Wabash CarbonSAFE

Subtask 4.1 - Application of Policy Frameworks for Improved Carbon Capture and Storage Social Site Characterization & Stakeholder Engagement

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Amelia Brumbaugh and John A. Rupp

O'Neill School of Public and Environmental Affairs, Indiana University, 1315 E. Tenth Street, Bloomington, IN 47405

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Principal Investigator: Mr. Christopher Korose
Business Contact: Illinois State Geological Survey
615 E. Peabody Drive
Champaign, IL 61820-7406

EXECUTIVE SUMMARY

Anthropogenic climate change threatens environmental and human health globally. Limiting these threats requires large-scale and innovative greenhouse gas mitigation responses across carbon-intensive energy and industrial sectors. Carbon capture and storage (CCS) technologies present potential opportunities for mitigating climate change while maintaining a diverse energy resource portfolio. Successful development of CCS physical sites requires effective and efficient project management solutions that elicit and incorporate the concerns and perspectives of diverse stakeholders. Due to the urgency of climate change mitigation technology implementation and the costs of CCS development, CCS project developers cannot risk setbacks by poor stakeholder assessment that concern management processes. Thus, this report presents four prominent policy frameworks and associated case studies as opportunities to improve CCS social site characterization and stakeholder engagement. After comparing the relative effectiveness and efficiencies of each framework with regard to CCS, this report concludes that the Advocacy Coalition Framework, Narrative Policy Framework, and Policy Conflict Framework can improve the CCS social site characterization process, while the Collaborative Governance Framework paired with the Q-Methodology provides an ideal framework for direct stakeholder engagement. Overall, this report finds that the Narrative Policy Framework and the Collaborative Governance Framework are most ideally suited for the purposes of CCS social site characterization and stakeholder engagement.

I. INTRODUCTION

Growing threats of anthropogenic climate change have instigated wide-ranging efforts for greenhouse gas mitigation across the globe (IPCC, 2018). Carbon capture and storage (CCS) technologies – which broadly involve the direct capture, transportation, and storage of carbon dioxide (CO_2) emissions from point sources – present potential opportunities for climate change mitigation (Leung et al., 2014). Because the beliefs, values, and actions of relevant stakeholder coalitions have considerable influence on the success of energy-related projects globally (Wüstenhagen et al., 2007; Perlaviciute & Steg, 2014; Upham et al., 2015), siting of projects that use geological reservoirs for CO_2 storage requires social site characterization and stakeholder analysis efforts alongside traditional technical characterization surveys (Wade & Greenberg, 2011). The characterization of diverse and often intangible values of numerous stakeholder groups is complex, necessitating the use of theoretical "policy frameworks" to organize and apply various methods to assess and analyze stakeholder concerns and elicit their perspectives.

Information gained from such social characterization is vital for adequately informing the developers, regulators, and the public about the risks and benefits associated with complex energy projects. Information from policy framework analysis can be utilized by those who wish to promote agendas that aim to enhance technical understanding, change opinions, utilize stakeholder input to improve decision making, and build coalitions either in support of or opposition to a given project. Additionally, assessment of risk perception and benefit-cost analysis of projects can be enhanced by incorporating evaluations of stakeholder concerns using policy framework analysis. The overall purpose of this investigation is to explore the suite of relevant theoretical social frameworks and related case studies, comparing and contrasting their potential applicability for evaluating the social context in which carbon capture and storage projects are developed.

The large-scale application of CCS and other climate change mitigation strategies to meet CO_2 reduction goals not only relies on technological advancements; energy project feasibility also depends heavily on public perception of new technologies in impacted communities. Research regarding CCS public perception indicates that this emerging technology is largely unknown and misunderstood by the majority of citizens in the U.S. and abroad. As such, the ultimate perception of CCS by a significant section of the public is largely decided according to the messaging and sociopolitical context that an individual is exposed to relative to their understanding of technology and the practice of CCS (L'Orange Seigo et al., 2014). In addition to the modes of communication used to engage with the public, perceptions of trust between parties and procedural fairness in project development are cited indicators of public acceptance for CCS deployment (Huijts et al., 2007; Gough et al., 2002; Terwel et al., 2012; Tokushige et al., 2007; Wallquist et al., 2012). Additionally, negative public perception of CCS often relates to perceived tradeoffs between investment in CCS development versus advancement in renewable energy technologies (L'Orange Seigo et al., 2014).

The benefits, costs, and complexity of implementing project-specific stakeholder engagement are cited widely in project management literature. Failure to adequately elicit and address stakeholder concerns and perspectives may result in delayed project timelines, cost overruns, and general project inefficiencies (Olander & Landin, 2005). The potential costs associated with project delay or failure are amplified when projects involve public-private partnerships, entail significant investments, and cover wide geographic areas (El-Gohary et al., 2006; Mok et al., 2015). Beyond the fiscal implications of stakeholder engagement initiatives, project developers have an ethical obligation to inform stakeholders and consider their input; these ethical implications are particularly fundamental when projects entail significant risk to individuals, communities, or the planet (Benn et al., 2009). Risk perception varies and depends on individual core beliefs, values, and experiences (Beecher et al., 2005), meaning that merely publishing facts about the risks and benefits of a particular project will do little to manage the varying

perceptions of stakeholders. Thus, because CCS projects are large-scale, involve diverse stakeholders through public-private partnerships, and have substantial environmental risk implications, thoroughly informing stakeholders, eliciting nuanced perspectives, and assuring stakeholders of a project's value is essential for project success.

Managing technical projects in the context of community-specific social, political, and economic circumstances requires complex, dynamic research that balances qualitative and quantitative analytical methods. In order to assess factors influencing CCS development success across the globe, Ashworth et al. (2012) introduced a comparative analysis of the non-technical aspects of existing CCS projects. Key factors impacting the success of these projects were identified, which included the following characteristics: alignment of government and project team members; identification and attention to social context; involvement of communication efforts early in project development; and extent of flexibility and adaptability in project plans. Thus, strategies for optimizing communication subject matter and mechanisms for public engagement have substantial implications for CCS project success. However, determining social context and ideal modes of communication require the collection of qualitative data – such as local community ties, trust, media influence, and fundamental views – which are difficult to collect and quantify (Ashworth et al., 2011).

Consistent with Ashworth et al. (2012), the National Energy Technology Laboratory's (NETL) Best Practice Manual for Outreach and Education for Geological Storage Projects emphasizes the importance of engaging with stakeholders early in project timelines (NETL, 2017). Creating an atmosphere of public trust, communication, and equity encourages stakeholders to engage in meaningful ways that can aid in project development and improve chances for project success. Examples of key best practices include establishment of a strong outreach team, initiation of social site characterization, outreach program organization, and development of key messages and materials tailored to specific audiences. The aforementioned stakeholder engagement best practices manual presented by NETL provides guidelines for critical steps toward stakeholder engagement. However, determining what constitutes a 'strong outreach team' or an optimal messaging and outreach strategy is very subjective. The subjective nature of these challenges begs the following question: how can researchers determine the narratives, outreach program organization structure, outreach teams, and other engagement mechanisms best suited to elicit concerns and perspectives of CCS stakeholder groups?

The design and implementation of an effective stakeholder engagement program is of particular importance to the Wabash CarbonSAFE Feasibility project, a multisector collaboration to develop a commercial-scale geological CO_2 storage complex near Terre Haute, Indiana. Here, project participants have completed initial social site characterization of the proposed storage complex area. Stakeholder identification in this region revealed a range of possible local, state, and national interest groups ranging from government, community groups, environmental organizations, industry, utilities, educational institutions, and media outlets (Greenberg et al., 2019). Effective stakeholder analysis and engagement is essential for the success of this emerging opportunity for CCS demonstration in the Midwest of the United States.

However, more research is needed to adequately characterize the core beliefs and fundamental principles of relevant stakeholders, as well as identify optimal outreach teams, mechanisms for engagement, and key messages and materials tailored to certain stakeholder values. Application of various analytical approaches in the social sciences, collectively termed "policy frameworks" – are tools which broadly provide a structure to evaluate policy issues, opportunities to compare research findings across projects, and often suggest specific methodologies to assess social phenomena – could provide CCS project developers with theoretically-grounded methods for enhancing efforts to elicit stakeholder concerns and perspectives (Sabatier & Weible, 2014).

The following section of this report expands upon the definition and purpose of several policy frameworks that could be applied to assessing stakeholder interests in a given project. The scope of individual CCS projects involves the beliefs and interactions of stakeholders at the coalition-level; thus, the most relevant policy frameworks identified in this report focus the scope of research on individual stakeholders that ultimately construct stakeholder coalitions. The Advocacy Coalition Framework (ACF) is presented first due to its foundational value relative to the other frameworks evaluated, including the Narrative Policy Framework (NPF), Collaborative Governance Framework (CGF), and Policy Conflict Framework (PCF). The Institutional Analysis and Development Framework (IAD), as well as the associated Social-Ecological Systems Framework (SES), are also prominent policy frameworks; however, the scope of these frameworks is beyond the coalition or "sub-system" level needed for individual CCS project development applications (Sabatier & Weible, 2014; Ostrom, 2008). Thus, the overall purpose and application of the IAD and the SES is outlined generally, but the analysis section of this report will omit these two frameworks.

First, this report introduces the purpose of frameworks and presents an overview of the ACF, NPF, CGF, PCF, and AID/SES (Part II). Next, salient case studies relevant to CCS social site characterization and stakeholder engagement are analyzed (Part III). Each case study analysis includes the following sections: a case study overview, methodologies, conclusions, and pertinence to CCS stakeholder analysis and social site characterization. After an evaluation of each framework and associated case studies, the overall applicability, strengths, and weaknesses of each framework and case study regarding CCS will be compared and contrasted in a comparative analysis (Part IV). Although there are often many relevant case studies in academic literature for the policy frameworks presented, this report provides only a sample of case studies that provided noteworthy methodologies and are uniquely relevant to CCS project stakeholder analysis. Finally, this report concludes with a discussion (Part V) and a brief conclusion (Part VI) that will note the effectiveness and efficiencies of each framework and highlight frameworks that are particularly valuable for CCS.

II. DEFINING A POLICY FRAMEWORK

Before delving into policy frameworks and methodologies relevant to carbon capture and storage stakeholder engagement, it is first essential to define and present the core purpose of a given framework. Addressing the complexity of social systems and providing a means for cross-study comparison requires the use of paradigms that are narrow enough to frame the issues, actors, trends, and variables pertinent to particular situations; yet these paradigms must be of broad enough scope and contain enough flexibility for application across a wide range of situations and research objectives. Specificity of assumptions and methodologies range widely between different frameworks, but each can be aptly characterized under the general concept of a policy theory as described by Sabatier & Weible (2014).

Though no consensus has been reached regarding a specific definition of a "theory" in policy process research, according to Ostrom (2011), the terms "framework" and "theory" are often cited interchangeably in the policy literature. Each of these terms generally seek to explain human behavior, but they have subtle differences. While frameworks generally "identify the elements and general relationships among elements" and include a "general set of variables" to assess some phenomenon, theories are typically nested within frameworks and seek to "make assumptions that are necessary for an analyst to diagnose a specific phenomenon, explain its processes, and predict outcomes (Ostrom, 2011)." Similarly, Sabatier & Weible (2014) explain that the purpose of using a policy theory is to "stipulate a limited set of relationships, from the much larger and untamable set, about which concepts relate, why and how, under what conditions, by and for whom, and when (Sabatier & Weible, 2014)." Nested again within a framework and theory is a methodology, which the Project Management Institute broadly

describes as “a system of practices, techniques, procedures, and rules used by those who work in a discipline (Project Management Institute, 2008).”

For clarity, each framework discussed throughout this report falls under these general definitions of policy frameworks. While several frameworks provide distinct methodologies and include specific assumptions, others serve as a conceptual blueprint for examining complex problems. Thus, methodologies can be an important component of a policy framework, but the terms “framework” and “methodology” are not inherently synonymous. Because some frameworks are more conceptual than others, the utilization of more than one framework to assess a particular policy issue can provide added insight. The frameworks presented in this report further vary in that some are better fit for social site characterization purposes, while others are more suited for direct stakeholder engagement.

For the purpose of stakeholder engagement, policy frameworks with narrowed scopes focused on the concerns and perceptions of individual actors and coalitions are most relevant to assessing stakeholder interests in a potential CCS project. Prominent theories encompassing this level of analysis include the Advocacy Coalition Framework (Sabatier, 1987), Narrative Policy Framework (Shanahan, 2013), Collaborative Governance Framework (Emerson et al., 2012), and Policy Conflict Framework (Heikkila & Weible, 2017). The Institutional Analysis and Development Framework (Ostrom, 2011) and Social-Ecological System Framework (Ostrom, 2009) are also prominent conceptual frameworks, but these generally represent a much broader scope than the other frameworks examined in this report. As such, the Institutional Analysis and Development Framework and Social-Ecological System Framework are addressed in the following introductory sections but are not included in the case study analysis.

Advocacy Coalition Framework

Extensive application of the Advocacy Coalition Framework (ACF) since its development in the early 1980s has established this framework as a cornerstone in policy process research. As of 2013, cross-disciplinary researchers utilized the ACF in 224 applications, the majority of which were focused on environmental policy-related issues. The prevalence of the ACF throughout policy process research stems from the ubiquity of the framework’s core questions: What factors affect the development and cohesion of policy-influencing coalitions? How is knowledge shared between concurring and opposing coalitions? What elements facilitate or hinder the prospects of certain policy changes? The aforementioned questions are only examples of the range of questions addressed under the ACF. Overall, Sabatier & Weible (2014) demonstrate that the ACF focuses on “factors that influence coalition formation, policy learning, and policy change (Sabatier & Weible, 2014).” A flow diagram representing the ACF is provided in Figure 1.

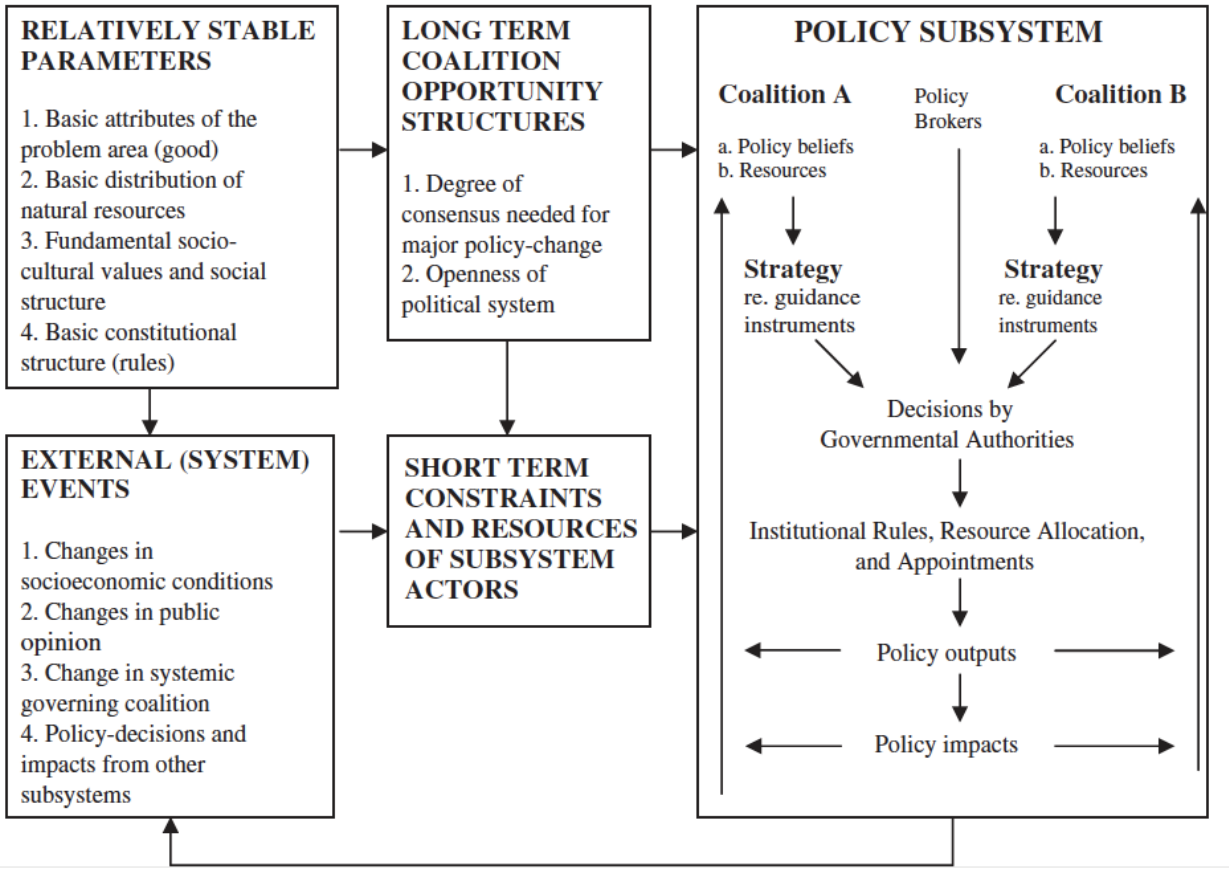

Figure 1. Flow Chart of the Advocacy Coalition Framework (Sotirov & Memmler, 2012).

