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Political ideology and public views of the energy transition in Australia and the UK[1]

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Abstract

We explore the relationship between political ideology and public attitudes towards a range of energy technologies (namely: biomass, coal, shale (or coal seam) gas, natural gas, carbon capture and storage, hydroelectricity, nuclear, solar thermal and photovoltaic, wave and wind energy). Our empirical analysis draws on the results of two similar nationally representative public surveys that were conducted in Australia and the UK in 2017. Our findings suggest that political ideology is significantly associated with public attitudes towards energy technologies. Specifically, supporters of left-leaning political parties tend to be more supportive of renewables and opposed to biomass, shale (coal seam) gas, nuclear and fossil fuel energies compared to right-leaning individuals. We also create an alternative ideological proxy to capture the relative emphasis that parties place on the environment and economy and find that supporters of environmentally focused parties generally express similar energy preferences to left-leaning individuals and economy-focused respondents align with right-leaning attitudes. Our findings are robust to different choices of proxy.

Introduction

The growing scientific and political consensus surrounding the need for effective mitigation to prevent dangerous levels of global warming has secured renewable energy sources and other low-carbon technologies such as carbon capture and storage (CCS) a central place in national energy and climate policy debates. However, while the deployment of renewable energy technologies has rapidly increased in recent years[2], this has not been the case for CCS (Reiner 2016). Efforts to explain empirical pathways of the energy transition emphasise the importance of public acceptance in facilitating, or obstructing, the deployment of energy technologies (e.g. Karlstrom and Ryghaug 2014; Ashworth et al. 2019; Marques et al. 2010; Devine-Wright 2008; Sovacool 2009; McGowan and Sauter 2005).

Public attitudes towards energy technologies have been attributed to various tangible factors such as proximity to project sites (Schively 2007), income levels (Israel and Levinson 2004) and age (Dietz et al. 2007). Recent scholarship emphasises the role of socio-psychological

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[2] The average annual global growth rate in modern renewables (i.e. excluding hydro energy) is 5.4 percent over the last decade (2008-2018) (REN21 2019).

sources such as knowledge about the various energy technologies (Hobman and Ashworth 2013); environmental beliefs (Sovacool 2009; Tranter 2011; Itaoka et al. 2014); trade-offs between the costs, risks and benefits (Huijts, Molin and Steg, 2012); the way that each energy technology is framed (Corner et al. 2011; Wiest et al. 2015); and the potential for pseudo-opinions (de Best-Waldhober et al 2009). There have also been a small handful of comparative studies across jurisdictions (Reiner et al, 2006; Aas et al 2014; Schumacher et al 2019). Yet despite the highly political nature of energy policy, surprisingly little research has been conducted to understand the influence of political ideology on public acceptance of energy technologies (Karlstrom and Ryghaug 2014). Building on the rich strand of political psychology scholarship that asserts that partisanship causes voters to harmonise personal opinions in-line with their party's position (e.g. Gerber et al. 2010; Redlawsk 2002), we empirically investigate the role of political ideology in shaping public attitudes towards energy technologies by undertaking ordinary least squares regression of survey results obtained from similar public attitude questionnaires conducted in Australia and the UK in 2017.

It is often argued that along a left-right continuum, left-of-centre parties tend to ascribe higher values to the environment vis-à-vis competing interests than those on the right-of-centre (McCright et al. 2016; Neumayer 2004; Lachapelle et al. 2012; Tranter and Booth 2015). The former also tend to be more supportive of government intervention in the economy (Potrafke 2017; Baskaran 2011), which is conducive to the deployment of large-scale centralised energy projects that typically rely on state sponsorship in the initial deployment stages. Drawing on this literature, several scholars (e.g. Cadoret and Padovano 2016; Karlstrom and Ryghaug 2014) argue that left-leaning individuals are likely to favour renewables over fossil fuels, which could be labelled as reflecting concern for the environment, in contrast to right-leaning individuals, who are expected to be more dismissive about climate change and, therefore, less supportive of renewable energies. On one hand, given greater concern about the environment, and therefore, climate change, it might be expected that left-leaning individuals would be more likely to support the deployment of CCS as an effective means to combat climate change (Karlstrom and Ryghaug 2014; Neumayer 2004). On the other hand, concern over potential local environmental risks and the potential for continued reliance on fossil fuels may lead these left-leaning individuals to remain opposed to CCS projects (e.g. Vogele et al. 2018).

The role of political ideology in influencing public energy preferences has implications for the social feasibility of decarbonisation policies and net zero commitments, particularly since any ability to meet an ambitious climate target appears to be increasingly reliant on rapidly upscaling low-carbon and negative emissions technologies (principally CCS-based options) (IPCC 2014, 2018). Therefore, a better understanding about the role of political ideological factors in shaping public attitudes towards these key energy policies would help identify potential areas of conflict between ideological perspectives and policy options for energy transition. This research is especially pertinent for democratic contexts, where policymakers are often reluctant to adopt energy policies if they expect their electorates will be unsupportive (Poortinga et al. 2011,2019), as well as for nascent technologies such as CCS, which are often obstructed due to strong public opposition undermining their 'social licence

to operate' (Dowd and James 2014:364). Better understanding of the ideological sources of opposition towards energy technologies also presents an opportunity to assess the effectiveness of potential strategies such as communication frames (Wiest et al. 2015; Feldman and Hart 2018) and political compromises (Kousser and Tranter 2018) in addressing issues of concern to bridge partisan divides.

Despite both being parliamentary democracies and advanced industrialised economies, Australia and the UK have followed very different paths of energy transition. While both countries have pledged to contribute to global mitigation efforts by deploying more low carbon energy sources such as renewables, it is widely agreed that the UK's nationally determined contribution (NDC) to international mitigation efforts is significantly more ambitious than that of Australia. At Paris, Australia pledged to reduce its emissions by 26 to 28 percent by 2030 relative to 2005 (Government of Australia 2015) and in late 2020 simply recommitted to this target with no increase in ambition, which led to significant criticism at home and abroad (Readfern, 2021). By contrast, the original UK NDC was to reduce greenhouse gas emissions by 40 percent in 2030 relative to a 1990 baseline, in line with those of other EU member states at the time. More recently the UK substantially increased its target to 68 percent by 2030 in line with its commitment to net zero as part of its five-year resubmission (HM Government 2020).

Each country's energy policies and associated infrastructure investment over the last decade reflect similar differences. In the UK, renewable electricity generation increased from one percent to around a third of total electricity generation between 2000 and 2018 (BEIS 2019), while the share of fossil fuel energy fell from 75 percent in 1990 to 43 percent of total energy generation in 2019 (National Grid 2020). In Australia, the share of renewables of total electricity generation approximately doubled from around ten to twenty percent from 1992 to 2018 (DEE 2019a). Fossil fuels, however, continue to be the primary source of electricity, despite having fallen from around 87 to 79 percent of total electricity generation over the same period (Ibid. 2019). Growth in renewable energy deployment has been uneven in both countries, with wind accounting for around half of energy generation in Scotland (BEIS 2019) and solar a similar share in South Australia (DEE 2019b).

Historically, policy approaches in each country can be traced to the development of their energy resources and the role of energy and natural resources in the respective economies. However, over the past 10-15 years there has been a notable divergence in the politics surrounding the energy transition. In the UK, where (largely imported) coal energy has steadily been declining over the past half century, all of the major political parties (the Conservatives, Labour and Liberal Democrats) agreed the country should aim to become a leader of the low carbon energy transition. This is demonstrated, for example, by the Low Carbon Transition Plan (HM Government 2009) and Carbon Plan (HM Government 2011) which were respectively put in place by Labour and Conservative/ Liberal Democrat coalition governments, although this consensus has subsequently faded as right-wing members of the Conservative Party, who are opposed to climate policy, became more influential within the party (Lockwood 2013; Carter 2014). . In contrast, any energy transition is a highly contentious issue in Australia. Australia is one of the world's largest

coal and natural gas producers and exporters. In the 2018-19 financial year, 25 percent of the country's total export earnings were derived from these commodities (Department of Foreign Affairs & Trade, 2020). While all of the major Australian parties (Australian Labor Party, Liberal Party of Australia and National Party of Australia) agree that more renewables should be deployed[3], disagreement over the share of renewables of total energy, whether or not fossil fuels should be phased out and the target date for net zero emissions have been far more polarised across the major parties in comparison to the UK. Although individual Australian states have aggressive renewable and net zero targets, there is no comparable climate target at the federal level. Climate change, in particular, has been a major cleavage across and within parties and was a contributing factor in several changes in leadership of both the Labor and Liberal parties, including multiple changes of prime ministers. Thus, if political ideology is associated with public acceptance of energy technologies, it is interesting to explore whether it contributes to the formation of more disparate views in the Australian context where energy technologies are politically more polarising.

We analyse the results of two similar public surveys that were conducted in the UK and Australia in 2017 to investigate empirically the relationship between political ideology and public attitudes towards a range of energy technologies. Our analysis suggests that, broadly, those who vote for parties on the political right are more likely to express support for the deployment of fossil fuels, nuclear energy and CCS while those who vote for the political left tend to be more supportive of renewable energies. These findings cohere with previous observations about the role of political ideology in shaping attitudes towards energy technologies (e.g. Feldman and Hart 2018; Tranter 2011,2013; Fielding et al 2012), which has important implications for the popularity and social feasibility of energy policy (e.g. Weist et al. 2015; Poortinga et al. 2019). We also find evidence that supporters of environmentally-oriented political parties, such as the Greens, tend to hold similar attitudes to those of a leftist disposition and express higher support for renewables relative to fossil fuels, CCS and nuclear energy, while adherents of economic-focused parties express more support for fossil fuels, CCS and nuclear energy relative to renewables. Our results are robust to proxy choice including both continuous and categorical measures of political ideology.

This paper consists of six sections. The next section draws on the political psychology scholarship that explores the effect of political ideology on public attitudes and the literature on ideology and environmental perceptions to develop a theoretical framework for investigating the effect of ideology on public attitudes towards energy technologies. Section three describes the surveys, variables, coding and method of analysis used in this research. Section four discusses the results from our primary model of left-right ideological orientation. Section five presents the results of two sets of robustness tests: the first repeats the regressions replacing our ideology variable with an alternative continuous and categorical proxies of left-right orientation; while the second test posits an alternative measure of ideology centring on environmental versus industrial focus and analyses the effects of this

[3] 23.5 percent renewable electricity generation as a share of total electricity by 2020 is the most conservative target set by the LNP.

alternative ideological framework on energy attitudes. The last section reflects on the findings to identify some key theoretical and empirical implications.

