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News Consumption, Partisanship, and Energy Preferences in Brazil and the United States

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ABSTRACT

The transition to a more sustainable energy system must consider public perceptions of energy sources and the influences that shape them. This study compares support for renewable and non-renewable sources that make up the energy grid in Brazil and the United States (US), two nations with different energy mixes, political histories, and media systems. Through national surveys, we assess how different national energy configurations impact attitudes about renewables and non-renewable sources. Then, we analyze what attitudes are influenced by each nation's partisan identities and media consumption habits. Results indicate that attitudes reflect the fact that some energy sources are more politicized than others. In the US, polarization regarding coal and renewables manifests strong partisan differences, which are amplified by media consumption choices. In Brazil, since hydropower was adopted by both left- and right-leaning governments, the impact of partisanship on support for energy sources is more limited. Results suggest attitudes about energy are subjected to processes of partisan polarization, with media messages amplifying those effects. Findings underscore the need to invest in policies promoting media literacy and fact-based science communication, empowering the public to recognize when energy debates are manipulated to fit partisan narratives, often at the expense of evidence.

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Energy preferences; media consumption; partisanship; energy transition

1. Introduction

Understanding public perception of energy sources is needed to inform a transition to a more just and sustainable energy system. The production of electricity via fossil fuels is one of the largest drivers of climate change, and renewable energy technologies are increasingly affordable and technologically capable of meeting demand. However, implementation of this energy transition to renewable sources in many nations has lagged, and a lack of reliable access to energy plagues

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many emerging economies worldwide. Public perceptions of energy sources help shape energy policy and contribute to the social acceptance of different types of energy technology (Batel et al., 2013; Bergquist et al., 2020; Cousse, 2021). Therefore, it is important to assess how micro and macro-level variables – including national context, demographics, political leanings, and media use – impact public favorability of different energy sources.

Various studies have analyzed public perceptions of specific energy sources, including coal (Mayer, 2022), hydropower (Mayeda & Boyd, 2020), wind (Firestone & Kirk, 2019), solar (Carlisle et al., 2015), and renewable sources in general (Batel et al., 2013; Culley et al., 2011; de Sena et al., 2016). These studies find micro-level influences, such as demographics, interact with macro-level variables like democratic governance or country import/export status to explain perceptions of those sources (Sovacool et al., 2012).

This study compares support for various renewable and non-renewable energy sources that make up the energy grid in Brazil and the United States (US), two large and diverse countries with significant regional and global significance, both politically in general and in issues of environmental concern and policy precisely. We selected these nations for the analysis for two main theoretically relevant reasons. First, despite their commonalities, including a sizeable range of energy source options, they have developed different energy mixes and distribution systems. While the US has historically relied on coal and natural gas in a decentralized infrastructure, hydropower is the main energy source for the nationally integrated Brazilian grid. Second, these countries have different media systems, with Brazil experiencing military censorship and government intervention until the late 1980s. We concur with Hallin and Mancini (2004) that comparative media studies allow scholars to build better theories, and this study seeks to use this approach to identify the relationship between media consumption and energy attitudes more fully and accurately, as explained by the differences and similarities between the selected countries.

Using national surveys in both, we first analyze how demographics and political variables help explain favorability towards energy sources. Then, we assess how media consumption patterns influence energy favorability, an area largely unexplored in the literature. Ultimately, we aim to discover if attitudes about the energy system are political and how media use shapes those perceptions.

2. Background and literature review

2.1. Why compare the US and Brazil?

We chose the US and Brazil to conduct our analysis because the two nations have different energy mixes, political histories, and media systems. Conversely, these countries also have many similarities, such as cultural diversity and large geographical size with diverse options for energy production. Further, they are market-oriented countries, implying their decisions on energy issues consider their competitiveness in the global and domestic markets. Both are democracies (i.e. inhabitants have some voice in strategic decisions such as energy production).

However, the countries' energy grid development is very different, and therefore, their energy matrices have different configurations, which may influence how citizens support various energy sources. They are also experiencing climate change in very different ways, such as how droughts in California might affect their support for hydropower or that the Brazilian matrix is highly dependent on hydropower rather than fossil fuels.

Since the 1940s, the U.S. energy system transitioned from heavy reliance on hydropower to coal and, more recently, transitioned to natural gas as the baseload energy source. The current energy mix is natural gas (38.4%), coal (21.9%), nuclear (18.9%), wind (9.2%), and hydropower (6%) (EIA, 2022). There are regional differences in the mix, with some states moving faster than others towards renewables with environmental advantages, such as wind energy in the upper great plains and solar in the semi-arid and sunny southwest. Renewables have grown rapidly in recent years but

remain a supplemental energy source throughout many parts of the country. Electricity generation in the U.S. is characterized by decentralization – utilities vary significantly in their coverage area, energy mix, management, and ownership structure. State and municipal governments often have significant decision-making authority in regulating utilities.

In the U.S., one of the most consistent predictors of environmental attitudes is political partisanship, wherein conservatives or Republicans are less likely than Democrats to support a range of environmental policies or report less concern for environmental problems like climate change (Hamilton et al., 2014; Hazboun & Boudet, 2020; McCright, 2011). Energy sources are less polarized than climate change in general, but conservatives or Republicans tend to be more supportive of fossil fuels, and liberals or Democrats are more supportive of renewables (Brown & Hess, 2016; Hazboun et al., 2020; Mayer, 2022; Mayer & Smith, 2023).

The Brazilian electricity matrix is highly centralized in the *National Integrated System* (SIN, Portuguese acronym) and has a variety of sources, but hydropower is the bedrock of energy production. Its current mix is 60.2% hydro, 11.4% wind, 8.8% biomass, 2.6% solar, 16% fossil fuel (non-renewable), and 1% nuclear (EPE, 2022). These percentages can vary according to the time of the year, i.e. when there is not enough rain, the share of hydroelectricity is reduced, and thermal (i.e. fossil fuel) sources may increase their contribution. The energy production is also unevenly distributed in space; e.g. the Northeast is the region that produces most of the wind energy, whereas the Southeast, the Amazon region, and the South of the country generate most of the hydro given their favorable physical characteristics. The SIN connects most of the country, and the energy produced in one portion of the territory is redistributed to others according to their needs (EPE, 2022).

Historically, hydropower has been Brazil's primary energy source since the military dictatorship (1964–1985) and continued to expand during the following democratic regimes. Energy policies did not significantly change between the military and democratic right and left-leaning presidencies (Castillo, 2019). According to Costa et al. (2017), discourses about energy policy, especially institutional narratives about hydropower, did not change between 1969 and 2010. The authors also emphasize that, despite leftist governments in the early 2000s, the technocratic discourse ignored the socioeconomic and environmental impacts of hydropower dams.