The ACF includes well-established assumptions. For example, the ACF assumes that individuals within coalitions cannot process all stimuli, they are driven by their core beliefs, and they tend to hyperbolize the maliciousness of opposing coalitions via the "devil-shift." Further, the ACF posits that understanding how scientific information is integrated into or diverted from belief systems is important for assessing the policy issue (Sabatier & Weible, 2014). Understanding the interactions, learning processes, and policy beliefs between advocacy coalitions is pertinent to CCS stakeholder analysis. The scope of the ACF, termed the "subsystem" level, as well as its focus on discerning the conflicts of core beliefs between opposing coalitions and its consideration of scientific knowledge dissemination, presents an optimal theory for framing the complexity of CCS stakeholder relations. Further, the sheer magnitude of existing ACF application in stakeholder literature renders the ACF an essential consideration for future CCS stakeholder engagement efforts.

Narrative Policy Framework

After formal establishment in 2010, the Narrative Policy Framework (NPF) has gained recognition for its powerfully focused insight into how narratives shape individuals' core belief systems and are often key for effective communication. Ultimately, this framework posits that narratives represent subjective opinions and sociocultural values of individuals and groups with common interests. By understanding the root of narratives shaping certain individuals or coalitions, important information is more effectively disseminated, and disputes are more easily resolved. The NPF relies on four narrative elements: the setting, characters, plot, and moral. Additionally, the NPF literature has concluded that to be considered a policy narrative, the communication in question must include at least one character and must have some form of policy stance (Sabatier & Weible, 2014).

The NPF is flexible enough to apply on multiple policy levels, noted as micro, meso, and macro scales. The micro-level of the NPF focuses specifically on individual narratives and the influence of narratives on public perception, while the meso-level considers how coalitions shape and maintain their narratives. Limited literature exists for macro-level NPF analysis, but its purpose is to explore the impact of narratives embedded in culture. The relationship between meso and micro level narratives are presented in Figure 2.

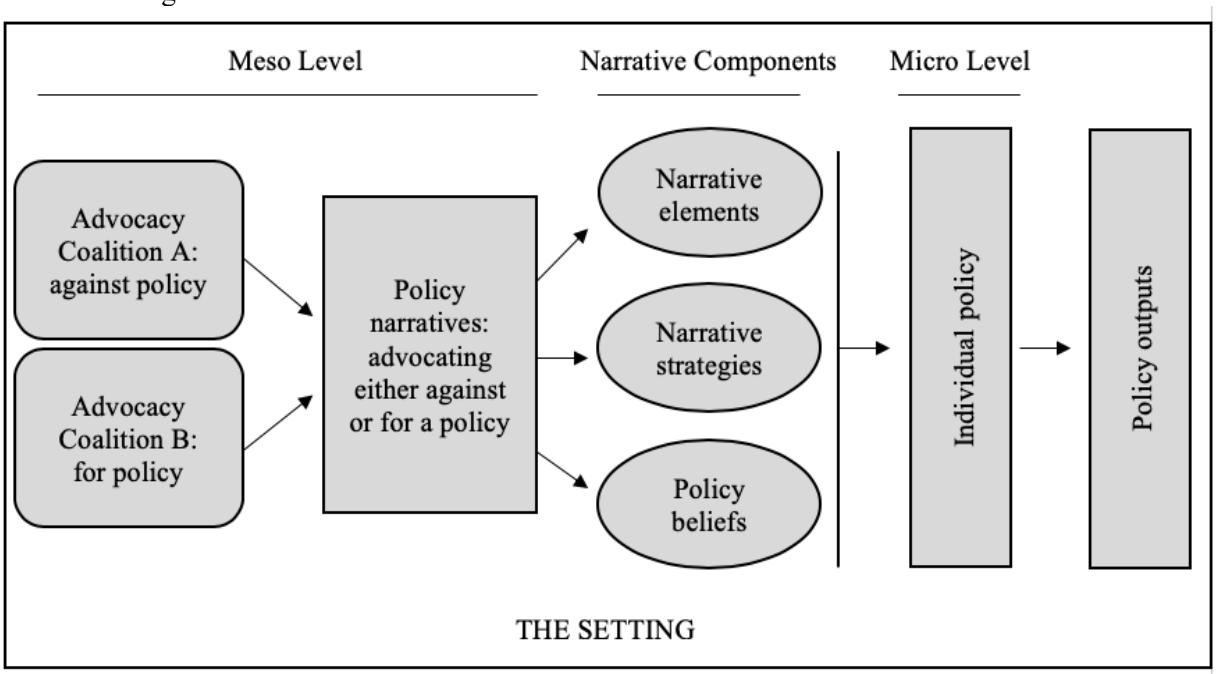

Figure 2. Meso and Micro Levels of the Narrative Policy Framework (Adapted from Sabatier & Weible, 2014).

The Narrative Policy Framework is a well-documented foundation for understanding how narratives influence stakeholder concerns and opinions. CCS is controversial and commonly misunderstood, with numerous narratives shaping public perception of the issue. Narratives are an essential component for understanding and communicating with CCS stakeholder; thus, CCS projects would benefit from the utilization of methodologies that fall under the Narrative Policy Framework.

Collaborative Governance Framework

Stemming from the Advocacy Coalition Framework and a variety of network management literature, the Collaborative Governance Framework (CGF) is a broad conceptual framework for addressing collaborative learning, dispute resolution, and cross-coalition decision-making among diverse stakeholders. Although numerous studies utilized the concept of collaborative decision-making prior to the publication of a formal framework (Agranoff & McGuire, 1998; Daley, 2009; Koontz & Thomas, 2006), Emerson et al. (2012) developed the integrative Collaborative Governance Framework to clearly characterize the drivers, components, and application of collaborative governance. Traditional notions of collaborative governance assume relevance only to public management issues. However, Emerson et al. (2012) emphasize the value of the CGF for issues impacting nongovernmental stakeholders, particularly those related to complex public-private partnerships.

According to Emerson et al. (2012), collaborative governance can be defined as "the processes and structures of public policy decision making and management that engage people constructively across the boundaries of public agencies, levels of government, and/or the public, private and civic spheres in order

to carry out a public purpose that could not otherwise be accomplished." The CGF assumes that collaborative processes take place in a System Context, which broadly incorporates the social, economic, and political setting of a particular problem. Nested within the System Context is a Collaborative Governance Regime, which represents the area in which a collaborative decision-making process may take place. If certain drivers are present within the System Context, Collaborative dynamics – which include Principled Engagement, Capacity for Joint Action, and Shared Motivation – can take place. This process may then lead to collaborative action and subsequent impacts (Emerson et al., 2012). Figure 3 presents a graphical representation of the CGF.

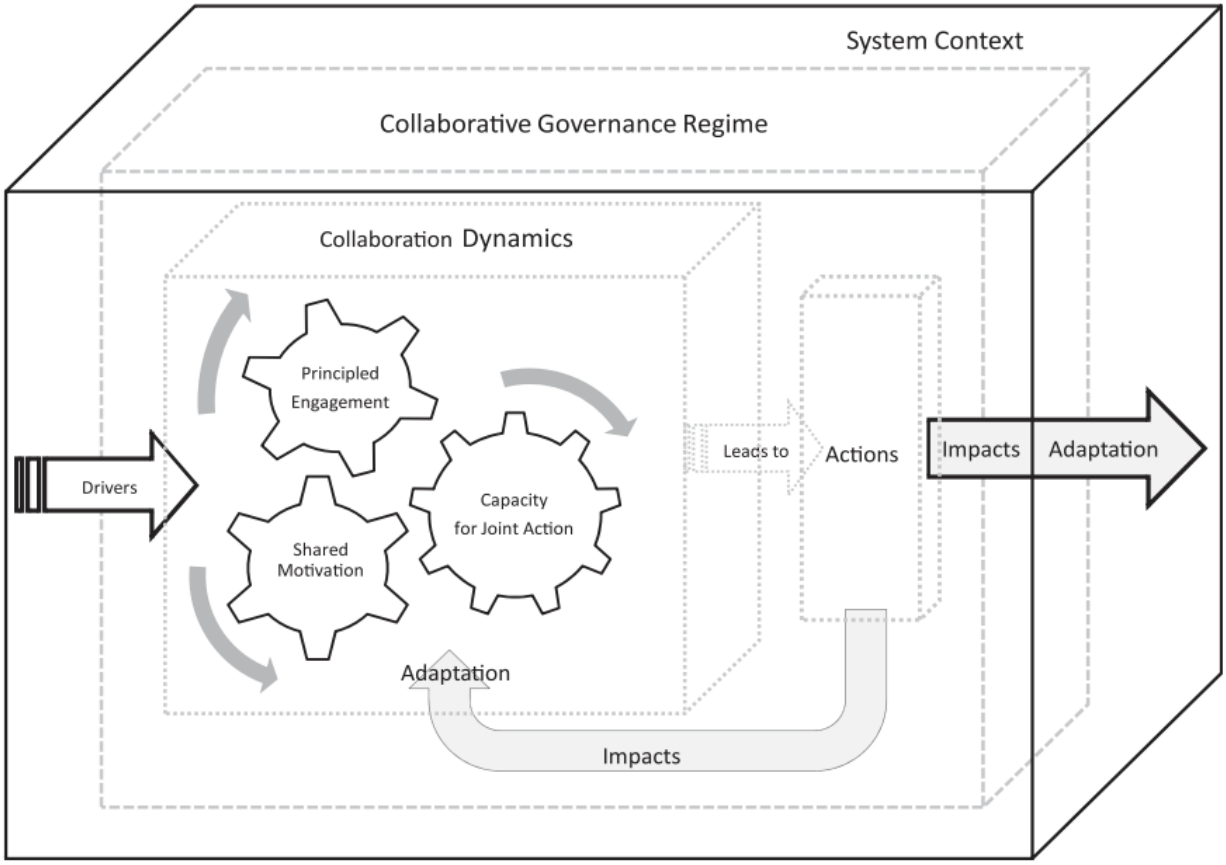

Figure 3. Flow Chart of the Collaborative Governance Framework (Emerson et al., 2012).

System-level drivers that lead to collaborative governance include Leadership, Consequential Incentives, Interdependence, and Uncertainty. First, a trusted leader with a drive to reach productive compromises is needed for effective collaborative governance; this individual or group should be relatively impartial to the opinions of other participants in the collaborative process. Second, a problem must have real consequences for stakeholders. Third, the problem cannot be solved by one person or group alone; instead, collaboration is necessary to accomplish optimal goals. Finally, when uncertainty exists, groups are driven to collaborate in order to "reduce, diffuse, and share risk (Emerson et al., 2012)."

In cases where these Leadership, Consequential Incentives, Interdependence, and Uncertainty qualities exist, collaborative governance is essential. Principled stakeholder engagement by way of collaborative governance is sustained when stakeholder interests are appropriately collected and quantified, issues are deliberated between diverse stakeholders, and joint decisions are made. Due to relevance of the CGF to public-private partnerships and its applicability to issues with high uncertainty

and consequential incentives, this framework provides an ideal foundation for CCS stakeholder analysis and engagement.

Policy Conflict Framework

While conflict between people and coalitions is typically assumed as a given in other frameworks, conflict analysis is the fundamental basis of the Policy Conflict Framework (PCF). Focusing on the identification of ideological conflicts, willingness to compromise, and interconnections of stakeholder groups, the PCF is a relatively new addition in the policy process literature. The PCF posits that conflicts shape and are shaped by a policy setting, which includes four categories: levels of action, policy actors, events, and the policy issue. Further, the framework identifies episodes of policy conflict, which include cognitive characteristics (i.e. the magnitude of competing opinions, perceived threats from opponents, and willingness to compromise) and behavioral characteristics (i.e. strategies individuals use to influence outcomes). Figure 4 presents the connections between policy setting, episodes of policy conflict, and feedback in the PCF (Heikkila & Weible, 2017).

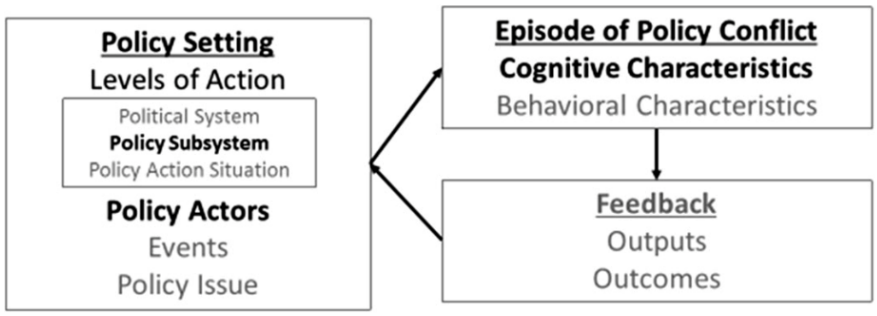

Figure 4. Fundamental Components of the Policy Conflict Framework (Weible, 2017).

Measuring relative intensity of policy conflict through the PCF lens assists policymakers and project developers to better understand the strength of stakeholder group convictions, allowing for more informed and targeted engagement strategies. The PCF includes well-crafted assumptions and associated methodologies that allow researchers to directly operationalize the framework's purpose. However, because the PCF was only recently established in 2017, literature utilizing this framework is limited. Nevertheless, the few existing applications of the PCF include studies on conflict in the oil and gas sector, rendering the PCF a pertinent framework for CCS stakeholder analysis consideration (Heikkila & Weible, 2017).

Institutional Analysis and Development Framework (IAD) and the Social-Ecological Systems Framework (SES)

Compared to the other frameworks assessed in this report, the Institutional Analysis and Development Framework (IAD) and the Social-Ecological Systems (SES) Framework provide more conceptual approaches to mapping out complex, societal issues. Development of the IAD began with Ostrom and her colleagues seeking a mechanism to delineate how individuals and communities develop "institutional arrangements to solve collective action problems and provide shared benefits," particularly in cases of common-pool resources (Sabatier & Weible, 2014; Ostrom, 2008). The IAD begins with the identification of an "action arena," which is the framework's unit of analysis. Within the action arena, both "action situations" and "actors" are identified. Additionally, biophysical conditions, community attributes, and the rules governing a particular action arena are identified. Finally, the interactions

between actors in relation to action situations are predicted and the outcomes are evaluated. A flow chart highlighting the IAD process is depicted in Figure 5.

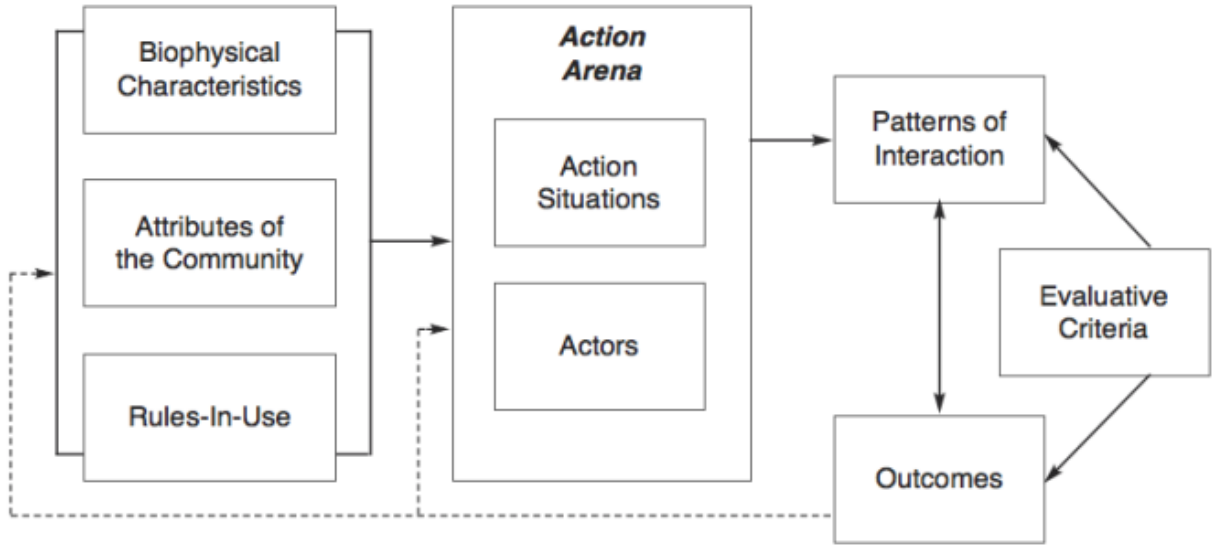

Figure 5. Fundamental Components of the Institutional Analysis and Development Framework (Ostrom, 2005).

The IAD provides significant insight for exploring each of the aforementioned components and can be utilized at multiple levels of analysis. In general, the IAD is a tool for complex, institutional problem-solving; the framework aids researchers in finding and making connections between a broad range of issues relevant to a particular problem.

