

# Fossil Fuel Employment and Public Opinion about Climate Change

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# Fossil fuel employment and public opinion about climate change

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## Abstract

Public opinion about climate change has been shown to vary according to gender, age, ideological views, and placement in social networks, while variation in climate policy has been explained referring to economic factors such as reliance on fossil fuels. Nevertheless, an individual's type of employment – which combines social networks and economic interests – has not to date been used as a predictor for public opinion about climate change. Using data from Norway, we find that respondents working with fossil fuels show significantly less acceptance of mainstream climate scientific findings than the general population. This result implies that climate science communication needs to integrate information about how the economic situation of specific groups may be affected by mitigation efforts: one needs to imagine a coal or oil worker in the room. Furthermore, policymakers pushing for more mitigation need to facilitate employment opportunities in fields requiring skills similar to those found in the fossil fuels sectors, such as carbon capture and storage, energy efficiency, and offshore wind.

**Keywords:** Climate change, employment, climate science assessment, survey, Norway, fossil fuel industry

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## Introduction

Public understanding and acceptance of climate science is important because substantial mitigation action cannot be sustained in democracies without broad public support. At the same time, there is considerable variation in the degree to which people accept the principal findings of climate science, whether related to the presence of global warming, its attribution to human actions, or the severity of impacts. In the academic literature, this variation in public opinion about climate change has been explained with reference to a large number of factors, from science comprehension via ideology to group membership, social pressure and media coverage of climate change.

An early view on the link between climate science comprehension and climate risk assessment states that increased knowledge about climate science would lead to greater risk awareness and subsequently to increased support for policy. This view is often referred to as the information or knowledge deficit model (Bulkley 2000; Norgaard 2011) or science comprehension thesis (Kahan et al. 2012). The implication of these frameworks is that more information about climate science would enhance the public's desire to support mitigation and adaptation policies. In recent years, empirical findings going against the predictions of the information-based framework have been numerous. Political orientation has been highlighted as having a moderating effect on US public opinion about climate change (Dunlap and McCright 2008; Hamilton 2011; McCright and Dunlap 2011) and in Europe ([author]; Eurobarometer 2009). Kahan et al. (2012), studying a representative sample of US adults, find that the perceived risk of climate change co-varies more with political and ideological attitudes than with scientific literacy and numeracy. Indeed, they demonstrate that disagreement over the risks of climate change widens between different groups as science literacy and numeracy increase. The authors conclude that individuals tend to choose beliefs that serve their personal interests as members of a group, deriving social benefits from conformity, rather than striving for the most objective scientific information at any given time.

However, no study has so far emphasized the effects of individual employment characteristics. Based on analyses of Norwegian survey data from 2011 and 2013, we argue in this article that the degree to which a person's job contributes to climate change plays a crucial role in how that person relates to climate science. Norway serves as a good case because the extraction of fossil fuels, in the form of oil and gas, constitutes a dominant economic sector and major source of employment.

## Theoretical rationale: the effect of economic interests

Economic variables, when used in individual-level studies of public views on climate change, tend to limit themselves to income and whether the respondent is employed or not. At the aggregate level, by contrast, a number of studies have integrated economic trends as key

explanatory variables. Scruggs and Benegal (2012) argue that a recent decline in public concern about climate change is linked to recent economic hard times, while the weather also plays a role. In a similar study, Shum (2012) finds that changes in quarterly GDP growth rates have an effect on attitudes about climate change, but discounts the effect of short-term changes in temperature. By contrast, Brulle et al. (2012) dismiss economic explanations and emphasize the role of communication by elected officials as the key factor accounting for variation in public opinion about climate change among US adults from 2002 to 2012.

