

Americans' Views of Fusion Energy: Implications for Sustainable Public Support

Hank Jenkins-Smith, Carol Silva, Kuhika Gupta, Joe Ripberger,
Andrew Fox, and Will Livingston



OU Institute for Public Policy Research and Analysis (IPPRA)

- IPPRA' interdisciplinary team focuses on improving our **social choice infrastructure** to enable effective, sustainable policy decisions
- We work with clients (federal agencies, national labs, and others) to provide analysis, data and advice on across a range of policy issue areas, including:
 - Energy; facility siting, new technologies
 - Community engagement research to facilitate social/technical decision making
 - Nuclear security program sustainability
 - Weather, climate, and natural disasters
 - Education/workforce development

The Fusion Energy Context

- Successful commercialization of fusion energy poses both technical and social challenges
- The social challenge is to achieve sustainable public acceptance of a novel energy technology that will require investment, development, facility siting, manufacturing and energy production
- Commercial nuclear energy has made a large contribution to the US energy mix over the last 80 years; but we must also **overcome an enduring legacy** of accidents, perceptions, and disappointments
- But we first need to understand the differences and similarities in public perceptions, trust and acceptance between fusion and other energy sources
- There has been very little previous systematic research on the social acceptance of fusion energy, and none focusing on the US

Energy and Environment

- As part of our energy portfolio, IPPRA began conducting annual surveys on energy and the environment in 2006
 - Most comprehensive source of information on public attitudes about nuclear energy technology in the world
- We also use machine learning and NLP to analyze millions of messages on Twitter about nuclear energy, including messages about fusion energy
 - Information sharing networks
 - Sentiment, key topics, disinformation, and emerging ideas

PLANET Tool

Public and Local Attitudes about Nuclear Energy Technology

From the Fastest Path to Zero Initiative & National Institute for Risk & Resilience

Maps

Methodology

Data Export

About

Joseph Ripberger

These maps show how Americans' nuclear energy risk perceptions, benefit perceptions, and policy support vary at the state and county levels.

Select a measure below and click on the map to explore data for each county.

Support for building new reactors

Risk Perception

Benefit Perception

Select a state below to see a map showing county information for that state.

Select a state

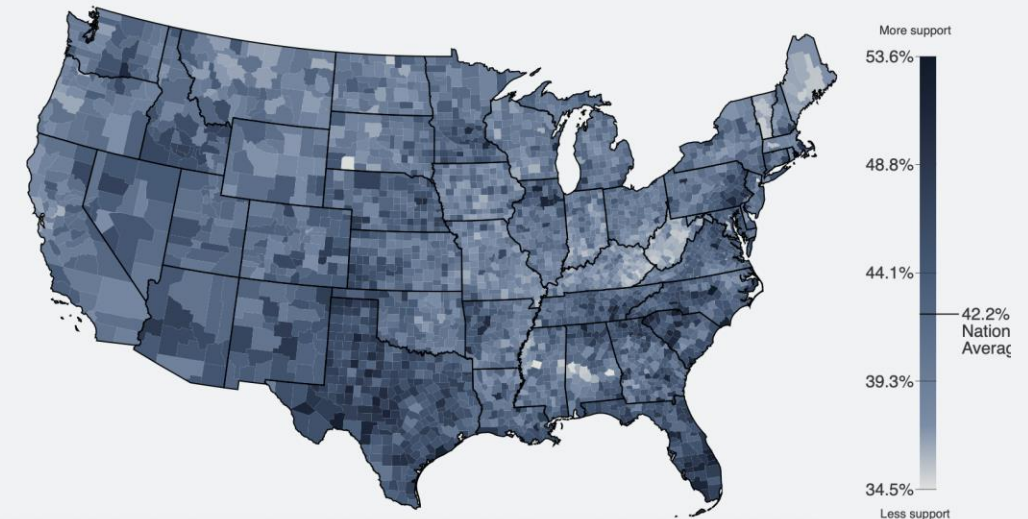
UNITED STATES

Estimated % of adults who support construction of new nuclear reactors

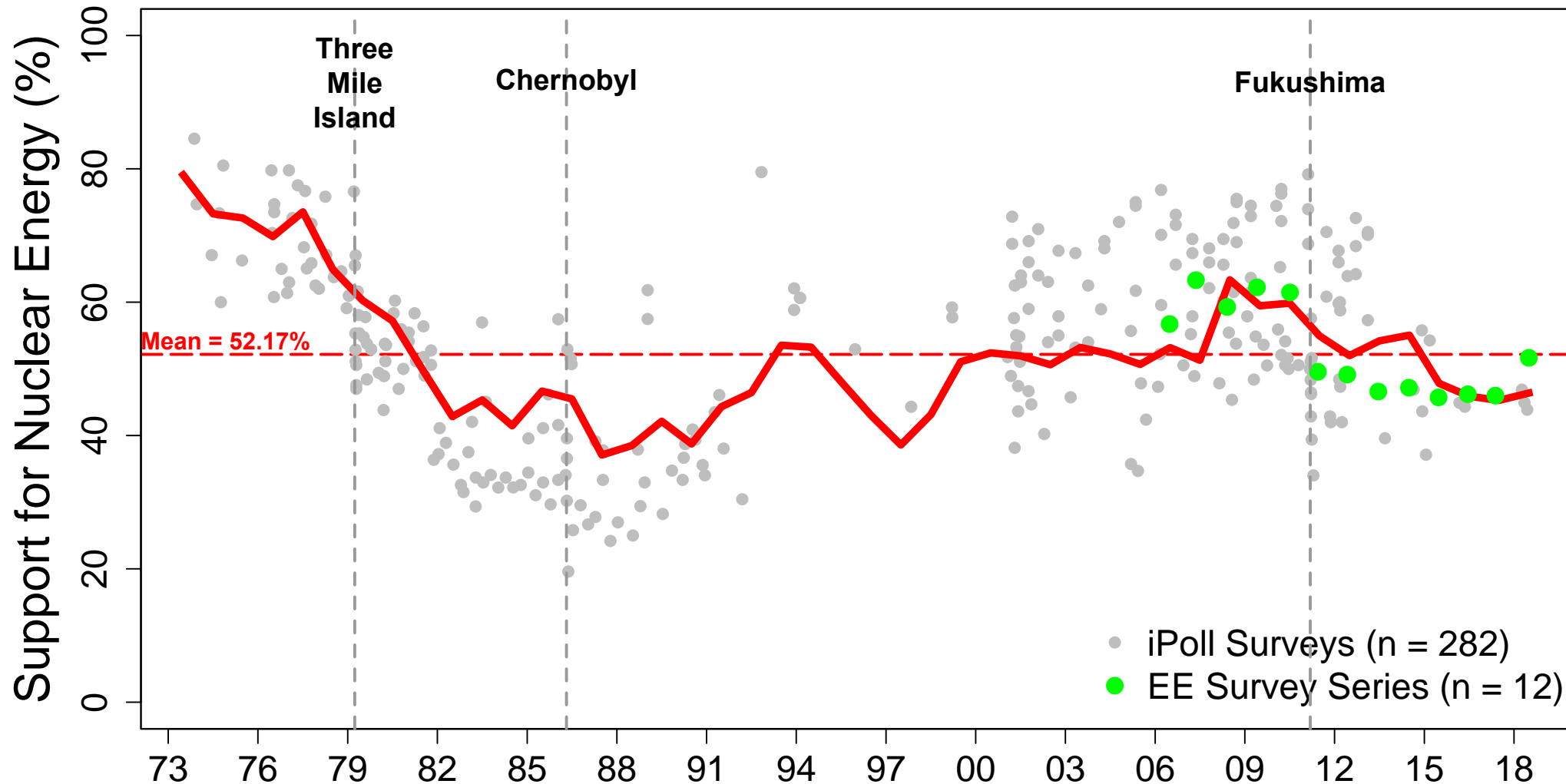
Counties

raw value

difference



Evolution of Nuclear Attitudes in the US



Gupta, K., Nowlin, M. C., Ripberger, J. T., Jenkins-Smith, H. C., & Silva, C. L. (2019). Tracking the nuclear 'mood' in the United States: Introducing a long term measure of public opinion about nuclear energy using aggregate survey data. *Energy Policy*, 133, 110888.

Fusion Energy Survey

- Sample of 2,016 people who are demographically representative of the US adult population
 - Date: January 19-30, 2023
 - Average complete time: 12 minutes
 - Weights to match US census estimates (gender, age, race, ethnicity, and geographic region)
- Roughly 60 questions
 - Focus on fusion energy
 - Questions on traditional nuclear energy and advanced nuclear energy technologies to provide baseline comparison



Images and Public Narratives

Image differences across three randomly assigned prompts

Narratives about fusion will be entangled with narratives about traditional nuclear energy.

To measure this, we randomly assigned respondents to one of three groups and elicited the images associated with descriptors of fusion and nuclear energy:

“Can you tell us the first three words or phrases that come to you when you think about [...]”

- *fusion energy*
 - *nuclear fusion*
 - *nuclear energy*
- } random assignment

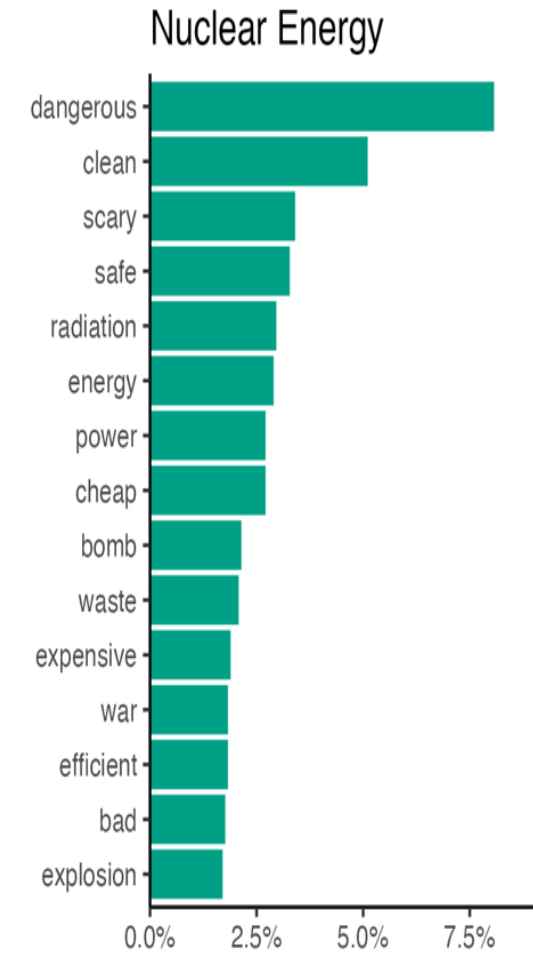
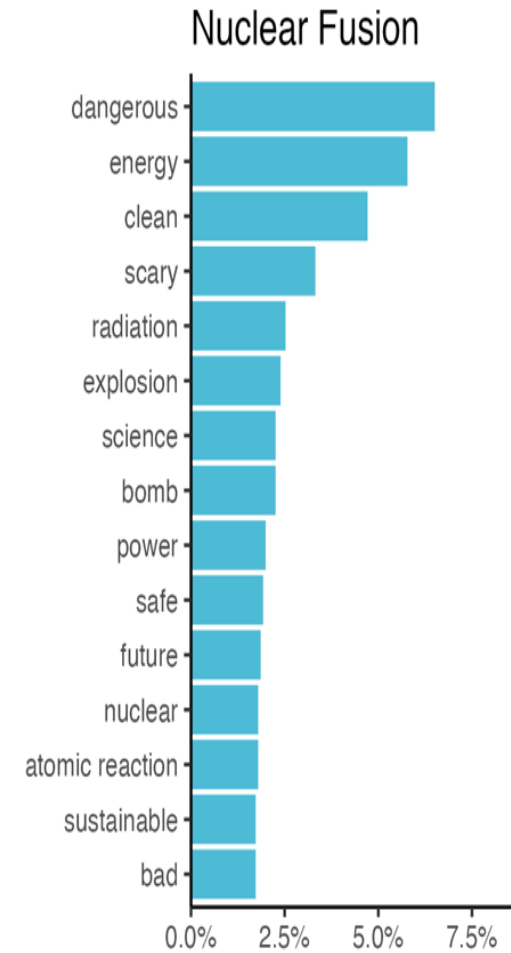
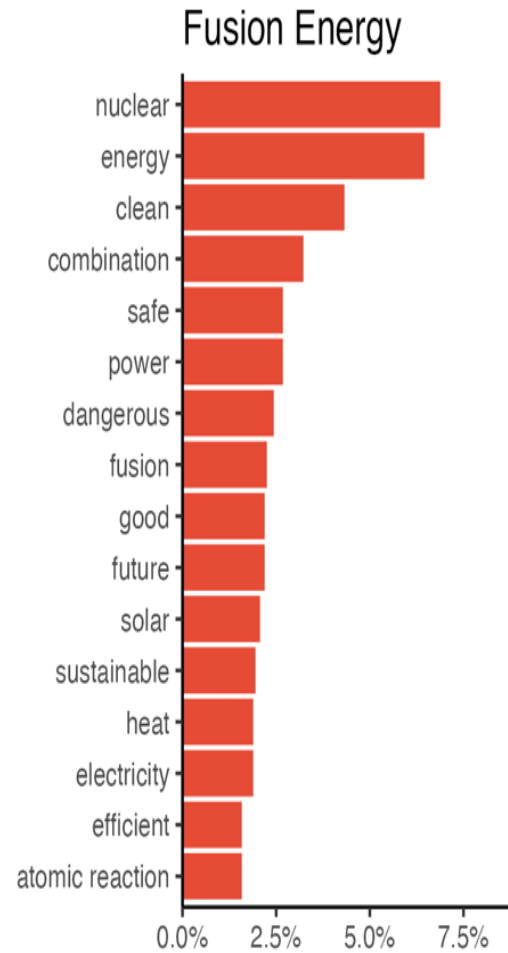
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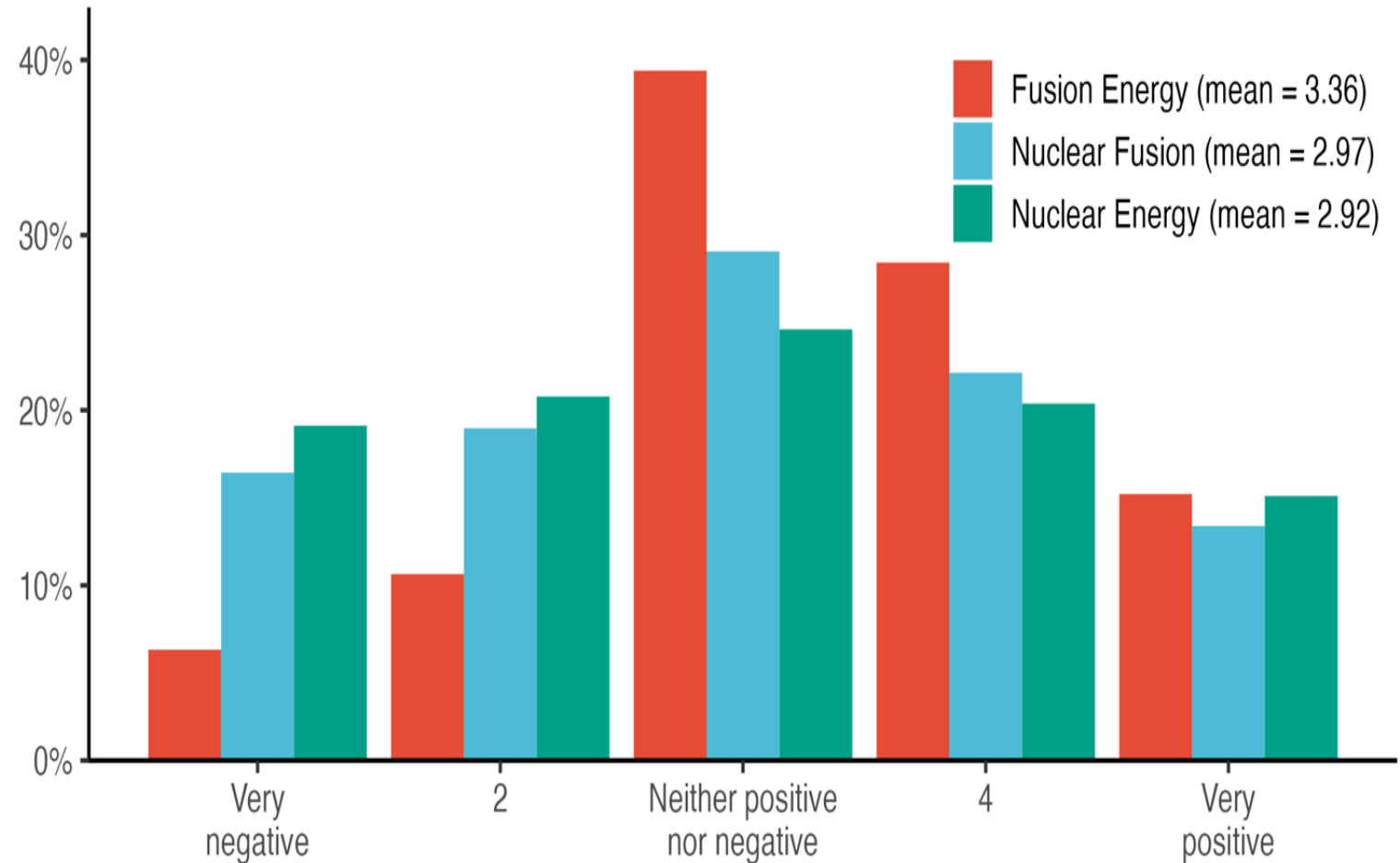