Theorising the influence of political ideology over public attitudes towards renewable energy and CCS

While public attitudes towards energy technologies have been attributed to various tangible factors such as perceived costs and benefits of different energy sources (L'Orange Siego et al. 2014), proximity to deployment sites (Schively 2007), income level (Israel 2004), gender (Sundstrom and McCright 2016) and age (Dietz et al. 2007), recent studies devote more attention to socio-psychological sources. Leading examples of such explanations include the level of knowledge about different energy technologies (Hobman and Ashworth 2013; Ogarra et al. 2005), belief in the anthropogenic origin of climate change (Dowd et al. 2014; Itaoka et al. 2014) as well as broader worldviews (Sovacool 2009; Tranter 2011) and the way that each technology is framed and communicated (Corner et al. 2011; Koot et al. 2016).

Yet very little work has been done on the relationship between political ideology and voters' energy preferences. As Karlstrom and Ryghaug (2014) point out, this gap in the literature may be because environmental and energy issues do not easily fit within the traditional left-right typology, making it difficult to align different energy preferences with political parties. Nonetheless, there are grounds to argue that voters are likely to adopt their political party's position towards energy technologies and the environment. Even if these issues are not central to an individual's political ideology, parties can influence voters by placing value on other issues, thereby 'de-sensitising' individuals to environmental and energy technology issues (e.g. Gerber et al. 2010; Redlawsk 2002; Karlstrom and Ryghaug (2014). Gillard (2016), for example, finds that right-leaning policymakers and media contributed to the unravelling of climate consensus under the Conservative-Liberal coalition government (over 2010-2015) in the UK by taking a strategic decision not to make climate change a central theme. Moreover, political ideologies provide individuals with a shared belief and value system, which shapes how they view and react to the world (Jost et al. 2011). Thus ideology performs an important cognitive function by acting as a ready framework for organising and analysing information about policy issues (Huckfeldt et al. 1999). Indeed, partisanship has been found to influence public attitudes towards several issue-areas such as government spending (Thomas and Evans 2005), immigration (Knoll et al. 2011) and science (Blank et al. 2015). Causality can also flow in the opposite direction as individuals are likely to vote for the party which complements their pre-existing value and beliefs. Unlike in the UK, voting in Australia is compulsory, which creates a large proportion of swing voters who are likely to exhibit less stable ideological and political affiliations.

Several studies have investigated the effect of political ideology on public attitudes towards environmental issues, particularly in relation to climate change. Many have found that supporters of left-leaning ideologies tend to hold stronger concerns about global warming than their conservative counterparts (McCright et al. 2016; Hamilton 2007; McKewon 2012; Neumayer 2004; Lachapelle et al. 2012; Tranter and Booth 2015). In the Australian context, Fielding et al. (2012) find that politicians from centre-left and progressive parties (the Labor and Green parties) exhibit beliefs that are more consistent with the scientific consensus that

climate change is happening than non-aligned or conservative politicians. Similarly, in the UK, Poortinga et al (2011) find that Conservative voters are more likely to be climate skeptics. There is a broad assertion in the literature that voters of left-wing parties generally place higher value on the environment than right-wing voters, who allegedly prioritise other interests such as the economy and industry, with the political centre falling somewhere in-between these extremes.

While these divisions have been attributed to various ideological differences, two fundamental points of contention stand out. First, there is disagreement over what is the role of the government in the economy (Hess et al. 2016). Broadly, the economic right is supportive of laissez-faire markets and opposed to government intervention, which is widely thought to be necessary for effective environmental regulation (Dunlap et al. 2001; McCright and Dunlap 2011). This type of economic ideology – widely referred to as neoliberalism - is often used to justify market-oriented preferences that impede decarbonisation (Fielding et al. 2012; Hess et al. 2016 ;Gillard 2016). In the UK, for example, far-right members of the Conservative Party have justified their opposition to climate policy on the grounds that it would result in unwarranted state intervention (e.g. carbon tax and 'green' subsidies) (Lockwood 2013; Carter and Clements 2015). The economic left, on the other hand, is supportive of strong government regulation and therefore, theoretically at least, more accommodating to the kind of government presence that is needed to drive energy transition. The second point of contention is about the importance of the environment relative to other issue-areas such as the economy or industry. Broadly, socio-cultural rightists are thought to value conservative morality, cultural conformity and traditional priorities such as the economy and industry while social leftists place more emphasis on the environment (Hillen and Steiner 2019; Batstrant 2015). Empirical research suggests that the association is strongest in fossil rich countries, where energy transition is more difficult to reconcile with the traditional priorities of the political right because climate policy entails significant changes in key sectors of the economy (particularly of fossil industries) (Carter 2014; Hess and Renner 2019; Batstrant 2015).

A small number of scholars investigate whether such ideological dispositions could be a factor in shaping public attitudes towards energy preferences. The fundamental focus of this research is on the level of support for energy policies that are consistent with decarbonisation, centering around renewable (and nuclear) energy (Karlstrom and Ryghaug 2014; Hess et al. 2016; Populus 2005) and energy-efficient technologies (Gromet et al. 2013). There is no consensus on whether voters decide to support parties whose energy policies are consistent with their underlying beliefs or individuals harmonise their views in line with their party, although most research focuses on the latter possibility (Kousser and Tranter 2018). Most of this scholarship proceeds from the assumption that partisanship fulfils an important cognitive function by providing voters with cues and 'information shortcuts' for formulating opinions about energy policy, which is, essentially, an unfamiliar issue for most people (Walker et al. 2018:671; Mayer 2019).

There is also disagreement about where political parties' influence over energy attitudes might come from. One argument is that voters are predisposed to support their party's stance

on energy because they are more likely to be consistent with their own pre-existing values, belief-systems, and socio-political priorities (Maibach et al. 2013; Petrovic et al. 2014; Wiest et al. 2015; Gromet et al. 2013; Stanley et al. 2021). For example, a number of authors concur that right-leaning individuals are more likely to support decarbonisation when it is presented as a means for pursuing energy security rather than climate mitigation (e.g. Kousser and Tranter 2018; Gromet et al. 2013; Maibach et al. 2013). Conservative segments also tend to be more supportive of energy transition when it is perceived to be compatible with broader economic goals (Gillard 2016; Linde 2018), which is more likely to be the case in countries that do not possess large fossil reserves (Hess and Renner 2019; Batstrant 2015). It has also been suggested that left-leaning individuals are more likely to support climate policy because they tend to hold stronger global than national place attachments (Devine-Wright 2015) and lower levels of social dominance beliefs (Stanley et al. 2021), both of which are associated with opposition towards energy transition. In another approach, Mayer (2020) proposes that in contexts where energy policy is strongly polarised such as the US, political orientation is an important part of personal identity, which predisposes supporters of different parties to disagree over the energy transition as a way of safeguarding their sense of self. Another hypothesis is that voters defer the task of formulating attitudes about energy policy to their political party because they trust their leaders to make appropriate judgements, while individuals adopt opposing positions to those of other parties due to their mistrust of opposition leaders (Kousser and Tranter 2018). Political ideological influence over energy attitudes has also been attributed to partisan bias in choice of information sources on energy matters and partisan processing of energy information. According to this perspective, supporters of different parties tend to consult (and trust) different sources (e.g., media outlets) for information about climate change and energy policy and interpret energy information in ways that reinforce their underlying political beliefs (Walker et al. 2018).

The empirical evidence on the extent to which partisanship matters is quite varied. In the US, there is evidence of partisanship over low-carbon energy (Mayer 2020), offshore wind (Sokoloski et al 2018), oil and gas production (Malin et al 2019) and shale gas (Clarke and Evensen 2019). Moreover, given the sharp partisan divide over climate in the US, Feldman and Hart (2018) find that a climate change frame lowers support for low-carbon energy relative to pollution or security frames among Republicans whereas these different frames had no impact on independent or Democratic voters. By contrast, in Germany, Engels et al (2013) find no strong political party basis for climate-change skepticism although skepticism itself is related to low levels of political participation as well as with lower support for renewables and being less critical of nuclear energy. In a comparative study of Australia, New Zealand, Sweden and Norway on the role of 'party cues', Linde (2018) finds a clear polarisation between two distinct left-right groupings of parties in Australia and New Zealand over climate mitigation policies, but no such clear grouping between party supporters in Norway and Sweden. In particular, Kousser and Tranter (2018) find that respondents are guided by positions taken by their political party leaders on the subject of policies for addressing climate change – they become more or less polarised along party lines depending upon whether their party leaders converge or diverge on a policy proposal.

Drawing on this scholarship, we expect that right-leaning individuals are likely to oppose the deployment of renewables and CCS because these policies require significant government intervention in the economy, e.g. to subsidise renewables, impose a carbon tax and finance high start-up investments for large-scale projects, which conflicts with the laissez-faire ideology to which they subscribe. Since CCS can be deployed to absorb the carbon emissions from fossil fuel plants, there is a counterargument that anti-interventionists could support CCS because it allows for continued use of fossil fuels. These policies also assume that environmental concerns, particularly climate change, are less paramount to other issue-areas. Conversely, while left-leaning individuals should not possess the same kind of aversion against extensive government intervention, the alleged higher value that leftist ideologies place on the environment provides additional grounds for expecting that they should be more supportive of renewables and CCS (Neumayer 2004). Yet we expect that the alleged leftist preference for CCS will be less pronounced than that for renewables because of the environmental risks (e.g. leakage) that are associated with CCS (Itaoka et al. 2014; Vogele et al. 2018). Furthermore, across the spectrum, because public knowledge about energy technologies, particularly more recent technologies such as CCS, is lacking (e.g. Ashworth et al. 2019; Hobman and Ashworth 2013), we expect that individuals should generally be sensitive to energy cues from their party and turn to political ideology for guidance on a relatively complex and unfamiliar issue.

Methods

Questionnaire design

The questionnaire design aimed to identify key factors associated with public support for twelve energy technologies and sources: biomass, coal, unconventional gas (coal seam gas (AU)/shale gas (UK)), natural gas, gas or coal with CCS (as one option), geothermal, hydro, nuclear, solar-thermal, solar photovoltaic, tidal and wind energy. It was also intended to maintain a level of replicability with other previously conducted questionnaires to monitor changes in the evolution of preferences for different energy technologies (e.g. Jeanneret et al. 2014). The questionnaire was designed in Australia in collaboration with a Chinese team for comparative purposes (see Ashworth et. al 2019), first applied in Australia and subsequently adapted to the UK context.

