q-study participants in all themes had different preferences for different types of energy (as did survey respondents). However, many of these participants brought up the importance of how and where energy is developed not just the type of energy. The social license they gave for energy development was

often conditional on where it was sited, how it would support communities, and how it would impact wildlife and landscapes. For example, participants raised the importance of siting energy activities in areas where development already existed to minimize any additional energy footprint. Participants also spoke about the importance of how siting would affect migration routes for wildlife, community and residents' quality of life, hunting opportunities, and scenic beauty. Considering ways of developing energy that are in alignment with Wyoming residents' values can also play a role in building social license.

- 4. Desire for more state-level planning and policy:** Survey respondents and Q-study participants in both the 2020 study and the 2023 study expressed the strong desire for more state-level planning and policy development related to energy in Wyoming. The State of Wyoming is already actively involved in energy issues and policy. And in the three years between the two studies, state-level leadership has done much to plan for Wyoming's energy future and develop the policy framework to support it. For example, the Wyoming Energy Authority developed a state-wide "all-of-the-above" energy strategy to guide the state's approach to energy, Governor Mark Gordon set the goal of Wyoming achieving net-zero carbon emissions, and Wyoming attained primacy for permitting Class VI injection wells for permanent storage of CO₂. The results from this study indicate that Wyoming residents want more of this type of proactive planning and leadership related to energy and want to be engaged in state-level planning. Residents are thinking critically about the role of economics, policy, education, and communities in forming Wyoming's energy future. They want deliberate and well-thought-out decision making and they want to be engaged in the process. To build social license, this engagement can be valuable. The engaged public has knowledge that needs to be included in decision-making, to process complicated issues, and to create social license for the plans and policies that are developed.

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APPENDIX A: THE 2022 SURVEY

SURVEY OF PUBLIC VALUES AND PREFERENCES RELATING TO WYOMING’S ENERGY FUTURE

Section 1: YOUR RELATIONSHIP TO ENERGY IN WYOMING

Q-1 Is anyone in your household employed in an energy industry (e.g. mining, production or transmission)? (Please circle one response.)

1. Yes. What type of energy-related industry: _____
2. No
3. Unsure

Q-2 Please check the types of energy operations that are within 100 miles of the places you live, work, or recreate.

Oil/natural gas-based drilling and electricity generation	Natural gas-based electricity generation plant	Hydroelectric energy generation plant
Coal mining	Oil refinery	Uranium mining
Wind farm	Coal-based electricity generation plant	Trona mining
Rooftop Solar	Carbon capture utilization and storage facility	Bentonite mining
Utility-scale solar (e.g., solar farm.)	Don't know/Not sure	Other (describe)_____

Section 2: ENERGY IN WYOMING

Q-3 What should Wyoming’s energy future look like? The following is a list of energy related activities that are either being done or could be done in Wyoming. How much do you favor or oppose each one in the future?

	Strongly Favor	Favor	Neutral	Oppose	Strongly Oppose	Not sure
Wind energy	1	2	3	4	5	6
Coal mining	1	2	3	4	5	6
Coal-based electricity generation	1	2	3	4	5	6
Uranium mining	1	2	3	4	5	6
Oil/natural gas-based electricity generation and drilling	1	2	3	4	5	6
Natural gas-based electricity generation	1	2	3	4	5	6
Oil refining	1	2	3	4	5	6

Utility-scale solar farm	1	2	3	4	5	6
Rooftop solar	1	2	3	4	5	6
Nuclear-based electricity generation	1	2	3	4	5	6
Carbon capture utilization and storage	1	2	3	4	5	6
Rare earth elements/critical minerals mining	1	2	3	4	5	6
Hydrogen generation	1	2	3	4	5	6
Other (describe)_____	1	2	3	4	5	6

Q-4 Please indicate your level of agreement with the following statements regarding **wind energy development** in Wyoming:

I support wind energy development because:	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Don't Know
It provides state and local revenue.	1	2	3	4	5	6
It supports our country's energy needs.	1	2	3	4	5	6
It provides electricity without CO ₂ emissions.	1	2	3	4	5	6
It provides well-paying jobs.	1	2	3	4	5	6
I support wind energy development for other reasons, please specify:	_____					

Q-5 Please indicate your level of agreement with the following statements regarding **wind energy development** in Wyoming:

I oppose wind energy development in Wyoming because:	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Don't Know
It has negative impacts on wildlife.	1	2	3	4	5	6
It is unreliable.	1	2	3	4	5	6
It has negative impacts on recreational activities.	1	2	3	4	5	6
It has too large of an environmental footprint.	1	2	3	4	5	6
I oppose wind energy development for other reasons, please specify:	_____					

Q-6 Please indicate your level of agreement with the following statements regarding **utility-scale solar farm development** in Wyoming:

I support utility-scale solar farm development in Wyoming because:	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Don't Know
It provides state and local revenue to Wyoming.	1	2	3	4	5	6
It supports our country's energy needs.	1	2	3	4	5	6
It provides electricity without CO ₂ emissions.	1	2	3	4	5	6
It provides well-paying jobs.	1	2	3	4	5	6
I support utility solar farm development for other reasons, please specify: _____						

Q-7 Please indicate your level of agreement with the following statements regarding **utility-scale solar farm development** in Wyoming:

I oppose utility-scale solar farm development because:	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Don't Know
It is unreliable	1	2	3	4	5	6
It has negative impacts on wildlife.	1	2	3	4	5	6
It has negative impacts on recreational activities	1	2	3	4	5	6
It has too large of an environmental footprint	1	2	3	4	5	6
I oppose utility solar farm development for other reasons, please specify: _____						

Q-8 Please indicate your level of agreement with the following statements regarding **oil and gas extraction and energy generation** in Wyoming:

I support oil and gas extraction and electricity generation because:	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Don't Know
It provides reliable energy.	1	2	3	4	5	6
It provides state and local revenue	1	2	3	4	5	6
It supports our country's energy needs.	1	2	3	4	5	6
It provides well-paying jobs in Wyoming	1	2	3	4	5	6
I support oil and gas extraction and electricity generation for other reasons, please specify _____						

Q-9 Please indicate your level of agreement with the following statements regarding **oil and gas extraction and electricity generation** in Wyoming:

I oppose oil and gas extraction and energy generation because:	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Don't Know
It has negative impacts on recreational activities.	1	2	3	4	5	6
It has negative impacts on wildlife, air and water quality.	1	2	3	4	5	6
It contributes to climate change globally.	1	2	3	4	5	6
I oppose oil and gas extraction and electricity generation for other reasons, please specify _____						

Q-10 Please indicate your level of agreement with the following statements regarding **coal mining and coal-based electricity generation in Wyoming.**

I support coal mining and coal-based electricity generation because:	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Don't Know
It supports our country's energy needs.	1	2	3	4	5	6
It provides well-paying jobs in Wyoming	1	2	3	4	5	6
It provides state and local revenue	1	2	3	4	5	6
It provides reliable energy.	1	2	3	4	5	6
I support coal mining and coal-based electricity generation for other reasons, please specify: _____						

Q-11 Please indicate your level of agreement with the following statements regarding **coal mining and coal-based electricity generation in Wyoming.**

I oppose coal mining and coal-based electricity generation because:	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Don't Know
It has negative impacts on wildlife, air and water quality.	1	2	3	4	5	6
It has negative impacts on recreational activities.	1	2	3	4	5	6
It contributes to climate change globally.	1	2	3	4	5	6
I oppose coal mining and coal-based electricity generation for other reasons, please specify: _____						

Section 3: THE FUTURE OF ENERGY IN WYOMING

Q-12 Which one of the following statements regarding **hydrogen generation** in Wyoming *best describes* your opinion? (Please select one.)

- I support all types of hydrogen generation.
- I support hydrogen generation if it is produced from fossil fuels.
- I support hydrogen generation if it is produced from fossil fuels and uses carbon capture utilization and storage so there are minimal CO₂ emissions.
- I support hydrogen generation if it is produced from renewable sources so there are minimal CO₂ emissions.
- I support any kind of hydrogen generation that minimizes CO₂ emissions.
- I do not support any types of hydrogen generation.
- I don't know.

Q-13 Please indicate how strongly you agree or disagree with each of the following statements regarding: **nuclear-based electricity generation in Wyoming:**

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Don't Know
Nuclear-based electricity generation is an important industry to develop to support Wyoming's economy.	1	2	3	4	5	6
Nuclear-based electricity generation is important because it provides reliable, low-carbon energy.	1	2	3	4	5	6
Nuclear-based electricity generation is safe.	1	2	3	4	5	6

I am concerned about health and safety issues related to having a Nuclear-based electricity generation plant in Wyoming.	1	2	3	4	5	6
I am concerned about health and safety issues related to storing nuclear waste in Wyoming.	1	2	3	4	5	6

Q-14 Which one of the following statements *best describes* your level of support for or opposition to these ways of capturing and storing CO₂?