Images

After the word elicitation, we measured the differences in the positive and negative emotions attached to the imagery:

“When you think about this word or phrase, do you have positive or negative feelings?”

Responses were coded on a 5-point scale, ranging from “very negative” (1) to “very positive” (5)



Public awareness of fusion energy

Awareness

To measure the US public's awareness, and to set up the following questions about fusion energy, we provided the following introduction:

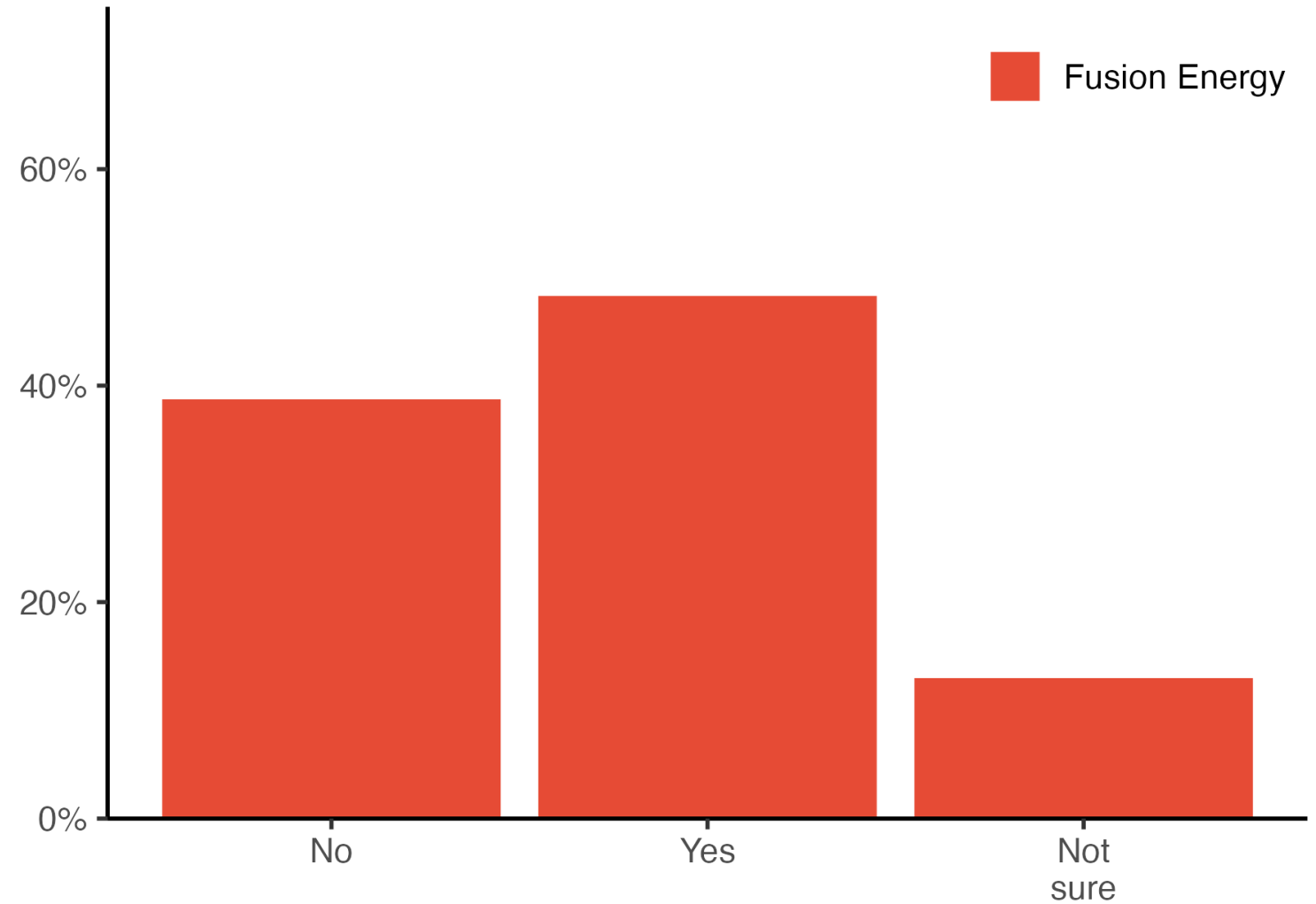
Now we want you to think carefully about fusion energy. Please review this information before you continue.

The US government is providing incentives to accelerate research and development of fusion energy. Fusion is the process of combining two or more small atoms to form a single larger atom. This process, which powers the sun, releases an enormous amount of energy. Some scientists believe that we can harness it on earth to produce a clean, safe, and virtually limitless energy source. While progress has been made in developing fusion as a viable energy source, it is still in the development stage and is not yet ready for widespread use.

Awareness

We then asked:

Before reading this information, had you heard about *fusion energy*?

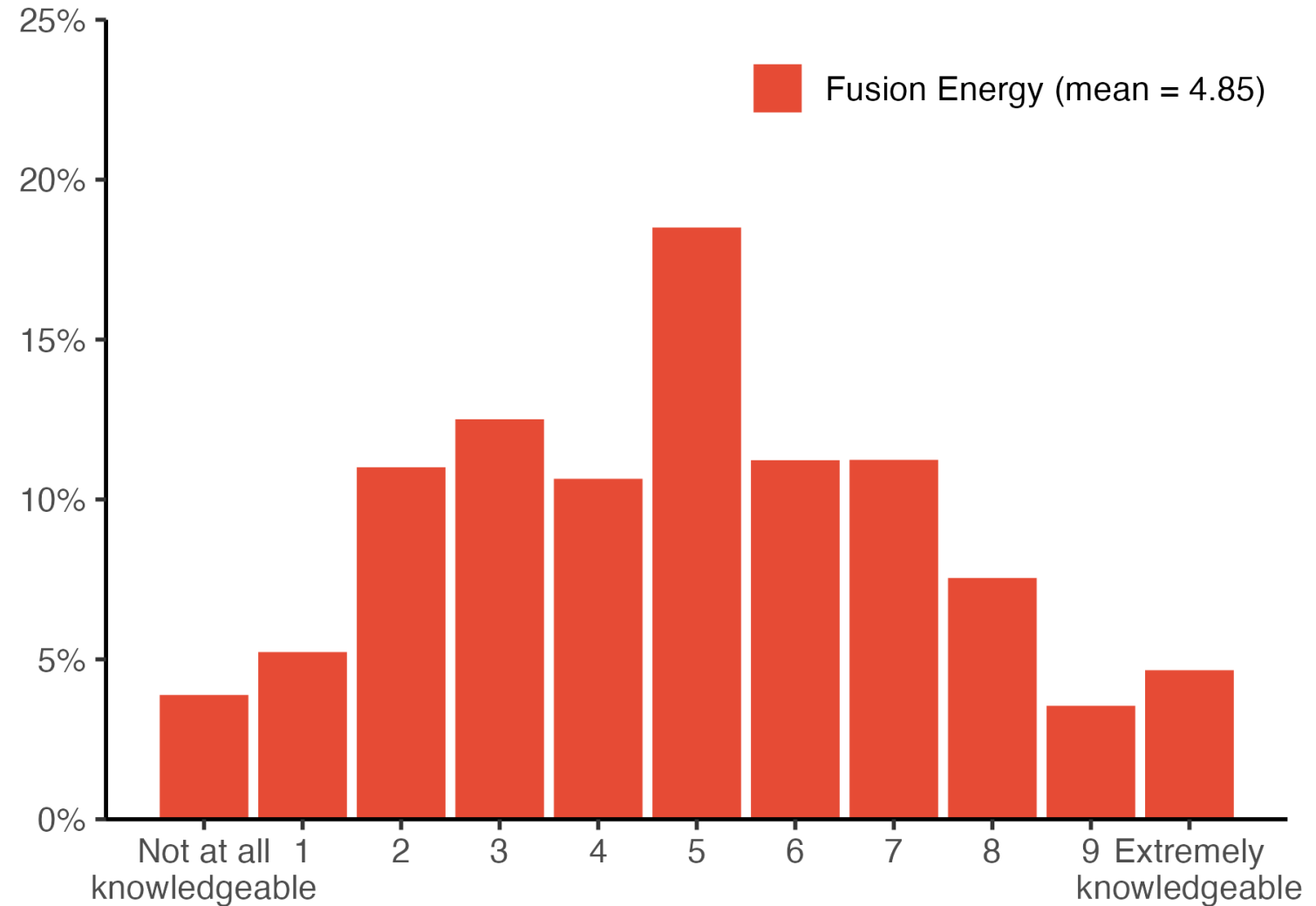


Source: OU IPPRA Fusion Survey (2023)

Self-reported knowledge of fusion energy

For those who said they were aware of fusion energy (before taking this survey), we asked:

“How would you rate your knowledge of *fusion energy* technology?”