While the economy's role in explaining aggregate public opinion on climate change remains unsettled, the influence of economic interests on political expression and preferences is relatively clear. A growing body of scholarship has analyzed the strategies, techniques, and effectiveness of fossil fuel industry organizations (Lahsen 2005; Layzer 2007), contrarian scientists (Dunlap and McCright 2011; Lahsen 2008; McCright and Dunlap 2003; Oreskes and Conway 2010; Washington and Cook 2011) and conservative politicians and think tanks (Lahsen 2005; McCright and Dunlap 2003; Oreskes and Conway 2010) in promoting views that go against the findings of the vast majority of climate scientists. In terms of more direct routes of economic representation, roll call records show that members of the US Congress are more likely to vote against measures to restrain greenhouse gas emissions if they represent districts with high levels of emissions per capita (Cragg, Zhou, Gurney og Kahn 2012). At the local level, US cities with high levels of employment in carbon-intensive industries are less likely to commit to the voluntary Cities for Climate Protection campaign (Zahran et al. 2008).

Economic interests have also long been recognized in political science as a principal determinant of individual political preferences, such as those expressed by voters in elections (Lipset 1963). Maslow's (1943) hierarchy of basic needs theory connects economic development and safety with the formation of preferences at the individual level. Maslow argues that if some basic needs are not satisfied, an individual will not pay attention to needs that are less basic. Unemployment is mentioned as an example on a threat to safety needs. If a person feel that her job is threatened, her most important need is to keep the old job or getting a new one. As a consequence, reduced attention is paid to less basic needs such as environmental safety. Based on Maslow's theory it can thus be expected that individual preferences regarding climate change depend in part on an individual's economic situation. Consequently, if an individual's job depends on the production or consumption of fossil fuels, the principal sources of human-made global warming, it is likely that this personal economic interest influences the same individual's interpretation of climate science and the risk of global warming.

There are at least two avenues along which employment may affect views on climate science. First, for someone whose job is strongly tied to the production or consumption of fossil fuels, there is a particularly strong reason to hope that climate change is exaggerated as a threat. This because strong climate policy reducing fossil fuel use would affect the market value of sector-specific skills and the opportunities for finding or retaining attractive employment. Thus, reduced concern about climate change expresses an income-protective tendency in evaluating climate science. We thus offer individual economic interests as the

explanation of why some sets of individuals choose to interpret climate risk differently from others.

Second, individuals working in fossil fuel-intensive industries are likely to experience a relatively stronger psychological need to resolve the cognitive dissonance introduced by climate science. Strategies to resolve the conflict between one's employment and the consequences of global warming are also likely to be sustained collectively in the workplace. This is likely to happen as individuals create identity-protective motivations to shape their beliefs to those of like-minded others in order to avoid dissonance and protect social standing (Kahan et al. 2007).

Consequently, we hypothesize that opinion on climate change will display less concern and more skepticism than that of the general public, all else equal, among individuals working in fossil fuel-intensive industries.

## Data and methods

Our analysis is based on data collected through two population surveys conducted in 2011 and 2013 with a total sample of 2,595 Norwegian respondents of age 18 years or older. Examining the effect of employment in the energy sector is particularly suitable in Norway, where the extraction of oil and gas constitutes a dominant industry as well as a major source of national income (Eika et al 2010). The data were collected in two web-based surveys by the polling firm TNS Gallup in November 2011 and April/May 2013. The sample from 2011 consists of 1,532 respondents while the sample from 2013 consists of 1,063 respondents. Both surveys were sent out to randomly selected respondents that have agreed to be a part of a web survey panel. The panel consists of 50,000 respondents. The size of the panel indicates that it is possible to draw representative samples of the population. The panel respondents' characteristics have been mapped previously, and this mapping is used to target the relevant respondents. Altogether the sample is in line with the population characteristics, with some exceptions regarding age and educational level. A weight is calculated from the product of a demographic weight (region, gender and age) adjusted according to educational level. However, adding or removing weights does not substantively alter the results, and we will therefore report unweighted results.<sup>3</sup> While the respondents participating in the web panel are randomly selected and individuals may not sign up for participation without being personally contacted, it is not possible to control for systematic bias connected to the individuals choosing not to participate in the web panel. In both years, the survey was sent to the respondents as an e-mail invitation to participate together with a link to the survey's webpage. See note below Table 4 for details.