Energy systems undergo periods of stability and flux. As we noted above, the U.S. moved away from hydropower in the 60s and 70s and has relied heavily upon fossil fuels such as coal and, more recently, natural gas and nuclear. Wind and solar energy are now growing rapidly, and while they represent a relatively small portion of total generation, this could change in the future. In Brazil, hydropower has long been the dominant energy source, with fossil fuels playing a less important role. Like the US, wind and solar have great potential and are growing rapidly.

Considering both nations' political history related to energy policy and current energy mix, we categorized each country's energy sources as "major" or "supplemental." The major sources are established energy sources that vary between the countries and are often responsible for a large portion of energy production. In the US, these sources included coal, nuclear, and natural gas since the 1960s when hydropower experienced a steady decline due to social and environmental concerns. In Brazil, hydropower is *the* major energy source, followed by thermal. Supplemental sources are generally renewables and up-and-coming sources that do not comprise most of the grid.

Our overarching research question asks:

RQ1: What factors shape energy source favorability in the United States and Brazil?

Given the literature on partisan views on energy sources, we hypothesize:

H1: Conservatives are more likely to view major energy sources more favorably than liberals in the United States.

H2: Liberals are more likely to view supplemental sources more favorably than conservatives in the United States.

Very few studies, if any, have analyzed how partisan leaning relates to favorability towards various energy sources in Brazil. As such, we ask:

RQ2: How does partisan leaning relate to favorability of energy sources in Brazil?

Regarding hydropower specifically, since the literature suggests both right and left-leaning governments have promoted it in Brazil, we do not expect differences in terms of political partisanship for being pro or against it:

H3: There will be no relationship between partisan leaning and support for hydropower in Brazil.

2.2. Media influence: comparing media systems

Public attitudes about issues of social concern are also shaped by media messages (Kim et al., 2002), and many studies have investigated how various energy sources have been framed in the news (Berardo et al., 2020; Gearhart et al., 2019; Kim et al., 2014). We also know that partisanship is associated with media consumption choices, and both of them are related to opinions on emergent technologies (Druckman & Bolsen, 2011) and issues like global warming (Thaker et al., 2017). Further, the provision of information about energy sources' costs and emissions can significantly change favorability ratings for those sources (Hobman & Ashworth, 2013).

Accounts of partisan polarization typically argue that the media provides a conduit between elites and rank-and-file partisans, with the latter group receiving "elite cues" (Brulle, 2021; Brulle et al., 2012; Carmichael & Brulle, 2017; Tesler, 2018). Yet few studies directly measure media consumption and its relationship to political ideology (or party affiliation) and energy attitudes.

The US and Brazilian media systems have noticeable differences that are theoretically relevant, and we build on the work of Hallin and Mancini (2004) to identify these differences. In their seminal study on media systems in Europe and North America, the authors identify four dimensions that shape a typology of media systems: market structure, political parallelism, degree of professionalism, and state's role. The combination of these dimensions generated three media models. The *democrat corporatist model*, identified in North and Central Europe, is characterized by high circulation, early press development, strong professional association, and a medium degree of regulation and intervention from the government, largely aimed at promoting pluralism. The media system in Southern Europe follows a *polarized pluralist model*, where degrees of professionalism and circulation are low, and there is high political parallelism, with groups instrumentalizing the press. The first country we analyze here, the United States – along with the UK and Canada – follows the liberal model, with a high circulation press, information-oriented internal pluralism, high levels of professionalism, and market-oriented outlets. More recently, political polarization has led to the emergence of a rich partisan news ecosystem in the US. Specifically, right-wing alternative media has expanded and entered the mainstream, often pushing science denialism (McIntyre, 2018; Michiko, 2018; Wendling, 2018). Outlets such as Fox News form an established conservative media ecosystem, often working with the Republican Party (Jamieson & Cappella, 2008). By 2021, about 90% of media companies in the US are controlled by six corporations.

Despite their theoretical importance, scholars adopting the models proposed by Hallin and Mancini (2004) beyond the Western countries analyzed have pointed out some shortcomings with the typology, which ignores essential aspects that do not fit into the categories. In fact, these scholars note that most non-Western countries, like Brazil, have a hybrid form of the ideal types proposed (Voltmer, 2012). Importantly, many of these countries' media systems have endured decades of authoritarian rule and heterogeneous democratization processes that cannot be explained by models generated in Western "advanced" democracies. Albuquerque (2012) notes that several elements of the polarized pluralist model do not neatly fit Brazil's media system. For example,

political parallelism is weakened, with dozens of existing political parties having a reduced role. The press did not develop similarly to the US professional tradition, with newspapers being economically dependent on the state for subsidies and without freedom of speech under the military regime (Azevedo, 2006; Mattos, 2002; Straubhaar, 1989). On the other hand, media organizations were private and market-oriented from their inception – different from the polarized pluralist model.

In Brazil, the airwaves are public concessions, and the Brazilian Ministry of Communications awards broadcast licenses to companies or individuals (Reis Mourão, 2016). The structure of the media system was formed in the early twentieth century, but it was during the military dictatorship that family-based oligopolies were formed because of the regime's goals and global capitalism (Gorgen, 2009). Currently, a limited number of families own the Brazilian media system (Matos, 2008), and local affiliates are assigned according to regional and often quid-pro-quo alliances. In 2017, the Media Ownership Monitor Brazil analyzed 50 media outlets belonging to 26 communication groups or companies, and found out that five groups or their owners concentrate more than half of the outlets: Grupo Globo owns 9, Grupo Bandeirantes owns 5, other 5 belong to the Macedo family (taking into account Grupo Record and IURD's outlets, both belonging to the same owner), 4 belong to the regional-scale Grupo RBS (from Rio Grande do Sul State) and 3 to Grupo Folha.

In the last three decades, the expansion of communication groups from churches or religious sects has transformed the Brazilian media system (Aires et al., 2017; Basso, 2011; Gorgen, 2009), closely aligned with evangelical representatives in Congress. These channels often promote conservative ideas and are generally very supportive of the right-wing policies of former President Jair Bolsonaro, who was in office between 2019 and 2022. Also recently, outlets traditionally perceived as leaning conservative – particularly the Globo corporation – were attacked by former president Jair Bolsonaro as part of his anti-mainstream media populist discourse. As a result, channels like *Rede Globo* and *Folha de S. Paulo* started being perceived as liberal media, while pro-Bolsonaro networks like *Record* and *SBT* became the preferred choices for conservatives. However, no studies employing content analysis have yet confirmed that the content produced by these outlets is indeed partisan, especially regarding energy.

Regarding environmental news, Mourão and Sturm (2018) show that the country's environmental beat developed with a technocentric perspective, and coverage is centered around key events, usually natural disasters. In an analysis of a dam accident, the authors found that coverage was mainly episodic and focused on official viewpoints, with very few articles explaining socioenvironmental concerns. As Mourão et al. (2022) also found in their historical study on coverage of hydropower, the lack of thematic coverage related to the environment and energy might limit public debate regarding the composition of the country's matrix and its socioenvironmental consequences.

