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Republicans and Democrats differ in why they support renewable energy

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ABSTRACT:

Americans strongly support policies aimed at increasing the use of renewable energy. Prior research has found that, overall, support for renewable energy tends to be motivated primarily by people's perceptions that it creates economic benefits and reduces environmental harms. However, the extant research has not established how these motivations vary across political segments. Here we investigate (a) if and how Republicans and Democrats differ in their stated motivations for supporting a transition to renewable energy, and (b) what demographic and attitudinal variables best predict Republicans' and Democrats' support for renewable energy policies. Using a nationally representative sample of American registered voters, we found a consistent pattern across multiple methods of analysis: Republicans' (compared to Democrats') support for renewable energy is driven more by considerations of economic costs/benefits, whereas Democrats' (compared to Republicans') support is driven more by concern about global warming. These partisan differences hold significant implications for those who seek to effectively tailor policy and strategic communication to these political segments.

1. Introduction

In the context of climate change, dependence on foreign energy sources, and a finite global supply of fossil fuels, renewable energy provides diverse and substantial economic, political, and environmental benefits. However, the amount and rate of renewable energy development in the U.S. are not solely determined by environmental, political, and economic value, but are also influenced by public opinion—via both consumer demand and public policy support. Thus, research on public opinion about renewable energy can generate great strategic value for policymakers, industry stakeholders, and advocates.

Much prior research indicates that a majority of Americans have positive attitudes toward renewable energy sources and support policies to increase the use of renewable energy for producing electricity (Ballew et al., 2019; Bolsen and Cook, 2008; Greenberg, 2009; McCarthy, 2019; Leiserowitz et al., 2019a; NSEE, 2015; Schaffner and Ansolabehere, 2015). Most Americans rate solar and wind energy more favorably than coal and nuclear, and support increasing solar and wind energy use and decreasing the use of coal (Stoutenborough et al., 2015). Scholars argue that these differences have a simple explanation. In a summary of extensive research on American public opinion about energy, Ansolabehere and Konisky (2014) state that "there is a simple, unifying structure to public opinion about energy, and that is the desire to have an energy system that simultaneously reduces environmental harms and economic costs" (p. 124).

However, although most Americans want energy that is cheap and clean, the relative priority of these considerations may vary across political segments of the public. In this study, we investigate this question: Why do Republicans and Democrats, respectively, support a transition to renewable energy? We approach this question from two perspectives. First, we investigate what people *say* are the reasons they support a transition to renewable energy. This approach has the advantage of directly measuring individuals' stated preferences and can reveal where Republicans' and Democrats' stated rationales converge and diverge. Second, we investigate which *individual-level variables* (e.g., demographics, beliefs, attitudes) best predict support for renewable energy. This approach has the advantage of quantifying the relative explanatory power of multiple variables and can reveal which predictors of support differ between Republicans and Democrats.

Corresponding to these two research questions, we first review the extant research identifying the rationales supporting renewable energy and then review the research on the individual-level variables that predict support for renewable energy.

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2. Reasons for supporting renewable energy

Ansolabehere and Konisky (2014) argue for a "Consumer Model" of energy opinions such that "people evaluate energy choices as goods" (p. 8). In other words, public support for renewable energy is based on its perceived characteristics and effects. Prior research has shown that these considerations include economic, environmental, health, religious, and political implications and effects.

2.1. Economic reasons

Perceptions of whether a transition to renewable energy would reduce (or increase) energy costs are a primary driver of support (or opposition). Surveys and experiments have demonstrated that higher perceived energy costs are related to dramatic decreases in public support (e.g., Aldy et al., 2012; Ansolabehere and Konisky, 2014; Stokes and Warshaw, 2017). Moreover, the negative effects of messages that emphasize personal economic costs (e.g., electricity bills) can override the positive effects of emphasizing accompanying environmental benefits (Aklin and Urpelainen, 2013; Bayulgen and Benegal, 2019).

Early experiments from 2002 to 2011 informed participants that electricity from renewables was (as much as five times) more expensive than electricity from fossil fuels, because that was the case at that time (for a summary, see Ansolabehere and Konisky, 2014). These experiments observed significant decreases in support for renewables after being informed of these higher costs. However, the costs of electricity generated from renewable sources have decreased dramatically since then, and in many locations have reached parity with the costs of electricity from fossil fuels (Gray et al., 2018; IRENA, 2019). Thus, considering the current relative costs of renewables may have a positive influence on support, rather than the previously observed negative effect.

Another economic reason to support renewable energy is that the renewable energy industry currently provides nearly 800,000 jobs in the U.S., and more than 10 million jobs globally (IRENA, 2018), while also catalyzing investments in growing businesses and emerging technologies. Additional potential economic benefits of increased use of renewable energy include decreased volatility in energy costs (e.g., Rentschler, 2013; Rintamäki et al., 2017), decreased military costs of protecting access to foreign energy resources (Dancs et al., 2008), and the intuitive practical advantage of inexhaustible sources.

In the U.S., many Americans are aware of the changing economics of energy. More than one third of U.S. adults perceive electricity from solar (38%) and/or wind (38%) to be less expensive than electricity from coal, while fewer think that renewables are more expensive than coal (solar 25%, wind 19%; Leiserowitz et al., 2018). Similarly, almost half estimate electricity from solar (48%) and wind (45%) will get even cheaper in the next decade, while far fewer think that these energy sources will get more expensive in the next decade (solar 13%, wind 12%). Further, a majority of Americans (58%) think that policies intended to transition to renewable energy will increase economic growth (Leiserowitz et al., 2018). In sum, economic perceptions are important drivers of Americans' support for renewable energy.

2.2. Environmental and health reasons

Many Americans are aware of the environmental and health advantages of renewable energy. Survey data indicate that large majorities of Americans think wind (83%) and solar (86%) are safe, whereas only 41% think coal is "safe" (Stoutenborough et al., 2015) Similarly, 62% of Americans think coal energy is at least "moderately" harmful to people's health, compared with only 5% who think wind and solar are harmful to health (Leiserowitz et al., 2018).

Additionally, a majority of Americans are worried about global warming and its health effects (Ballew et al., 2019; Leiserowitz et al., 2019b; Maibach et al., 2015) and think that corporations, the government, and individuals should do more to help reduce global warming (Leiserowitz et al., 2019a). Given that transitioning from fossil fuels to renewable energy constitutes a significant step toward mitigating global warming and its effects (Edenhofer et al., 2011), it follows that limiting global warming may be a common reason for wanting to transition to clean, renewable energy sources.