Many years after the creation of the IAD, Ostrom and others essentially expanded the biophysical component of the IAD to create a new contribution to the policy process literature – the Social-Ecological Systems (SES) Framework (Ostrom, 2009). Comparable to the IAD, the SES provides a blueprint for problem-solving, but places extensive emphasis on natural resources and governance systems (Sabatier & Weible, 2014). As shown in Figure 6, the SES requires the determination of users, governance systems, resource systems, and resource units. The SES also includes detailed second-tier variables within resource units, resource system, governance system, and user components.

Numerous studies have utilized the IAD and the SES to lay out complex institutional and common-pool issues and develop independent methodologies to address relevant questions. The IAD and the SES differ from other frameworks discussed in this report due to their highly conceptual nature and broad scope. Rather than focusing on the stakeholder coalition level, the IAD and SES function best at the extensive institutional level. Therefore, while this methodology to investigate and reveal key relations of resources, policies, and stakeholders, which certainly is of value to assessing a CCS development project in general, it is not as relevant for CCS stakeholder engagement and social site characterization. Therefore, this report will not evaluate case studies using the IAD and SES or its applicability as a stakeholder analysis approach due to its broad scope.

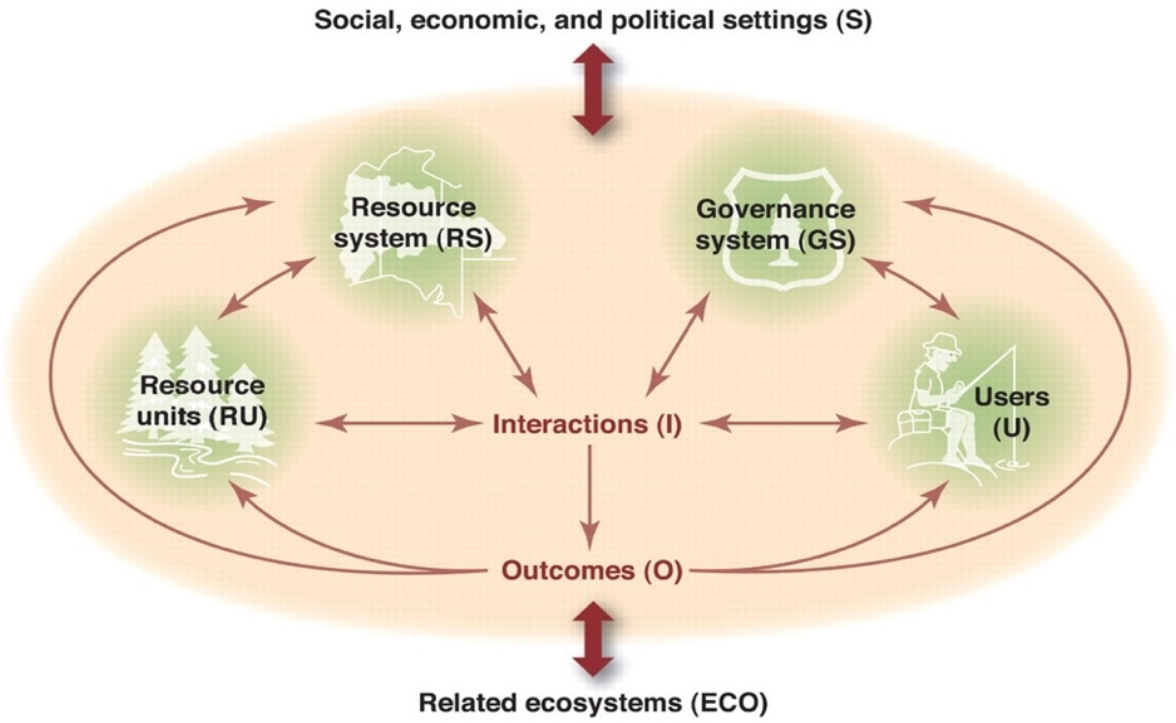

Figure 6. Fundamental Components of the Social-Ecological System Framework (Ostrom, 2009).

Summary of Frameworks

Table 1 summarizes the salient attributes and applicability of the various policy frameworks. For each framework – including the Advocacy Coalition Framework (ACF), Narrative Policy Framework (NPF), Collaborative Governance Framework (CGF), Policy Conflict Framework (PCF), and Institution Analysis and Development Framework/Social-Ecological Systems Framework (IAD/SES) – multiple characteristics are noted. These characteristics include the overall scope of the framework, key questions addressed, clarity of associated methodologies, and extent that the framework has been applied in practice. Figure 7 illustrates the general relationship between the frameworks. The IAD has a broad institutional scope, whereas the other frameworks focus on subsystem-level issues (i.e. beliefs, actions, or activities of coalitions and the individuals that comprise coalitions). Within the category of subsystem level frameworks, the ACF was developed first and addresses issues concerning general coalition dynamics. Scholars later developed the NPF, CGF, and PCF, which all address more specific questions about coalitions. The CGF is quite broad, so it could also be used on an institutional level depending on a study's research scope.

Table 1. Summary of Policy Frameworks

	ACF	NPF	CGF	PCF	IAD/SES
Scope of Analysis	Interaction at the coalition and subsystem levels.	Applications at the micro, meso, and macro levels.	Particularly valuable for coalition-level collaboration, but the scope can be interpreted broadly.	Conflict at the individual and group levels.	Broad, conceptual blueprint for examining institutional-level issues.
Key Questions	"What factors influence coalition formation, policy learning, and policy change (Sabatier& Weible, 2014)."	"Do narratives play an important role in the policy process (Sabatier& Weible, 2014)?"	How can collaborative learning, dispute resolution, and cross-coalition decision-making be applied to address complex issues (Emerson et al., 2012)?	"Under what settings do policy conflicts emerge, endure, and subside and which forms have what consequences (Heikkila & Weible, 2017)?"	"How do people devise institutional arrangements to solve collective action problems and provide shared benefits (Sabatier& Weible, 2014)?"
Methodology Clarity	Clearly stated assumptions. Many case studies use consistent ACF methods and generally include surveys used as appendices.	Clear methods and codebooks available for applying the framework in various contexts.	The framework is highly conceptual, so it must be paired with specific methodologies.	Methods are defined in existing literature, but there have been few applications of this framework thus far.	Clear guidelines for laying out policy issues, but very conceptual in nature.
Extent of Application	Extensive use in multiple countries, with particular use in environmental policy-related issues.	Some applications in the United States, but the NPF is still a relatively new framework.	Many case studies cite collaborative governance broadly, but the official CGF is a relatively new development.	Very recent application for oil and gas conflict issues. Due to the recent development of the PCF, only a few applications exist.	Many cases have used the IAD/SES throughout the world to conceptually address common-pool and stakeholder issues.

*ACF = Advocacy Coalition Framework, NPF = Narrative Policy Framework, CGF = Collaborative Governance Framework, PCF = Policy Conflict Framework, IAD/SES = Institutional Analysis and Development Framework/Social-Ecological System Framework.

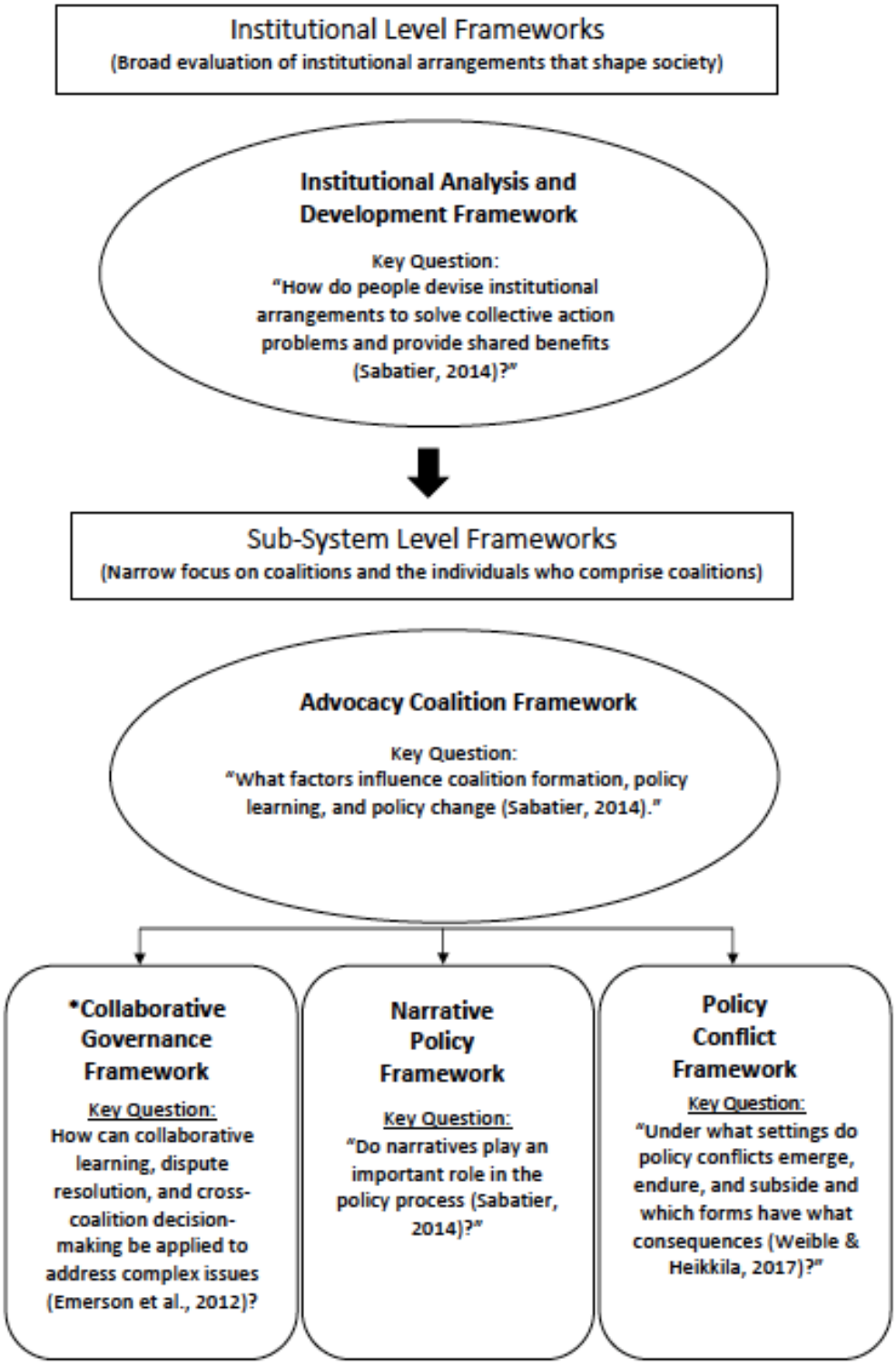

Figure 7. Policy Framework Relationship Overview.

III. CASE STUDY ANALYSIS

Planning stakeholder analysis efforts under the umbrella of well-established policy frameworks provides a multitude of benefits. Understanding the academic policy framework literature can provide valuable insight into how these unique methods can be applied to assessing stakeholder coalition strategies; understanding optimal messaging channels for public communication; optimizing collaborative discourse; incorporating stakeholder values into decision-making; and measuring the intensity of conflict among stakeholder coalitions, all of which are useful for organizing engagement initiatives.

Further, policy framework utilization allows for improved cross-study comparison; for instance, using a systematic approach through the lens of particular policy frameworks for social site characterization across several controversial energy development projects would contribute to more comprehensive conclusions regarding stakeholder perspectives and successful energy site selection. To provide specific, actionable options for CCS stakeholder engagement and social site characterization through the lens of particular policy frameworks, this report explores case studies that fall within the following policy frameworks: Advocacy Coalition Framework (ACF), Narrative Policy Framework (NPF), Collaborative Governance Framework (CGF), and Policy Conflict Framework (PCF). Each case study analysis includes a case overview, methodologies used, conclusions, and applicability to CCS.

This analysis begins with the ACF, which serves as an early foundation for the more recent frameworks addressed. Because the NPF, CGF, and PCF ultimately extended from specific limitations of original ACF fundamental principles, the ACF analysis serves as a cornerstone for exploring these extensions. This ACF section includes a single case study focused on energy project-related stakeholder analysis. This fairly straightforward example of the ACF's applicability to stakeholder analysis is followed by more nuanced cases that fall under the NPF, CGF, and PCF. To introduce applicability of the NPF, two case studies are presented. The first incorporates content analysis to broadly assess the narratives employed by existing stakeholder coalitions. Next, another application of the NPF is introduced, which involves determining minimally divisive narrative elements that can utilized for broad stakeholder communication efforts.

Following NPF analysis, this section explores applications of the CGF. Although the specific cases utilized in this section do not explicitly reference the CGF, the purpose and methodologies employed relied on collaborative social learning, conflict resolution, and decision-making; thus, the cases presented are nested within the Collaborative Governance Framework and provide analytical examples relevant to CCS social site characterization and stakeholder engagement. The first CGF case study utilizes Q-Methodology and Constructive Conflict Methodology, which allowed researchers to quantify the success of a collaborative process related to bioenergy. The second case study employed contingent valuation – a benefit-cost analysis approach for incorporating non-market values into collaborative decision-making – for measuring value tradeoffs in hydroelectric dam operations. Finally, this analysis examines a PCF case study. Because the PCF is a relatively new addition to the policy framework literature, only one case study has been officially published to date. However, this particular case study evaluates the sources and magnitude of conflict between stakeholder coalitions in Colorado's oil and gas policy subsystem, which can have consequential impacts on the success of energy-related projects.

In sum, this case study analysis section of the report presents case studies from various policy frameworks in the following order: the Advocacy Coalition Framework, Narrative Policy Framework, Collaborative Governance Framework, and finally the Policy Conflict Framework. For each case study, the following sections are included: a research overview, a methodological evaluation, a case study conclusion, and an appraisal of applicability to CCS stakeholder analysis. This case study analysis section of the report is followed by a comparative analysis section, which comprehensively compares the frameworks and case studies evaluated. Overall, each case study and framework provide unique benefits

and addresses certain questions; thus, rather than favoring a single framework, CCS project developers could utilize a combination of examples provided. As evident in the following case studies, it is common – and often very beneficial – for researchers to use more than one framework or methodology in order to tailor the study to their particular circumstances.

Advocacy Coalition Framework Case Studies

Formally established in the early 1980s, the Advocacy Coalition Framework (ACF) is pervasive throughout public policy literature. The extensive scope of the ACF, which broadly includes "factors that influence coalition formation, policy learning, and policy change (Sabatier& Weible, 2014)," is a core component of policy frameworks succeeding the ACF. The Narrative Policy Framework (NPF), Collaborative Governance Framework (CGF), and Policy Conflict Framework (PCF) – which are explored in the following sections of this report – all utilize this broad base; these additional frameworks differ in that they extend from the core ACF framework to address more specific coalition-level issues. Though numerous literature sources have applied the ACF, this report focuses on a single case that provides context for the ACF generally and introduces its value for energy-related stakeholder analysis efforts.

The ACF: Opportunities to Advance General Stakeholder Analyses

A. Case Overview

Understanding the ability of different coalitions to individually and collectively process information and engage in policy-making activities is an essential component for stakeholder analysis and social site characterization of any project or policy. Elgin & Weible (2013) posit that the Advocacy Coalition Framework (ACF) is an ideal theoretical blueprint for addressing these factors within a stakeholder analysis. To demonstrate the applicability of the ACF to stakeholder analysis, Elgin & Weible (2013) utilized this framework to assess the "beliefs, networks, resources, and activities of policy actors" within stakeholder coalitions related to Colorado state energy practices broadly. The prevalence of energy resources in Colorado combined with concerns about climate change risks that led to increased state-level renewable energy standards led to a division in policy coalitions. Thus, this case presents an example of the value of using the ACF for stakeholder analysis efforts.

Ultimately, this study focused on coalition membership and beliefs, networks, resources, and policy strategies. While the ACF is broad enough to encompass each of these factors, the framework does not include methods to quantify the relative strength of coalition resources and policy strategies. To address this shortcoming, Elgin & Weible (2013) complemented the ACF with the Policy Analytical Capacity (PAC) – a method for assessing individual and coalition ability to gather and use information. Researchers hypothesized that coalitions made up of members with significant experience and skills related to policy analysis, modeling, and other relevant abilities may be more effective at influencing public opinion and policy. The PAC allowed Elgin & Weible (2013) to quantify coalition experience and skills, which are important components of coalition resources and subsequent policy strategies.

B. Methods

To analyze stakeholder coalitions related to Colorado energy policy, Elgin & Weible (2013) honed their research to focus on the following factors: beliefs and coalition membership, coalition networks, coalition resources, and coalition strategies. After identifying stakeholders relevant to the Colorado energy policy subsystem, researchers distributed online surveys via E-mail. To assess stakeholder coalition beliefs and coalition membership, surveys divided coalition membership into those advocating and opposing climate change-related policy. Along with general policy preference coalition, respondents were asked about their professional affiliation, including government, business, nonprofit, and academia. Further, respondents were asked about their core belief system, which ranged from very liberal to very

conservative for both fiscal and social issues. An example of Elgin & Weible's (2013) assessment of these factors are presented in Table 2.

