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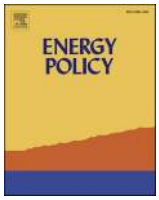

Controversy in wind energy construction projects: How social systems impact project performance

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ABSTRACT

The energy industry strives to address a number of challenges—satisfy increasing energy demands, fulfill renewable energy policy requirements, and update aging infrastructure. Complicating energy projects are the controversies they can stir among stakeholders, sparking disagreements about environmental, economic, and aesthetic outcomes. Conflicts such as protests, petitions, or lawsuits can lead to schedule delays and cost overruns, which are difficult for project sponsors to predict. Using literature and news media, this study aims to identify trends in project controversies across energy projects. The study uses a mixed deductive and inductive content analysis to determine which actions, project phases, and stakeholders are discussed most frequently within both academic literature and news media. Using code cooccurrences, the study evaluates which stakeholders take specific actions at different project phases. Results show that the most active opposing stakeholders to energy development projects are community members, and actions opposing a project most frequently occur in the proposal phase. These results highlight the importance of engaging with communities early in project lifecycles. Opposition typically includes dissemination of information within communities, including letters to editors, internet newsletters, and public meetings. From this analysis, policy recommendations are provided for energy project sponsors to better anticipate and mitigate conflict.

1. Introduction

The successful implementation of energy projects worldwide is critical to meet growing global energy demands, fulfill global policy commitments (e.g., UN Sustainable Development Goal 7; United Nations, 2015), and replace or update aging infrastructure. As reflected in international policy frameworks (e.g., Paris Climate Agreement and Sustainable Development Goal 7; United Nations, 2015), there is a global need for investment in clean, affordable, and efficient energy sources (McCollum, 2018). As the world's population grows and developing countries seek to expand their middle classes, demands for reliable and affordable energy are also increasing. On the other hand, developed countries need to update aging energy infrastructures to mitigate reliability issues (ASCE, 2021). Recent events have revealed a lack of resiliency in the energy sector. In 2021, Texans contended with electricity failures during Winter Storm Uri, which impacted human health and safety. Some Texans relying on medical equipment that required electricity had to seek emergency care during outages (Huff, 2021). In August of 2020, Californians endured a record-breaking heat wave that caused rolling blackouts throughout the state, putting people at risk for heat-stroke or other illnesses (Nguyen, 2020). Such failures further highlight the urgent need for reliable and resilient energy systems (Norton, 2021; Roth, 2020).

Despite energy investment needs and supportive policy directives in many countries, energy construction projects often generate controversy throughout their project lifecycle. In energy projects, controversy—a public dispute marked by strong opposing opinions—can take many forms. These can include virtual information campaigns (Simonelli, 2014), public demonstrations (SayanCaner, 2019), or lawsuits (Colvin et al., 2019), and may occur across multiple project phases. For instance,

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the Cape Wind Project, an off-shore wind energy project proposed in Nantucket Sound, Massachusetts, was opposed by various stakeholders including homeowners, tribal organizations, local officials, and fishermen who cited aesthetic, environmental, and economic concerns (Seelye, 2017). This controversy led to lawsuits, protests, and significant delays. When controversy does occur, energy projects often face cost overruns (i.e., increase in expenditures due to unforeseen circumstances; e.g., Love et al., 2014; Plebankiewicz, 2018; Subramani et al., 2014), schedule delays (i.e., deviation from the planned scheduled activities; Catalão et al., 2021; Hwang and Yang, 2014; Yap et al. 2021), or even project termination. Controversy's impacts can disrupt a project's normal progression, compromising the project and the energy system's ability to meet demand and undermining energy developers' operational performance.

Although controversy is common in construction projects, uncertainty exists around how the social system—defined here as the stakeholders involved with the project—interacts with energy projects (i.e., the engineering system or built environment), and how opposition from the social system can lead to negative project performance and outcomes. Most literature focuses on other infrastructure systems (e.g., transportation; Love et al., 2014) or internal conflict (e.g., design errors; Hegazy et al., 2011). Research on energy construction projects typically focuses on one case study (e.g., Awakul and Ogunlana, 2002; Garcia et al., 2016; Teschner and Holley, 2019), limiting generalizability across geographies and projects. There is a dearth of knowledge about the following: when a controversy is most likely to occur during a project, which stakeholders tend to be involved, and how project sponsors can most effectively engage with opposing stakeholders to minimize negative outcomes. Without understanding the factors that contribute to controversy, project sponsors (e.g., developers, governments) will be limited in their ability to anticipate and mitigate controversy due to epistemic uncertainty.

The successful and efficient construction of energy projects is critical to ultimately meeting long-term energy demands and policy goals. As such, this study seeks to understand large-scale trends in controversy from external stakeholders (e.g., community members, regulators, elected officials) during energy construction projects. The analysis process was twofold. First, the research team conducted a systematic literature review to characterize case studies present in the literature to understand broad trends in controversy across the global energy sector (e.g., wind, pipelines, mining). Specifically, the analysis identified the following: (1) types of opposing action, (2) reactions from project developers and supporters, (3) opposing stakeholders involved, and (4) project phases in which the controversy occurred. Henceforth, these four factors are referred to as controversy characteristics. Using the four emergent characteristics identified in the literature review, the research team conducted a news media analysis focused on wind energy projects globally. The search was narrowed to wind energy due to its increasing prioritization in both US domestic and global policy (The White House, 2021; United Nations, 2015). During this second stage of analysis, key themes between controversy characteristics were identified. For example, the research team identified the most common type of opposition for each stakeholder type in addition to the project phases associated with each stakeholder group and their opposing actions. If all energy project types had been included in this stage of analysis, these relationships would be complicated by the vastly different nature of projects (e.g., mining verses wind), bringing in too many interacting factors. Instead, by focusing on one type of energy project (i.e., wind energy), a clearer understanding of such relationships emerged. Results from both analyses allow for practical recommendations for energy project sponsors to anticipate and understand controversy, enabling decision makers to better respond to and mitigate controversy.

2. Literature review

Researchers have explored controversy in construction projects from many perspectives. Such approaches can be grouped into three major areas—conflict scope (e.g., internal or external stakeholders (Area 1), conflicts in different phases of a project lifecycle (Area 2), and the cause or effect of project controversy (Area 3). The literature has used various sectors to understand these trends in controversy in construction projects; a breakdown of these research areas by infrastructure type is shown in Table 1.

2.1. Internal conflict in construction projects (area 1)

Most studies tend to examine conflicts occurring within a construction project. These internal conflicts can encompass labor issues, supply chain logistics, and design errors (Hegazy et al., 2011; Hwang and Yang, 2014). Internal conflicts and resulting changes can occur due to errors in the initial design or decisions to make changes after construction has commenced, perhaps due to the emergence of new technologies over the course of a long construction duration (Saad et al., 2021). Many studies argue for increased collaboration among designers and builders to improve project performance, often citing integrated project delivery (IPD) as an essential tool (Ling, 2020; Raouf and Al-Ghamdi, 2019; Sepasgozar et al., 2019). Internal conflict is widely studied in construction management because most of these challenges and solutions are within construction managers' control. Issues such as design errors have clear (albeit not always simple) solutions including more collaboration amongst designers or innovative technology for clash detection. What these studies of internal conflict do not address are the external stakeholders who often impact construction projects. The construction industry has yet to cultivate a deep understanding of social systems and how they interact with construction projects. Building a greater understanding of social systems by investigating external controversies could lead to more successful projects.