2.3. Religious reasons

About one in eight Americans adults say that, to them, the single most important reason to reduce global warming is to "protect God's creation" (Goldberg et al., 2019). The ethic of stewardship of the Earth is a common teaching in Christianity and other religions. It is possible that many also use this rationale as a primary reason to support renewable energy, particularly if continued pollution from fossil fuels is considered poor stewardship of the Earth.

2.4. Political reasons

Some people may be motivated by the political effects of transitioning from fossil fuels to renewable energy sources. The fossil fuel industry has significant power in American politics through their extensive lobbying efforts and public misinformation campaigns (Brulle, 2014; Oreskes and Conway, 2011), and thus some people may support a transition to renewable energy to reduce that influence. Additionally, further development of renewable energy sources in the U.S. could increase the independence of the U.S. from foreign energy sources (U.S. EIA, 2019). Prior research has found that individuals who support reducing the importation of energy are also more likely to support wind power development (Klick and Smith, 2010), and a survey of energy industry professionals found that among that group, energy security is prioritized slightly more highly than environmental impacts and economic costs (Manley et al., 2013).

3. Predictors of support for renewable energy policy

In addition to identifying the diverse reasons that people have for supporting renewable energy, much research has also identified diverse individual-level variables that are significant predictors of a person's support for or opposition to renewable energy. In this section we review the research identifying these predictors.

As reviewed above, Americans' perceptions of environmental harm and (to a lesser degree) economic costs are the leading predictors of support for the use of renewable energy sources versus fossil fuels (Ansolabehere and Konisky, 2014; Greenberg, 2009; Klick and Smith, 2010). Some demographic and ideological variables may also play a role, albeit smaller, in explaining support for renewable energy policies. In 17 waves of a nationally representative survey of American adults conducted between 2008 and 2017, support for four specific energy policies (funding research into renewables, regulating CO_2 as a pollutant, setting strict CO_2 limits on coal-fired power plants, and requiring 20% of electricity to be produced by renewable sources) was higher among women (compared to men), people with higher educational attainment, Democrats (compared to Independents or Republicans), and liberals (compared to conservatives) (Ballew et al., 2019). A separate analysis of data found that gender (female), (higher) education, and (liberal) ideology are significant positive predictors of support for an index of three of those four renewable energy policies (Olson-Hazboun et al., 2018).

Further, for both Republicans and Democrats, individuals' beliefs and attitudes about climate change are significant predictors of support for energy-related policies that are designed to reduce CO_2 emissions and mitigate climate change (Ansolabehere and Konisky, 2014; Olson-Hazboun et al., 2018), even after accounting for other demographics (Goldberg, Gustafson, Ballew, Rosenthal and Leiserowitz, in press). Another study found that people were more likely to support

wind power if they considered its lack of greenhouse gas emissions to be an advantage (Klick and Smith, 2010).

Affective responses also underlie risk perceptions of energy and environmental issues (e.g., Leiserowitz, 2006; Peters and Slovic, 1996; Slovic et al., 2005). In turn, as reviewed above, perceptions of environmental harms are a primary driver of energy preferences. It is not surprising then that research also finds that general affect about global warming ("Is it a good or bad thing?") and discrete emotions about global warming (e.g., anger, helplessness, hopefulness) are significant predictors of support for climate change policies (Goldberg et al., in press; Leiserowitz, 2006; Smith and Leiserowitz, 2014). Some scholars have placed considerable emphasis on the role of affective evaluations in explaining energy preferences, posing a "dual-process model" of energy support that describes the separate influences of cognitive beliefs and emotions (Truelove, 2012).

In addition, various efficacy perceptions (e.g., the feasibility and effectiveness of solutions to the threat of global warming) are significant predictors of support for environmental behaviors and policy support (e.g., Bamberg and Moser, 2007; Roser-Renouf et al., 2014).

4. The present study

As mentioned above, prior research has shown that Americans' preferences for energy sources are mostly driven by perceptions of whether it is cheap and whether it is clean. The extant research has investigated this question both by recording individuals' self-reported rationales and by developing statistical models that identify the demographic and attitudinal variables that best predict support for renewable energy (e.g., Ansolabehere and Konisky, 2014). However, research has not investigated if and how the relative balance of these stated preferences and predictors, respectively, vary across key segments of the public. For example, the economic benefits of renewable energy may be more important for one group of people, while the environmental benefits are more important for another group. Such variation, if present, could have high strategic, practical, and theoretical value. Thus, to begin to fill this gap in the literature, the present study investigates if and how the stated rationales for (RQ1), and the statistical predictors of (RQ2), support for renewable energy differ between Republicans and Democrats.

Both research questions address the broader query of if and how Republicans and Democrats differ in the factors underlying their support for renewable energy, albeit from different methodological perspectives. RQ1 focuses on the difference between Republicans and Democrats in their conscious, self-reported rationales. In contrast, RQ2 focuses on quantifying the predictive power of individual-level variables and comparing those predictors across groups. Because study results can be highly sensitive to the study's design (Landy et al., 2020) and analytical approach (Silberzahn et al., 2018), using two different methodological approaches helps to broaden the utility of the results and to increase confidence in the overall pattern of results.

5. Methods

5.1. Sampling and procedure

To answer the research questions, we use data from a survey administered to a nationally representative probability sample of U.S. adults (aged 18 and over). The data were collected using the Ipsos KnowledgePanel® from November 28 to December 11, 2018 and were weighted to match U.S. Census parameters. Ipsos KnowledgePanel® members were recruited using both random digit dialing and address-based sampling techniques that covered almost all U.S. residential phone numbers and addresses. Individuals who chose to participate but did not have Internet access were loaned computers and given Internet access. The survey items used in the present analyses were part of a larger survey measuring public opinion of climate change and related issues, with a mean completion time of 27 min. The renewable energy items that comprise the core of the present study were presented first in the survey, and thus responses to these items could not have been affected by later survey items about climate change and politics.

In total, 1114 participants self-administered this online survey, 966 of whom were registered voters. All reported data and analyses include only these registered voters. This sample used in our analyses was 52% female and had a mean age of 47.74 (median = 48; $SD = 17.50$). A six-point scale of education was computed from participants' stated highest level of educational attainment (Less than high school = 10%; High school = 29%; Some college or Associate's degree = 29%; Bachelor's degree = 18%; Master's degree = 10%; Doctorate or professional degree = 5%). A seven-point scale of income was computed from participants' stated yearly household income (Less than $25,000 = 14%; $25,000 to $34,999 = 8%; $35,000 to $49,999 = 12%; $50,000 to $74,999 = 17%; $75,000 to $99,999 = 14%; $100,000 to $149,999 = 17%; $150,000 or more = 19%).

