Best Practices for Community Engagement and Stakeholder Involvement – Case Study at Utah FORGE

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Utah FORGE, Outreach, Community Engagement, Best Practices

ABSTRACT

The U.S. Department of Energy's Frontier Observatory for Research in Geothermal Energy (FORGE) is a field laboratory located in rural Beaver County, UT, with a modest population of 7400. This paper will address the various strategies and best practices for a positive, supportive, and engaging community outreach.

From its beginning, the team has demonstrated that stakeholders' support is essential for the project's success and future growth. To successfully promote greater understanding of the project and foster geothermal literacy, multiple target audiences have been identified. They include the general public, educators, K-12 and university students, local landowners, legislators, regulators, and the scientific community. To ensure each audience is engaged with a message specifically tailored to them, the outreach employs a website, social media, email marketing, media relations/announcements, scientific conferences, lectures, videos, webinars, shared data repository, and in-person presentations, activities and briefings. As part of the University of Utah, the team leverages the opportunities available through various colleges and departments to develop interactive products, Science, Technology, Engineering and Mathematics/Science, Technology, Engineering, Arts, and Mathematics (STEM/STEAM) activities and other avenues to gain wider reach. For example, webinars intended for grade school students, geothermal song parody contests for middle schoolers, and elementary school geothermal poster contest were developed.

Through proactive transparency on the project's progression and site activities, and by embracing the local culture, the team has been welcomed as *de-facto* members of the community, allowing for ongoing trust and continued open dialogue, thus mitigating potential opposition and cultivating deeper community support for the project. For example, attendance at the County Fair and other events affords individuals the direct opportunity to ask questions and present any concerns to representatives from the team.

Reaching beyond the traditional audiences with a wide range of mechanisms, Utah FORGE has empowered the community to foster a sense of pride and ownership in the success of the research. The best practices developed, and the lessons learned are applicable to current and future geothermal projects engaging with local communities.

1. Introduction

The potential of geothermal energy is seemingly limitless. It provides a source of clean, renewable energy that, along with solar and wind power, offers viable alternatives to fossil fuels. The Utah Frontier Observatory for Research in Geothermal Energy (FORGE) is a dedicated underground field laboratory sponsored by the U.S. Department of Energy. The purpose of the project is to develop, test and de-risk the tools and techniques necessary to advance Enhanced Geothermal System (EGS) technologies.

As with any EGS project, outreach and communication are essential for ensuring the project's success and acceptance. In order to achieve this success, the identification and proactive engagement of various stakeholders is paramount. Specifically, multidirectional communication is needed to foster acceptance, trust, and involvement by these stakeholders.

Outreach must be tailored to the community being impacted, as Smith, et. al. (2018) noted, it is important to recognize that "one size" does not fit all. The Utah FORGE project is being conducted approximately 16 km northeast of the town of Milford in Beaver County, Utah, an area designated as a rural community. The outreach and engagement primarily reflect the unique values and interests of those living in the area.

Milford boasts a population of ~1700 residents, while Beaver County ranks 24th out of 29 counties in the state for population density. Additionally, the county is home to Utah's Renewable Energy Corridor that includes conventional geothermal plants, solar and wind fields, and a biogas facility. The importance of Utah FORGE as a center of EGS research and development has not gone unnoticed by the local residents and state officials.

Nevertheless, the potential of geothermal energy remains less understood than other renewable sources. In January and February 2021, the University of Utah's Department of Communication conducted an initial survey of over 1000 individuals in 10 western states to determine overall understanding and acceptance of geothermal energy, and familiarity with EGS. The survey was led by Dr. Sara Yeo of the University of Utah in collaboration with Dr. Meaghan McKasy of Utah Valley University. Results indicate that an overwhelming majority of respondents know geothermal is a renewable energy (74%), nearly half think it is beneficial to society as a whole (47%), and almost half support its use (45%). However, one-quarter of those polled do not feel well informed about geothermal energy, and 24% believe EGS is risky to society as a whole.(McKasy and Yeo 2023, *in press*).

