

How Chinese Online Media Users Respond to Carbon Neutrality: A Quantitative Textual Analysis of Comments on Bilibili, a Chinese Video Sharing Platform

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Abstract

This research investigates how users of Bilibili, a video sharing website based in China have responded to carbon neutrality. By conducting quantitative textual analyses on 3,311 comments on Bilibili using LDA topic extraction and content statistics, this research discovers that: (1) Bilibili users have assigned more weight to geopolitical topics (56.3%) than energy (22.0%) and environmental topics (21.7%). (2) When assessing carbon neutrality, Bilibili users considered geopolitical (53.8%) and energy factors (15.8%) more heavily than factors related to the class (9.2%), economy (8.9%), environment (8.7%), and definition (3.6%). (3) More Bilibili users had negative (64.6%) attitudes towards carbon neutrality, with only a small portion of them expressing positive (26.8%) and neutral (8.6%) attitudes. (4) Negative attitudes towards carbon neutrality were mainly driven by geopolitical concerns about the West's approach to China, other countries' free-riding on China's efforts and the West's manipulation of rules, doubts about the feasibility of energy transition and suspicion of capitalists exploiting consumers through this concept. This research highlights the geopolitical concerns behind the environmental attitudes of Chinese people, deepening our understanding to psychological constructs and crisis sensitivity of Chinese people towards environmental issues.

Keywords: carbon neutrality, online comments, textual analysis, Bilibili, China

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“Carbon Neutrality,” which was included in China's 14th Five-Year Plan for Renewable Energy Development, is aimed at reducing energy consumption and CO₂ emissions while increasing the use of non-fossil fuel energy sources and promoting forest coverage (The State Council of the PRC, 2021). This conception has taken on geopolitical significance amidst the ongoing conflict between Russia and Ukraine, as it has increased the risk of energy crises and exacerbated strains between China and the West. Russia's halt of gas delivery to Europe via the Nord Stream pipeline has forced Europe to modify its carbon neutrality plans, with Germany reactivating coal-fired reserve power and Copenhagen postponing its carbon neutrality plan (Bir, 2022; *Deutsche Welle*, 2022; Szumski, 2022). Europe's situation has drawn attention to the vulnerability of carbon neutrality to geopolitical risk and energy dependence, as well as the discretionary nature of carbon neutrality standards. Moreover, China's reluctance to condemn Russia's invasion of Ukraine and its emphasis on the China-Russia partnership have exacerbated tensions between China and the West. The West's imposition of sanctions against China, as well as China's counterstrike measures, have fuelled China's growing suspicion and hostility towards Western-led initiatives and standards, including carbon neutrality (Crawford et al., 2022; Glaser, 2022; Tewari & Josephs, 2022).

Previous research has highlighted several dimensions of carbon neutrality, including geopolitics, energy, economy, social class, environment, and definition. Geopolitical issues include the unfair distribution of carbon duty between developing and developed countries, and the dominance of the West in setting carbon neutrality rules (Tongla, 2022). Energy-related challenges center around the technological feasibility of energy transition, as renewable energies are susceptible to geographical conditions and underdeveloped transmission technologies (Xun et al., 2022). The economic impact of carbon neutrality is also a subject of debate. While some studies confirm its benefits to enterprise outputs and technology innovation (Dussaux, 2020; Yang et al., 2019), others highlight its time cost (Peng et al., 2020; Zhao et al., 2022) and negative impacts on regional economic gaps (Zhang et al., 2021).

On social class issues related to carbon neutrality, scholars have pointed out the unfair distribution of carbon duties between different groups. Specifically, some argue

that ordinary consumers and low-income groups are taking on a disproportionate burden of carbon reduction compared to wealthy individuals and capitalists (Robinson, 2022; Zandt, 2022). In addition, there are ongoing debates about the sources of climate change and the role of CO₂ in ecosystems. While some argue that human activity is the primary cause of climate change and focus on the negative impacts of greenhouse effects (IPCC, 2013), others highlight the importance of Earth activities and the positive effects of CO₂ on stimulating photosynthesis (Chinese Academy of Sciences, 2013). Finally, scholars have also examined the definition of carbon neutrality itself, particularly how corporations' autonomy in regulating the scope of this concept has resulted in ambiguity and inconsistency of carbon neutrality plans in China (Yao & Wu, 2021).