Data collection and sample demographics

In Australia and the UK, market research companies were engaged to collect data via online surveys from nationally representative randomised samples aged 18 years of age and older. In Australia, Q & A Research collected data between June and August 2017, and of the 2540 completed surveys, 2383 valid responses were retained in the final dataset. The geographical distribution of participants per state follows a representative random sampling, corresponding to state population size (95% confidence level and +/-1.76% confidence interval). Data in the UK were collected by Opinium Research between October and November 2017 following the general election in June the same year. A total of 2028 valid responses were retained in the final dataset. Table 1 in the appendix provides an overview of the socio-demographic characteristics of respondents in Australia and the UK.

Data analysis

Descriptive and bivariate analyses (cross-tabulations, one-way ANOVA and t-tests) explored relationships between demographic characteristics and self-reported levels of knowledge of and support for each of the twelve energy technologies. Factors related to support, and perceptions of climate change and environmental attitudes, were also examined. Factor analyses and regressions further examined the strength of associations between support for energy technologies and key variables, including voting preferences.

An ordinary least squares (OLS) regression was conducted for each of the energy sources and technologies to examine the effect of political ideology on the dependent variable of interest, the public level of support. To ascertain levels of support, participants were presented with simple definitions of each technology and asked to indicate how strongly they agreed or disagreed (on a scale of 1=strongly disagree to 7=strongly agree) with each as an option for generating their country's future energy needs.

Self-declared voting preferences were used as a proxy for ideological orientation. Respondents were asked to indicate which political party they voted for in the most recent elections (2016 in Australia and 2017 in the UK) from a list of the most popular parties as well as options for other parties and non-voting.

Voting preferences were translated into ideological orientation by drawing on existing indices of political party positions on a left-right spectrum. While we employ multiple proxies to capture ideological orientation in the robustness section below, our main variable is derived from the Parties, Institutions and Preferences (PIP) database, which evaluates parties' manifestos to locate parties on a left-right political spectrum (Gabel and Huber 2000). The PIP methodology employs content analysis to compare manifesto statements with core left (socialist) and right (economically liberal and conservative) principles and assigns parties scores from -25 to 25, with negative values denoting left and positive values right-leaning ideology.[4] Table 1 displays the Left-Right index scores of the main Australian and UK parties in the PIP dataset according to the latest manifestos that were published prior to the conduct of the surveys. One limitation of the dataset is that it excludes two key parties that participated in the 2016 Australian elections - the Nick Xenophon Team (NXT) and Pauline Hanson's One Nation (PHON) - which comprise around ten percent of the voting preferences reported in our Australia survey. As part of the robustness analysis below, we draw on alternative sources which include NXT and PHON.

Australia			UK		
Abbreviation	Party	L-R index	Abbreviation	Party	L-R Index
Greens	Australian Greens	-20.00	Green	Green Party	-19.19
NPA	National Party of Australia	-1.88	LibDem	Liberal Democratic Party	-9.81
ALP	Australian Labor Party	-1.40	Labour	Labour Party	-6.32
LPA	Liberal Party of Australia	14.24	Tories	Conservative Party	-0.73
			UKIP	United Kingdom Independence Party	3.74

Table 1: Main political parties and PIP Left-Right Index scores in Australia and UK.

[6] The PIP can be accessed from University of Greifswald, Department of Political Science and Communication Studies, Comparative Politics Database: : http://comparativepolitics.uni-greifswald.de/data.html.

To isolate the effect of political ideology from the influence of other sources of public attitudes, two independent variables were included in the model: belief in the causes of climate change; and self-rated knowledge of the relevant energy technology. Acceptance of anthropogenic climate change is believed to increase support for renewable energy and CCS (McCright et al. 2016; Ashworth et al. 2019). Knowledge has been found to promote acceptance of energy technologies (Hobman and Ashworth 2013; Ogarra et al. 2005). Age, gender, income and level of education were included as demographic control variables. Table 2 describes the variables, associated survey question and coding. Tables 1 and 2 in the appendix provide the descriptive statistics (mean, standard deviation and sample size) of the nonnumeric and numeric variables respectively. The data obtained from the Australian and UK surveys were fed into the following regression model containing the complete set of variables from Table 2:

$$\text{Support}_{(\text{energy technology})} = \beta_0 + \beta_1\text{Ideology} + \beta_2\text{CauseCC} + \beta_3\text{Knowledge}_{(\text{energy technology})} + \beta_4\text{Age} + \beta_5\text{Gender} + \beta_6\text{Income} + \beta_7\text{Education}$$

Variable	Variable	Coding/scale
Support (DV)	The level of support (or opposition) for the deployment of the twelve energy technologies.	*Please indicate how strongly you agree or disagree with the following options as potential ways of generating [country name]'s future energy needs.* Seven-point scale: 1=strongly disagree, 4=neither agree nor disagree, 7=strongly agree
Ideology	Self-declared voting preferences in the last elections at the time of survey.	Voting preferences were used to infer political ideological leanings by assigning each of the major parties involved in the last Australian and UK elections a Left-Right index score from the Parties, Institutions and Preferences database. Scores range from -25 (left-leaning) to 25 (right-leaning).
CauseCC	Respondents were asked to choose one of four options to denote what they believed to be the main source of climate change, providing a measure of belief in anthropogenic global warming.	Scores were assigned to denote increasing level of importance attached to anthropogenic origins of climate change in accordance with the ordinal options. *Assuming global warming is happening, do you think it is:* (1) No sources because global warming isn't happening (2) Caused mostly by most natural changes in the environment (3) Caused by both natural changes in the environment and human activities (4) Caused mostly by human activities
Knowledge	Self-declared level of knowledge about each of the twelve energy technologies.	*Please indicate your current level of knowledge about the following energy sources and technologies.* Seven-point scale: 1=no knowledge, 4=moderate knowledge, 7=expert knowledge
Age	Age in years	Range (18-91)
Gender	Binary variable	1 = male, 2 = female
Income	Household total income per year (pre-tax)	Respondents were asked to choose from decile income brackets in the appropriate currency.
Education	Highest level of education completed	Respondents were asked to choose from options reflecting the main educational brackets in each country as shown in the appendix (*table A1*).

Table 2: Variables, data sources and coding.

Results

Table 3 reports the mean values and standard deviations of the dependent variable, support for the various energy technologies, in both samples. The (unequal) t-test statistic and

associated p-value (shown in brackets) in the far-right column indicate that the difference in means is statistically significant in all cases except solar photovoltaics.

Energy Technology	Australia		UK		T-test statistic (p-value)
	Mean	SD	Mean	SD	
Biomass	3.55	1.56	4.53	1.39	-22.09 (0.000)
Coal	3.75	1.79	3.50	1.65	4.78 (0.000)
Coal seam (AU)/ shale gas (UK)	3.50	1.71	3.36	1.77	2.79 (0.005)
Gas	4.15	1.55	4.33	1.47	-3.94 (0.000)
CCS	3.81	1.56	3.95	1.39	-3.30 (0.001)
Geothermal	4.32	1.55	4.68	1.35	-8.31 (0.000)
Hydro	5.33	1.31	5.51	1.28	-4.70 (0.000)
Nuclear	3.67	1.94	4.03	1.85	-6.29 (0.000)
Solar (thermal)	5.41	1.37	5.58	1.32	-4.29 (0.000)
Solar (PV)	5.59	1.36	5.60	1.30	-0.10 (0.924)
Wave	5.11	1.48	5.60	1.38	-11.57 (0.000)
Wind	5.39	1.51	5.68	1.43	- 6.62 (0.000)

Table 3: Mean support for energy technologies. AU n=2383; UK n=2030.

Participants in both countries reported higher levels of support for renewables (hydro, solar thermal and PV, wave, and wind) and low levels of support for fossil fuels (coal, gas, and coal seam/shale gas). While coal was among the least popular energies in both countries, UK respondents were noticeably more opposed to it (M=3.50) compared to Australian respondents (M=3.75). This is likely to be a reflection of the significant transition away from coal power in the UK and Australia's reliance on coal both for electricity and for export. Although biomass energy comprises around ten percent of total renewable electricity generation in both countries (IEA 2019), it was even less popular than coal in Australia (M=3.55), with UK respondents notably more supportive (M=4.53). The unenthusiastic assessment of biomass in Australia has been attributed to concern over the risks it poses to native forests and the need for the development of technological capacity to facilitate biofuel production in the country (Puri et al. 2012; Puri and Abraham 2012). In addition, the UK expressed somewhat greater support for nuclear energy (M=4.03) compared to Australia (M=3.67), which is possibly reflective of greater familiarity with nuclear power in the UK since 18.7 percent of generation in 2018 was nuclear power (BEIS 2019), as well as the Australian prohibition on nuclear energy that has been in place since the 1960s.

Figure 1 depicts the distribution of political party ideologies across a left-right spectrum in the two countries. While both samples peak around the political centre, the distributions differ in important respects. In Australia, party ideologies are distributed across a wider range of the L-R spectrum (from -20 to 14.2), suggesting that parties' ideological views tend to be more extreme than in the UK, where ideologies are more concentrated around the centre (from -19.2 to 3.7). In addition, Australian party ideologies are noticeably left-skewed (skewness = -0.46) indicating that stronger right-leaning ideologies are more popular than in the UK (skewness = -0.22).

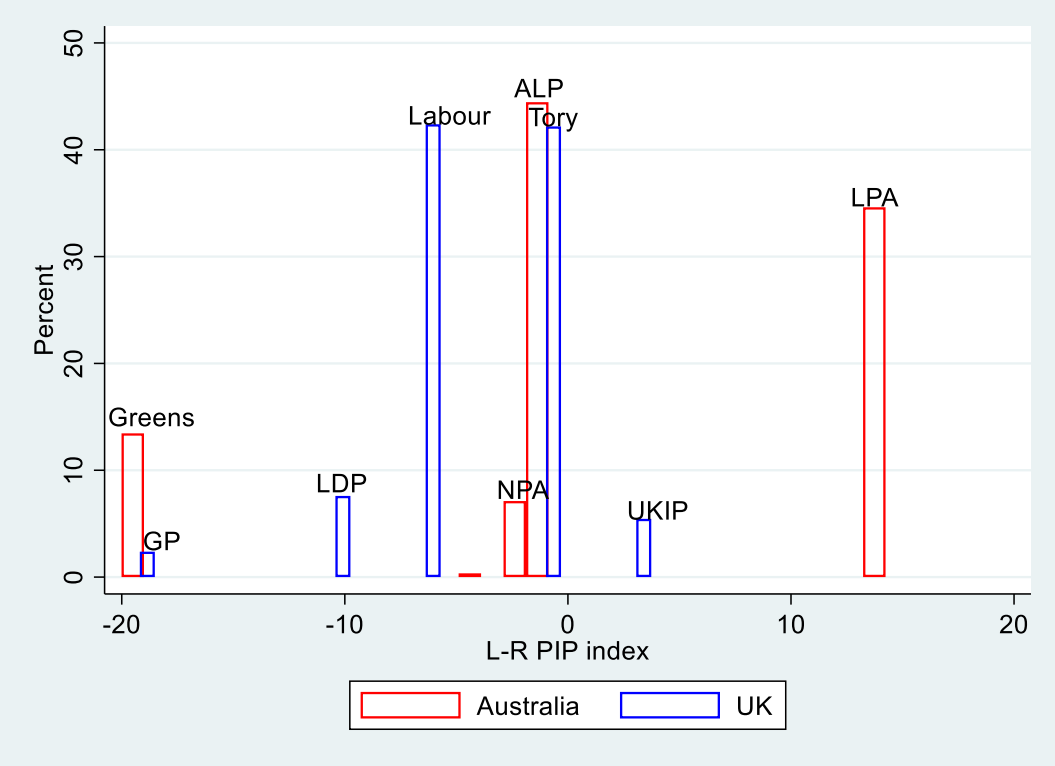

Figure 1: Distribution of political ideologies.

