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Issue Framing and U.S. State Energy and Climate Policy Choice

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Abstract

Experimental and case study research has highlighted the importance of issue framing to the adoption of state renewable energy and climate change policies. Yet this relationship has not been tested within broader models of state policy adoption. We fill this gap by exploring the relationship between issue-framing patterns and climate/renewable energy policy activity across the 50 U.S. states, controlling for other well-known determinants of state environmental policy choice. Our results confirm that framing patterns for these issues vary markedly between states and regions and that a higher proportion of frames highlighting the economic benefits of climate change and renewable energy policies is positively associated with state policy activity. These results further confirm the importance of new issue frames related to economic benefits in subnational climate and renewable energy politics.

KEY WORDS: climate policy, energy policy, renewable energy, framing, policy innovation and diffusion, state policy

实验研究和案例研究强调了议题建构对州级可再生能源及气候变化政策采纳的重要性。不过(这一关系还未在更广的州级政策采纳模式中加以验证。通过探究美国50州的议题建构模式和气候/可再生能源政策活动之间的关系，同时控制州级环境政策选择的其他决定因素，我们填补了该研究空白。研究结果证实了两点，第一，议题建构模式在各州和区域之间差异显著；第二，更高比例的、强调气候变化和可再生能源政策的经济利益的议题建构，　与州政策活动呈正相关。该研究结果进一步证实了强调次国家气候和可再生能源政治的经济利益的新议题建构的重要性。

关键词：气候政策, 能源政策, 可再生能源, 建构, 政策创新和扩散, 州政策,

La investigación experimental y de estudios de caso ha destacado la importancia del encuadre de problemas para la adopción de políticas estatales de energía renovable y cambio climático. Sin embargo, esta relación no ha sido probada dentro de modelos más amplios de adopción de políticas estatales. Cubrimos este vacío explorando la relación entre los patrones de encuadre de problemas y la actividad de políticas de energía renovable / clima en los 50 estados de EE. UU., Controlando otros determinantes bien conocidos de la elección de políticas ambientales estatales. Nuestros resultados confirman que los patrones de encuadre para estos temas varían notablemente entre estados y regiones y que una mayor proporción de marcos que destacan los beneficios económicos del cambio climático y las políticas de energía renovable se asocia positivamente con la actividad de las políticas estatales. Estos resultados confirman aún más la importancia de los nuevos marcos temáticos relacionados con los beneficios económicos en el clima subnacional y las políticas de energía renovable.

PALABRAS CLAVE: política climática, política energética, energías renovables, encuadre, innovación y difusión de políticas, política estatal

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Introduction

In the United States and other nations, *states and other subnational units* have become critical actors in addressing climate change. Yet U.S. state activity in this policy space varies dramatically, from global leadership (California, New York), to moderate activity (Illinois, New Mexico), to effectively no activity (Alabama, North Dakota). Based on this state of affairs, scholars have sought to understand what factors make a state more likely to adopt policies addressing this challenge. Studies have explored the nature of interstate competition and policy learning in driving policy adoption, as well as internal state characteristics such as the strength of the fossil fuel industry, citizen ideology, and problem severity (Berry & Berry, 2018). Departing from these conventional measures, scholars examining case studies of state climate policy have cited evidence of the importance of other factors, especially specific issue-framing strategies promoting different conceptualizations of the issue (Rabe, 2016; Raymond, 2016; Wiener & Koontz, 2010). The presence of different framing strategies has not been incorporated in larger 50-state analyses, however, to see if they can increase our power to predict state policy action beyond more traditional variables such as ideology or problem severity. This paper fills this gap by incorporating measures of issue framing in different states as a possible determinant of state climate and renewable energy policy action.

This paper draws on an active body of research documenting the rise of new frames for climate change and renewable energy. Multiple frames have emerged in this research as important to public opinion and political action, including frames (1) promoting economic development from acting on climate change and renewables, (2) highlighting costs for energy consumers, (3) stressing the public health gains from reducing use of fossil fuels, or (4) emphasizing the benefits from reduced climate change impacts such as rising sea levels or dangerous heatwaves. Meanwhile, other research indicates that longer-standing frames stressing the scientific certainty or uncertainty of climate change remain prevalent and influential.

Looking specifically at these different framing messages, we find that framing patterns vary dramatically by state, with science framing still being quite common in many Southern and more conservative states, whereas economic development and other policy frames are more common in other parts of the country. In addition, we find that greater prevalence of a frame emphasizing the economic benefits of climate change mitigation and renewable energy is associated with greater state policy activity. These findings illustrate both the potential relationship between framing strategies and policy outcomes and the unique political significance of economic development frames in the climate change debate.

Our analysis proceeds as follows. First, we present our hypotheses based on a review of existing research on determinants of state environmental policy choice, including work in the innovation and diffusion literature as well as work on issue framing and climate and energy policy choice. After discussing our methods, we present our analysis of framing patterns across all 50 states, as well as test for the potential of different types of frames to predict state policy activity. Finally, we discuss the implications of our results for scholars working on issue framing and innovation and diffusion models of climate and renewable energy policy adoption as well as other policy issues.

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Traditional Determinants of State Climate and Energy Policy

As Berry and Berry (1990) first noted, factors affecting state policy innovation can be traced back to Mohr's (1969) theory of innovation: motivation to innovate, obstacles to innovation, and resources to overcome obstacles. Building on these insights, scholars examining climate change and renewable energy policy adoption have tested a wide range of factors as possible determinants of state climate and renewable energy policy adoption, including general factors believed to influence state policy innovation and diffusion and factors specific to energy and environmental policies. We briefly review these factors below.