Several studies have investigated the environmental attitudes of Chinese people and linked them to demographics (Cao et al., 2009; Wang et al., 2022), exposure to mass media (Awan et al., 2022; Harris, 2004), emotional attachment to ecological issues (Chan, 1999), patriotism (Hamada et al., 2021), and cultural orientations (Xue et al., 2016; Xiang et al., 2019). However, there is a lack of research on how Chinese people perceive and evaluate various dimensions of specific environmental issues in the current international context, particularly regarding their response to decarbonization actions from the perspectives of geopolitics, energy, economy, environment, class and definition. Detailed analysis of public opinion can help us understand how the Chinese public makes trade-offs between different factors, providing frameworks for analyzing their environmental attitudes.

This study aims to deepen our understanding of Chinese people's environmental attitudes by taking online materials related to carbon neutrality as a case. By conducting a quantitative textual analysis of 3,311 comments on Bilibili, a video sharing website based in China with a primary user base consisting of young people (78% within 18-35 age range), from April 20, 2022 to January 16, 2022, this study seeks to answer two research questions: (1) What are the main topics related to carbon neutrality discussed by Bilibili users? (2) When assessing carbon neutrality, what arguments do Bilibili users make, what factors do they consider, and what attitudes do they take?

Methodology

Conducting a comprehensive public opinion survey on the topic of carbon neutrality in China can be challenging due to sampling difficulties, lengthy timelines, and high costs. As an alternative, online textual analysis can provide additional insights into Chinese public opinion on the issue. This method has several advantages, including providing the ability to analyze large sample sizes, obtain less biased responses, achieve cost-effectiveness, and yield rapid results. Therefore, quantitative textual analyses, including LDA topic extraction and content statistics, are used in this research.

Texts were crawled from Bilibili using Python programming. Bilibili is a video-sharing website in China. Bilibili has a predominantly young user base, with most users under the age of 30, accounting for 78.67% of the total. The average user age is 22.8 years old and Bilibili is the community with the highest concentration of college students. The gender ratio on Bilibili is 57:43, with a higher proportion of male users. The user distribution is widespread across different regions, with the highest number of users in East China (34%), followed by South China (21%), North China (17%), Central China (15%), and Southwest China (13%). Analyzing user comments on this platform may provide insights into the opinions of Chinese young people.

The dataset consists of 3,311 comments from April 20, 2022, to January 16, 2023, on 11 Bilibili videos related to carbon neutrality. Videos with over 100 comments in the comment section were selected. The timeframe starts from April 20, 2022, as it is the first related video posted after the Russia-Ukraine full-scale war. Table 1 provides information about the selected videos. Irrelevant comments, such as those discussing the video posters or from fans' flattering comments, were manually removed. For argument statistics, the data scale is 1,053. The comments in this section are those that express clear attitudes towards carbon neutrality.

Table 1

Title, Posting Date and Length of the Videos Whose Comments Were Analyzed

Video Titles	Posting Date	Video Length (Minutes:Seconds)
The energy game between China, Europe, and America: What direction will China's carbon neutrality take?	April 20, 2022	7:6
Why is "carbon neutrality" a turning point for overtaking?	June 20, 2022	7:58
Wonderful carbon neutrality.	August 12, 2022	11:11
The fraud is exposed, so why does China still support carbon neutrality?	August 26, 2022	3:49
Is Europe giving up on carbon neutrality? Why aren't they mentioning not letting Chinese people eat meat anymore?	August 27, 2022	9:23
Europe: We're done with carbon neutrality! China: It's okay, I'll still play with you.	August 31, 2022	7:57
Why is the world undergoing an energy transition? Understanding China's carbon neutrality and future energy structure.	September 16, 2022	13:5
Why does China have to pursue the carbon neutrality path? The economic game behind carbon neutrality.	September 20, 2022	14:9
Want to play carbon neutrality? Europe: What the hell are you talking about?	October 10, 2022	7:21
Will China be more enthusiastic about carbon neutrality while facing carbon emission sanctions from abroad?	October 27, 2022	16:24
The EU carbon border tax is now in effect, what impact does it have on us?	January 1, 2023	7:53

Results

Topic Extraction

This section uses Latent Dirichlet Allocation (LDA) topic modeling to extract the main topics from the comments. The process involves several steps. First, the sentences

were divided into bags of words for processing in later steps. Second, stop words such as pronouns, auxiliary words, articles, conjunctions, punctuations, and special symbols were removed line by line. Third, a TF-IDF vector was built and the TF-IDF feature word lists were obtained. Finally, the LDA topic or component number was selected to extract the main topics. To determine the optimal number of topics, the PCA method was used to separate the total into several relatively independent components. The number of topics was chosen based on how well the components can be separated from each other.