Tables 4 and 5 present the results of the regression analysis for each energy technology in Australia and the UK respectively.

Consistent with our expectations, the results suggest that there is significant ideological divide in public attitudes towards different energy technologies, particularly between fossil fuels and renewables. Broadly, those who voted for parties on the political right are more likely to support the deployment of fossil fuels, nuclear energy and CCS while those on the political left display higher levels of support for renewables. In both countries, a one-point increase in one's L-R score, which corresponds to a one-point rightwards movement along the political spectrum, is associated with a small increase in expressed support (in the range of 0.01 to 0.05) for the deployment of coal, shale (coal seam) gas, natural gas, CCS and nuclear energy. The coefficients are significant at the 0.01 level or less, indicating statistical significance of one percent or higher. This finding aligns with several previous studies which have found that adherents of leftist political ideologies tend to place higher value on the environment and support effective policy outputs targeting environmental quality. The results also provide some evidence that supporters of leftist ideologies are likely to be more supportive of renewable energy. In Australia, a one-point increase in an individual's rightward political leaning is associated with a small decrease in support (in the range of 0.01 to 0.02) for solar thermal, solar PV, wave and wind energy. The results are significant at the 0.001 level. While the equivalent coefficients for the UK sample (row 1, Table 5) also possess negative signs, suggesting an inverse relationship between right-wing ideology and renewables, only the wind and wave coefficients are statistically significant. Thus, while there appears to be a similar association between the right being more supportive of fossil

Variable	Biomass	Coal	Shale Gas	Natural Gas	CCS	Geothermal	Hydro	Nuclear	Solar (thermal)	Solar (PV)	Wave	Wind
Ideology	0.01	0.03***	0.03***	0.02***	0.02***	0.00	-0.00	0.02***	-0.01***	-0.01***	-0.01***	-0.02***
beliefCC	-0.10*	-0.57***	-0.33***	-0.26***	-0.27***	0.06	0.14***	-0.32***	0.39***	0.39***	0.36***	0.49***
Knowledge	0.36***	0.18***	0.15***	0.22***	0.18***	0.27***	0.23***	0.31***	0.20***	0.15***	0.23***	0.22***
Age	-0.01***	-0.01**	-0.01***	0.00	-0.00	0.00*	0.01***	0.00	0.00**	0.01***	0.00*	0.00
Gender	0.08	-0.14	-0.14*	-0.32***	-0.13	-0.23***	-0.06	-0.45***	0.07	0.19*	-0.00	0.16**
Income	-0.03*	-0.02	-0.01	-0.01	0.01	-0.03	-0.02	0.00	-0.03*	-0.01	-0.03	-0.01
Education	-0.02	-0.01	0.01	0.03**	0.01	0.03**	-0.01	0.05*	0.03*	0.03*	0.01	0.02
Adjusted R2	0.09	0.15	0.09	0.12	0.09	0.12	0.11	0.16	0.12	0.12	0.13	0.15

Table 4: Regressions of PIP ideology and Australian attitudes towards energy technologies (n=1,811).
Note: Two-sided significance levels indicated by *** for p<0.001, ** for p<0.01 and * for p<0.05.

Variable	Biomass	Coal	Shale Gas	Natural Gas	CCS	Geothermal	Hydro	Nuclear	Solar (thermal)	Solar (PV)	Wave	Wind
Ideology	0.01	0.02**	0.05***	0.03***	0.02***	0.00	-0.00	0.05***	-0.01	-0.01*	-0.01	-0.02**
beliefCC	0.07*	-0.46***	-0.41***	-0.26***	-0.23***	0.09**	0.24***	-0.24***	0.35***	0.30***	0.38***	0.47***
Knowledge	0.21***	0.03	-0.03	0.13***	0.09***	0.24***	0.23***	0.27***	0.17***	0.21***	0.25***	0.18***
Age	0.00*	0.01*	-0.00	0.02***	0.01***	0.01***	0.01***	0.01***	0.00*	0.01***	0.00*	-0.00
Gender	-0.03	0.23**	0.48***	-0.03	0.01	-0.11	0.08	-0.72***	0.14**	0.10*	0.15*	0.28***
Income	0.01	-0.01	0.02	0.01	0.01	0.00	-0.00	0.05**	-0.00	0.00	-0.00	-0.01
Education	-0.01	-0.18**	-0.02	-0.05*	-0.01	0.02	0.00	-0.01	-0.01	0.00	-0.03	0.01
Adjusted R2	0.04	0.08	007	0.07	0.04	0.08	0.12	0.13	0.08	0.10	0.11	0.11

Table 5: Regressions of PIP ideology and UK attitudes towards energy technologies (n=1,809).
Note: Two-sided significance levels indicated by *** for p<0.001, ** for p<0.01 and * for p<0.05.

fuels and the left renewables, ideology seems to play a less influential role in shaping attitudes towards solar thermal and wave energy in the UK.

Beyond the division over fossil fuels versus renewables energy options, political ideology also seems to play a significant role in shaping attitudes towards fossil fuels with CCS. In both countries, a one-point increase in rightward orientation is associated with a statistically significant rise in support for gas or coal with CCS by 0.02 points. If, as many previous works claim, a more left-wing orientation places higher value on the environment relative to right-wing ideologies, the reported positive association between right-leaning ideology and CCS may stem from the apparent incompatibility between left-of-centre values and the danger that gas or coal with CCS encourages continued reliance on fossil fuels.[5] By contrast, political ideology is not found to have a statistically significant effect on attitudes towards biomass, hydro and geothermal energy in either country.

Some important observations relating to the independent variables are also worth noting. First, out of all the variables (including political ideology), belief in anthropogenic climate change and knowledge about each energy technology appear to have the largest significant effects on energy attitudes. In both countries, stronger belief in anthropogenic activity as being responsible for climate change is associated with greater opposition towards fossil fuels (and nuclear energy) and higher support for renewables. Summarising across both countries, a one-point increase in anthropogenic belief is associated with a statistically significant (absolute) change of 0.10 to 0.57 points in support across the various energy technologies. Interestingly, believers of anthropogenic climate change are not more supportive of CCS and nuclear as one might expect given the significant potential contribution of the technology to mitigation. Our results suggest the contrary scenario that acceptance of anthropogenic climate change fuels greater concern over the possible environmental consequences of CCS as a one-point increase in one's leftward leaning is associated with a clear decline in support (by 0.27 points in Australia and 0.23 points in the UK). A one-point increase in self-assessed knowledge about each energy technology is associated with a statistically significant increase in support for all energy technologies (excluding coal and shale gas in the UK) in range of 0.13 to 0.36 points.

Consistent with previous research, the results also suggest that knowledge significantly increases support for energy technologies. The only exception is shale gas and coal in the UK, where knowledge about the energy sources is not associated with a statistically significant effect on attitudes.

Several of the socio-demographic control variables are also significant, although the effect sizes are much smaller compared to the preceding factors. While the effect sizes involved are very small (ranging from a thousand of a decimal place to 0.03 points), age has a significant, albeit small, effect on shaping attitudes towards most energy options in both countries. Broadly, older respondents tend to hold more positive attitudes towards the deployment of renewables and nuclear energy in both countries. However, while a one-year increase in respondent age is associated with a statistically significant 0.01 point decline in support for

[5] This argument is often made by environmental activists (e.g. Greenpeace 2008).

biomass, coal and coal seam gas in Australia, age does not appear to have a significant effect on corresponding attitudes in the UK. Gender appears to have mixed effects across the countries; in Australia, females are significantly less supportive of deploying coal seam gas, gas, geothermal and nuclear energy and significantly more supportive of solar PV and wind energy than males. While gender has a significant effect on energy attitudes in the UK, the directions of the reported effects are largely contradictory to those obtained from the Australian sample. The corresponding entries in table five (row five) suggest that, unlike in Australia, UK females are significantly more supportive of two key fossil fuels - coal and shale gas. The effect of gender on modern renewables is consistent with the Australian results as females are reported to be significantly more supportive of solar thermal, solar PV, wave, and wind energy than males. Consistent with most attitudinal research (e.g. Sundstrom and McCright 2016; Ansolabehere and Konisky 2009,2014), the effect of gender on nuclear attitudes is striking and consistent across both countries: females are significantly less supportive of nuclear energy than males - by 0.45 points in Australia and 0.72 in the UK. The effects of income and education were generally small in magnitude and insignificant.

Robustness tests

Two sets of tests were conducted to evaluate the robustness of the above findings and extend the inferences about the relationship between political ideology and attitudes towards energy technologies. First, the regressions from the last section were repeated using two alternative proxies of left-right orientation to evaluate whether the effects of ideology remain consistent when the PIP scores are replaced with an alternative continuous proxy as well as categorical dummy variables denoting parties. Due to space constraints, the results and discussion of these tests are reported in the appendix (see tables A4 and A5). Second, using the same survey data, the correlations between Likert responses towards statements about the environment and economy and voting preferences were used to create an alternative framework for evaluating political orientation based on how environmentally versus economically focused parties are. The environment-industry data was regressed with attitudes towards energy technologies to determine whether the environmental-economic focus of parties influences energy preferences.

Environment-economy orientation

Concern over the environmental consequences of energy project decisions are a major factor in shaping attitudes towards energy technologies. Moreover, as demonstrated by the preceding analyses, environmental issues do not always follow the traditional left-right schema: for example, some voters from the left and right can agree with each other in putting environmental concerns over industrial development and vice versa (Karlstrom and Ryghaug 2014). Furthermore, as Hillen and Steiner (2019) point out, it is possible to hold leftist socio-cultural views, which implies greater emphasis on the environment, while, being economically rightist or opposed to government market intervention.