Table 2. Colorado oil and gas subsystem coalition membership and belief system (adapted from Elgin & Weible, 2013).

	Anticlimate Change Coalition	Proclimate Change Coalition
Total number of policy actors	55	205
Number and percent of policy actors by affiliation*		
Government	12 (22%)	67 (33%)
Business	29 (52%)	58 (28%)
Nonprofit	7 (13%)	47 (23%)
Academic/research	7 (13%)	31 (15%)
Deep core beliefs†		
Fiscal***	3.65	2.65
Social***	2.93	1.77

Note: Independent samples Kruskal–Wallis test with significance levels at *p < .05, ***p < .001
†Deep core belief scale: 1 = "very liberal," 2 = "liberal," 3 = "moderate," 4 = "conservative," 5 = "very conservative."

Surveys further assessed the core beliefs of respondents by expanding upon energy-related policy opinions. For example, respondents were asked about their opinions on the severity and cause of climate change, as well as their policy beliefs related to carbon taxes, cap and trade programs, and renewable energy policies. Elgin & Weible (2013) analyzed coalition networks by asking respondents about how often respondents interact with individuals with different beliefs. Additionally, surveys asked if respondents took part in "coalition building in the past year."

Researchers utilized methods originating from the Policy Analytical Capacity (PAC) to collect information about coalition resources, such as coalition members' relevant experience and skills. To assess coalition resources on an individual scale, surveys asked respondents to list their education and years of relevant experience. Further, respondents either affirmed or denied having formal training in the following quantitative subjects: statistics, modeling, applied research, policy evaluation, trend analysis, and policy analysis.

Elgin & Weible also assessed policy analytical capacity on a coalition scale by asking respondents about the level of priority their affiliated coalition places on energy policy issues in Colorado; the relevant knowledge and skills of their organization as a whole; and the extent to which daily issues superseded long-term coalition energy policy goals. Finally, researchers assessed coalition strategies by asking respondents how many coalition members took part in certain policy-related activities each year. For instance, each respondent was asked to provide the percentage of coalition members who informed public officials, consulted with the public, and conducted energy-related research that year. Example survey topics addressed by Elgin & Weible (2013) are provided in Appendix A.

C. Conclusions of the Case Study

The majority of respondents identified as part of the overall climate policy advocate coalition. Key differences in core beliefs and opinions between climate policy advocates and opponents relate to general perceptions of climate change severity and preferred mechanisms for mitigation. Coalition groups had similar participation rates in coalition building behavior, and members of each coalition group primarily interacted with others who held similar beliefs. Further, climate policy advocate and opponent coalitions indicated similar levels of personal experience, education, and training. Coalition groups primarily differed in the extent of formal training in statistics and mathematical modeling. Climate policy advocates

tended to have more quantitative training than the opposing coalition, which can be valuable for influencing policy and enhancing coalition building efforts.

D. Applicability of Framework to CCS

Elgin & Weible (2013) presented a useful and straightforward methodology to assess the beliefs, resources, and coalition interactions of energy policy-relevant stakeholder groups. In this study, researchers complemented the strong theoretical underpinnings of the ACF with the Policy Analytical Capacity (PAC), which provided a methodology to assess stakeholders' ability to gather and use information. Stakeholder groups in the Colorado energy policy subsystem – such as environmental organizations, governmental groups, and industry coalitions – are similar to stakeholder groups relevant to CCS development. Further, conflicts regarding climate change mitigation policy is extremely pertinent to CCS stakeholder concerns. Thus, CCS stakeholder analyses and social site characterization efforts would benefit from emulating Elgin & Weible's (2013) use of the ACF and PAC for stakeholder engagement initiatives. The data gained from this analysis provides valuable baseline information for interacting with stakeholders and receiving basic opinion and background information.

For the purpose of their study, Elgin & Weible (2013) complemented the ACF with the PAC due to their interest in coalitions' ability to collect and process information. In policy theory literature relevant to stakeholder analyses, using specific methodologies and more tailored policy frameworks that draw from the ACF is common. Although the ACF is a well-developed, strong foundation for understanding coalitions in policy subsystems, numerous frameworks and methodologies have evolved from this foundational framework to address more specific questions regarding coalition behavior and interactions. Thus, the ACF is most useful and straightforward when paired with a more specific framework or methodology. If CCS researchers are interested in stakeholder coalitions' ability to gather and process information, accompanying the ACF with the PAC is an ideal pairing.

Narrative Policy Framework Case Studies

The Narrative Policy Framework has wide-ranging applicability to stakeholder coalition analysis. The results of NPF analyses are not only valuable to academic literature; analysis outcomes aid project developers to understand stakeholder core values shown through existing coalition content, to craft non-divisive messaging, and to more strategically plan outreach initiatives. Assessment of the applicability of using the NPF for CCS stakeholder analysis initiatives is evaluated through the lens of two very different uses of the framework: a narrative content analysis of offshore wind power coalitions and a survey methodology to determine narrative components preferred by different coalitions relevant to river restoration efforts.

Understanding Coalition Narratives through Public Content

A. Case Overview

Coalitions representing values across the political and industrial spectrum share their beliefs and sway their constituents using narrative messaging. The plot and character identification in such narratives differ considerably between opposing coalitions, with some narratives containing more "villains" and presenting a more divisive story. The public is often deeply moved by the narratives presented by coalitions, resulting in significant implications for project and policy success. With increased messaging through a range of media platforms, understanding the narratives employed by relevant coalitions is key to the success of controversial projects. In a salient introduction to the applicability of the Narrative Policy Framework, Shanahan et al. (2013) assessed the narratives utilized by two opposing coalitions in the Cape Wind controversy, a divisive offshore wind power pilot project planned to be developed off the coast of Nantucket, Massachusetts.

Shanahan et al. (2013) sought to explain the structure of the narratives used by each coalition, as well as the cohesion and consistency of coalition narratives in their messaging. The Cape Wind project served as an ideal development for studying coalition narratives used to address controversial topics. In addition to the complex permitting regime for offshore wind siting (Musial & Ram, 2010), a wide range of stakeholder groups, including Native American tribes, wealthy homeowners, and fishermen, opposed the project's development. The heated debate over Cape Wind was captured in many media outlets. Cape Wind Associates, along with Clean Power Now and Greenpeace, were prominent Cape Wind proponents; the Alliance to Protect Nantucket Sound, contrarily, emphatically opposed the project.

In addition to assessing the narratives used by coalitions in this particular case, Shanahan et al. (2013) contributed a thorough Codebook for analyzing media content for narrative components (Appendix B). Many studies have used the same or a similar codebook to conduct NPF analyses from various sources, such as social media (Gupta et al., 2018) and Youtube videos (McBeth et al., 2017). Thus, researchers interested in coalition narratives used in other contentious policy subsystems can conduct a similar analysis with relative ease.

B. Methods

Utilizing a combination of online press releases, newsletters, editorials, Youtube videos, and other resources, Shanahan et al. (2013) analyzed the narratives employed by various competing coalitions. Table 3 presents a range of coalition sources used in this analysis.

Table 3. Sources used for Cape Wind narrative analysis (adapted from Shanahan et al., 2013).

Pro-Wind Farm Coalition	% (n)	Anti-Wind Farm Coalition	% (n)
Cape Wind Associates	25% (32)	Alliance to Protect Nantucket Sound	70% (53)
Clean Power Now	25% (31)	Kennedy family	7% (5)
Greenpeace	18% (21)	Native American Tribe & Fishermen	15% (12)
Media	32% (41)	Media	8% (6)
Washington Post		*The Boston Herald*	
Washington Times		*The Boston Globe*	
New York Times		*Cape Cod Times*	
Cape Cod Today		*Providence Journal*	
		Falmouth Enterprise	
Total	100% (125)	Total	100% (76)
Grand total of policy narratives = 201			

Using the Codebook provided in Appendix B, researchers assessed coalition narratives for three primary categories: narrative elements, narrative strategies, and policy beliefs. Narrative elements include various characters, such as villains, heroes, and victims; different types of stories, including stories of decline and stories of victory; the causal mechanisms, which measure how intentional the harm caused by a villain is; whether or not the plot includes a solution; and if the narrative includes scientific evidence. Narrative strategies include the "devil-shift," which measures how often coalitions deem themselves as heroes and other coalitions as villains, and the overall societal distribution of costs and benefits of the policy in question. Finally, policy beliefs are a measure of the value placed on wildlife victims versus human victims; group victims versus individual victims; and conservation heroes versus business heroes. Table 4 aptly characterizes the variables utilized in this analysis.

After coding the total of 201 coalition narratives, researchers compared both the intercoalition and intra-coalition narrative elements, narrative strategies, and policy beliefs employed through online communications.

Table 4. Measures of narrative elements, narrative strategies, and policy beliefs used to analyze Cape Wind coalition public content (adapted from Shanahan et al., 2013).

Variable Category	Description/Coding Schema
Narrative Elements	
Characters	
Heroes	Total number, also coded into the following categories: Business/industry; Cultural/historical; Conservationist/environment; Other; Government/public sector
Villains	Total number, also coded into the following categories: Business/industry; Cultural/historical; Conservationist/environment; Other; Government/public sector
Victims	Total number, also coded into the following categories: Wildlife/nature/environment; Economic; Cultural/historical; Other human; Both biocentric and anthropocentric
Story type	Yes or no, also coded into the following categories: 1. stories of decline (stymied progress, story of decline, change is only an illusion) 2. control stories (conspiracy, helplessness and control, blame-the-victim) 3. victory stories
Causal mechanism	Yes or no, also coded into the following categories: 1. intentionality; 2. mechanical; 3. inadvertence; 4. accidental
Solution	Yes or no
Science/evidence	Yes or no
Narrative Strategies	
Devil shift	Percent of total hero references to self as hero—percent of total villain references to other as villain/total
Distribution of costs/benefits	Diffused or concentrated
Policy Beliefs	
Nature–human	Wildlife victims- human victims/total
Polis–market	Group victims—individual victims/total
Conservation–business	Conservation heroes—business heroes/total

C. Conclusions of the Case Study

Shanahan et al. (2013) found significant differences between narratives employed by Cape Wind advocates and opposing coalitions. The pro-wind coalition included a solution to the policy issue much more often than the opposing coalition, and the solutions employed by these advocates were consistent within the coalition over time. Further, the narratives of the pro-wind coalition were primarily composed of stories of victory, whereas the anti-coalition focused on stories of decline. Character types utilized by opposing coalitions also differed, with the anti-wind coalition using many more victims and employed the "devil-shift" more often in their narratives than the pro-wind coalition. The anti-wind groups also tended to concentrate benefits of the Cape Wind project to a small minority while diffusing the costs of the projects to many more people.

Coalitions also differed in their core policy beliefs. The anti-wind group favored a more human-centered policy belief, whereas the pro-wind group was fairly moderate between nature and human values. Further, Cape Wind opponents had a more individualistic policy belief and advocates tended to be more group centered. Finally, the anti-wind coalition narratives were more likely to show conservation-

oriented beliefs while pro-wind narratives had a moderate position between conservation and business interests. Although many differences were identified, opposing Cape Wind coalitions had some similarities in their narratives. Both groups tended to use intentional causal mechanisms, meaning that they often identified the villains in opposing coalitions as intentionally causing harm. Further, neither group relied heavily on scientific evidence to promote their position.

D. CCS Applicability

Conducting a Narrative Policy Framework analysis by way of media content analysis is a relatively straightforward and cost-effective way to identify the perceptions of CCS stakeholder groups. The Codebook created by Shanahan et al. (2013) is simple to follow and researchers can find coalition narrative content in a range of online sources. Researchers do not have to depend on survey responses or interviews; instead, data is freely available via media references. Similar to offshore wind power development in the case of Cape Wind, CCS stakeholder coalitions are likely driven by narratives rather than scientific information alone. As CCS technology is not well understood by the mass public, media narratives likely influence preconceived notions of stakeholders. By utilizing this methodology for CCS stakeholder analysis, project specialists can better untangle the narratives surrounding CCS and more directly address issues identified as "villains" in media.

At this point in time, no studies have used the NPF to assess the narratives used by CCS advocates and opponents. Thus, there are ample opportunities for pioneer CCS NPF analyses. Researchers could perform narrative content analysis related to coalitions involved in particular CCS projects. Alternatively, if coalition narrative content is limited for a particular subsystem, a larger-scale analysis of CCS narratives nationally may also be beneficial. As stakeholders are influenced by national media, a broader analysis of CCS narratives in U.S. media may also be informative. If researchers chose to use a NPF content analysis, it is suggested that they do so in addition to other stakeholder engagement strategies. While this methodology is valuable for social site characterization and for understanding the narratives around CCS, it does not necessarily capture nuanced perspectives from underrepresented stakeholder groups.

Determining Non-Divisive Narratives for Cross-Coalition Communication

A. Case Overview

The Narrative Policy Framework has applicability beyond understanding existing narratives utilized by coalitions; researchers can also utilize it to aid in crafting well-informed messages for cross-coalition communication. Because narratives tend to reflect the core values of individuals and coalitions, framing an issue using a contentious narrative may instantly isolate certain groups and prevent effective discourse. McBeth et al. (2010) posit that the overall narratives driving policy coalitions and individuals fall into two primary camps: the "Duty-Based" narrative and the "Engaged-Citizen" narrative. The Duty-Based narrative essentially focuses on individualism, independence from government, and duty to one's community, while the Engaged-Citizen narrative takes on wider-world view and centers on a dedication to improving the livelihood of the environment and people across the globe (McBeth et al., 2010). Thus, the Duty-Based narrative may be favored by those who deeply value independence and responsibility within a community, whereas the engaged-citizen narrative can oblige those committed to wider-world issues.

Clearly, many audiences likely share values from both types of narratives; but which narrative is most universally accepted and least contentious? To better understand this question, McBeth et al. (2017) evaluated narrative preference of stakeholders relevant to controversial river restoration issues in the Portneuf River Region, located in the western United States. Researchers introduced stakeholders to Duty-Based and Engaged-Citizen narratives, as well as a purely scientific statement related to the issue, and then asked stakeholders to identify the narrative that best reflects their values. Further, stakeholders

identified characters within the narratives who they most supported. McBeth et al. (2017) related stakeholder responses to stakeholder group affiliation to evaluate the narratives favored by particular groups.

Overall, the goal of this study was to determine how narratives and scientific information are perceived by various stakeholder groups in order to craft non-divisive ways to communicate with the public and stakeholders. This form of NPF analysis should not be misconstrued as a means to manipulate stakeholders by yielding to a certain narrative; instead, it should be used to develop a deeper understanding of stakeholder values and a tool to craft less contentious public messages. Further, if leaders from an opposing coalition reach a mutual understanding for a particular project or policy, they can better disseminate information to their constituents by using minimally contentious narratives.

B. Methods

River restoration efforts in the Portneuf River Region of Idaho impact a diverse range of stakeholder groups, such as scientists, businesses, environmental activists, landowners, and agricultural and ranching coalitions. To assess the narratives favored by these groups, McBeth et al. (2017) employed two methods: an online survey and follow-up interviews selected from respondents. Stakeholders were identified by researchers' personal knowledge, presence in media coverage, and public meeting attendees. Additionally, researchers requested that known stakeholders contribute additional suggestions for stakeholder identification. Following stakeholder identification, researchers shared online surveys constructed in SurveyMonkey with stakeholders via E-mail.

Overall, 157 stakeholders were contacted, but only 85 completed the survey. Respondents varied by sector affiliation, including 31 percent from government, 46 percent identified as activists, and 23 percent from the business sector. Stakeholders were provided with a Duty-Based narrative, an Engaged-Citizen narrative, and a science statement and were asked a series of questions related to how well each narrative represents their values. In the Duty-Based narrative, the Federal government was presented as the villain, businesses and local recreation users were shown as victims, and responsible individuals and businesses were depicted as heroes. Alternatively, heroes in the Engaged-Citizen Narrative were identified as individuals acting on climate change issues and promoting global-citizenship; the victims in this narrative were plants and animals, and industry interests were depicted as villains. The science statement, on the other hand, presented only scientific facts and was not in a narrative format. The survey narratives used are provided in Appendix B.

In the online survey, stakeholders recorded whether or not each narrative reflected their beliefs. Control variables in this model included how often stakeholders used tributaries in the river system, demographic information, and as well as other variables that could impact the regression analysis. The survey also evaluated respondents' reactions to various characters in each narrative. Finally, 20 respondents from the various coalition groups were interviewed and presented with the same set of narratives. Researchers asked interviewees which narrative best reflects the values of their affiliated organization.

C. Conclusions

McBeth et al. (2017) found that of the respondents surveyed, the science statement and the Engaged-Citizen narrative resulted in the highest preference. However, because respondents were largely drawn from government workers, scientists, and environmental activists, these findings may not translate to other policy subsystems. Although fewer stakeholders most strongly identified with the Duty-Based narrative in this case, preference for this narrative did not vary based on political ideology; this corroborates the findings of Lybecker et al. (2013), which determined the Duty-Based narrative to be accepted across political ideology and coalition groups.

