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Incumbent resistance and the solar transition: Changing opportunity structures and framing strategies

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ABSTRACT

Sustainability transitions often involve policy conflicts, especially when incumbents perceive threats to their business models, and conflicts involve framing of competing positions in the public sphere. Using the case of the growth of distributed solar energy in the U.S. electricity sector, this study shows how the concepts of industry and political opportunity structures can help to explain variation in discursive strategy. First, when incumbents perceive the growth of the challenger as a threat, the industry opportunity structure closes, the volume of framing activity in the public sphere increases as contention grows, and the differentiation in framing (the ratio of pro- to anti-transition frames) between incumbents and challengers increases. Second, with respect to the political opportunity structure, the selection of frame types (environmental versus economic-consumer) varies in relationship to control of the government by conservative or progressive parties. Theoretical implications for transitions studies are discussed.

1. Introduction

Because sustainability transitions often involve a fundamental change in an industry, government policy guidance is generally necessary to ensure that the transition does not stall or fail. In some cases, incumbent organizations in an industry are able to integrate government policies for a sustainability transition into their existing business models, and transition policy can proceed without ongoing opposition from industry. Examples can be found for a range of policies, such as the substitution of chemicals and materials with liability risk (e.g., chloroflourocarbons) and the adoption of energy-efficiency measures for buildings. However, in other cases the incumbents perceive a threat from new technologies and the new market entrants, and they mobilize to reduce policy support for the transition. These incidents of incumbent mobilization or "regime resistance" (Geels, 2014) often coincide with counter-mobilizations by transition supporters. Consequently, conflicting coalitions can emerge over the level, direction, and type of policy support for a transition (e.g., Haukkala, 2018; Hess, 2016; Markard et al., 2016; Rosenbloom, 2018). In the process, challengers, incumbents, and their supporters bring their cases to the public sphere and engage in discursive strategies to win support from the public and from policymakers. These strategies tend to change as a transition advances from a small network of niche experiments to higher levels of institutionalization, but strategies also can change across different political jurisdictions.

This study contributes to the literature on the politics of sustainability transitions by identifying systematic patterns in the discursive strategies of actors. A good topic for the study of this problem is the conflict between utilities and distributed solar energy in the U.S. In some states, the utilities have mobilized to reverse or block policy support for distributed solar energy, particularly for net metering, which is a highly favorable policy for distributed solar because it pays customers at the retail price for electricity.

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Whereas utilities have consistently attempted to unwind policy support for distributed solar energy, solar-energy customers and companies have attempted to protect and expand policy support (Hess, 2016). As these conflicts appeared in the public sphere of media coverage and political debate, coalitions of supporters of both incumbents and challengers formed, and they developed arguments to win support from both the public and policymakers.

The framing of arguments is far from the only factor that affects the outcome of political conflicts over transition policy, but it is nevertheless crucial because of the close relationship between framing and policy coalitions (Hajer, 2006). The literature on sustainability transitions has recognized the study of frames, storylines, and discursive strategies as an important dimension of the politics of transitions (see the review below). This study builds on previous work by examining systematically how the concepts of political and industry opportunity structures can contribute to a better understanding of variation of discursive strategies over time and across space. It also provides a methodological contribution by developing a quantitative approach to measuring framing and to finding general patterns that link framing to opportunity structures.

2. Theoretical background

2.1. Discursive strategies and the politics of sustainability transitions

Increasingly, researchers who study sustainability transitions and energy policy have recognized that they are political processes (Köhler et al., 2019; Meadowcroft, 2011). This research problem of the "politics of transitions" has become increasingly salient with the rise of conservative and authoritarian political leaders who have adopted anti-environmental policy positions. Industrial incumbents associated with the fossil-fuel sector in Australia, Canada, the U.S., and some European countries have forged coalitions with conservative and far-right political leaders to oppose energy-transition policies and to polarize the political field of energy-transition policymaking.

As suggested above, an important dimension of political contention over sustainability transition policies involves the discursive work that different actors undertake in order to undermine or to defend policies. One influential approach that is relevant to this study is the analysis of storylines associated with discourse coalitions (e.g., Rosenbloom, 2018; Stephan, 2017). A storyline is a "condensed statement summarizing complex narratives" that are used by opposing coalitions (Hajer, 2006: 69). A similar approach, frame analysis, has also been used in sustainability transition studies (e.g., Fuller and McCauley, 2016; Gruszka, 2017; Hess, 2018, 2019). A collective action frame refers to a scheme of interpretation that motivates collective action and mobilization (Benford and Snow, 2000). Both approaches, which will be characterized here together as "discursive strategies," have been applied to the analysis of sustainability transitions and to energy policy, and a substantial literature has developed (for a review, see Isoaho and Karhunmaa, 2019).

Within this broader literature, some studies map out differences in discursive strategies that are associated with competing coalitions (e.g., Rosenbloom et al., 2016; Stephan, 2017). They also recognize that frames are developed in response to the counterframing of opponents (e.g., Dodge, 2017) and to attempts to resonate with the values and beliefs of the broader public (McCammon, 2013). Moreover, both challengers and incumbents engage in frame experimentation and innovation in response to changes in the composition of coalitions over time (Hess, 2018, 2019).

The previous research provides a good background framework for the central problem of this study: the analysis of how and why discursive strategies change over time and across different political contexts. In addition to the factors described above, the explanation of historical and geographical variation requires attention to structural conditions or contextual factors that both shape and are shaped by the framing and counterframing activities of coalitions. Macro-structural approaches anchored in broad, historical and environmental factors are helpful for understanding landscape changes such as the historical rise of right-wing populism and its connections with anti-sustainability politics (Johnstone and Newell, 2018). These broad conditions can include changes in the political and economic context such as the economic cycle (Rosenbloom et al., 2016; Rosenbloom, 2018) and disasters and environmental change (Stauffacher et al., 2015). But meso-level approaches that attend to the structures of institutions (e.g., the state or industry) can also provide insights and explanations into more specific developments in the way frames change. For example, discursive strategies change in response to new public policies (Rosenbloom et al., 2016; Stauffacher et al., 2015), and they can change as both incumbents and challengers adapt to the institutionalization of a transition (Hess, 2019).