Therefore, in this section, we evaluate parties through the lens of an alternative ideological framework based on orientation towards environmental versus economic issues. We infer each party's position on an environment-economy spectrum by regressing the self-declared

importance that respondents gave to various environmental, economic and technocratic factors (listed in Table 6 below) with political parties.

Factor
Environmental issues (e.g. impact on ecosystems, humans, plants and animals)
Climate issues (e.g. level of CO_2 emissions, global warming)
Economic issues (e.g. job opportunities, knowledge and skill development, power plant building)
Cost (e.g. installation or maintenance cost)
Electricity price (i.e. the cost of electricity to you as the consumer of electricity)
Reliability of electricity supply (i.e. stability in the supply of electricity to your home, 'power cuts'.

Table 6: Environmental and economic factors that influence energy attitudes.
Note: Respondents were asked the following question: 'In deciding whether or not to support new energy sources and related technologies, please indicate how much you consider the following factors' (on a scale of 1-7: 1=not at all, 4=to some extent, 7=very much) in reference to the factors listed in the table.

Table 7 shows the coefficients between political parties and responses to each factor. The results suggest that there are notable divergences in the emphasis that voters of different political parties place on the various factors. In Australia, perhaps unsurprisingly, the Greens appear to be the most environmentally-oriented party as supporters tend to express greater concern over environmental and climate issues and less over economic, cost and electricity reliability issues than other parties. In the UK, Lib Dem supporters appear to express the greatest concern over environmental and climate issues, followed by the Green and Labour parties. At the other end of the spectrum, the supporters of the PHON in Australia and UKIP and Tories in the UK place less emphasis on environmental and climate issues, with PHON supporters expressing significantly more concern over cost, electricity price and reliability issues in comparison to supporters of other parties.

The last row of Table 7 averages the coefficients of the six statements to reflect voters' combined responses to all factors and forms the basis of our location of parties on an environment-economy spectrum, with lower values indicating higher environmental and higher values economic orientation. Since positive associations for the first two statements (on environment and climate change) indicate orientation towards environmental issues, coefficients in these rows were inverted to align with the interpretation of the other economy-focused variables.[6] Interestingly, the spread of values in our environment-economy-focus spectrum in the last row is significantly wider in Australia (ranging from -98.07 to 100.00) than in the UK (from -70.16 to 34.64), suggesting that these issues are more polarising across party lines in Australian politics.

The final step of our analysis was to repeat the full regression replacing the L-R proxy with our Env-Econ measure to evaluate the influence of environmental-economic orientation on attitudes towards energy technologies.[7] Table 8 reports the results alongside the PIP coefficients for reference.

[6] Mean values were stretched to generate a spread of values from approximately -100 to +100.
[7] The env-econ scores in table 7 were rescaled (divided by 1000) to generate coefficients of sufficient magnitude as reported in table 8.

Factor	Australia (n=2,383)						UK (n=2,030)				
	Greens	NPA	ALP	LPA	NXT	PHON	Green	LDP	Labour	Tories	UKIP
Environmental issues	0.40**	-0.36*	-0.01	-0.36***	-0.12	-0.58***	0.50*	0.54***	0.50***	0.08	-0.47***
Climate issues	0.76***	-0.38*	0.33**	-0.30**	0.12	-0.90***	0.54*	0.58***	0.55***	-0.13	-0.74***
Economic issues	-0.11	0.29**	0.09	0.22*	-0.17	0.28*	0.15	0.24	0.18†	0.21*	-0.05
Cost	-0.29*	0.22	0.03	0.19*	-0.11	0.26*	-0.43†	0.13	-0.00	0.17†	-0.28
Electricity price issues	-0.54***	0.11	-0.05	0.06	-0.17	0.39**	-0.20	-0.06	0.04	0.18†	-0.13
Reliability of electricity supply	-0.43***	0.01	-0.05	0.07	-0.14	0.17	-0.29	0.12	0.22*	0.29***	-0.12
Env-Econ score	-98.07	53.10	-11.63	46.51	-22.87	100.00	-70.16	-26.74	-23.64	34.64	24.42

Table 7: Env-econ correlations and scores by party.

Note: Two-sided significance levels indicated by *** for p<0.001, ** for p<0.01,* for p<0.05 and † for p<0.1

Energy	Australia		UK	
technology	L-R	Env-Econ	L-R	Env-Econ
Biomass	0.01	1.23*	0.01	3.42**
Coal	0.03***	4.12***	0.02**	4.54**
Shale gas	0.03***	2.96***	0.05***	0.02***
Gas	0.02***	2.50***	0.03***	0.01***
CCS	0.02***	2.00***	0.02***	0.01***
Geothermal	0.00	0.18	0.00	-0.3.8
Hydro	-0.00	0.79	-0.00	-0.23
Nuclear	0.02***	2.45***	0.05***	10.01***
Solar (thermal)	-0.01***	-1.09***	-0.01	-1.18
Solar (PV)	-0.01***	-0.590	-0.01*	-2.63**
Wave	-0.01***	-1.25*	-0.01	-1.51
Wind	-0.02***	-1.92***	-0.02**	-10.02 ***
N	1811	2383	1809	2030

Table 8: Regression coefficients of environment-economy model.
Note: Two-sided significance levels indicated by *** for p<0.001, ** for p<0.01 and * for p<0.05.

Interestingly, the signs of the significant Env-Econ coefficients are consistent with the PIP estimates, suggesting that environmental focus plays a role somewhat akin to that of leftist political ideology, and economic focus to rightist ideology, in shaping energy attitudes.[8] In both countries, stronger economic focus is significantly associated with higher support for fossil fuels (coal and gas) and the controversial technologies (shale (coal seam) gas, CCS, nuclear energy and biomass). Though less pronounced than the L-R estimates, economic orientation is also significantly associated with less support for wind in both countries. Also in accordance with our expectations, economic orientation is also associated with significantly lower support for solar thermal and tidal energy in Australia and solar photovoltaic and wind energy in the UK. Unlike the PIP results, the Env-Econ results suggest that economic orientation is significantly associated with higher support for biomass energy in both countries. Like the PIP results, environmental or economic orientation does not have a significant effect on attitudes towards geothermal or hydro energy. However, compared to PIP results, the magnitudes of even the statistically significant coefficients are smaller in magnitude, suggesting that L-R dynamics are more influential than environmental-economic focus in shaping energy attitudes.

Conclusion

The results of this article suggest that political ideology appears to play an important role in shaping public attitudes towards a range of energy technologies and the energy transition more broadly. When we employ a conventional left-right conceptualisation of ideology, we find strong evidence that left-leaning individuals tend to be relatively more supportive of

[8] The correlation coefficients are 0.94 and 0.83 respectively for the AU and UK datasets, implying that overlap between left-right and environmental-industrial divisions are stronger in Australia.

renewable energies and right-leaning individuals of fossil fuels and more controversial energy technologies including CCS, shale (coal seam) gas and nuclear energy. These results are robust to choice of proxy and align with much of the existing literature on ideology and energy attitudes (e.g. Karlstrom and Ryghaug 2014; Hess et al. 2016; Populus 2005; Neumayer 2004).

Our findings also suggest that different conceptualisations of ideology beyond the traditional left-right spectrum are also important in influencing public energy attitudes. As hypothesised, we find strong evidence that supporters of environmentally-focused parties tend to be more supportive of renewable energies and less supportive of fossil fuels and CCS, shale (coal seam) gas and nuclear energy compared to supporters of economically-focused parties. The similarities that we find between the attitudes of those who voted for leftist, environment-focused parties and those who voted for right-wing, economy-focused parties, suggest that there may be some overlap between the ways the ideological spectrums appear to influence public attitudes towards energy technologies. From a researcher's perspective, our results suggest it may be possible to gauge public opinion towards different energy technologies by analysing the relative popularity of political parties and employ dominant ideological frameworks to compare the energy attitudes of parties and publics across countries.

Our research suggests that certain communication strategies might be particularly effective in overcoming partisan divisions towards energy policy. Previous works find that supporters of different parties respond differently to frames about climate change. Wiest et al. (2015), for example, find that focusing on the local impacts of climate change is effective in persuading Republicans to take mitigative measures, bringing their attitudes closer to those of Democrats. Similarly, Feldman and Hart (2018) find that Republicans are more likely to support certain low-carbon energy policies (namely, renewable energy investment, revenue-neutral carbon taxation and fuel efficiency regulations) when they are framed as ways for reducing air pollution or energy dependence rather than climate change. Our findings that opposition towards energy transition policies tends to be concentrated among conservative segments of the public, who are generally reluctant to support policies that are justified on environmental grounds, suggest that frames which resonate with right-leaning individuals could prove particularly effective in overcoming opposition to energy transition policies.

Our research does not address the causal question of whether individuals vote for the party that most closely resembles their (pre-existing) beliefs or whether they come to harmonise their own attitudes in line with their party. However, it does have implications for how we might arrive at cross-partisan consensus if, as some contend (e.g. Tranter 2011,2013; Kousser and Tranter 2018), the latter is true. The potential for political leaders to narrow (or widen) public attitudes by adopting similar (or opposing) positions has been demonstrated to be particularly important in the context of the COVID-19 pandemic. This suggests that political elites could play an important role in building consensus towards energy policy over the recovery period at a time when policymakers and publics are keen to build resilience against the other major crisis of the century - climate change. Several international organisations (e.g. IMF 2020; OECD 2020) and leading politicians in the largest emitting countries (e.g. Biden 2020; Jinping 2020) have called for a green recovery, which would stimulate economic

growth through investment in low-carbon energy technologies. If political leaders can agree, then post-COVID recovery could create a window of opportunity for harmonising the attitudes of right-leaning individuals with the more environmentally-oriented energy preferences of the political left.

References

Aas, Ø., Devine-Wright, P., Tangeland, T., Batel, S., & Ruud, A. (2014) Public beliefs about high-voltage powerlines in Norway, Sweden and the United Kingdom: A comparative survey. *Energy Research & Social Science*, 2:30-37.

Ansolabehere, S. and Konisky, D. (2009) Public Attitudes Toward Construction of New Power Plants. *Public Opinion Quarterly*, 73(3):566-577.

Ansolabehere, S. and Konisky, D. (2014) *Cheap and Clean: How Americans think about energy in the age of global warming*. Cambridge, Massachusetts; London, England, The MIT Press.

