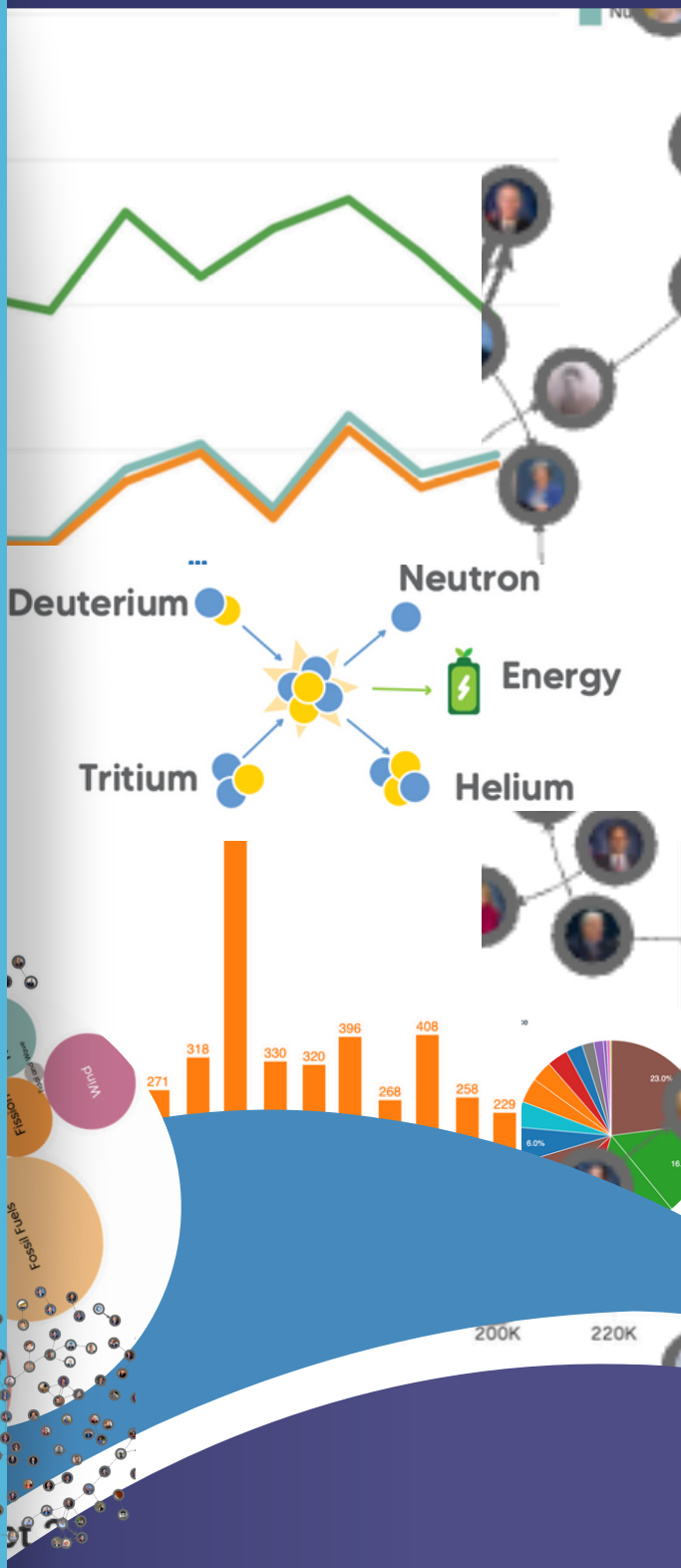
2024

CRACKING THE CODE: PUBLIC PERCEPTIONS OF FUSION VS. FISSION ENERGY AS A CLIMATE SOLUTION



Prepared By

Authored by Dr. Saira Hashmi, DDes, Director of Research and Outreach
Co-Authored by Jane Hotchkiss, President
Co-Authored by Wally Johnston, Managing Director

ENERGY for the COMMON GOOD
Soon enough to make a difference

ENERGY for the COMMON GOOD
Soon enough to make a difference

Cracking the Code: Public Perceptions of Fusion vs. Fission Energy as a Climate Solution

Authored by Dr. Saira Hashmi, DDes, Energy for the Common Good
Co-Authored by Jane Hotchkiss, Energy for the Common Good
Co-Authored by Wally Johnston, Energy for the Common Good