This study argues that the analysis of the relationship between structural conditions and discursive strategy can be improved by using the concept of "opportunity structure" as a bridge between structure and agency in the meso-level analysis of discursive strategy. Work to date in transition studies has shown how the concept of political opportunities can be applied to variation in levels of support for a transition at the national and subnational level (Hess et al., 2018) and how opportunity structures can be an important explanatory factor in the comparative analysis of transition success and failure (Elzen et al., 2011). However, the concept of opportunity structures has remained relatively under-utilized in the study of the politics of transitions. Although there is recognition of the general institutional context as an explanatory structural factor for variation in discursive strategy, the concept of opportunity structures provides a way to connect the agency of actors in transitions with structural conditions.

The concept of political opportunity structures was developed by Eisinger (1973), who examined the effects of how open or closed the government is to claims by social movements. Subsequent work identified structural aspects of the state that were associated with more open political opportunities for social movements (Kitschelt, 1986; McAdam, 1996), and researchers in this tradition also emphasized the importance of using the concept in a way that specifies the sociopolitical context and temporality of political opportunities (Meyer and Minkoff, 2004). Of special importance for the study of industrial transitions, the concept of political opportunities was subsequently extended to the analysis of industrial change with the parallel theorization of the "industry opportunity

structure." For example, Schurman (2004) identified various features that make an industry more or less open to reform proposals and change, and Soule (2012) and Weber et al. (2009) drew attention to different levels of analysis, including the structure of firms in an industry and the structure of different networks within a firm.

This study integrates the concept of opportunity structures into the analysis of discursive strategies to show how this meso-level explanatory approach can help to identify general patterns in different discursive strategies over time and across places. Thus, the study contributes to a more precise formulation than "context" or "landscape" in transition studies, which can include both meso-level and macro-level structures, and it provides a way of further developing the agency-structure-discourse relationship. The study also brings a methodological innovation into this area of research by developing a strategy for measuring framing activity, by conducting a quantitative analysis of the relationship between changes in framing strategies and changes in opportunity structures, and by connecting broad patterns identified by quantitative analysis with the qualitative analysis of actors' statements in specific historical and geographical contexts. By bringing a mixed-methods approach to this problem, the study can point to general patterns and also to how such patterns enable the interpretation of cases. It also has general implications for the study of the politics of transitions.

2.2. Opportunity structures, framing, and distributed solar energy in the U.S

In this section, the concept of changes in political and industry opportunity structures is used to develop a research strategy for the analysis of variation in discursive strategies with respect to solar energy in the U.S. between two time periods (2005–2007 and 2015–2017) and across types of state government. The United States government is federalist, with powers allocated between the federal government and the state governments and territories. Because energy policy is made at both levels, state governments have the ability to enact significant energy-transition policies such as greenhouse-gas emissions regulations and renewable portfolio standards. Moreover, the federal government has generally not shown leadership on energy-transition policies, and responsibility has fallen to the states. The reasons for the lack of leadership from the national government are complex, but they include the increased polarization of political parties and the connections between conservative politicians who oppose regulation and supporters from the fossil-fuel sector.

In the U.S., there are two major political parties: the Republican Party, which is center-right to far-right, and the Democratic Party, which is center-left to democratic socialist. Although there is rotation of parties in state governments, increasingly states have tended to become heavily dominated by one party or another (Elliot and Baltz, 2013; McCright et al., 2014; Persily, 2015). States dominated by the Democratic Party are known as "blue states," those dominated by the Republican Party as "red states," and those with a more mixed politics as "purple states." Blue states tend to be found in the Northeast and West coast (such as New York and California), and red states tend to be located in the South and Great Plains (such as Texas, Florida, and Kansas). The Midwest (Iowa, Ohio, Michigan) tends to be more mixed.

During the baseline period of this study (2005–2007), state-government legislatures and governors' offices controlled by either major political party tended to support renewable portfolio standards, and there was common ground across moderates in both parties on this issue. In some cases the Republican Party governors of these states supported renewable portfolio standards and cap-and-trade policies for greenhouse-gas emissions. Moreover, immediately after Barack Obama was elected to the presidency in 2008, political opportunities at the federal government level appeared to be open for significant general support for low-carbon energy, and in 2009 he implemented policies in support of his campaign promise to create five million green jobs.

However, party differences on this issue rapidly became more polarized, and in mid-2010 the legislative effort in Congress to develop a national renewable portfolio standard and a national cap-and-trade regime failed. By late 2010, spending by interest groups and donors associated with the fossil-fuel sector had contributed to the purging of moderate Republican candidates from both state and federal offices. Moreover, in the November 2010 midterm elections, the Democratic Party lost control of the Senate, and the political opportunity structure for federal government reform policy closed. These changes culminated with the election of President Donald Trump in 2016, control of both houses of Congress by the Republican Party during the first two years of his presidency, and a shift to Republican Party control of state governments in many cases. The shift in balance within the Republican Party from moderate conservatives to far-right conservatives accompanied the party's increasing opposition to renewable energy and climate-mitigation policies, and many elected officials in the party voiced either open denial of climate science or some form of skepticism of climate-mitigation policy. These views were connected with hostility toward and even retrenchment of renewable energy policy in states controlled by the Republican Party.

However, political opportunities for solar energy development remained open in state governments controlled by the center-left Democratic Party ("blue" states), including the economically influential states of California and New York. In these states, an environmental or climate-change framing of energy legislation remained a viable discursive strategy for energy-transition coalitions. Indeed, some Democratic Party leaders embraced the environmental framing and used it to distinguish their party's leadership on the issue from the lack of action on climate mitigation policy of their Republican rivals. In turn, Republican Party opponents tended to frame solar and renewable energy as expensive and unaffordable. They did so by connecting their opposition to energy-transition policy with a populist economic framing that warned consumers that government mandates would cause increase energy costs. Thus, from a political opportunity perspective, one would expect to see significant differences in framing between states controlled by the Democratic Party (blue states) and those controlled by the Republican Party (red states).