Ashworth, P., Sun, Y., Ferguson, M., Witt, K. and She, S. (2019). Comparing how the public perceives CCS across Australia and China. *International Journal of Greenhouse Gas Control*, 86:125-133.

Baskaran, T. (2011) Fiscal decentralization, ideology and the size of the public sector. *European Journal of Political Economy*, 27(3):485-506.

Batstrant, S. (2015) More than Markets: A Comparative Study of Nine Conservative Parties on Climate Change. *Politics & Policy*, 43(4): 538-561.

Biden, J. (2020) Build back better: Joe Biden's Jobs and Economic Recovery Plan for Working Families. *Official website of Joe Biden*. Available from: https://joebiden.com/build-back-better/

Blank, J. and Shaw, D. (2015) Does Partisanship Shape Attitudes toward Science and Public Policy? The Case for Ideology and Religion. *Annals of the American Academy of Political and Social Science*, 658:15-35.

Cadoret, I. and Padovano, F. (2016) The political drivers of renewable energies policies. *Energy Economics*, 56:261-269.

Carter, Neil (2014) The politics of climate change in the UK. WIREs *Climate Change*, 5:423-433.

Carter, N. and Clements, B. (2015) From 'greenest government ever' to 'get rid of the green crap': David Cameron, the Conservatives and the environment. *British Politics*, 10(2):204-225.

Clarke, C. and Evensen, D. (2019) The politics of scientific consensus? Political divergence and partisanship in unconventional energy development in the United States. *Energy Research & Social Science* 51: 156-167.

Corner, A., Venables, D., Spence, A., Poortinga, W., Demski, C. and Pidgeon, N. (2011) Nuclear power, climate change and energy security: Exploring British public attitudes. *Energy Policy*, 39(9):4823-4833.

de Best-Waldhober, M., Daamen, D., and Faaij, A. (2009). Informed and uninformed public opinions on CO2 capture and storage technologies in the Netherlands." *International Journal of Greenhouse Gas Control* 3(3):322-332.

Department for Business, energy and Industrial Strategy (BEIS) (2019) Energy Trends: March 2019, special feature article – Nuclear electricity in the UK. Available from: https://www.gov.uk/government/publications/energy-trends-march-2019-special-feature-article-nuclear-electricity-in-the-uk [Accessed March 2020].

Department of Foreign Affairs & Trade (2020) Composition of Trade Australia 2018-2019. January 2020. Statistics Section. Available from: https://www.dfat.gov.au/sites/default/files/cot-2018-19.pdf [Accessed April 2020].

Department of the Environment and Energy (DEE) (2019a) *Australian Energy Update 2019*. Australian Energy Statistics, Canberra.

Department of the Environment and Energy (DEE) (2019b) Australian Energy Statistics, Canberra. Table O, March. Available from: www.energy.gov.au/publications/australian-energy. [Accessed April 2020].

Devine-Wright, P., Price, J. and Leviston, Z. (2015) My country or my planet? Exploring the influence of multiple place attachments and ideological beliefs upon climate change attitudes and opinions. *Global Environmental Change*, 30:68-79.

Dietz, T., Dan, A. and Shwom, R. (2007) Support for Climate Change Policy: Social Psychological and Social Structural Influences. *Rural Sociology*, 72(2):185-214.

Dietz, T., Kalof, L. and Stern, P. (1998) Gender, Values and Environmentalism. *Social Science Quarterly*, 83(1):354-364.

Dowd, A. and James, M. (2014) A Social Licence for Carbon Dioxide Capture and Storage: How Engineers and Managers Describe Community Relations. *Social Epistemology* 28(3):364-384.

Dunlap, R., McCright, A. & Yarosh, J. (2016) The Political Divide on Climate Change: Partisan Polarization Widens in the U.S. *Environment: Science and Policy for Sustainable Development*, 58:5, 4-23

Dunlap, R., Xiao, C. and McCright, A. (2001) Politics and Environment in America: Partisan and Ideological Cleavages in Public Support for Environmentalism. *Environmental Politics*, 10(4):23-48.

Engels, A., Otto, H., Schäfer, M. and Held, H. (2013) "Public climate-change skepticism, energy preferences and political participation." *Global Environmental Change* 23(5): 1018-1027.

Feldman, L., and Hart, P. (2018) Climate change as a polarizing cue: framing effects on public support for low-carbon energy policies. *Global Environmental Change* 51: 54-66

Fielding, K., Head, B., Laffan, W., Western, M. and Hoegh-Guldberg, O. (2012) Australian politicians' beliefs about climate change: political partisanship and political ideology." *Environmental Politics* 21(5): 712-733.

Gerber, A., Huber, G. and Washington, E. (2010) Party, Affiliation, Partisanship and Political Beliefs: A Field Experiment. *American Political Science Review*, 104(4): 720-744.

Gillard, R. (2016) Unravelling the United Kingdom's climate policy consensus: The power of ideas, discourse and institutions. *Global Environmental Change*, 40:26-36.

Government of Australia (2016) Australia's intended Nationally Determined Contribution to a new Climate Change Agreement *UNFCCC website*. Available from: https://www4.unfccc.int/sites/NDCStaging/pages/Party.aspx?party=AUS

Greenpeace (2008). *False Hope: Why carbon capture and storage won't save the climate*. Greenpeace International, Amsterdam, The Netherlands.

Gromet, D., Kunreauther, H. and Larrick, R. (2013) Political ideology affects energy-efficiency attitudes and choices. *Proceedings of the National Academy of Sciences of the United States of America*. 110(23):9314-9319.

Hamilton, L. (2011) Education, politics and opinions about climate change evidence for interaction effects. *Climatic Change*, 104:231-242.

Hess, D. and Renner, M. (2019) Conservative political parties and energy transitions in Europe: Opposition to climate mitigation policies. *Renewable and Sustainable Energy Reviews,* 104:419-428.

Hillen, S. and Steiner, N. (2019) The consequences of supply haps in two-dimensions policy spaces for voter turnout and political support: The case of economically left-wing and culturally right-wing citizens in Western Europe. *European Journal of Political Research*, 59(2):331-154.

HM Government (2009), *The UK Low Carbon Transition Plan: National Strategy for Climate and Energy*, The Stationery Office, London.

HM Government (2011), *The Carbon Plan: Delivering our low carbon future*, Department for Energy and Climate Change (DECC), London.

HM Government (2020) The United Kingdom's Nationally Determined Contributions.

Hobman, E. and Ashworth, P. (2013) Public support for energy sources and related technologies: The impact of simple information provision. *Energy Policy*, 63:862-869.

Hoegh-Guldberg, H. (2012) Australian politicians' beliefs about climate change: political partisanship and political ideology, *Environmental Politics*, 21:5, 712-733.

Huckfeldt, R., Levine, J., Morgan, W. and Sprague, J. (1999) Accessibility and the Political Utility of Partisan and Ideological Orientations. *American Journal of Political Science*, 43(3): 888-911.

Huijts, N., Molin, E. and Steg, L. (2012) Psychological factors influencing sustainable energy technology acceptance: A review based comprehensive framework. *Renewable and Sustainable Energy Reviews*. 16(1):525-531.

Intergovernmental Panel on Climate Change (2014) *Fifth Assessment Report (AR5) Synthesis Report*. IPCC, Geneva.

Intergovernmental Panel on Climate Change (2018) *IPCC Special Report on Global Warming of 1.5'C*. IPCC, Geneva.

International Monetary Fund (2020) *World Economic Outlook: A long and difficult ascent.* IMF, Washington DC.

Israel, D. and Levinson, A. (2004) Willingness to pay for environment quality: Testable empirical implications of the growth and environment literature. *Contributions to Economic Analysis & Policy* 3(1): 1-29.

Itaoka, K., Saito, A., Dowd, A., de Best Waldhober, M. and Ashworth, P. (2014) Influence of the Large Earthquake and Nuclear Plant Accident on Perception of CCS. *Energy Procedia*, 63:7133-7140.

Jeanneret, T., Muriuki, G. and Ashworth, P. (2014). Energy technology preferences of the Australian public: Results of a 2013 national survey. CSIRO: Pullenvale. EP145414.

Jinping, X. (2020) Address of the Chinese President at the Climate Ambition Summit. Xinhua, 12 December 2020. Transcript available from: http://www.xinhuanet.com/english/2020-12/12/c_139584803.htm

Jost, J. and Amodio, D. (2011) Political ideology as motivated social cognition: Behavioral and neuroscientific evidence. *Motivation and Emotion*, 36:55-64.

Karlstrom, H. and Ryghaug, M. (2014). Public attitudes towards renewable energy technologies in Norway. The role of party preferences. *Energy Policy* 67: 656-653.

Knoll, B., Redlawsk, D. and Sanborn, H.(2011) Framing Labels and Immigration Policy in the Caucuses: Trying to Out-Tancredo Tancredo. *Political Behavior*, 33:433-454.

Kousser, T., and Tranter, B. (2018) The influence of political leaders on climate change attitudes. *Global Environmental Change* 50 (2018): 100-109.

Seigo, L., Selma, D., and Siegrist, M. (2014) Public perception of carbon capture and storage (CCS): A Review. *Renewable and Sustainable Energy Reviews*, 38:848-868.

Lachapelle, E., Borick, C. and Rabe, B. (2012) Public attitudes toward climate science and climate policy in federal systems: Canada and United States compared. *Review of Policy Research*, 29(3):334-349.

Linde, S. (2018) Political communication and public support for climate mitigation policies: a country-comparative perspective. *Climate Policy*, 18(5): 543-555.

Lockwood, M. (2013) The political sustainability of climate policy: The case of the UK Climate Change Act. *Global Environmental Change*, 23:1339-1348.

Maibach, E.W., Roser-Renouf, C., Vraga, E., Bloodhart, B., Anderson, A., Stenhouse, N., Leiserowitz, A., 2013. A National Survey of Republicans and Republican-Leaning Independents on Energy and Climate Change. Retrieved from. Yale University and George Mason University, Yale Project on Climate Change Communication, New Haven, CT. http://environment.yale.edu/climate-communication/files/Republican_Views_on_Climate_Change.pdf.

Malin, S., Mayer, A., Crooks, J., McKenzie, L., Peel, J. and Adgate, J. Putting on partisan glasses: Political identity, quality of life, and oil and gas production in Colorado. *Energy Policy* 129 (2019): 738-748.

Marques, A., Fuinhas, J. and Manso, P. (2010) Motivations driving renewable energy in European countries: A panel data approach. *Energy Policy* 28: 6877-6885.

Mayer, A. (2019) Partisanship, politics and the energy transition in the United States: A critical review and conceptual framework. *Energy Research & Social Science* 53:85-88.