We measure public opinion about climate change using an index consisting of degrees of agreement or disagreement on a 1-5 scale with six statements related to the existence, attribution, and impact of climate change ( $\alpha=.822$ ). In each of the three groups, one statement expresses the conventional scientific view, as for example stated by the Intergovernmental Panel on Climate Change (IPCC), while the other expresses a climate

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<sup>3</sup> Comparisons between population data and the sample selections can be found in tables A1 and A2 in the online supplemental material.



skeptical view. This setup avoids any potential problems of affirmation bias, by which respondents may be more likely to agree with positive statements than disagree with identical but negatively phrased statements. For each of the six statements, respondents were asked to indicate degrees of agreement or disagreement with the given statement, using a scale from one (strong disagreement) to five (strong agreement). The statements are given in Table 1.

*Table 1: Components of climate change opinion index ( $\alpha=.810$ )*

No.	Statement	Type	Treatment
1	I am certain that climate change is happening.	Trend	
2	Floods and heat waves are not increasing in volume, they are just being reported more by the media.	Trend	Inverted
3	Climate change is largely human-made.	Attribution	
4	Reports that human activities cause climate change are exaggerated.	Attribution	Inverted
5	We know enough today to say that climate change is a problem.	Impact	
6	Climate change is receiving too much attention.	Impact	Inverted

The resulting index aggregates these six variables.<sup>4</sup> A score of five indicates full agreement with the conventional scientific view that climate change is happening, that human influence is a major causal factor behind it, and that unmitigated climate change will probably cause major hazards. By contrast, a score of one indicates consistent skepticism of the existence, human attribution, and impact of climate change. A score of three indicates agnosticism. Alternative index constructions and models using single statement variables were also tried, yielding results similar to the ones presented in this paper.

The distribution of the values on our climate opinion index is given in Figure 1. The mean response is 3.66 and the median is 3.67, signifying mild agreement with conventional climate science on average. The standard deviation of the variable is .85. As the figure indicates, a clear majority of respondents are either agnostic or express views compatible with conventional climate science, while few are outright skeptical. Eighty of the respondents have average scores of three (which signifies the option to «neither agree nor disagree») or higher.

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<sup>4</sup> Missing values for any of the six indicators generate a missing value for the full index. No relationship was found between explanatory or control variables and whether a respondent failed to answer one or more climate-related questions. About 13 percent of respondents have missing values on the climate opinion index both among respondents in the energy sector and those outside the sector. The component variable with the lowest amount of missing values is the first attribution variable in Table 1, "Climate change is largely human-made." Substituting this variable for the index yields consistent results with those shown in the models below.