	Strongly Support	Support	Neutral	Oppose	Strongly Oppose	Not sure
Point Source Capture (capturing CO ₂ directly from a large facility such as a coal or natural gas-based electricity generation-fired electricity plant)	1	2	3	4	5	6
Direct Air Capture removing CO ₂ directly out of the air)	1	2	3	4	5	6
Permanent Geologic Storage (injecting CO ₂ into deep geological formations underground for permanent storage)	1	2	3	4	5	6
Enhanced Oil Recovery (Inject CO ₂ into existing oil reservoirs to store CO ₂ and improve oil recovery)	1	2	3	4	5	6
Materials Production (using CO ₂ to make products such as cement)	1	2	3	4	5	6
Permanent Geologic Storage for out-of-state generated carbon	1	2	3	4	5	6

Q-15 Please indicate how strongly you agree or disagree with each of the following statements regarding permanent geologic storage of CO₂ in Wyoming:

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Don't Know
Geologic storage of CO ₂ is important because it can support Wyoming's economy.	1	2	3	4	5	6
Geologic storage of CO ₂ important because it can allow Wyoming to produce reliable, low-carbon energy from its fossil resources	1	2	3	4	5	6
Geologic storage of CO ₂ should be one of many low-carbon energy industries that Wyoming develops.	1	2	3	4	5	6

Geologic storage of CO ₂ is a safe and effective way to permanently store CO ₂ .	1	2	3	4	5	6
Developing a geologic storage industry in Wyoming supports the continued use of fossil fuels which results in CO ₂ emissions and contributes to climate change.	1	2	3	4	5	6
Geologic storage of CO ₂ requires expensive technology and infrastructure and may not be economically viable.	1	2	3	4	5	6

Q-16 In your own words, what are your opinions about geologic storage of CO₂ in Wyoming and if it should be a part of Wyoming's energy industry?
Open-ended

Q-17 *Enhance Oil Recovery (EOR) is the process of injecting CO₂ into existing oil fields to produce oil that would not otherwise be accessible. During the EOR process, a part of the injected CO₂ is permanently stored underground. Please indicate how strongly you agree or disagree with each of the following statements regarding **using captured CO₂ for EOR**:*

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Don't Know
EOR is a safe effective way to permanently store CO ₂ while also producing oil.	1	2	3	4	5	6
EOR is an important industry that contributes positively to Wyoming's economy.	1	2	3	4	5	6
EOR contributes to the negative consequences of climate change by producing more oil, which results in increased CO ₂ emissions.	1	2	3	4	5	6
EOR is expensive and may not be economically viable.	1	2	3	4	5	6

Section 4: ACCESS TO ENERGY INFORMATION

Q-18 Where do you get most of your information about energy industries, markets, and technologies? Please mark all that apply.

- Local TV
- Network TV
- Cable TV
- Local or State Newspapers (print or digital)
- National or International Newspapers (print or digital)
- Radio
- Social Media
- YouTube
- Friends/family/acquaintances
- Scholarly articles
- Wyoming Energy Authority publications/events
- University of Wyoming publications/events
- Other _____(open-ended)

Q-19 Do you think there is enough readily accessible and understandable information about energy industries, markets, and technologies?

- Yes.
- Generally, yes.
- It depends on the type of energy industry, market, and technology.
- Generally, no.
- No.
- I don't know because I don't seek out information about energy industries, markets, and technologies.

Q-20 What energy topics would you like to have more easily accessible and understandable information about?
Open-ended

Section 5: CLIMATE CHANGE AND VALUES

Q-21 Which of the following statements best describes your opinion about climate change? (Please select one).

- I don't think climate change is happening.
- I have no idea whether climate change is happening or not.
- I think climate change is happening, but it is caused by natural fluctuations in Earth's temperatures that are *not* caused by humans.
- I think climate change is happening and I think it is largely caused by humans.

Q-22 We have asked you many questions about energy activities in Wyoming. Now we would like to know in what ways is Wyoming important to you by offering you the following hypothetical scenario to consider.

Imagine that you could “spend” \$100 to ensure that the State of Wyoming is able to maintain its values. You may allocate or spend the \$100 in any way you like, but your total spending may not exceed \$100. You might spend all \$100 on one value (and \$0 on all others), or you might spend \$50 on one value, \$25 on another value, and \$25 on yet another value. Remember, the total dollars you spend should equal \$100. (Reference to money is not made to actual money, your own or the State’s budget).

- \$___ **Aesthetic value** - I value Wyoming because I enjoy the scenery, sights, sounds, smells, etc.
- \$___ **Biological diversity value** – I value Wyoming because it provides a variety of fish, wildlife, plant life, etc.
- \$___ **Cultural value** - I value Wyoming because it is a place for me to continue and pass down the wisdom and knowledge, traditions, and way of life of my ancestors.
- \$___ **Community value** - I value Wyoming because it is the location of my community and I wish to preserve that community and its health, security, and welfare.
- \$___ **Economic value** - I value Wyoming because it provides economic opportunities related to minerals, tourism, hunting, energy production and other sectors.
- \$___ **Future value** - I value Wyoming because it allows future generations to know and experience the forests as they are now.
- \$___ **Historic value** - I value Wyoming because it has places and things of natural and human history that matter to me, others and/or the nation.
- \$___ **Intrinsic value** - I value Wyoming in and of itself, whether people are present or not.
- \$___ **Learning value** - I value Wyoming because we can learn about the environment through scientific observation and/or experimentation.
- \$___ **Life Sustaining value** - I value Wyoming because it helps produce, preserve, clean, and renew air, soil, and water.
- \$___ **Recreation value** - I value Wyoming because it provides a place for my favorite outdoor recreation activities.
- \$___ **Spiritual value** - I value Wyoming because it is a sacred, religious, or spiritually special place to me or because I feel reverence and respect for nature there.
- \$___ **Subsistence value** - I value Wyoming because it provides necessary food and supplies to sustain my life.
- \$___ **Therapeutic value** - I value Wyoming because it makes me feel better, physically and/or mentally.