Mayer, A. (2020) Social support for de-carbonizing the energy system: The role of expressive partisanship. *Environmental Science & Policy* 109 (2020): 83-94.

McCright, A., Dunlap, R. and Marquart-Pyatt, S. (2016) Political ideology and views about climate change in the European Union. *Environmental Politics*, (25)2: 338-358.

McGowan, F. and Sauter, R. (2005). *Public Opinion on Energy Research: A Desk Study for the Research Councils*. Sussex Energy Group, SPRU, University of Sussex

McKewon, E. (2012) Talking point ammo: The use of neoliberal think tank fantasy themes to delegitimize knowledge of climate change in Australian newspapers. *Journalism Studies*, 13:277-297.

National Grid (2020) Britain hits historical clean energy milestone as zero carbon electricity outstrips fossil fuels in 2019. National Grid Website. Available from: https://www.nationalgrid.com/britain-hits-historic-clean-energy-milestone-zero-carbon-electricity-outstrips-fossil-fuels-2019 [accessed March 2020].

Neumayer, E. (2004) Th environment, left-wing political orientation and ecological economics. *Ecological Economics* 51(3-4):167-175.

Organisation for Economic Co-operation and Development (2020) *OECD Environment Working Papers No. 164: What policies for greening the crisis response and economic recovery? Lessons learned from past green stimulus measures and implications for the COVID-19 crisis. OECD Website.* Available from: www.oecd.org/environment/workingpapers.htm

Petrovic, N., Madrigano, J. and Zaval, L. (2014) Motivating mitigation: when health matters more than climate change. *Climate Change* 126:245-254.

Poortinga, W., Spence, A., Whitmarsh, L., Capstick, S. and Pidgeon, N. (2011) Uncertain climate: An investigation into public scepticism about anthropogenic climate change. *Global Environmental Change* 21(3): 1015-1024.

Poortinga, W., Whitmarsh, L., Steg, L., Böhm, G. and Fisher, S. (2019) Climate change perceptions and their individual-level determinants: A cross-European analysis. *Global Environmental Change* 55: 25-35.§§

Potrafke, N. (2017) Partisan politics: The empirical evidence from OECD panel studies. *Journal of Comparative Economics*, 45(4):712-750.

Puri, M. and Abraham, R. (2012) Biofuel production: Prospects, challenges and feedstock in Australia. *Renewable and Sustainable Energy Reviews*, 16(8):6022-6031.

Puri, M., Abraham, R. and Barrow, C. (2012) Biofuel production: prospects, challenges and feedstock in Australia. *Renewable and Sustainable Energy Reviews*, 16:6022-6031.

Readfern, G. (2021) Australia's new climate pledge to UN criticised for not improving on 2030 target, *The Guardian*, 5 January.

Redlawsk, D. (2002) Hot Cognition or Cool Consideration? Testing the Effects of Motivated Reasoning on Political Decision Making. *Journal of Politics*, 64: 1021–44.

Reiner, D. M., Curry, T. E., De Figueiredo, M., Herzog, H. J., Ansolabehere, S. D., Itaoka, K., Johnsson, F.. and Odenberger, M. (2006). American exceptionalism? Similarities and differences in national attitudes toward energy policy and global warming. *Environmental Science & Technology* 40(7): 2093-2098.

Reiner, D. M. (2016) Learning through a portfolio of carbon capture and storage demonstration projects, *Nature Energy*, 1: 15011.

Renewable Energy Policy Network for the 21st Century (REN21) (2019) *Advancing the global renewable energy transition.* Available from: www.ren21.net/GSR [Accessed February 2020].

Rudolph, T. J. and Evans, J. (2005) Political Trust, Ideology and Public Support for Government Spending. *American Journal of Political Science*, 49(3): 660-671.

Schively, C. (2007) Understanding the NIMBY and LULU Phenomena: Reassessing Our Knowledge Base and Informing Future Research. *Journal of Planning Literature*, 21(3): 255–266.

Schumacher, K., Krones, F., McKenna, R., and Schultmann, F. (2019). Public acceptance of renewable energies and energy autonomy: A comparative study in the French, German and Swiss Upper Rhine region. *Energy Policy*, *126:* 315-332.

Sokoloski, R., Markowitz, E. and Bidwell, D. (2018) Public estimates of support for offshore wind energy: False consensus, pluralistic ignorance, and partisan effects. *Energy Policy* 112 (2018): 45-55.

Sovacool, B. (2009) Rejecting renewables: The socio-technical impediments to renewable electricity in the United States. *Energy Policy*, 37: 4500-4513.

Stanley, S. K., Wilson, M.S. and Milfont, T. (2021) Social dominance as an ideological barrier to environmental engagement: Qualitative and quantitative insights. *Global Environmental Change*, 67:102223.

Sundstrom, A.and McCright, A. (2016) Women and nuclear energy: Examining the gender divide in opposition to nuclear power among Swedish citizens and politicians. *Energy Research & Social Science*, 11:29-39.

Tranter, B. (2011) Political divisions over climate change and environmental issues in Australia, *Environmental Politics*, 20:1, 78-96.

Tranter, B. (2013) The great divide: Political candidate and voter polarisation over global warming in Australia. *Australian Journal of Political History*, 59(3):397-413.

Tranter, B. and Booth, K. (2015) Skepticism in a changing climate: A cross-national study. *Global Environmental Change*, 33:154-164.

Vogele, S., Rubbekle, D., Mayer, P. and Kuckshinrichs, W. (2018) Germany's "No" to carbon capture and storage: Just a question of lacking acceptance? *Applied Energy*, 214:205-218.

Walker, C., Stephenson, L.and Baxter, J.(2018) "His main platform is 'stop the turbines'": Political discourse, partisanship and local responses to wind energy in Canada. *Energy Policy*, 123:670-681.

Wiest, S., Raymond, L. and Clawson, R. (2015) Framing, partisan predispositions, and public opinion on climate change. *Global Environmental Change*, 31:187-198.

Yoo, B., Donthu, N., & Lenartowicz, T. (2011). Measuring Hofstede's Five Dimensions of Cultural Values at the individual level: Development and validation of CVSCALE. *Journal of International Consumer Marketing, 23*(3-4):193-210.

Appendix

Questionnaire design

To ascertain eligibility, respondents first answered screening questions (age, gender, postcode). The questionnaire was divided into seven sections covering a range of topics: (1) perceived and objective knowledge of energy technologies; (2) levels of support and associated factors for energy technologies; (3) economic trade-offs, e.g. costs and reliability; (4) beliefs about climate change and environmental issues; (5) individual and household pro-environmental and energy behaviours; (6) CCS vs renewable energy perceptions; and (7) socio-demographic information, including individual values and political voting behaviour. Most questions in the sections on economic trade-offs, climate change, and energy behaviours were adapted from the OECD EPIC survey and the World Values Survey, which has included similar questions since 1995. The climate change section also included items on values, norms and beliefs drawn from Steg, Dreijerink and Abrahamse (2005). Questions on individual values were drawn from the CVSCALE (Yoo et al. 2011).

Data collection

Data were cleaned and analysed using Stata/MP v.15.1 (StataCorp LLC). Completed surveys were discarded if participants had responded in a biased way, such as ‘straightlining’, which occurs when respondents ‘fail to differentiate between the items with their answers by giving identical (or nearly identical) responses to all items using the same response scale’ and can negatively affect both reliability and validity of survey responses [24, p. 521].

The demographic characteristics of the samples shown in tables A1 and A2 are representative of gender and age in each country.

Australia (n=2383)			**UK (n=2030)**		
Age	47.50 years	(SD=16.82)	50.96 years	(SD=15.72)	
Gender	***n***	***%***		***n***	***%***
Male	1161	(48.70)		962	(47.39)
Female	1222	(51.30)		1068	(52.61)
Education					
Below Year 10	76	(3.19)			
Year 10 or equivalent	206	(8.64)	GCSE/ O-level/ CSE	410	(20.20)
Year 11 or equivalent	88	(3.69)	Vocational qualifications	208	(10.25)
Year 12 or equivalent	383	(16.07)	A level or equivalent	413	(20.34)
Certificate (incl. trade)/ Diploma/ Adv. Diploma	784	(32.90)			
Bachelor degree (including honours)	530	(22.24)	Bachelor degree or equivalent	644	(31.72)
Postgraduate qualification (incl. PhD)	305	(12.80)	Masters/ PhD or equivalent	222	(10.94)
Other (please specify)	12	(0.50)	Other	27	(1.33)
			No formal qualifications	106	(5.22)
Income					
Less than $30,000	476	(19.97)	Less than £7,000	87	(4.29)
$30,000 - $59,999	559	(23.45)	£7,000 - £12,999	200	(9.85)
$60,000 - $89,999	459	(19.26)	£13,000 - £17,999	186	(9.16)
$90,000 - $119,999	308	(12.92)	£18,000 - £22,999	176	(8.67)
$120,000 - $149,999	265	(11.12)	£23,000 - £28,999	228	(11.23)
$150,000 - $179,999	100	(4.20)	£29,000 - £34,999	225	(11.08)
$180,000 - $199,999	49	(2.06)	£35,000 - £42,999	245	(12.07)
$200,000 - $219,999	32	(1.34)	£43,000 - £52,999	210	(10.34)
$220,000 - $239,999	23	(0.97)	£53,000 - £66,999	140	(6.90)
$240,000 - $269,999	12	(0.50)	£67,000 - £118,999	172	(8.45)
$270,000 - $299,999	15	(0.55)	£119,000 - £199,999	19	(0.94)
More than $300,999	14	(0.59)	More than £200,000	6	(0.30)
Other (please specify)	71	(2.98)	Other (please specify)	136	(6.70)
Voting behaviour					
Greens	267	(11.20)	Green	47	(2.32)
NPA	111	(4.66)	LibDem	132	(6.50)
ALP	807	(33.86)	Labour	692	(34.09)
LPA	622	(26.10)	Tories	735	(36.21)
NXT	73	(3.06)	UKIP	89	(4.38)
PHON	183	(7.68)			

Table A1: Socio-demographic statistics.

Note: Percentage shares of total sample are shown in parentheses.