Contentiousness of villains, heroes, and victims in the survey narratives ranged widely. For instance, while proponents of the Duty-Based narrative disagreed with the depiction of non-human organisms as victims in the Engaged-Citizen narrative, the Duty-Based depiction of businesses and local recreation users as victims was much less contentious across all respondents. Thus, the characters used in a narrative have significant implications for cross-coalition acceptability. In reference to the interviews held after respondents completed the survey, McBeth et al. (2017) found a mixed response from interviewees. Ultimately, 60 percent of those interviewed claimed that their preference of narrative would be shared by their affiliated coalition.

D. CCS Applicability

Greenberg et al. (2011) emphasize the importance of consistent and accurate messaging for building stakeholder trust and maintaining project transparency. Thus, although engagement strategies are most effective when they are adapted to particular stakeholder groups (Ashworth et al., 2012), the core messaging for a project must be consistent. Although stakeholders often have particular narrative components with which they most identify, some narratives are more divisive than others. The NPF is a potentially a useful tool for determining agreeable narrative ideals that can best reach a diverse audience without alienating certain groups, making it a valuable tool for framing CCS issues.

In addition to crafting narratives that can reach a large portion of stakeholders, utilization of the NPF increases understanding about how various stakeholder groups tend to form opinions and react to situations, allowing project management to form outreach teams that are best suited to engage with particular stakeholder groups. For instance, outreach teams that include business experts may be more effective in engaging with stakeholder groups that tend to align with narratives promoting businesses as "heroes"; contrarily, if a stakeholder group tends to identify businesses as "villains," then a business-focused outreach team may not be ideal for engagement efforts. Ultimately, this form of NPF analysis is useful for finding narratives that connect with core values shared between many different stakeholder groups and for planning coalition-specific engagement strategies.

Collaborative Governance Framework Case Studies

The Collaborative Governance Framework (CGF), which involves processes for collaborative learning, dispute resolution, and decision-making among stakeholder coalitions, is inherently quite broad. Although the concept of collaborative processes is not new, an integrative framework for Collaborative Governance was not formalized until 2012 (Emerson et al., 2012). Thus, although numerous stakeholder analysis case studies fall under this framework, many are not formally labeled under the CGF lens. Consequently, the case studies examined throughout this section introduce specific methodologies to operationalize collaborative learning, dispute resolution, and cross-coalition decision-making, allowing them to be broadly categorized under the CGF.

First, a case study is presented that evaluates the efficacy of a "Biomass Dialogue" among stakeholder coalitions in the Netherlands. This case presents methods for organizing and evaluating a process for collaborative learning and dispute resolution. Next, a case study about Colorado's hydroelectric dam management presents methods for quantifying stakeholder non-market values and incorporating those values into decision-making. Drawing from benefit-cost analysis methodologies, this case presents opportunities for collaborative decision-making by way of social benefit-cost quantification.

Assessing Collaborative Governance and Constructive Conflict Using Q-Methodology

A. Case Overview

Energy-related policy decisions are rife with environmental, economic, and social trade-offs. The Netherlands, as well as many other countries, continues to modify its predominant stance on the role of bioenergy in the nation's future power portfolio. Stakeholders across the Netherlands hold wide-ranging perspectives regarding bioenergy potential, and individuals tend to silo themselves into coalitions and often do not engage in meaningful discourse with those of other opinions; yet, direct interactions between stakeholders of varying perspectives are key for social learning, civil exchange of ideas, and potential compromise (Emerson et al., 2012).

Bringing together stakeholders for discourse is often a critical component of collaborative governance. While this concept is straightforward and evident in theory, effectively planning, moderating, and evaluating such efforts is complex. In order to develop a "Biomass Dialogue" workshop for bioenergy-related stakeholders in the Netherlands and to broadly evaluate the effectiveness of a participatory process on social learning and constructive discourse, Cuppen (2012) utilized both the Constructive Conflict Methodology and the Q-Methodology. As the purpose of this study related to collaborative social learning and conflict resolution processes, these particular methodologies are nested within the Collaborative Governance Framework.

The Constructive Conflict Methodology (CCM), which provides a general roadmap for planning stakeholder workshops, was developed by Cuppen (2009) with the assumption that certain levels of conflict are essential for social learning and collaborative decision-making. The basic steps of the CCM first involve identifying relevant stakeholders for a workshop and then establishing sub-groups of like-minded stakeholders to develop their own arguments within the workshop.

After stakeholders discuss their opinions with those of similar viewpoints, subgroups are then mixed to drive confrontation of varying perspectives. Finally, workshop leaders engage with some form of synthesis where different perspectives are integrated into an idea or solution. Overall, Cuppen (2012) formed a bio-energy stakeholder workshop using the CCM principles. The Q-Methodology, which is described in more detail in the following 'Methodology section,' was the tool used to select stakeholders, categorize initial subgroups, and quantify changes in opinion following the workshop.

B. Methodology

The Q-Methodology – which was initially used in psychological research in the mid-1930's – is now an expanding methodology for assessing stakeholder perspectives and was key in operationalizing both the inputs and evaluation of this bioenergy collaborative stakeholder process (Stephenson, 1935; Cuppen, 2016; Forouzani et al., 2013). Thus, a brief discussion of the Q-Methodology is needed. This methodology begins with establishment of the communication concourse surrounding a particular issue, which is a broad collection of statements representing a range of relevant viewpoints. Sampling of the communication concourse yields a concise "Q-set," which is a list of several statements representing a range of policy beliefs. Typically, after recruiting stakeholders from a range of backgrounds, participants are then asked to rank each statement from the Q-set based on how much they agree or disagree. The resulting quantitative data allows for in-depth analysis while the original qualitative statements assure representation. Based on the results, groups with common interests are categorized (Cotton, 2015).

Cuppen (2012) first used the Q-Methodology to categorize the range of perspectives provided by stakeholder interviews. In total, researchers conducted qualitative interviews with 75 stakeholders from numerous backgrounds, such as energy industry leaders, environmental groups, non-governmental organizations, and government officials. Using qualitative information from interviews, the "Q-Set" was

established; this set consisted of six general perspectives, ranging from “Keep all options open” to “Hit the brakes” with regard to bioenergy development.

From the original pool of 75 stakeholders, 30 people representing different perspectives were invited to participate in the Biomass Dialogue, which consisted of three workshops. Following the general steps of the Constructive Conflict Methodology, participants were first grouped according to the perspectives represented by the Q-Set. Next, participants representing opposing views were mixed and instructed to confront difference in perspective. The final “synthesis” step involved collectively identifying problems that must be overcome and outlining an ideal future of bioenergy according to different stakeholder perspectives.

The stakeholders who participated in at least two of the three workshops were asked to participate in a post-workshop Q-Methodology evaluation; these participants were asked to re-rank their opinions based on the original Q-set. These responses were compared to their responses before the Biomass Dialogue workshops, providing a method for pre-post analysis. Further, a control group was formed by asking stakeholders who did not participate in any of the workshops to complete a post-assessment. Figure 8 presents an outline of this sampling process.

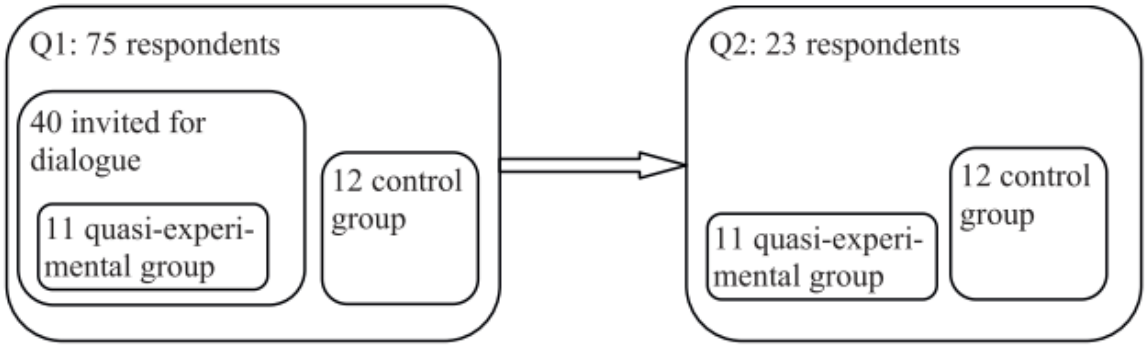

Figure 8. Overview of quasi-experimental sampling technique used by Cuppen (2012) to evaluate the impacts of collaborative discourse between stakeholders relevant to the Netherlands bioenergy policy.

In addition to the Q-Methodology components used in this study, qualitative information was obtained following each Biomass Dialogue using participant evaluation forms. These forms asked general follow-up questions regarding how open and respectful the workshop was and how much each participant learned in the process.

C. Conclusions

Overall, participants who took part in the Biomass Dialogue indicated an increased agreement or rationalization with perspectives outside of their initial viewpoints. Engaging in direct dialogue with those of other perspectives increased stakeholders’ understanding of the complexity of sustainable energy tradeoffs. These results were corroborated by both quantitative analysis of the Q-sets, as well as qualitative feedback from workshop participants. One participant stated that they learned “about the perspective of other stakeholders,” which “deepened and broadened my environmental perspective.” Another stakeholder acknowledged the complexity of stakeholder opinions, noting that “even Shell thinks in a nuanced way.”

Implications of this study’s findings are multifaceted: collaborative governance-related processes offer potential for increased social learning, reaching mutual understanding between stakeholder groups, and eliciting representative perspectives from many diverging stakeholder groups. Because this case involved broad policy opinions related to bioenergy rather than a single bioenergy development or piece

of legislation, stakeholders were not necessarily encouraged to negotiate for a complete solution. Instead, stakeholders were encouraged to learn about complex ideas from others and to build mutual respect with those who may hold opposing viewpoints. Further, the collaborative dialogue offered a civil space for policy-relevant collection of stakeholder concerns and perspectives.

D. CCS Applicability

Balancing the numerous tradeoffs related to bioenergy and managing bioenergy-related stakeholder concerns is similar to those that are of importance to stakeholders in relationship to a CCS project. Similar to bioenergy efforts, the purpose of CCS is to mitigate the climate impacts associated with greenhouse gas emissions from the traditional fossil fuel industry. While the technology has considerable benefits for greenhouse gas mitigation, it presents tradeoffs related to land-use, environmental risk, and allocation of economic resources for sustainable energy. While many CCS project developers have likely recognized the need to host collaborative stakeholder workshops, doing so in a structured way that can be evaluated for success is difficult. Following the example of Cuppen (2012), CCS efforts to elicit stakeholder perspectives, increase social-learning, and reduce conflict would benefit from using the Constructive Conflict Methodology and Q-Methodology to operationalize the Collaborative Governance Framework.

Utilization of a process similar to Cuppen (2012) would allow for direct engagement via initial qualitative interviews, synthesis of ranging viewpoints, cross-coalition collaboration, and evaluation of engagement program success. Because stakeholders of opposing viewpoints would engage through workshops, these groups may be more likely to reach mutual understandings in the future. Further, even after any workshops are held, the categories of stakeholder viewpoints (i.e. Q-sets) can be utilized in surveys to assess larger-scale community opinions over time. Thus, the results of this process would contribute to numerous applications important for CCS stakeholder engagement.

Using Contingent Valuation to Integrate Stakeholder Non-Use Values into Decision-Making

A. Case Overview

The Collaborative Governance Framework broadly considers non-market values that contribute to stakeholders' beliefs and the subsequent impacts of these values on collaborative learning and decision-making. Non-market values are those that cannot be quantified strictly by monetary means. Though it is evident that such values are an incredibly important component of stakeholder opinions, these elusive factors are very difficult to quantity and incorporate into decision-making. Jones et al. (2016) present a method for evaluating the non-market values of stakeholders and an opportunity to integrate such findings into the benefit-cost analysis of large-scale energy and water resource projects. Focusing on the value trade-off between relatively 'clean,' cost-effective hydropower versus improved riverine protection, Jones et al. (2016) sought to understand how non-market values contributed to stakeholder beliefs in association with proposed operational changes to the Glen Canyon Dam in Colorado.

Specifically, Jones et al. (2016) evaluated 'non-use' values, which are values placed on impacts to society outside of ones' own experience. In the case of the Glen Canyon Dam in Colorado, modifying the hydropower output from the dam would disrupt the lives of rural communities and Native American tribes who rely on low-cost hydropower. Even if stakeholders are not part of the rural or Native American groups directly impacted by this change, they may place non-use, non-market value on protecting these other communities. Further, if hydropower from the dam is reduced, increased fossil fuel reliance is a potential trade-off; while this change may not directly impact a particular stakeholder group, they may place value on mitigating associated air pollution and greenhouse gas emissions.

Contingent valuation – which involves surveying stakeholders regarding their willingness-to-pay (WTP) to advance or prevent a development – is increasingly utilized in benefit-cost analysis to integrate

non-market values. Jones et al. (2016) used contingent valuation but utilized the method to evaluate overall public opinions regarding the Glen Canyon Dam and changes in opinion based on different types of values. While the purpose of this study was not to derive a final WTP value to include in a project benefit-cost analysis, future efforts could extend a process similar to Jones et al. (2016) for benefit-cost analysis application. Ultimately, Jones et al. (2016) present an opportunity to both assess the non-market values of stakeholders and utilize quantified values in tools for decision-making, thereby aiding in collaborative governance and adaptive management.

B. Methodology

To assess non-market values associated with changes to the Glen Canyon Dam of the Colorado River, Jones et al. (2016) elicited responses from 2,465 individuals through a national survey. Because this particular study sought to assess general non-use values, this wide-ranging respondent base was appropriate. Surveys focused on two primary negative impacts of operational changes to the Glen Canyon Dam: potential increases in power costs – impacting rural communities and Native American tribes who depend on low cost power – and potential increases in air pollution due to the trade-off between hydropower and fossil fuels. The survey first exposed respondents to background information about the Glen Canyon Dam, followed by potential positive and negative impacts of current operations and proposed changes. Respondents were assigned to different 'treatment groups,' such as information that focused on negative impacts on Native Americans, rural communities, and/or increased air pollution due to power tradeoffs.

Surveys employed a referendum vote option and an evaluation of willingness-to-pay (WTP) following the presentation of introductory information aforementioned. After asking respondents if they would vote yes or no for the proposed change, the survey asked how likely that individual would be to pay an extra $25 in taxes annually to support the option chosen. Figure 9 presents an example decision tree for respondent preferences.

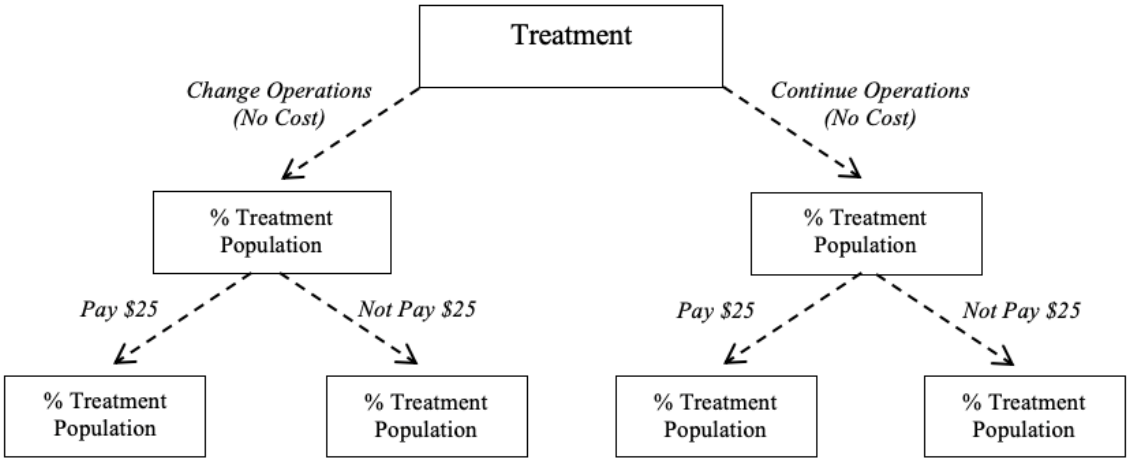

Figure 9. Decision of tree of respondents' preference for Glen Canyon Dam operational changes and associated willingness-to-pay (WTP) for preferences (adapted from Jones et al., 2016).

An example of survey input and questions are provided in the Appendix C. Ultimately, for each treatment group, respondents were categorized into four groups: voters for continued dam operation at no cost; voters for dam operational changes at no cost; voters for continued dam operation at a WTP of $25; voters for dam operational changes at a WTP of $25. Again, the purpose of this particular study was to

assess the general impact of non-use values on stakeholder preferences rather than deriving an actual WTP value for use in a benefit-cost analysis. The surveys administered by Jones et al. (2016) included several other questions related to political ideology, education level, extent of environmental concerns, and many other variables. While these variables could be used to address the values of particular stakeholder groups, Jones et al. (2016) used these attributes as control variables for their general analysis. A description of all control variables considered is listed in Figure 10.