Utahns, however, were slightly more likely to support both geothermal energy and EGS than respondents in other Western states. When asked if they support the use of geothermal energy, 48% of Utahns agreed compared to 45% of other respondents. They were also somewhat more likely to support EGS than others, 30% to 28%. Interestingly, whereas 15% of total respondents stated they definitely do not support EGS, only 9% of Utahns felt the same.

To successfully foster a greater understanding of geothermal energy in general and EGS specifically, target audiences have been identified. They include the general public, K-12 students, university students, the scientific community, legislators, regulators, educators, and local stakeholders (e.g., landowners). Communication with and outreach to each of the intended audiences is based exclusively on accomplishing an overarching vision of increasing overall geothermal and EGS literacy.

A variety of resources and activities have been employed to disseminate information about Utah FORGE, its development, drilling and stimulation activities, and achievements. These resources include, among others, the Utah FORGE website, social media platforms, media relations efforts, email marketing, quarterly newsletter, lectures, webinars, interns, interdepartmental collaboration, and in-person meetings.

2. Required Components for Best Practices

Utah FORGE is implementing a "best practices" approach to its outreach and communication efforts following Majer et al. (2016). Four main requirements, and their essential components, have been identified and are listed below.

1. Identify key stakeholders early in the process. Significant effort and time were invested in identifying stakeholders and engaging them from the beginning of the Utah FORGE project, starting in 2015, which has allowed for effective and targeted outreach. The Utah FORGE Outreach and Communication program has always been designed to encourage multi-fronted communication between a variety of stakeholders, with transparency and community participation at its core.

   Forming an early, transparent, and ongoing dialogue with Utah FORGE's myriad stakeholders established a level of trust and understanding around safety and environmental issues, including induced seismicity. Utah FORGE has implemented the means for stakeholders to provide feedback, ask questions and make comments through its website, public meetings and social media platforms.

2. Establish an appropriate Outreach and Communication team. Utah FORGE clearly defined the processes for both internal and external communications. Since the outreach team serves as the "face" of the project, a diverse group has been assembled, ensuring the right message is delivered to the appropriately-identified audience by the most suitable team member or "proxy." Therefore, along with the core team responsible for the planning and implementation of day-to-day outreach and communication efforts, additional experts are tapped as appropriate. These additional outreach team members include – but are not limited to – scientists, engineers, seismologists, and on-site staff. At times, depending on the message, Utah FORGE may elicit assistance from community leaders, public safety officials and regulators.
3. Provide the community with complete and credible information. The ongoing success of the Utah FORGE EGS project depends on the acceptance and support of the community, which encompasses a large group of stakeholders. In turn, this community cannot continue to offer its acceptance and support without having up-to-date information available that reflects their interests, which for residents of the area can include potentially contentious issues such as induced seismicity.
4. Gain a community perspective as a pathway for gaining public trust. Utah FORGE believes understanding the diverse concerns of the community has better equipped the project to demonstrate both its commitment to, and support of, the community. Therefore, stakeholder involvement in the process was initiated early in the project. A broad coalition of stakeholders – including those living closest to the site – has been defined, and the needs

of the community have been identified. Efforts have been made to continue expanding the positive economic impact that the project is having on the area.

3. Identifying Audiences

Utah FORGE identified a wide variety of local, national, and international stakeholders, both within and outside of the geothermal community. These audiences range from landowners with property adjacent to the site to science teachers, from schoolchildren to national legislators. Importantly, audience identification is constantly evolving to include new groups with whom to share the overall vision of increasing geothermal and EGS literacy.

3.1 General Public

Reaching out to local, national and international audiences helps to increase geothermal energy literacy and its potential place in the country's energy portfolio, to raise awareness of Utah FORGE, and to highlight Utah's leading role in developing technology that can be replicated in virtually any geographic location.