This study focuses on how audiences consume news media in both countries in patterns that we label *news repertoires* (Mourão et al., 2018). A *news repertoires* approach acknowledges that in the complex media landscape of the twenty-first century, measuring news consumption using a single medium or outlets provides a limited view of use patterns. This approach considers the combination of media platforms, outlets, and/or content types people regularly use (Kim, 2016). Research based on repertoires provides multifaceted analyses, and it has been used to study patterns of news use (Peters et al., 2022), the relationship between repertoires and political attitudes (Mourão et al., 2018; Schwarzenegger, 2020), social media engagement (Dvir-Gvirsman, 2022), to cite a few. In this study, we focus on *news repertoires* based on news outlets of various orientations, media types, and geographical reach, following the approach used by Mourão et al. (2018). These items were selected based on their relevance to the study topic (different companies and media types might give more or less attention to energy news) and goals (relationship between political leaning and attitudes).

Here, we aim to investigate if news media consumption relates to favorability of energy sources:

RQ3: How do news media repertoires relate to the favorability of energy sources in a) the United States and b) Brazil?

3. Methods

Data for this study come from two national online surveys conducted in Brazil and the US (n = 2,015 for Brazil; n = 1,523 for the US) in 2022. Respondents were asked about their political ideology and political party, how often they follow news about energy, and how often they consume news from various news outlets and social media over the previous 12 months.

For the dependent variables, participants were asked how favorable or unfavorable their views on the energy sources that make up each country's mix were. In the US, participants were asked about natural gas, coal, nuclear, wind, hydropower, and solar energy. In Brazil, they were asked about hydropower, thermal, wind, biofuels, solar, and nuclear energy.

3.1. US data characteristics

Figure 1 provides the distribution of the favorability items from the U.S. survey data. A strong majority of respondents view natural gas, wind, hydropower, and solar favorably, while coal and nuclear were viewed comparatively less favorably. We conducted a factor analysis on these items (Table 1), which suggested a two-factor solution wherein coal, nuclear, and natural gas loaded on the first factor and wind, hydropower, and solar loaded strongly on the second factor. We combined these items into two scales that we refer to as "major energy favorability" (Cronbach's alpha = 0.62, mean = 4.345) and "supplemental energy favorability" (Cronbach's alpha = 0.74, mean = 5.686) respectively, conforming to the theoretical expectations outlined above. Both scales range from 1 to 7.

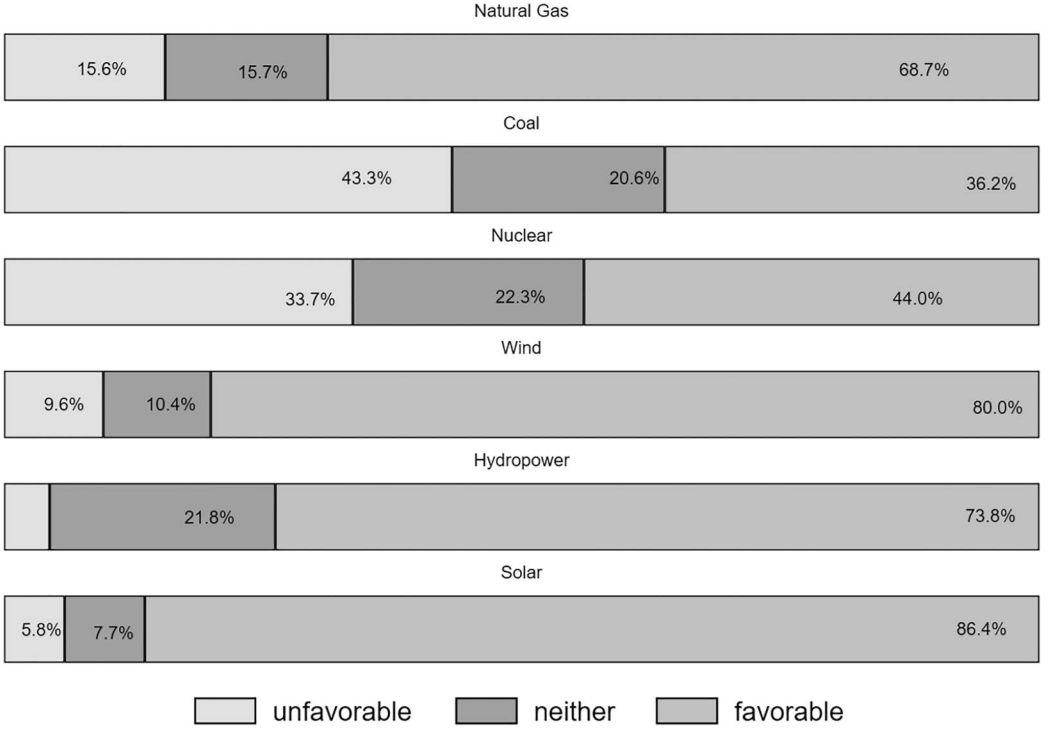

Figure 1. Distribution of favorability items in the US.

Table 1. Factor analysis for energy favorability, US.

	Factor1	Factor2	Factor3
Natural Gas		0.786	
Coal		0.760	
Nuclear		0.355	0.601
Wind	0.886		
Hydropower	0.499		0.587
Solar power	0.948		
Eigenvalues	2.150	1.553	0.403
Unique Variance	0.516	0.373	0.097

Note: We performed the factor analysis on a polychoric correlation matrix using the iterated principal factors method for extraction with a varimax rotation.

3.2. Predictors

One motivation for this analysis is to understand how political ideology and party affiliation influence the perceived favorability of energy sources. Our indicator for political ideology (liberal, middle of the road, conservative) and political party affiliation also has three categories (Republican, Independent, Democrat). Table 2 shows the descriptive statistics for the US data.

For media consumption, we adapted vetted questions from prior studies in the US (e.g. Mourão et al., 2018; Mourão & Robertson, 2019) and conducted a factor analysis on these items to determine their dimensionality (Table 3). National newspapers (e.g. NY Times, USA Today, Washington Post), national network television (e.g. ABS, CBS, PBS or NPR, CNN news and opinion), and liberal news sites all loaded strongly on the first factor – we combined these items into a scale ranging from 1 to 5 ($M = 2.409$, Cronbach's alpha = 0.801). Conservative media (e.g. Fox News, OAN) also loaded strongly on a single factor, and we combined these items into a scale (mean = 2.318, Cronbach's

Table 2. Descriptive statistics for U.S. data.