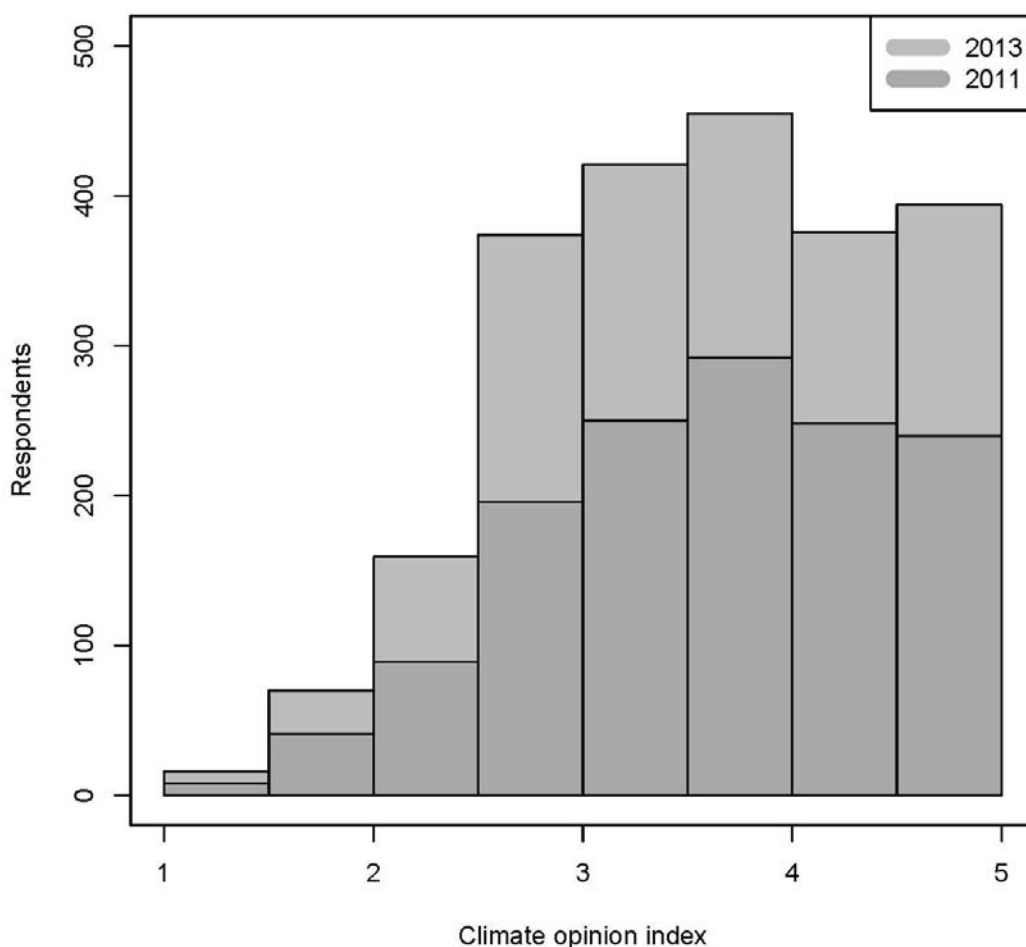


Figure 1. Distribution of public opinion about climate change in Norway (N=1,958). The histogram shows data from the 2013 study stacked on top of the 2011 data.

Employment data by sector were given for 1,582 respondents of the total sample of 2,595. The remaining respondents were students, retirees, or otherwise not employed. Of those employed, 80 or just over five percent of the sample reported working in the oil, gas, or energy sector. In Norway, this essentially means the fossil fuel industry, which includes exploration, drilling and refining, equipment manufacturing, and support services. About eight percent of Norwegian jobs are directly or indirectly linked to demand from the oil and gas sector (Eika et al 2010). Fossil fuels dominate the country’s energy sector in employment terms, while hydroelectric power and other renewables employ few people by comparison. It is thus reasonable to expect that the 80 respondents identified above constitute an approximately representative sample of the Norwegian oil and gas sector.

We measure individual political ideology placement as an index ( $\alpha=.708$ ) composed of three statements given in Table 2. For each of the three statements, respondents were asked to indicate degrees of agreement or disagreement using a scale from one (strong

disagreement) to five (strong agreement). A score of five on the resulting index indicates that the respondent expresses individualist values, while a score of one indicates that the respondents express collectivist values. According to Aardal (2011:85), the public-private dimension, which also can represent a measure on the respondents' collectivist and individualist values (Kahan et al. 2011, 2012), constitutes a useful indicator of the Norwegian left-right axis.

*Table 2: Components of individual political ideology placement index ( $\alpha=.71$ )*

No.	Statement	Treatment
1	A high level of taxes keeps public services secure	Inverted
2	More of the tasks performed by the public sector today should be performed by the private sector	
3	Government intrudes too much into people's lives	

## Results and discussion

To what extent does energy sector employment influence public opinion about climate change? Table 3 displays our public opinion index broken down by sector employment and year. This simple result indicates a clear difference in opinion between those working in the energy sector and those outside it. The difference between the two groups narrows somewhat in 2013, but remains statistically significant at the .05 level.