Source: OU IPPRA Fusion Survey (2023)

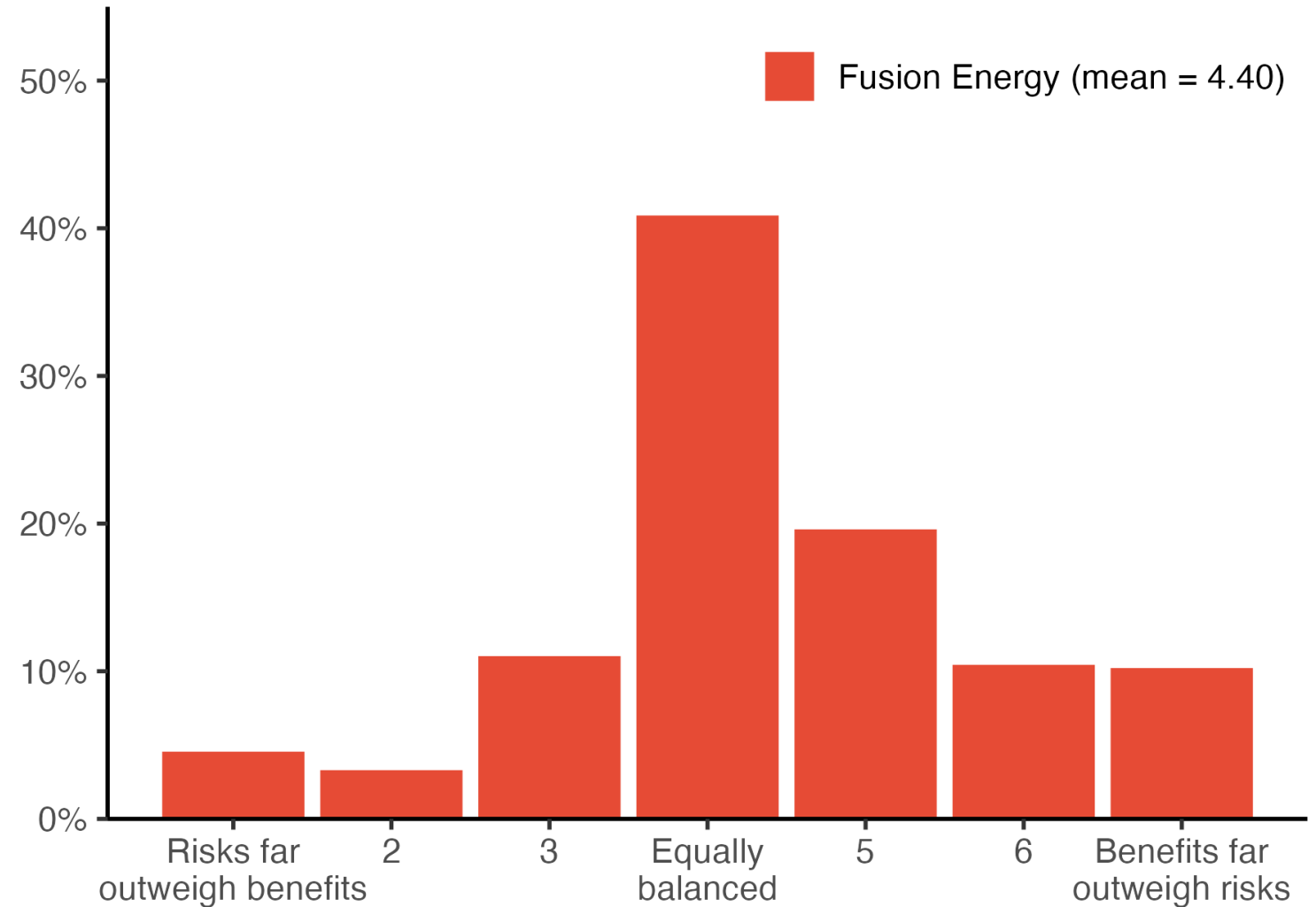
Risk and benefit perceptions

Risk and benefit perceptions

To measure risk and benefit perceptions, we asked the following question:

As with all energy sources, there are both risks and benefits of fusion energy.

How do you rate the overall balance of the risks and benefits of fusion energy in the US? It is ok if you don't know very much about the technology. Just give us your first impressions.



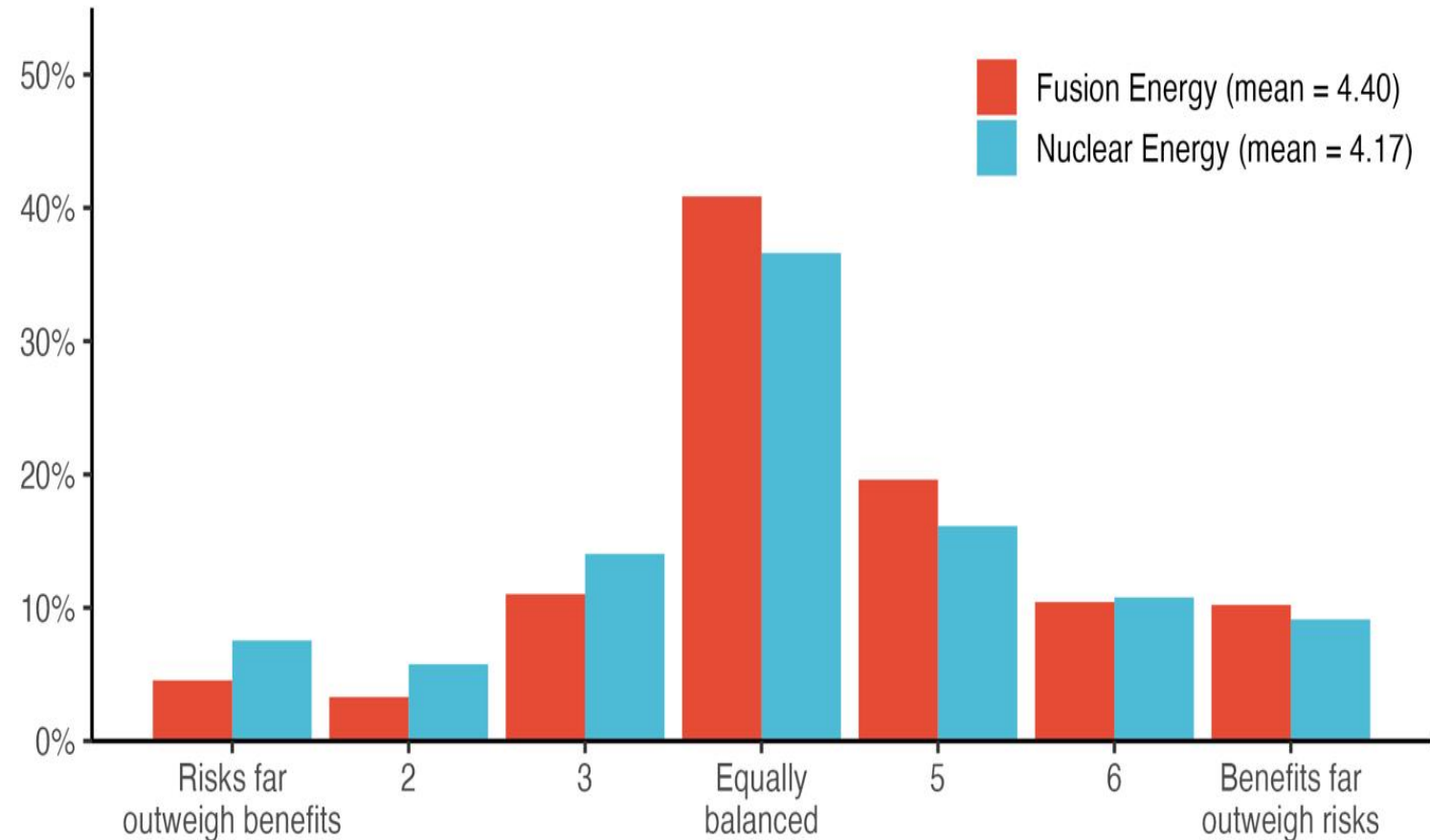
Source: OU IPPRA Fusion Survey (2023)

Risk and benefit perceptions

We compared the perceived risks of fusion energy with those of “advanced nuclear energy” (SMRs, micro-reactors) and traditional “nuclear energy”:

- How do you rate the overall balance of the risks and benefits of nuclear energy in the US?

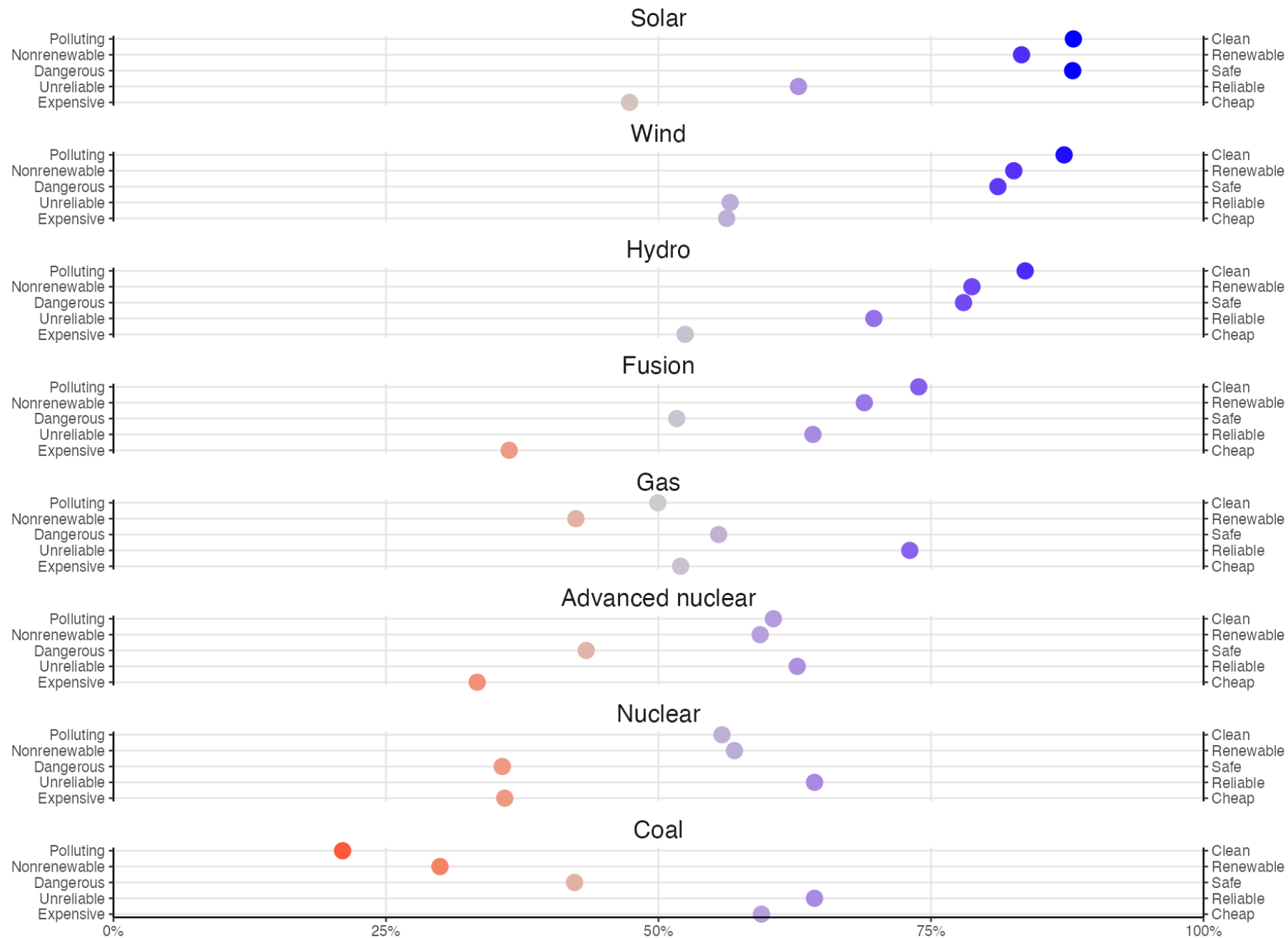
The perceived balance currently favors fusion energy, though the differences are modest



Attributes

Now we want to know what kinds of qualities you associate with different sources electricity. Please select a description in each row for every energy source.

Polluting ↔ Clean
 Nonrenewable ↔ Renewable
 Dangerous ↔ Safe
 Unreliable ↔ Reliable
 Expensive ↔ Cheap



Support and opposition

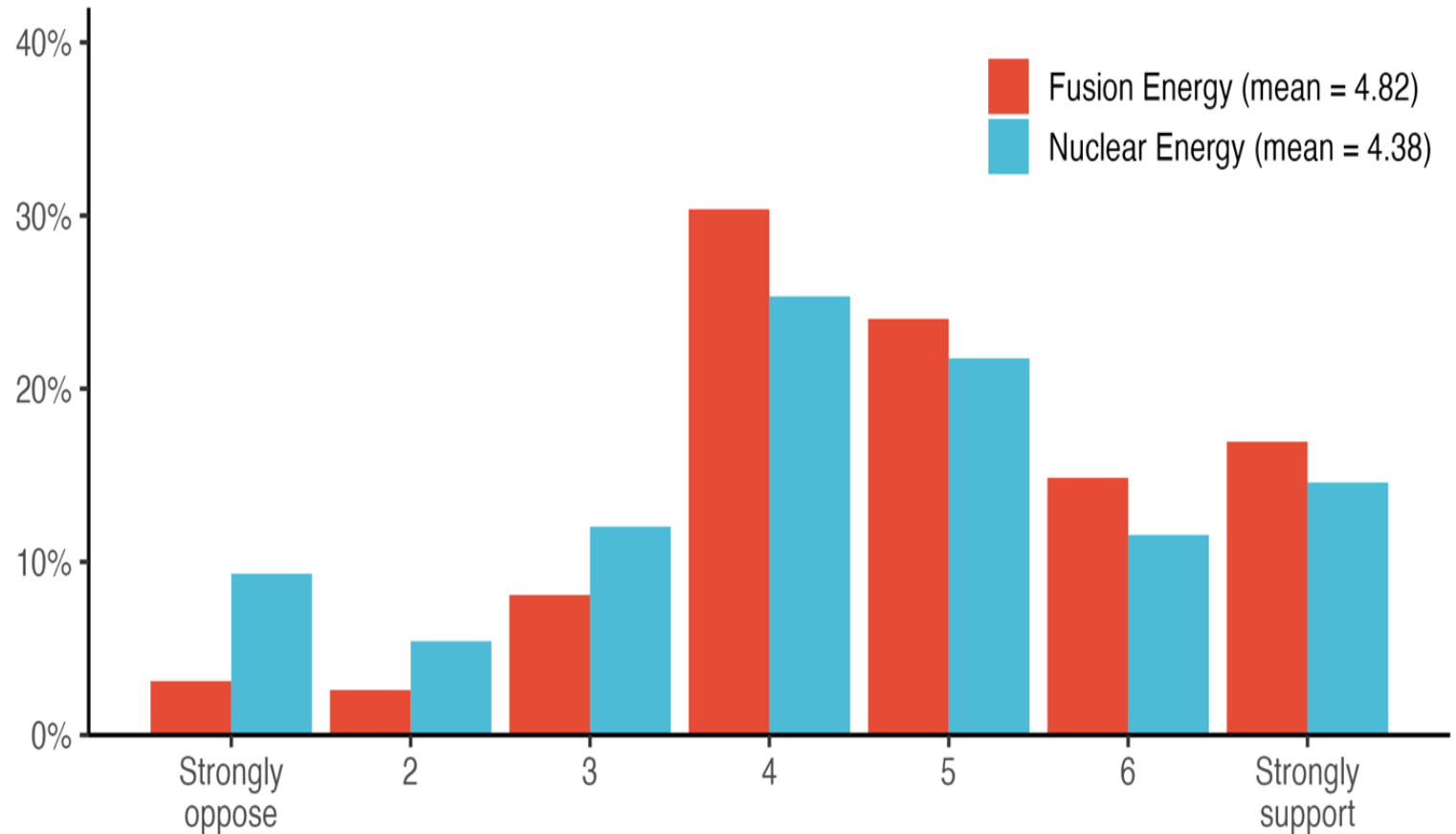
Support and opposition

To measure general support for fusion energy, in comparison with nuclear energy, we asked:

How do you feel about the construction and use of **fusion** power plants to generate electricity in the US?