Public perception plays a pivotal role in shaping energy policy and adoption of climate solutions. This paper explores the effectiveness of fusion's efforts to influence public opinion and position itself as a climate solution by partnering with renewables, while distinguishing it from fission. It's important to note that fusion energy offers the promise of clean and abundant energy. However, there is a possibility that funding intended for fusion might be redirected to fission, possibly due to the public's limited understanding of the nuances between the two. To gain insights into this landscape, we have conducted a review of polls, surveys, and relevant reports from diverse sources and supplemented by an analysis of the public opinion data from the social media platforms mainly X (formerly Twitter), Reddit and news outlets. Our aim is to clear up the confusion surrounding public understanding of these energies, thereby fostering a discussion and offering suggestions on how to enhance public awareness and position fusion energy at the forefront for investors, thus garnering stronger public support.

What are these Nuclear Energies?

Chemical Process: We begin our journey by simply defining them. Fusion, defined as the process of combining two light elements into one heavier element, releases a significant amount of energy [Fig.1]. In a fusion reaction, Hydrogen isotopes deuterium and tritium combine to form helium, releasing energy. The isotopes are heated to extremely high temperatures – greater than 100 million degrees Celsius – long enough for the nuclei to fuse together, forming a helium nucleus and a free neutron. The total mass of the resulting single nucleus is less than the mass of the two original nuclei. The leftover mass becomes energy (US DOE Office of Science). This is the same process that powers the sun and other stars, thus presenting the potential to

provide a nearly limitless source of energy, and only a small amount of short-lived radioactive waste.

On the other hand, Fission is a process in which a heavy atomic nucleus splits into smaller nuclei, causing enormous radioactive waste [Fig 2].

FIG. 1 Fusion

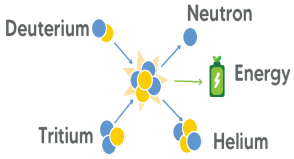
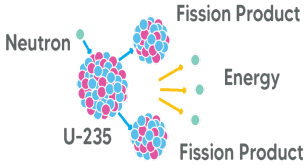


FIG. 2 Fission



In a nutshell besides the chemical process, differences between fusion and fission include;

Aspect	Fusion	Fission
Energy Production	Four times more energy per kilogram of fuel than fission (IAEA).	Less efficient compared to fusion; relies on heavy elements.
Fuel Source	Deuterium (extracted from seawater) and tritium (generated from fusion reactions with lithium) (IAEA).	Uranium-235 and plutonium-239 (limited supply) (World Nuclear Association), (IAEA).
Safety and Enviromental Impact	Short-lived minimal radioactive waste, safer, environmentally friendly, sustainable (IAEA).	Requires careful handling of waste, risk of catastrophic failure, long-lived radioactive waste.
Sustainability	Potential for inexhaustible supply of fuel (millions of years).	Relies on finite resources.
Energy Security	Offers independence in energy reliance and geopolitical peace.	Depends on international trade and resource availability.
Scalable	With limited expected regulatory requirements and minimal land-use needs, fusion machines can be sited in urban areas/near consumers.	Requires large infrastructure and careful regulatory oversight. Efforts underway to develop advanced designs for improved scalability, such as small modular reactors (SMRs) and advanced fission reactors.

Understanding these differences is essential to comprehend the role of fusion in this Fusion-Fission Nexus, particularly in combating the climate crisis and pursuing sustainable, abundant, clean energy solutions and such clarity would encourage the resources towards fusion supporting climate change efforts. We examined the public survey data, polls and relative reports, finding that these surveys demonstrated a lack of clarity among the public in understanding the concepts of ‘nuclear energy’, ‘nuclear fusion’, ‘nuclear fission’. Following this, we explored the data we gathered from the social media platforms.

Public Opinion Data and Social Media Trends

Mixed Public Opinion: Mixed Public Opinion: Polls and surveys offer a nuanced portrayal of public sentiments toward nuclear fission as a prospective climate solution. However, this depiction may not accurately capture the breadth of diverging views. While some members of the public advocate for nuclear power due to its low carbon emissions, others voice concerns regarding safety and waste management. According to a Pew Research survey conducted in May 2023, 41% of Americans favored federal encouragement of nuclear energy, marking a 6% increase from the previous year.