2.2. Controversy during the construction phase (area 2)

The literature on construction project controversy most often centers on issues arising in the construction phase of a project—when the works are being implemented (e.g., Hwang and Yang, 2014; Mahato et al., 2011). These studies focus on internal conflict that causes work to stop or slow down while already in progress. Sometimes, components may already be complete and require significant time and money to disassemble and replace. By focusing on the construction phase, these studies are able to observe the causes of construction delays and the impacts on both costs and schedule (e.g., Hegazy et al., 2011; Yap et al. 2021). However, these studies are confined to construction activities and do not consider much of the prior design work or later operations. Naturally, factors that contribute to project delays and overruns are not limited to this phase but are present throughout all phases, from proposal to operation.

2.3. Assessing the impact of controversy on project success (area 3)

Much of the research concerning construction conflicts focuses on conflict outcomes. Some researchers (e.g., Teschner and Holley, 2019) examine the cost implications of project conflicts, while others (e.g., Hegazy et al., 2011) study the impact of conflicts on construction project schedules. These studies strive to quantify the consequences by building models to show past project consequences or projections to improve future schedule and budget planning (Hwang and Yang, 2014; Park, 2021; Yap et al. 2021). Such studies often provide solutions for overcoming setbacks on a project and implementing changes to move forward after issues have occurred. While these studies are useful in understanding the outcomes of project conflicts, they shed little light on components that contribute to controversy in many projects (e.g., stakeholders, type of opposition).

Table 1
Major focus areas of existing controversy literature.

	Area 1		Area 2		Area 3	
	Internal Conflict	External Conflict	Construction Phase	Project Lifecycle	Conflict Causes	Project Outcomes
Transportation						
Love et al. *(2014)*	X		X			X
Park (2021)	X		X			X
Commercial Building						
Subramani et al. *(2014)*	X		X		X	
Plebankiewicz (2018)	X		X			X
Mining						
Boutilier and Thomson (2014)		X	X		X	
Teschner and Holley (2019)		X		X		X
Multiple Types						
Yap et al. 2021	X		X		X	
Ling, 2020	X			X		X
Hwang and Yang (2014)	X		X			X
Olander and Landin (2005)	X	X		X		X
Energy						
Sovacool et al. *(2014)*	X			X		X
Mahato et al., 2011	X		X		X	X
This Study		**X**		**X**	**X**	

2.4. Gap in literature: research on controversy in energy construction projects

Many studies on construction controversy focus on projects outside the energy sector, such as healthcare, mining, and transportation (see Table 1). In fact, the transportation sector makes up a large portion of these studies (e.g., Anastasopoulos et al., 2012; Park 2021)—likely due to project data being more accessible, allowing for large modeling and statistical studies. Using large data sets, researchers have found that schedule delays and cost overruns are impacted by project size (Love et al., 2014). While these transportation studies provide an understanding of some project risks, they are limited in their applicability to other industry sectors. To analyze conflicts, risk, and consequences, researchers often utilize construction project case studies. Teschner and Holley (2019), for example, studied social conflict between a mining company and the surrounding community. Saad et al. (2021) used a system dynamics approach to predict the effect of design changes on project results in healthcare construction. Additionally, some of the literature focuses on the mining industry and the implications associated with conflicts linked with such projects (Boutilier and Thomson, 2014; Teschner and Holley, 2019).

Studies on schedule and cost delays in energy construction projects, while less prevalent, often center around a case study of one or two projects (e.g., Conway and Duguay, 2019; Groves et al., 2013; Simonelli, 2014). Mahato et al. (2011) used a sample case study of a hydropower construction project to develop a simulation model for the project's conflicts and outcomes, providing details for future projects to reference. Although these case studies provide insights about many of the project components, conclusions from single case studies often cannot be easily extrapolated to other energy projects. Some studies, though, use a large number of projects to evaluate broad trends across the energy sector, often focusing on one geographic region (e.g., Turkey; Sayan 2019) or one type of energy project (e.g., power plants; Sovacool et al., 2014). While researchers have studied controversies surrounding nuclear power (e.g., Jasanoff and Kim, 2009; Diaz-Maurin and Kovacic, 2015), these studies generally explore public perceptions of the nuclear power sector as a whole, rather than specific projects. Other energy-focused studies explore innovative project-delivery methods (al Subaih, 2015) or alternative risk assessments (Naderpajouh et al., 2014) to further develop the energy construction industry.

This study uses the lessons learned from past or ongoing energy construction projects described in the literature. Instead of focusing on one project (as is typical), it evaluates many projects to learn about the diverse challenges and solutions surrounding controversy in energy projects and understand broader trends to generalize findings. The current study diverges from past research to focus on external controversies surrounding energy infrastructure projects that involve social and regulatory system stakeholders. Such an approach allows for an understanding of the characteristics and consequences of controversy that can impact a project throughout its lifecycle.

3. Methods

3.1. Literature and media data collection

The research team performed a content analysis (i.e., systematically classifying qualitative content based on categories; Berger, 2005), first using academic literature and then news media to understand controversy in energy development projects. Through the use of broad search terms (see Fig. 1a), the Web of Science database yielded numerous project case studies from the literature ("Web of Science" 2021). The results included controversy amongst external stakeholders on energy infrastructure construction projects, including biomass, hydropower, wind, and fossil fuels. Geographic location was not restricted in the search, yielding a worldwide sample. A key component of this selection process was searching for case studies that included details about motivations for conflicts, stakeholders involved, actions taken by stakeholders, and specific consequences of those actions (e.g., schedule delays and cost overruns). While many studies discuss project controversy and impacts broadly, often analyzing mitigation tactics, fewer studies provide specific details about the cause and effect of controversy in a given project case study. Through the process shown in Fig. 1a, the selection was systematically reduced from 8326 articles to 11 articles (further indicating the dearth of knowledge in this space). The excluded articles consisted mostly of broad studies of multiple projects, studies of conflicts without any detail on individual projects, or projects that were not energy-related.

The Nexis Uni database provided news articles concerning controversial wind energy development projects globally (LexisNexis, 2020). The media analysis allowed for an understanding of the discourse and reflection upon how society engages with this subject. Researchers have noted that content analysis of mass media is "an indirect way of making inferences about people" (Berger, 2005). Capturing discourse that occurs in the media enabled the researchers to better understand