Variable name	Description	Coding
IDEOL	Political ideology	1=strongly liberal; 2=liberal; 3=slightly liberal; 4=middle of the road; 5=slightly conservative; 6=conservative; 7=strongly conservative
ENV	Environmentalism index	1–5 scale; 1=low concern about the environment, 5=high level of concern about the environment
INDIV	Values competition and individualism	0–10 scale; 0=not at all, 10=completely
GOVT	Trust in gov't/authority and values group loyalty	0–10 scale; 0=not at all, 10=completely
HYDRO	Electricity from hydropower using dams is preferable	1=yes, 0=no
SHOULD	Officials should consider survey results	1=yes, 0=no
WILL	Believe officials will consider survey results	1=yes, 0=no
WTPPOLCY	Use of WTP is a "good way" to set env. policy	1=yes, 0=no
RESID-ENV	Do not trust residents to have well informed views on environment	0–10 scale; 0=completely disagree, 10=completely agree
TAXES	Believes currently pays too much in taxes	0–10 scale; 0=completely disagree, 10=completely agree
VISITEDGC	Visited the Grand Canyon in the past	1=yes, 0=no
PLANGC	Plan to visit the Grand Canyon	1=yes, 0=no
AGE	Age	Continuous
FEMALE	Female	1=yes, 0=no
INC	Income	Continuous
EDUC	Education	1=elementary/some HS; 2=HS grad/GED; 3=some college; 4=college grad; 5=some grad work; 6=master's degree; 7=doctorate degree
RURAL	Rural area	1=yes, 0=no
BLACK	Black	1=yes, 0=no
HISPAN	Hispanic	1=yes, 0=no

Figure 10. Additional attributes recorded in Jones et al. (2016) survey for use as Glen Canyon Dam non-market value analysis control variables (image adapted from Jones et al., 2016).

Overall, Jones et al. (2016) used the variables listed in Figure 10 for two primary purposes: to evaluate whether personal attributes impact non-market values and as control variables for non-market value analysis associated with each treatment group (i.e. survey information focused on negative impacts to air pollution, rural populations, and/or Native American groups).

C. Conclusions of the Case Study

Survey respondents who were exposed to treatments that emphasized negative impacts on Native Americans, rural communities, and air pollution were much less likely to support the proposed changes in dam operation regardless of personal attributes. Thus, even though the negative impacts discussed did not necessarily impact respondents directly, respondents placed value on these social and environmental issues. Jones et al.'s (2016) methodological approach to assessing non-market, non-use values associated with human-ecosystem tradeoffs is useful for understanding what social and environmental values are most salient to stakeholders of a particular project or policy. Further, researchers can utilize contingent

valuation methods for applying 'votes' and values into benefit-cost analyses and subsequent decision-making. While Jones et al. (2016) did not conduct this study explicitly following a particular framework, the outcomes and future applications of the analysis fits within the broad scope of the Collaborative Governance Framework.

D. CCS Applicability

The scope of Jones et al.'s (2016) analysis of non-market values associated with the Colorado River Glen Canyon Dam was broad and its purpose was generally exploratory (i.e. researchers were not seeking direct stakeholder perspectives or using contingent valuation to determine actual benefit-cost analysis implications of non-market values). However, the concept of eliciting the values and perspectives of stakeholders via contingent valuation and utilizing this data to inform decision-making has applicable implications for CCS project developers. To provide value to CCS stakeholder engagement efforts, a related study would differ from Jones et al. (2016) in the following regards: surveys should be administered to relevant stakeholders – such as local landowners, businesses, Federal partners, and community members related to a particularly CCS site – as opposed to a broad sample population; willingness-to-pay assessment should provide a range of dollar values rather than $0 or $25 only; and stakeholder attribute data should be utilized to assess the values of different types of stakeholders.

If an actual benefit-cost analysis is conducted for a particular CCS site, the non-market value data collected by contingent valuation methods could provide more representative results. Even if values are not used for a benefit-cost analysis, gaining an understanding about the prioritization, direction and strength of values held by a given stakeholder group through a quantitative means could enhance efforts for social site characterization and stakeholder engagement. In addition to providing an option for integrating a stakeholder 'vote' on project development activities, a survey similar to that of Jones et al. (2016) could measure the strength of stakeholder values and perspectives. Thus, the methods employed in this case study have significant application for integrating stakeholder values and perspectives into CCS project plans and goals.

Policy Conflict Framework Case Studies

The Policy Conflict Framework (PCF) is a recent development in policy framework literature. The building blocks providing the foundation of this framework draw heavily from the Advocacy Coalition Framework. Similar to the ACF, the PCF accesses policy beliefs and interactions between various coalitions within a policy subsystem; yet the PCF forms a critical extension beyond the ACF by directly focusing on conflict among policy coalitions. Sabatier & Weible (2014) note the importance of conflict in understanding coalition interactions and observe this limitation of the original ACF. The PCF extends from the ACF by encompassing valuable techniques for directly assessing the magnitude, variation, and source of conflict among coalitions within policy subsystems. Understanding the cognitive characteristics of conflict within a particular subsystem may be valuable for understanding the strength of coalition beliefs and the magnitude of belief variation between stakeholder groups. By articulating and quantifying specific components of policy conflict between coalitions, policymakers and project specialists have increased potential to improve stakeholder outreach initiatives.

Understanding Coalition Conflict

A. Case Overview

Due to the recency of the Policy Conflict Framework, few studies have yet to specifically utilize it. Literature involving the PCF is limited relative to other well-established policy frameworks; nonetheless, studies that have used this framework provide salient applications for assessing conflict related to controversial energy developments. Heikkla & Weible (2017) identified the PCF as a critical framework

for understanding coalition-level conflicts within the context of how Colorado develops its oil and gas resources. Recent growth in the oil and gas industry operating in Colorado has inflated conflicts between several stakeholder groups, such as industry coalitions, environmental groups, local homeowners, and government officials.

Through the lens of the PCF, this study sought to identify three features of policy conflict among stakeholder groups: willingness to compromise, level of perceived threats from rival opinions, and strength of political beliefs or convictions. Researchers assessed these specific attributes of policy conflict in relation to coalition identify and political affiliation. Further, the study considered level of education and experience in the oil and gas sector into account when measuring the strength of policy beliefs. Detailed assessment of factors that may influence policy conflict renders this particular study and the PCF generally as important considerations for social site characterization and stakeholder engagement applications in other contexts.

B. Methods

To inform the structure and questions included in the study's survey, Heikkla & Weible (2017) conducted nine interviews with individuals of various backgrounds relevant to the oil and gas subsystem in Colorado, such as those affiliated with the federal government, state and local government, industry, environmental nonprofits, and community landowners. Using the background information contributed by these interviewees, the survey was created in Qualtrics and emailed to 453 policy actors who are well informed and/or active in the oil and gas subsystem. The list of the survey population was created after researching online and media reports, as well as receiving recommendations from the individuals initially interviewed.

To address the willingness to compromise, level of perceived threats from rival opinions, and intensity of policy position divergence between actors, the survey asked as series of questions and assessed the intensity of policy beliefs by asking respondents to rank their responses on a scale of 1 to 5. In order to measure "divergent policy positions," survey questions involved current policy positions on hydraulic fracturing for oil and gas development. Options were ranked as "stop," "limit," "continue at the current rate," "expand moderately," and "expand extensively."

Next, researchers measured stakeholders' "perceived threats from opponents" by asking respondents to rank the extent to which opposing views of hydraulic fracturing "Threaten you personally and professionally" and "Threaten the state of Colorado." Finally, to assess stakeholder "unwillingness to compromise," respondents were provided with several "what-if" scenarios and asked if they would support expansion or government-imposed limitation of hydraulic fracturing under each. Based on respondents' original positions, researchers quantified the willingness to compromise according to these various "what-if" scenarios. The study also assessed perceived "risks relative to benefits" of hydraulic fracturing and the "rigidity" of those perceptions over time for each stakeholder.

To address policy conflict attributes on a coalition scale, this study examined the stakeholder group affiliation associated with each respondent. Further, Heikkla & Weible (2017) captured additional stakeholder traits, such as general political beliefs, "diversity of experience" with oil and gas issues, and level of education. A summary of traits assessed in this study is provided in Appendix D.

C. Conclusions

Heikkla & Weible (2017) found that the majority of policy conflict in the Colorado oil and gas subsystem was of low to moderate intensity. Indeed, 43 percent of respondents fell into the low end of the conflict intensity spectrum, while 21 percent were considered "moderate intensity" and 36 percent were labeled as "high intensity;" thus, the majority of respondents were not associated with the extremely rigid,

uncompromising image often portrayed in contentious oil and gas subsystems. Respondents who did indicate high levels of policy conflict characteristics were more likely to be associated with an organization, rendering interpersonal attributes a more informative indicator of conflict than intrapersonal attributes. However, one type of intrapersonal attribute was a significant indicator of conflict attributes: personal political ideology. In this analysis, individuals with more conservative political ideologies tended to indicate an increased willingness to compromise. Additionally, respondents who have elevated risk perception show an increased willingness to compromise.

Many of the findings in this study – particularly the finding that individuals with increased risk perception are more likely to show a willingness to compromise – were surprising to the researchers. While factors associated with policy conflict may often seem intuitive, heuristics for predicting conflict in a subsystem are commonly flawed. Unless an unbiased analysis focuses specifically on conflict within a particular policy subsystem, project and policy planners are likely to under or overestimate conflict levels and misconstrue conflict characteristics. Thus, the PCF presents an ideal model for directly assessing the intensity and characteristics within a subsystem. Because various stakeholder groups may feel particularly threatened by certain organizations and will likely vary in their willingness to compromise, a broadened understanding of policy conflict is valuable for selecting appropriate communication channels and discussion topics for stakeholder engagement initiatives.

D. CCS Applicability

Rather than taking policy conflict surrounding a particular CCS initiative as a given and using heuristics to create assumptions about the conflict characteristics of various stakeholder groups, project developers could utilize the PCF to develop a more representative understanding of conflict realities. Similar to the oil and gas subsystem of Colorado, CCS projects have stakeholders ranging from environmental groups and landowners to industry coalitions and government officials. Measuring the intensity of policy beliefs, perceived threats from opponents, and willingness to compromise of such stakeholder groups can aid in social site characterization, developing ideal outreach teams and strategies, and tailoring messages for particular stakeholder groups (NETL, 2017).

Further, project developers can utilize PCF findings to strategically plan stakeholder groups meetings. For instance, directly joining two stakeholder groups for public discourse will likely be much more productive if those particular stakeholder groups indicate low to moderate conflict intensity and are not in stark opposition to each other; here, stakeholders may be more likely to provide valuable concerns and perspectives, build mutual understanding, and bypass surface level conflicts.

Quantifying the strength of policy beliefs, perceived threats from opponents, and willingness to compromise among CCS stakeholders could be conducted by utilizing Heikkla & Weible's methodology as a blueprint. Designing "what-if" scenarios to measure willingness to compromise is particularly transferable to CCS initiatives. If new information would not modify a particular stakeholder's position whatsoever, then proper outreach initiatives could be targeted to focus on issues beyond basic facts. If this method is utilized, survey designers should be clear that the "what-if" scenarios are not meant to be factual or informative of the current situation; they are only to assess ones' initial opinion on CCS.

IV. COMPARATIVE ANALYSIS

Each framework and associated case studies provide unique insight for conceptualizing, planning, executing, and improving the process of CCS social site characterization and stakeholder engagement. However, as evident from the case studies provided, some frameworks have more relevancy to this process than others. The following comparative analysis will review each aforementioned framework, address strengths and weaknesses of each, and compare the effectiveness and efficiencies of each in

relation to CCS. This comparative analysis concludes with a table comparing the key questions, methodologies, and relative strengths and weaknesses of each framework and case study.

The ACF is a broad, well-established framework that served as a basis for additional questions that resulted in other policy frameworks, including the Narrative Policy Framework, Collaborative Governance Framework, and Policy Conflict Framework. The applicability of the ACF to CCS stakeholder analysis is clear through the research of Elgin & Weible (2013), which generally asks the following question: What are "the beliefs, networks, resources, and activities" of policy actors in the Colorado Oil and Gas Subsystem?

Through online surveys, researchers utilized the ACF and the Policy Analytical Capacity (PAC) protocol, which allowed them to assess general stakeholder beliefs and their aptitude for organizing and using information. Overall, Elgin & Weible's (2013) use of the ACF presents opportunities to address general questions regarding stakeholder concerns and perspectives, as well as information about coalition resources and their potential for influencing policy. Although applying a similar online survey methodology for addressing the general beliefs of CCS stakeholders would be efficient due to its relative simplicity, researchers may face practical difficulty in incentivizing completed survey responses. Further, it may be difficult to integrate the results of this type of study into decision-making or using results to improve stakeholder engagement protocols for CCS. While a combination of the ACF and the PAC could provide an initial overview of coalition structures and general beliefs of stakeholders relevant to CCS, it would likely be limited in its effectiveness in capturing nuanced viewpoints.

This analysis examined two case studies that applied the NPF. The first case assessed the narratives utilized by coalitions relevant to offshore wind development (Shanahan et al., 2013), and the second identified narratives that were most commonly shared between stakeholders of different backgrounds (McBeth et al., 2017). Shanahan et al. (2013) developed a NPF codebook for analyzing narratives found in public media; this resource can be used by other researchers as a straightforward, inexpensive tool for characterizing existing narratives surrounding an issue. While understanding existing narratives is valuable for characterizing local coalition values and planning future communication initiatives, this application of the NPF does not elicit nuanced perspectives and concerns from stakeholders.

McBeth et al. (2017) utilized the NPF by way of online survey methodologies. By evaluating stakeholder responses to "Duty-Based" and "Engaged Citizen" narratives, as well as a "science statement," researchers found that the majority of respondents found the "Duty-Based" narratives to be the most generally agreeable. Thus, McBeth et al.'s application of the NPF is a valuable tool for identifying minimally divisive narratives for use in wide-spread public communication. Further, this analysis identifies the narratives most preferred by certain constituents, which could allow messaging to be tailored to specific stakeholder groups. However, similar to Shanahan et al.'s (2013) use of the NPF, identifying preferred narratives alone does not intrinsically elicit project-specific concerns of stakeholders. In sum, CCS projects would benefit from using the NPF in their social site characterization phase due to its efficiency and effectiveness in analyzing essential narratives used for communication. NPF results may be used to inform stakeholder engagement plans aimed at effectively eliciting stakeholders' nuanced perspectives and project-specific viewpoints

The CGF is a fairly broad framework for assessing social learning, conflict resolution, and decision-making related to collaborative processes. This report examined two case studies that fell within CGF boundaries: a process for organizing and evaluating the effectiveness of collaborative roundtable discussions (Cuppen, 2012), and a method for quantifying and integrating collaborative social values into decision-making (Jones et al., 2016). Cuppen (2012) used to two methods – including the Q-Methodology and the Constructive Conflict Methodology – to carefully organize and evaluate a Biomass Dialogue with relevant stakeholders. These methodologies were valuable for eliciting stakeholder beliefs through

qualitative interviews, using such information quantitatively to carefully plan collaborative roundtable discussions, and to evaluate the outcomes of the Biomass Dialogue. Thus, this study presented a highly effective method to elicit stakeholder concerns and perspectives. However, if conflicts between opposing stakeholder groups are extreme, this type of collaborative exercise may be counterproductive.

Jones et al. (2016) presented a unique opportunity to quantify stakeholder values and incorporate those values into project benefit-cost analyses, creating an opportunity for collaborative decision-making. This study used contingent valuation – a survey method to evaluate non-market values of stakeholders in benefit-cost analyses – to quantify elusive stakeholder values. In addition to asking respondents to vote 'yes' or 'no' for certain hydropower management changes, Jones et al. (2016) requested participants' willingness to pay (WTP) for their particular choice. Such WTP numbers could be utilized as proxies for the strength of stakeholder values or they could actually be considered as benefits and costs in project benefit-cost analysis.

This type of CGF analysis would provide a quantitative method to measure stakeholder concerns and perspectives and could provide opportunities for collaborative decision-making. However, asking respondents to rank their WTP is extremely subjective and could be easily manipulated. Overall, the CGF is broader and less tangible than the other frameworks; thus, it may be more complicated and less efficient to apply to CCS stakeholder engagement efforts directly. However, if the CGF is paired with a specific methodology – such as the Q-Methodology or contingent valuation – it presents a unique and highly effective opportunity for managing collaborative discussions and decision-making.

The PCF is the most recent application in the policy framework literature reviewed throughout this report. In the only official PCF publication to date, Heikkla & Weible (2017) used this recently developed framework to measure the intensity of policy conflict, level of perceived threats, and willingness to compromise among stakeholder coalitions in Colorado's oil and gas subsystem. Using a combination of qualitative interview and survey methods, this study presented examples for measuring willingness to compromise among stakeholders and the level of conflict between certain coalitions. The PCF would be very valuable and efficient for understanding conflict intensity prior to CCS project public meetings and managing CCS stakeholder outreach initiatives. Because the applicability of this framework to CCS efforts is focused on measuring and understanding CCS-related stakeholder conflict intensity, it is limited in that it would not be effective for directly eliciting CCS stakeholder concerns and perspectives. However, the PCF could provide valuable insight to CCS stakeholder dynamics and would contribute to CCS stakeholder opinion elicitation if paired with additional frameworks and methodologies.