- Local audiences – Engaging local audiences in Milford City, Beaver County, the state of Utah and the surrounding region maintains social license to operate and provides the opportunity to increase overall understanding about the potential of geothermal energy and to raise awareness of Utah FORGE – a cutting edge science in "our own backyard". This understanding promotes support of geothermal energy, dispels myths, and reduces the possibility of "NIMBYism" (Not in My Back Yard), while limiting opposition to the project's efforts through transparency. Moreover, active participation by and open dialogue with the local communities helps to ensure environmental justice is maintained in the area.
- National audience – Reaching out to national audiences helps to increase greater understanding of geothermal energy and its overall potential across the country's energy portfolio. A 2019 *Business Insider* poll indicated that geothermal ranked fourth in preference by Americans to power their communities – well behind solar, wind and hydroelectric, and on par with natural gas.
- International audience – Targeting audiences abroad helps realize similar goals to those of the national audience – particularly the geographic agnostic replication offered by EGS. Additionally, Utah FORGE brings recognition to the U.S. Department of Energy and the state of Utah by fostering international collaboration (e.g., Switzerland in tool development).

3.2 Students

Although students benefit from outreach to the general public, a focused, classroom-based approach has proven more successful. Students are categorized into two groups: K-12 and university-level.

Utah FORGE has introduced geothermal energy into the K-12 classrooms. Discussions and hands-on experiments have taught students the potential of geothermal energy as a renewable and viable energy source.

Growing the number of university students who understand the potential offered by geothermal and engaging with this demographic has helped to broaden the understanding of geothermal energy in general, increased comprehension of the research being done around EGS to optimize the geothermal technologies required in the production process its role in the country's energy portfolio as we strive for cleaner, renewable energy sources. Additionally, this outreach allows for the even greater interconnectivity of diverse departments within the University of Utah.

3.3 Scientific and Engineering Community

The scientific community is vital for disseminating the novel data and technology coming out of Utah FORGE and to help build credibility for the project. Sharing of scientific and engineering research and results with the non-geothermal community may spark advancements in new tools and techniques not currently being utilized in geothermal development and exploration.

For example, the oil and gas and geothermal communities share a number of disciplines and technology spaces. Both benefit from each other's learnings and innovation.

3.4 Public and Elected Officials

Congressional members serving on key committees e.g., Energy and Natural Resources, Utah's delegation, Beaver County officials have a vested interest in the development of Utah FORGE and geothermal energy. Although these decision makers benefit from our outreach to the general public, special effort has been made to ensure that high quality information is supplied to keep them informed of the project's activities and successes.

3.5 Media

Local, trade and national reporters, including those covering energy, sustainability, and policy are an important audience. Reporters are crucial for delivering key messages about the developments and ongoing projects working in the geothermal industry. Leveraging relationships with reporters, and providing timely and relevant information to them throughout the course of a project steers the narrative and serves to announce breakthroughs and successes helping to garner grater public support.

3.6 Environmental Justice Advocacy Groups

Ensuring that local citizens are consistently informed about the project, its progress and its impact on their communities, as well as providing opportunities for individuals and groups to express concerns that are satisfactorily addressed, are two of the cornerstones of environmental justice. Educating local advocacy groups about geothermal energy and Utah FORGE's efforts to secure environmental justice has tied the project's purpose to the wider environmental landscape.

4. Establishing a Dedicated Outreach Team

A dedicated outreach and communication team engages with the community and serves as the 'face' of the project. These can include both paid positions, and collaborative partnerships. These collaborations serve two important purposes: they increase geothermal literacy to audiences who may not otherwise be exposed to the concept; and provide resources to the project and avenues that may not be otherwise available.

At Utah FORGE, a team consisting of a project coordinator and a marketing and communications specialist developed and implement the outreach program. Together they oversee the day-to-day efforts and serve as the public "face." However, additional personnel include student interns, who provide graphic design and content creation support; Ph.D. faculty members and candidates, who work on curricula and Canvas page creation; and undergraduate students who assist at community events and develop hands-on modules.

Collaborative positions with the University of Utah's Department of Communication and Utah Valley University's Department of Communication oversee the creation and distribution of consumer surveys. They and their teams have proven invaluable to our understanding of the general public's awareness of geothermal energy.

These collaborations further integrate the Utah FORGE project into the University of Utah.

5. Mechanisms for Reaching Community

A myriad of mechanisms should be utilized in an outreach and communication program to engage the widest audience and to provide strategically targeted updates and information.