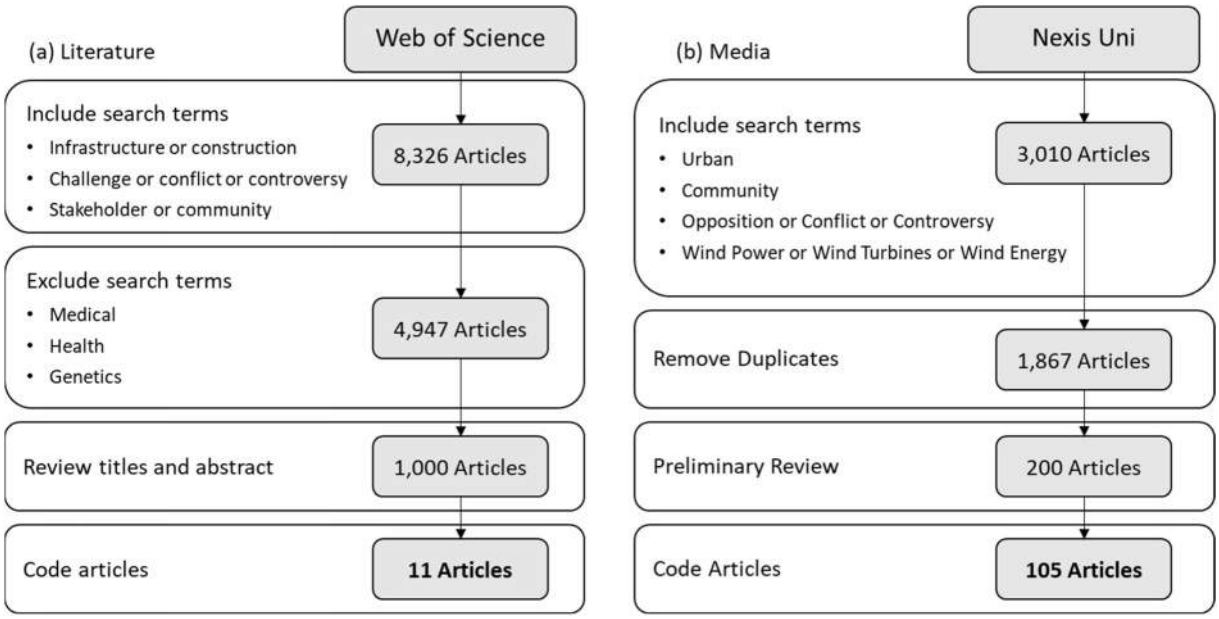

Fig. 1. Literature and media search processes.

stakeholder perspectives. Fig. 1b summarizes the media search process. The initial media article selection included a broad search of specific keywords related to controversy in wind energy projects. After eliminating duplicate and off-topic articles from the initial search, the selection was narrowed from 3010 to 105 relevant news articles representing a range of wind projects, geographic locations, and controversies. Excluded articles included a broad range of sources. For instance, some government budget documents only included wind energy as a line item, without any context for further analysis. Large news reports included discussions of wind energy in one section, but without any conflict referenced until a later, unrelated topic. Articles included in the media analysis included specific wind energy projects, with some detail regarding conflicts, stakeholders, or consequences.

3.2. Qualitative content analysis

Using NVivo Data Analysis Software (QSR International Pty Ltd, 2020), the research team conducted a hybrid deductive and inductive content analysis (Saldaña, 2013; Spearing et al., 2022) of academic literature first, followed by media articles. Fig. 2 illustrates the coding framework applied. First, deductive coding (i.e., when a coding scheme is determined prior to analysis; Casello, 2015; Krippendorff, 1989) was performed on the literature using a framework seeking the (1) rationale, (2) action, and (3) context describing the conflicts (see Table 2 for category definitions). This deductive framework was codesigned by eight academics and subject matter experts working in an international energy organization. An inductive coding process was performed next, allowing further sub-codes to emerge that described the details of the controversies which constituted the core of the coding dictionary (Saldaña, 2013). These inductive sub-codes included specific stakeholder groups (e.g., community members or local council), oppositions/-reactions (e.g., legal action or community outreach), and the project phases in which the controversy occurred, amongst other themes or project characteristics that emerged in the data. Table 2 contains the definitions of all deductive and inductive codes, with examples. Upon confirming the coding framework for the academic literature, a similar process was followed to code the media articles. Beginning with the academic literature enabled a better understanding of expected conflict in the media and allowed for a more efficient coding process at this stage. Finally, code cooccurrence matrices were used to identify overlap between codes within each article (Guest et al., 2014; Ryan, 1999; Saldaña, 2013). Identifying cooccurrences allowed for a greater understanding of the context in which conflict occurs. For instance, in a comparison of stakeholders and project phases, it was clear that community members were coded most often during the proposal phase.

When coding documents, the unit of analysis used was a paragraph, and these units could be coded to more than one category (i.e., simultaneous coding; Saldaña, 2013). To assess reliability, the Mezzich's Kappa was calculated for codes using 13 data sources—two journal articles and 11 media articles (i.e., 10% of the dataset). The kappa value was over 0.6, which for qualitative research is considered satisfactory (Burla et al., 2008; Everitt, 1996).

3.3. Limitations

As with any study, this one is not without limitations. Because part of the analysis uses media data as a source, controversy that occurred through media (e.g., newspaper opinion pieces) may be overrepresented in the results, while other arenas (i.e., locations an action takes place; e.g., social media, protests) may be underrepresented. Additionally, media can be biased. Media outlets may choose to present the views of specific stakeholders (e.g., residents) over those of other stakeholders (e.g., project developers) or vice versa, and the level of attention given to certain controversies and involved stakeholders may not reflect their true significance as measured by project impact. However, as other researchers have shown, insightful conclusions using media data can be made (Bohensky and Leitch, 2014; Osman and Faust, 2021; Spearing et al., 2021). In fact, media provides unique insight about social systems that cannot easily be inferred from other data sources (e.g., project reports).

It is also important to note that the projects observed in this study are, as shown in Tables S1 and S2 in the Supplemental Material, skewed toward English-speaking countries. While the literature includes a more diverse range of geographic locations, it is challenging to find English media sources regarding projects in countries where English is not the primary language. Performing qualitative content analysis in multiple languages presents a number of challenges and requires highly accurate translations (Squires, 2009). For these reasons, this study focuses exclusively on English language articles, while acknowledging the potential for future contributions of analyses that consider additional languages. Further, while the academic literature includes energy technology broadly, the scope for the media data is bounded to wind

