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Untapped Geothermal Energy: An Active Negotiation Between Incumbents and Challengers Within the Geothermal Community

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ABSTRACT

There exists what appears to be an impressive potential for geothermal energy production in the United States, yet it has remained largely untapped. Geothermal power represents just 0.4 percent of the utility-scale electricity generation compared to 37 percent for the clean energy sources of nuclear, hydro, solar, and wind. Geothermal district heating systems number a mere 23 in the United States. What explains this gap? Why is it, given the ongoing energy transition in the United States, that geothermal energy production's time has not yet come? Existing research points to the economic, geographic, and technical limitations of geothermal. But more needs to be done to understand non-technical hurdles and opportunities for geothermal. This paper reports on preliminary research from an ongoing qualitative study examining how the geothermal energy community frames and discusses geothermal technologies, which shape policy attention and agenda setting both intentionally and unintentionally. Using the Strategic Action Fields concept, this paper examines how challengers attempt to destabilize incumbents in the geothermal community to alter incumbent strategies of discourse, advocacy, framing, narratives, and business models.

1. INTRODUCTION

The geothermal community currently is negotiating and testing various discourses through which to frame its objectives, technologies, strengths, weaknesses, and opportunities. Geologists, geochemists, industry advocates, and other stakeholders in the geothermal community advance various benefits and risks of geothermal as the world undertakes efforts to decarbonize. Fligstein & McAdam (2011) describe "a constant jockeying going on" among actors who constantly shift and make adjustments based on their perceptions or actions and those of others. The discourse and frames energy coalitions create are influential to determine how stakeholders from the broader low-carbon energy community can successfully persuade policymakers, the media, investors, and the general public to make sense of and understand the benefits of a particular low-carbon energy technology and what is at stake (Benighaus & Bleicher, 2019; Betsill & Stevis, 2019; Lee & Hess, 2019; Fligstein & McAdam, 2012; Goffman, 1974). How these benefits and risks should be framed to external audiences, such as the media, investors, policymakers, and the general public, is currently being negotiated within the geothermal community, that is, between incumbents and challengers. This negotiation threatens to realign existing power relations and narratives agreed upon by incumbents (Betsill & Stevis, 2019; Fligstein & McAdam, 2011; Jordan, 2009; Smith et al., 2005). Incumbent actors are those whose interests are thought to be better served by the current or dominant system and power structure. Incumbents benefit from "a position of power and can be expected to resist transition efforts that disrupt their privileged position or redirect the transition towards changes that enhance their position" (Betsill & Stevis, 2019, p. 384). Challenger actors mobilize efforts that destabilize the existing power structure, recruit targeted incumbents to their cause, and generally consist of members that more recently joined a community (Betsill & Stevis, 2019; Smith and Stirling, 2010).

Using the Strategic Action Fields (SAF) concept developed by Fligstein and McAdam (2011), this study examines how challengers attempt to destabilize incumbents in the geothermal industry to alter incumbent strategies of discourse, advocacy, and making money. SAF seeks to explain how social actors from a community generate stability and change and how actors collaborate and cooperate when there is competition and conflict (Fligstein & McAdam, 2011). Compromise generated by internal tension is inherent within coalitions and communities, where members seek to coalesce in their effort to negotiate, design, and influence the way technology innovations and policy considerations are framed and what "rules of the game" are established within which to operate (Fligstein & McAdam, 2011).

In the United States and around the globe, geothermal continues to produce a fraction of electricity and heat energy relative to other low-carbon energy technologies, warranting analysis and investigation into how the geothermal community functions both internally and externally. Since around 2018, the geothermal community has experienced an influx of challengers that seek to change the culture, advocacy style, business models, and communication strategies of the community, thereby expanding and adding new dimensions to the framing process. Many of these challengers are individuals and companies that traditionally have worked in the oil and gas industry. As individuals, according to interviews with former oil and gas employees now working in geothermal, they grew tired of the endless market cycles negatively impacting their families, they believe peak oil has been reached, and/or they are genuinely concerned about mitigating and reversing climate change caused by their former industry. Other challengers advance technologies that are not yet commercialized or advocate for a change to the traditional narratives and business models used by the geothermal community.