In addition to changes in the political opportunity structure, there were also changes occurring in the industry opportunity structure. Although there are many public (usually municipal) and cooperative (usually rural) utilities, the electricity industry in the U.S. is dominated by investor-owned utilities, which are private-sector corporations that are generally publicly traded on stock

markets. These entities have sought to maintain the sociotechnical regime of baseload power generated by coal, nuclear, natural gas, and large hydropower. At first the utilities tended to ignore distributed solar energy because it was such a small percentage of overall generation. Thus, during the baseline period of 2005–2007, there was relatively little controversy over solar energy because of its insignificance. However, after 2010 there was significant growth in distributed solar energy. Annual non-utility (residential and business) solar installation capacity grew rapidly from under 400 MW in 2009 to over 4000 MW in 2018 (Solar Energy Industries Association, 2018). Moreover, the percentage of new generation capacity additions for all solar grew from 4% in 2010 to over 30% in 2015 and subsequent years (Solar Energy Industries Association, 2018). Although favorable policy, especially in states with Democratic Party control, was an important causal condition for the growth of new solar installations, the trend was also driven by the falling price of distributed solar energy and the rise of countervailing industrial power from the technology and finance sectors. Viewing rooftop solar as a good long-term investment and a portal into the future market of the Internet of things, these industries provided substantial financing for distributed solar energy. They were especially important in the development a financing arrangement known as "third-party ownership," which allows building owners to gain access to distributed solar via a lease (the developer pays for the system, and the customer leases it from the developer) or a power purchase agreement (the developer pays for the system and sells the solar energy power to the customer at a fixed rate). The substantial flow of investment funds into these arrangements provided countervailing finance for the lack of investment by the utilities (Hess, 2013).

By 2013 analysts for the utility industry had recognized the threat posed by the growth of distributed solar, and they made unfavorable comparisons between the utilities and other sectors where technological change had proven highly disruptive, such as digital imaging for Kodak film, the iPhone for the Blackberry, and cellular phones for land lines (Kind, 2013). The perceived threat of distributed solar to revenue streams, grid stability, and the sociotechnical regime of baseload generation led the utilities to mobilize in many state governments to end pro-solar policies such as net metering and to block attempts to authorize third-party ownership (Hess, 2016). In the extreme case of the state of Hawaii, the high cost of electricity had led to rates of adoption of distributed solar energy in some neighborhoods that were so high that the utility stopped new solar installations and claimed that distributed solar was creating a crisis in load management.

As the utilities mobilized to slow or halt the growth of solar energy, opposing coalitions formed. The utilities formed alliances with supporters in state governments (usually conservative members of Republican Party), and the solar industry formed alliances with solar consumers, environmentalists, and their supporters in the state government (usually members of the progressive wing of the Democratic Party). Consequently, the salience of the issue grew in the public sphere as battles erupted in multiple states over policy support for solar energy. Utilities articulated economic and technological frames to argue that distributed renewable energy would lead to increases in costs and grid instability and that distributed solar involved a transfer of wealth from solar customers to non-solar customers, who subsidized the grid services of solar customers. As the utilities mobilized against solar, their framing became more focused on the negative effects of solar, and in the later time period (2015–2017) they shifted the debate over solar energy from an environmental and sustainability issue to an economic-consumer issue.

With this background in mind, it is possible to formulate research questions that utilize the concept of opportunity structure to develop an analysis of how opportunity structures interact with differences in discursive strategy. Specifically, we ask the following research questions:

Q1. Where industry opportunity structures become more closed due to perceptions by the incumbents that the transition poses a substantial threat, and where incumbents mobilize to block sustainability policies, how are the volume and differentiation of framing activities affected? Our expectation is that the volume will increase for all actors involved (utilities, solar industry, environmental organizations, and government actors) because conflicts will increase. Moreover, for the utilities the ratio of anti-solar frames to pro-solar frames will also increase as they mobilize resistance. A similar pattern will appear among government actors as they become caught up in the controversy. However, solar energy advocates and civil society supporters will remain supportive of solar. Thus, the volume of frames will increase and the differences in framing strategy among actors will also increase.

Q2. In contexts where the political opportunity structure for sustainability transition policies is more closed, how are framing strategies affected? Our expectation is that in the context of the closing of political opportunities in the U.S. during this period, economic-consumer frames will be more prominent than environmental frames in the later time period (2015–2017, when the backlash against energy-transition policies was widespread). Moreover, economic-consumer frames will be more prominent than environmental frames in "non-blue" states (that is, states not controlled by the Democratic Party).

In summary, this approach brings together the concepts of industry and political opportunity structure with work on discursive strategies in transition politics to delineate patterns in framing with reference to changes in opportunity structures. It helps to integrate the already developed line of research in transition studies on the discursive aspects of the politics of transitions and to show how patterns in the opportunity structure-discursive strategy relationship can be measured and studied in the politics of transitions.

3. Method

3.1. Data and sample

Because the focus here is on identifying general relationships between opportunity structures and framing strategies, the study adopts a primarily quantitative research method based on the counting of frames. However, a qualitative comparison of two states is also included in order to explore the broader relationships in framing strategies used by different types of actors in specified contexts and to show how the structural patterns can be related to the qualitative analysis of cases.

A standard approach to the systematic analysis of framing in the public sphere is to use statements made by relevant actors in

media reports. This study uses articles from ProQuest News and Newspapers based on the combination of three search terms: “utility or utilities,” solar, and net metering. The comprehensive database includes news media articles from a range of sources, including the large national newspapers (e.g., *The New York Times*), local city papers, alternative press, ethnic press, news wires, and news magazines. Examples of specific articles are discussed in the qualitative results section.

Articles were selected from two time periods: January 1, 2005, through December 31, 2007, and January 1, 2015, through December 31, 2017. The two time periods reflect the general historical change in both the political and economic opportunity structure as described above. Articles within each time period were sorted by relevance, with the most relevant articles first. This method resulted in 490 articles for the first time period and 3316 articles for the second time period. The higher level of articles in the second period reflected the growth of media interest in the topic due to the increased conflicts over solar policy, but the second period also had many repeats of the same arguments and included a greater number of irrelevant articles.

Six undergraduate research assistants gathered data. For each article, the following information was collected: the type of article (news or editorial), placement (page number), date, media source, article title, and location of the media source. In addition, the students briefly described the conflict or topic of the article, a list of actors who appeared in each article and the organizational affiliation of the actors, and a list of arguments for or against solar energy made by each actor in each article. For each time period, data collection by the students proceeded until the saturation point was reached, that is, the point at which articles started to repeat the same actors with the same arguments. For the first time period 490 articles met the inclusion criteria, and coding stopped at 300 articles. For the second time period, coding stopped at 450 articles out of 3316 articles. Thus, the students collected data on a total of 750 articles.