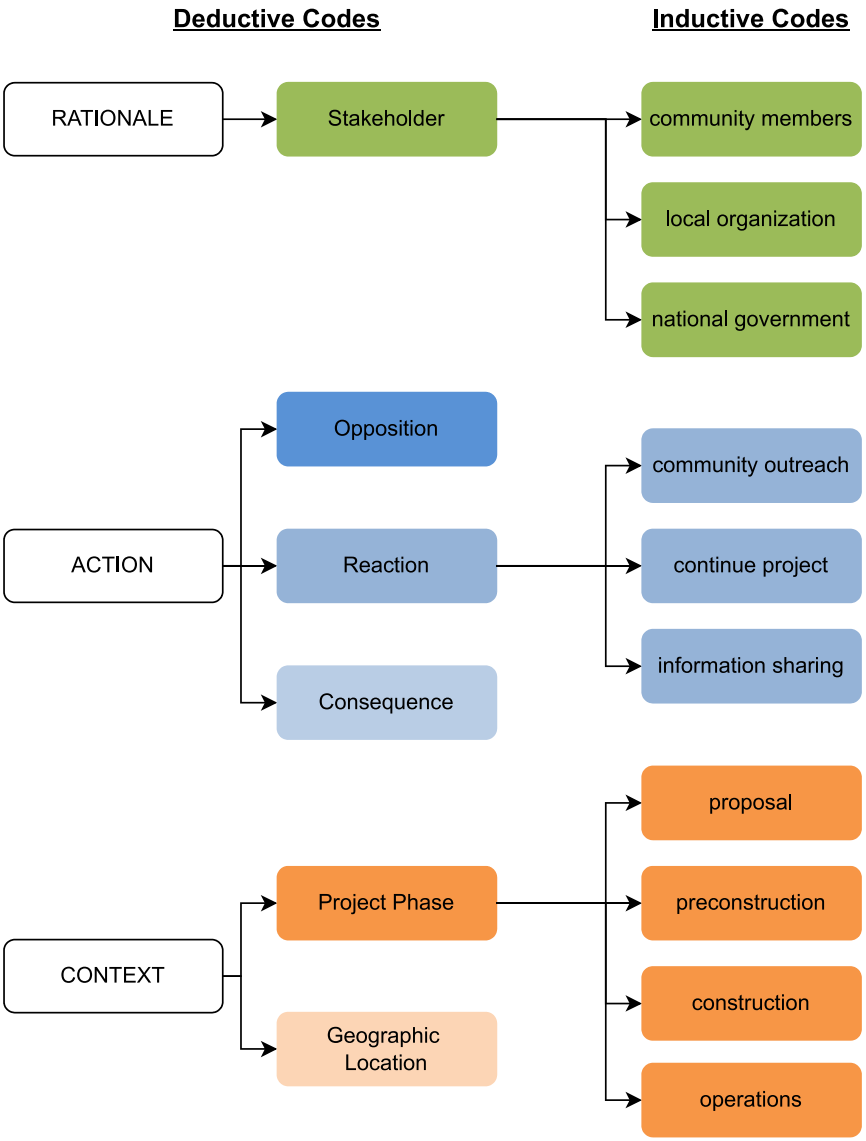

Fig. 2. Hybrid deductive-inductive coding framework. Deductive codes are shown to the left. A subset of the inductive codes—which emerged in the data through the analysis—are shown to the right.

energy. The results from the media analysis are not directly transferrable to other types of energy projects (e.g., pipeline construction) because of contextual differences (e.g., wind energy projects are geographically isolated whereas pipeline projects often span multiple jurisdictional boundaries, crossing through numerous communities and even countries). However, results can used to inform future studies investigating other types of energy projects or more quantitative applications such the development of models to assess the impacts of controversies and various interventions. Bounding the scope to wind energy was an important research design decision to ensure that interacting factors could be identified, and not overshadowed by differences between energy types. For instance, stakeholder concerns over perceived potential impacts of a given energy project—which in turn impact the stakeholders involved—can vary based on the energy type (e.g., contamination concerns with nuclear projects versus noise pollution concerns with wind projects). Despite this, insightful conclusions can be made about controversy in wind energy projects and can be used as a foundation for future media analyses about controversy in energy projects. For instance, researchers may use data scraping or natural language processing to analyze media on energy projects broadly, as the sample size would be too large for this initial analysis.

4. Results & discussion

First, literature data were leveraged to understand the emergent controversy characteristics across all project types. The analysis results were divided by renewable and non-renewable energy projects to allow for comparison. Next, media data about only wind energy projects were studied, using the four controversy characteristics revealed in the literature as a starting point (i.e., the literature informed the media analysis).

4.1. Emergent controversy characteristics in literature

Table 2 summarizes the coded controversy characteristics. While there are many characteristics included in the coding, to answer the questions of who, what, and when, the focus is on the following four key characteristics: (1) oppositions, (2) reactions, (3) stakeholders, and (4)

Table 2
Coding dictionary.

Code	Definition	Example
RATIONALE	Stakeholders involved and reason behind controversy	
Stakeholder	People or organizations involved in the project controversy	"Many residents expressed their concerns about the siting of the project on Ridge Hill with respect to noise, visual impact and wildlife" (Kulp, 2010).
Community Members	Residents of the local community impacted by the project	"Nearby Montgomery Place residents voiced strong opposition to the project" (Postmedia Breaking News, 2015).
Local Organization	Organized group at the community level	"The group Water Wells First has fought for two years against a wind farm" (Shreve, 2018).
Local Council, Government	Political leaders or entity acting at the municipal or county level	"Bluewater council has thrown its support behind a proposed boundary for wind developments" (Forrest, 2011).
State, Provincial Government	Political leaders or entity acting at the state or provincial level	"The State Government refuses any variations to the wind farm and Trust Power walks away from the project" (Garvis, 2009).
National Government	Political leaders or entity acting at the National or Federal level	"Norway's petroleum and energy ministry has placed an ambitious 2 billion NOK offshore wind power investment plan on hold" (Utility Week, 2008).
National Organization	Organized group at the national level	"The Sierra Club opposed the cable that would cross the Hudson" (Wald, 2010).
Private Corporation	For-profit company	"Trustpower reveals it has put the project on hold indefinitely" (Garvis, 2009).
Other	Unspecified opposers; indigenous groups; researchers	"Critics fought hard to stop Sunrise Powerlink from getting built" (Roth, 2020).
ACTION	**Efforts taken by stakeholders involved in controversy**	
Opposition	Action taken by those who are trying to stop or change the project	"The Sierra Club, however, has filed a lawsuit against Kern County over its approval of the North Sky River and Jawbone projects" (Burger, 2011).
Activism	Action directed towards the developer or decision-maker (e.g., protests, collecting signatures, writing letters to decision-makers)	"A few hundred protesters gathered prior to the April 28 vote, under the banner of anti-turbine lobbyists" (Slater, 2010).
Information Sharing	Spreading news and educating the community about the project (e.g., writing letters to the editor, speaking at public meetings, sharing flyers)	"The motion arose after the Molonglo Landscape Guardians … gave a presentation to the last meeting" (Filor, 2005).
Legal, Governmental Action	Action taken through the legal or regulatory systems (e.g., lawsuits, environmental regulations)	"… who have filed a small blizzard of appeals and lawsuits to slow or stop development projects" (Durbin, 2001).
Other	Opposition that is vague or non-specific	"There has been spotty opposition from area residents who see wind turbines as a threat to their way of life" (Burger, 2011).
Reaction	Action taken by the entity trying to implement the project, as a reaction to an opposing action	"The company rented town hall and held a public meeting to present information about the company, about wind energy in general, and a few details about their vision" (Kulp, 2010).
Community Outreach	Engaging with the community in which the project is planned	"Clean Line will pay landowners the full market value for easements of land it builds on" (The Northern Star, 2016).
Continue Project	Ignore the opposition and continue plans for the project	"a Chicago-based company's wind farm was still imposed on one Southwestern Ontario community … even after it voted against wind turbines in a referendum" (Shreve, 2018).
Information Sharing	Spreading news and educating the community about the project	"Greenpeace has launched a 30 s television ad criticizing … Democrats for their opposition to a proposed wind power farm" (Hume, 2007)
Legal, Governmental Action	Lawsuits, regulations, etc.	"Broad Mountain Power LLC, which is trying to build two dozen windmills atop Broad Mountain in Packer Twp., files an appeal in Carbon County Court challenging recent zoning amendments" (Standard-Speaker., 2019).
Make Changes to Project	Change the project design or conduct research into possible changes	"Plans for a 40–80 turbine wind farm at Sellicks Hill announced but community opposition based on noise and visual impact caused the project to be scaled back to 20 turbines" (Garvis, 2009).
Withdraw, Terminate Project	Key stakeholders withdraw from project or it is terminated	"The turbines had been the subject of numerous complaints from bird advocates, but the shutdown was the company's own decision" (Subramaniam, 2020).
Consequence	Impact of controversy on the project	"there was a concerted opposition campaign that encouraged local people to fill in proforma objection forms … and the bid ultimately failed" (Flight International, 2019).
CONTEXT	**Time and place of controversy**	
Project Phase	Construction project phase in which the conflict takes place	"Parts of the community are already up in arms about the project … residents will fight the proposal" (Bolling, 2007).
Proposal	Phase in which design is not yet finalized	"Packer Twp. Supervisors … say they have signed petitions against a proposed wind farm atop Broad Mountain" (Standard-Speaker., 2019).
Preconstruction	Phase in which permitting is in progress	"A resident appeal saw the Victorian Civil and Administrative Tribunal also back the permit for a two-turbine farm" (Bolling, 2007).
Construction	Phase in which work is put in place	"They have already compacted the soil with their heavy machinery, they have destroyed the drip irrigation system and damaged the topsoil" (Ruiz-Marrero, 2012).
Operations	Phase in which project is operational	"The louder the wind turbine noise was, the more people reported being very or extremely annoyed" (