How do you feel about the construction and use of **nuclear** power plants to generate electricity in the US?

Responses were coded on a 7-point scale ranging from “strongly oppose” (1) to “strongly support” (7)

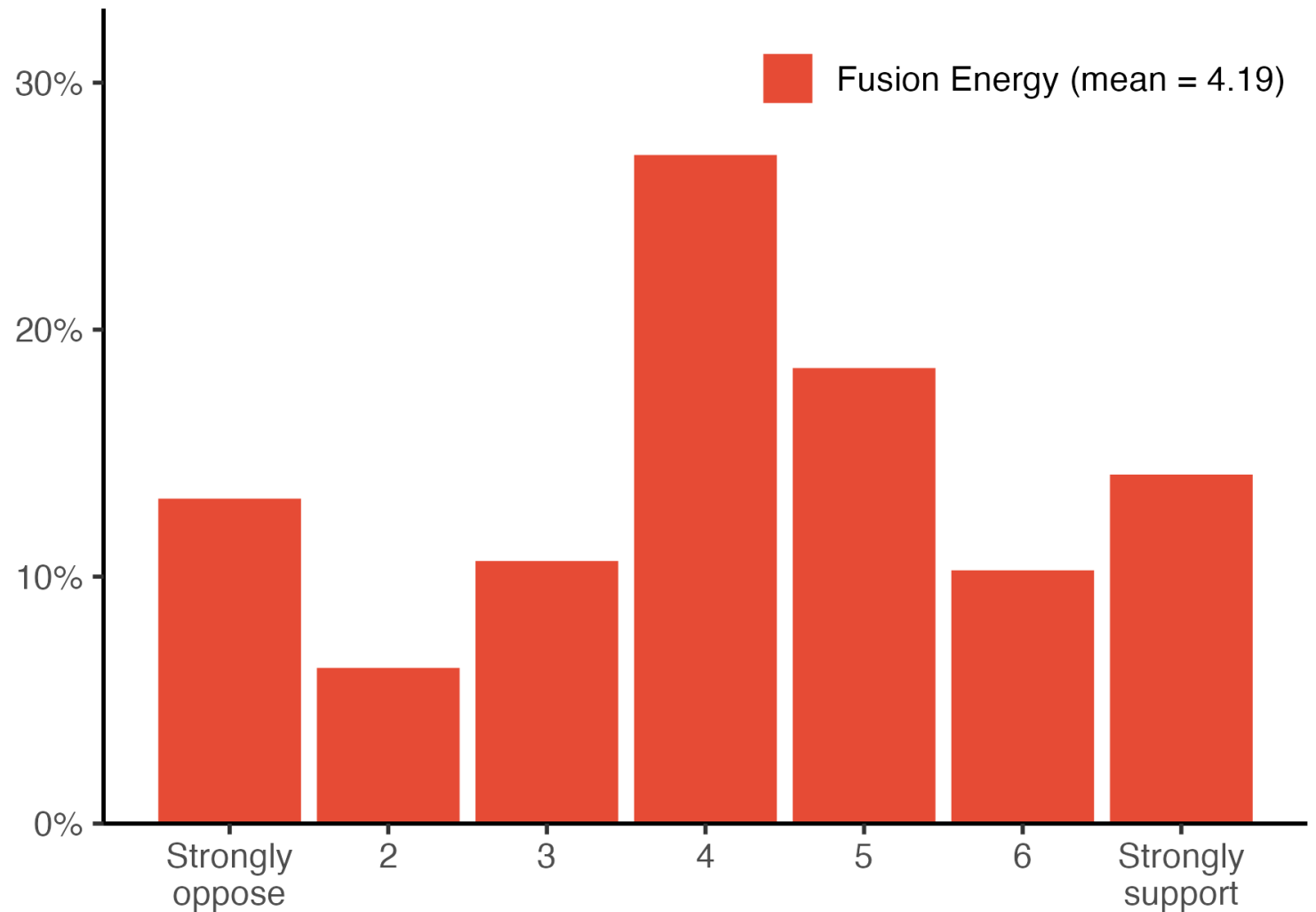


Support and opposition

The legacy of traditional nuclear energy is most apparent in the area of facility siting and NIMBY reactions. For fusion, we posed the following question:

Some companies are looking for communities in the US to host pilot facilities for fusion energy. These facilities would be used to conduct research and development on **fusion energy**, and, eventually, house pilot power plants that convert fusion energy into electricity.

How would you feel about a proposal to host a **fusion energy** facility within [10 | 50] miles of your residence?

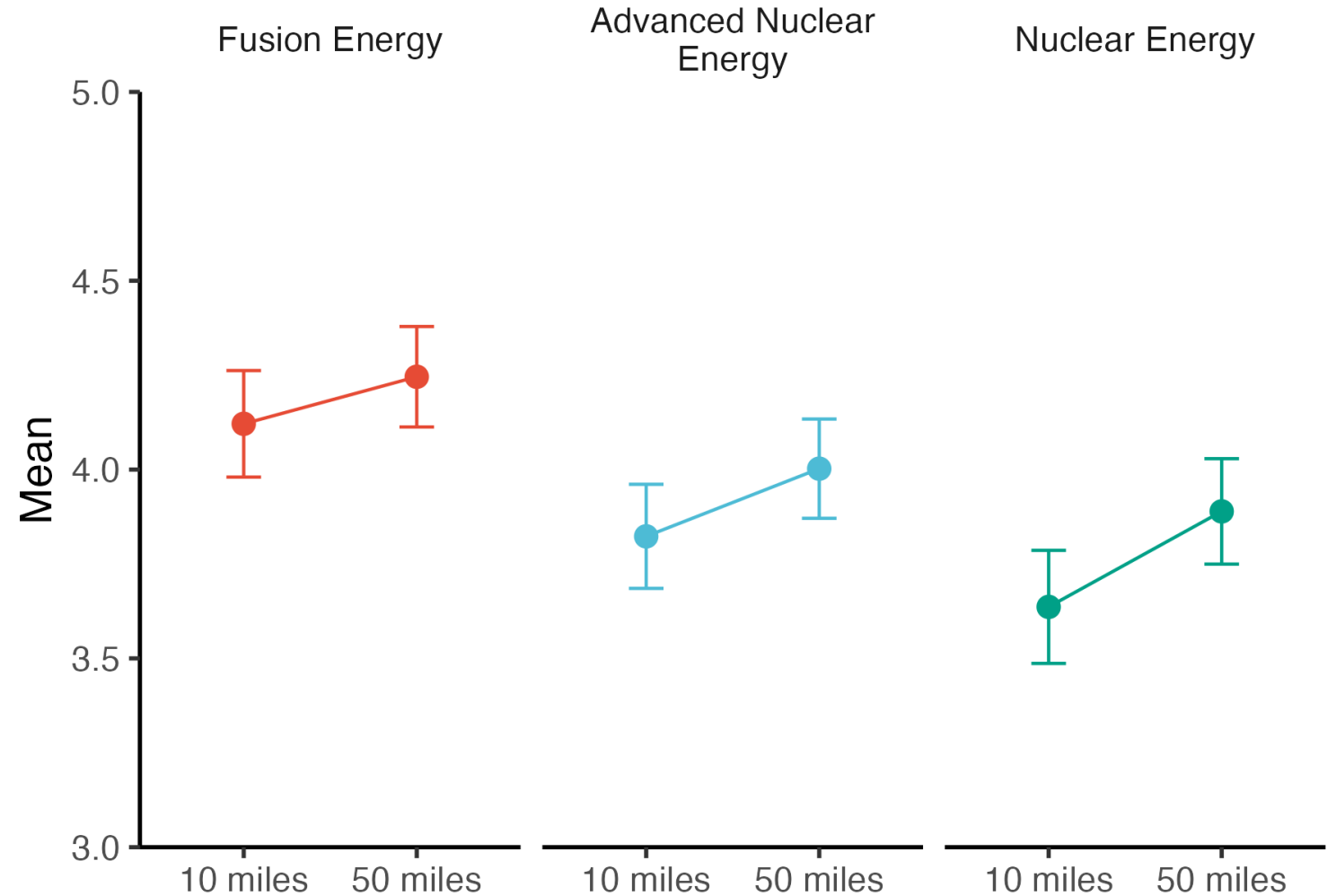


Source: OU IPPRA Fusion Survey (2023)

Support and opposition

We experimented with the effect of distance on support for facility siting, randomly assigning respondents to hear that the proposed site was 10 or 50 miles from their residence:

- How would you feel about a proposal to host a **fusion energy** facility within [10 | 50] miles of your residence?
- How would you feel about a proposal to host a **nuclear energy** facility within [10 | 50] miles of your residence?
- How would you feel about a proposal to host an **advanced nuclear energy** facility within [10 | 50] miles of your residence?



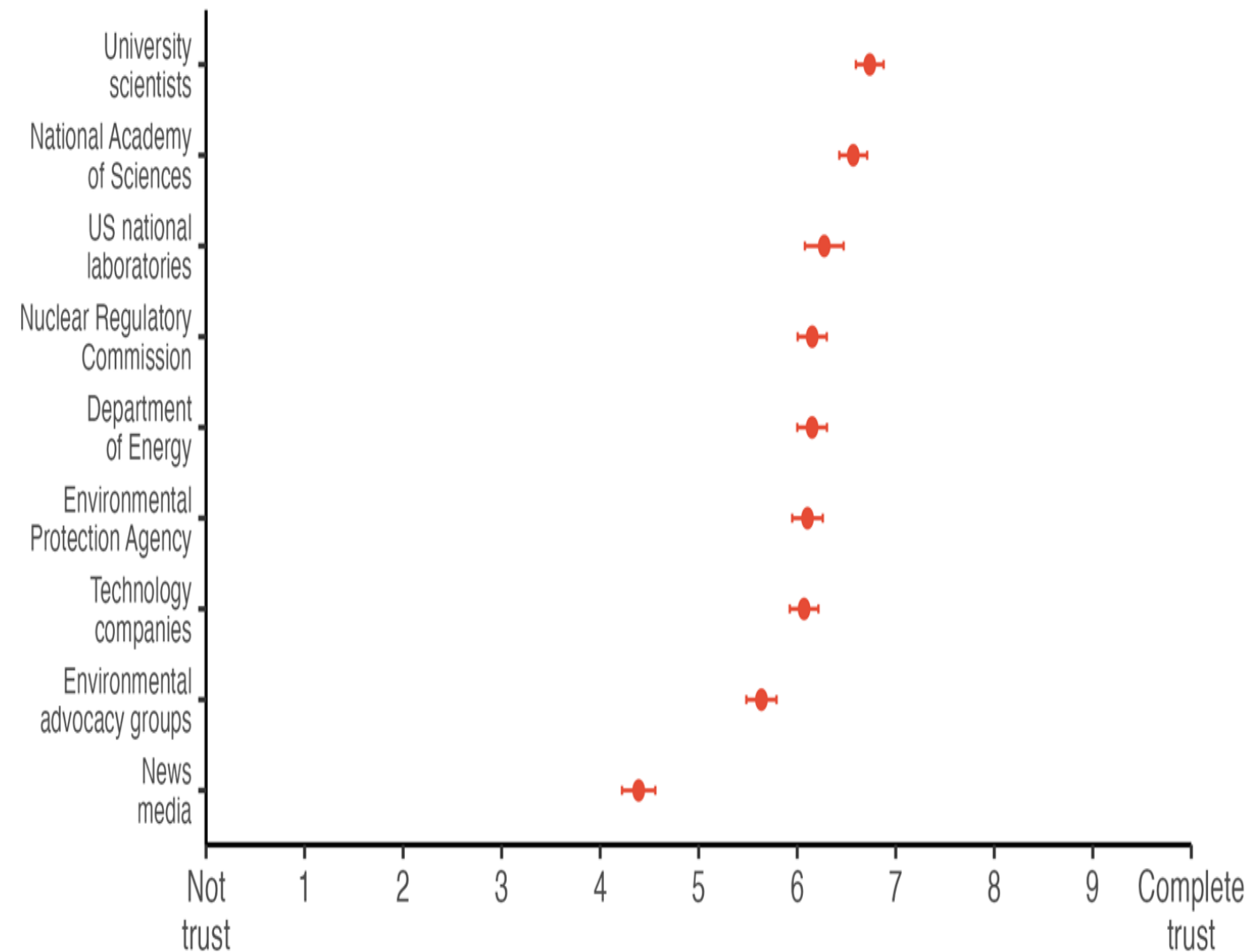
Source: OU IPPRA Fusion Survey (2023)

Trust

Trust in technical experts

New technologies can be technically complex and getting information you can trust is important. Please indicate your level of trust in information about fusion energy provided by technical experts from each of the following organizations.