This paper offers a preliminary peek into a larger project (a dissertation) exploring non-technical reasons why geothermal electricity generation has remained a stagnant technology for the last half century when other low-carbon energy technologies (i.e., hydro, nuclear, wind, solar, batteries) have experienced rapid market growth. The limited scope of this paper addresses the emergent theme that there is an active and at times unharmonious negotiation occurring between incumbents and challengers within the geothermal community. This theme is repeatedly referenced at geothermal conferences and in over three dozen interviews with members of the geothermal community as well as with informed observers who are intrigued and actively monitor geothermal technology developments. The concept of Strategic Action Fields, developed by Fligstein and McAdam (2011), is used to analyze qualitative data collected for this study and scrutinize the emergent theme of how challengers attempt to destabilize incumbents in the geothermal industry to alter their strategies for making money, narrating stories, and advocating for growth.

2. METHODS

Geothermal was selected as the case study, in part, because there exists significant potential for geothermal energy production in the United States in the form of electricity and heat, yet it has remained largely untapped relative to other low-carbon energy sources (USEIA, 2021; Lindsey, et al., 2018; Wall & Young, 2016; Pletka & Finn, 2009; Tester, et al., 2007a; Tester, et al., 2007b; Green & Nix, 2006). Adoption of geothermal remains limited even though the conversation around addressing climate change through energy policy continues to evolve in ways that benefit low-carbon energy technologies. "While there seems to be a consensus among policymakers that energy systems have to change substantially, the precise formulation of the problem, determining who is responsible and what sustainable energy systems look like, is contested" (Kern, 2012, p. 91). There is robust conversation about what technologies policymakers should support in the ongoing energy transformation to low-carbon energy, yet geothermal technologies are rarely mentioned, and when they are, often appear in footnotes.

This ongoing study incorporates semi-structured interviews and unstructured participant field observations of the geothermal community. Semi-structured interviews are conducted via Zoom. An interview guide is used, but in semi-structured interviews, some deviation from the script is expected and encouraged (Fontana & Frey, 2005; Kvale & Brinkmann, 2009; Rubin & Rubin, 2011; Tracy, 2013; Kallio, et al., 2016). Scholars such as Kallio, et al. (2016) emphasize that the interview guide "offers a focused structure for the discussion during the interviews but should not be followed strictly" (p. 5). This study includes 62 semi-structured interviews with policymakers in legislative and executive offices at both federal and state levels, geothermal industry front groups or lobbyists, CEOs and senior executives at geothermal operator and service provider companies, geothermal industry advocacy organizations, academic and research entities that study geothermal technologies, other renewable energy entities, and capital investors and financiers. The quantity of interviews exceeds the number range that is acceptable according to qualitative research scholars (Guest, et al., 2006; Hagaman & Wutich, 2017) and focuses on access and data saturation. There are not firm non-probabilistic sample size guidelines in a qualitative study such as this, and qualitative methodological research suggests interviews should continue until the researcher achieves a point of saturation, meaning no new information or themes are discovered or observed in the data (Guest, et al., 2006; Hagaman & Wutich, 2017; Hennink, et al., 2017). Responses from interview participants are anonymous so confidentiality is protected, and participation is voluntary.

Data analysis, organization, coding, connectivity, and insight are occurring with the assistance of qualitative data analysis software (NVivo). The study takes an iterative approach to data analysis, in part, because interviewing the sample population and data analysis occur simultaneously. Interviews have been coded to identify data as it links to, or represents, phenomena or "synthesizing concepts" (Tracy, 2013, p. 28). Tracy explains that the phenomena uncovered during data analysis may be "a concept, belief, action, theme, cultural practice, or relationship" (Tracy, 2008, pg. 189). Qualitative research scholar Saldaña (2016) describes a phenomena or synthesizing concept as "a word or short phrase that symbolically assigns a summative, salient, essence-capturing, and/or evocative attribute for a portion of language-based or visual data" (p. 4).