5.1 Website

The Utah FORGE website is utilized to provide updates about the progress of the project, while offering resources and information to increase overall geothermal and EGS literacy. We have introduced "fun" activities such as a 'Did You Know' trivia about geothermal energy, a geothermal term glossary, and an interactive geothermal-themed crossword puzzle. Scientists can also access the wiki pages where detailed information about the project, research, and data is publicly available.

5.2 Social Media

Social media platforms are an important part of engagement. According to Pew Research Center, in 2021 almost half of social media users got their news from various platforms (Facebook, Twitter, Instagram, etc.). Understanding the demographics most common for each platform helps to target the right audience with the appropriate message.

In Utah FORGE's case, the most successful social media platform has been LinkedIn, seeing an almost 75% increase in followers year over year and a doubling of impressions of posts. (Figure 1).

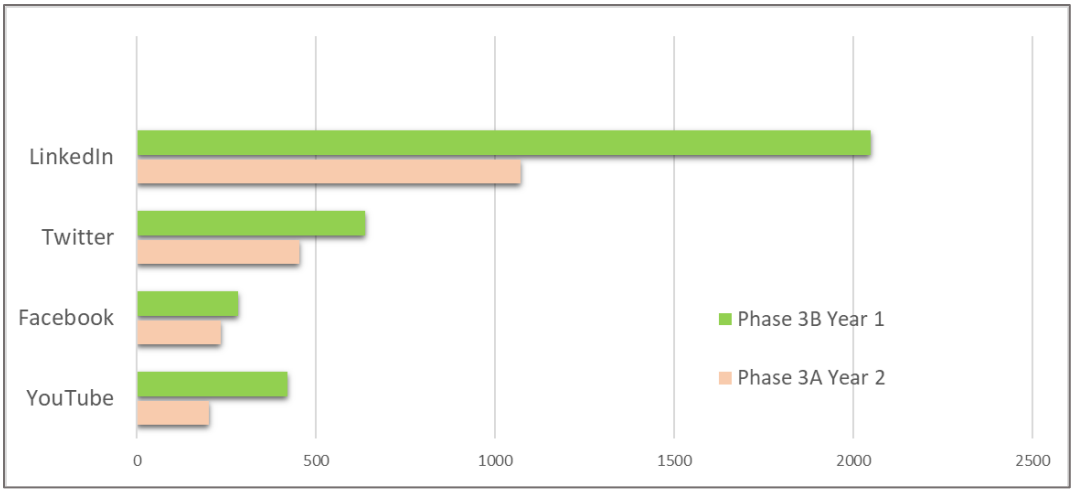


Figure 1. Growth comparison in social media posts from Year 2 of Phase 3A of the project to Year 1 of Phase 3B.

5.3 E-Mail Distribution Subscribers

A subscription-based email distribution list allows individuals to request information, announcements, news and updates be directly emailed to them.

According to Campaign Monitor, successful email marketing campaigns result in open rates of 15-25%; with a click through rate of 2.5%. As a result of careful selection of topics and strategically scheduled email campaigns, Utah FORGE averages an impressive 46% open rate and an 11% click-through rate.

5.4 Media Outreach

Proactively pitching news and story ideas to the various media outlets, allows the general public to learn about the project and its progress. Additionally, local media can help to instill a sense of community pride and ownership.

Coverage of the Utah FORGE project is often highlighted in the general mainstream media and in geothermal and other energy industry outlets. Between April 1, 2022 to March 31, 2023, there were 65 stories garnered. Media stories were run in general local consumer publications such as *The Salt Lake Tribune* and *The Deseret News*; national-level outlets such as *Forbes Magazine*, *Science* and *Scientific American*; industry publications like Think GeoEnergy, Renewables Now, and *Power Magazine*. Stories also appeared in the University of Utah online publication @TheU, and in the local Beaver-area newspaper *The Beaver County Journal*, as well as on radio and television.

Although it is impossible to calculate how many people were reached through media relations efforts, we can quantify that *Forbes Magazine* has a circulation of over 930,000, *Science* has a readership of 400,000 weekly, and *The Deseret News* and *The Salt Lake Tribune* enjoy a combined circulation of over 150,000 copies.