When considering *motivation*, scholars argue that citizens' environmental attitudes ought to significantly influence a state government's desire to adopt new environmental policies (Lyon & Yin, 2010; Matisoff & Edwards, 2014). Many of these studies find that state environmental policy action is reliably linked to more liberal citizen ideologies (Lyon & Yin, 2010; Matisoff & Edwards, 2014; Wiener & Koontz, 2010).

In addition to citizen attitudes and ideology, interest groups also affect policy motivation (Karch, 2007; Vachon & Menz, 2006). Organized renewable energy interests can significantly increase the likelihood of policies promoting renewable energy in a state, for example, whereas states with strong interests threatened by renewables are less likely to adopt such policies (Lyon & Yin, 2010; Wiener & Koontz, 2010). Evidence concerning interest groups is inconsistent, however, as other studies find no relationship between the presence of polluting industries and environmental policy innovations (Sapat, 2004; Vachon & Menz, 2006). In general, interest group influence may vary depending on the public salience of the issue, with interest groups having less effect on high salience issues (Ringquist, 1994).

Although some scholars argue that states with more serious pollution and environmental problems are more likely to adopt environmental policies (Daley & Garand, 2005; Potoski & Woods, 2002), evidence for this relationship is also mixed, especially for climate change policies. This could be, in part, due to the diversity of "problems" associated with fossil fuel–based energy, which have ranged in prior studies from higher energy prices (Kagan, 2019) to local air pollution (Matisoff, 2008). A number of studies have determined that public support for policy action increases with the perception of more severe local climate impacts (Spence, Poortinga, & Pidgeon, 2012; Wiest, Raymond, & Clawson, 2015).

States must also have the *resources* to act on their problems. Broadly, wealthier states are believed to have greater capacity for innovation. Multiple studies have linked a state's economic development and wealth to its likelihood of adopting new environmental policy innovations (Daley & Garand, 2005; Lester, 1995; Sapat, 2004), including Renewable Portfolio Standards (RPS) policies to increase production of renewable energy (Matisoff, 2008). In addition, the professionalism of state government has been found to increase the likelihood of stronger environmental policies (Hays, Esler, & Hays, 1996).

In addition to internal determinants, the actions of other states can influence a state's policy choices. Although these diffusion effects can be quite important for some policies, studies examining climate and energy policies have found that

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Table 1. Typology of Climate/Energy Frames

	Positive: "Climate mitigation or renewable energy should be pursued because…"	Negative: "Climate mitigation or renewable energy should not be pursued because…"
Economic development	Cites larger economic arguments for acting on anthropogenic climate change (ACC) or renewable energy, including competitive advantage for alternatives over traditional energy sources	Cites larger economic arguments against acting on ACC or renewable energy, including competitive disadvantage for alternative energy over traditional energy sources
Consumer impact	Cites tangible benefits for energy consumers from acting on ACC or renewable energy, including financial savings and other important quality-of-life improvements	Cites negative effects on energy consumers from acting on ACC or renewable energy, including financial savings and other important quality-of-life improvements
Public health	Cites public health or other quality-of-life threats to people from non–greenhouse gas co-pollutants, such as local air pollution	Denies or downplays public health or other quality-of-life threats to people from non–greenhouse gas co-pollutants, such as local air pollution
Environmental impact	Cites environmental threats from ACC to human society or nonhuman communities, or how action to address ACC including renewables will/would reduce those threats	Denies or downplays environmental threats from ACC to human society or nonhuman communities. May indicate ACC is potentially beneficial for humans or nonhuman communities, or potential environmental harms from renewable energy
Science certainty	Claims that ACC is happening; Scientific evidence for ACC is certain or correct including apparent evidence of ACC occurring (e.g., recent weather); Claims scientists agree on ACC, describes evidence or scientific publications concerning existing or new climate change mechanisms	Denies or downplays that ACC is happening; scientific evidence for ACC is uncertain or wrong including apparent evidence (e.g., recent weather); Claims scientists disagree on ACC' describes evidence questioning accepted mechanisms of climate change

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internal characteristics are more powerful predictors of state policy actions (Matisoff & Edwards, 2014; Wiener & Koontz, 2010). Following these findings, we focus on internal characteristics for this initial analysis of the power of framing patterns to predict state policy choice.

Issue Framing and State Climate and Renewable Energy Policy

Issue framing has been missing from quantitative analyses of determinants of state climate and renewable energy policies, despite evidence of the importance of new modes of climate change communication to promote climate action (Kahan, 2012; Nisbet & Mooney, 2007). Multiple case studies confirm the importance of framing in state climate and renewable energy policy choice (e.g., Rabe, 2004; Raymond, 2016; Wiener & Koontz, 2010), so we seek to incorporate a measurement of issue framing in our analysis.

Like others working on framing in policy making, we follow Gamson and Modigliani (1987, p. 143) in defining a frame as a "central organizing idea or story line that provides meaning" to the factors related to an issue. Framing shapes public opinion by emphasizing important aspects of an issue, and downplaying others, providing a method of understanding what occurred or what *ought* to be done, influencing the nature of policies around critical issues like climate change (Borah, 2011; Chong & Druckman, 2007).

Research has identified several prominent framing strategies for climate and energy policies (Table 1). One has been to emphasize the scientific consensus on the threat of climate change as a reason for action (Moser, 2010). Scientists have long championed this method for promoting public support for climate change policies, building on the gateway belief model that scientific beliefs promote more favorable climate policy attitudes (van der Linden, Leiserowitz, Feinberg, & Maibach, 2015). Although these scientific explanations do not always promote positive attitude change in a value-centric public (Nisbet & Mooney, 2007), some research indicates that they remained a leading communication strategy through the time period we study (Boussalis & Coan, 2016).

Other research has indicated the growing importance of frames highlighting more immediate economic costs and benefits of climate change action and inaction (Cann & Raymond, 2018; Hennes, Ruisch, Feygina, Monteiro, & Jost, 2016). These framing strategies show promise in securing a broader base of support by connecting climate action to existing public values and the economic opportunities in "green jobs" (Nisbet & Scheufele, 2009; Rabe, 2008).