After students had finished collecting data, a single person (the lead author) read the 750 articles and made decisions regarding exclusions. The following reasons were used for exclusion: lack of full text (54 articles), duplicates (103 articles), articles that had no arguments (123 articles), and articles from venues outside the U.S. (24 articles). After exclusions, there were 129 articles for the first time period and 317 from the second time period. The lead author then coded each article for statements made by an actor type or paraphrases by the journalist of the statements by the actor type. Actor types were coded into five groups: utility industry, solar industry, civil society (mostly environmental groups), government, and “other” (a residual category).

For each article and for each quotation or paraphrase by an actor type within the article, the presence or absence of a frame was recorded. A frame is defined here as a recurring argument that appears multiple times across actors and articles and provides a reason for supporting or opposing solar energy. The categories of frames were derived empirically by grouping together the recurring arguments. (See Table 1). In turn, frames were grouped together into two main types based on the research questions above: economic-consumer frames and environmental frames. Economic-consumer frames are understood as referring to broad benefits to the economy such as job creation and economic development, and consumer frames are understood as economic benefits and rights for households and businesses. In contrast, environmental frames included references to climate change mitigation (or lack of risk of climate change) or to general environmental benefits such as clean air. A residual type of “other” frames was also included for frames such as national security or technological feasibility. Although the coding tracked the third type, these differences were not the focus of the research project, and they were not analyzed.

In summary, the unit of observation (the row of the spreadsheet) was the news media article, and the unit of analysis was the presence or absence of a frame in the statements made by an actor type (the columns of the spreadsheet). For example, in one news article (Penn, 2015), one actor type appeared who represented the utility industry, one the solar industry, and one “other.” For each actor type in an article, a code of 1 was assigned for each of the 20 frames in Table 1 if the frame was present for any actor representing the actor type, and a code of 0 was assigned if the frame was not present. With five actor types and 20 frames, a total of 100 columns were coded for each article for the frames. The residual categories of “other actors” and “other frames” were not included in the analysis.

3.2. Variables and analytic strategy

The frames are the dependent variables. The total number of pro-solar frames and the total number of anti-solar frames were calculated for each actor type for each article. This variable was used in the frequency counts and in the multivariate analysis. Additional frequency counts were calculated for the following variables: actor type, political leaning of the state (conservative versus progressive), time period (2005–2007 and 2015–2017), and type of frame (economic-consumer and environmental).

There were two main independent variables of interest: time period and political leaning of the state in which the news media source is located. Time period was coded with 2015–2017 as 1 and 2005–2007 as 0. Political leaning of the state was coded as 1 for progressive states (described as “blue”) and 0 for conservative states (“not blue”). The term “progressive” is used here to refer to states with Democratic Party control and favorable renewable energy policy. To develop the list, we began with states for which the Democratic Party was in control of both houses of the state legislature during both periods. We then excluded states from this list that had Republican governors during this period who were not supportive of solar energy (Maryland, New Jersey, and New Mexico), and we added three states that had Democratic Party control of both houses in one period and of one house in the other period but that had a high renewable portfolio standard and otherwise strong support for renewable energy from the legislature and governor (Delaware, New York, and Oregon). The resulting list of "blue" states was as follows: California, Connecticut, Delaware, Hawaii, Illinois, Massachusetts, New York, Oregon, Rhode Island, Vermont, and Washington. The remaining states were classified as "other" or “not blue.”

Three different methods were used. The quantitative method used descriptive statistics to examine various frequency counts for comparison across actor types, time periods, type of state, and type of frame. In addition, multivariate analysis used negative

Table 1
Environmental and Economic-Consumer Frames.

Frame Type	Pro- or Anti-Solar	Frame	Description
Environmental	Pro	Climate change	Discusses greenhouse-gas emissions and/or climate change and perceives solar as solving this particular environmental problem
Environmental	Pro	Other environmental benefits	Discusses other environmental challenges of traditional energy and perceives solar as solving these environmental problems
Economic-consumer	Pro	Market demand	There is a market demand for solar; solar has the right to compete in the free market
Economic-consumer	Pro	Economic development and job creation	Solar contributes to the local, regional, and/or national economic development; solar can create jobs
Economic-consumer	Pro	Benefits of competition	Utility companies have a monopoly over the market
Economic-consumer	Pro	Rights of homes to have solar	Businesses and homes have the right to have solar
Economic-consumer	Pro	Fairness for non-solar customers	Response to actions, speeches, and policies that portray solar as unfair to non-solar customers
Economic-consumer	Pro	Lower utility rates	Solar leads to lower utility rates
Other	Pro	Social benefits of solar	Benefits of solar include equality, health, and related issues
Other	Pro	Technological advancement	Solar is an advancement of technology
Other	Pro	Public image	Solar is important for the public image (for government, companies, institutions, civil society etc.)
Other	Pro	Regional/national security	Solar is important for regional and national energy security, energy independence, or less nuclear energy
Environmental	Anti	Solar not environmental (climate change)	Solar is not as environmentally beneficial as people claim (specifically focusing on climate change)
Environmental	Anti	Solar other environmental harms	There are other environmental harms that solar can pose
Economic-consumer	Anti	Market demand for non-solar	There is a market demand for non-solar, i.e., traditional utilities need to be maintained; free market argument for non-solar
Economic-consumer	Anti	Cost of solar and renewable energy	High cost for solar and other types of renewable energy, specifically referring to monetary cost
Economic-consumer	Anti	Unfair competition	Utility companies do not have enough power in the market, and they need to take control of the market (unfair competition from subsidized solar)
Economic-consumer	Anti	Unfair to non-solar customers	Actions, speeches, policies that are portray solar as unfair to non-solar customers
Other	Anti	Social cost of solar	Social costs of solar such as equality issues
Other	Anti	Technological instability	Grid instability due to intermittency and related load issues

binomial regression with the following dependent variables: (1) the total number of pro-and anti-solar frames in each article and (2) the frequency of frame type by actor type for each article. This method was not used to establish full causality for the selection of frame types because the full understanding of causes of frame selection would require a historical, qualitative method. Rather, the analysis was used to separate out the effect of the time period and types of states to help to differentiate the political and industry opportunity structures. The analysis included a calculation of the interclass correlation coefficient (ICC) to determine whether multilevel modelling would be an appropriate choice, and the ICC (0.053) indicated that the differences would be more attributed to the individual level rather than group. Methods that would support a count variable were considered. To test for robustness, we used three different types of inferential statistics, namely, the negative binomial regression, the zero-inflated negative binomial regression, and the hurdle analysis. We used the Vuong test to check the model fit and concluded that the negative binomial regression had the best fit out of the three. (This test examines model fitness for different estimation techniques for a dependent variable that is a count variable.)