5.2. Measures

5.2.1. Reasons to transition to clean, renewable energy

To assess the level of personal importance assigned to each of 16 potential reasons to transition to renewable energy, we asked participants "How important to you personally, if at all, are each of the following reasons to transition to 100% clean, renewable energy?" (See Fig. 1 for all 16 reasons). Nine percent of participants opted out of responding to this question by instead selecting "N/A because I do not support a transition to 100% clean, renewable energy." The remaining 91% of participants rated the personal importance of the 16 reasons, presented in random order, on a five-point scale from "not at all important" to "extremely important."

To establish participants' single most important reason to transition to clean, renewable energy, a subsequent question asked, "Which of these reasons to transition to 100% clean, renewable energy is most important to you?" The survey programming used a "tie-breaker" system such that each participant's highest-rated reasons were automatically displayed in this follow-up question. For example, if a participant rated zero reasons as "extremely important" (the top response category) but three reasons as "very important" (the second-highest response category) and five reasons as "somewhat important" (the third-highest response category), then those three "very important" reasons would be displayed in the tie-breaker follow-up question that asked the participant to indicate which one was most important.

5.2.2. Policy support for 100% clean, renewable energy

An index of policy support was created from responses to five items assessing support for different renewable energy policies and the priority that the government should place on renewable energy ($M = 3.14$; $SD = 0.72$). The policy support index demonstrated good internal consistency (Cronbach's $\alpha = 0.87$). An exploratory factor analysis performed in SPSS with maximum likelihood estimation and direct oblimin rotation indicated that a one-factor solution was most appropriate, as determined by Kaiser's eigenvalue criteria (eigenvalue of one-factor solution = 3.26; two-factor = 0.54). Appendix A displays each items' wording, response options, mean, standard deviation, and first factor loading.

5.2.3. General affect

General affective impression of renewable energy was assessed by asking "On a scale from −3 (very bad) to +3 (very good), do you think [clean] [renewable] energy is a bad thing or a good thing." As part of a separate inquiry into differential perceptions of "clean energy" versus "renewable energy," a randomly selected half of participants saw one phrasing, while the other half saw the other phrasing. Subsequent survey items used the hybrid phrasing "clean, renewable energy." For the present analyses, the six-point scale was recoded to range from 1 (very

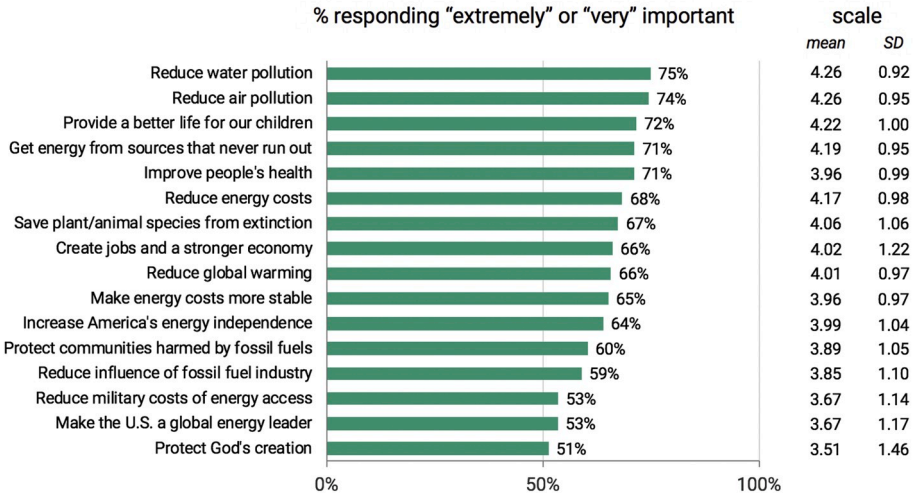

Fig. 1. Sixteen reasons to transition to 100% renewable energy rated by American registered voters on a five-point scale of importance. *Note:* Bars represent the percentage out of the full sample responding either "(5) extremely important" or "(4) very important."

bad) to 6 (very good) ($M = 5.33$; $SD = 0.92$), and responses from both randomized conditions were combined because their means were not significantly different ("clean" $M = 5.33$, $SD = 0.90$; "renewable" $M = 5.33$, $SD = 0.93$; $t(907) = 0.04$, $p = .97$, $d = 0.003$).

5.2.4. Perceived harmfulness of energy sources

Participants were asked "To the best of your knowledge, how harmful are each of the following energy sources to people's health?" with responses given to separate items of "Solar," "Wind," and "Coal." Harmfulness perceptions of other energy sources (e.g., nuclear) were measured but were not used in the present analyses. The displayed order of these energy sources was randomized. Responses were recorded on a scale from "Not at all harmful" (1) to "Extremely harmful" (5), with an additional option of "Don't know." The solar and wind items were combined to form an index of perceived harm of renewable energy sources (Spearman-Brown coefficient = 0.76; $M = 1.24$; $SD = 0.57$), while the coal item was used alone ($M = 3.54$; $SD = 1.19$). An additional question asked, "In your view, does air pollution from the use of fossil fuels harm the health of Americans?" with response options of "Yes" (75%), "Don't know" (15%), and "No (9%).

5.2.5. Perceived economic impacts of an energy transition

Two items measured perceptions of the economic costs and benefits of renewable energy. The first was "Overall, government policies intended to transition away from fossil fuels (coal, oil, natural gas) and toward clean energy (solar, wind) will …" with responses given on a three-point scale of "Reduce economic growth and cost jobs" (1), "Have no impact on economic growth or jobs" (2), and "Improve economic growth and provide new jobs" (3) ($M = 2.43$; $SD = 0.78$). The displayed order of response options was randomized between two orders (1-2-3 or 3-2-1). The second item was "To the best of your knowledge, does electricity produced from each of the following energy sources cost more, less, or about the same as electricity produced by burning coal?" Responses were given on a five-point scale from "Costs much more than coal" to "Costs much less than coal," with an additional option of "Don't know." The "Solar" and "Wind" items were combined to form an index of perceived cost advantage of renewables over coal (Spearman-Brown coefficient = 0.85; $M = 3.49$; $SD = 1.39$).

5.2.6. Global warming opinions

We included four measures of global warming attitudes. First, worry about global warming was measured using a single item asking, "How worried are you about global warming?" with a four-point scale from "Not at all worried" (1) to "Very worried" (4) ($M = 2.85$; $SD = 0.98$). Second, we asked "How big of an effort should the United States make to reduce global warming?" Responses were given on a four-point scale with options of "No effort" (1), "A small-scale effort, even if the costs are low" (2), "A medium-scale effort, even if the costs are moderate" (3), and "A large-scale effort, even if the costs are high" (4) ($M = 3.02$; $SD = 0.96$). Third, we assessed personal interest in hearing about solutions to global warming by creating an index of two items: "How interested are you in hearing or reading news stories [in your local news media] [in the national news media] about the solutions to global warming?" Responses to these two items were provided on four-item scales from "Not at all interested" (1) to "Very interested" (4) (Spearman-Brown coefficient = 0.95; $M = 2.57$; $SD = 1.10$).