Variable	Mean	Std. Dev.	Min	Max
Political Ideology				
Liberal	0.32	0.467	0	1
Middle of road	0.335	0.472	0	1
Conservative	0.345	0.476	0	1
Education				
High School or Less	0.366	0.482	0	1
Associates Degree	0.16	0.366	0	1
Bachelor's Degree	0.272	0.445	0	1
Master's or more	0.203	0.402	0	1
Age				
18–24	0.071	0.257	0	1
25–34	0.185	0.388	0	1
35–44	0.215	0.411	0	1
45–54	0.106	0.308	0	1
55–64	0.169	0.375	0	1
65 and older	0.254	0.435	0	1
Party				
Republican	0.313	0.464	0	1
Independent	0.237	0.425	0	1
Democratic	0.45	0.498	0	1
Income				
Less than $25,000	0.146	0.353	0	1
$50,000 to $74,999	0.202	0.402	0	1
$75,000 to $99,999	0.19	0.392	0	1
$100,000 to $124,999	0.162	0.369	0	1
$100,000 to $124,999	0.1	0.3	0	1
$125,000 or more	0.2	0.4	0	1
White	0.787	0.409	0	1
Female	0.511	0.5	0	1
Conservative Media	2.318	1.244	1	5
Mainstream Media	2.409	1.052	1	5
National-Local TV	3.302	1.014	1	5

Table 3. Factor analysis, US media consumption data.

	National newspapers and liberal	Conservative media	Local media and broadcast TV
Local or regional newspapers			0.36
Local or regional television stations			0.86
National newspapers (e.g. New York Times, USA Today, Washington Post)	0.6		
National Network Television (ABC, CBS)	0.32		0.81
PBS or NPR	0.58		
CNN news or opinion	0.83		
Fox news or opinion		0.79	
MSNBC news or opinion	0.83		
Conservative news sites (Newsmax, Brietbart, the Blaze)		0.9	
Liberal news sites (e.g. Daily KOs, Occupy Democrats)	0.67	0.38	
Eigenvalues	4.62	1.27	0.96
Unique Variance	0.609	0.1673	0.1263

Note: Questions asked how often (never, rarely, occasionally, frequently, very frequently) the respondent consumed each news source in the past 12 months. We performed the factor analysis on a polychoric correlation matrix using the iterated principal factors method for extraction with a varimax rotation.

alpha = 0.775). Finally, local newspapers, local news, and national broadcast TV loaded strongly on a third factor that we call Local-National (mean = 3.302, Cronbach's alpha = 0.716).

We also use a range of control variables. These include education in four categories (1 = High school or less, 2 = Associates Degree, 3 = Bachelor's Degree, 4 = Master's or more), age (1 = 18–24, 2 = 25–34, 3 = 35–44, 5–45–54, 6 = 65 or more), income (1 = less than $24,999, 2 = $25,000–$49,999, 3 = $50,000–$74,999, 4 = $75,000–$99,999,5 = $100,000–$124,999, 6 = $125,000 or more). We also use binary variables for race and sex. Table 1 provides descriptive statistics for all variables.

3.3. Brazil data characteristics

In Figure 2, we provide the distribution of energy source favorability from the Brazilian data. Hydropower is viewed in very favorable terms (73.1%), as is wind (84.9%) and solar (89.5%). Only 38.6% of respondents rated nuclear as "favorable."

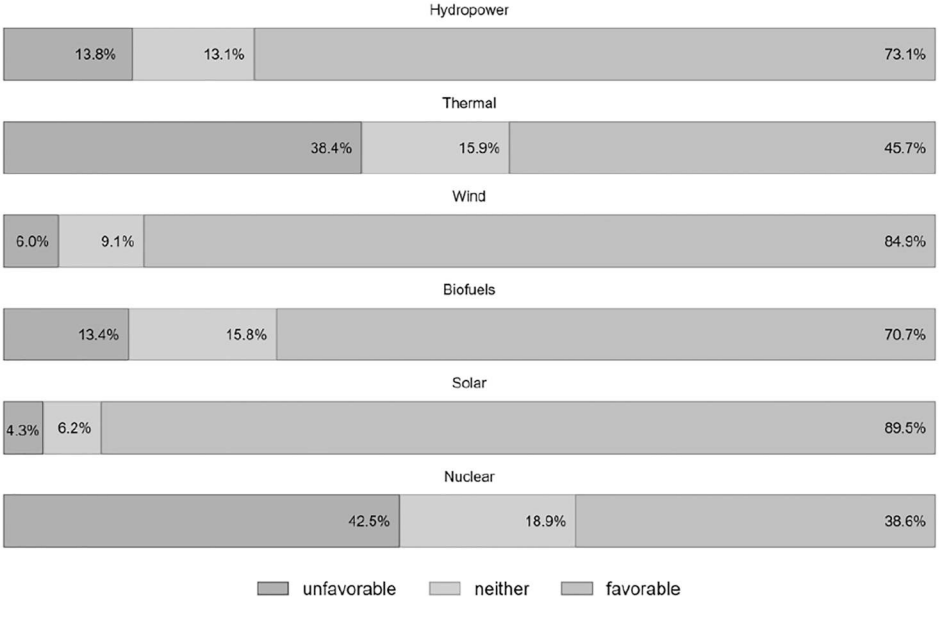

Figure 2. Distribution of energy source favorability items, Brazilian Sample.

Table 4. Factor analysis for energy favorability, Brazil.

	Factor 1	Factor 2	Factor 3
Solar Power	0.986		
Wind	0.889		
Biofuels	0.620	0.513	
Thermal		0.870	
Nuclear		0.711	
Hydropower	0.479	0.559	0.334
Eigenvalues	2.403	1.862	0.189
Unique Variance	0.519	0.402	0.041

Note: We performed the factor analysis on a polychoric correlation matrix using the iterated principal factors method for extraction with a varimax rotation.

We conducted a factor analysis on these items (Table 4), finding a two-factor solution. However, we found some more nuanced peculiarities than considering major sources as non-renewables and supplemental as renewables. First, as with the US, supplemental energy sources are loaded together (solar, wind, and biofuels). However, it is important to note that biofuels are legacy sources in Brazil, dating back to programs launched by the military dictatorship in the early 1950s. Importantly, hydropower is the primary source in the country, despite being seen by many as a renewable source, notwithstanding its significant social and environmental impacts.

Interestingly, nuclear power, which represents only a fraction of the energy grid, factorially loaded with major sources, suggesting respondents' attitudes about hydropower are more connected to thermal and nuclear than renewable sources. Following the factor analysis, we combined the solar, wind, and biofuels items into a "supplemental" scale (mean = 4.402, Cronbach's = 0.732) and hydropower, nuclear, and thermal into a "major" scale (mean = 5.917, Cronbach's alpha = 0.662). Importantly, our analysis is based on historical and contextual considerations rather than just factorial loading. Given their prominence for each country, in the results section, we detail an analysis that isolated hydropower and coal from the models to provide further depth to our findings.

3.4. Predictor variables

Our indicator of political ideology has four categories (clearly right-wing, more right-wing than left-wing, more left-wing than right-wing, and clearly left-wing). Since the survey was conducted before the 2022 elections, we also asked respondents how they intended to vote in the upcoming election (Bolsonaro, Lula, or some other candidate) to assess their political leanings. Table 5 has the descriptive statistics of our variables.