*Table 3: Public opinion on climate change by sector and year*

Year	Not energy sector	Energy sector	All
2011	3.72 (.84)	3.09 (.78)	3.70 (.84)
	n=1,325	n=39	n=1,364
2013	3.60 (.86)	3.25 (.92)	3.59 (.86)
	n=870	n=31	n=901
Both years	3.67 (.85)	3.16 (.84)	3.66 (.85)
	n=2,195	n=70	n=2,265

Standard deviations in parentheses.

Table 4 shows the results of three multivariate OLS regression models estimating the effect of energy sector employment on public opinion about climate change. Model 1 tests our main hypothesis using only a dummy variable for employment in the energy sector. The result is consistent with the hypothesis and significant at the .01 level. The explained variance expressed by the  $R^2$  statistic is very low in this model, which is mainly explained by the fact that only about five percent of the respondents work in the energy sector.

*Table 4: Effects of employment on public opinion about climate change*

	(1)	(2)	(3)
	Climate opinion index	Climate opinion index	Climate opinion index
energy	-0.51	-0.37	-0.26
	(0.10)**	(0.10)**	(0.10)**
Age		-0.07	-0.08
		(0.02)**	(0.02)**
Gender		0.28	0.22
		(0.04)**	(0.03)**
Income		-0.03	-0.01
		(0.01)*	(0.01)
Education		0.18	0.14
		(0.02)**	(0.02)**
Individual political ideology placement			-0.34
			(0.02)**
Constant	3.67	3.03	4.23
	(0.02)**	(0.10)**	(0.11)**
Observations	2265	2042	1958
R-squared	0.01	0.10	0.24

Robust standard errors in parentheses

\* significant at .05 level; \*\* significant at .01 level.

The second model includes the control variables age (four groups), gender, education (five groups), and household income (eight groups)<sup>5</sup>. As hypothesized, energy sector employment results in respondents' average opinion score moving in a direction away from acceptance of the mainstream scientific view and toward agnosticism and skepticism, all else equal. In Model 2, the effect has the size of .37, or just over one-third of a point on the 1-5 scale. The finding is statistically significant at the .01 level. The result supports our hypothesis that opinion about climate change is more agnostic or skeptical among individuals working in the energy sector, even when we control for important demographic variables such as gender, age, income and education.

<sup>5</sup> Details on operationalization can be found in table A3 in the online supplemental material.

A concern with this finding might be that there is a bias in which people choose to work in the energy sector, and that this bias relates partly to individual political ideology placement, which has been known to influence opinion about climate change. To address this concern, Model 3 includes the ideology variable presented in Table 2 above. The main hypothesis remains supported by the model, but the effect now shrinks from about one-third to one-quarter of a point on the 1-5 survey scale. The finding remains significant at the .01 level.

What details may be offered about the structure of the relative climate agnosticism and skepticism among fossil fuel workers in Norway? One hypothesis might be that energy sector employment will drive skepticism more among the less educated than among the more educated. In material interest terms, those with relatively higher education are more likely to be able to find employment outside the energy sector if strong mitigation policy is implemented. Following the knowledge deficit model, it would also be likely that those with less education are more likely to be swayed by skeptical arguments. On the other hand, more educated skeptics may be more comfortable in their skepticism because they may feel that they know science, and its processes of trial and error, better (Kahan et al., 2012). To test this proposition, we ran regression models with an interaction term between education and energy sector employment (not shown). However, no clear effect was found of interplay between fossil fuel employment and education level in terms of their effect on climate change opinion.

Finally, we sought to establish any interaction effect between energy sector employment and individual political ideology placement. A positive and significant coefficient on such an interaction term would indicate that energy workers to the right of the political center are less skeptical, and/or those to the left less concerned, than those outside the energy sector. We expect a certain convergence of views in the workplace, which would suggest less ideologically-driven polarization over climate change within the sector than in society at large. This might hold bearing in mind that a workplace in the energy sector is not equivalent to the entire sector as a place for social interaction. However, in our model runs (not shown), we find no statistical evidence that individual political ideology placement plays any different role for public opinion on climate change within the energy sector than outside the sector. However, the distribution on the political ideology index among the respondents employed in the energy sector are skewed to the right (mean = 3.39) compared to the general population (mean = 2.98), indicating that either people with more conservative ideological views are drawn towards work in the oil and gas sector or that their ideological orientations are adapted to a general norm at the workplace. A regression analysis (not shown) with the ideology index as the dependent variable confirms this positive effect of employment in the energy sector on the respondents' score on the ideology index. These results indicate that there is a mediating effect between employment in the energy sector and ideology. Nevertheless, the effect of employment in the energy sector is significant even when controlling for ideological variation, indicating that the employment effect remains independent and strong.