Even more research has stressed the political importance of another economic frame stressing consumer energy costs. For example, an exhaustive study of U.S. public opinion documented a "consumer model" of energy policy preferences: Americans want their energy at "low economic cost" and with "little social cost" in the form of tangible health risks from pollution (Ansolabehere & Konisky, 2014, p. 9). Likewise, Stokes and Warshaw (2017) found that describing an RPS policy in terms of higher potential residential energy costs had a significant and substantial negative effect on policy support, whereas talking about the policy's potentially positive effect on air pollution increased public support.

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In-depth case studies of climate policy adoptions and failures also provide evidence that frames stressing tangible benefits and costs for the public are politically critical (Rabe, 2016; Raymond, 2016; Skocpol, 2013). For example, new frames emphasizing how carbon revenue could reduce consumer energy costs were an important catalyst for recent subnational enactments of carbon pricing. Starting with the Regional Greenhouse Gas Initiative created by 10 Northeastern U.S. states in 2008, multiple carbon pricing policies have reframed emissions as a use of the "atmospheric commons" that must benefit most or all citizens in a tangible manner (Raymond, 2016). In many cases, the public benefits generated by politically successful policies take the form of refunds to citizens and energy consumers or investments in energy efficiency improvements to help defray higher energy costs (Harrison, 2012; Raymond, 2019). They can also stress the benefits of a cash payment to all citizens in the form of a "carbon dividend" from carbon taxes or sale of emission allowances (Carattini, Kallbekken, & Orlov, 2019).

Beyond consumer costs, advocates have increasingly stressed public health and quality-of-life gains from reducing other pollutants associated with traditional energy production from fossil fuels in ways that have assisted important energy and climate policies in California and Canada (Mendez, 2020; Raymond, 2020). Survey research has also shown the efficacy of this framing on public support for climate policy (Maibach, Nisbet, Baldwin, Akerlof, & Diao, 2010). Finally, messages concerning reducing local climate change impacts such as wildfire, drought, or flooding threats have also been effective in some policy settings (e.g., Karapin, 2016; Rabe, 2008), as well as in experimental studies on public opinion (Pidgeon, 2012).

In sum, a range of studies has found that different ways of framing climate change and renewable energy policies can have a significant effect on both public support for and the political success of such policies, but these frames have yet to be incorporated into a broader study of state climate and energy policy adoption. Although there are arguments in favor of the importance of each type of frame, we rely on the preponderance of recent research indicating that messages concerning the economic benefits and costs of a climate or renewable energy policy are most politically important. Thus, our primary hypotheses are as follows:

H1: States with a higher (lower) prevalence of positive *economic development* frames will have a greater (smaller) number of climate change and renewable energy policies.

H2: States with a higher (lower) prevalence of positive *consumer impact* frames will have a greater (smaller) number of climate change and renewable energy policies.

Methods

To test these hypotheses, we use a cross-sectional analysis of issue framing and climate change policies across the 50 U.S. states from 2012 to 2017. Specifically, we test our hypotheses by running OLS models of different measures of state framing prevalence along with control variables against state policy activity, consistent with other studies seeking to predict state performance on an index of policies (e.g., Abel, Salazar, & Robert, 2015; Weldon, 2006).[1]

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We developed our model for testing issue frames as follows. First, we ran an OLS model using all of the control variables from the policy determinants literature reviewed above. We then used stepwise backward elimination to remove insignificant control variables. Although scholars have noted the potential of stepwise regression to erroneously identify "noise" variables (Zhang, 2016), stepwise elimination is an appropriate strategy for building an efficient set of theoretically justified control variables to investigate a phenomenon (Ruengvirayudh & Brooks, 2016). We then added different framing variables to the simplified control model to see if there was any improvement in model performance. In particular, we test our primary hypotheses by asking if the addition of the economic development framing variable (H1) or the consumer impact framing variable (H2) improves our ability to predict a state's policy action in this area.

Framing Sample

We used coverage of climate and renewable energy over our time period in leading state newspapers to estimate patterns of framing around climate change and renewable energy in each state. It is important to note that we are not hypothesizing that media coverage is having a direct effect on state policy choices. Rather, we use local media coverage as the best record of elite framing patterns for these issues in each state. To gather these data, we collected a sample of newspaper articles containing the terms "climate change" or "renewable energy" from January 1, 2012 to December 31, 2017 from a leading newspaper by circulation in each of the 50 U.S. states.[2] The goal was to gather a sample of 40 articles spaced across the time period of interest for each state. For the 15 states with less than 40 articles containing the search terms, we used all available articles (the smallest number of articles was 20 for New Hampshire). For the 35 states with more than 40 articles, we drew a random sample of articles distributed equally across the time period.[3] Because the average population of articles was approximately 85 per state, our sample size gave us a reasonable average margin of error in generalizing to the full population of state articles while keeping state media samples at an equivalent and manageable size for coding. Additionally, our sample is relatively balanced across time but does reflect the increasing attention given to climate change and renewables over our time period, with the smallest number of articles in 2012 (8.2% of sample) and the largest number in 2017 (26.6% of sample). The final sample contained 1,899 articles, or an average of 38 articles per state.

Content Analysis for Frames

Our typology of issue frames (Table 1) builds on recent work (Cann & Raymond, 2018), grounded in the pioneering analysis of McCright and Dunlap (2000). All frames in this typology are classified as positive or negative: positive frames encourage climate change action, whereas negative frames either downplay the need for action or highlight the costs related to climate change policies. We revised and validated the final codebook using multiple coders working on a pilot sample of newspaper articles that is not included in our reported data set.