(*continued on next page*)

Table 2 (*continued*)

Code	Definition	Example
		Postmedia Breaking News, 2015).
Geographic Location	Country in which the project is planned/built	United States; Australia; Norway; UK

project phase. These provide the most valuable information for developers trying to mitigate controversy and, as shown below, yielded the most interesting trends, allowing for specific recommendations. Table 3 shows the frequencies at which each controversy characteristic was coded in the academic literature, divided between renewable and non-renewable energy projects.

As shown in Table 3, the emergent opposing actions found in the literature included activism (21%; e.g., public protests, community meetings), information sharing (27%; e.g., online newsletters, flyers, social media campaigns), and legal/governmental action (34%; e.g., lawsuits, legal appeals). Interestingly, legal/government action was the most frequently occurring opposition in literature. A potential reason for this high frequency is that in most cases, legal actions must be addressed by project sponsors. While developers might be able to ignore protests or online campaigns, they are often obligated to engage with legal challenges. Additionally, local councils and other regulatory bodies may be able to intervene when challenges are pursued via this channel. For instance, in 2013, the developers of the Saklıkent Hydropower Plant in Turkey requested to withdraw their permits from the local government after three years of court proceedings initiated by the opposing stakeholders (SayanCaner, 2019). This finding is also noteworthy considering the expensive nature of legal pursuits. These costs would likely be significant for stakeholders opposed to a project, creating a barrier for many groups. Because legal actions are commonplace, expensive, and typically require a direct response from the energy developer, developers should plan potential legal challenges into their budgets to avoid surprise cost overruns, while also seeking mitigation strategies to prevent costly challenges in the first place.

18% of the excerpts coded to opposition were grouped into the "other" code, which included focus groups, coalition building, and refusal to cooperate with inquiries. For instance, in Delaware and Otsego Counties in New York, landowners refused to allow surveyors on their properties to gather environmental data. The developers, seeking land easements for gas pipelines, were unable to move forward without the landowners' cooperation (Simonelli, 2014). Non-renewable energy projects included more references to activism and information sharing (26% and 33%, respectively) than renewable energy projects (17% and 22%, respectively), which is not surprising given that many activist groups support clean energy (e.g., Greenpeace, Earth Day Foundation). The South Wales Gas Pipeline confronted significant opposition due to concerns around the environmental impacts of such a project. One of the opposing communities, Milford Haven, was especially concerned about the potential harm of the pipeline because of a previous oil spill, the Sea Empress Disaster in 1996, in their waterway (Groves et al., 2013). Such conflicts are rooted in the *type* of energy project, revealing that controversy varies based on the type of resources used. Interestingly, renewable energy projects included more legal and other actions (36% and 24%, respectively) than non-renewable energy (31% and 10%, respectively). Perhaps one reason for a higher frequency of legal action for renewable energy projects is that the controversy is rarely only community members against a developer, as is more common in non-renewable energy projects. Renewable energy projects tend to be more complex when considering people's values. A wind farm can be positive from an environmental standpoint, as it reduces fossil fuel emissions; however, it can also pose environmental challenges as it requires a great amount of land and can impose on natural ecosystems. These challenging disagreements often necessitate legal arbitration to reach a final decision. For instance, the Pedras Negras wind farm proposed in Galicia, Spain, was debated by the regional government, with environmental groups, political parties, and local citizens on both sides of the battle (Upham, 2015).

Table 3
Frequency table showing number of excerpts represented by each code in literature sources, divided by renewable and non-renewable energy projects.

	Renewable Energy Projects		Non-Renewable Energy Projects		Total	
	Count	Rel Freq	Count	Rel Freq	Count	Rel Freq
Opposition						
Activism	10	17%	11	26%	21	21%
Information Sharing	13	22%	14	33%	27	27%
Legal, Governmental Action	21	36%	13	31%	34	34%
Other	14	24%	4	10%	18	18%
Reaction						
Community Outreach	8	19%	1	6%	9	15%
No Changes	10	23%	2	13%	12	20%
Information Sharing	2	5%	4	25%	6	10%
Legal, Governmental Action	10	23%	2	13%	12	20%
Design Changes	4	9%	4	25%	8	14%
Project Termination	9	21%	3	19%	12	20%
Stakeholder						
Community Members	34	33%	22	39%	56	35%
Local Organization	7	7%	9	16%	16	10%
Local Council, Government	16	16%	8	14%	24	15%
State, Provincial Government	2	2%	3	5%	5	3%
National Organization	1	1%	4	7%	5	3%
National Government	16	16%	3	5%	19	12%
Private Corporation	17	17%	6	11%	23	14%
Other	10	10%	2	4%	12	8%
Project Phases						
Proposal	45	85%	32	94%	77	89%
Preconstruction	0	0%	2	6%	2	2%
Construction	5	9%	0	0%	5	6%
Operation	3	6%	0	0%	3	3%

*Relative frequencies represent the percent out of the parent code (e.g., Reaction).

The top emergent reactions taken by energy project developers in the literature dataset included community outreach (15%), no changes (20%), information sharing (10%), legal/government action (20%), design changes (14%), and project termination (20%). For both renewable and non-renewable project types, project termination occurred at the highest frequency (21% for renewable, 19% for non-renewable). This finding is notable as it represents a loss in investment towards providing energy services to meet increasing demand. Because most actions occur at the proposal phase, this trend may reflect proposed projects that do not pass the permitting process. Interestingly, in response to opposition many project developers made no changes (20%), indicating that there may be a lack of collaboration and community involvement in projects. Such trends may have cascading impacts later in a project's lifecycle (e.g., protests during operations leading to early decommissioning). This finding shows the importance of continued research on techniques for constructive community engagement in energy projects (Firestone et al., 2018; Jami and Walsh, 2017). Another response to controversy included additional community outreach (19% for renewable, 6% for non-renewable). Although coded at a lower frequency, this is a sign that some project sponsors are striving for community engagement.

Reactions notably varied across energy project type. Actions taken by non-renewable energy project sponsors included information sharing and design changes (25% each) at higher frequencies than renewable energy projects (5% and 9%). This pattern likely reflects the type of opposing actions these projects experienced; non-renewable projects were more likely to be subject to activism and information sharing campaigns. Therefore, project developers would be more likely to respond with actions that directly target these concerns (e.g., increasing public awareness, publicizing changes or accommodations to design plans). For instance, the developers of a natural gas pipeline in New York were required to hold public meetings to share information about the proposed project in response to social media campaigns against the project (Simonelli, 2014). At these meetings, both the opposers and developers spoke to share their information and voice concerns.