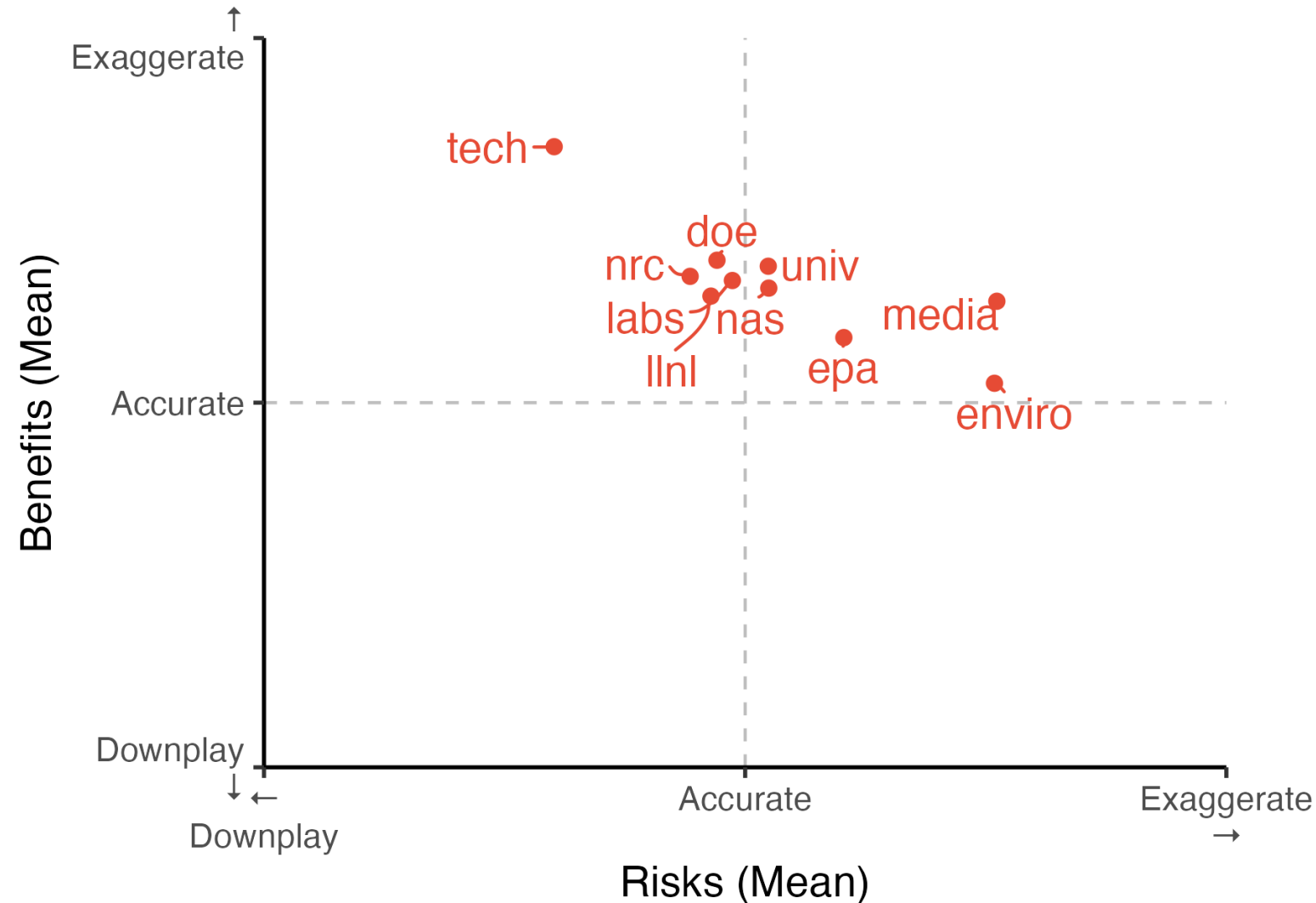
- US Nuclear Regulatory Commission
- US Environmental Protection Agency
- US national laboratories
- US Department of Energy
- Lawrence Livermore National Lab
- National Academy of Sciences
- Environmental advocacy groups
- Companies that are researching and developing fusion energy
- University scientists
- News or media



Perceived bias of technical experts

Now we want to know your impressions of how different organizations are likely to describe the **risks** of fusion energy. Some organizations may downplay or exaggerate risks while others accurately report on them. Please rate your impressions of how each organization is likely to describe the risks of fusion energy.

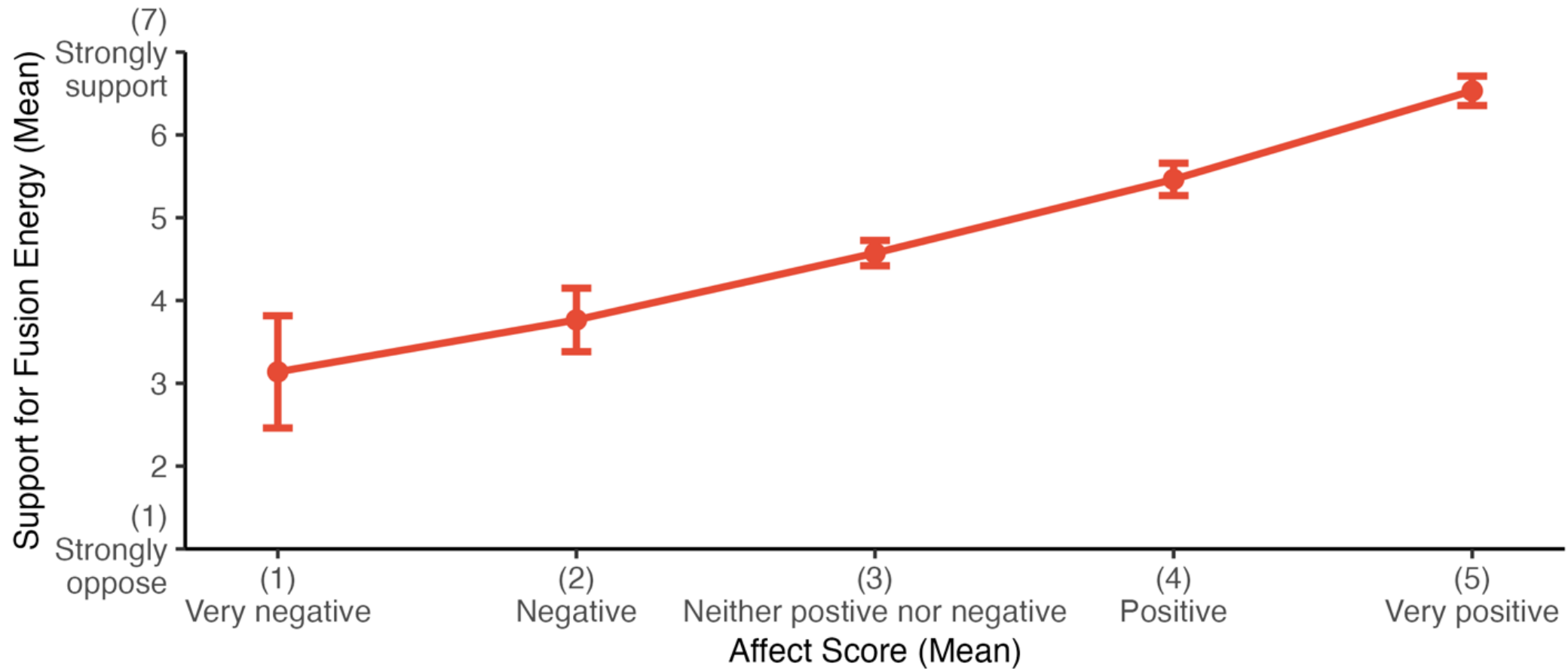
We also want to know your impressions of how different organizations are likely to describe the **benefits** of fusion energy. Some organizations may downplay or exaggerate benefits while others accurately report on them.



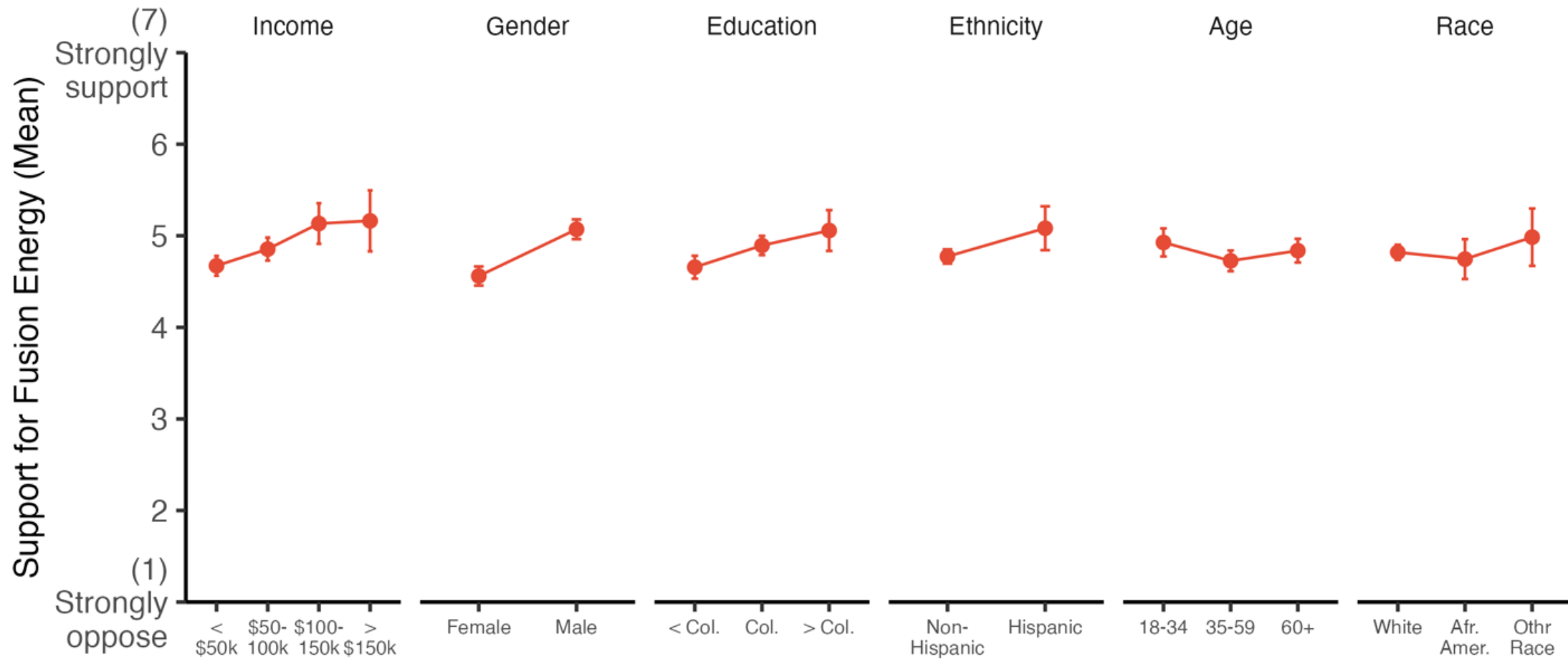
Source: OU IPPRA Fusion Survey (2023)

Who supports fusion energy?

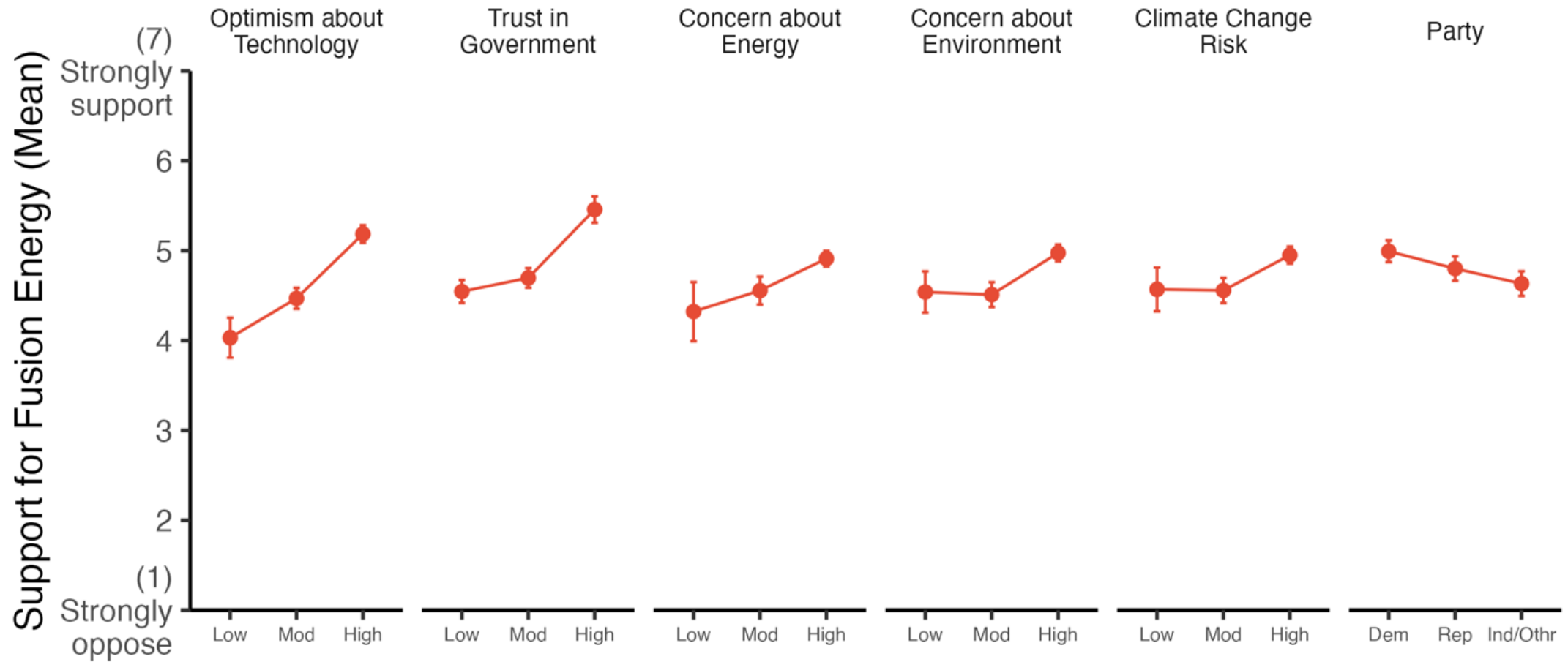
Who supports fusion energy?