To document the prevalence of each frame in different states, we manually coded articles in our sample for the presence of different frames, based on the descriptions

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in the codebook. The unit of analysis was the article, and a single article could have multiple frames present. Intercoder reliability tests indicate acceptable levels of agreement between coders (average of 98% agreement, Krippendorff's alpha = .87 across all frames).

To create our state-level variables for frame prevalence, we aggregated the coding results into the percentage of articles containing each frame type by state. In our California sample, for example, 24 of 41 articles featured a positive environmental impact frame, for a value of 59%. This allowed us to test the major frame types described in the literature by looking at the relative percentage of articles featuring each frame as independent variables in our models predicting greater or lesser state policy activity.

Dependent Variable—Climate Change and Renewable Energy Policies

The dependent variable in this analysis is an index of five state policies to promote renewable energy and mitigate climate change, many of which have been previously identified as leading policies in this area (Carley, 2011):

1. *Carbon pricing policies* are market-based policies that reduce greenhouse gas emissions by increasing their cost. They come in two main forms: emissions trading systems and carbon taxes.
2. *Public Benefit Funds (PBF)* provide funding for renewable energy or energy efficiency efforts through a surcharge on energy bills.
3. *RPS* impose legal requirements on utility companies that a certain percentage of electricity come from renewable sources by a given date. (We also included the closely-related Alternative Energy Portfolio Standard in this measure.)
4. *Net metering programs* allow excess energy generated by consumers to be sold back to the utility for credit, incentivizing household renewable energy installations.
5. *Energy Efficiency Resource Standards* require utilities to reduce electricity demand through increased energy efficiency.

The final measure of a state's policy activity is the number of these policies that each state had adopted as of December 2017 (see Table 2), as indicated primarily by the National Conference of State Legislatures (NCSL) and the Center for Climate and Energy Solutions databases. Our policy variable ranged from 0 to 5 (M = 2.64, SD = 1.74). Because there is no obvious reason to weigh one of these types of policies more heavily in assessing a state's overall commitment to renewable energy and climate change policy, we follow previous work in weighting each policy equally in our scale (Daley & Garand, 2005; Hays et al., 1996; Weldon, 2006).

Covariates

In addition to the hypothesized effects of framing, our models include covariates that scholars have identified as significant determinants of state environmental or climate change policies as discussed in the literature review. Because these variables have different scales, and our primary goal is to assess the relative influence

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Table 2. State Renewable and Climate Policy Adoptions

State	Renewable Portfolio Standard/Alternative Energy Portfolio Standard	Public Benefit Fund	Net meter	Energy Efficiency Resource Standard	C pricing	Total
California	X	X	X	X	X	5
Connecticut	X	X	X	X	X	5
Maine	X	X	X	X	X	5
Massachusetts	X	X	X	X	X	5
New Hampshire	X	X	X	X	X	5
New York	X	X	X	X	X	5
Rhode Island	X	X	X	X	X	5
Vermont	X	X	X	X	X	5
Washington	X	X	X	X	X	5
Delaware	X	X	X		X	4
Illinois	X	X	X	X		4
Iowa	X	X	X	X		4
Maryland	X		X	X	X	4
Michigan	X	X	X	X		4
Minnesota	X	X	X	X		4
Nevada	X	X	X	X		4
North Carolina	X	X	X	X		4
Oregon	X	X	X	X		4
Pennsylvania	X	X	X	X		4
Wisconsin	X	X	X	X		4
Arizona	X		X	X		3
Colorado	X		X	X		3
Montana	X	X	X			3
New Jersey	X	X	X			3
New Mexico	X		X	X		3
Ohio	X		X	X		3
Texas	X	X		X		3
Arkansas			X	X		2
Florida		X	X			2
Hawaii	X			X		2
Missouri	X		X			2

(Continues)

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Table 2. (Continued)

State	Renewable Portfolio Standard/Alternative Energy Portfolio Standard	Public Benefit Fund	Net meter	Energy Efficiency Resource Standard	C pricing	Total
Utah		X	X			2
Georgia			X			1
Idaho		X				1
Indiana			X			1
Kansas			X			1
Kentucky			X			1
Louisiana			X			1
Nebraska			X			1
North Dakota			X			1
Oklahoma			X			1
Virginia			X			1
West Virginia			X			1
Wyoming			X			1
Alabama						0
Alaska						0
Mississippi						0
South Carolina						0
South Dakota						0
Tennessee						0
Total	29	25	41	26	11	

Sources: National Conference of State Legislatures and Center for Climate and Energy Solutions.

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of framing within these models, we standardize the variables prior to running the analyses.

Citizen Ideology—We included a standard measure for citizen ideology developed by Berry, Ringquist, Fording, and Hanson (1998). For this index, ideology ranges from 0 to 100 with higher values reflecting more ideologically liberal citizens (Berry, Fording, Ringquist, Hanson, & Klarner, 2010). Given our time frame of interest, we used the average score by state between 2012 and 2016 (M = 49.37, SD = 15.31).

Interest Group Strength—We included a measure of a state's dependence on carbon-intensive industries as a proxy for industrial interest group strength.[4] To capture this, we used the proportion of real Gross State Product (GSP) from mining, quarrying, and oil and gas extraction versus all industries. These data are the average between 2012 and 2017 and are obtained from the U.S. Bureau of Economic Analysis (M = 3.40%, SD = 6.19%).

State Resources—Consistent with prior studies (Matisoff, 2008), we included a measure of state wealth as a proxy for a state's resources to enact new programs. We used average GSP per capita between 2012 and 2017 obtained from the U.S. Bureau of Economic Analysis (GDP by State—U.S. Bureau of Economic Analysis, 2021) (M = 51,027.78, SD = 9,845.57). We also included a measure of state legislature professionalism on a 5-point scale from the NCSL (M = 2.92, SD = 0.99).