Nevertheless, a larger majority expressed a preference for wind and solar power (66%).

Unclear Trends from Gallup Poll (2019-2023): In 2023, 55% of participants favored nuclear energy, up from 49% in 2019.

Additionally, a 2021 Gallup Energy Poll focusing on domestic energy preferences revealed that 39% of respondents advocated for increased emphasis on nuclear power, while 28% favored a decrease, and 32% preferred the level of emphasis to remain unchanged. These findings illustrate shifting attitudes toward energy, with a growing inclination towards renewables such as wind and solar power, while opinions on nuclear energy remain divided. Despite a general increase in support for nuclear energy over the years, it prompts the question: ***which form of nuclear energy—fusion or fission—is truly gaining favor among the public amidst these varied opinions?***

Gender and Partisan Differences:

Attitudes towards nuclear energy/power vary significantly by gender and party affiliation. Men are more likely to support the Federal Government's encouragement of nuclear power production, and this trend extends to favoring power plants to generate electricity.

Gender Differences in Support of Government Encouragement of Nuclear Power Production:

A Pew Research Survey from May 2023 reveals significant gender differences in attitudes toward nuclear energy: 54% of men support Federal Government efforts to encourage Nuclear Power production, while only 28% of women share this support. Also, 71% of men and 44% of women are in favor of having more nuclear power plants to generate electricity. This discrepancy highlights a gender divide in perceptions of nuclear energy. However, the survey does not specify whether it addresses fission or fusion, limiting a comprehensive understanding of these gender differences due to the ambiguity of the type of nuclear energy discussed.

Youth Engagement: According to The Climate Capital young Americans exhibit strong support for stringent climate change legislation without necessitating much persuasion.

The challenge, however, lies in the voter registration and turnout among 18 to 30-year-olds. Roughly, 50% of this age group

is registered to vote, in stark contrast to about 75% registration individuals above 50.

Research suggests that with increased participation, 65% of younger voters would choose officials who prioritize climate issues. The report does not clarify whether the youth's support for climate initiatives includes fusion or fission, leaving it uncertain whether young people are aware of the distinctions between fission and fusion. Further studies are needed to assess the awareness level regarding the differences between fission and fusion among both younger and older populations.

Partisan Difference in Support of Government Encouragement of Nuclear Power Production:

Pew Research Survey indicates that 34% of Democrats believe the Federal Government should encourage the production of Nuclear Power, whereas 71% of Republicans are in favor of such Government's support. This highlights a significant partisan divide, with Republicans more inclined to support the Government being involved in nuclear energy production.

When it comes to having more nuclear power plants to generate electricity, 44% of Democrats show support compared to 67% of Republicans. This pattern of partisan divide mirrors the support for Government encouragement showcasing a clear divide in attitude towards expanding nuclear energy infrastructure.

As per IPSOS polls (June 10, 2022), a recent Reuters/ IPSOS poll indicates that two in five Americans say they are familiar with nuclear energy power plants (43%) showing comparable levels of awareness to solar power plants (44%) and wind power plants (45%). Forty-five percent of Americans express support to nuclear power/energy plants, with coal-fired plants (36%) and gas-fired plants (41%) garnering less support. It remains unclear whether this support of nuclear power plants is based on a clear understanding of the distinct concepts of nuclear fusion and nuclear fission energies.

These statistics highlight significant variations in attitudes toward nuclear energy based on gender and political affiliation, with men and Republicans generally showing more support compared to women and Democrats. Yet again, it is unclear if this support specifically targets fusion or fission or if the surveys addressed these concepts and if the concepts are clear to the respondents. This ambiguity leaves the question of which type of nuclear energy being supported unresolved, and further emphasizes the necessity for more precise definitions and distinctions in public opinion research.

ENERGY for the COMMON GOOD
Soon enough to make a difference

Evaluating Public Opinions of Fusion vs. Fission: Data Collection, Analysis and Insights

We analyzed data from X (formerly Twitter), Reddit and various news outlets focusing on public posts and comments related to both fission, fusion and other energies. Our analysis was centered on demographics and sentiments expressed in the discussions surrounding fusion and fission.