For media consumption, we combined the authors' expertise to adapt items from prior research and determined a comprehensive list of relevant news outlets for this study. We conducted a factor analysis and retained three factors (Table 6). The first item, diverse media users, comprises those who get news from a diverse range of outlets, including national newspapers, online-first news organizations, podcasts, and weekly magazines ($M = 2.609$, Cronbach's alpha = 0.922). The second item comprises those who watch mainly Globo and local news, including TV affiliates ($M = 3.526$, Cronbach's alpha = 0.791). The third item represents those who watch Record and SBT, two TV stations that are closely aligned with right-wing former President Jair Bolsonaro ($M = 3.328$ Cronbach's alpha = 0.819).

We use several control variables. These include education (less than High School, High school, Bachelor's, Master's, Doctorate), income (less than $R1,001, R$1,002 to $R2,200, R$2,202–R$3,300, R$3,301–R$5,500, R$5,501–R$11,000, R$11,011–R$22,000, R$22,001 or higher), age (18–24, 25–34, 35–44, 45–54, 55–64, 65 or order), and sex and race.

Table 5. Descriptive statistics for Brazilian data.

Variable	Mean	Std. Dev.	Min	Max
Political Ideology				
Clearly right-wing	0.276	0.447	0	1
More right than left	0.273	0.446	0	1
More left than right	0.265	0.442	0	1
Clearly left	0.185	0.388	0	1
Vote Intentions				
Lula	0.306	0.461	0	1
Bolsonaro	0.243	0.429	0	1
Other/none	0.452	0.498	0	1
Education (ref = less than HS)				
Less than High School	0.028	0.166	0	1
High School/ GED	0.340	0.474	0	1
Bachelors.	0.524	0.500	0	1
Masters degree	0.084	0.277	0	1
Doctoral degree	0.024	0.153	0	1
Age				
18–24	0.156	0.363	0	1
25–34	0.293	0.455	0	1
35–44	0.305	0.461	0	1
45–54	0.158	0.365	0	1
55–64	0.075	0.263	0	1
65 or older	0.012	0.111	0	1
Income				
Less than $R1,000	0.099	0.299	0	1
R$1,002 to R$2,999	0.184	0.388	0	1
R$2,300 to R$3,299	0.168	0.374	0	1
R$3,300 to $5,499	0.218	0.413	0	1
R$5,500 to R$10,999	0.228	0.420	0	1
R$11,000 to R$21,999	0.074	0.262	0	1
R$22,000 or more	0.028	0.166	0	1
White	0.529	0.499	0	1
Female	0.609	0.488	0	1
Media Consumption				
Diverse media use	2.609	1.061	1	5
Globo and local media	3.526	1.008	1	5
SBT and Record (conservative)	3.328	1.206	1	5

Table 6. Factor analysis media Brazil.

	Diverse media users	Globo/local news	Record/SBT (conservative)
Brasil 247	0.8378		
O Antagonista	0.8189		
Terça Live	0.8076		0.3792
Folha de S. Paulo	0.7537	0.4802	
O Estado de S. Paulo	0.7505	0.4416	
Weekly magazines	0.7233	0.3967	
CNN Brasil	0.6307	0.3769	
News podcasts	0.6147		
UOL	0.5716	0.4721	
Globo (including TV Globo, Globo News, and G1)		0.7747	
Local newspapers		0.5934	0.4964
O Globo newspaper	0.5093	0.5807	
Local news programs on TV		0.5291	0.4516
Record (including TV Record, Record News and R7)			0.8028
SBT (including SBT Brazil)			0.7595

Note: Questions asked how often (never, rarely, occasionally, frequently, very frequently) the respondent consumed each news source in the past 12 months. We performed the factor analysis on a polychoric correlation matrix using the iterated principal factors method for extraction with a varimax rotation.

4. Results

4.1. Results for the US

Table 7 provides regression results for the OLS regression models for the energy favorability scales (we use OLS because the dependent variable is continuous) in the US. All models were estimated in

Table 7. Regression models for energy source favorability, U.S. data.

	Major[a] Energy Baseline b/(se)	Major Energy Media b/(se)	Supplemental[b] Energy Baseline b/(se)	Supplemental Energy Media b/(se)
Political Ideology (ref = Liberal)				
Middle of the Road	0.104	−0.028	−0.141	−0.053
	(0.090)	(0.083)	(0.078)	(0.076)
Conservative	0.710***	0.326**	−0.256**	−0.030
	(0.108)	(0.103)	(0.094)	(0.094)
Education (ref = Some college)				
Associates	−0.092	−0.111	−0.131	−0.160
	(0.098)	(0.090)	(0.086)	(0.082)
College	−0.046	−0.007	0.162*	0.036
	(0.090)	(0.083)	(0.078)	(0.076)
Master's or more	0.138	0.063	0.240**	0.080
	(0.104)	(0.097)	(0.091)	(0.089)
Age (ref = 18–24 years old)				
24–34	0.091	0.053	0.078	0.109
	(0.146)	(0.133)	(0.127)	(0.122)
35–44	0.144	0.078	0.184	0.173
	(0.144)	(0.132)	(0.126)	(0.121)
45–54	0.064	0.091	0.228	0.251
	(0.161)	(0.148)	(0.140)	(0.135)
55–64	−0.186	0.075	−0.077	−0.079
	(0.150)	(0.140)	(0.131)	(0.128)
65+	−0.111	0.118	0.062	0.104
	(0.143)	(0.135)	(0.125)	(0.124)
Political Party (ref. Republican)				
Independent	−0.482***	−0.205*	0.312***	0.182*
	(0.105)	(0.098)	(0.092)	(0.089)
Democrat	−0.346***	−0.079	0.539***	0.214*
	(0.104)	(0.100)	(0.091)	(0.092)
Income (ref = $24,999 or less)				
$25,000 to $49,999	−0.179	−0.206*	0.073	0.056
	(0.113)	(0.104)	(0.099)	(0.095)
$50,000 to $74,999	−0.167	−0.188	0.148	0.103
	(0.118)	(0.108)	(0.103)	(0.099)
$75,000 to $99,999	−0.030	−0.096	0.166	0.162
	(0.125)	(0.115)	(0.109)	(0.105)
$100,000 to $124,999	0.195	0.086	−0.149	−0.156
	(0.144)	(0.132)	(0.126)	(0.121)
$125,000 or more	0.366**	0.206	0.181	0.138
	(0.129)	(0.119)	(0.113)	(0.108)
White	−0.123	−0.121	0.195*	0.225**
	(0.087)	(0.080)	(0.076)	(0.073)
Female	−0.250***	−0.127*	−0.105	−0.073
	(0.069)	(0.063)	(0.060)	(0.058)
Conservative		0.492***		−0.214***
		(0.031)		(0.028)
Mainstream		−0.151***		0.337***
		(0.043)		(0.039)
Local National		0.074*		0.106**
		(0.036)		(0.033)
Constant	4.545	3.438	5.161	4.604
R2	0.153	0.293	0.115	0.192

Note: *** for $p < 0.001$, ** for $p < 0.01$, * for $p < 0.05$.
[a]Coal, natural gas and nuclear.
[b]Wind, solar and hydropower.