Problem Severity—Consistent with the range of options for theorizing problem severity in the climate change/renewable energy context discussed above, we tested three different specifications for this variable.

First, to look at energy costs we included the average state retail price of electricity (in cents/kWh) from the U.S. Energy Information Administration (State Electricity Profiles—U.S. Energy Information Administration, 2021) (M = 11.05, SD = 3.56).

Second, following previous scholarship, we included a measure of air pollution operationalized as the average percent of each state's population living in a nonattainment area for one or more of the six Clean Air Act criteria air pollutants in 2012, taken from the EPA's Green Book (M = 0.37, SD = 0.35).

Finally, we created a new problem severity variable for the state's expected impacts from climate change by using the Climate Impact Lab's American Climate Prospectus (Houser, Hsiang, Kopp, & Larsen, 2015). To create the variable, we combined each state's projected coastal (storm damage), crime, labor, agricultural, mortality, and energy impacts from climate change into a variable that is the predicted total damages of climate change per capita (in 2011 USD per capita) by 2080 (M = 654.74, SD = 572.68).

Results

We start with a discussion of the patterns of framing for these issues across the 50 states before turning to an analysis of the potential for those frames to predict a state's policy activity.

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Table 3. Overall Framing Prevalence By Type

Frame Type	% Positive Frames	% Negative Frames	% Total Frames
Economic development	26%	13%	33%
Consumer impact	11%	8%	17%
Public health	7%	0%	8%
Environmental impact	49%	5%	50%
Science certainty	38%	18%	46%

Note: Figures represent percentage of media articles featuring that frame. Because articles can feature multiple frames, rows and columns do not total to 100%.

Patterns of Framing

Overall, we find wide variation in climate and renewable energy framing (Table 3). On average, the most commonly used category of framing in our sample is the environmental impact frame, appearing in 50% of all articles nationally. Typical environmental impact frames cite a broad range of environmental threats from climate change, many with a focus on regional concerns. For example, a 2014 article in Oregon quoted the 2013 National Climate Assessment: "Climate change is increasing the vulnerability of forests to ecosystem change and tree mortality through fire, insect infestations, drought and disease outbreaks." These environmental impact frames appeared in at least 25% of articles in every state, and dominated discussion in places like Oregon (81% of all articles) and Washington (67%), where expected climate impacts from drought and fire risks are very high.

Science frames were the second most common in our sample, appearing in 46% of all articles, with a high value of 78% in North Carolina and a low of 20% for Michigan. A typical negative science frame is demonstrated by a 2016 article in North Carolina: "Global land temperatures have plummeted by one degree Celsius since the middle of this year—the biggest and steepest fall on record…The last three years may eventually come to be seen as the final death rattle of the global warming scare."

Although less common in our sample, there was also significant variation across states in the frequency of economic development, consumer impact, and public health frames. For example, although consumer impact frames were present in only 17% of articles nationally, they appeared in 44% of articles in Michigan, and 41% in Texas. In both states, these frames tended to emphasize how renewable energy would affect energy costs for consumers (both positively and negatively). For example, a 2012 article reporting on increasing Michigan's RPS described opposition from trade unions and utilities claiming, "the proposed standard is unrealistic and would lead to billions of dollars in higher energy costs for Michigan consumers."

Public health frames were the least common nationally, appearing in only 8% of all articles, although with more frequency in Michigan (32%) and Utah (21%). These were typically stated in terms of air pollution health impacts. For example, a 2014 article in *The Salt Lake Tribune* noted that under a carbon tax: "Americans would enjoy better health as coal-fired power plants and other dirty energy sources are phased out and their toxic fumes eliminated."

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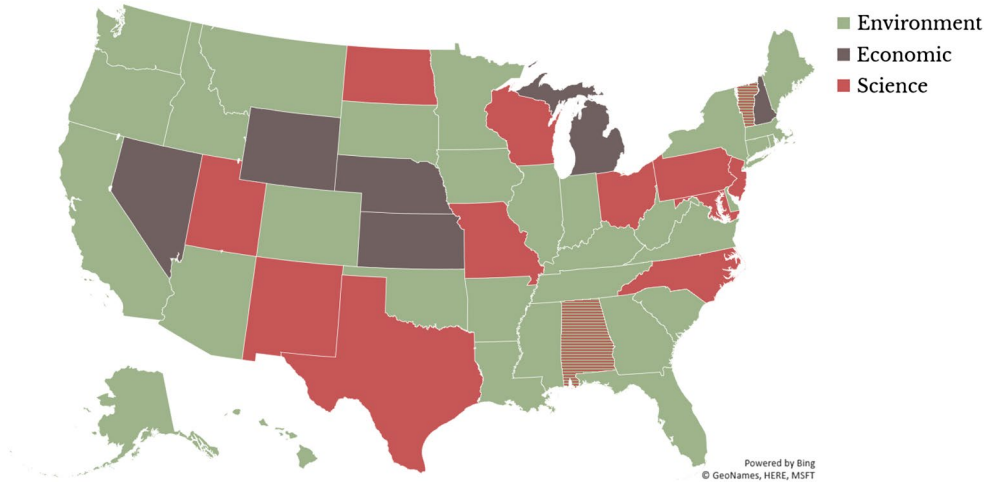