The third analysis was a comparative case study of California, a traditional blue or progressive state, and Florida, which is a traditional red or conservative state. We analyzed the complete set of articles that were in the data set for the two states to exemplify and clarify the interpretation of the general patterns (N = 66 for California and N = 33 for Florida).

4. Results

4.1. Volume of participation and differentiation

The results are consistent with our expectations for the first research question. (See Fig. 1.) Volume of frames is shown as a percentage of a type of frame used by an actor type summed across articles for a category (e.g., the sum of utilities' pro-solar frames in 2005–2007) divided by the total number of all frames used by the same actor type in both time periods (e.g., pro- and anti-solar frames used by utilities in both 2005–2007 and 2015–2017; thus, the sum of utility pro-solar and utility anti-solar percentages adds to 100%). The percentage volume of frames increases for all four of the actor types between the two time periods. Differentiation is not relevant for the solar industry and civil society actors, who deploy pro-solar arguments consistently during the two time periods.

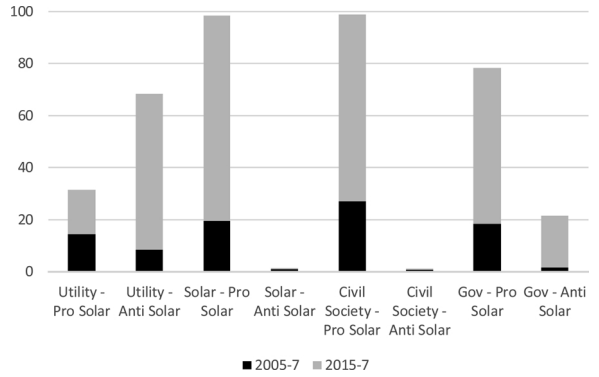

Fig. 1. Percentages of Arguments by Actor Types.

However, it is relevant for the utilities: in 2005–2007 they tended to make more pro-solar than anti-solar arguments, but in 2015–2017 the opposite was the case. For government actors, the percentage of anti-solar arguments also increases from 2005–2007 to 2015–2017; the change indicates that the government actors were more divided on the issue in the later time period.

Table 2 provides another way of looking at the same relationships. The negative binomial regression analysis treats the time period 2015–2017 as the independent variable and state political leaning as the control. (Anti-solar arguments by solar companies and civil society organizations are not included because of the small N.) The findings are consistent with the frequency counts in Table 1. The utilities became more anti-solar over time, and anti-solar arguments by government actors also increased over time, a finding that is consistent with the increased political polarization. For the solar industry, the volume of pro-solar arguments also increased over time (a trend in the opposite direction from the utilities), but the p-value is marginally significant at 0.051.

4.2. Frame types

With respect to the second research question, Fig. 2 shows the percentage of frames by actor type in each time period. The percentage is based on the total number of a type of frame for an actor type in a time period (e.g., for utilities, the total number of environmental frames in 2005–2007) divided by the total number of frames for all actor types in each time period (e.g., the total number of environmental and economic-consumer frames made by all four actor types in 2005–2007; thus, all of the black bars sum to 100%, and all of the grey bars sum to 100%). All actor types use economic-consumer frames with greater frequency than environmental frames, and all actor types use environmental frames less frequently in 2015-2017 than in 2005–2007. The use of economic-consumer frames also increases in 2015-2017 among all actors except civil society, which is comprised mostly of environmental organizations and therefore is less likely to jettison environmental frames even as the opportunity structure becomes more hostile to this strategy of framing of arguments in favor of solar energy.

For Fig. 3, the results suggest some differences between blue (progressive or left-leaning) and non-blue states consistent with a political opportunity perspective, but other differences are less obviously consistent with the perspective. The percentages are based on the total number of frame types used by an actor type in a type of state (e.g., for utilities, the total number of environmental frames in a blue state) divided by the total number of frames by all actor types in a state political type (e.g., the total number of environmental and economic-consumer frames made by all four actor types in all blue states; thus, all of the black bars sum to 100% and

Table 2
Negative Binomial Regression Estimates of Counts of Arguments by Different Actors.

	Dependent variable					
	UtilityPS	UtilityAS	SolarPS	CivilPS	GovPS	GovAS
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Constant	−1.890***	−2.212***	−1.242***	−.664**	−1.232***	−3.652***
	(.305)	(.292)	(.225)	(.209)	(.275)	(.616)
2015-2017	−.736*	1.020**	.487	.081	.261	1.621*
	(.362)	(.310)	(.250)	(.237)	(.313)	(.646)
Blue States	.740*	.242	.089	0.121	−.495	−.615
	(.365)	(.246)	(.237)	(.238)	(.328)	(.489)
Observations	446	446	446	446	446	446
Log Likelihood	−163.132	−282.529	−378.222	−437.602	−299.242	−127.534
Theta	.208**	.544**	.372***	.302***	.187***	.213*
	(.080)	(.177)	(.076)	(.051)	(.040)	(.102)
Akaike Inf. Crit.	332.265	571.058	762.443	881.204	604.484	261.067

Note: *p < 0.05; **p < 0.01; ***p < 0.001. Standard errors are reported in parentheses underneath coefficients.
Here, PS refers to pro-solar frames and AS refers to anti-solar frames.

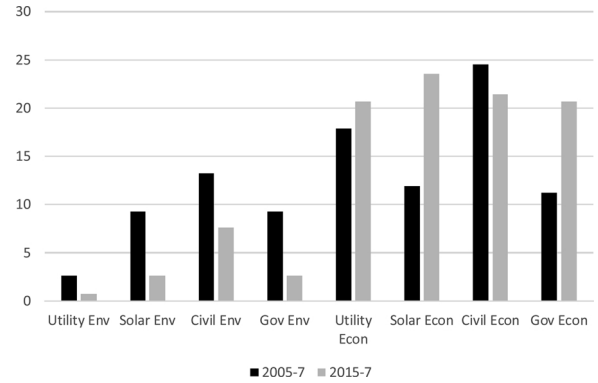

Fig. 2. Use of Frames by Actor Types and Time Periods in Percentages.