5.2.7. Effectiveness and feasibility perceptions

To assess the perceived feasibility of a transition to 100% renewable energy, we asked "How confident are you that electric utilities in your state could meet the goal of producing 100% of their electricity from clean, renewable energy sources (such as wind and solar) by 2050, if they were required to by your state government?" Response options were given on a five-point scale from "Not at all confident" (1) to "Extremely confident" (5) ($M = 2.96$; $SD = 1.23$), with an additional option of "Don't know."

To measure the perceived effectiveness of a renewable energy transition in regards to reducing global warming, we asked "If all nations of the world switched to 100% clean, renewable energy by 2050, how effective would that be at limiting global warming?" Responses were given on a four-point scale from "Not at all effective" (1) to "Very effective" (4) ($M = 3.06$; $SD = 0.92$) with an additional option of "Don't know."

5.2.8. Political variables

To measure political party affiliation, participants were asked "Generally speaking, do you think of yourself as a …" with response items of "Republican," "Democrat," "Independent," "Other," and "No party/not interested in politics." Participants that responded with "Independent" or "Other" were asked a follow-up question of "Do you think of yourself as closer to the …" with response options of "Republican party," "Democratic party," and "Neither." For all analyses in this study, Republicans ($N = 356$) are defined as the registered voters who either answered "Republican" to the first question or leaned toward the "Republican party" in the follow-up question. Democrats ($N = 466$) are defined as those who either answered "Democrat" to the first question or leaned toward the "Democratic party" in the follow-up question.

To measure political ideology, participants were asked "In general,

do you think of yourself as …" with five response options labeled "Very conservative," "Somewhat conservative," "Moderate, middle of the road," "Somewhat liberal," and "Very liberal" coded on a 1 to 5 scale ($M = 3.05$; $SD = 1.05$).

5.3. Missing data procedures

The data used in RQ2 contain two distinct types of missing values. The first type are the values missing due to non-response, which occur at a rate of no more than 1.30% for any variable. The second type are "Don't know" (DK) responses, which were a valid response option provided for several variables. For measurement validity, it is important to allow DK responses when the nature of the question is such that many respondents might legitimately feel they do not know enough to state an opinion—for example, the cost of electricity from renewable energy compared to the cost of electricity from coal. These DK responses were chosen frequently (see Appendix B), a finding that is well-established in other research on public understanding of renewable energy (e.g., Klick and Smith, 2010; Stoutenborough et al., 2015).

There are several common options for handling these "missing" responses. Listwise deletion removes all cases with any missingness on any relevant variables, pairwise deletion removes cases only when an estimate requires a variable with a missing value, and mean substitution replaces missing values with that variable's mean. All three of these methods are known to bias results, especially when missingness is nonrandom and is systematically related to the outcome variable (as is likely the case here). Myers (2011) provides an extended discussion of these methods and recommends using full-information maximum likelihood (FIML) estimation in the present situation. Rather than deleting or imputing missing values, FIML estimates the model from all available information in the data. Although listwise and pairwise deletion are known to be inferior to FIML in this situation, we can increase confidence in our findings by investigating whether results are consistent across different analytical decisions (Steegen et al., 2016). Therefore, in addition to using FIML, we also investigated RQ2 using pairwise deletion and listwise deletion and we report the results of these additional analyses in the online supplement.[1]

6. Results

6.1. RQ1 results

For 15 of the 16 reasons to transition to 100% renewable energy, more than half of American registered voters said the reason was either "extremely" or "very" important to them (the lone exception was "protect God's creation" [51%], for which the margin of error overlaps with 50%; Fig. 1). The reasons most often rated as "extremely" or "very" important were "reduce water pollution" (75%) and "reduce air pollution" (74%), followed by "provide a better life for our children and grandchildren" (72%), "get energy from sources that never run out" (71%), "reduce energy costs" (71%), and "improve people's health" (71%). On the right-hand side of Fig. 1, the means and standard deviations of the five-point personal importance scale are given for each reason.

To answer RQ1, we investigated these proportions separately among Republicans and Democrats. Despite strong overall endorsement of most reasons to transition to renewable energy, there are large differences in the frequencies with which Democrats and Republicans said they were important. Fig. 2 shows that the greatest partisan divide is for "reduce global warming" (a 46-percentage-point partisan difference), followed by "protect communities harmed by fossil fuels" (a 41-point difference), and "reduce the influence of the fossil fuel industry" (a 36-point difference).

There are also differences between Democrats and Republicans when response scales for the 16 items are treated as continuous four-point scales. Table 1 displays the results of *t*-tests of mean differences and corresponding effect sizes (Hedge's *g* is used due to unequal group sizes), as well as the frequency with which each reason was chosen as the single "most important" by Republicans and Democrats, respectively.

In a stark partisan difference, "reduce global warming" had the *highest* mean importance score among Democrats and had the *lowest* mean importance score among Republicans (Table 1). After "reduce global warming," Democrats rated "reduce air pollution," "reduce water pollution," and "provide a better life for our children" highest on the importance scale (Table 1). Among Republicans, "reduce energy costs," "get energy from sources that never run out," "reduce water pollution," and "increase America's energy independence" were rated highly on the importance scale. "Protect God's creation" was the only reason for which Republicans' mean importance rating (3.65) was greater than the Democrats' mean (3.35).

Democrats most often chose "reduce global warming" (33%) as their single most important reason, followed by "provide a better life for our children and grandchildren" (13%), and "improve people's health" (12%). In contrast, Republicans' most frequent choices for the single most important reason were "to get energy from sources that will never run out" (15%), "reduce energy costs" (14%), and—as was also common among Democrats—"provide a better life for our children and grandchildren" (15%). "Increase America's energy independence" was chosen as most important by many Republicans (10%) but was rarely chosen by Democrats (2%).

6.2. RQ2 results

6.2.1. Multiple regression models

To answer RQ2, we first used multiple regression to test which variables are significant predictors of support for (the index of five) renewable energy policies. Our analytic strategy followed that of Leiserowitz (2006) and Goldberg et al. (in press), who each investigated the predictors of support for an index of climate change mitigation policies. Specifically, we first used separate blocks of predictors (e.g., demographics, perceived harms) to assess how strongly each block predicted policy support. We then combined all of the predictor variables into a single model to assess the predictive strength of each when accounting for all the other variables. Both steps were done for Republicans and Democrats separately.[2] The standardized coefficients in the full models were then compared using *z*-tests (Paternoster et al., 1998) to determine whether differences between coefficients were statistically significant.