Each topic is named based on the top 30 TF-IDF feature words associated with it. The first and second topics are both geopolitics-related, with their highest proportions of words related to countries, such as "developing country," "developed country," "West," "dollar," "Europe," and "America." However, they differ in their specific focus. The first topic focuses on geopolitics between developing and developed countries, while the second focuses on geopolitics between China, Europe, and America. The third topic has a greater emphasis on energy-related terms, with over half of its top-ranked words being related to energy, such as "power generation," "photovoltaic," "energy," "new energy," "energy storage," "solar power," "nuclear electricity," "electric car," "thermal power," "battery," "gasoline," "coal," and "wind power." Thus, it is categorized as an energy-related topic. The fourth topic is centered around environmental issues, with its top-weighted words related to "emission," "Earth," "human," "environment," and "climate." Thus, this topic is named the environment topic (see Table 2).

Table 2 presents the main topics and their top 30 TF-IDF feature words, ranked in descending order based on their TF-IDF proportion in the corpus. The results reveal that geopolitical topics make up the largest proportion at 56.3%, with the topic of relations between developing and developed countries (32.1%) having a higher weight than that between China, Europe, and America (24.2%). The energy-related and environment-related topics follow closely behind, accounting for approximately 22% and 21.7% of the corpus, respectively.

Table 2

Topics and Top 30 TF-IDF Words

Topic	Top 30 TF-IDF Feature Words
Topic 1 (32.1%) Geopolitics: Developing and Developed Countries	West, energy, development, country, carbon neutrality, globe, new energy, China, emission reduction, global warming, developing countries, industry, oil, developed countries, transition, fossil, limit, clean, traditional, dollar, benefit, energy saving, technology, our country, nuclear energy, industry, approach, science and technology, pollution, scam
Topic 2 (24.2%) Geopolitics: China, Europe, and America	environmental protection, Europe, Europe and America, China, carbon neutrality, rule, enterprise, country, world, America, cost, concept, business, industrialization, good, taxation, waste, international, individual, foreign countries, price, import, reality, domestic, export, game, handle, natural gas, war, market
Topic 3 (22%) Energy	carbon dioxide, carbon neutrality, China, technology, power generation, EU, photovoltaic, energy, synthesis, new energy, energy storage, Germany, tree planting, solar power, production, Russia, automobile, nuclear electricity, electric car, thermal power, battery, product, gasoline, coal, wind power, civilization, manufacturing, natural gas, electricity grid, wind power
Topic 4 (21.7%) Environment	emission, earth, human, Alibaba, America, environment, climate, discourse power, nuclear fusion, enterprise, corporate, desert, forest, standard, controllable, Ant Group, temperature, China, history, European people, resource, carbon tax, air defense, plant, temperature, greenhouse effect, protect, gas, destroy, greenhouse

Note. The words were extracted in Chinese using Chinese analytical packages and translated from Chinese to English.

Content Statistics

This section presents statistics on Bilibili users' arguments on carbon neutrality based on classifications of factor considerations and attitude. The main arguments are summarized by the author and manually counted, as shown in Table 3. The results have been validated by a second coder, and discrepancies have been resolved by reaching a consensus on 26 contentious items and removing those that were deemed to be ambiguous by both coders. Overall, the majority of Bilibili users view carbon neutrality as a tactic employed by the West to restrain China's development. Additionally, they believe that other countries will not follow China's lead in achieving carbon neutrality. Conversely, the least number of Bilibili users expressed the belief that carbon neutrality will shock the oil-based dollar hegemony or result in new environmental problems.

Based on factor dimensions, geopolitics (53.8%) emerges as the dominant factor, while definition (3.6%) is considered the least important consideration in assessing carbon neutrality. The second-highest weight is given to the energy factor (15.8%), while the class (9.2%), economy (8.9%), and environment-related factors (8.7%) receive similar weight.

Among the geopolitics-related arguments, the dominant ones view carbon neutrality as a Western approach to restrain developing countries and express distrust towards other countries' efforts to achieve carbon neutrality. In contrast, a minority of arguments concern the potential impact of carbon neutrality on the oil-based dollar hegemony. In terms of energy-related considerations, Bilibili users were more concerned about the cost and technological barriers of energy transition than the role of carbon neutrality in driving energy upgrades and prospects of nuclear energy application.