Figure 1. Most Common Positive Frames By State

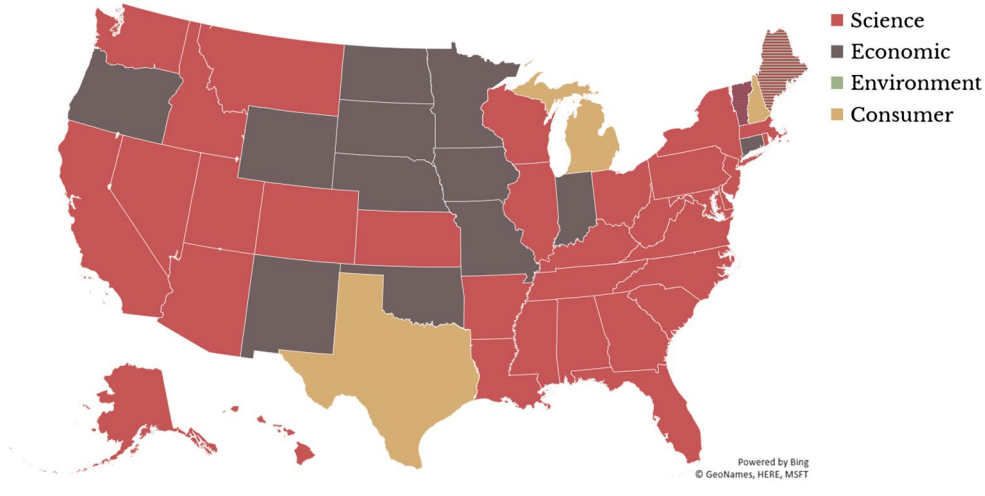

Figure 2. Most Common Negative Frames By State

These framing patterns confirm how much variation there is in climate and renewable energy discourse between states. As suggested by other recent studies, science frames no longer dominate the discourse around climate change—other frames (notably environmental impacts and economic development) are common in our sample. In addition, frame types such as public health framing that have been found to be politically effective in some settings are relatively uncommon within our data.

In addition to differences between frame types, there is notable variation between positive and negative framing patterns. In particular, very few articles feature negative environmental frames (5%) downplaying the potential impacts of climate change compared with the frequency of articles with positive environmental frames stressing those impacts (49%). This suggests that there are certain frames that are not being directly counter-framed, and that opponents of climate policy action avoid

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mentioning the public health and environmental implications of these policies. By comparison, the frequency of positive and negative consumer impact frames is more balanced, suggesting a more direct framing contest.

Turning to the most common frames in each state, we find that framing in our sample varies noticeably by both state and region. We consider the relative prevalence of positive and negative frames, respectively. Starting with positive frames, we find that environmental frames were the most prevalent type of positive frame in 31 states (Figure 1). Positive science frames stressing the certainty of climate science were most common in 11 states, including both traditionally liberal and conservative states, especially in the Ohio River valley area. Finally, positive economic development frames were most common in six states, including some (Nevada, Wyoming) where there is high potential for renewable energy development as well as major fossil fuel extraction activity.

By contrast, we see two broad patterns when looking at the distribution of negative frames (Figure 2): A block of states in the South where frames concerning scientific uncertainty regarding climate change were most prevalent, and a group of Great Plains and Mountain states where economic development frames portraying climate or renewable energy action as harmful to economy were most common. Interestingly, three states—Texas, Michigan, and New Hampshire—featured more negative consumer cost frames than any other negative frame, suggesting a focus on energy costs can be prominent in states with very different political and economic profiles.

Exploring these trends further, we ran OLS models predicting the frequency of different positive and negative frames using our controls and a "Southern" dummy variable. This analysis found citizen ideology and the Southern region variable to be significantly related to fewer positive economic development frames, while higher energy prices were associated with a larger percentage of positive consumer impact frames, suggesting these positive consumer messages appear more frequently where

Table 4. Baseline Models Predicting State Policy Adoption

	Full Model	Simplified Model
Citizen ideology	0.767***	0.849***
	(0.16)	(0.14)
Gross state product per capita	0.173	
	(0.12)	
Industrial interest group	–0.168	
	(0.13)	
Climate vulnerability	–0.112	
	(0.11)	
Energy prices	–0.409**	–0.350*
	(0.14)	(0.13)
Air pollution	0.141	0.229*
	(0.12)	(0.10)
Legislative professionalism	0.120	
	(0.11)	
Constant	0.011	0.000
	(0.09)	(0.09)
R^2	.628	.586
df	41	46
Akaike Information Criterion	105.9	104.8

Note: Standard error in parentheses.
*$p < .05$; **$p < .01$; ***$p < .001$.

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energy costs are more salient. In terms of negative frames, Southern states were significantly more likely to have negative Science frames with the Southern dummy variable explaining nearly 30% of the variance. These results indicate there are complicated factors driving both positive and negative issue framing patterns beyond our basic control variables like ideology.

Determinants of State Policy Adoptions

Table 4 summarizes the results of our full model of control variables predicting state climate and renewable policies, as well as our simplified model after we removed insignificant variables via backward elimination. In the simplified model, citizen ideology and two of our measures for problem severity (energy prices and air pollution) are statistically significant. As expected, states with more liberal populations tend to have more climate/renewable energy policies. Contrary to some previous work on RPS policies, however, we find that higher energy prices are associated with *fewer* climate and renewable energy policies, suggesting states may be concerned about arguments that these policies will raise energy costs for residents. And consistent with expectations that the public would support these policies to improve local air quality, higher air pollution rates are associated with more climate and renewable energy policies. The other measure of problem severity, projected climate vulnerability, as well as the other three potential determinants, GSP per capita, interest group strength, and legislative professionalism, were not statistically significant and were eliminated from the model. All regression models were checked using the variance inflation factor, and there were no issues with multicollinearity.

Based on the results in Table 4, we used the simplified model in testing the ability of different frames to improve prediction of a state's policy actions.[5] To test the association of each frame with policy activity, we included each framing variable along with our controls in a separate model (Table 5).