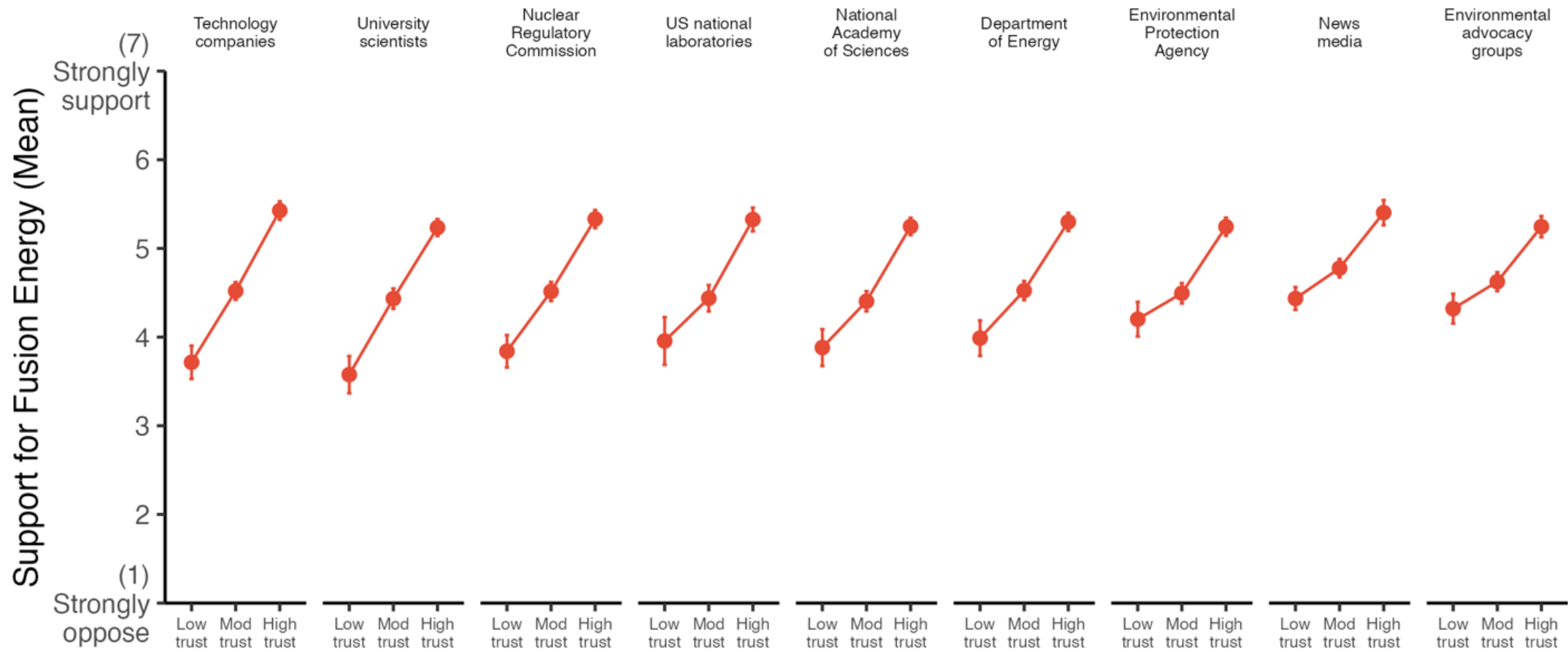
Who supports fusion energy?



Who supports fusion energy?



Who supports fusion energy?



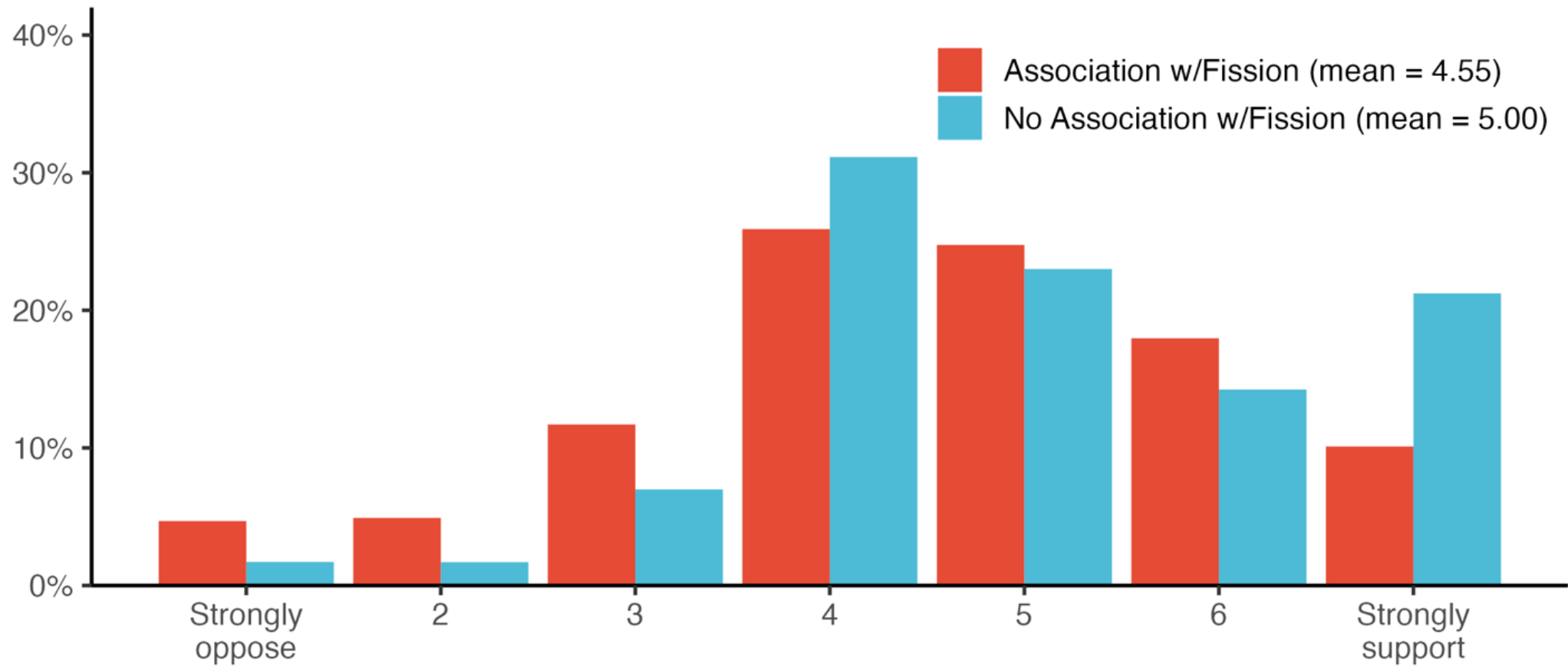
Implications of Association with Fission Energy

Association with fission

Respondent Support for Fission vs. Fusion Energy

	Oppose Fusion Energy (Response = 1-3)	Not Sure about Fusion Energy (Response = 4)	Support Fusion Energy (Response = 5-7)
Oppose Fission Energy (Response = 1-3)	10%	8%	9%
Not Sure about Fission Energy (Response = 4)	2%	14%	10%
Support Fission Energy (Response = 5-7)	2%	9%	37%

Association with fission



Takeaways

Takeaways

Images

- Impressions of fusion energy are generally positive (impressions of “nuclear fusion” are a bit less positive)
- Some people associate fusion energy with nuclear energy, even if we call it fusion energy

Awareness

- Many people have heard of fusion energy, but are not confident that they know much

Risk and benefit perceptions

- Benefit perceptions slightly outweigh risk perceptions, but many people are right in the middle
- Not yet polarized; but ripe for entanglement with traditional nuclear narratives

Support and opposition

- Most people say they support fusion energy, but many remain unsure
- A bit less support for hosting a fusion energy facility, but comparatively high

Takeaways

Trust

- Trust is highest for university scientists, NAS, and labs; lowest in news/media
- People expect technology companies to exaggerate the benefits and downplay the risks of fusion energy
- Trust drives support for fusion, notably for tech developers and regulators

Who supports fusion energy?

- Views and images about nuclear energy are most predictive of support
- Demographic differences are relatively small
- Beliefs about technology, trust in government, and concerns about energy and the environment are also important; not yet infected by political polarization

Implications

- Know where you are on the trust map
- Understand that no-one controls the narrative, and narratives shape imagery
- Entanglement with the traditional nuclear narrative is probable
- Trust is a precious resource – particularly for tech developers and regulators. Don't squander it.

Thank you! Questions?

Contact Information:

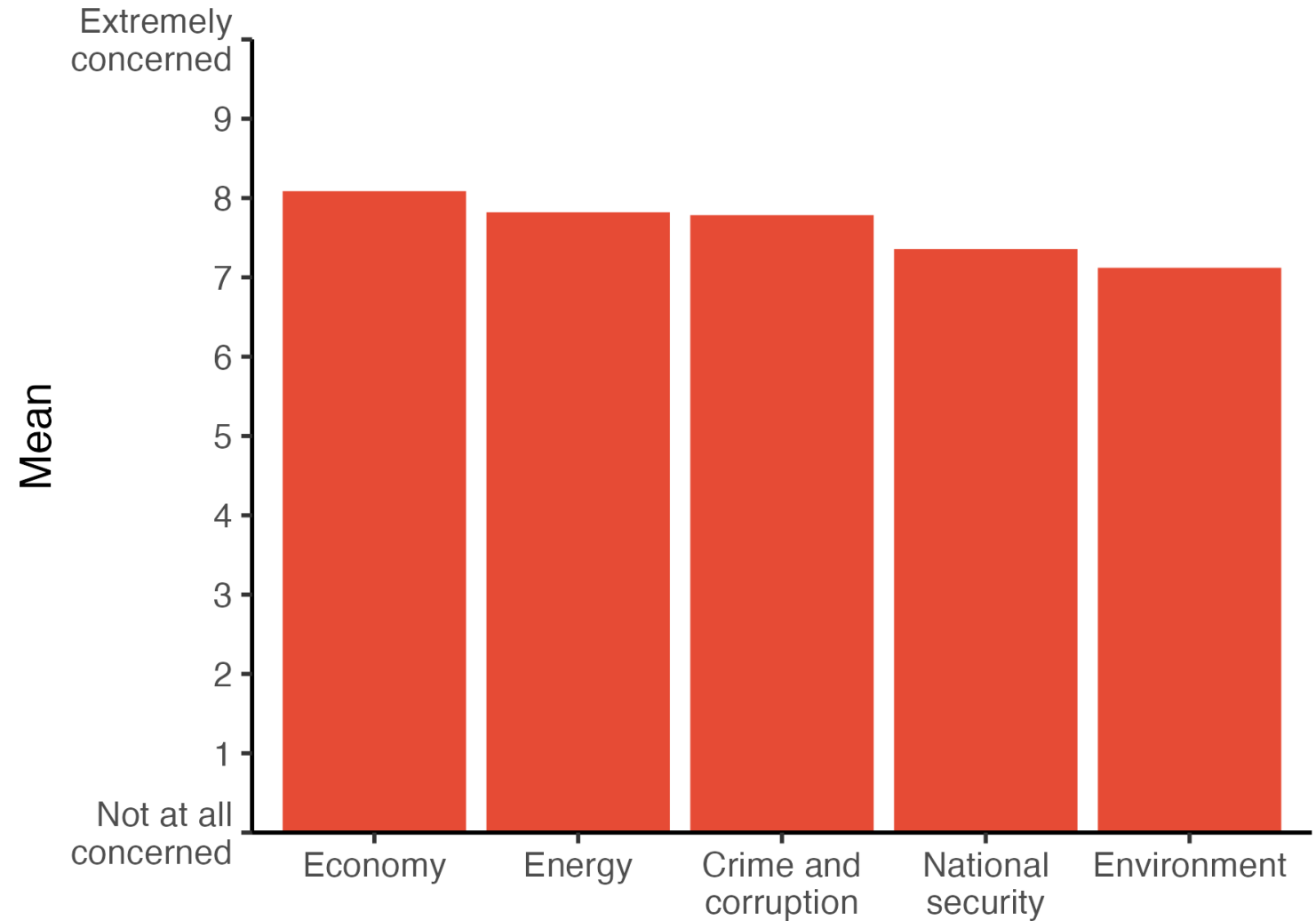
- Hank Jenkins-Smith (hjsmith@ou.edu)
- Carol Silva (clsilva@ou.edu)
- Kuhika Gupta (kuhikagupta@ou.edu)
- Joe Ripberger (jtr@ou.edu)
- Andrew Fox (asfox@ou.edu)



Concerns

Please rate your level of concern about each of the following issues:

- National security (including terrorism and war)
- Energy (including cost and availability)
- Economy (including jobs and inflation)
- Crime and corruption
- Environment (including pollution and climate change)