The reactions that emerged from renewable energy projects were most often no changes and legal action (23% each) compared to non-renewable energy projects (13% each). Again, these reactions correspond to the opposing actions experienced by the project type. Renewable projects faced less opposition in the form of activism and information sharing, but a higher percentage of legal action, when compared to non-renewable projects. Therefore, renewable project developers are mostly likely (and required by law in many cases) to respond to such opposition through legal avenues.

In both project types, community members are discussed more frequently than any other stakeholder (33% for renewable, 39% for non-renewable). Community members are important, as they, more than anyone else, are likely to be impacted by the development through noise, visual, and other disturbances. Moreover, they are frequently the end users of the project itself. Some community members fear impacts on their local economy. For instance, in Clatsop County, Oregon, community members opposed the construction of a liquefied natural gas (LNG) facility, arguing that the project would damage the local tourism industry (Tran et al., 2019). This is a common thread throughout many of the community-opposed projects—a fear that a new energy project will damage local environments, impacting local tourism. Consideration of local communities can be a valuable component to mitigating consequences. Notably, the distribution of stakeholder types is similar across different types of renewable and non-renewable energy projects. Practically, this trend indicates that some controversy-management protocols might be transferred to various types of energy projects. For instance, templates and norms for community outreach for wind energy projects could be translated to other project types (e.g., pipelines).

In both renewable and non-renewable energy projects, most action occurred during projects' proposal phase (85% for renewable and 94% for non-renewable). As discussed in the literature review, most construction analysis literature focuses on the construction phase of projects. This emphasis on the construction phase is likely due to the level of control that project developers have at various stages of a project. In the construction phase, developers are able to focus on technical challenges and solutions (e.g., improved scheduling techniques, more accurate cost forecasting). Shifting attention to the proposal phase, however, would require a better understanding of social systems. While construction challenges are largely internal to a project, proposal phase challenges involve many external stakeholders. This discrepancy highlights a gap in the literature regarding proposal phase management techniques in energy projects and points to a need for further research into managing controversy during the project proposal phase.

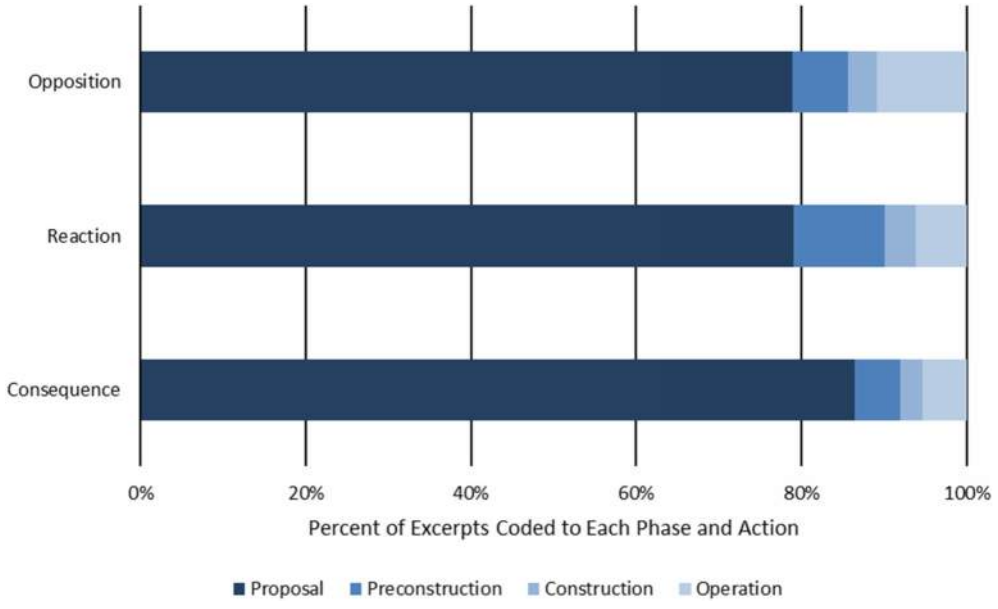

Fig. 3. Percentage of excerpts coded to opposition, reaction, and consequence according to project phase using media sources about wind energy projects.

4.2. Relationships between controversy characteristics—code cooccurrence in media

4.2.1. Project phases and actions

Using media data about wind energy projects, Fig. 3 shows that all actions, including oppositions, reactions, and consequences, occur most frequently during the proposal phase of a project. This high frequency is likely because the proposal phase represents the first time that outside stakeholders become aware of a project, often through information campaigns or public meetings. Opposition is likely prevalent here when stakeholders recognize the influence that they can have on the project. Controversy during the proposal phase can lead to design changes, as modifications at this stage are not nearly as costly as they are at subsequent stages (Yang and Wei, 2010). For instance, in Queanbeyan, Australia, community members opposed a new wind-project development, citing concerns over wildlife impacts and noise disturbances. Through council meetings where residents expressed their concerns, the developer agreed to site the turbines in a manner sensitive to these issues (Filor, 2005). Modifications at that early stage were more feasible than if the opposition had waited until construction began. During the proposal phase, the developers have yet to spend money on material fabrication, procurement, or construction. Therefore, reactions (actions taken by stakeholders supporting the project such as project developers) are most prevalent in the proposal phase as well. It is likely that project developers are more willing to listen to opposing stakeholders and implement changes that satisfy both parties before work has been put in place and large investments have been made.

It is noteworthy that in this analysis, news media is not simply a source of information but also a tool used in controversy. Stakeholders on both sides of a conflict can enlist media to share information from their point of view. This can lead to an excess of information in media, especially during a proposal phase when designs can still be influenced. Fig. 3 shows that consequences (e.g., schedule delays, cost overruns, project termination) are most prevalent in the proposal phase. One explanation is that media often reports on projects while they are ongoing, capturing changes as they occur. For example, a proposal phase opposing action could be information sharing, where community members hand out flyers to their neighbors regarding a new project. A proposal phase reaction could include making changes to a project, where developers decrease the number of turbines after receiving feedback from community members. A consequence in the construction phase could include schedule delays, cost overruns, or termination of a project.

4.2.2. Project phases and stakeholders

Fig. 4 displays the stakeholders involved throughout a wind project's lifecycle. In every phase of a project, community members are the most active stakeholder. Geographic constraints likely play a significant role in the stakeholder results due to the localized nature of both wind energy and media sources. Community members are often directly affected by energy development projects due to their proximity to the site and reliance on energy output. Residents living near wind project sites may be concerned about disruptions due to noise (Ki et al., 2022) or light (Pohl et al., 2021). For instance, in Myponga Beach, a community in South Australia, residents spoke out against a wind farm, fearing the health implications of living so close to the turbines (Garvis, 2009). Many also voiced concerns over visual disturbances and potentially adverse impacts on tourism (The Journal, 2003). Decreased tourism holds significant economic implications for local businesses. Community members also cited financial concerns over energy bills as the implementation of new energy sources can be costly at first (Graf, 2013). Also important to recognize are conflicts in the social system surrounding an energy project. When neighbors or friends have differing views on how energy development projects should be handled, distrust can interfere with relationships. In fact, residents of King Island, Australia claim that many lifelong relationships were severed due to disagreements during the proposal process of a wind energy farm (Colvin et al., 2019). Distrust can grow amongst community members, and the energy developer or political leaders can be viewed with suspicion.