Assessing Gender and Partisan Differences through social media platforms analysis:

Attitudes towards nuclear energy are notably influenced by gender and political affiliation, aligning with earlier polls/surveys that indicated a higher propensity among men and Republicans to support nuclear energy production than women and Democrats. Men are more inclined to back the Federal Government's promotion of nuclear energy production, and this inclination also extends to support for nuclear power plants for electricity generation.

Data from January 2024 gathered from social media platforms reveals a gender disparity in discussions about nuclear energy. Approximately 71% discussing fission are men, compared to about 26% who are women. In discussions on fusion, the trend is similar with an average of 75% men and 18% women participating. In the wider context of nuclear energy space, an average of 71% men are in favor of nuclear energy compared to an approximately and average of 25% who are women.

Social Media Analysis: Trends on Fusion vs. Fission in Posts and Comments

Analyzing social media conversations offers critical insights into public sentiments and emerging trends in the energy landscape. From September 2022 to January 2024, there was a significant surge in the volume of posts related to energy topics, with the number of discussions increasing from approximately **186 million to about 237 million.** Within this discourse, discussions about fission and fusion energy garnered significant attention. During this time frame, fission and fusion energy discussions received considerable attention, highlighting their importance in the energy dialogue.

Our analysis, drawing on public opinion data from various social media platforms including X (previously Twitter), Reddit and news

outlets, illuminates the dynamic of these conversations. In this period, fission-related discussions accounted for approximately 7 million posts while fusion discussions tailed around 1 million, with X (previously Twitter) serving as the primary platform for these discussions.

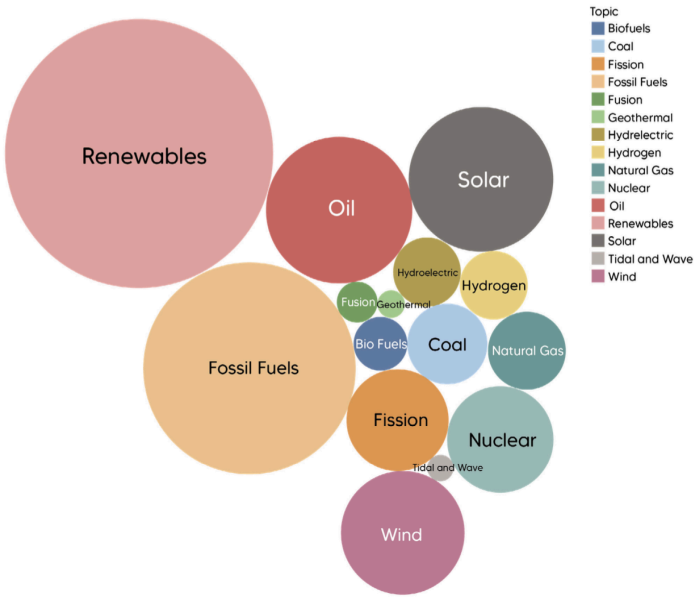
The breakdown of the energy discourse from September 2022 through January 2024 shows a strong focus on renewable energy [Fig.3], with:

Total nuclear + fission + fusion is about **23 million**

Total renewable energy posts, including subcategories is about **125 million**

Total fossil fuels energy posts, including subcategories is about **83 million** [Fig.3]

FIG. 3 Relative Size of the Conversation



Monthly averages during this period were approximately 230,000 for renewables and 130,000 posts about solar, respectively [FIG. 5]. Fission maintained an average of 66,000 posts per month, while Fusion, on the other hand, averaged around 10,000 posts per month [FIG. 5] with X (previously Twitter) maintaining a substantial presence with about 29% of the conversations, while news sources generated about 49% of the posts, indicating continued and sustained interest in this advanced energy technology.

Particularly in December 2023, fusion-related discussions spiked, especially during COP 28, with over 17,000 posts on X alone and more than 90,000 across various platforms. Despite this uptick in fusion discourse, conversations about fossil fuels remained predominant, indicating ongoing challenge in

shifting the discourse towards clean energy alternatives.

While fusion was celebrated as a potential game-changer, specifically at COP 28, and has been positively received [FIG. 4], fission, on the other hand, appeared to position itself in a subtler manner [FIG. 6], possibly aligning with the discourse around fusion. The question arises: "***did fission position itself in the sun accidentally with the words 'nuclear energy' and 'nuclear fusion', used ample of times?*** This could be attributed to the higher policy action generated for fission during this time period.