\$100 Total Value Allocation

Section 6: SOME INFORMATION FROM YOU

Q-23 In what community do you live or what community is closest to your home? _____

Q-24 How long have you lived in Wyoming? _____YEARS (enter 1 for 1 year or less)

Q-25 Is the residence where you received this survey your primary residence? Yes No

Q-26 What is your age? _____YEARS

Q-27 Are you? 1. Male 2. Female 3. Other:_____

Q-28 What is your political worldview?
___Moderate ___ Liberal ___Conservative ___ Extremely liberal ___Extremely conservative

Q-29 What is your political affiliation?
___Independent ___ Republican ___Democrat ___ Other

Q-30 What is the highest level of education you have completed? (Please check one response).

___Less than high school diploma ___ High school diploma or GED ___ Technical/Vocational/Associates
___Some college no degree ___ 4-year college degree ___ Some graduate work
___ One or more graduate degrees

Q-31 What was your approximate annual household income before taxes in 2021?.

___Less than \$ 10,000 ___ \$ 10,000 - 24,999 ___ \$ 25,000 - 49,999 ___\$ 50,000 - 74,999
___ \$ 75,000 - 99,999 ___ \$ 100,000 - 124,999 ___ \$ 125,000 - 149,999 ___ \$ 150,000 or more

Q-32 Are you retired? 1. Yes 2. No

If not, **what is your occupation?** OCCUPATION_____

Q-33 Is there anything else you would like to share regarding your views on Wyoming's energy future?

Your time and effort will help shape Wyoming's ability to thrive in the future. Thank you.

APPENDIX B: 2022 SURVEY CORRELATIONS BETWEEN ENERGY TYPES, DEMOGRAPHIC CHARACTERISTICS, VALUES, AND CLIMATE CHANGE

Table B1: Correlations between demographic characteristics and emerging/expanding energy industries

Emerging/expanding energy industries				
Demographic characteristics	Nuclear-based electricity generation	Carbon Capture Utilization and Storage	Rare earth elements / critical minerals mining	Hydrogen generation
Gender	.335, p = .05	.156 p = .004	.333, p = .000	.313, p = .000
Education			-.180, p = .001	
Years in Wyoming				
Age			-.163, p = .002	
Climate Change Beliefs		-.147, p = .007		
Showing correlations that are significant (p<.05). No correlations with political affiliation or income.				

Table B2: Correlations between values and emerging/expanding energy industries

Emerging/expanding energy industries			
Values Respondents have related to Wyoming - Significant associations only.	Carbon Capture Utilization and Storage	Rare earth elements / critical minerals mining	Hydrogen generation
Aesthetic			
Biodiversity			
Cultural			
Community		-.175, p = .009	
Economic	.196, p = .000		.154, p = .004
Future			

Historic		-.157, p = .049	
Intrinsic			
Learning		-.190, .p = .011	
Life Sustaining		-.293, p = .000	
Recreation		-.172, p = .006	
Spiritual		-.215, p = .003	
Subsistence			
Therapeutic		-.236, p = .002	
Showing correlations that are significant (p<.05). No correlations with nuclear-based electricity generation.			

Table B3: Correlations between demographic characteristics and conventional and more established energy industries

Conventional and more established energy industries						
Demographic characteristics	Wind	Coal-based Electricity	Uranium Mining	Oil and Natural gas-based electricity generation and drilling	Utility-scale solar farm	Rooftop solar
Gender		.113, p = .036	.334, p = .000	.130, p = .016		
Political Affiliation	.321, p = .000	-.397, p = .000		-.309, p = .000	.326, p = .000	.242, p = .000
Education	-.130, p = .015	.110, p = .041	-.133, p = .014		-.175, p = .001	-.212, p = .000
Years in Wyoming		.159, .003	.141, p = .009	.143, p = .008		
Age			-.135, p = .012	-.120, p = .026	.155, p = .004	.106 p = .050
Climate Change Beliefs	.497, p = .000	-.581, p = .000	-.141, p = .009	-.535, p = .000	.478, p = .000	.431, p = .000
Showing correlations that are significant (p<.05). No correlations with income.						