Stata 16/BE, and we used the standard level of 0.05 to determine statistical significance. We start with a model that includes the political variables (i.e. ideology and party affiliation) and the controls and then add the media consumption variables, using the R^2 statistic to evaluate changes in model fit with the addition of the new variables.

Model 1 implies that there is a statistically significant difference between liberals and conservatives in their favorability towards major energy sources (coal, natural gas, and nuclear) (b = 0.710, $p < 0.001$), and Republicans view these energy sources more favorably than Democrats and Independents. The control variables have mostly null to modest effects. In the second model, we add the media consumption indicators. Conservative media consumption is associated with increased favorability towards major energy sources (b = 0.492, $p < 0.001$). On the other hand, national newspapers/liberal media consumption is associated with reduced major energy source favorability (b = −0.151, $p < 0.001$) and local media/broadcast TV consumers also have slightly more favorable views towards major energy sources (b = 0.074, $p < 0.05$). The effects of the political variables have been attenuated from model 1, and the R^2 has increased from 0.153 to 0.293.

The following two models in Table 7 use the supplemental energy scale as the dependent variable. Compared to liberals, conservatives have less favorability towards supplemental energy sources (b = −0.256, $p < 0.01$), while Democrats view these sources more favorably (b = 0.539, $p < 0.001$). Except for white race and more education, the control variables have mostly null effects. The second model for supplemental energy adds in the media consumption variables, which have improved the R^2 from 0.115 to 0.192 and the coefficient for "conservative" is now no longer statistically significant, and the coefficient for Democratic party affiliation is much smaller. Consumers of conservative media view supplemental energy less favorably (b = −0.214, $p < 0.001$), while national newspapers/liberal media consumption and local media/broadcast TV consumption are associated with increased favorability.

To more intuitively understand our regression results, we calculated predicted values for each category of political ideology and conservative media consumption set to its lowest score, midpoint,

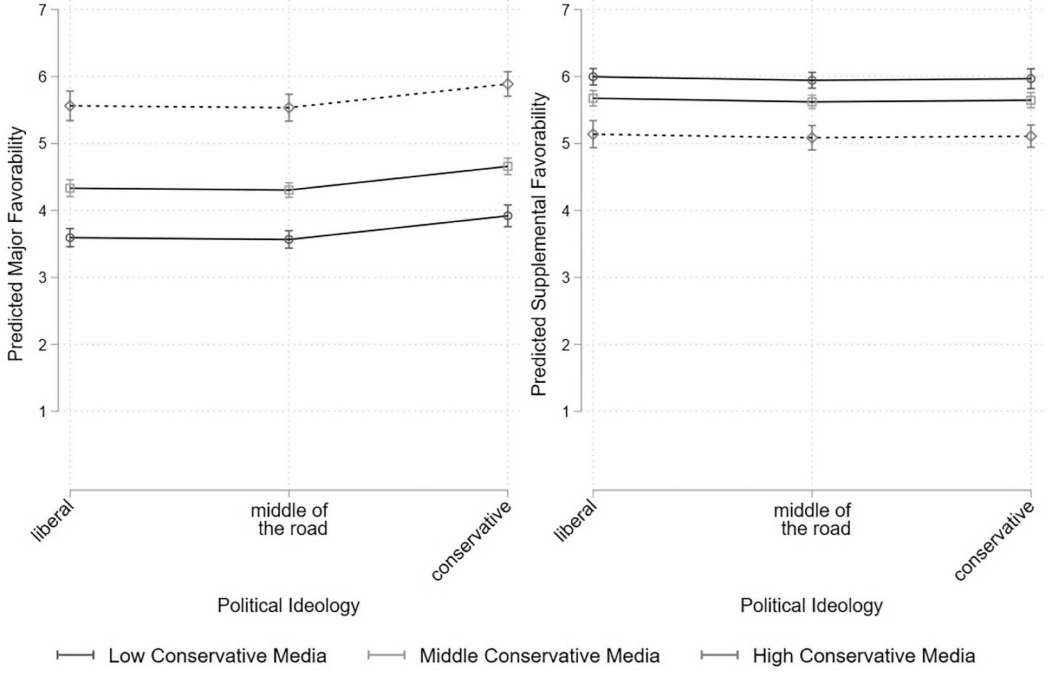

Figure 3. Predicted scores of Energy Source Favorability.

Note: Estimates derived from Table 7, Model 4. All other predictors held at their observed values.

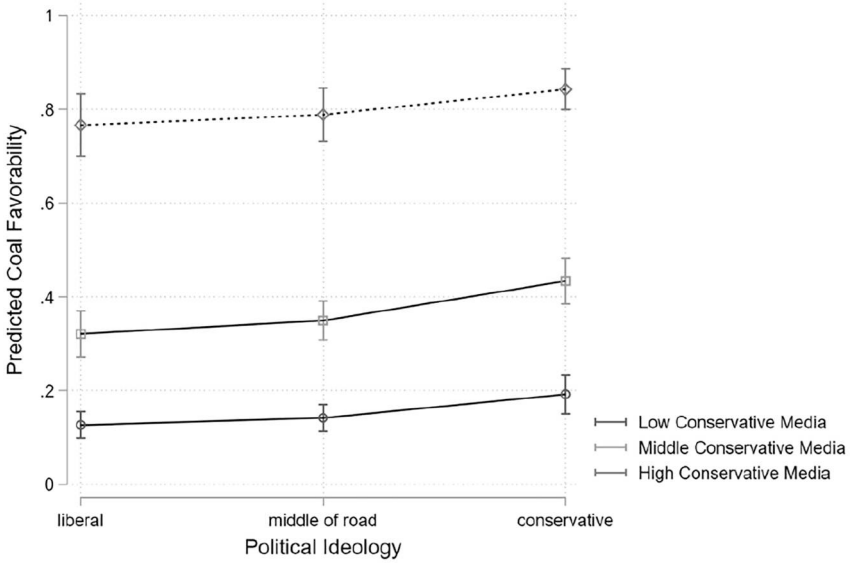

Figure 4. Predicted values of coal favorability by political ideology and conservative media consumption.

and highest score. Figure 3 shows a significant gap in favorability for major energy sources (coal, natural gas, nuclear) between those with low conservative media consumption and those with high social media consumption. Indeed, the figure implies that the effect of ideology is comparatively modest – conservatives score some 0.5 higher on the favorability scale than liberals, but the gap between the "low" curve and "high" curve is roughly 2 points. Panel 1 implies that conservatives who consume large amounts of conservative media view major energy sources in especially favorable terms. On the other hand, panel 2 underscores the null effects of ideology in Table 3, model 4 as the curves are nearly flat for supplemental energy sources. Yet, again, there is a larger effect of conservative media consumption, with a persistent gap of about 1 point between "low" consumers and "high" consumers.