Results of the analyses are reported in Table 2. The analyses were conducted using FIML estimation for missing values and then compared with results using pairwise deletion for missing values. The FIML method (Table 2) and the pairwise deletion method (Table A in the supplement) produced nearly identical results, such that in the full models the standardized coefficients differed by more than 0.02 for only one variable (belief that fossil fuels harm human health, which was a non-significant predictor). This adds additional confidence in the strength of these findings. The listwise deletion method (Table B in the supplement) resulted in larger deviations in magnitude of coefficients compared to the results from the other two methods, although the substantive patterns are similar. This larger deviation is not entirely surprising, because listwise deletion is one of the worst methods of handling missing data because of the biases it introduces (Myers, 2011). Here, we summarize the findings from the FIML method because it is the

[1] FIML and pairwise deletion produced results that were virtually identical. Listwise deletion produced results that were somewhat different, but indicated a similar general pattern.

[2] The correlation matrices for Republicans and Democrats, respectively, are available in Appendix C.

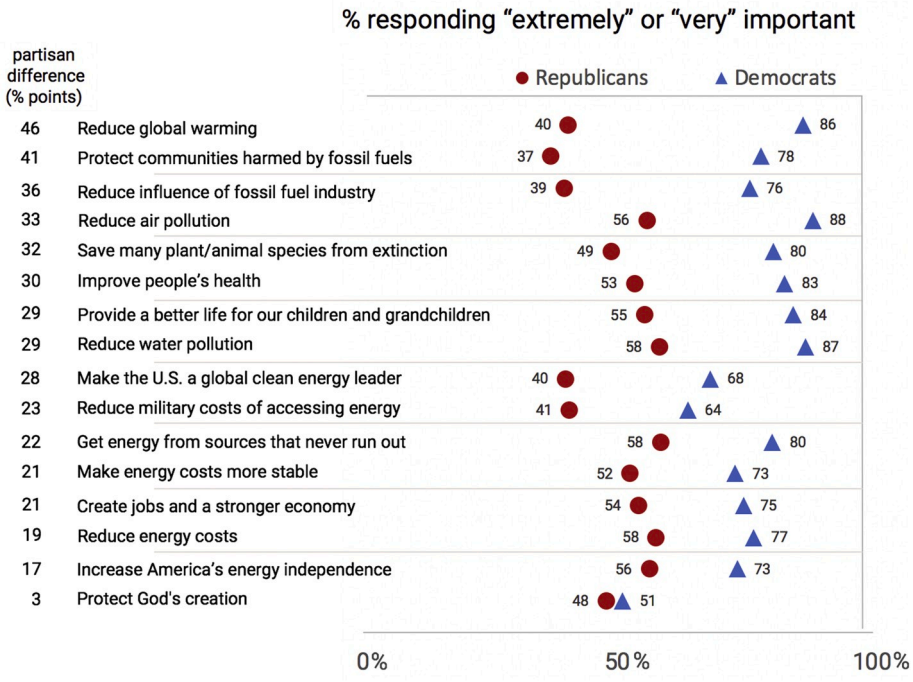

Fig. 2. Difference between the proportions of Republican and Democratic registered voters who said the reasons to transition to renewable energy were "extremely" or "very" important.

Table 1
Comparing Democrats' and Republicans' ratings of the importance of reasons to transition to 100% clean, renewable energy.

Reason to transition to renewable energy	% top choice		Rep Mean	Rep SD	*Dem mean*	*Dem SD*	t	p	Hedge's g
	Rep	Dem							
Reduce global warming	7	**33**	3.28	1.42	**4.54**	0.79	14.76	.000	1.17
Reduce influence of fossil fuel industry	2	4	3.38	1.17	4.21	0.93	10.23	.000	0.81
Reduce air pollution	7	4	3.91	0.98	**4.52**	0.76	8.96	.000	0.72
Protect communities harmed by fossil fuels	1	2	3.49	1.04	4.18	0.94	8.76	.000	0.70
Save plant/animal species from extinction	4	2	3.70	1.16	4.34	0.89	8.05	.000	0.64
Protect God's creation	10	6	3.65	1.16	3.35	0.89	2.60	.010	0.64
Improve people's health	5	**12**	3.87	0.99	4.42	0.86	7.49	.000	0.60
Reduce water pollution	3	1	**3.99**	0.93	**4.47**	0.76	7.38	.000	0.58
Provide a better life for our children	**15**	**13**	3.93	1.03	4.44	0.87	6.90	.000	0.54
Make the U.S. a global renew. energy leader	1	3	3.37	1.15	3.97	1.10	6.74	.000	0.53
Energy from sources that never run out	**15**	7	**4.00**	0.92	4.37	0.89	5.18	.000	0.41
Reduce military costs of energy access	1	1	3.43	1.21	3.89	1.08	5.21	.000	0.41
Create jobs and a stronger economy	4	1	3.82	0.99	4.16	0.91	4.66	.000	0.36
Make energy costs more stable	2	3	3.81	0.95	4.11	0.90	4.02	.000	0.33
Reduce energy costs	**14**	6	**4.01**	0.90	4.22	0.92	2.78	.006	0.23
Increase America's energy independence	10	2	3.94	1.01	4.14	1.00	2.50	.013	0.20

Note: % top choice = within each party, the % of registered voters who selected this reason as their single most important reason. For each party, the top three reasons by frequency selected as "top choice" and the top three by mean importance are bolded. Analyses exclude those (n = 103) who opted out of this question.

preferred method for handling missing data (Myers, 2011).

General affect toward renewable energy was a significant predictor of renewable energy policy support for both Republicans and Democrats. Beyond that, however, there were considerable differences in the predictors of policy support for the two parties. For Republicans, the belief that renewable energy will improve economic growth (creating jobs; boosting the economy) was a significantly stronger predictor of policy support than for Democrats. Similarly, the desired scale of a national effort to reduce global warming *when considering the costs* was a marginally stronger predictor for Republicans than for Democrats (p = .07). Perceptions of the practical feasibility of generating 100% of electricity from renewable sources by 2050 was a significant predictor for Republicans but not for Democrats, although the difference between these relationships was not itself statistically significant.

A mostly different set of significant predictors emerged for Democrats. All three global warming attitudes were significant predictors for Democrats, whereas only one (the one referencing costs) was a significant predictor for Republicans. Worry about global warming and interest in the solutions to global warming were also marginally stronger predictors for Democrats than for Republicans (worry p = .06; interest p = .05).