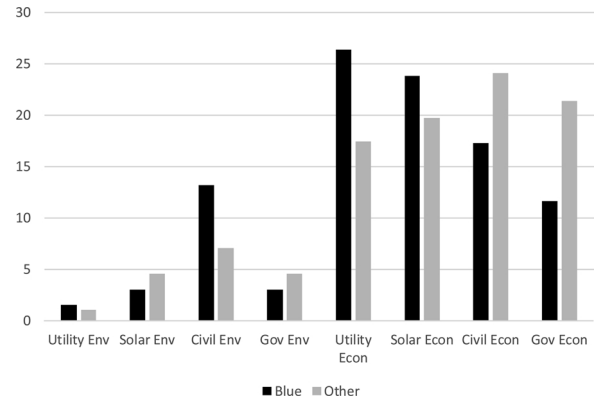

Fig. 3. Use of Frames by Actors and State's Political Leanings in Percentages.

all of the grey bars sum to 100%). As in Fig. 2, for all actors, economic-consumer frames appear more frequently than environmental frames.

For civil society organizations, the pattern is consistent with the expectation. Civil society organizations tend to use more environmental frames in blue states than in other states, and they tend to use more economic-consumer frames in other states than in blue states. For government actors, the difference between blue and other states is small for environmental frames, and there is a higher percentage of economic-consumer frames in other states than in blue states. These patterns are consistent with the view that actors will shift in more hostile political opportunity structures away from environmental to economic and consumer frames.

However, for the utility and solar industries, environmental frames are not employed very frequently in either type of state, and for both industries economic-consumer frames are employed more frequently and more frequently in blue states. We interpret this finding to mean that utilities predominantly use economic-consumer frames, and they are more active in blue states (where they have a more closed opportunity structure for their battles against solar energy). In response, the solar industry follows this pattern as a counter-framing strategy. Thus, there are differences based on the opportunity structure, and from Table 2 utilities tended to be more pro-solar in blue states, but from Table 3 the utilities also tended to use economic-consumer frames rather than environmental frames in blue states.

Table 3 provides a multivariate analysis of the same relationships. Again, for all four actor types there is a negative relationship between the frequency of environmental frames and the later time period, but in this analysis the negative relationship is statistically significant only for the solar industry. Likewise, all four actor types show a positive relationship between economic-consumer frames and the 2015–2017 time period, and the relationship is significant for the utilities, solar industry, and government actors. With respect to state type, the relationship between blue states and environmental frames is positive for civil society organizations, and the relationship between blue states and economic frames is positive for the utilities. In other words, directions of the coefficient for the economic-consumer frames and blue states are consistent with the frequency counts in Fig. 3.

4.3. Qualitative comparison

A comparison of all media reports in the data set for California (a "blue" state with a strong record of support for renewable energy, including solar) and Florida (a more conservative state with a mixed record for solar energy) was completed. In both states the Republican Party was in control of the governor's office in the 2005–2007 period (Arnold Schwarzeneggar in California and Jeb Bush in Florida); however, the two Republican governors were relatively moderate Republicans, and pro-solar laws were approved

Table 3
Negative Binomial Regression Estimates of Counts of Frames by Different Actors.

	Dependent variable:							
	Utility_Env	Solar_Env	Civil_Env	Gov_Env	Utility_Econ	Solar_Econ	Civil_Econ	Gov_Econ
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
Constant	−3.623***	−2.159***	−2.127***	−2.137***	−1.705***	−1.910***	−1.187***	−1.912***
	(.647)	(.313)	(.311)	(.339)	(.223)	(.259)	(.204)	(.285)
2015-2017	−.954	−.888*	−.181	−.755	.476*	.920***	.218	.967**
	(.803)	(.408)	(.351)	(.426)	(.241)	(.278)	(.23)	(.311)
Blue States	.565	−.279	.702*	−.384	.480*	.190	−.251	−.535
	(.834)	(.492)	(.336)	(.514)	(.208)	(.230)	(.236)	(.290)
Observations	446	446	446	446	446	446	446	446
Log Likelihood	−39.247	−104.401	−178.187	−109.180	−312.491	−321.002	−335.077	−288.764
Theta	.080	.469	.254*	.234	.962*	.574***	.636***	.390***
	(.095)	(.433)	(.099)	(.148)	(.385)	(.161)	(.186)	(.104)
Akaike Inf. Crit.	84.493	214.803	362.375	224.360	630.982	648.004	676.154	583.528

Note: *p < 0.05; **p < 0.01; ***p < 0.001. Standard errors are reported in parentheses underneath coefficients.

during this period. For example, in California during the 2005–2007 period, the state government approved the Global Warming Solutions Act of 2006 (Assembly Bill 32), which set in process the state's cap-and-trade system for greenhouse-gas emissions, and Assembly Bill 532 of 2007, which supported solar energy on state government buildings. Likewise in Florida during Governor Jeb Bush's administration, the state government approved the Renewable Energy Technologies and Energy Efficiency Act of 2006 (Senate Bill 888), which supported the diffusion of solar through tax incentives and credits. By 2015–2017, the situation was much more divergent. Under the leadership of Democratic Party Governor Jerry Brown, California charged ahead with advanced renewable portfolio standards and other policies supportive of solar, whereas in Florida Republican Governor Rick Scott reduced the state's previous commitments to renewable energy and told state-government employees not to discuss climate change.

With respect to the utilities, the quantitative analysis indicated that in the second time period, they became more anti-solar and used more economic-consumer frames, and they also used more economic-consumer frames in blue states. In the review of media statements by utilities, significant changes were evident between the two time periods, but differences between the two states were not evident. In 2005–2007, the utilities showed both opposition to and support for solar energy in California, whereas in Florida there were no arguments for or against solar. This makes some sense because California's renewable energy transition was receiving substantial policy support by 2005–2007, and the topic was salient, whereas in Florida there was much less policy support and issue salience at the time.

By 2015–2017, utilities in both states were showing more consistent opposition to solar energy, especially by drawing attention to the financial implications of the growth of solar for non-solar customers. For example, in 2015 Caroline Choi, the Vice President of Energy and Environmental Policy of Southern California Edison, commented,

All customers who use the grid should help pay to operate and upgrade the grid… Costs for residential solar have fallen dramatically, and it is time to update the structure used to enable rooftop solar to reflect the advances in the solar industry (Penn, 2015).