5.5 Scientific Community Outreach

Although data might be available through online resources, such as a website or a data repository (GDR), presenting research findings at scientific conferences offers valuable peer to peer interactions and affords attendees the opportunity to discuss topics directly with the subjects experts.

The Utah FORGE team and its research associates attend conferences around the world. Among the conferences and meetings at which presentations were made were the Japan Oil, Gas and Metals National Corporation (JOGMEC), the Japan Petroleum Exploration Company (JAPEX), IMAGE 2002, the Geothermal Rising Conference, the DEEP Annual Meeting, the Engineering National Advisory Council, the Society of Petroleum Engineers, the American Rock Mechanics Association, the European Geothermal Congress, the ES 2022 Student Conference and Exhibition, the 2022 International Forum on Pohang Earthquake, the Utah Geothermal Working Group, and the Stanford Geothermal Workshop.

5.6 Field Trips

In-person visits to a research site offer first hand understanding of the complexities associated with an EGS project. They allow for greater transparency and move the theoretical to the practical.

There has always been great interest in visiting the Utah FORGE site by media, elected officials, students, and others from the geothermal community. Among those who have traveled to the site are U.S. Senator Mitt Romney, U.S. Rep. John Curtis, Beaver County Commissioners, parliamentarians from Belgium, geoscientists from Hungary, and students participating in the National Science Foundation-funded Research Experience for Undergraduates (REU) / Research Experience in Utah for Sustainable Materials Engineering (ReUSE) at the University of Utah Materials Science and Engineering Department.

For those unable to travel to the remote site, the Utah FORGE team has secured inclusion of information about the project in an upcoming exhibit at the Natural History Museum of Utah, which enjoys some 250,000 visitors annually. The exhibit, tentatively titled A Climate of Hope, will focus on steps underway to address climate change. A section of the exhibit to be called Innovators Needed will highlight a specific Utah organization's work each year. Utah FORGE has been selected to be the first group featured. The exhibit is slated to open in Autumn 2023.

5.7 Webinars and Videos

Webinars and videos are an engaging option for outreaching to the stakeholders and serve as an important communication tool. Videos are an effective medium for rapid and engaging information delivery. Webinars deliver complex concepts and offer convenient learning options to audiences who otherwise cannot participate in lectures in person due to distances or conflicting schedules.

The Utah FORGE has produced webinars targeted at audiences ranging from K-12 students to scientists interested in geothermal energy and EGS research. The webinars have had nearly 17,000 views. In addition, several videos about the successful drilling of wells, stimulation, community support, flyover views of the site and time-lapses have been produced resulting in over 25,000 views.

5.8 Printed Materials

Printed materials allow specific information to be organized and delivered directly from the project team. This ensures accuracy of the message and the facts provided. This medium lets audiences to decide when to absorb the information and refer back to it at their convenience.

Utah FORGE has created a library of printed materials, ranging from flyers and brochures to a media kit and FAQs. Additionally, to provide the local population with a sense of pride in the project, posters have been created and placed in a display case in a popular park in Milford, Utah (Figure 2).

Figure 2: Display case in Milford City park.

5.9 Surveys

Utilizing consumer surveys provides insight into the level of familiarity with, and understanding of, geothermal energy and EGS among the general population. To measure the efficacy of the team's outreach efforts, surveys are most telling when conducted on a regular basis.

In collaboration with our colleagues at the University of Utah Department of Communication and the Utah Valley University Department of Communication, a survey of 1,000 individuals in 10 western states was conducted in 2021 (McKasy and Yeo 2021, *in press)*. A national follow-up survey is scheduled for 2023 to evaluate broader participant understanding and support of geothermal energy.

5.10 Outreach to Elected and Other Officials

Elected and other officials are an important audience, and consistent engagement with them is paramount for continued support. These stakeholders exert influence in financial, permitting and policy decision making.