FIG. 4

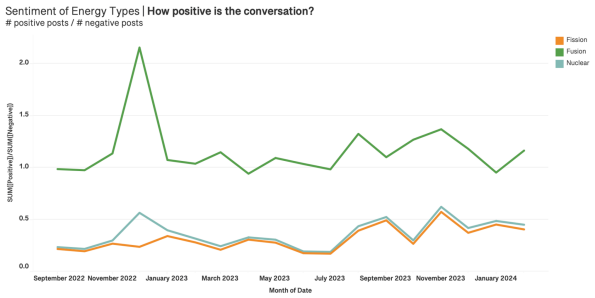


FIG. 5

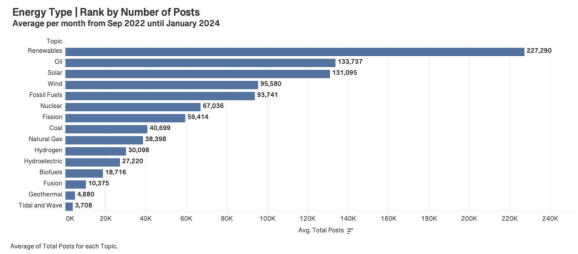
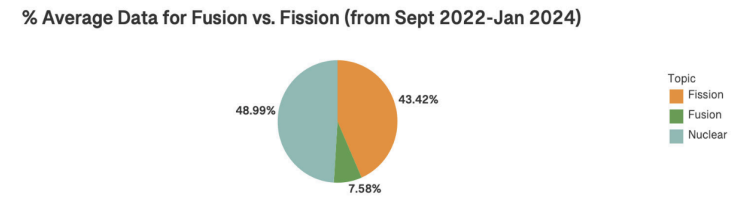


FIG. 6



Sentiment Analysis of Social Media Posts on Fission vs. Fusion:

The perception of fission versus fusion is markedly influenced by the prevalence of negative emotions. The negative emotional language commonly associated with "Nuclear," encompassing fear, sadness, surprise, and anger, does not seem to extend to "Fusion." The primary concern with fusion lies in the ambiguity of its timeline for becoming a viable energy source, often perceived as perpetually "just a few years away." However, this stigma is gradually diminishing. Conversely, terms like "fission" or simply "nuclear" often lead to confusion, underscoring the urgent need for policy interventions to clearly distinguish "fusion" from "fission" in both discourse and decision-making related to fusion energy. It's imperative to provide a clear path for the commercialization of fusion energy to prevent it from being mistakenly associated with fission, a technology often concerned for its potential for destruction. Clear and precise communication is critical, as the public may find it challenging to discern between these

terms. Transparency stands as the cornerstone in this context.

Insights and Conclusion:

Our insights indicate the importance of featuring fusion prominently alongside renewable energy at key international gatherings, such as COP 28, to effectively address and correct the public's misconceptions regarding the differences between fusion and fission.

At COP 28, fusion was celebrated as an exciting breakthrough, attracting positive attention, while fission was approached in a more nuanced way, likely influenced by its connection to fusion, which was dominating headlines at the time, as it generated higher policy action during this period. This suggests that fission may have unintentionally benefited from the repeated use of terms like 'nuclear energy' and 'nuclear fusion', leading to a potential merging of the two concepts under the broad term 'nuclear' energy. This confluence may have contributed to a 'Fusion-Fission Nexus', blurring the lines between the two technologies. Moreover, the increase in social media discourse on fusion energy, especially following COP 28, highlights a growing public interest and recognition of fusion as a sustainable clean energy option. The critical question remains: ***can this momentum be utilized to position fusion as a leader in the clean energy transition?***

We argue that promoting discussions on social media about fusion energy could amplify support for the technology, thereby directing more funding towards it as a means to address climate challenges. A remarkable instance of this was observed when, at the time, US Special Presidential Envoy for Climate John Kerry, at a summit i n New York on September 20, 2023 (WNN), emphasized the essential role of nuclear energy in achieving net-zero goals and lauded the Net Zero Nuclear initiative, which recently welcomed GE Hitachi Nuclear Energy (GEH) as its inaugural corporate partner.