Likewise, Florida Power & Light (FPL) spokeswoman Alys Daly argued that net metering provides a subsidy to solar customers, and "in other states, customers pay a small fee to use the grid" (Hurtibise, 2016). These comments are reflective of a nationwide campaign by the utility industry to end net metering policies and to add sometimes prohibitive grid-connect charges to distributed solar customers. The primary frame for this campaign was that the growth of distributed solar energy was shifting costs to non-solar customers and thus represented an unfair transfer from non-solar customers to solar customers. The utilities' shared economic-consumer framing strategy across the two states in the 2015–2017 period is consistent with the interpretation that utilities were responding more to changes in the industry opportunity structure (the growth of solar and the recognition of the threat that it poses) and less to differences in the political opportunity structure between a blue and a red state.

With respect to the solar industry, the quantitative analysis showed that solar companies reduced the use of environmental frames and increased the use of economic-consumer frames between 2005–2007 and 2015–2017. The review of media statements in 2005-2007 indicated that solar companies in California were encouraging consumers to make the change to solar. In doing so, they used environmental frames such as the following statement in 2006 by the President and CEO of Expedient Energy, Darr Hashempour:

People are more educated about the environment than they were 10–20 years ago. They are learning that we cannot be as wasteful as a nation, and right now we are wasting everything we have. We can't afford to do that anymore (Rogers, 2006).

Florida solar companies also emphasized the significance of environmental benefits of solar, such as the following statement in 2007 by Florida Renewable Energy Association Craig Williams, executive director of the Altamonte Springs:

It definitely has the potential to supply our needs many times over once it gets down to the right price…If we install in large quantities, we can bring back the electric car, take care of our transportation fuel problems, solve the global warming problem, solve the foreign oil problem and take care of coal mining and nuclear waste (Swartz, 2007).

However, in 2015–2017, solar companies were more concerned with attempts to debunk utilities' economic-consumer arguments such as the claim that non-solar customers are subsidizing solar customers. In other words, solar companies were engaged in counterframing in response to the utility industry's arguments. In California, solar companies were also concerned with an attempt by

the utilities to charge a substantial connection fee. This change in context led to a greater reliance on economic-consumer frames, and many statements addressed the claims that utilities needed to charge solar customers more and end net metering. For example, in California, Brad Heavner, Policy Director of the California Solar Energy Industries Association, commented:

The utilities continue to use false analysis to claim that net metering is a huge subsidy…Rather than accepting the commission's decision and allowing their customers to go solar under fair rules, the utilities are fighting to keep opportunities away from their customers (Nikolewski, 2016).

Likewise, in Florida the solar industry was also responding to their sense that utilities were blocking solar progress, even to the point of developing a misleading ballot initiative that would stifle solar energy development. For example, Pete Wilking, president of A1A Solar Contracting Inc., the largest volume solar contractor in North Florida, said:

JEA [Jacksonville Electric Authority], based on what their policy plans are, they want to monopolize the solar industry by putting in large arrays and give their customers a choice, which is fine, but they appear to be doing it at the expense of rooftop solar (Kitchen, 2016).

In summary, as for the utility industry, the qualitative review of statements by the solar industry indicated consistency across the two states and a shift to economic-consumer arguments in response to the utility industry's attacks on the consumer benefits and economics of distributed solar energy.

With respect to civil society, the quantitative analysis indicated a positive association between environmental frames and blue states. Often the statements by civil society actors in California showed a combination of environmental and economic-consumer frames, such as the following statement in 2005 by Bernadette Del Chiaro, Environment California, in reference to a $2.5 billion state investment in solar energy:

This is a win-win policy for all-Californians, bringing cleaner air, great energy independence and affordable energy for all to enjoy…What makes this bill so exciting is that instead of solar being just for the backwoods hippie and Malibu millionaire, we're talking about making solar as mainstream and cost-effective for all Californians as double paned windows and insulation (Desert, 2005).

In contrast, in Florida civil society organizations adopted a more defensive posture, which was associated with an absence of environmental framing and a presence of economic-consumer frames. For example, David Pomerantz, the director of the Energy and Policy Institute, a pro-renewable energy watchdog group, stated in 2016:

I think you look at a state like Florida, where there's virtually no net metering now, the number of rooftop solar installations is minuscule relative to Duke Energy's [and others'] grid, and these guys are talking about the cost shift like it's apocalyptic (Paulson, 2016).

Although civil society organizations in both states are pro-solar, the California organizations tend to use both environmental and economic-consumer frames, whereas in Florida the concern is more with rebutting public concerns with cost.

With respect to government actors, the quantitative analysis found that economic-consumer and anti-solar frames were associated with the 2015–2017 period. This pattern did not appear clearly in the comparison of the two states. The review of statements by government actors for California indicated consistent support for solar energy across the two time periods. This is not surprising because it is a solidly "blue" state with legislative and gubernatorial support for energy-transition policies. For Florida, statements by government actors were generally favorable in the 2005–2007 period, but there were almost no statements in the 2015–2017 period. In other words, the change in the political opportunity structure in the later period is reflected in a change from support to silence from government employees (a change that would be reflected in the regression analysis). The change is not surprising because Governor Rick Scott received $1.1 million in support from the utilities in the 2014 election, and state workers faced the threat of job loss for talking about climate change (Dickinson, 2016). A rare example of a government actor who spoke about the issue was a statement by Paige Kreegel, a physician and former Republican Party member of the Florida House of Representatives. In 2014 he lost his seat in a primary election challenge from another Republican, and he said that he learned from that experience that "you don't go against the utilities" (Barton, 2015).

5. Conclusion

By bringing the combined analysis of opportunity structures and discursive strategy into transition studies, it becomes possible to identify specific patterns of how contextual or landscape factors affect changes in discursive strategy that occur as transitions develop. This study has three main general implications for research on sustainability transitions, one of which is methodological and the other two of which are theoretical.

With respect to methodology, this study suggests that variation in the political and industry opportunity structure both across space (e.g., the comparative analysis of governments with more open and more closed opportunity structures) and over time can be used to formulate with some precision an analysis of how structural conditions interact with discursive strategy. One can track variation in actor types, time periods, and opportunity structures to show how these factors affect framing strategy and volume. Through multivariate analysis, it is also possible to see the relative strength of different types of relationships and to discern general causal patterns. The type of insight gained from this method is different from and complementary to that gained from the deep, historical analysis of case studies that is common in transition studies. The two approaches can be integrated by bringing the broad picture of "bird's eye" patterns from quantitative analysis to enable the search for patterns in qualitative material that might otherwise be missed. Likewise, qualitative analysis can provide insights into the meaning of quantitative results (such as the shift from pro-solar to no frames in the case of Florida government officials, a change that can help provide context for the multivariate analysis). Thus, the study suggests how the integration of quantitative and qualitative methods can improve case study analysis.