Figure 2 displays simulated effects of explanatory variables from Model 3 on our climate opinion index using the Clarify software (Tomz et al. 2003). The mean response is displayed as a horizontal red line. For each simulation run, explanatory variables were held at their means except the variable of interest. For example, simulating the respondents in the «Age 18-29» group, the four-category age variable was held at the lowest level, displaying the significantly greater support for the conventional scientific view in this age group.

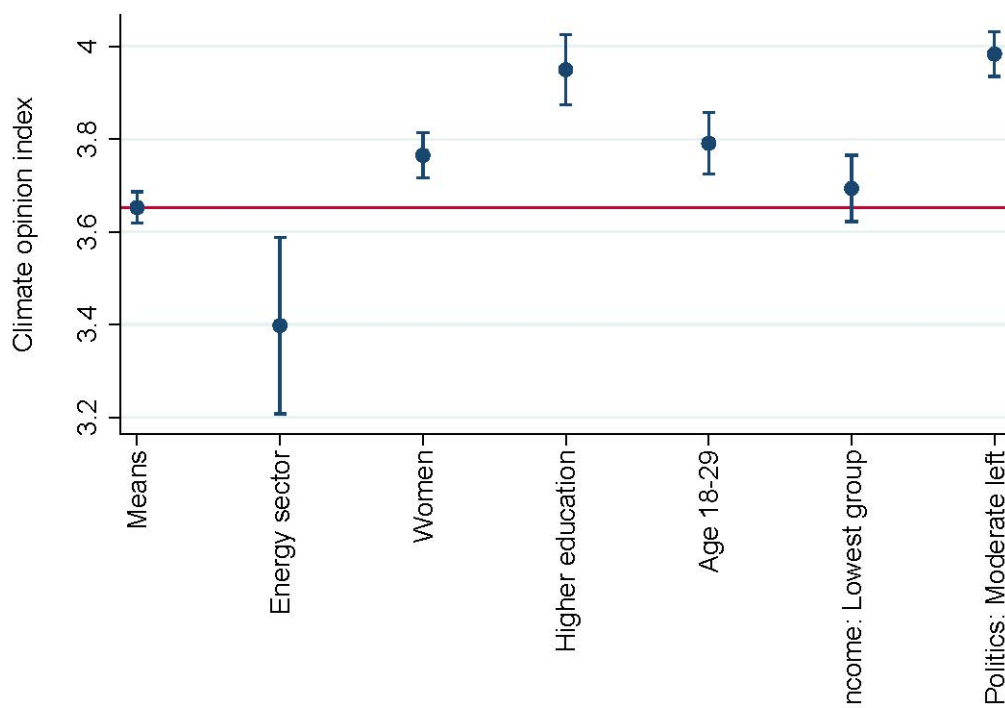


Figure 2. Opinion on climate change as a function of employment and other variables. This figure reports simulation results based on Model 3, Table 4. Whiskers indicate two standard errors around the regression coefficients.