Models 2 and 3 test our hypothesis concerning economic development frames. The results indicate that positive economic development frames are significantly ($p < .001$) related with the number of policies adopted, consistent with H1. Negative economic frames, by contrast, are not significantly associated with the number of policies in a state. The strength of the relationship between positive economic development frames and policies adopted is also large relative to the control variables. Citizen ideology has the largest association with policy action: a one standard deviation increase in citizen ideology leads to a .936 standard deviation increase in policies adopted with the other variables in the model held constant. The prevalence of positive economic development frames is the next best predictor of policy action with a standardized coefficient of .354, greater than air pollution and equal to the influence of energy prices. Thus, this type of framing improves our ability to predict policy activity as well as or better than two measures of problem severity.

Models 4 and 5 test our hypothesis concerning consumer impact frames. Here we find that these frames were not significantly related to state policy activity, contrary to H2. Unlike economic development frames, more discussion of climate change and renewable energy in terms of consumer costs or benefits was not associated with a significant difference in policy action.

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Table 5. OLS Regression Models Including Different Frames

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Citizen ideology	0.849***	0.936***	0.814***	0.868***	0.861***	0.853***	0.859***	0.843***	0.850***	0.843***
	(0.14)	(0.12)	(0.14)	(0.14)	(0.14)	(0.14)	(0.15)	(0.14)	(0.14)	(0.14)
Energy price	-0.350*	-0.358**	-0.384**	-0.385*	-0.331*	-0.347*	-0.359**	-0.349*	-0.387*	-0.358*
	(0.13)	(0.12)	(0.14)	(0.14)	(0.14)	(0.14)	(0.14)	(0.14)	(0.14)	(0.14)
Air pollution	0.229*	0.285**	0.209	0.245*	0.214*	0.218*	0.226*	0.236*	0.222*	0.229*
	(0.10)	(0.09)	(0.10)	(0.11)	(0.11)	(0.11)	(0.10)	(0.11)	(0.10)	(0.10)
Positive economic frames		0.354***								
		(0.09)								
Negative economic frames			–0.130							
			(0.12)							
Positive consumer frames				0.072						
				(0.10)						
Negative consumer frames					0.078					
					(0.10)					
Positive public health frames						0.044				
						(0.10)				
Positive environmental frames							-0.121			
							(0.10)			
Negative environmental frames								0.062		
								(0.10)		
Positive science frames									–0.095	
									(0.10)	
Negative science frames										–0.036
										(0.10)
Constant	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	(0.09)	(0.08)	(0.09)	(0.09)	(0.09)	(0.09)	(0.09)	(0.09)	(0.09)	(0.09)
R^2	.586	.698	.597	.590	.591	.588	.600	.589	.593	.587
df	46	45	45	45	45	45	45	45	45	45
Akaike Information criterion	104.8	91.0	105.4	106.3	106.2	106.6	105.1	106.4	105.9	106.7

Note: Standard error in parentheses.
*$p < .05$; **$p < .01$; ***$p < .001$.

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Looking at other prominent frame types, we also found no significant relationships between frame prevalence and state policy adoptions. In some cases, these results may have been driven by the scarcity of certain frames, such as public health frames (Model 6), in our sample.[6] On the other hand, environmental impact frames were the most common in our sample, but still had no significant relationship with a state's policy activity (Models 7 and 8). The same is true for the relatively common science frames as well, which also had no discernable relationship with state policy actions (Models 9 and 10).

In sum, we find that the inclusion of positive economic development frames (Model 2) increases the explained variance from approximately 59% to nearly 70%. In addition, in examining the Akaike Information Criterion, a widely used method for choosing between models, we can conclude that the model including those frames is a notable improvement on the simplified base model (Model 1).

Discussion

Our analysis demonstrates that climate and renewable energy framing patterns differ dramatically across the United States. This suggests that research on framing and climate/energy policy enactment must consider the different types of issue framing that predominate in different contexts. For example, science framing was still common in the South and more conservative states from 2012 through 2017. By contrast, economic frames, both positive and negative, were most common in the West and the Great Plains, possibly due to the strong renewable energy potential in those regions as well as their important traditional energy industries. These differences in the political discourse over climate change and renewable energy support the argument that state policy action on this issue will require a variety of messages tailored to a state's local circumstances. Our analysis of factors predicting these framing patterns also suggests that there is something unique in Southern states that is associated with a higher frequency of negative science frames, at least through 2017. These initial results indicate the value of more research on the *causes* of different framing patterns in different states, as well as their policy implications.

Our analysis also confirms the importance of several internal determinants previously found to predict state policy action. Our baseline model explained approximately 59% of the variance in state climate change and renewable energy policies, as compared to a prior study (Matisoff & Edwards, 2014) of the adoption of state energy policies from 1990 to 2008 in which internal characteristics explained approximately 50% of the variance. Additionally, like Matisoff and Edwards (2014), our strongest predictor of state policy action was citizen ideology, with more ideologically liberal states having more climate and renewable energy policies. It is also notable that our measure of a state's vulnerability to climate change impacts was not associated with renewable and climate policy activity, contrary to some research findings that local impacts are an important potential cause of state policy action.

A more novel finding from these results is that patterns of issue framing can help predict a state's propensity to enact climate and renewable energy policies. The significance of positive economic development framing in predicting greater policy activity in our 50-state model reinforces case study research indicating that these frames have

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been important in promoting adoption of new climate and renewable energy policies. Although these frames are a weaker predictor of policy action than ideology, they are as strong as other standard predictors such as air quality or energy prices. This is additional evidence of the potential generalizability of case study findings that framing is a key factor in explaining state policy choice on this issue. It is also relevant to the growing body of research suggesting public support for climate policies that emphasize jobs and economic benefits, much as has been done by advocates of a "Green New Deal" in the United States (Bergquist, Mildenberger, & Stokes, 2020).