Table B4: Correlations between values and conventional and more established energy industries

Conventional and more established energy industries						
Values related to Wyoming	Wind	Coal-based Electricity	Uranium Mining	Oil and Natural gas-based electricity and drilling	Utility-scale solar farm	Rooftop solar
Aesthetic	-.185, p = .006					
Biodiversity		.144, p = .039				
Cultural	R .274, p = .001	-.244, p = .003	.175, p = .040	-.213, p = .011	.174, p = .038	
Community			-.155, p = .021			.325, p = .000
Economic		-.159, p = .038	-.159, p = .040	-.183 p = .016		
Future	R -.196, p = .013					
Learning			-.193, p = .010			
Life Sustaining		-.177, p = .018	-.273, p = .000	-.226, p = .002	.178, p = .018	
Recreation				.124, p = .050		-.144, p = .023
Subsistence	.172, p = .037					
Therapeutic			-.181, p = .020			
Showing correlations that are significant (p<.05). No correlations with Intrinsic, historic or spiritual values.						

Table B5: Correlations between demographic characteristics and EOR

Demographic characteristics	EOR is a safe, effective way to permanently store CO ₂ while also producing oil.	EOR is an important industry that contributes positively to Wyoming's economy.	EOR contributes to the negative consequences of climate change by producing more oil, which results in increased CO ₂ emissions.	EOR is expensive and may not be economically viable.
Gender	.180, p = .003	.222, p = .000	-.139, p = .021	
Political Affiliation	-.223, p = .000	-.290, p = .000	.305, p = .000	.162, p = .013
Income	-.186, p = .003	-.202, p = .001	.217, p = .000	
Years in Wyoming	-.150, p = .014	.199, p = .001		
Age				.171, p = .007
Climate Change Beliefs	.198, p = .001	.257, p = .000	-.471, p = .000	
Showing correlations that are significant (p<.05). No correlations with education.				

Table B6: Correlations between demographic characteristics and geologic storage

Demographic characteristics	Geologic storage of CO ₂ is important to support Wyoming's economy.	Geologic storage of CO ₂ is important because it can allow Wyoming to produce reliable, low-carbon energy from its fossil resources.	Geologic storage of CO ₂ should be one of many low-carbon energy industries that Wyoming develops.	Geologic storage of CO ₂ is a safe and effective way to permanently store CO ₂ .	Developing a geologic storage industry in Wyoming supports the continued use of fossil fuels which results in CO ₂ emissions and contributes to climate change.	Geologic storage of CO ₂ requires expensive technology and infrastructure and may not be economically viable.
Gender	.152, p = .009	.150, p = .012	.212, p = .000	.196, p = .002	.135, p = .023	
Political Affiliation		-.132, p = .029	-.145, p = .014			-.139, p = .027
Education					.140, p = 0.18	
Income				.184, p = .004		
Years in Wyoming		.129, p = .031		.133, p = .034		
Age						
Climate Change Beliefs		.141, p = .018				
Showing correlations that are significant (p<.05)						

Table B7: Correlations between demographic characteristics and information sources

		# Respondents	Local TV #	Network TV #	Cable TV	Wyoming Newspapers #	(Inter)national newspapers #	Radio	Social Media	Family/friends
Politics	Democrat	54	20	15	9	23	15	18	12	19
	Independent	83	10	29	27	48	36	30	37	46
	Republican	203	51	41	41	93	43	60	52	99
Gender	Men	202	39	43	36	93	59	60	46	69
	Women	144	43	45	43	72	35	51	57	99
Education	< 4 Year college degree	161	38	43	39	66	49	63	50	96
	4-year college degree +	193	46	45	42	104	60	63	53	76
Age	< 60	139	23	30	22	66	43	46	45	62
	>60	210	72	58	79	115	52	74	36	82
Missing			260	268	252	173	261	237	276	211

Table B8: Correlations between energy information accessibility and gender

Do you think there is enough readily accessible and understandable information about energy industries, markets, and technologies?