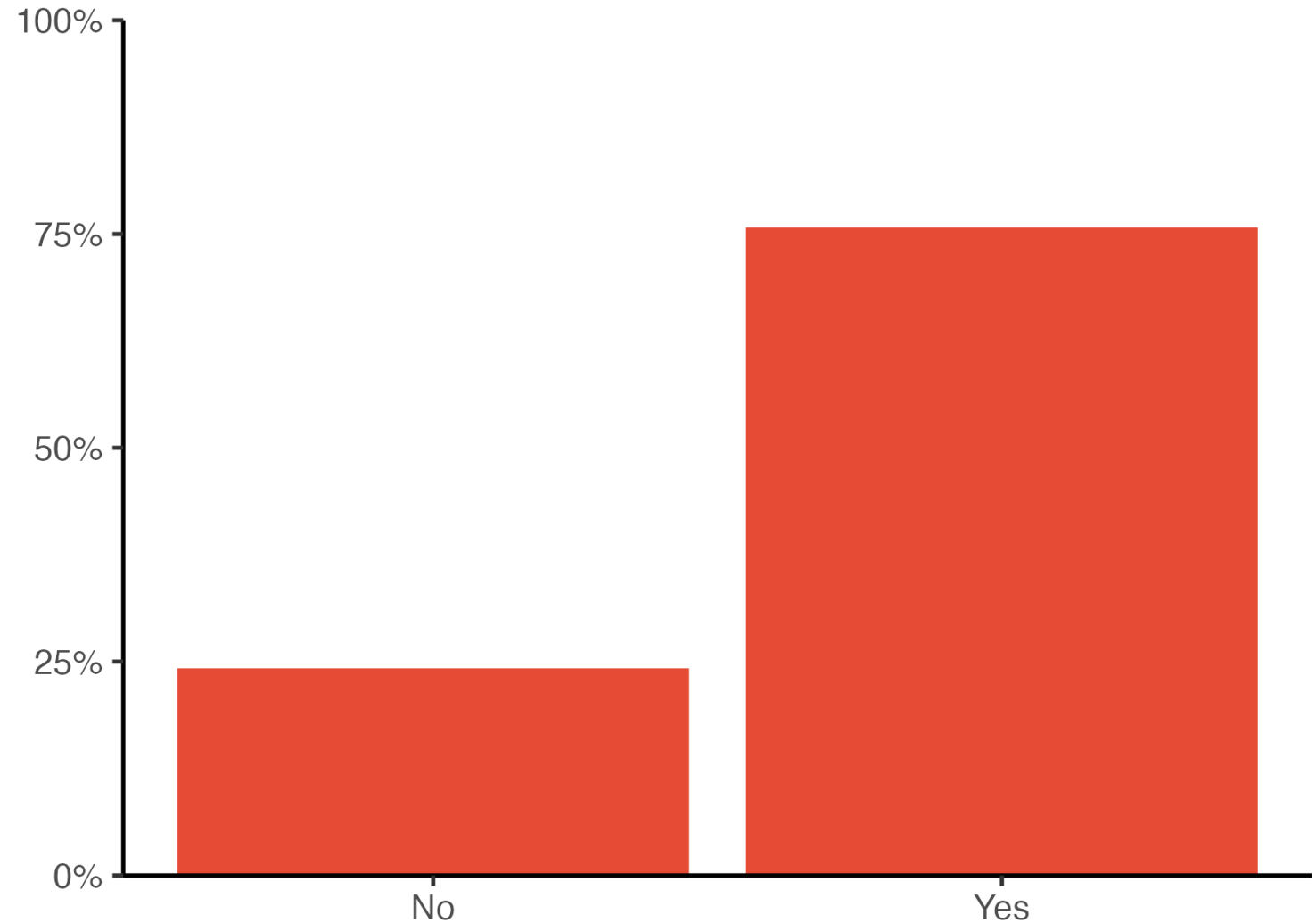


Source: OU IPPRA Fusion Survey (2023)

Climate change

As you may know, the issue of global warming has been the subject of public discussion over the last few years.

In your view, are greenhouse gases, such as those resulting from the combustion of coal, oil, natural gas, and other materials, causing average global temperatures to rise?



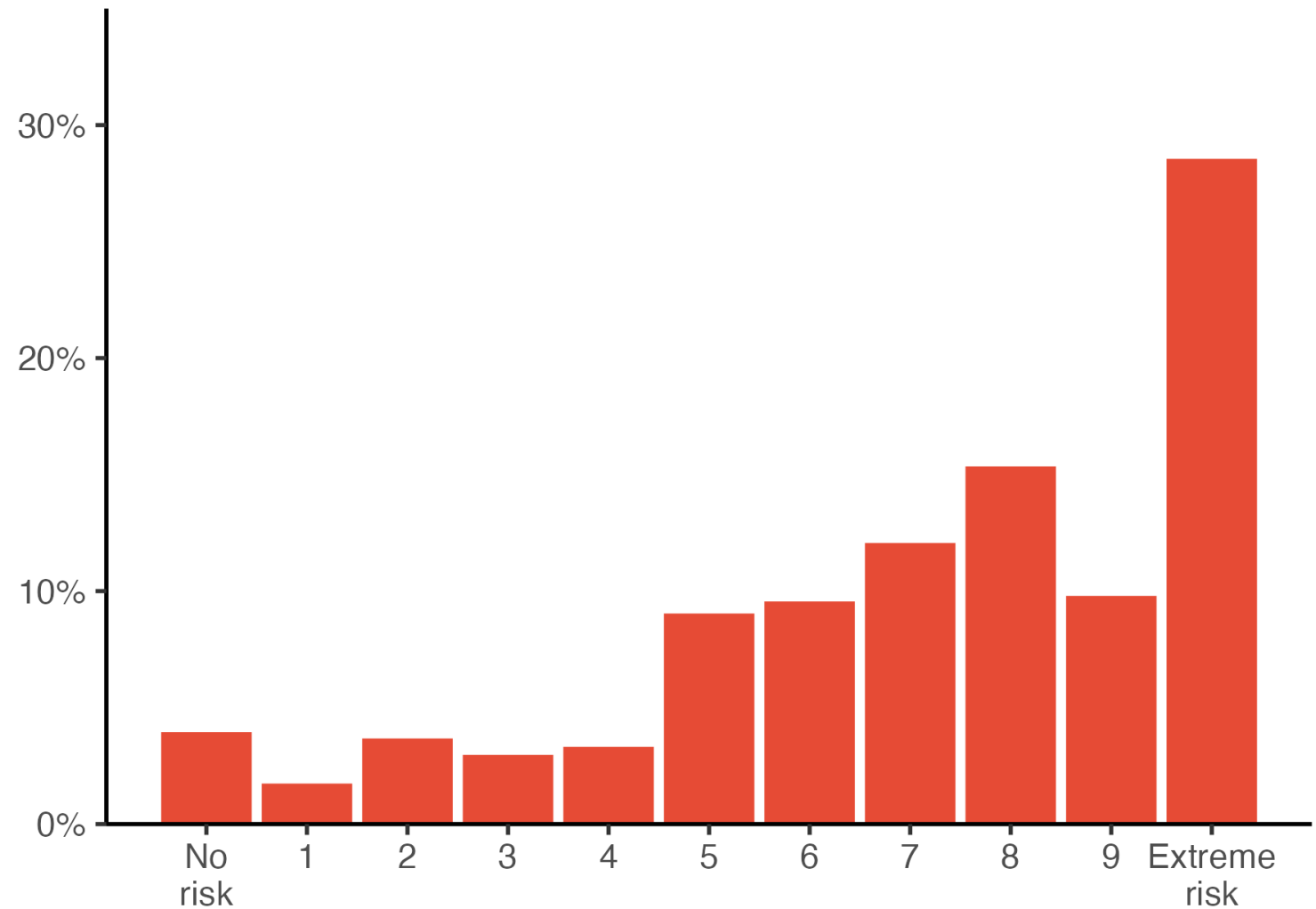
Source: OU IPPRA Fusion Survey (2022)

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In your view, are greenhouse gases, such as those resulting from the combustion of coal, oil, natural gas, and other materials, causing average global temperatures to rise?

On a scale from zero to ten, where zero means no risk and ten means extreme risk, how much risk do you think global warming poses for people and the environment?

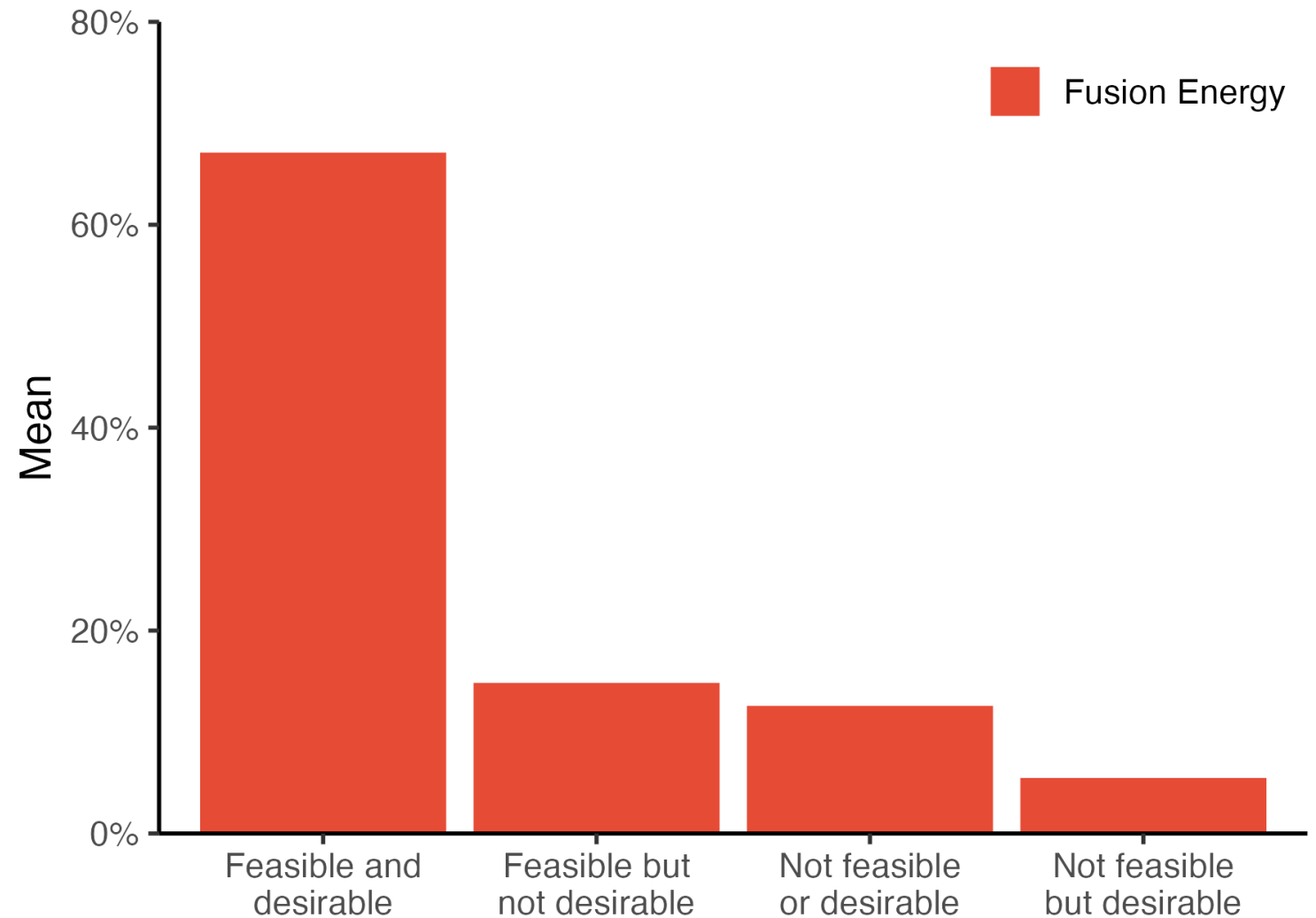


Source: OU IPPRA Fusion Survey (2023)

Feasibility and desirability of fusion

Given what you know now, will it be technically **feasible** to produce electricity from fusion energy in the future? (In other words, can it happen?)

Given what you know now, will it be **desirable** to produce electricity from fusion energy in the future? (In other words, should it happen?)

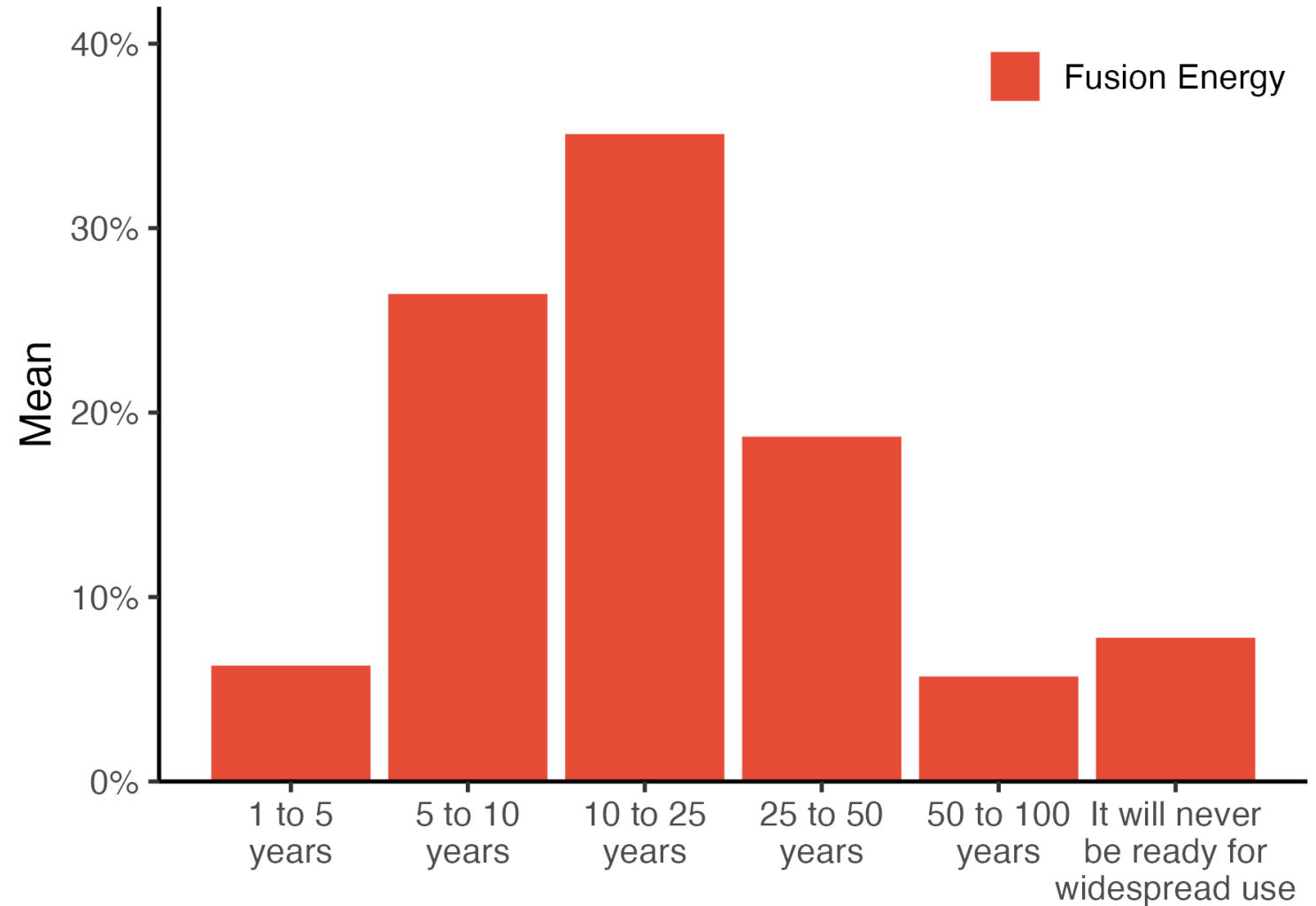


Source: OU IPPRA Fusion Survey (2023)

Perceived time to widespread deployment

We asked our survey respondents:

If you were to guess, when do you think fusion energy technology will be ready for widespread use in the US?