Media sources likely focus on community members as the main stakeholder in these stories because they are their main audience and are most impacted by the project. Journalists engage with community members to collect information on their concerns about a project so that they can share relevant information in their writing. This engagement with community members should be mirrored by developers, recognizing that community members are impacted by their work. The strong presence of community members in the data set shows the importance of outreach strategies throughout the project's lifecycle. However, project sponsors especially need to integrate public outreach proactively before construction and operations phases (e.g., holding town halls or public meetings). Such recommendations are supported by other studies, which found that residents' perceptions of fairness of the planning process and involvement in early stages were the main predictors of whether or not they supported a wind project in their area (Ki et al., 2022; Pohl et al., 2021). Early and frequent engagement may therefore mitigate conflicts or disagreements before opposition grows and negatively impacts projects.

While the local government is most active during the proposal phase,

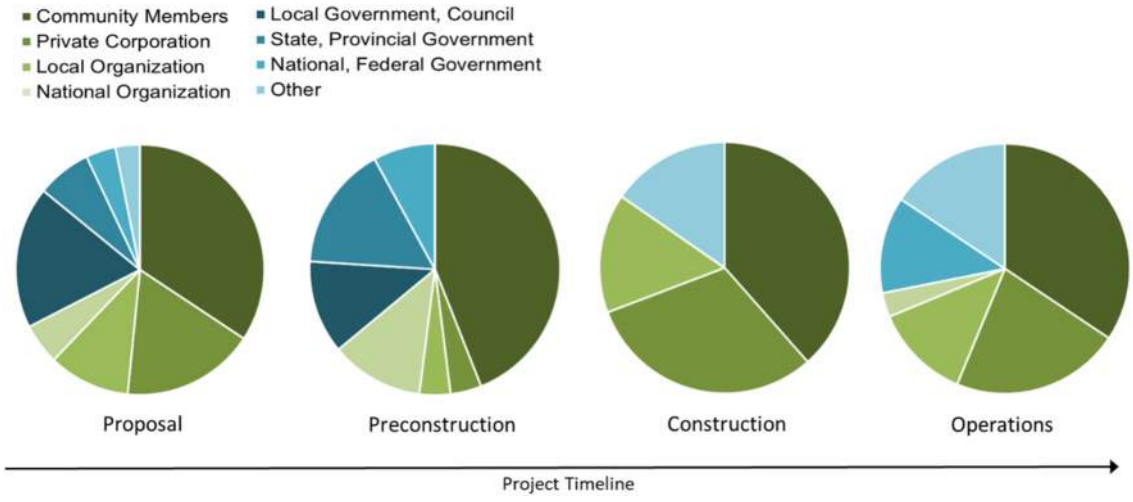

Fig. 4. Timeline showing stakeholders by project phase using media data about wind projects. The pie charts are based on the number of excerpts coded to each stakeholder in each phase.

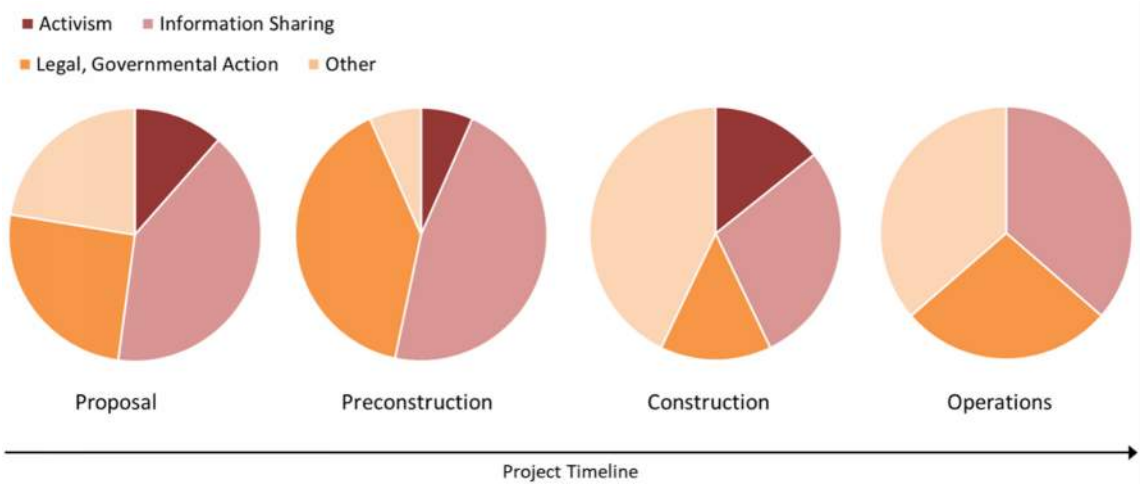

Fig. 5. Timeline showing opposing actions by project phase using media data about wind projects. The pie charts are based on the number of excerpts coded to each opposing action in each phase.

this involvement decreases over time and is entirely absent from the construction and operations phases (Fig. 4). Early in a project's timeline, a local government may have some power. During this time, the local government often engages with the community, ensuring political leaders consult with their constituents. However, local councils cede authority as a project begins. Once they issue permits and finalize a design, these local leaders surrender much of their influence. For instance, at the prompting of local community members, a Zurich council proposed a zoning boundary to limit the area in which wind development was permitted. Shortly after, there was pushback that claimed that council did not hold such authority (Forrest, 2011). Additionally, a wind farm in Port Elgin in Ontario, Canada, ran into controversy when the regulations allowing it were superseded by newer, stricter standards. Because the new regulations required the turbines to be sited farther away from residences, town council voted to ask the Ministry of the Environment to rescind its approval. While the local council did not have authority to stop the project, they attempted (unsuccessfully) to influence decision-makers in higher positions (Allick, 2011). Once the ministry confirmed the project, the town council could do nothing.

4.2.3. *Project phases and actions*

Fig. 5 shows the relative frequencies of opposing actions according to project phases. Information sharing, which includes the dissemination of relevant project information to project stakeholders, is the most prevalent form of opposition in the proposal and preconstruction phases. Information sharing can include the distribution of paper flyers, email newsletters, and social media campaigns. This high frequency is a logical trend, as the purpose of media is indeed information sharing. Media sources additionally have the advantage of sharing information in real-time, throughout a project's lifecycle.

Most wind projects are highly localized, affecting an immediate community but not often society beyond that. This may lead to a proliferation of local media reports. Recognizing the prevalence of information sharing, wind energy supporters can modify their methods of community outreach accordingly. First, project sponsors can help to ensure that the information being shared with communities is accurate. They can reach out to local media sources or communicate through social media channels. With a greater understanding of who is engaged with the information and where they are looking for information, sponsors can ensure their messaging is reaching the right people.

Information sharing was influential when a wind farm in the small UK village of Deeping Saint Nicholas faced opposition because residents were concerned with preserving the countryside. News articles detailed the story of a couple who hoped to raise awareness of potential health implications of living near turbines, claiming sleep deprivation from noise pollution. The couple also debated the issue on radio stations and created a DVD to share their story (Moss, 2007). The reported stories were intended to be emotional. Understanding these media stories and tactics can be helpful for project sponsors to develop their own strategies for conveying truthful information.