Subsequently, at COP 28 on December 5, 2023, John Kerry shifted his narrative from a general emphasis on **'nuclear' to a specific focus on 'nuclear fusion'**, a terminology shift marking a significant, strategic pivot — a progression of statements-signaling a gradual but deliberate pivot in attention.

"***There is potential in fusion to revolutionize our world***", Kerry stated at the COP28 summit in Dubai, crystallizing the importance of this shift (Reuters).

At the Atlantic Council Energy Forum, he unveiled a global fusion strategy, advocating for collective efforts to exploit this clean, universally accessible form of energy. However, ***lingering questions persist about equitable access- can they be resolved?*** On December 5, 2023, at COP28 in Dubai, President Jane Hotchkiss of Energy for the Common Good highlighted the shift from theoretical discussions to practical deployment, aiming to ensure that the benefits of fusion extend to all, not just a privileged few, and democratize access within a shorter time frame. Such pronouncements are pivotal in clarifying public confusion over fusion versus fission.

"Our strategy shifts us from theory to deployment, ensuring fusion benefits everyone, not just elites, and democratizes access in years, not decades."

— President Jane Hotchkiss of ECG

In conclusion, the discourse between fusion and fission transcends mere terminology, bearing significant implications for our climate and energy future. It's imperative to shift public perception towards a more enlightened understanding that differentiates clearly between fusion and fission. This involves debunking misconceptions, highlighting fusion's potential as a sustainable and plentiful energy source. We believe that discussions by leaders at significant conferences and in general can demystify the differences between fusion and fission, significantly shaping public perception and ultimately strengthening efforts to mitigate climate change.

As support for nuclear energy grows, enhancing public awareness and refining communication strategies become crucial for changing perceptions and expanding support for fusion energy within the array of climate solutions. This necessitates a transition from mere perception to an informed perspective, aiming to close the knowledge gap regarding fusion's true role in combating climate change. The frequent confusion between nuclear fission and fusion in public discussions highlights the need for policy interventions to delineate their differences clearly.

Moreover, it's important to consider the level of awareness in various demographics, particularly in marginalized communities or those with minimal to no influence. The presence of voices highlighting these distinctions and their visibility in public

discourse is vital. These considerations prompt further inquiry into how well-informed or unaware the public truly is and the efforts of stakeholders to dispel nuclear energy myths. Conducting additional research, through polls and surveys, on public attitudes and acceptance of fusion will be valuable and to figure out ***whether the voices that call out these differences receive adequate visibility?*** As the world pursues sustainable energy solutions, ensuring that our journey is guided by accurate information, transparency and clear understanding, rather than misconceptions, is essential for a sustainable and bright future.

ECG's Role in Fusion Energy:

Fusion Timeline and ECG's Involvement in Fusion Energy

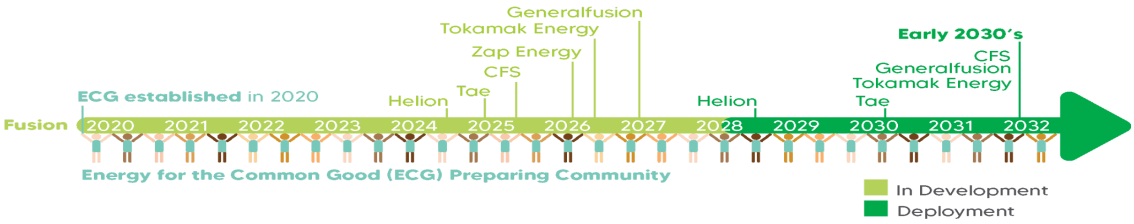


FIG. 6: ECG's Role The graphical presentation of data is taken from Brister, J., Koenig, R., & Warden, J. (2023). Fusion in 10 years – Is this 'the real thing' or 'here-we-go-again'? ATW, 68(5), 7.
Illustrated by Camille Warford

By employing graphical timelines, ECG illuminates the path toward fusion energy, facilitating community engagement, awareness, and readiness. ECG is doubling down on its endeavors to equip communities for fusion energy, spanning from pre-commercialization groundwork to post-implementation support, ensuring a timely and meaningful impact — soon enough to make a difference. ECG continues to scale up outreach and engagement programs, strategizing through a data-driven approach. We are dedicated to fostering community readiness and adaptation to fusion energy technologies.