Each framework assessed could be used to address some of the unique questions relevant to CCS stakeholder analysis and social site characterization, though each framework can vary in its scope and the complexity of its assessment. These frameworks and methodologies differ primarily in how directly they elicit and incorporate stakeholder concerns and opinions into their particular style of analysis, as well as how time-consuming and costly each framework may be to practically implement an assessment of stakeholder values. In general, the frameworks are similar in their focus on subsystem and coalition level issues. The frameworks broadly differ in the following ways: the ACF is a foundational framework for assessing coalition dynamics generally; the NPF is a more tailored application of the ACF and focusses on how narratives shape and are shaped by society; the CGF is arguable the most broad framework analyzed as it largely assesses collaborative learning, dispute resolution, and cross-coalition decision-making; and the PCF is another tailored application of the ACF that focuses on the magnitude of conflict in a policy or project process.

Overall, the NPF and PCF provide important preliminary steps to characterize project narratives and to quantify the intensity of conflict among stakeholder coalitions, respectively. These frameworks are very valuable for social site characterization which can inform plans for stakeholder engagement, but they

are unlikely to directly elicit nuanced perspectives from stakeholders. Although the ACF and the CGF are much broader than the NPF and PCF, these wide-ranging frameworks are more likely to directly elicit stakeholder concerns and perspectives.

CGF-related research by Cuppen (2012) is particularly valuable for direct stakeholder engagement. This study used a combination of methods that included numerous qualitative interviews, collaborative discussions among stakeholders of varying perspectives, and survey methodologies to quantify success of a collaborative dialogue event. However, CGF-type analyses may be especially time-consuming and expensive to implement; a similar study would require many in-person interviews and funds to support a collaborative dialogue event. Thus, an application of the CGF would likely be less efficient than the methodologies used in other frameworks. Because Shanahan et al. (2013) developed a codebook for analyzing narratives in public content, a content based NPF study would likely be the least demanding and most efficient analysis of the cases presented above.

Table 5 presents a summary of the frameworks and case studies analyzed. The Advocacy Coalition Framework and the Policy Conflict Framework have only one associated case study each, whereas the Narrative Policy Framework and Collaborative Governance each have two associated case studies. For each case study, the key questions, methods, advantages, and challenges are discussed.

Table 5. Summary of Case Studies

Framework	Case Study Source	Key Questions	Methods	Advantages	Challenges
Advocacy Coalition (ACF)	Elgin & Weible, 2013	What are "the beliefs, networks, resources, and activities" of policy actors in the Colorado Oil and Gas Subsystem?	- Online surveys. - Policy Analytical Capacity (PAC) protocol.	- Straightforward method for assessing general stakeholder opinions and coalition resources.	- May be difficult to incentivize survey completion. - Unclear methods for incorporating responses into decision-making and stakeholder engagement plans.
Narrative Policy (NPF)	Shanahan et al., 2013	What narrative elements do different offshore wind power stakeholder coalitions employ?	- Online content analysis. - Codebook designed specifically for the NPF.	- Low cost method to identify narratives utilized by existing coalitions. - Researchers can use developed codebook to evaluate a variety of public media sources.	- Content analysis alone does not necessarily capture nuanced concerns and perspectives of stakeholders.
	McBeth et al., 2017	What narrative elements are least divisive among various stakeholders?	- Online surveys. - Asked respondents to rank support for "Duty-Based" and "Engaged Citizen" narratives.	- Very valuable for crafting public messaging. - Communicating through minimally divisive language could increase stakeholder willingness to engage.	- Does not capture specific concerns and perspectives of stakeholders.

Collaborative Governance (CGF)	Cuppen, 2012	How do collaborative dialogue sessions influence social learning, mutual understanding between stakeholder groups, and elicitation of concerns and perspectives?	- Q-Methodology. - Constructive Conflict Methodology - Combination of surveys and roundtable discussions.	- Beneficial for carefully organizing collaborative discussions and quantifying success. - Could be applied to the "large group process" literature related to CCS (Ashworth et al., 2009).	- Potential for conflict if participating stakeholders hold extremely different viewpoints. - Very complex, time-consuming, and likely expensive to implement.
	Jones et al., 2016	How can stakeholder values be quantified and incorporated into decision-making?	- Online survey/ Contingent valuation - Benefit-Cost Analysis	- Opportunity to integrate stakeholder non-market values into project benefit-cost analyses.	- Accurate valuation of stakeholders' values is subjective and would require a large sample size for use in an actual benefit-cost analysis.
Policy Conflict (PCF)	Heikkla & Weible, 2017	What is the intensity of policy conflict, level of perceived threats, and willingness to compromise among stakeholder coalitions in Colorado's oil and gas subsystem?	- Qualitative interviews. - Online surveys.	- Ability to assess how likely certain stakeholder groups are to compromise. - Quantifies intensity of conflict between coalitions, which would be valuable for mitigating conflict in collaborative discussions.	- Assessing conflict intensity and willingness to compromise does not directly elicit stakeholder concerns and perspectives.

V. DISCUSSION

Climate change poses eminent threats to environmental and human health, necessitating effective and timely greenhouse gas mitigation responses globally. Large-scale deployment of CCS technologies present potential to lesson climate change risks while maintaining a diverse energy portfolio (Leung, 2014). Advancement in technologies and methods for physical site characterization is critical for the economic viability and safety of wide-spread CCS development. However, all physical CCS facilities lie within complex socio-political settings that have potential to disrupt project development regardless of physical site feasibility. Long-term success of CCS ventures will require the active involvement of a variety of types of stakeholders and the overall social acceptance of different community members and coalitions.

Understanding and managing the diverse and intangible beliefs and values of various communities is extraordinarily complex. Beyond the assessment of quantitative factors, such as demographic data and socioeconomic trends, CCS project developers and regulators must also analyze local community ties, trust, media influence, and fundamental views of a community (Ashworth et al., 2011). Effective social site characterization informs the coordination of outreach initiatives to elicit and incorporate the concerns and perspectives of stakeholders. Because CCS technologies are widely unknown or misunderstood by the general public, community perceptions and trust of a particular CCS project will likely be profoundly impacted by stakeholder engagement quality (L'Orange Seigo et al., 2014).

According to NETL (2017), essential elements for CCS project success include the strategic organization of outreach programs and the development of tailored messaging to unique audiences. Conceptually, understanding the beliefs of stakeholders, developing strong outreach teams, and crafting public messages may seem straightforward. In practice, however, characterizing the beliefs of various stakeholders and making informed program management decisions based on research findings is difficult. Therefore, CCS projects would greatly benefit from the use of theoretically grounded frameworks aimed at understanding dynamic stakeholder beliefs and incorporating public input into decision-making. With regard to CCS, an optimal framework or combination of frameworks would be effective at capturing nuanced perspectives, have a means to incorporate findings into stakeholder engagement and decision-making process, and be reasonably efficient and practical to apply.

Assessing individual CCS project stakeholder issues requires frameworks with a narrowed scope tailored to subsystem-level issues. As such, this report focused on the following policy frameworks and their applicability to CCS social site characterization and stakeholder engagement initiatives: the Advocacy Coalition Framework (ACF), Narrative Policy Framework (NPF), Collaborative Governance Framework (CGF), and Policy Conflict Framework (PCF). This report utilized case studies related to each framework in order to elucidate the value of each to CCS stakeholder issues.

Ultimately, the frameworks and associated case studies assessed fall into two categories: (1) preliminary social site characterization techniques to inform methods for engagement and (2) conceptual foundations to elicit stakeholder concerns and perspectives. The ACF, NPF, and PCF fall into the former category (1), while the CGF broadly falls into the latter (2). Frameworks aimed at social site characterization contain methods to understand the identities and experiences of individuals that construct coalitions; procedures to categorize the narratives utilized by existing coalitions and the influence of narratives on the core beliefs of stakeholders; and techniques to assess the dynamics within and between coalitions. Within this category, the ACF differs from the NPF and PCF in that it contains less specific methodologies, it is much more broad, and it served as a foundation for the NPF and PCF. In sum, the NPF and PCF can be considered as extensions of the ACF designed to address more specific issues impacting coalitions.

The Collaborative Governance Framework is unique from the other three frameworks analyzed due to its focus on collaborative learning, dispute resolution, and cross-coalition decision-making. Thus, CGF is particularly valuable for directly eliciting concerns and perspectives of stakeholders, whereas the ACF, NPF, and PCF are generally more useful for characterizing existing stakeholder dynamics, narrative preferences, and coalition conflict. The literature directly defining the CGF provides a broad framework definition and set of assumptions, but it does not specify or suggest specific methodologies to operationalize CGF-related research. Thus, the CGF is effective at eliciting nuanced concerns and perspectives, but the ACF, NPF, and PCF may be more efficient in terms of direct framework applicability and relative ease in research design.

Each framework and associated case study discussed throughout this report is uniquely suited for CCS social site characterization and stakeholder engagement. In order to illustrate the value of the ACF to CCS stakeholder analysis efforts, this report utilized research conducted by Elgin & Weible (2013). Here, researchers used the ACF to quantify the "beliefs, networks, resources, and activities of policy actors" relevant to energy practices within Colorado. Due to the focus of this case study on energy-related practices and the identification of stakeholders across government, business, nonprofit, and academic fields, it is particularly applicable to CCS stakeholder issues. In addition to identifying climate change beliefs and political ideologies among stakeholder groups, analysis of each coalition's ability to sway policy by way of relevant education, technical skills, and priority level of energy-related issues to each coalition aided in characterizing how each coalition could shape policy outcomes. In sum, CCS project experts seeking to characterize general coalition beliefs and potential likelihood to sway project outcomes could emulate Elgin & Weible's (2013) ACF work, providing an effective and efficient application for the CCS social site characterization.

The NPF could serve several distinct purposes, such as analyzing the existing narratives employed by coalitions, identifying minimally divisive narratives for public communication efforts, and analyzing the risk perception of various individuals. Each use of the NPF is valuable for CCS social site characterization and stakeholder engagement. Shanahan et al. (2013) utilized the NPF to analyze media narratives by coalitions supporting and opposing the Cape Wind offshore wind energy project. Because CCS is not well understood by many individuals, media narratives will likely have a strong impact on public views of CCS projects. Therefore, analyzing narratives used by opposing coalitions would be instructive for addressing CCS stakeholder concerns.

As evident by McBeth et al. (2017), the NPF may also be used to determine narrative elements with which certain stakeholder coalitions most identify. Because the development of trust between CCS project experts and the public necessitates clear and consistent messaging (Greenberg et al., 2011), the NPF could be used to effectively and efficiently incorporate minimally divisive narratives for overall public communication efforts. Although the NPF is limited in that it does not elicit nuanced, project-specific concerns and opinions from stakeholders, information gathered about the narratives preferred or used by stakeholders could be informative for understanding risk perception of different coalitions. Because narratives presented to CCS stakeholders would likely involve various narratives around climate change, analysis of risk perception via the NPF would be particularly informative about global environmental risk perception.

The CGF is most applicable to CCS stakeholder engagement efforts when performed in a similar manner to applications done by Cuppen (2012) where researchers used the Q-Methodology – a mechanism to select stakeholders, categorize initial subgroups, and quantify changes in opinion following collaborative discussions sessions – as a tool to operationalize collaborative governance analysis. Here, researchers utilized concepts from the CGF and Q-Methodology to develop, organize, and evaluate the effectiveness of a collaborative program aimed at influencing social learning, mutual understanding between stakeholder groups, and elicitation of concerns and perspectives related to bioenergy policy in

the Netherlands. CCS projects would benefit from using a similar process in order to strategically gather stakeholder groups, elicit nuanced perspectives, and use findings to guide adaptability in project plans. Large group discussions regarding CCS have already been promoted as an effective means of CCS stakeholder engagement (Ashworth et al., 2009); thus, application of the CGF's theoretical foundations alongside practical Q-Methodology tools would effectively enhance the overall "large group process" form of stakeholder engagement. However, the CGF is complex and time-consuming to implement, making it the least efficient framework analyzed for CCS efforts.

The PCF includes straightforward methodologies to analyze coalition dynamics (Heikkla & Weible, 2017). Specifically, the PCF focuses on understanding conflict between and within coalitions. Most importantly for CCS stakeholder analysis, CCS project experts can us the PCF to measure the magnitude of policy conflict within a community and identify the reasons for conflict between certain actors. CCS researchers can use the PCF to provide quantitative backing to conflict assumptions, informing crucial social context questions by explaining how intense division is between stakeholder groups (Ashworth et al., 2012). Findings from the PCF would direct efforts to organize outreach teams by aligning tailored outreach teams to certain stakeholder groups in order to minimize conflict (NETL, 2017). CCS project experts could also use the PCF to organize outreach programs, specifically those that bring multiple stakeholder groups together. For instance, findings from the PCF could inform the seating arrangement at informational sessions where numerous diverse stakeholder groups are present. Although results from the PCF may inform stakeholder engagement issues, it is not effective at directly eliciting stakeholder concerns and perspectives.

Each framework analyzed has potential to address unique questions regarding CCS stakeholder issues. However, the NPF and the CGF show particular promise because of the NPF's focus on coalition narratives and the CGF's applicability in eliciting nuanced perspectives. Identifying narratives preferred or vocalized by certain stakeholder groups can serve several purposes for CCS social site characterization. Understanding what and how to communicate with stakeholders (Ashworth et al., 2012), creating key messages (Greenberg et al., 2011), and developing tailored outreach programs (NETL, 2017) are all related to the core beliefs imbedded in narratives. Therefore, the NPF has potential to guide several CCS outreach objectives simultaneously. Literature that characterizes optimal CCS stakeholder outreach programs also emphasize the value of large group discussion processes and the importance of adaptive management (Ashworth et al., 2009; NETL, 2017). Theoretical backing of the CGF in addition to the utility of the Q-Methodology could render such group processes more effective.

Because Shannahan et al. (2013) have produced an easy-to-follow codebook (Appendix B) that researchers can use to review the narratives utilized in numerous types of written and media content by stakeholder coalitions, the NPF is fairly inexpensive and straightforward. For specific CCS projects, researchers could use this NPF codebook to identify narrative elements from local sources. For instance, researchers could analyze news articles and videos, public commentary, and blogs by local stakeholders to gain a clearer picture about how narratives are shaping public opinion about a particular CCS project. Additionally, because national media is likely to shape local opinion, this form of meso-level NPF analysis could also be conducted on content published by prominent supporting and opposing CCS coalitions nationally.

Conducting the NPF on a micro-level scale similar to McBeth et al. (2017) could guide the design of consistent and minimally divisive public messaging (Appendix B). After identifying a range of relevant CCS stakeholders from different backgrounds, researchers could create and distribute an online survey that asks respondents to choose from a series of narratives that differ in the amount of scientific data included, the heroes and victims presented, and overall plot based on which narrative they most identify with. For instance, narratives could differ in their emphasis on climate change mitigation versus local economic benefits as the story's "hero." Stakeholder narrative preferences would allow CCS project

experts to craft the least controversial messages possible for public statements and inform tailored outreach communications to specific stakeholder groups.

The CGF and Q-Methodology would advance a large group process for CCS stakeholder engagement. Following the workflow of Cuppen (2012), CCS researchers could first use the Q-Methodology to conduct qualitative interviews from a range of stakeholder groups. Drawing common types of statements based on qualitative interviews would then direct the creation of an online survey about stakeholder opinions on a range of CCS issues. Stakeholders that respond to the online survey may then be invited to participate in a large group discussion process, similar to Cuppen's (2012) "Biomass Dialogue." Stakeholder opinion data gathered from the online surveys could direct organization of the collaborative dialogue session; for instance, seating placement could begin with positioning stakeholders with similar beliefs next to each other toward the beginning of the session to minimize initial conflict, and then gradually mingle stakeholders with divergent views. Post-dialogue sessions surveys may then serve to quantify the success of the large group process in terms of building mutual understanding and eliciting stakeholder concerns in an effective manner.

Although some frameworks specify more tangible methodologies than other, all frameworks provide researchers with a blueprint to form hypotheses and take actionable steps to understand complex social phenomena (Sabatier & Weible, 2014). Frameworks should be chosen according to the scope, timeline, and central questions of a research project. While the ACF, NPF, CGF, and PCF all fit within the subsystem scope and timeline of CCS development projects, they all differ with regard to central questions addressed. Therefore, CCS researchers must decide what questions regarding stakeholder dynamics are most important to their specific projects. By complementing CCS stakeholder analysis best practices with theoretical policy frameworks, project developers will be better suited to manage the intricate and dynamic social dimensions of CCS development that may inevitably disturb CCS physical site progress.

VI. CONCLUSIONS

Carbon capture and storage technologies present emerging opportunities for climate change mitigation. While scientific research and physical site characterization are essential for CCS success, failure to incorporate social site characterization and stakeholder engagement initiatives may hinder the promise of CCS. Overall, this report summarized relevant social policy frameworks that CCS project specialists may utilize to assess stakeholder coalition dynamics, organize outreach initiatives, and elicit the concerns and perspectives of various stakeholders.