Legal action appears at the highest frequency during the preconstruction. This is likely due to the permitting and regulatory processes required in this phase. It appears that perhaps legal action often begins in the proposal phase, aided by other actions, and then increases when permitting and preconstruction begin. Wind energy developers can benefit from this knowledge by preparing for legal challenges early in a project lifecycle. Developers can additionally increase community outreach in the proposal phase, potentially warding off some of the opposition in subsequent phases. This would be especially advantageous due to the expensive nature of lawsuits, compared to other forms of action.

While activism is included at a lower frequency than other forms of opposition, it does increase notably from the preconstruction to construction phase. This shift can be explained by several contributing factors. While stopping a project is quite difficult once construction has commenced, the more extreme actions (e.g., on-site protests) are more suited to the construction phase because there is a physical location for a demonstration. There may also be information saturation once the proposal and preconstruction phases are finished, meaning community members have learned everything they wish to about the project.

4.2.4. *Stakeholders and actions*

Each stakeholder group participates in opposition in a unique manner. As expected, the three levels of government considered here—local, state, and national—engage in legal action most often (Fig. 6). Compared to other stakeholders, though, community members engage in legal action the least. This discrepancy may be due to barriers to entry to the legal system for an individual or even collective non-governmental groups, shown in the low frequency of legal action for local and national organizations as well. This divide between the social and legal systems may contribute to the proliferation of controversy in infrastructure development projects. In the UK village of Deeping Saint Nicholas, residents have tried to challenge a wind farm through legal routes. After spending over £5000 without any success, a resident explained that they shifted their focus to media outlets instead, claiming it would require at least £30,000 to reach higher courts (Moss, 2007). These extreme costs to pursue legal action make it far more difficult for

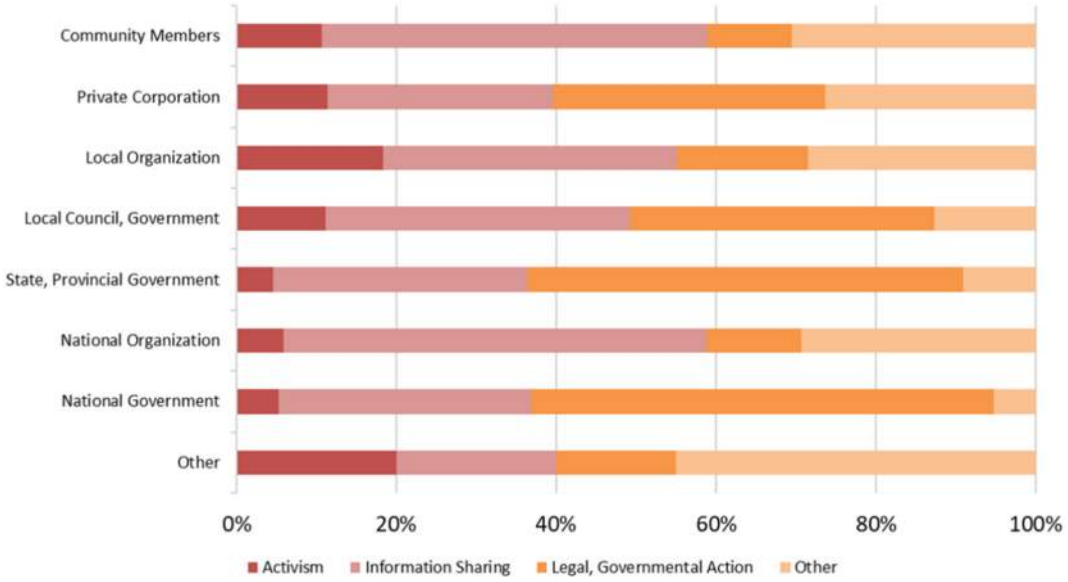

Fig. 6. Stakeholders involved in different types of opposition in wind projects, using media data.

community members to be impactful, especially those in rural areas. The rural community of Bald Hills, outside of Brisbane, Australia, raised $150,000 for a panel hearing on a windfarm that was planned for their area (Allott, 2004). In these cases, when legal action is unattainable for community members, they often turn to information sharing and activism, relying on relationships within the social system. Campaigns and activism require cooperation and communication amongst members of the social system. When a new wind energy project was proposed in a rural UK community, community members formed a campaign group to oppose it. They used existing community networks to disseminate flyers and objection letters to neighbors (Aitken, 2010).

5. Conclusions and policy implications

This study evaluated the characteristics and trends in controversy from external stakeholders during energy construction projects. A systematic literature review of energy projects of multiple types (e.g., wind, pipelines, mining) was conducted, using case studies present in literature to understand broad trends in controversy across energy projects. The following controversy characteristics were identified in the literature: (1) types of opposition, (2) reactions from project developers and supporters, (3) stakeholders involved, and (4) project phase in which controversy occurs. External stakeholders tended to engage in three types of opposition—activism, information sharing, and legal action. The reactions by project sponsors most often included ignoring the opposition or making changes to the project. Additionally, the stakeholders that are most active in taking opposing actions were community members, likely because they are most personally affected by energy development projects. Most of these actions took place early in a project's lifecycle—the proposal phase—indicating that early action is critical to mitigating the effects of controversy.

Using literature data as a basis, a mixed deductive and inductive content analysis was performed on news media focused on wind energy projects globally. Code cooccurrences revealed more specific trends between controversy characteristics within wind energy projects. Understanding when and how specific stakeholder groups oppose a project enables project sponsors to better predict, plan for, and respond to controversy. The analysis showed that both oppositions and reactions occur most frequently during the proposal phase of a project. While information sharing was used consistently, it decreased over time as activism increased.

These results highlight several takeaways for project sponsors and policymakers to consider when assessing controversy around energy projects. Given that community members were the most frequently involved stakeholder throughout all project phases, and in alignment with community engagement literature (e.g., Boyle et al., 2022), this study's central recommendation is for early, structured, and transparent community engagement. For their part, policymakers and local officials seeking to protect and satisfy constituents, while also bringing new development to their area, should mandate transparent community engagement from project sponsors. Local media sources in particular should be utilized to share truthful information about projects, potential benefits, and engagement opportunities. Additional key recommendations for project sponsors include the following: dissemination of thorough, accurate information about the project via project websites and printed materials; frequent and accessible public meetings to engage with community members; and partnerships with community members to modify project plans, when feasible, to accommodate community concerns. While these conclusions are based specifically on wind projects, these recommendations will benefit policymakers and project sponsors promoting other types of renewable energy projects, as we would expect similarities between this classification of projects. These practical recommendations will allow energy project sponsors to better anticipate and understand controversy, and thus, more effectively respond to and address stakeholder concerns.

CRediT authorship contribution statement

Michaela LaPatin: Data curation, Formal analysis, Conceptualization, Writing – original draft, Writing – review & editing. **Lauryn A. Spearing:** Conceptualization, Validation, Writing – original draft, Writing – review & editing. **Helena R. Tiedmann:** Conceptualization, Validation, Writing – original draft, Writing – review & editing. **Miriam Hacker:** Conceptualization, Writing – review & editing. **Olga Kavvada:** Conceptualization, Writing – review & editing. **Jean Daniélou:** Conceptualization, Writing – review & editing. **Kasey M. Faust:** Supervision, Conceptualization, Validation, Writing – review & editing.

Declaration of competing interest

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

Data availability

Data will be made available on request.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.enpol.2023.113507.

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