	Gender		Total
	Male	Female	
Yes.	4.0%	3.5%	4.1%
Generally, yes.	21.5%	9.1%	16.2%
It depends on the type of energy industry, market, and technology.	26.0%	25.9%	26.1%
Generally, no.	32.5%	29.4%	31.0%
No.	10.5%	19.6%	14.2%
I don't know because I don't seek out information about energy industries, markets, and technologies.	5.5%	12.6%	8.4%
Total	100.0%	100.0%	100.0%

Table B9: Correlations between beliefs about climate change and support for energy industries

Energy Types	Correlation with Climate Change	Interpretation
	Significant differences between CCHC (climate change is human caused) and NHC (climate change is NOT human caused).	
Wind Energy	-.440, p = .000	CCHC, supports more wind
Coal-based Electricity	.569, p = .000	NHC, supports more coal-based electricity
Uranium Mining	.159, p = .003	NHC, supports more oil/natural gas
Oil/natural gas-based electricity generation and drilling	.509, p = .000	NHC, supports more utility scale solar farms
Utility scale solar farms	-.418, p = .000	CCHC, supports more rooftop solar
Rooftop solar	-.384, p = .000	CCHC, supports more CCUS

Nuclear-based electricity generation	No correlation	
Carbon Capture Utilization and Storage	No correlation	
Rare earth elements/critical minerals mining	No correlation	
Hydrogen generation	No correlation	

APPENDIX C: COMPARISON BETWEEN 2019 AND 2022 SURVEYS

Table C1: Comparison between support for types of energy industries in 2019 and in 2022

Attitudes regarding Types of Energy

How strongly do you favor or oppose each of these energy related activities?	Year Survey	Mean	t	Sig. (2 tailed)	Mean Difference	Interpretation
Wind energy	2019	2.21	-4.95	.000	-.466	Less Support
	2022	2.68				
Coal	2019	2.32	2.26	.024	.203	More support
	2022	2.12				
Oil	2019	2.06	2.853	.004	.210	More support
	2022	1.85				
Gas	2019	1.73	No Significant Difference			/
	2022	1.86				
Rooftop solar	2019	2.01	No Significant Difference			/
	2022	2.09				
Nuclear-based electricity generation	2019	2.91	6.00	.000	.537	More support
	2022	2.37				
Carbon capture utilization and storage	2019	2.61	3.01	0.45	.138	More support
	2022	2.47				
Rare earth elements / critical minerals mining	2019	2.58	4.47	.000	.300	More support
	2022	2.28				

Table C2: Comparison between support and opposition to wind energy in 2019 and in 2022

Differences in levels of support and opposition regarding Wind Energy between 2019 and 2022

	Year Survey	Mean Range 2 to -2	t	Sig. (2-tailed)	Mean Difference
Support because: it provides state and local revenue.	2019	1.23	11.195	.000	.932
	2022	.30			
Support because: it supports our country's energy needs.	2019	1.35	12.548	.000	1.083
	2022	.27			
Support because: it provides electricity without CO2 emissions.	2019	1.18	9.414	.000	.821
	2022	.36			
Support because: it provides well-paying jobs.	2019	1.12	8.529	.000	.702
	2022	.42			
Oppose because: it has negative impacts on wildlife.	2019	1.41	6.963	.000	.824
	2022	.59			
Oppose because: it is unreliable.	2019	1.40	8.456	.000	.967
	2022	.43			
Oppose because: it has negative impacts on recreational activities.	2019	.95	6.249	.000	.848
	2022	.10			
Oppose because: it has too large of an environmental footprint.	2019	1.40	7.089	.000	.880
	2022	.52			

Means reflect Strong Agreement/Favor (2) to Strong Disagreement/Opposition (-2)

Table C3: Comparison between support and opposition to oil and gas activities in 2019 and in 2022

Differences in levels of support and opposition regarding oil and gas energy activities

	Year Survey	Mean Range 2 to -2	t	Sig. (2-tailed)	Mean Difference
Support because: it provides reliable energy.	2019	1.59	4.336	.000	.227
	2022	1.36	4.230	.000	.227
Support because: it provides state and local revenue.	2019	1.69	5.836	.000	.277
	2022	1.41	5.661	.000	.277
Support because: it supports our country's energy needs.	2019	1.56	4.318	.000	.240
	2022	1.32	4.225	.000	.240
Support because: it provides well-paying jobs in Wyoming.	2019	1.65	4.973	.000	.245
	2022	1.40	4.853	.000	.245
Oppose because: it has negative impacts on recreational activities.	2019	.99	10.572	.000	1.532
	2022	-.55	12.735	.000	1.532
Oppose because: it has negative impacts on wildlife, air and water quality.	2019	1.66	11.318	.000	1.860
	2022	-.20	18.956	.000	1.860
Oppose because: it contributes to climate change globally.	2019	1.72	11.661	.000	2.067
	2022	-.35	19.485	.000	2.067

Means reflect Strong Agreement/Favor (2) to Strong Disagreement/Opposition (-2)

Table C4: Comparison between support and opposition to coal related activities in 2019 and 2022

Differences in levels of support and opposition regarding activities related to coal energy

	Year Survey	Mean Range 2 to -2	t	Sig. (2-tailed)	Mean Difference
Support because: it supports our country's energy needs.	2019	1.55	5.967	.000	.393
	2022	1.15	5.990	.000	.393
Support because: it provides well-paying jobs in Wyoming.	2019	1.65	6.549	.000	.374
	2022	1.27	6.574	.000	.374