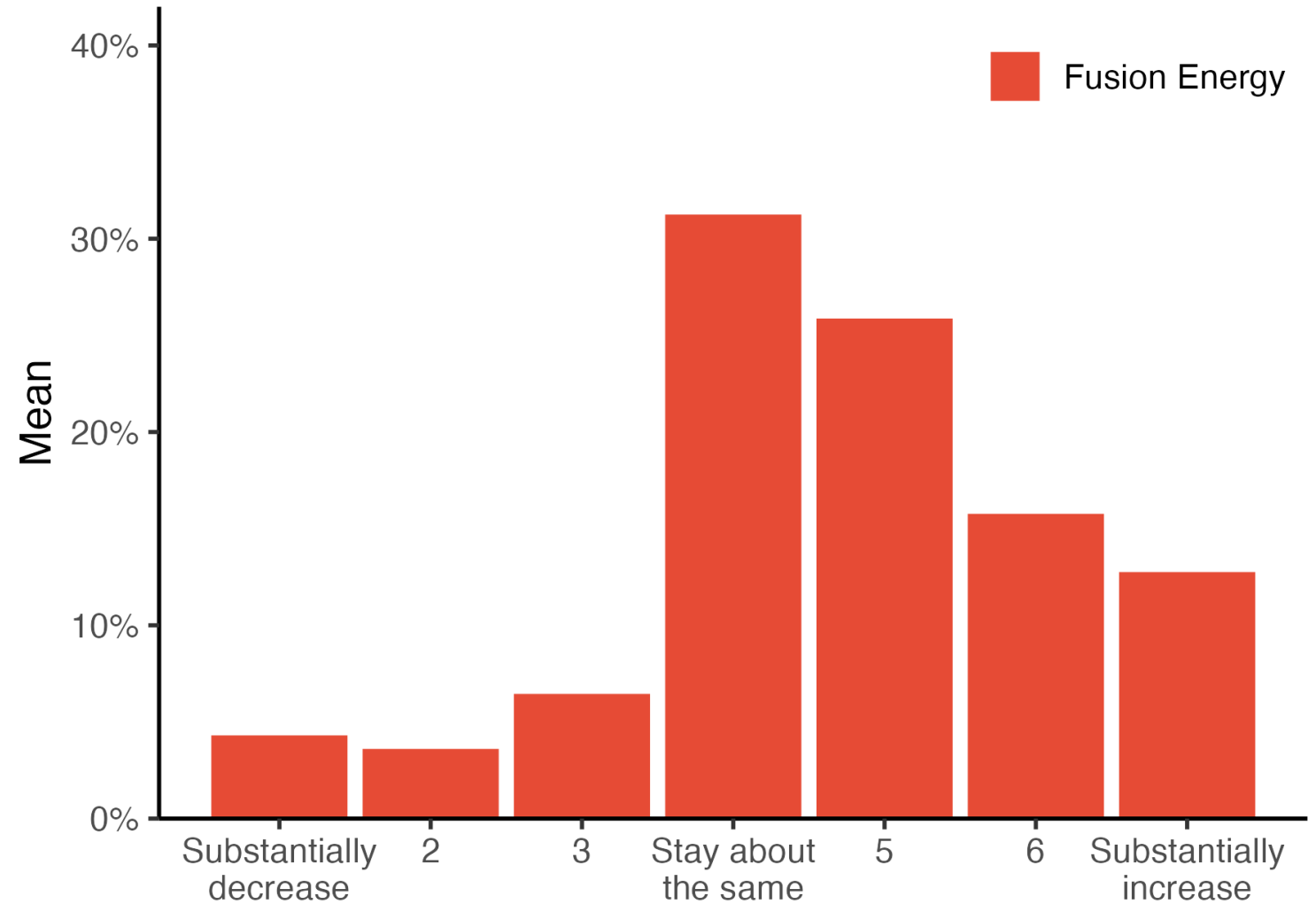
Source: OU IPPRA Fusion Survey (2023)

Preferences for public investment in fusion energy

Now we want you to think about government investment priorities.

How should government spending change for research and development on fusion energy in the US?

Responses were coded on a scale ranging from “substantially decrease” (1) to “substantially increase” (7).

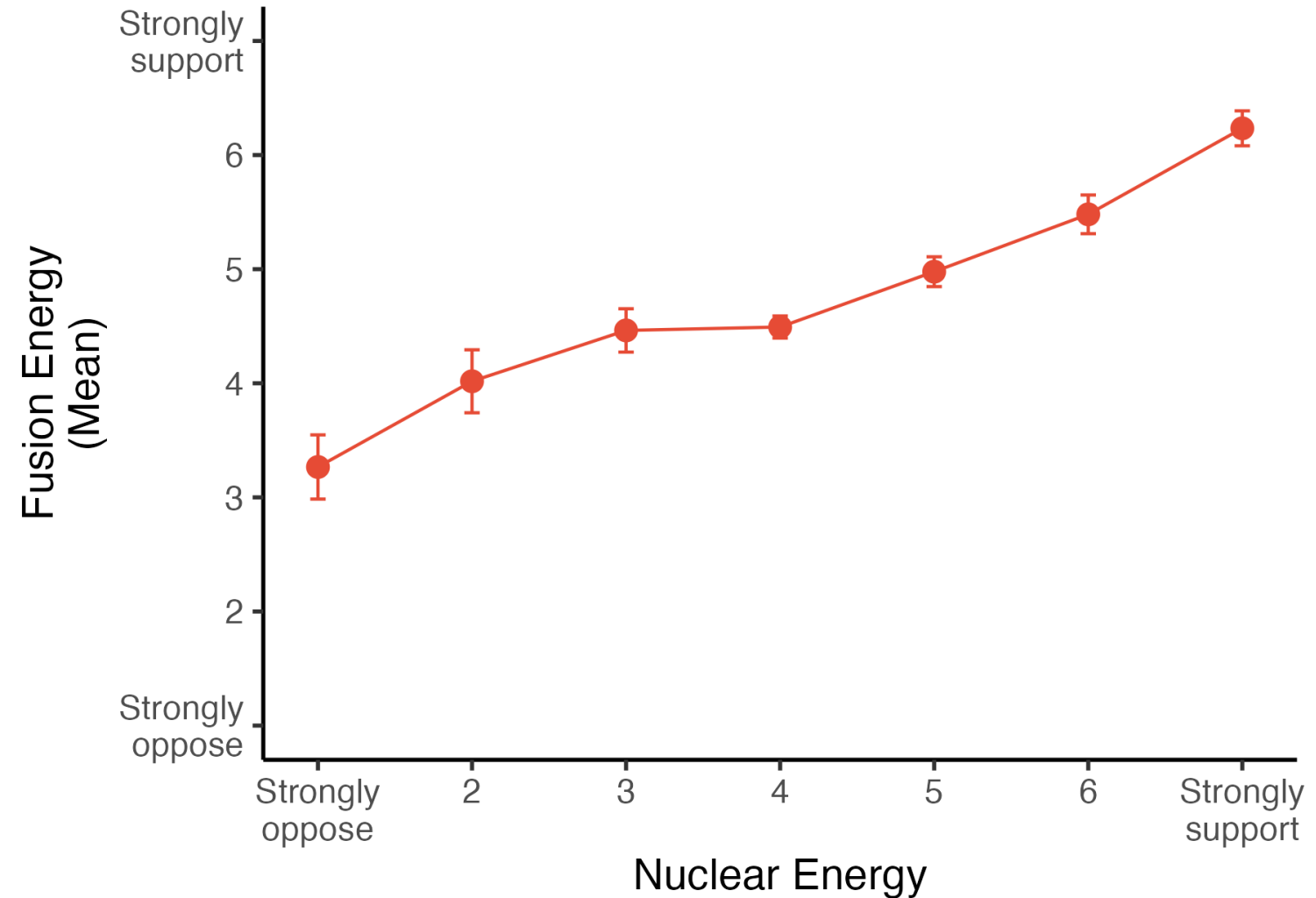


Source: OU IPPRA Fusion Survey (2022)

Who supports fusion energy?

On average, people who support nuclear energy also support fusion energy; people who oppose nuclear lean towards opposing fusion energy

- Most predictive variable in the dataset
- Not perfectly correlated
 - 10% of the sample *opposes* nuclear energy but *supports* fusion energy
 - 2% of the sample *supports* nuclear energy but *opposes* fusion energy

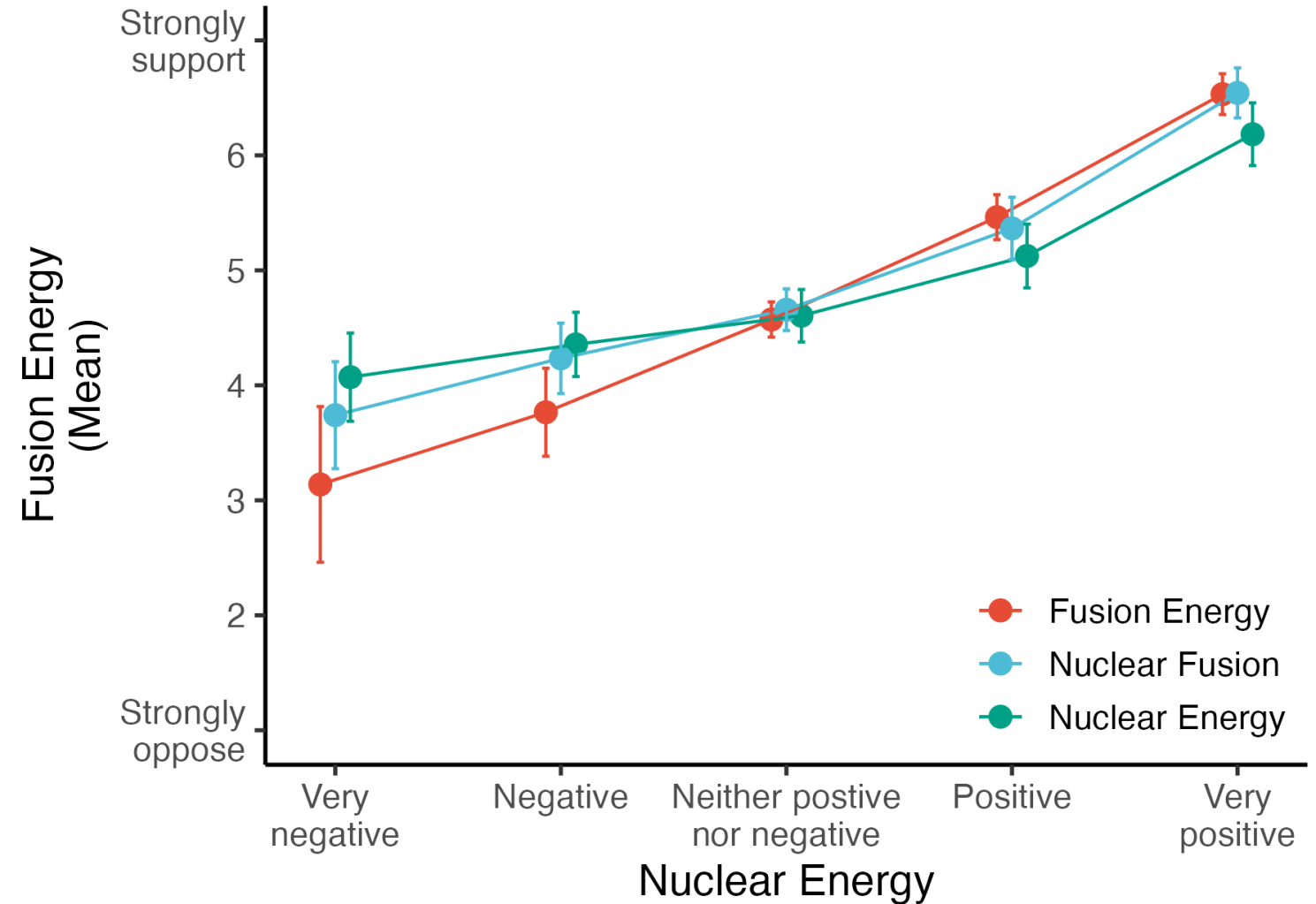


Source: OU IPPRA Fusion Survey (2023)

Who supports fusion energy?

Images were the next most predictive variable in the dataset

- People with positive first impressions were much more supportive of fusion energy than people with negative first impressions
- Impressions of nuclear fusion and nuclear energy are also very important



Source: OU IPPRA Fusion Survey (2023)