Participant observations in the field capture context within which people interact, provide first-hand experience with a setting to avoid guessing about context, uncover issues people may be unwilling to discuss in an interview, and may identify phenomena that escape awareness of the community being observed (Tracy, 2013; Patton, 2014; Jorgensen, 2014; Leedy, et al., 2019). Field observations are unstructured to allow for flexibility and an iterative approach for interpretations to adjust or change over the course of the study (Tracy, 2013; Leedy, et al., 2019). Field observations are inherently less structured and allow researchers to determine how people interact and behave in an environment (Silverman, 2008; Patton, 2014; Jorgensen, 2014). By using field observations, this qualitative study is able to capture the context within which the geothermal community interacts. This creates opportunities to identify matters about which community members may be unwilling to discuss in an interview and to view social life as a series of interlocking events (Silverman, 2008; Van Maanen, 2011; Jorgensen, 2014). Field observations have occurred in person and virtually (due to the ongoing COVID-19 pandemic). Observations occurred in person at the 2022 and 2021 Geothermal Rising Conference and the World Geothermal Congress 2020+1. Virtual observations have occurred at the 2021 PIVOT conference, 2021 Stanford University Geothermal Workshop, 2021 American Clean Power conference, and eight other clean energy and energy policy conferences not specifically focused on geothermal energy.

3. FINDINGS

The geothermal community appears to be engaged in an active and at times unharmonious negotiation between incumbents and new community members who are challenging the traditional boundaries within which the geothermal community communicates both internally and externally. The definition of the geothermal community is not well established. For the purpose of this study, the geothermal community has been condensed into four broad categories: political and policy entities, industry entities, advocacy organizations and academic institutions, and informed observers.

The political and policy entities within the geothermal community include actors like elected politicians, political appointees, and career civil servants as well as entities like political parties and their policy platforms and government agencies. A second group making up the broader geothermal community are industry entities that incorporate industry representatives and lobbyists, industry associations, traditional oil and gas firms, as well as geothermal companies and other renewable generation companies like wind and solar. Increasingly, major oil and gas companies, service providers, and consulting organizations (i.e., Chevron, BP, Baker Hughes, Schlumberger) are establishing or acquiring efforts to participate in the clean energy transition and some of these efforts include the use of geothermal technologies.

A third group is made up of advocacy organizations and academic institutions such as research organizations and interest organizations, energy or environmental non-governmental organizations, higher education academic institutions, the major energy labs in the United States (i.e., National Renewable Energy Laboratory in Colorado, Idaho National Laboratory, Oak Ridge National Laboratory in Tennessee). At this point in the research, this paper combines these educational and advocacy entities because they may work in parallel, receive grant funding from similar sources, and arguably offer independent and/or third party perspectives. Finally, there is a fourth category that this study refers to as the informed observer, which includes capital investors and financiers, primarily from the private sector and including "green" banks, venture capital firms, impact investors, private equity companies, and corporate development teams within larger companies. The media and journalists are also included in the informed observer category. These groups may be redefined during ongoing data analysis.

Incumbent actors are those whose interests are thought to be better served by the current or dominant system and order or power structure (Betsill & Stevis, 2019; Fligstein & McAdam, 2011; Jordan, 2009; Smith et al., 2005). "Incumbent actors are constantly having to defend their orders while challengers use political opportunities in an effort to organize or reorganize existing orders" (Fligstein & McAdam, 2019, p. 2). Incumbents are defined as individuals at companies and organizations that have generally conducted geothermal activities for over 15 years or more. Examples include geothermal operators currently generating electricity or heat. Incumbents also include geothermal service providers that offer consulting, financial planning, reservoir management technical assistance, well modeling, seismicity support, drilling, and other contracted services for about 15 years or longer.

Challenger actors mobilize efforts that destabilize the existing power structure, recruit targeted incumbents to their cause, and generally are newer members to join a community (Betsill & Stevis, 2019; Smith and Stirling, 2010). For the purposes of this study, challengers are defined as individuals, companies, and organizations that have been in geothermal activities for less than ten years, and often less than five years. Examples include geothermal energy operators whose technologies remain in research and development, pilot project phases, and are not yet commercialized. Examples also include geothermal service providers who leverage skills and experiences from the oil and gas industry and transitioned into the geothermal industry within the last five years.

This paper introduces a geothermal community category of informed observer, which includes the media, investors, and some policymakers who are intrigued by geothermal innovations and are monitoring the geothermal industry. These informed observers may also be stakeholders from other low-carbon energy advocacy organizations.

Responses from interview participants are anonymous so confidentiality is protected, and participation is voluntary. This paper does not include quotations from the interviews because the project is not yet complete. Direct quotes have not gone through member checks with study participants. Member checks are a validation technique used in qualitative research (Patton, 2014; Thomas, 2017). These checks provide study participants with the opportunity to engage with and clarify interview data usually several months after their semi-structured interview.