6.2.2. *Relative weight analyses*

Because regression coefficients are sensitive to other variables in the model, particularly when there are high correlations between predictors (LeBreton et al., 2004), a useful supplement to regression analyses is relative weight analysis (RWA; Tonidandel and LeBreton, 2011; Tonidandel and LeBreton, 2015). RWA is a technique that transforms predictor variables into a new set of variables that are as similar as possible to the original variables but are completely independent of one another.

Table 2
Predictors of renewable energy policy support (Estimating "Don't know" with FIML).

	Separate Models 1-7				Full Model				
	Republicans		Democrats		Republicans		Democrats		
	Adj. R^2	β	Adj. R^2	β	Adj. R^2	β	Adj. R^2	β	z-test
1. Demographics	.06		.06		.65		.69		
Gender		.16**		-.05		.09*		-.01	1.87
Education		.09		.16*		.00		.06	1.06
Income		-.20**		.10		-.08		.07*	2.72**
2. Ideology	.08		.09						
Political Ideology		.29***		.30***		.03		-.02	0.93
3. General Affect	.27		.34						
RE Is a Good/Bad Thing		.52***		.59***		.23***		.28***	0.64
4. Harms	.25		.22						
Wind/Solar Harmful		-.03		-.21**		.04		.01	0.43
Coal Harmful		.25***		.32***		.05		.11**	1.09
Foss. Fuels Harm Health		.35***		.18*		.06		-.01	0.96
5. Econ Impacts	.39		.19						
RE Improve Economy		.51***		.35***		.24***		.09*	2.60**
RE Cheaper Than Coal		.22***		.20**		.05		.08*	0.50
6. GW Opinion	.45		.54						
Worried About GW		.16*		.36***		.06		.23***	1.90
U.S. Effort on GW, Considering Costs		.42***		.22***		.25***		.12**	1.80
Interested in Solutions		.16**		.34***		.06		.20***	1.94
7. Effective and Feasible	.39		.24						
100% RE Feasibility		.33***		.21***		.11*		.04	1.05
RE is Effective on GW		.44***		.39***		.04		.15**	1.55

Note: Registered voters only. ***$p < .001$; **$p < .01$; *$p < .05$. Gender coded as 1 = Male and 2 = Female. Political ideology scale ranges from 1 ("Very conservative") to 5 ("Very liberal"). Adj. R^2 = adjusted R-squared. β = standardized coefficient. Z-test = absolute value of z-score from a z-test comparing the full model standardized coefficients (β) of Republicans and Democrats. RE = renewable energy. GW = global warming. Republican n = 356; Democrat n = 466.

This technique resolves collinearity issues associated with multiple regression and provides an intuitive measure of effect size for each predictor. Specifically, RWA produces "raw weights" that represent the percentage of variance that each predictor explains in the dependent variable, such that they sum to the total model R^2.

To conduct the RWA, we used the RWA Web tool (Tonidandel and LeBreton, 2015). This tool provides a choice between listwise and pairwise deletion methods. Because FIML was not an option offered by the RWA program, we chose pairwise deletion in order to maintain close consistency with the multiple regression results summarized above. We entered all variables used in the previous analyses predicting the policy support index. As above, analyses were run separately for Democrats and Republicans. Further, significance tests comparing weights of Democrats and Republicans were automatically computed using the RWA Web tool. Fig. 3 summarizes the results in terms of raw weights, and Appendix D reports the complete RWA results with both raw and

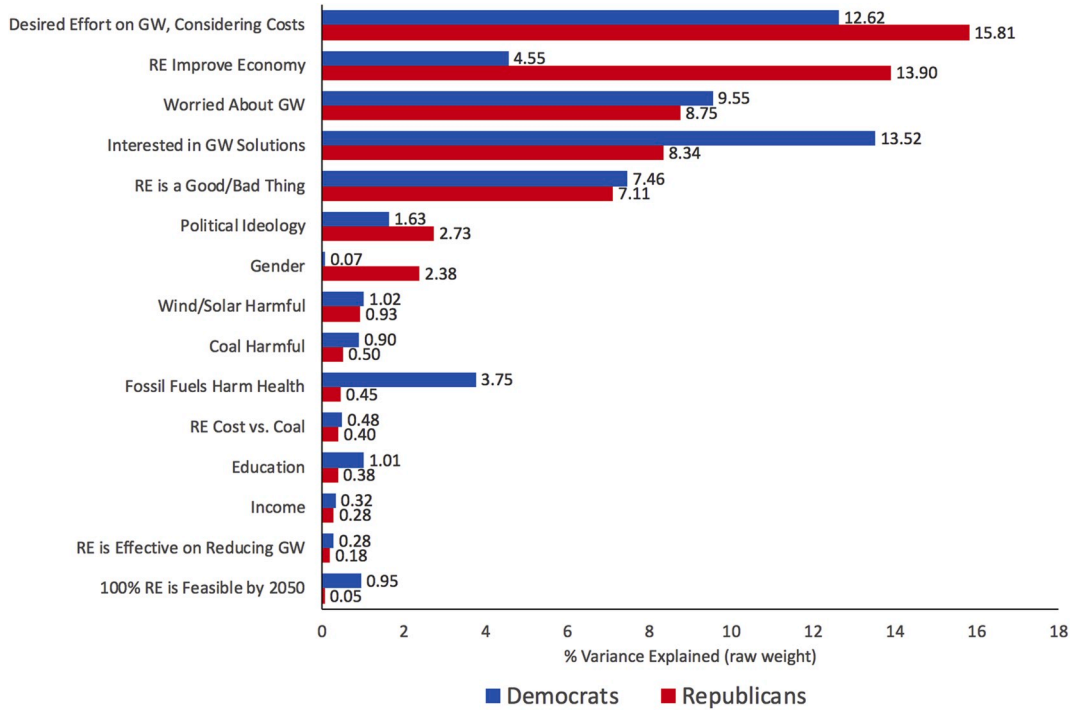

Fig. 3. Raw weights (% variance explained) for each predictor of renewable energy policy support, as calculated by Relative Weight Analysis for Democrats and Republicans, respectively. RE = renewable energy. GW = global warming.

rescaled weights.

The belief that renewable energy improves economic growth and provides new jobs explained significantly more variance in policy support among Republicans (13.90%; Fig. 3) than among Democrats (4.55%) (95% CI for difference: 4.36, 14.69), as did gender (Republicans: 2.38%; Democrats; 0.07%; 95% CI for difference: 0.64, 4.95). In contrast, interest in solutions to global warming explained significantly more variance in policy support among Democrats (13.52%) than Republicans (8.34%; 95% CI for difference: 10.55, −0.49), as did belief that air pollution from fossil fuels harms human health (Democrats: 3.75%; Republicans: 0.45%; 95% CI for difference: 6.37, −1.10), and the belief that reaching 100% renewable energy is possible by the year 2050 (Democrats: 0.95%, Republicans: 0.05%, 95% CI for difference: 3.15, −0.08).