Literature and our results indicate that coal has heightened resonance in conservative political circles, and therefore, we conducted additional models isolating coal from its factorial loading with an ordinal logistic regression model for coal favorability. Like our models from Table 7, we first estimate a model with the political variables and controls and add the media consumption variables in the second model. We found conservative media consumption is associated with heighted favorability towards coal, a point that is further illustrated in the predicted probabilities displayed in Figure 4. Figure 4 implies small partisan effects on the probability of a "favorable" rating for coal but much larger effects of conservative media consumption. For instance, a conservative who consumes little conservative media is less likely to view coal favorably by roughly 0.20 than a conservative who consumes a "middle" volume of conservative media. This suggests the importance of media consumption in amplifying a particular narrative about coal among conservatives.

4.2. Results for Brazil

Table 8 provides the regression results for the legacy and niche energy source scales. As with the U.S. data, we use OLS regression estimated in Stata 18/ MP. For each outcome, we first estimate a model that includes all the predictors and controls except for the media consumption variables – these are added in the second model. We use the R^2 to assess improvements in model fit.

Table 8. Regression models for energy source favorability, Brazil data.

	Major[a] Energy Baseline b/(se)	Major Energy Media b/(se)	Supplemental Energy Baseline b/(se)	Supplemental Energy Media b/(se)
Political Ideology (ref. clearly right-wing)				
more right than left	−0.053	−0.119	0.013	−0.016
	(0.107)	(0.099)	(0.080)	(0.078)
more left than right	−0.394***	−0.317**	0.075	0.061
	(0.119)	(0.111)	(0.089)	(0.087)
clearly left	−0.377**	−0.391**	0.267**	0.243*
	(0.135)	(0.126)	(0.101)	(0.099)
Vote Intentions (ref = Lula)				
Bolsonaro	0.032	0.165	−0.127	0.012
	(0.122)	(0.118)	(0.092)	(0.093)
other	−0.046	0.016	−0.148*	−0.111
	(0.098)	(0.092)	(0.074)	(0.072)
Education (ref = less than HS)				
High School/ GED	−0.417	−0.493*	0.488**	0.425*
	(0.238)	(0.220)	(0.179)	(0.173)
bachelors	−0.498*	−0.616**	0.643***	0.584***
	(0.238)	(0.221)	(0.179)	(0.174)
masters	−0.417	−0.692**	0.521**	0.425*
	(0.265)	(0.246)	(0.199)	(0.194)
phd	−0.187	−0.643*	0.615*	0.484
	(0.342)	(0.318)	(0.257)	(0.250)
Age (ref = 18–24 years old)				
25–34	0.221	0.043	0.027	−0.026
	(0.122)	(0.113)	(0.091)	(0.089)
35–44	0.347**	0.223	0.240**	0.198*
	(0.123)	(0.115)	(0.093)	(0.090)
45–54	0.126	0.136	0.294**	0.277**
	(0.140)	(0.130)	(0.105)	(0.102)
55–64	−0.293	−0.083	0.287*	0.342**
	(0.173)	(0.161)	(0.130)	(0.127)
65+	0.183	0.293	0.175	0.234
	(0.337)	(0.312)	(0.253)	(0.245)
Less than R$1,000				
R$1,002 to R$2,999	−0.033	−0.103	0.190	0.202
	(0.160)	(0.149)	(0.121)	(0.117)
R$2,300 to R$3,299	0.126	−0.001	0.412***	0.406***
	(0.163)	(0.152)	(0.123)	(0.119)
R$3,300 to $5,499	0.199	0.011	0.460***	0.416***
	(0.161)	(0.150)	(0.121)	(0.118)
R$5,500 to R$10,999	0.285	0.024	0.571***	0.508***
	(0.163)	(0.152)	(0.122)	(0.119)
R$11,000 to R$21,999	0.803***	0.377*	0.717***	0.617***
	(0.195)	(0.183)	(0.147)	(0.144)
R$22,000 or more	0.984***	0.553*	0.263	0.195
	(0.261)	(0.244)	(0.196)	(0.191)
Female	−0.003	0.009	−0.232***	−0.268***
	(0.078)	(0.073)	(0.059)	(0.057)
White	−0.042	−0.027	0.166**	0.191***
	(0.077)	(0.071)	(0.058)	(0.056)
Media Consumption				
Diverse media users		0.422***		−0.034
		(0.046)		(0.036)
Globo and local media		0.054		0.296***
		(0.049)		(0.039)
SBT and Record (conservative)		0.150***		0.028
		(0.037)		(0.029)
Intercepts	4.702	3.171	4.918	3.952
R^2	0.061	0.196	0.096	0.154

Note: *** for $p < 0.001$, ** for $p < 0.01$, * for $p < 0.05$.
[a]Hydropower, thermal and nuclear.
[b]Wind, solar and biofuel.

Left-wing identification is associated with less favorability towards major energy sources (hydropower, thermal and nuclear), but the effect of voting intentions is not statistically significant. The addition of the media consumption variables in model 2 has improved the R^2 from 0.061 to 0.192. Consumers of high media have more favorable views of major energy sources (b = 0.422, $p < 0.001$), as do consumers of SBT and Record (b = 0.150, $p < 0.001$).

For supplemental energy sources (wind, solar, and biofuels), including the media consumption variables also improved the R^2 (0.096 to 0.154). "Clearly left" political ideology is statistically different from "Clearly right" (b = 0.243, $p < 0.05$), but other ideological differences are minimal. Compared to major energy sources, the effects of media consumption appear to be more limited. Only Globo-Local is statistically significant (b = 0.296, $p < 0.001$).

Given the unique importance of hydropower to the Brazilian energy system and its cultural salience, we estimated an ordinal logistic regression model for hydropower favorability with the same set of predictors that we used in the OLS models. Notably, there are no statistically significant partisan differences in favorability for hydropower – its favorability appears to be non-partisan. Most control variables have null effects, but there are some differences based on media consumption. Both diverse, high media use (b = 0.296, $p < 0.001$) and SBT/Record (b = 0.161, $p < 0.001$) are associated with increased hydropower favorability (Table 9).

5. Discussion

This study was set out to understand how political attitudes and media consumption patterns shape citizens' levels of support for various energy sources. We selected the US and Brazil, countries with different development types of energy grids (centralized vs decentralized), and their energy matrices have distinctive mixes, political histories, and media systems. In the US, coal and natural gas are the primary sources, holding significant cultural and political identity significance among conservatives. In Brazil, hydropower is not only *the* main legacy energy source but also the most important energy source in the country, and it has been promoted by governments on the right and the left as crucial for the country's development. Here, we discuss our findings considering the research questions listed above.