Regarding the environment factor, about 52.0% of Bilibili users do not view human activity as the main contributor to climate change, while around 41.0% of them support achieving carbon neutrality to protect global environment for the sake of human survival. Only 6.5% of Bilibili users believe that carbon neutrality will lead to new environmental problems.

When it comes to the economy-related factors, approximately 56.0% of Bilibili users hold negative views on the impact of carbon neutrality on economic development and living standards, while the rest take a more positive outlook on carbon neutrality's roles in driving sustainable economic development. As for class-related arguments, more emphasis is placed on capitalists' exploitation of ordinary consumers through carbon neutrality (63.0%), while less attention is paid to the unfair distribution of carbon duty between the rich and the poor (37.0%). In terms of the definition dimension, the argument states that carbon neutrality lacks clear and unified standards.

The attitudes of Bilibili users towards carbon neutrality vary, with 64.6% of them expressing negative attitudes towards it, while 8.6% hold neutral positions; 26.8% of Bilibili users show positive attitudes towards carbon neutrality. Geopolitical concerns, such as the West's weaponization of carbon neutrality, other countries' free riding on China's efforts, and the West's manipulation of carbon neutrality rules, are the main reasons for negative attitudes. Additionally, some Bilibili users' express skepticism about the feasibility of energy transition, as well as concerns about capitalists exploiting consumers under the guise of carbon neutrality. Few people attribute the negative prospects of carbon neutrality to its negative impact on the environment or its inability to shock the dollar hegemony.

Bilibili users who support carbon neutrality primarily view it as a way for China to gain voice power, promote energy upgrading and enhance competitiveness in energy technology rivalry, rather than a means to challenge the dominance of the oil-based dollar. Other important reasons for this positive attitude include the potential positive impacts of carbon neutrality on economic development, environmental protection, and energy security. For Bilibili users taking a neutral stance, they tended to mention the limited impact of human activities slightly more often than the prospect of nuclear energy.

Table 3

Total Argument Statistics

Factor	Attitude	Arguments	Count
Geopolitics	Negative	Carbon neutrality is weaponized by the West to restrain development of developing countries.	204
Geopolitics	Negative	Other countries will not follow the rules to achieve carbon neutrality and will even have a free ride on China's efforts.	110
Geopolitics	Negative	Rules and standards of carbon neutrality are subjected to the West's manipulation for its own interests.	75
Geopolitics	Negative	Compared to the West, China is not a big carbon emission country; hence, it is West who should be responsible for decarbonization rather than China.	27
Geopolitics	Negative	Even if carbon neutrality is reached, the hegemony of U.S. dollar is still not shockable.	3
Geopolitics	Positive	Achieving carbon neutrality can help China gain more voice power in international arena.	62
Geopolitics	Positive	Achieving carbon neutrality can improve China's energy competitiveness amid big power rivalry.	45
Geopolitics	Positive	Achieving carbon neutrality can reduce China's fossil fuels reliance on foreign countries, thereby improving China's energy security.	30
Geopolitics	Positive	Achieving carbon neutrality can shock the oil-based dollar hegemony.	10
Energy	Negative	Cost and technological barriers of energy transitions are too high to make carbon neutrality possible.	67
Energy	Positive	Carbon neutrality can drive China to update its energies or energy technologies.	56

Table 3

Total Argument Statistics (Contd.)

Factor	Attitude	Arguments	Count
Energy	Neutral	We should wait to see whether large-scale application of controllable nuclear energies can be achieved before judging the appropriateness of carbon neutrality.	43
Environment	Negative	The methods and processes to achieve carbon neutrality will bring new environmental problems.	6
Environment	Positive	Carbon neutrality can improve the global environment and sustain human's survival.	38
Environment	Neutral	Human activity may not be the main source of climate change; hence, its impacts on carbon neutrality may be very limited.	48
Economy	Negative	Carbon neutrality will stymy economic development of China and lower the quality of life of Chinese people.	53
Economy	Positive	Carbon neutrality will drive economic sustainable development over the long term.	41
Social Class	Negative	Carbon neutrality is the game of capitalists, who exploit consumers to gain interest via this concept.	61
Social Class	Negative	It is rich people rather than poor ones that mainly cause carbon emissions and environmental problems; hence, carbon neutrality, which aims at the mass, is unfair to poor people.	36
Definition	Negative	The definition of carbon neutrality itself is too empty, unclear, and lacks definite and unified standards.	38