Nevertheless, the combination of methods also has some limitations. Attention to the broad categories of frame types (economic-consumer versus environmental) involves a level of analysis that misses the deep play of the appropriation, selection, countering, and innovation of specific frames that can be found in historical case studies of framing and coalitions (Hess, 2019). A second limitation is that changes in the political and industry opportunity structures may coincide, as they did in this case with the change from 2005–2007 to 2015–2017, thus making it hard to distinguish which type of structural change is influential. Our solution was to include a comparison of blue and non-blue states and to control for the time period, but the results were mixed because the utilities showed a preference for economic-consumer frames in blue states even when controlling for time period, and the utilities were making such a strong display of economic-consumer frames that the solar industry was drawn into counterframing that used corresponding economic-consumer frames.

With respect to theory, the analysis has two general implications for the study of the politics of transitions. One implication involves the analysis of opposing storylines and frames in the context of political polarization. In situations where a transition is advancing and the incumbent organizations perceive the growth of new entrants and new technologies (e.g., distributed solar energy) to be against their interests, it is possible that incumbents will see that there is a need to adapt, and they will begin to adjust to a world of distributed renewable energy. One would expect this response to occur where there is a strong policy signal from the government in support of a distributed-energy transition and where there is relatively little party polarization on the issue. However, in the time and place studied here, the response of the utilities was largely a strategy of regime resistance, and their statements about the challenger technology became more negative during the second time period. In contrast, for advocates of the transition (e.g., the solar industry and environmentalists), their framing strategy remained uniformly supportive over time. Thus, this study shows a process of polarization of framing whereby the ratio of pro-transition to anti-transition frames decreases among the incumbents and government actors but remains steadily favorable among the energy-transition coalition advocates in the solar industry and environmental civil society.

To some degree the polarization of framing can be conceptualized in terms of strategic decisions that incumbents and challengers make in order to gain support for their policy positions in the public sphere and in the government. However, the development is also embedded in the broader trend toward political polarization described at the outset of the study, where climate-mitigation and energy-transition policies have become deeply partisan in some countries. In the U.S., these changes are largely the result of an institutional field that powerful corporations built since the 1970s to “corral” the federal government in a neoliberalizing direction (Barley, 2010). As a result of these broader institutional and cultural changes, energy policy preferences have become embedded in deeply held political identities, and the framing conflicts represent more than a conflict between incumbents and challengers in an industrial field. Moreover, because conservatives in the U.S. tend to be more opposed to anthropogenic climate change than to renewable energy, using frames that do not reference climate change and instead favor economic arguments in favor of new energy technologies may be an effective way to reduce the partisan divisions or at least to attempt to mobilize support across the divisions (Hamilton et al., 2018; Hess and Brown, 2017).

A related implication is that the public display of divergent and polarizing frames for a policy issue will not necessarily contribute to a positive resolution for a pro-sustainability transition coalition. This study suggests that a highly visible, polarized debate in the public sphere tends to spread from the incumbents and challengers to government officials, and their frames become more divergent between supportive and opposing perspectives. Both the volume of framing and the spread of polarization to government officials may contribute to the closing of political opportunities for additional policy support for the transition. Thus, one of the implications of this study for future research in transition and energy politics is that it is not necessarily bad for transition policies to remain invisible or out of the public limelight. In other words, less visible conflict may enable more flexible positions from all actors and a more open opportunity structure for negotiation and supportive policy development. One implication of this study is to suggest the values of a strategy that moves conflict off-stage or out of the public limelight through early negotiation before the conflict becomes public and subjected to frame polarization. It may not always be possible to do so, especially if the incumbent-challenger conflict is embedded in broader political polarization.

The second main theoretical contribution involves the theoretical assumption that an environmental framing of sustainability transitions is necessarily the best strategy in the public sphere. Although there is an assumption in the sustainability transitions literature that climate change and other environmental problems are widely recognized problems and therefore present a general and prima-facie case for support for transition policies, this view is not universally shared in the broader public sphere. With the rise of right-wing populism in many countries and its associations with opposition to climate-change and renewable-energy policies, environmental frames may become increasingly contested in some countries and subnational regions. Moreover, as this study indicates, opponents of sustainable energy transition policy develop counter-framing based on economic-consumer considerations such as the cost of the transition. For example, industry incumbents and their political allies in government deploy these frames in the public sphere to formulate the transition as an expensive or elitist policy and to raise populist support for transition stasis or roll-back policies.

In this situation, energy-transition coalitions face two options. They can continue to use the environmental frames and to reject the economic-consumer counterframing of opponents, thus engaging in a contest of frames. This strategy may be feasible where there is broad public and governmental support for environmental and sustainability policies, that is, where discursive and political opportunities remain open for energy-transition policy. But the analysis also shows, contrary to expectation, that even in these situations of relatively open opportunities (e.g., blue states) and controlling for time period, incumbents will tend to use economic-consumer frames more than environmental frames, and challengers also increase their use of economic-consumer frames as they are drawn into counterframing. This finding, which was different from the expectation, provides some insight into the extent to which the relationship between discursive strategy and opportunity structure may be non-intuitive.

In summary, this study encourages future research in the study of the politics of energy transitions to examine the connections between political polarization and populism, and in doing so it also encourages the research field to examine assumptions about how energy transitions are and should be justified in the public sphere. This study suggests the limitations of the assumption that even where political opportunities are more open to transitions, advocates of sustainability transition policies are safe to use environmental frames. Instead, they may be drawn into the web of arguments raised by incumbents in the public sphere, and the non-environmental frames may have particular resonance when connected with populist themes such as unfair cost burdens being shifted to non-solar customers. The long-term outcome of such visible disputes in the public sphere may involve compromise and a settlement. However, the experience across states in the U.S. suggests that the outcome may also involve ongoing conflict with a resulting patchwork pattern, where some locations move forward and others end up slowing or blocking transition policies. Although the focus is on the U.S., this pattern of variegated, uneven transitions across subnational governments, and by extension across national governments in a region, is readily apparent in other areas of the world (e.g., Germany and Poland). Thus, there is likely to be ongoing and general value in thinking through assumptions about political and discursive strategy with respect to variation in opportunity structures.

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