Support because: it provides state and local revenue.	2019	1.68	6.834	.000	.379
	2022	1.30	6.850	.000	.379
Support because: it provides reliable energy.	2019	1.61	5.878	.000	.362
	2022	1.25	5.903	.000	.362
Oppose because: it has negative impacts on recreational activities.	2019	.83	9.622	.000	1.266
	2022	-.44	10.542	.000	1.266
Oppose because: it contributes to climate change globally.	2019	1.73	12.540	.000	1.867
	2022	-.14	18.477	.000	1.867
Oppose because: it has negative impacts on wildlife, air and water quality.	2019	1.50	11.631	.000	1.679
	2022	-.18	16.041	.000	1.679
Support because: it supports our country's energy needs.	2019	1.55	5.967	.000	.393
	2022	1.15	5.990	.000	.393
Support because: it provides well-paying jobs in Wyoming.	2019	1.65	6.549		

Table C5: Comparison between values in 2019 and 2022

Group Statistics							
	Year Survey	N	Mean	t	Sig. (2-tailed)	Mean Difference	
Aesthetic value	2019	522	13.4964	.512	.609	.374	
	2022	357	12.9504				Same
Biological diversity value	2019	522	12.3336	.173	.863	.54604	
	2022	357	12.1717				Same
Cultural value	2019	522	5.6535	-2.779	.006	.16192	
	2022	357	7.9168				Increase
Community value	2019	522	9.6765	-2.846	.005	-2.26325	
	2022	357	12.4686				Increase
Economic value	2019	522	10.9926	.114	.910	.11787	
	2022	357	10.8747				Same
Future value	2019	522	8.9371	.544	.586	.11787	
	2022	357	8.4546				Same
Historic value	2019	522	6.9993	-2.284	.023	.48252	
	2022	357	8.7851				Increase

Intrinsic value	2019	522	5.0654	-4.207	.000	-3.48438	
	2022	357	8.5498				Increase
Learning value	2019	522	2.8259	-7.121	.000	-6.08241	
	2022	357	8.9083				Increase
Life sustaining value	2019	522	5.8853	-4.982	.000	-4.78493	
	2022	357	10.6703				Increase
Recreation value	2019	522	9.6554	-3.628	.000	-4.78493	
	2022	357	12.8943				Increase
Spiritual value	2019	522	3.8757	-7.476	.000	-6.52011	
	2022	357	10.3959				Increase
Subsistence value	2019	522	5.9993	-2.433	.015	-6.52011	
	2022	357	8.1717				Increase
Therapeutic value	2019	522	6.0903	-3.277	.001	-2.17234	
	2022	357	8.8411				Increase

APPENDIX D: Q-STUDY METHODS

Q-studies are conducted using Q-methodology to explain how participants view trade-offs in a particular situation. Q-methodology is an interview-based social science protocol that identifies the main themes in a discourse (in this case, the discourse around conventional, expanding, and emerging energy activities in Wyoming) using statistically valid, quantitative data. It also provides quantitative data to explain the themes. For example, one Q-study discovered three fundamental perspectives among ranchers regarding range management and the role of government.^{xliii} Armatas et al. conducted a Q-study in Wyoming to explore social-ecological vulnerabilities to water resources under climate change conditions and identified four distinct viewpoints: an environmental perspective, agricultural perspective, Native American perspective, and recreation perspective.^{xliiv}

The Q-methodology results in this report highlight the dominant perspectives key stakeholders hold regarding energy activities and their trade-offs for Wyoming. It is a methodology for identifying and illuminating the range of subjectivity in a discourse, and the reasons for the varieties of subjectivities within that range.

Figure D1: Definitions of the terminology used in this study

Terminology	Description
Q-Methodology	A method used to quantitatively and qualitatively measure subjectivity within a discourse.
Discourse	A conversation regarding a particular topic or issue. In Q-methodology the subject of analysis is the discourse, which is reflected by the statements used in the Q-sort, rather than a population of people.
Q-Study	A study using Q-methodology.
Q-Sort	The placement of cards in the format featured in Figure 1. Each card contains a statement that represents an opinion within a discourse.
Q-Sample	The collection of statements on cards used in a Q-sort.
P-Sample	The participants in a Q-study. Each participant is a stakeholder who represents a particular voice within a discourse.
Factor Analysis	A statistical method that correlates Q-sort responses into groupings or factors. Each grouping of statements is mathematically unique from other groupings.
Factor	A statistically identified group of statements.
Theme	A main perspective within a discourse that is associated with a factor.
Variance	Variance is the percentage of the discourse that is explained by a theme, whereby all themes together provide an understanding of Wyoming’s energy economic discourse.