Attention to economic development framing also provides new potential explanations for states that are outliers to general policy trends. For example, North Carolina had an above-average number of positive economic frames in its media sample (35%) and has enacted 4 out of 5 state climate and energy policies in our index, despite conservative ideology scores, and moderate energy prices and air pollution levels, all of which predict a low level of policy adoption. These results are consistent with the idea that frames stressing new jobs from renewables have had an effect, such as this statement in our media data by a corporate leader: "Renewable energy is fueling our economy. North Carolina is one of the best states in the country in renewables." Nevada is a conservative state with low energy prices that evinces a similar pattern: 4 out of 5 policies enacted and a particularly high prevalence of positive economic frames. In Nevada, the focus on "clean energy jobs" was even stronger, with multiple frames stressing how renewable energy bills would "promote solar and other renewables as a way to help the environment, improve health, and create jobs." In contrast, while New Jersey is the ninth most liberal state in our analysis, it has enacted only three policies (while most liberal states have four or five), and features the second lowest number of positive financial frames of any state (9%). These state-specific results support hypotheses concerning the ability of economic frames to influence policy choice in opposition to ideology and other traditional factors, and merit additional research.

It is also noteworthy that we do not find evidence of a relationship between other frame types and policies. The relative scarcity of some frames that have been found to be important in specific cases since 2017 suggests that these frames may have become more politically salient after our study period and thus remain untested in terms of their wider potential political efficacy. This is particularly true of positive "public benefit" frames related to consumer costs and public health—these frame types appeared infrequently in our data (11% and 7% of all articles, respectively) and were overwhelmed by other positive frame types related to climate impacts (49%) and science certainty (38%). It could be that these frames may prove to be more effective if and when they are adopted more widely, as appears to be happening in some key cases (Driesen, 2019; Raymond, 2019). Alternatively, they may have relatively narrow applicability in specific political contexts. At the same time, the fact that relatively widespread frames related to climate science or environmental impacts had no clear relationship with state policy patterns is an important contrast with experimental and other research suggesting these frames are effective in shaping public attitudes and policy choices related to climate change and climate policy. Here again, more research would be helpful.

Of course, our inability to associate framing patterns with policy choice could be a result of limitations of our research design. Media coverage is an imperfect record of

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state political discourse, and future work could code other textual data such as public and private state political records including hearings, bill language, and press releases. In addition, our dependent variable does not capture differences in the degree of ambition of the policies in our index, which vary across states. Using a different set of policies or a different weighting of those policies might identify different frames as important to predicting state policy action. Finally, there are important limitations to the cross-sectional nature of our analysis, which limits our ability to make causal claims concerning the patterns of association that we identify. In this respect, there is much to be gained by using an event history analysis approach to look at the timing of framing patterns and policy adoptions, as well as more case studies of particularly surprising policy adoptions.

An exciting implication of this research is the potential to incorporate issue framing patterns using the same methods to study a variety of other policies. Most immediately, there is a robust literature on the diffusion and innovation of climate change policies among cities (e.g., Bulkeley & Betsill, 2013; Deslatte, Feiock, & Wassel, 2017) that could benefit from variables capturing differences in local framing of these issues using the relevant local media sources, especially given case study research suggesting the importance of economic framing in this context as well (Homsy, 2018). In addition, this method could be applied to a variety of other state environmental policies where similar frames are likely to be important, such as variations in state policies for air pollution, water quality, or hazardous waste. Indeed, this method could also be applied to cases outside environmental and energy policies, especially other issues where research has suggested the importance of new frames for promoting important subnational policies, including gun control, capital punishment, welfare and family policy, or limits on smoking and other public health laws.

Conclusion

This paper evaluated the relative prevalence of different framing strategies for climate change and renewable energy in every state across the United States, and estimated the relationship of those framing patterns with relative state ambition in adopting renewable energy and climate policies. We find substantial differences in framing patterns among states, with most frames portraying the issues in terms of scientific certainty, environmental impacts, or economic development. Other frames identified by scholars as important in some high-profile climate change policy conflicts, such as those emphasizing consumer costs or public health benefits, were much less common across all 50 states, at least in our study's time frame.

In terms of negative frames, conservative and Southern states tended to feature more frames focusing on scientific uncertainty, although none of these frames were significantly associated with a lower level of policy activity. In terms of positive frames, those stressing environmental impacts were the most common in a majority of states ranging from the Northeast to much of the South and the Western United States. Out of these positive frames, however, only the less common frame focused on positive economic development was significantly associated with greater state policy action on these issues, even controlling for other key factors such as citizen ideology, local air pollution, and electricity costs.

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These results are a step toward generalizing case studies and public opinion research concluding that reframing climate and renewable energy issues in ways that emphasize local economic benefits can improve the likelihood of new policy adoption. In addition, this research indicates the still untested nature of other important frames, including those related to consumer impacts and public health gains from renewable energy and climate mitigation policies. Moving forward, more work needs to be done untangling these relationships to understand the nature of the connection between different framing strategies and state policy action. Additionally, more work is needed to better understand both how current framing strategies are influencing policies to mitigate climate change and how different framing strategies might work in the diverse state contexts across the United States. But these results reinforce others indicating the growing need to attend to issue framing in understanding patterns of climate and energy policy adoption across diverse political contexts.

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Notes

1 Given that our dependent variable is a count, we also ran our models using Poisson regression. We found no significant differences in either the influence of the variables or model fit, so we report the OLS results.
2 For 39 states, the first or second largest paper by circulation was available, for the final 11 states, a top five circulation paper was used.
3 For a small number of states, limitations of the newspaper search engine required us to take top 40 articles by "relevance" when using our search terms. Spot checks indicated that these articles were not unduly concentrated in a narrow time frame compared with the average distribution of articles over time in other states.
4 For this variable, no data were available for the state of Delaware.
5 As a robustness check, we also modeled each framing variable with the full set of controls and obtained similar results.
6 Indeed, we did not run a model for negative public health frames because they were so uncommon.

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