Variable	Australia			UK		
	Mean	Standard deviation	Sample size	Mean	Standard deviation	Sample size
Support (DV)						
Biomass	3.55	1.56	2383	4.53	1.39	2030
Coal	3.75	1.79	2383	3.50	1.65	2030
Shale (coal seam) gas	3.50	1.71	2383	3.36	1.77	2030
Gas	4.15	1.55	2383	4.33	1.47	2030
CCS	3.81	1.56	2383	3.95	1.39	2030
Geothermal	4.32	1.55	2383	4.68	1.35	2030
Hydro	5.33	1.31	2383	5.51	1.28	2030
Nuclear	3.67	1.94	2383	4.03	1.85	2030
Solar (thermal)	5.41	1.37	2383	5.58	1.32	2030
Solar (photovoltaic)	5.59	1.36	2383	5.60	1.30	2030
Wave	5.11	1.48	2383	5.60	1.38	2030
Wind	5.39	1.51	2383	5.68	1.43	2030
Ideology (PIP)	1.19	11.33	1811	-3.37	4.92	1809
Ideology (ParlGov)	4.60	2.76	2063	4.94	2.59	2030
CauseCC	3.13	0.86	2383	3.14	0.86	2030
Knowledge						
Biomass	1.86	1.36	2383	2.13	1.29	2030
Coal	3.79	1.46	2383	3.43	1.36	2030
Shale (coal seam) gas	3.11	1.57	2383	2.49	1.32	2030
Gas	3.82	1.42	2383	3.37	1.33	2030
CCS	2.53	1.55	2383	2.43	1.34	2030
Geothermal	2.67	1.60	2383	2.10	1.29	2030
Hydro	3.59	1.64	2383	2.85	1.40	2030
Nuclear	3.37	1.62	2383	3.01	1.39	2030
Solar (thermal)	3.80	1.55	2383	3.02	1.34	2030
Solar (photovoltaic)	3.30	1.77	2383	2.87	1.46	2030
Wave	2.85	1.60	2383	2.65	1.33	2030
Wind	3.79	1.48	2383	3.23	1.32	2030

Table A2: Descriptive statistics.

Robustness test: alternative proxies of left-right orientation

Political parties have been categorised according to multiple criteria such as, for example, where they are situated on left-right (e.g. the PIP, Political Compass, Parliaments and Governments, World Values Survey datasets), authoritarian-libertarian (e.g. Political Compass dataset) or environment-industry (e.g. Tjernshaugen et al. 2011; Kalrstrom and Ryghaug 2014) spectra, creating several different options for translating voting preferences into ideological orientation. Moreover, as we elaborate below, each approach carries its own strengths and weaknesses and raises concerns about the robustness of the preceding results to (ideological) proxy choice.

We address these concerns by repeating the previous regressions replacing the PIP with two alternative proxies of left-right orientation. Our first proxy is derived from the Parliaments and Governments (ParlGov) database and is comparable to the PIP dataset in that it provides a continuous series of index scores to capture parties' left-right orientation. Unlike the PIP dataset, ParlGov includes the NXT and PHON parties and incorporates public opinion and expert surveys as additional sources for inferring parties' ideological positions alongside manifesto statements (Doring and Regel 2019). Raw scores range from one to ten, corresponding to left-right leaning respectively and were multiplied by five to produce a comparable spread to the PIP scores. Table 3 summarises the main parties and corresponding ParlGov scores.

Australia			UK		
Abbreviation	Party	L-R index	Abbreviation	Party	L-R Index
Greens	Australian Greens	1.5	Green	Green Party	2.6
ALP	Australian Labor Party	3.9	LibDem	Liberal Democratic Party	4.3
NXT	Nick Xenophon Team	6.0	Labour	Labour Party	4.4
LPA	Liberal Party of Australia	7.4	Tories	Conservative Party	7.4
NPA	National Party of Australia	7.8	UKIP	United Kingdom Independence Party	7.8
PHON	Paul Hanson's One Nation	8.2			

Table A3: Main political parties and ParlGov Left-Right Index scores in Australia and GB.

We also coded political parties as categorical variables to evaluate whether the results remain consistent when the continuous measures of ideological orientation are replaced with dummy variables. We interpolated parties' ideological orientations by referring to positions on the left-right axes of the relevant Political Compass (PC) charts that were generated nearest the time of surveying.[9] Tables A4 and A5 report the ideology coefficients from the robustness tests alongside the PIP estimates for reference.

[9] The 2016 Australian election chart was used to analyse the Australia results and the 2017 chart for the UK. PC positions are inferred by evaluating party attitudes towards a series of predetermined survey questions through content analysis of parties' public statements and analysis of candidates' self-declared Likert-responses to the same survey questions.

Proxy	Biomass	Coal	Shale Gas	Natural Gas	CCS	Geothermal	Hydro	Nuclear	Solar (thermal)	Solar (PV)	Wave	Wind
PIP (n=1811)	0.01	0.03***	0.03***	0.02***	0.02***	0.00	-0.00	0.02***	-0.01***	-0.01***	-0.01***	-0.02***
ParlGov (n=2063)	0.01	0.10***	0.10***	0.07***	0.08***	0.01	-0.00	0.08***	-0.04***	-0.04***	-0.04***	-0.05***
Party dummy (n=2383)												
Greens	-0.17	-0.64**	-0.08	-0.44*	-0.18	0.07	-0.04	-0.31	0.40*	0.17	0.35*	0.61***
Katter	-0.28	-0.35	-0.23	-0.10	0.53	-0.85	-0.43	0.54	-0.66	-1.02	-0.85	-0.60
NPA	-0.08	0.31	0.74**	0.22	0.39†	0.17	0.17	0.32	0.05	-0.11	-0.13	0.17
ALP	0.00	-0.20	0.37†	0.05	0.09	-0.06	-0.14	-0.05	0.19	-0.04	0.03	0.43**
LPA	0.00	0.35†	0.86***	0.30†	0.46**	0.03	-0.11	0.36*	-0.03	-0.25	-0.18	0.03
NXT	0.05	-0.37	-0.02	-0.08	-0.32	-0.03	-0.20	-0.01	0.41*	0.06	0.20	0.43*
PHON	0.24	0.51*	0.72**	0.39*	0.44*	0.13	0.04	0.24	0.09	-0.01	0.04	0.24

Table A4: Ideology estimates using different L-R proxies for Australia dataset.

Note: Two-sided significance levels indicated by *** for p<0.001, ** for p<0.01, * for p<0.05 and † for p<0.1.

Proxy	Biomass	Coal	Shale Gas	Natural Gas	CCS	Geothermal	Hydro	Nuclear	Solar (thermal)	Solar (PV)	Wave	Wind
PIP (n=1809)	0.01	0.02	0.05***	0.03***	0.02***	0.00	-0.00	0.05**	-0.01	-0.01*	-0.01	-0.02**
ParlGov (n=2030)	0.02	0.02	0.09***	0.02	0.03**	-0.02	0.01	0.11***	-0.01	-0.00	0.00	-0.04**
Party dummy (n=2030)												
Green	-0.61**	-0.53*	-1.16***	-0.85***	-0.33	-0.40 †	0.17	-0.83**	-0.04	0.45*	0.25	0.18
SNP	0.06	-0.48*	-1.09***	-0.42*	-0.11	0.28	0.41*	-0.09	0.11	0.34*	0.18	0.27
PW	-0.33	0.45	0.20	0.25	0.38	0.47	0.75 †	0.42	-0.25	0.24	0.12	0.06
LDP	-0.08	-0.59**	-0.58**	0.25	-0.34*	0.25 †	0.45**	0.25	0.18	0.29*	0.25*	0.15
Labour	0.04	-0.18	-0.64***	-0.54**	-0.14	-0.02	0.28**	0.05	0.03	0.20*	0.22*	0.17
Tories	0.17	-0.04	0.31*	-0.01	0.19 †	-0.03	0.30**	0.88***	0.18	0.08	0.16	-0.15
UKIP	-0.13	0.28	0.14	-0.06	0.08	-0.30T	0.04	0.50*	0.03	0.06	-0.19	-0.37*

Table A5: Ideology estimates using different L-R proxies for UK dataset.

Note: Two-sided significance levels indicated by *** for p<0.001, ** for p<0.01,* for p<0.05 and † for p<0.1

The results obtained from the ParlGov model are strikingly consistent with the PIP estimates, both in terms of directions and levels of statistical significance. The PIP and ParlGov estimates do, however, exhibit some minor differences. While the signs of all but two of the ParlGov estimates correspond to the PIP coefficients[10], the latter tend to be larger in absolute terms than those from the original dataset (ranging from identical to quadruple the values in the first row), providing further evidence in support of our hypothesis that leftist ideologies tend to be more supportive of low-carbon and environmentally friendly energy technologies. Considering that we accounted for the difference in spread of the indices by multiplying the ParlGov indices to span a comparable range of values (i.e., normalise to have a range of 50), the latter results provide stronger evidence of the role of left-right ideology in shaping energy attitudes.

Only around one quarter of the entries in the third model with party dummies are statistically significant. As we elaborate below, this is probably because most political parties are not strongly environment or energy focused and therefore adopt less pronounced stances towards energy issues in general. In contrast, parties with a clearer environmental focus such as the Greens exhibit stronger (and therefore more significant) preferences for certain technologies than other parties which place more emphasis on other issues. Thus a horizontal reading of Tables 4 and 5 across the rows provides a more nuanced understanding of the (varying) role played by partisanship in shaping energy attitudes which is concealed by the continuous proxies. The PIP and ParlGov models could be criticised for inferring too much from the political spectrum indices by giving equal weight to parties that are not focused on environmental and industry issues.

A vertical reading of the tables by columns is consistent with the previous results: it suggests that CCS, shale (coal seam) gas and nuclear energy are more strongly associated with partisan divisions than other technologies. Each of these three energy technology columns reveal large significant associations between political party affiliation and technology attitudes in comparison to biomass and geothermal, which are the only two technologies that do not contain any significant entries in the relevant energy column.

With reference to the ideological axes in the relevant PC charts, the ideological inferences drawn from the current model are broadly consistent with our previous findings. In both countries, left-wing parties tend to be more supportive of renewables and opposed to the deployment of fossil fuel-based energies as well as the more controversial technologies (shale gas, CCS and nuclear). This is particularly clear for the Green parties in both countries, which are significantly associated with higher support for solar, wave and wind and less support for coal, shale gas, gas, CCS and nuclear energy. On the other end of the spectrum, right-leaning parties (i.e. the AU NPA, LPA and PHON and UK Tories and UKIP) tend to exhibit stronger support for fossil fuels and controversial energy technologies and less support for renewables. However, as in the PIP and ParlGov models, comparatively fewer

[10] The two exceptions are geothermal and hydro in the UK dataset, which were found to be negligible and statistically insignificant in both the PIP and ParlGov regressions.

technologies are found to be significantly correlated with right-leaning parties in both countries. Ideology has fewer determinate effects over energy attitudes in the political centre where parties such as the AU ALP and UK PW do not align with either set of ideal-typical expectations associated with left or right orientation.