Q-studies are regarded as one of the most scientific interview protocols available because they are replicable and generate statistically valid results. Q-studies have been applied in a variety of public lands and natural resource planning contexts. For more information about the application of Q-methodology, see the works of Addams and Proops^{xlv} and McKeown and Thomas.^{xlvi} Q-study results can serve as both a starting point for collaborative dialogue and provide the sideboards for what conditions and objectives are acceptable.

For this Q-study, the first step was to invite the potential interviewees identified by participants in the elicitation study. Although the survey was stratified by gender, the invitations to participate in this study were based on the individuals who were suggested to us in the elicitation study, and not stratified for gender. Invitations were sent by email to diverse stakeholders who are professionally involved in Wyoming’s energy discourse. Follow-up emails were sent and telephone made to determine individuals’ willingness to participate and to find a convenient time for them to be interviewed.

The resulting 22 interviews were conducted during October 2022 through January 2023. Each interview took on average 45 minutes.

Prior to the interviews being conducted, we prepared the Q-sample of statements which interviewees would be asked to sort. This was done using the exact language that survey respondents used in the open-ended survey questions. As a result, the language used in this study is rooted in Wyoming’s energy discourse using statements taken directly from Wyoming residents.

Figure D2: Q-study participant professional fields and gender

Participants		Professional Field	Participants	Gender
5		Industry	18	Male
5		Government	4	Female
1		Agriculture		
7		Conservation		
3		University		
1		Utility		

From an initial list of 55 statements, which were allocated into 13 categories, 36 statements were selected (see Table XX) using the following criteria:

1. The final Q-sample needed to include statements from all 13 categories.
2. Each statement had to use as much as possible the original, place-based language (although editing was sometimes necessary for sentence structure and clarity).
3. Each statement had to be clear, while maintaining the complexity of the interviewee’s thought, to reflect the trade-offs in residents’ minds.

Prior to being interviewed, each Q-study participant completed the Q-sort exercise online—a process of sorting the selected 36 statements in the Q-sample based on how strongly the participant agreed or disagreed with them. Participants were asked to rank the 36 statements from Strongly Agree (5) to Strongly Disagree (-5), based on the gridded pattern that appears in the example completed Q-sort show in *Figure D3*, with each number in the grid representing a different statement. A completed Q-sort reflects the degree to which a participant agrees or disagrees with each statement, which are numbered for identification. In this exercise it is important which column a statement is placed, but the row does not matter.

After participants completed the Q-sort exercise, we conducted interviews with them to understand their deliberation process in choosing how to sort the statements and the trade-offs they considered (see interview questions in *Appendix E*). Both the Q-sorts (which provided the quantitative data) and the interview (which provided the qualitative data) were used in our analysis.

The quantitative data was used to identify the main themes in the discourse and was conducted using principal components analysis to draw out statistically valid factors, where each factor represents a theme in a discourse. The 22 completed Q-sorts from our participants were loaded into PQMethod software, which uses principal components analysis to generate factors, or themes. The themes are derived from the numerical placement of the statements in each Q-sort on the continuum from -5 (strongly disagree) to 5 (strongly agree). Each theme resulting from PQMethod software is formed by a group of statements that correlate with each other. Resulting themes are also significantly different from each other.

The qualitative data was used to understand and explain the themes. Interviews were analyzed based the perspectives that most strongly characterize each theme. As a whole, Q-methodology reflects the internal deliberation a person goes through on any subject and captures the internal subjectivity of the participant and the context in which their deliberation takes place.

Figure D3: Diagram of Q-sort exercise showing grid on which participants must place 36 statements.

This figure represents an example of how a participant’s Q-sort might look after completion. Each number correlates to a different statement. The Q-sort reflects where the participant ranked each statement.

	Strongly Agree	5	4	3	2	1	Not Applicable	0	-1	-2	-3	-4	-5	Strongly Disagree
11		22	36	13	20	8		32	24	35	1		29	
		28	3	12	31	27		17	6	30	15			
			10	4	14	7		16	34	25				
				19	23	26		33	2					
					21	5		18						
						9								

APPENDIX E: Q-STUDY INTERVIEW QUESTIONS

1. While deciding what statements you agreed or disagreed with, were there any trade-offs that were particularly difficult?
2. Considering that these statements represent the public discourse or conversation regarding energy production and its future role in Wyoming, do you feel your viewpoints and opinions are represented? Is there anything missing?
3. What statements did you most agree with and why?
4. What statements did you most disagree with and why?
5. What statements wound up more in the middle section and why?
6. Generally, what would you change about energy production in Wyoming, if anything?
7. Why?
8. In Wyoming there is a running discussion about our “energy transition”. What does that phrase mean to you?
9. If we in the State of Wyoming are to be successful regarding your idea of an “energy transition”, what would that look like to you?



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