One question asked of participants related to their perspectives about how the geothermal community discusses and frames itself. Responses from incumbents at geothermal operators and service providers as well as academic institutions described geothermal technologies as risky, laden with upfront expenses, in-sync with messaging strategies, and welcoming to newcomers. Incumbents expressed confidence that the geothermal community had adequate processes through which to message narratives to informed observers like policymakers. Incumbents expressed feelings that the whole community was "rowing in the same direction" and "generally the industry advances the same message." Incumbents described the community as over-reliant on scientists and engineers and lacking sufficient focus on advocacy, communications, and talent management. Interviews with incumbents framed a discourse that presents a narrative of risk, false starts, and impediments to new geothermal technologies.

Challengers expressed attempts to reframe the geothermal discourse away from conversations of risk and toward a focus on different marketing strategies, increased advocacy efforts, and new business models. They argue a similar change in focus facilitated the oil and gas industry's success during the shale revolution of the 2000s in the United States. Challengers express a high level of discord within the geothermal community and a severe lack of unity around advocacy and narrative development. Challengers believe the incumbent geothermal community is "looking at themselves rather than looking outwardly," "far too complex," and "preaching to the choir." There is a sentiment among challengers that the geothermal community is adept at getting people already in this industry really excited about geothermal.

A lack of leadership over the last 15 years was raised by challengers. "There's a real gap in leadership," one challenger noted, and several others echoed that the community needs to move past entrenched cultural positions, reframe their message, and not be afraid to engage in difficult conversations. Additionally, challengers noted a new wave of racial and gender diversity that sets the geothermal community apart from other science and engineering communities. One challenger noted, "I've been so impressed with the number of women in the geothermal industry." Another challenger pondered if recent female leadership gains are "why advocacy and communication are being pulled up through the ranks" and if there is an element to women being "more willing to collaborate and discuss scary things."

Areas of agreement included a consensus that the geothermal community is over-reliant on scientists, geologists, and engineers for messaging; however, there is no active discussion on how to change this. Challengers are establishing their own marketing and advocacy operations within their companies and organizations to go at it alone or to bypass existing organizational structures and processes. Incumbents generally believe the current structures and organizations are sufficient for the needs of the geothermal community.

To the informed observer, the geothermal community is defined as nascent, ill-prepared, out-hustled, and pushing an overly scientific narrative. Informed observers expressed a genuine desire for geothermal to find success, but raised concerns about an overly scientific and risk averse culture. One informed observer and policymaker noted their interest in "mostly about supply chains, jobs, and costs," but the geothermal community communicates to them about "reliability, variability, capacity factor, all that stuff." The focus on scientific and technical benefits of geothermal energy, like capacity factor, baseload, blackstart, and flexibility, are not what catches the attention of policymakers, the media, investors, and advocates for other technologies. These informed observers and external audiences are more interested in supply chains, market applications, the chances of lowering ESG scores, creating jobs in communities, workforce transitions, diversity and inclusion, social equity, and saving money. Interested outsiders commented on the lack of advocacy at state and federal levels.

The lack of community cohesion is visible to the informed observer who notes the discord gives them pause to invest or consider policy support mechanisms. The active negotiation the geothermal community is going through limits the political capital, investment capital, and messaging capabilities to position geothermal technologies in an amenable light. One informed observer commented "the industry doesn't cooperate with itself and they work too much in silos." Another informed observer and investor commented how advocates for one technology dismissed another technology, "actually right now there's a lot of discord in the community."

4. CONCLUSION

The geothermal community appears to have an active and unharmonious ongoing negotiation over the way the community discusses its technological innovations and objectives around communication, messaging, and advocacy. This lack of cohesion is, in part, due to the influx of recent members joining the community who are challenging the incumbent status quo and who are actively seeking to change the geothermal community. As Fligstein & McAdam (2011) argue, there is "a constant jockeying going on" to position and influence policy and technology adoption choices. The geothermal community should seriously and genuinely acknowledge the ongoing negotiation and seek to redevelop or refine its narratives, discourse, and frames in ways that are amenable to both incumbents and challengers.

More findings and emergent themes from this qualitative research will be released throughout 2022 in publications and at conferences, workshops, and other events. Additional research will dive into findings around the frames and narratives, familiarity and education of geothermal technologies to informed observers, the use of imagery when framing a narrative, policy entrepreneurship and champions, incumbents and challengers, and the impact of niche environments to overcome lock-in and dependency.

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