Our findings indicate that the combination of economic self-interest and social milieu influences public opinion about climate change in the Norwegian energy sector, which is dominated by oil and gas extraction. We posit that part of the increased agnosticism and skepticism found in this part of the Norwegian population derives from direct economic interest, since taking climate science seriously implies that fossil resources need to be left underground, an outcome that would reduce the need to pay people to extract such resources. This would furthermore imply that jobs in the oil and gas sector are threatened. The findings are therefore in line with what we could expect based on Maslow's theory, as the safety of a person's job satisfies a more basic need than environmental protection. On an aggregated level Norgaard (2011) also links her explanation of the Norwegian population's attitudes towards climate change to economic structures. According to Norgaard, skeptical attitudes are connected to Norwegian oil production and the fact that

the Norwegian economy is flourishing with the current level of greenhouse gas emissions. Important reasons for skepticism are thus the social consequences for individuals and the political and economic consequences for Norway. This kind of skepticism is expressed by people choosing to «not noticing, looking the other way, and normalizing disturbing information» (Norgaard 2006, 366). Furthermore, due to the psychological need for identity to be consistent, and since identity is influenced by one's social setting, prevailing norms in one's social milieu will strongly influence one's perceptions of climate change. It makes sense for individuals to conform with prevailing notions in one's group – in this case, the workplace.

## Conclusions

The results presented in this article add a new dimension to the understanding of public opinion about climate change. Where previous studies have emphasized the effects of psychology, culture, group dynamics, and demographics, we introduce a novel explanatory factor in the form of individual economic interests. While the economy has certainly played a role in studies of aggregate public opinion as well as influencing corporate and political behavior regarding the issue of climate change, it has not to our knowledge received the same level of attention in explaining individual attitudes toward climate science. The present study starts remedying this deficit, hopefully initiating a new and important line of inquiry given the centrality of economic interests in the literature on political behavior.

As the results presented in this article give clear evidence of the effect of employment in the energy sector on opinion about climate change, the findings should be sought strengthened in future studies with the help of larger samples, by oversampling the energy sector, and with data from other countries. US and Canadian states and provinces with large fossil fuel sectors – such as, for example, Alaska, Wyoming, and Alberta – constitute prime locations for exports of the models presented here. The mechanisms conjectured in this article may also be tested using qualitative methods, for example by studying how climate change is being discussed and communicated internally in companies in the fossil fuel sector.

While our data are confined to one country, the findings have broader implications. Most importantly, this paper underlines the insight that when it comes to climate change, «the solution is the problem»: Citizens who are skeptical of key climate science findings are not primarily worried about scientific integrity *per se*, but rather about the potential or imagined implications of these scientific findings. Thus, in the same way that conservatives are more skeptical of climate science because they are worried about massive governmental interventions in the economy (Hamilton 2009), people working with fossil fuels are less willing to accept that climate change is a problem because they are worried about their jobs.

This fact implies new challenges for climate science communication, as it will no longer suffice to «repeatedly assert the correct information» (Leiserowitz 2006) or present the science a way that «does not threaten any group's values» (Kahan et al. 2012). While it is already known in the literature that the public's reception of messages on climate change is

shaped by pre-existing values and belief systems, communication with citizens whose jobs depend on extracting fossil fuels is made all the more difficult because new frames and messengers cannot change the fundamental problem. Such principles do not suffice as long as the implications of climate change mitigation policy for the fossil fuel industry are so clear and negative. As put by Upton Sinclair, «It is difficult to get a man to understand something, when his salary depends upon him not understanding it» (quoted in Esar, 1995:585).

What may then be done? First, policymakers need to communicate climate concerns by acknowledging the costs not only of climate change itself, but also the costs to major sectors of policies to cut emissions. This means not only talking about the risks related to climate change, but also providing compensatory options for those who will bear disproportionate costs from mitigation policy. Those options need to include alternative routes to employment and new opportunities for companies involved in fossil fuel extraction. Climate change communication needs to be imagined with a coal or oil worker in the room.

This in turn implies that what is considered optimal mitigation policy may not be the best mitigation politics. Government support for carbon capture and storage, geothermal energy, and offshore wind may thus be more expedient in countries and regions currently relying on fossil fuels, compared to supporting, say, solar power and biomass. This is because the former require skills already found in the fossil energy sector, for example related to combustion processes, drilling, pipelines, and offshore rigs. Indeed, from the policymakers' perspective, new training, employment, and investment opportunities in these fields may turn out to be the best form of climate change communication.

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