Discussion

The overwhelming focus of Bilibili users on the geopolitical aspects of carbon neutrality can be attributed to Chinese people's perception of the Western countries. Due to China's history of humiliation, patriotism education, and the government's anti-Western propaganda, many Chinese people have long viewed the West as their adversaries or enemies (Gries, 2004; Liebman, 2007; Zhou & Wang, 2017). Based on Silverstein's (1989) theories, Chinese individuals tend to view their adversaries' actions in an antagonistic light, leading them to oppose initiatives that align with their adversaries' interests or actions that involve cooperation with their foreign adversaries (Kinder & Kam, 2010; Silverstein, 1989).

Moreover, the media often constructs the West as "hegemonic," while China is portrayed as the "victim" (Gries, 2004), which may lead Chinese people to isolate themselves from the West through divisive narratives and discourses developed over decades (Barkhoff & Leerssen, 2021). With this psychological construct of Western countries, Chinese people also tend to overestimate the threats from Western countries in international cooperation, such as decarbonization efforts, by holding onto the notion of Western hegemony (Chernobrov, 2019).

Additionally, the outbreak of the Russia-Ukraine full-scale war may have intensified Chinese people's hostility towards the West, as well as their crisis consciousness regarding environmental and energy issues. On one hand, the war pushed some European countries to set aside their carbon neutrality plans, leading Chinese people to suspect that carbon neutrality is just empty talk and that the West is manipulating the rules to restrain developing countries. Europe's breach of promises may also make Chinese people anticipate that Western countries will not follow carbon neutrality rules and even attempt to get free rides on China's efforts. On the other hand, Europe's woes may have boosted the public sense of crisis, reminding Chinese people of the urgency to seek more voice power in the international arena and reduce their energy reliance on foreign countries by achieving carbon neutrality (Boyon, 2022; Stein, 2013).

Conclusion

This research has examined Bilibili users' response to carbon neutrality using quantitative textual analysis of online comments. The LDA topic extraction reveals that Bilibili users assigned greater importance to geopolitical topics (56.3%) compared to energy (22.0%) and environment topics (21.7%). Further content analysis shows that Bilibili users considered geopolitical and energy factors more than economy, environment, class, and definition when evaluating carbon neutrality. Additionally, more Bilibili users expressed negative attitudes (64.58%) towards carbon neutrality, citing geopolitical concerns about the West's approach to China, other countries' free-riding on China's efforts and the West's manipulation of carbon neutrality rules, doubts about the feasibility of energy transition, and suspicion of capitalists exploiting consumers through this concept.

This research emphasizes the high sensitivity of Bilibili users to foreign threats and their perception of China-West competition in the context of carbon neutrality. The concerns regarding foreign threats, coupled with a mindset of competition, tend to overshadow the importance of energy transition and environmental protection, resulting in a general resistance towards carbon neutrality among Bilibili users. Building upon this finding, additional research can delve into the underlying reasons why Bilibili users place significant attention on foreign threats concerning environmental issues and are deterred from participating in collective climate actions, despite the fact that climate change and the rejection of climate actions would also adversely affect their own interests.

However, this research also has some limitations. Firstly, the user base of Bilibili primarily consists of young people in China, which may not fully represent the broader demographics of the entire Chinese population. Secondly, like other Chinese video sharing websites, Bilibili is subject to government oversight, which could potentially introduce a bias in the comments towards conforming to China's central propaganda. Despite these limitations, analyzing Bilibili comments can still give a perspective on the opinions of Chinese young people, which constitute a significant portion of the population and play a crucial role in shaping societal trends and attitudes. To gain a more comprehensive understanding of the overall population's opinions, future

research could explore diverse data sources and platforms that attract a wider range of age groups and demographic backgrounds. This could include conducting surveys, interviews, or analyzing data from other social media platforms or online forums that cater to a broader audience.

This research offers policy insights for promoting carbon neutrality in China. One significant issue is the risk of nationalism, which can prevent rational thinking on environmental issues. As the research shows, Bilibili users are easily influenced by geopolitical threats and take a defensive stance against the West, which may result in overlooking the role of carbon neutrality in domestic energy and economic development or environmental protection. To address this issue, it is essential to conduct educational activities focused on energy and environmental issues, such as organizing lectures, workshops, or exhibitions, to educate the public and enhance their awareness of energy and environmental topics.

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