One of the strongest predictors of policy support for both Democrats and Republicans was the desired level of effort and cost that the U.S. should expend on reducing global warming (Fig. 3). Republicans (M = 2.39) scored far lower than Democrats (M = 3.53) on this variable, $t(743) = 19.91$, $p < .001$, with only 9% of Republicans choosing the top response category ("a large-scale effort even if the costs are high") compared to 62% of Democrats. However, for both parties, this particular attitude is highly predictive of support for renewable energy policy.

7. Conclusion and policy implications

Much prior research demonstrates that Americans have overwhelmingly positive views of renewable energy and renewable energy policies, primarily because they see renewable energy as more economical and less harmful than fossil fuels. However, the current study indicates that underneath this general pattern there are substantial differences between Republicans and Democrats a) in the reasons for supporting a transition to renewable energy that they say are most important, and b) in the attitudinal variables that best predict their level of support for a diverse set of renewable energy policies. Multiple analyses through multiple methods support the general takeaway that Republicans' support (more so than Democrats') is driven by considerations of economic costs/benefits, whereas Democrats' support (more so than Republicans') is driven by considerations of a specific environmental threat: global warming.

When asked to rate the importance of 16 reasons to transition to renewable energy, Democrats rated "reduce global warming" as the most important, whereas Republicans see it as the least important (by mean rating). Among Republicans, "reduce energy costs" and "get energy from sources that never run out" were rated among the most important reasons, higher than among Democrats. Republicans and Democrats were similar in that they both rated "provide a better life for our children" and "reduce [air] [water] pollution" among the most important reasons.

The results of regression analyses predicting support for renewable energy policies follow a similar pattern, such that the strongest predictors of Democrats' policy support included worry about global warming, interest in solutions to global warming, and perception that renewable energy will reduce global warming. The strongest predictors of Republicans' policy support included the belief that renewable energy improves economic growth and provides new jobs and opinions about how much effort the U.S. should put toward reducing global warming when considering the costs. Further, the RWA found that these two variables also explained the most variance in Republicans' policy support. The RWA also found that the interest in the solutions to global warming explains significantly more variance in policy support among Democrats than among Republicans, whereas the belief that the transition to renewable energy will increase economic growth explains significantly more variance in policy support among Republicans than among Democrats.

Among Democrats, reducing global warming is the primary stated rationale for supporting renewable energy and global warming attitudes play a prominent role in predicting their policy support. This contrasts with earlier studies suggesting that global warming beliefs and attitudes play a relatively minor role in overall public opinions about energy sources (e.g., Ansolabehere and Konisky, 2014), indicating the importance of partisanship below the surface of national public opinion results. It is also possible that our finding that global warming opinions play an important role in Democrats' support for clean energy policy is due to a change over time in the factors that determine renewable energy policy support.

These findings do *not* imply that when considering renewable energy, Republicans care *only* about economics. For example, 40% of Republicans identified "reduce global warming" as a "very" or "extremely" important reason to transition to renewable energy (Fig. 2), and one of the strongest predictors of policy support among Republicans (as with Democrats) was the desired level of effort and cost that the U.S. should expend on reducing global warming. Likewise, it is *not* the case that Democrats care *only* about environmental harms like global warming, since 77% said that reducing energy costs was a "very" or "extremely" important reason to transition to renewable energy (Fig. 2). Rather, our findings indicate a pattern of relative importance. That is, when it comes to supporting renewable energy, economic considerations play a relatively larger role among Republicans than among Democrats, and global warming concerns play a larger role among Democrats than among Republicans. Further, Republicans say economic reasons are the most important far *more often* than they say global warming is the most important, while Democrats say global warming is the most important reason far *more often* than they say economic reasons are most important (Fig. 2; Table 1). This study highlights important differences between groups while still acknowledging substantial heterogeneity and complexity within groups.

Interestingly, for both Republicans and Democrats, general affect about renewable energy is one of the strongest predictors of policy support. This aligns with prior work indicating that general affect about global warming is a significant predictor of global warming risk perceptions and policy support (Goldberg et al., in press; Leiserowitz, 2006), and should motivate continued research on the importance of affect and emotion in environmental and political psychology and communication.

Overall, these findings corroborate extensive prior research finding that perceptions of the costs and harms of energy sources are more important determinants of support for renewable energy policy than are demographics and political opinion. However, this study adds valuable nuance to the existing knowledge in three important ways. First, by evaluating whether and how Republicans and Democrats differ in the reasons they state for supporting renewable energy. Second, by testing a diverse set of reasons and predictors that provide more detailed information than general "costs" and "harms." Third, by applying multiple methods of analysis, including ranking the importance of stated priorities, predicting policy support with multiple methods of handling missing data, and evaluating the relative importance of these predictors using an additional method that corrects for some limitations of multiple regression. The patterns are strong and consistent across these diverse methods.

One limitation is that these correlational data do not establish causal effects. Future experimental work could determine whether stating different benefits of renewable energy (economic growth, global warming mitigation) is differentially effective for Republicans and Democrats. Another note of caution is that these findings reflect self-report data and thus these relationships may or may not be exhibited when the outcome variable is actual behavior, such as voting or consumer behavior.

In sum, while Republicans and Democrats both have favorable attitudes toward renewable energy sources and policies, these data suggest that the rationales for and predictors of their support differ substantially. Policymakers and strategic communicators can make use of this knowledge to calibrate their work—for example, strategically

emphasizing the economic benefits of renewable energy when communicating to Republicans and framing renewable energy as a solution to global warming when communicating to Democrats.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

CRediT authorship contribution statement

Abel Gustafson: Conceptualization, Investigation, Writing - original draft, Formal analysis, Visualization. **Matthew H. Goldberg:** Formal analysis, Visualization, Writing - review & editing, Investigation. **John E. Kotcher:** Investigation, Writing - review & editing. **Seth A. Rosenthal:** Investigation, Project administration, Writing - review & editing. **Edward W. Maibach:** Investigation, Project administration, Funding acquisition, Writing - review & editing. **Matthew T. Ballew:** Investigation, Writing - review & editing. **Anthony Leiserowitz:** Investigation, Project administration, Funding acquisition, Writing - review & editing.

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Appendix E. Supplementary data

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Appendix A

Items measuring support for renewable energy policies.