Based on what is understood to be the most relevant to CCS projects, this report concludes that frameworks should focus on the "subsystem level of analysis" to analyze stakeholders who compromise coalitions. All of the frameworks assessed, including the Advocacy Coalition Framework, Narrative Policy Framework, Collaborative Governance Framework, and Policy Conflict Framework, are applicable for assessing the social aspects of CCS developments; decisions to utilize one of these frameworks over another depends on the central research questions sought. In this regard, each framework differs in its relative effectiveness and efficiency with respect to social site characterization and stakeholder engagement.

Although each framework assessed provides unique analytical benefits, the Narrative Policy Framework and the Collaborative Governance Framework may be particularly suited for evaluating the social aspects of CCS efforts. The Narrative Policy Framework can be conducted via individual narratives (micro-level) or coalition narratives (meso-level), it is straightforward with many clear "codebooks" already available, and it can answer the following essential questions: How and what should be

communicated to stakeholders? What narratives are optimal for public messaging? What may constitute a good outreach team and program? Understanding narratives by way of the Narrative Policy Framework may also elicit risk perception information from relevant stakeholders. Thus, the Narrative Policy Framework is very efficient due to the relative ease of gathering large quantities of narrative information and is effective for social site characterization.

The Collaborative Governance Framework is more conceptual than the Narrative Policy Framework. It must be paired with a specific methodology – ideally the Q-Methodology – to be operationalized. Pairing the Collaborative Governance Framework with the Q-Methodology would inform and enhance the "large group process" concept that Ashworth et al. (2009) emphasized for CCS stakeholder engagement. When paired with a specific methodology, the Collaborative Governance Framework is effective at directly eliciting stakeholder concerns and perspectives; however, organizing complex collaborative discussion sessions is arduous and may be less efficient than other frameworks. In sum, although each framework has varying levels of effectiveness and efficiency, integration of policy frameworks into the CCS social site characterization and stakeholder engagement process is key in improving overall project success.

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VIII. APPENDICES

Appendix A: Advocacy Coalition Framework Image Excerpts

Table 3. Coalition Policy Core Beliefs

	Anticlimate Change Coalition				Proclimate Change Coalition			
	Government	Business	Nonprofit	Academic/Research	Government	Business	Nonprofit	Academic/research
Severity of predicted impacts is overstated***	−0.25	−1	−0.57	0	1.57	1.59	1.66	1.61
Human behavior is the principal cause***	0.67	0.66	1.14	0.14	−1.48	−1.34	−1.60	−1.35
Decisions on climate & energy are best left to the market***	0.17	−0.24	−0.86	0.43	1.45	1.48	1.47	1.52
Carbon tax is required***	1.58	1.07	1.57	0.71	−1.01	−1.02	−1.04	−1.03
Cap & trade is required***	1.58	1.24	1.43	1.29	−0.42	−0.67	−0.26	−0.10
Renewables policy is required***	0.00	0.41	0.86	0.14	−1.60	−1.48	−1.72	−1.77

Note: Independent samples Kruskal–Wallis test with significance levels at ***p < .001.
Policy core beliefs scale: −2 = "strongly agree," −1 = "agree," 0 = "neither agree nor disagree," 1 = "disagree," 2 = "strongly disagree."
p < .05 difference between organizations in the anticlimate change coalition on severity of climate change.

Table 4. Coalition Member's Interactions

	Anticlimate Change Coalition				Proclimate Change Coalition			
	Government	Business	Nonprofit	Academic/Research	Government	Business	Nonprofit	Academic/Research
Collaboration patterns with similar beliefs**	Monthly	Weekly	Weekly	Weekly	Weekly	Weekly	Weekly	Weekly
With opposite beliefs	Monthly	Monthly	Monthly	Weekly	Monthly	Monthly	Monthly	Monthly
Percent of coalition members who participated in coalition building in the past year*	75%	76%	71%	43%	84%	84%	98%	81%

Note: Independent samples Kruskal–Wallis test between coalitions with significance levels at *p < .05, **p < .01.
There is a p < .05 difference between organizations in the anticlimate change coalition on severity of climate change.

Table 5. Individual Policy Analytical Capacity of the Coalitions

	Anticlimate Change Coalition				Proclimate Change Coalition			
	Government	Business	Nonprofit	Academic/Research	Government	Business	Nonprofit	Academic/Research
Education†	4.83	5.21	5	5.33	4.78	5.11	4.77	5.42
Years of experience‡	3.08	4.03	3.14	2.83	2.88	3.11	3.57	3.23
Percent of affiliation members who have received formal training:								
Statistics*	67%	52%	43%	100%	48%	38%	36%	55%
Modeling*	50%	34%	0%	71%	22%	26%	19%	19%
Training in applied research	42%	21%	14%	71%	36%	34%	19%	65%
Policy evaluation	33%	45%	43%	14%	48%	52%	34%	42%
Trends analysis	33%	38%	14%	43%	27%	28%	15%	26%
Policy analysis*	25%	34%	43%	14%	48%	57%	47%	48%

Note: Independent samples Kruskal–Wallis test with significance levels at *p < .05.
†Education scale: 1 = "not a high school graduate," 2 = "high school graduate," 3 = "some college," 4 = "bachelor's degree," 5 = "master's or professional degree," 6 = "PhD, MR, or JD."
‡Years of experience scale: 1 = "less than 1 year," 2 = "1–5 years," 3 = "6–9 years," 4 = "10–14 years," 5 = "15–20 years," 6 = "greater than 20 years."

Table 6. Organizational Policy Analytical Capacity of the Coalitions

	Anticlimate Change Coalition				Proclimate Change Coalition			
	Government	Business	Nonprofit	Academic/Research	Government	Business	Nonprofit	Academic/Research
Organizational priority†	2.5	3.93	3.57	3.43	3.34	3.78	4.09	4.00
Adequate knowledge, skills, and people‡	3.00	4.00	3.71	3.57	3.38	3.81	3.72	4.17
Urgent day-to-day issues take precedence§*	4.17	3.41	3.71	3.29	3.82	4.03	3.87	3.87

Note: Independent samples Kruskal–Wallis test between and within coalitions, with significance levels at *p < .05.
†Scale: 1 = "much lower," 2 = "lower," 3 = "about the same," 4 = "higher," 5 = "much higher."
‡Scale: 1 = "very low capacity," 2 = "low capacity," 3 = "medium capacity," 4 = "high capacity," 5 = "very high capacity."
§Scale: 1 = "strongly disagree," 2 = "disagree," 3 = "neutral," 4 = "agree," 5 = "strongly agree."

Table 7. Activities and Strategies of the Coalitions

	Anticlimate Change Coalition				Proclimate Change Coalition			
	Government	Business	Nonprofit	Academic/Research	Government	Business	Nonprofit	Academic/Research
Percent of affiliation members who have participated in these activities in the past year:								
Implemented policies or programs	83%	34%	57%	14%	72%	48%	62%	52%
Appraised policy options	75%	48%	57%	43%	64%	60%	70%	52%
Informed officials	75%	66%	86%	29%	81%	66%	83%	65%
Evaluated policy processes, results, and outcomes	67%	59%	71%	71%	73%	64%	62%	58%
Consulted with the public	67%	55%	43%	71%	72%	60%	81%	61%
Negotiated in a multistakeholder consensus-based process	42%	66%	57%	14%	54%	57%	62%	42%
Conducted climate/energy research	33%	66%	71%	86%	54%	59%	66%	90%

Note: $p < .05$ difference among organizations in the anticlimate change coalition on implementation.
$p < .05$ difference among organizations in the proclimate change coalition on conducting research.

Appendix B: Narrative Policy Framework

Shanahan et al. (2013) Example NPF Codebook

Policy narrative number:_____Date of narrative (month and year):_____Coder initials:_____
Advocacy Coalition: Pro-Wind Farm Coalition_____Anti-Wind Farm Coalition_____
Group or individual within the coalition authoring the policy narrative:_____
Document type (circle one): press release; newsletter; editorial; *YouTube*; speech; other:_____

CORE STORY ELEMENTS

1. HERO/ALLY. Who is/are the direct or implied hero(es)/allies identified in the narrative? _____ TOTAL
   _____1a. business/industry is hero:
   _____1b. conservationists/environment is hero:
   _____1c. government/public sector is hero:
   _____1d. cultural/historical concerns is hero:
   _____1e. other heroes not in above categories:
2. VILLAIN. Who is/are the direct or implied villain(s) identified in the narrative?
   _____TOTAL
   _____2a. business/industry is villain:
   _____2b. conservationists/environment is villain:
   _____2c. government/public sector is villain:
   _____2d. cultural/historical concerns is villain:
   _____2e. other villains not in above categories:
3. VICTIM. Who is/are the direct or implied victim(s) identified in the narrative?
   _____TOTAL
   _____3a. wildlife/nature/environment is/are victim(s):
   _____3b. economic concerns is/are the victim(s):
   _____3c. cultural/historical concerns is/are victim(s):
   _____3d. other human concern(s) is/are victim(s):
   _____3e. both bio and anthropocentric
4. STORY TYPE.
   Does the narrative have a story type(s)? Yes or No
   If yes, what kind?
   a) stymied progress; b) story of decline; c) change-is-only-an-illusion; d) helplessness and control; e) conspiracy; f) blame-the-victim; g) truth claim; h) victory
5. CAUSAL MECHANISM.
   Does the narrative have direct or implied causal theory/theories? Yes or No
   If yes, what kind?
   a) intentionality; b) mechanical; c) inadvertence; d) accidental
6. SOLUTION.
   Does the narrative offer a policy solution? Yes or No
   If yes, what is the solution?
7. SCIENCE/EVIDENCE.
   Is science/evidence cited in the narrative? Yes or No
   If yes, what science is being used?
   Is the science used to a) support their argument, b) refute an argument, or c) matter-of-fact

POLICY NARRATIVE STRATEGIES

8. COSTS.
   a. Does the narrative imply or suggest that there are costs to their policy solution?
   If yes, who/what entities bear the bear the cost(s)?
   Are the costs a) concentrated or b) diffused?

   b. Does the narrative imply or suggest that there are costs to the opposed policy solution?
   If yes, who/what entities cost(s)?
   Are the costs a) concentrated or b) diffused?

9. BENEFITS.
   a. Does the narrative imply or suggest that there are benefit(s) to their policy solution?
   If yes, who/what entities bear the benefit(s)?
   Are the benefit(s) a) concentrated; b) diffused?

   b. Does the narrative imply or suggest that there are benefit(s) to the opposed policy solution?
   If yes, who/what entities bear the benefit(s)?
   Are the benefit(s) a) concentrated; b) diffused?

10. STANCE. On the whole, what kind of policy stance does the document or video portray or construct?
   a) winning stance (winning the "war")
   b) winning the battle, losing the war
   c) losing stance
   d) can't tell
   e) no stance
   f) projected to win

McBeth et al. (2017) Survey Narratives Example

Narratives Presented in Survey:

Account #1

Groups in southeast Idaho are currently working to improve water quality, water quantity, and recreational opportunities along the Portneuf River. For too long, the Portneuf River has been neglected and it is the individual responsibility of southeast Idaho citizens to assist in the economic restoration of the river. A polluted and channelized river harms local recreation users and businesses that depend on tourism. Groups that are working to restore the river to health are exercising good business sense and river restoration is an efficient way to better use our local resources. Local groups can take the lead in restoring the river as for too long, the federal government through the Corp of Engineers has had too much say in the river's management.

Account #2

Scientific evidence suggests the Portneuf River, as it passes through Pocatello, is ecologically impaired and does not meet standards guaranteed under the Clean Water Act. This evidence, which has existed for decades, includes chronically high levels of fine sediment and periodically elevated levels of bacteria, both conditions that may be exacerbated by the channelized state of the river and the low flows that typically occur in late summer. Therefore, sound ecological science supports the efforts by some community groups to restore the Portneuf River. If restoration efforts are coupled with ongoing monitoring of the river ecosystem, scientists will be able to evaluate whether these activities are successful. If they are successful, then the ecological state of the river should improve.

Account #3
Groups in southeast Idaho are currently working to improve water quality and water quantity in the Portneuf River in order to benefit the larger ecosystem and community. For too long, the Portneuf River has been neglected. Groups working to restore the Portneuf River are demonstrating good global citizenship, providing an excellent way for individuals to get involved in their community, and fight the adverse consequences of climate change. A polluted and channelized river harms living creatures such as fish, birds, and other organisms that are important for river biodiversity. For too long, industries and other economic interests have harmed the Portneuf River.

Survey Questions:
1-Which is these accounts do you most agree with and why? (note, you might not agree with the entire account but what one do you like the most overall?)
2-Which account do you think the general public in southeast Idaho would be most attracted to and why? What account do you think the general public would be least attracted to and why?
3-Which account of the river would get the most people involved and wanting to restore the river?
4-Do you think if decision makers used the narrative of your choice that they would be reaching out to get larger groups involved or would they be trying to "sell" the public by using a narrative that the public likes?

Appendix C: Collaborative Governance Framework

Jones et al. (2016) Example Survey Questions

"Government officials will consider many factors when deciding whether or not to change dam operations. One factor they would like to consider in whether various options are personally worthwhile to people like you. In the next question, we will describe the effects of two specific options being considered for dam operations. We would like you to tell us which of these two options you would prefer. People might consider several factors when deciding which option, they prefer, including the cost of each option and the expected effects of each option."

Option 1	Option 2
Dam operations would be changed to achieve a moderate reduction in the daily fluctuations in the river level. This option will result in the following conditions along the Colorado River in the Grand Canyon, and in affected communities:	**The dam would continue to be operated as it has in the past. This option will result in the following conditions along the Colorado River in the Grand Canyon and in affected communities:**
A continued modest decline in the number and size of beaches	A continued decline in the number and size of beaches
Lower risk of erosion to Native American traditional-use areas, sacred sites, and archeological sites	Higher risk of continued erosion to some of the Native American traditional-use areas, sacred sites, and archeological sites
Increase in the area available for vegetation of about 10%, so that the area available for birds and other forms of wildlife would increase by about 10%	A decrease in the area available for vegetation in the Study Area of about 10%, so that the area available for birds and other forms of wildlife would decrease by about 10%
A small improvement in conditions for native fish, but these populations, including those in danger of extinction, would probably continue to decline in numbers	A small deterioration in conditions for native fish. These populations, including those in danger of extinction, would probably continue to decline in numbers
A small improvement in conditions for trout, but stocking of trout would still be required to maintain the population	A small deterioration in conditions for trout. Stocking of trout would still be required to maintain the population
Higher electricity bills for the 1.5 million households receiving power from Glen Canyon Dam. On average, the electricity bills will be $5 higher per month	Lower electricity bills for the 1.5 million households receiving power from Glen Canyon Dam. On average, the electricity bills will be $5 lower per month
No average change in farm in- come, but about 300 farmers in southern Utah would see their incomes drop by 3%	No average change in farm in- come, but about 300 farmers in southern Utah would see their incomes increase by 3%

i. "Think about a situation in which you had an opportunity to vote for Option 1 or Option 2. Keeping in mind all of the potential effects described for each option above, and if adoption of either option would not cost you anything, would you vote for Option 1 or Option 2?"
    1. Option 1.
    2. Option 2.
    3. I would choose not to vote for either option.

ii. "The option you chose will be more expensive to operate and will thus increase the cost to taxpayers. The following question asks whether you, as a taxpayer, would vote for this option. As you think about your answer, please re- member that if this option is adopted, you would have less money for household expenses or to spend on other environmental issues. Would you vote for this option if adoption of this option would cost your household $25 in increased taxes every year for the foreseeable future?"
    1. Definitely No – I would definitely not vote for this option.
    2. Probably No – I would probably vote for this option.
    3. Not Sure – I am not sure if I would vote for this option.
    4. Probably Yes – I would probably vote for this option.
    5. Definitely Yes – I would definitely vote for this option.

Appendix D: Policy Conflict Framework

Heikkila & Weible (2017) Policy Conflict Attributes Assessed

Table 3 Descriptive statistics

Dependent variables	Valid cases	Minimum	Maximum	Mean	SD
Divergent policy position	196	0.04	2.04	0.96	0.75
Perceived threats	205	2.00	10.00	6.83	2.25
Unwilling to compromise	188	1.40	5.00	3.29	0.81
Conflict composite index	186	1.00	27.00	9.48	7.17

Scaled explanatory variables	Valid cases	Minimum	Maximum	Mean	SD
Political view (−2 = extremely liberal; +2 = extremely conservative)	186	−2	2	−0.25	0.83
Diversity of experience in oil and gas	190	8.00	32.00	20.62	4.66
Level of education	189	2.00	6.00	4.93	0.93
Perceived risks relative to benefits	213	−4.00	4.00	−0.31	2.10
Rigidity of risks and benefits	207	−1.00	1.00	0.55	0.52
Insular networks	192	0.00	8.00	2.20	2.01

Dummy explanatory variables	Valid cases	*N*	%
Industry affiliation	236	64	27
Env. or citizen group affiliation	236	44	18
Government or other affiliation	236	128	54