In research question 1 and hypotheses 1 and 2, we asked what factors shape energy source favorability, and suggested that conservatives would be more likely to view major energy sources more favorably and liberals would view supplementary sources more favorably. Our findings largely corroborate these expectations. According to the U.S. data, conservatives view major energy sources (especially fossil fuels) more favorably and view renewables less favorably than liberals. For research question 2, we sought to investigate partisanship and its effect on energy favorability in Brazil, expecting minimal partisan effects. Our results broadly support this expectation.

We also asked how news media repertoires shaped the favorability towards energy sources (research question 3). Our findings reveal that attitudes about some sources of energy are more politicized and associated with media use than others, and this relationship is shaped by broader political contexts, including the politicization of energy, science, and the environment (Mayer, 2019; Olson-Hazboun et al., 2016; Scheufele, 2014). In the US, this is evident by polarization around coal and renewables, with media influencing those attitudes beyond partisanship. This is not surprising given the country's history with coal (Mayer, 2022) and fossil fuels' prominence in political debates, especially during the 2020 Presidential Election. In Brazil, support for hydropower did not particularly follow partisan lines, reflecting how salient hydropower is in the Brazilian grid. Media use is associated with more support for hydropower, consistent with studies showing that Brazilian news has steadily presented it favorably, following government development priorities (Mourão et al., 2022). These findings underscore how hydropower has rarely been challenged in the news, in policy, and in public perceptions. While this source is often considered "renewable," it does have significant environmental and socioeconomic impacts that have been ignored in public discourse, which can be used to justify the building of new dams as a solution to energy shortages.

Table 9. Ordinal logistic regression models for hydropower, Brazilian data.

	Baseline Model b/(se)	Media Consumption b/se
Political Ideology (ref. clearly right-wing)		
more right than left	0.102	0.048
	(0.170)	(0.174)
more left than right	−0.152	−0.102
	(0.183)	(0.189)
clearly left	−0.311	−0.322
	(0.206)	(0.213)
Vote Intentions (ref = Lula)		
Bolsanaro	0.057	0.159
	(0.195)	(0.210)
other	−0.260	−0.229
	(0.149)	(0.155)
Education (ref = less than HS)		
High School/ GED	0.115	0.045
	(0.362)	(0.369)
bachelors	−0.048	−0.147
	(0.363)	(0.371)
masters	0.146	−0.091
	(0.410)	(0.419)
phd	−0.309	−0.669
	(0.538)	(0.555)
Age (ref = 18–24 years old)		
25–34	0.033	−0.069
	(0.176)	(0.179)
35–44	0.317	0.260
	(0.183)	(0.187)
45–54	0.425*	0.438*
	(0.215)	(0.218)
55–64	−0.029	0.130
	(0.260)	(0.264)
65+	0.626	0.672
	(0.652)	(0.655)
Less than R$1,000		
R$1,002 to R$2,999	0.013	−0.051
	(0.225)	(0.228)
R$2,300 to R$3,299	0.240	0.159
	(0.234)	(0.238)
R$3,300 to $5,499	0.432	0.295
	(0.232)	(0.236)
R$5,500 to R$10,999	0.266	0.067
	(0.232)	(0.236)
R$11,000 to R$21,999	1.081***	0.803*
	(0.323)	(0.332)
R$22,000 or more	2.170***	1.851**
	(0.639)	(0.644)
White	−0.005	0.025
	(0.118)	(0.121)
Female	−0.284*	−0.282*
	(0.123)	(0.126)
Media Consumption		
Diverse media users		0.296***
		(0.080)
Globo and local media		0.086
		(0.080)
SBT and Record (conservative)		0.161**
		(0.061)
AIC	2393.997	2336.141
BIC	2523.153	2481.442

Note: *** for $p < 0.001$, ** for $p < 0.01$, * for $p < 0.05$.

Other renewables have grown fast in Brazil in the last 15 years, with wind energy leading this rise. In 2007, Brazil generated 663 GWh of wind power, and in 2021, 72,286 GWh. As for biomass, it has been following wind power closely and improving its participation in electricity generation, but approximately 80% of this power is designated to the free market (big energy consumers and producers) or short-term market settlements. Solar PV installed power jumped from 123 MW, in 2016, to 25,373 MW in 2022. Generally, our descriptive findings show widespread support for these efforts. However, the limited effects of media consumption on these attitudes suggest that energy sources like wind, solar, and biomass are still not covered in the news very much, regardless of partisan orientation. Future studies using content analysis could properly test this assumption.

Our cross-country comparison also highlights how partisanship can frame and be reinforced by media choices. In the US, we found partisanship and media repertoires likely reaffirm pre-existing convictions of specific groups regarding energy sources. This is further exacerbated by the maturing of a highly partisan informational ecosystem online and offline (Mourão & Robertson, 2019; Weeks et al., 2016). In Brazil, while there is incipient media polarization, news repertoires show that partisan content's reach is still limited to high media users, who also consume various mainstream news. Overall, we found that the favorability of energy sources in Brazil is less affected by partisan division than in the US. Media consumption in general appear to be the primary driver of energy source preferences in Brazil, while in the US, it is a combination of partisan and media effects. These results imply that more work is needed to understand the mechanisms by which media shapes energy attitudes and how selective exposure and algorithmic curation might further exacerbate these effects.

Our study has several limitations. First, it uses a survey design which is limited by the way we operationalize attitudes about energy sources. This study is part of a larger project on energy preferences that will combine a multitude of qualitative and quantitative methods to better comprehend the complexities behind attitudes towards energy, acceptability of sources, and, ultimately, adoption or behavioral change. Second, we focus on two countries, and results cannot be generalized beyond Brazil and the US. Third, we analyze media impact based on self-reported consumption, but surveys cannot capture the nature of news coverage about energy issues. We urge scholars interested in the relationship between media and energy attitudes to conduct content analysis to identify key media narratives, followed by interviews with journalists to understand their process of news making.

Our findings indicate that perceptions of energy systems are influenced by patterns of media consumption. We suggest that policymakers and other actors who are working towards decarbonizing the energy system should consider how energy is framed in mass media, and what audiences are consuming from different media sources. Further, we should encourage and partner with media initiatives such as the Knight Center for Environmental Journalism and fact-checking agencies. In addition, outreach efforts must connect journalists with scientists, policymakers, and the public. These efforts should highlight the importance of scientific and evidence-based messages, reducing the harmful effects of tying energy attitudes to partisan identities or the editorial line of specific news organizations.

Finally, any efforts to rectify a possible misunderstanding of the viability of renewable energy technologies in the news must also consider the precarious conditions affecting reporters in their daily work. Studies on the relationship between media and public attitudes about science often harshly criticize the work of newsmakers, but any solution must include the constraints that reporters face when covering science, energy, and the environment in the current partisan ecosystem. These include poor working conditions, job insecurity, lack of safety, reduced time, shrinking staff dedicated to science/environment sections, anti-press discourse, and lack of access to information, to cite a few (Mourão & Sturm, 2018). We suggest that further research be conducted to provide policymakers, newsmakers, affected citizens, and other stakeholders with clear guidance on how to construct media campaigns tailored to different audience segments.

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