Item	Response Options	Mean	SD	Load
How much do you support or oppose requiring electric utilities in your state to produce 100% of their electricity from clean, renewable energy sources (such as wind and solar) by 2050?	Strongly Oppose (1) to Strongly Support (4)	3.17	0.85	.778
Do you think the following should be a low, medium, high, or very high priority for the president and Congress? Developing sources of clean energy.	Low (1) to Very High (4)	3.08	0.94	.719
How much do you support or oppose the following policies?				
Require electric utilities to produce at least 20% of their electricity from wind, solar, or other renewable energy sources, even if it costs the average household an extra $100 a year	Strongly Oppose (1) to Strongly Support (4)	2.89	0.99	.761
Fund more research into renewable energy sources, such as solar and wind power	Strongly Oppose (1) to Strongly Support (4)	3.33	0.80	.761
Provide tax rebates for people who purchase energy-efficient vehicles or solar panels	Strongly Oppose (1) to Strongly Support (4)	3.22	0.72	.734

Note: Data weighted to U.S. Census parameters. SD = standard deviation. Load = Factor loading for one-factor solution.

Appendix B

Frequency of No Response and "Don't Know" Responses for Predictor and Outcome Variables

Measure	Full Sample % No Response	Reps % DK	Dems %DK
Gender	0.00	–	–
Educational Attainment	0.00	–	–
Income	0.00	–	–
Political Ideology	1.30	–	–
Worried about GW	0.00	–	–
U.S. Effort to Reduce GW, Considering Costs	0.11	–	–
Interest in Hearing About Solutions to GW	0.70	–	–
RE Policy Support Index	0.11	–	–
General Affect: RE Is a Good/Bad Thing	0.28	7.38	7.63
Solar/Wind Are Harmful as Sources of Energy	0.66	15.69	11.72
Coal Is Harmful as a Source of Energy	0.83	14.84	13.37
Fossil Fuels Are Harmful to Human Health	0.98	16.90	12.89
Cost of RE Compared to Coal	0.47	25.12	21.56
100% RE by 2050 Is Feasible	0.26	10.72	7.31
100% RE Would Effectively Reduce GW	0.60	18.34	12.19

Note: % No Response = % missing due to non-response. % DK = % of registered voters choosing the Don't Know response. Reps = Republican registered voters; Dems = Democratic registered voters. RE = renewable energy. GW = global warming. Data weighted to U.S. census parameters.

Appendix C

Correlation Matrices for Republicans and Democrats.

	Republicans															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1. Policy Support (DV)		.166**	-.003	-.171**	.287***	.509***	-.118	.387***	.512***	.585***	.408***	.582***	.648***	.560***	.462***	.541***
2. Gender	-.065		-.067	-.031	-.052	-.087	-.130*	.162**	.206***	.119*	.075	.146**	.091	.122*	.137*	.094
3. Education	.224***	-.018		.403***	-.056	.001	-.143*	.228***	.086	-.053	-.085	.079	.116*	.027	-.051	.099
4. Income	.199***	-.152**	.500***		-.134*	.025	-.096	.084	-.013	-.116*	-.214***	-.081	-.054	-.157**	-.174**	-.042
5. Ideology	.293***	-.046	.242***	.150**		.160**	-.115	.138*	.102	.232***	.310***	.284***	.274***	.285***	.195**	.302***
6. RE Affect	.567***	-.096	.093	.022	.245***		-.086	.282***	.340***	.352***	.216***	.303***	.371***	.322***	.225***	.320***
7. Wind/Solar Harmful	-.254***	.039	-.028	-.082	-.211***	-.307***		-.167***	-.182***	-.172***	-.288***	-.070	-.104	-.063	-.107	-.299***
8. Coal Harmful	.382***	-.076	.167**	.030	.239***	.235***	-.147**		.400***	.307***	.301***	.348***	.355***	.186**	.284***	.369***
9. FFs Harm Health	.210***	-.015	-.034	.026	.017	.162**	-.006	.146**		.376***	.292***	.443***	.511***	.310***	.331***	.477***
10. RE Improve Economy	.385***	-.028	.075	.087	.129**	.279***	-.174***	.208***	.085		.357***	.380***	.391***	.383***	.369***	.376***
11. RE Cost vs Coal	.244***	.044	-.232***	-.099	.090	.105	-.207***	.092	.088	.160**		.318***	.302***	.274***	.409***	.368***
12. Worried About GW	.607***	.004	.182***	.116*	.322***	.398***	-.135**	.266***	.206***	.251***	.210***		.743***	.670***	.280***	.652***
13. GW Effort … Costs	.564***	-.010	.183***	.156**	.258***	.310***	-.156**	.279***	.151**	.296***	.175**	.483		.684***	.326***	.633***
14. Interest GW Solutions	.600***	-.001	.123*	.092	.218***	.317***	-.169**	.274***	.107*	.241***	.174**	.422***	.517***		.310***	.515***
15. Feasibility of 100% RE	.296***	-.068	.081	.026	.119*	.163**	-.102	.175**	.086	.150**	.074	.143**	.319***	.273***		.338***
16. RE is Effective on GW	.432***	-.093	-.075	.068	.077	.189***	-.185***	.168**	.064	.220***	.239***	.231***	.318***	.366***	.219***	
	1 Democrats	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

Note: ***$p < .001$; **$p < .01$; *$p < .05$.

Appendix D

Results of Relative Weight Analysis (Rescaled Weights and Raw Weights for Republicans and Democrats)

	Raw Weight		Rescaled Weight	
	Rep.	Dem.	Rep.	Dem.
1. Demographics				
Gender	2.38	0.07	3.82	0.11
Education	0.38	1.01	0.61	1.74
Income	0.28	0.32	0.45	0.56
2. Ideology				
Political Ideology	2.73	1.63	4.39	2.80
3. General Affect				
RE Is a Good/Bad Thing	7.11	7.46	11.43	12.84
4. Harms				
Wind/Solar Harmful	0.93	1.02	1.49	1.75
Coal Harmfulas	0.50	0.90	0.81	1.54
Foss. Fuels Harm Health	0.45	3.75	0.72	6.46
5. Econ Impacts				
RE Improve Economy	13.90	4.55	22.35	7.83
RE Cost vs. Coal	0.40	0.48	0.64	0.83
6. GW Opinion				
Worried About GW	8.75	9.55	14.08	16.43
Effort on GW Considering Costs	15.81	12.62	25.42	21.73
Interested in Solutions	8.34	13.52	13.41	23.27
7. Effectiveness and Feasibility				
Feasibility of 100% RE	0.05	0.95	0.08	1.63
RE is Effective on GW	0.18	0.28	0.30	0.48
Total R^2 (%)	62.19	58.09	–	–in

Note: Missing and DK responses were handled with pairwise deletion. RE = renewable energy. GW = global warming.

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