Utah FORGE provides regular briefings through in-person meetings with members of Congress and/or their staff, with County officials, City officials, and individual Utah state legislators. For example, in a 15-month period, well over 100 officials participated in virtual and face-to-face meetings, including U.S. Congressmen Chris Stewart and John Curtis, Sen. Mitt Romney, U.S. Secretary of Energy Jennifer Granholm, Gov. Spenser Cox of Utah, Gov. Jared Polaris of Colorado, Utah Lt. Gov. Deidre Henderson, and various officials from the Utah Office of Energy Development. Members of the Utah state Senate were also briefed about the project during the 2023 legislative session. Additionally, U.S. Secretary of Energy Jennifer Granholm visited the University of Utah to learn about the Utah FORGE project, as did Acting Assistant Secretary of Energy Alejandro Moreno and members of the Department's Geothermal Technologies Office.

5.11 Importance of K-12 Education and Higher Education

Students born into an era of global warming, experience noticeable eco-anxiety. Young people recognize the urgency of adopting renewable energy infrastructure better than anyone. Learning about sustainable alternatives to current technologies can help empower students to advocate for renewable energy sources and may help to counteract feelings of powerlessness. (Buening, 2023)

Traditionally educational systems favor STEM-based learning and research. However, art-focused activities can provide many emotional, physical and social outlets. Turning STEM into STEAM, can offer students a refreshing new way to look at the energy problems around them (Buening, 2023).

Utah FORGE introduced concepts of geothermal energy and EGS while addressing potential eco-anxiety among local students by conducting classroom contests, providing an artistic outlet for science-based learning. In one contest, team members visited fifth and sixth grade classes at three local elementary schools (Figure 3). Following the in-class lectures, the students created a poster about their favorite geothermal fact. Winners were selected and received a prize, and all the posters were displayed in the city library corresponding to each school's location. A short article was published in the local *The Beaver County Journal* announcing the winners and encouraging families and the community to visit the libraries and see the posters. One of the local librarians asked if she could continue displaying the posters several months after the contest concluded since community members were still coming in to view them.

Figure 3: In class lectures conducted in local elementary school.

Additionally, middle school students participated in a state-wide song parody contest. Here, the Utah FORGE team members visited middle school science classes to provide the basics of geothermal energy and its potential. Students created and submitted a geothermal-themed song parody video. The winners received prizes and were recognized in their schools or the Milford City council meeting (Figure 4). In one case, a special school-wide assembly was called to celebrate their school's winners. A short article recognizing the winners appeared in *The Beaver County Journal*.

Figure 4: Song parody contest winners receive their prizes during the Milford City council meeting.

Colleagues at the University of Utah College of Education created a Canvas page, which is a web-based educational tool, for educators to present online content to students, and assess student progress. This site was created specifically to provide geothermal and geoscience resources to teachers. Additionally, these colleagues provided a professional learning opportunity for teachers to understand the concepts of geothermal energy, geoscience in Utah, and the Science and Engineering Education (SEEd) Standards. Follow up workshops are planned for the next academic year. The site complements a series of five lesson plans developed by a Ph.D. candidate in the College of Education.

Utah FORGE regularly hosts a booth at the annual STEM Fest (Figure 5). To engage students, the team uses a thermal camera and hands-on modules to interact with students and discuss heat transfer, geothermal energy, and Utah FORGE. STEM Fest includes two days of school groups and an evening for families. Organizers estimated the 2022 event – the first since COVID-19 restrictions were lifted – saw over 13,000 participants.

Figure 5: Utah FORGE student intern Aleksander Goncharov interacting with students at STEM Fest.

6. Community Relations and Transparency

Giving back to the community is also key to the project's success, as noted by Smith et al., (2018). The success of the project's rests on the sense of ownership and pride the community. The local community is internationally recognized by the media, for example, as being the home of cutting-edge new technology, which may be an integral part of solving the climate crisis. This can only be achieved through consistent and multi-directional outreach in which credible and transparent information is exchanged.

At a minimum, representatives of Utah FORGE attend four regularly scheduled meetings annually, held by the Beaver County Commission and the Milford City Council (Figure 6). To alert the public to the fact that a Utah FORGE update will be provided during the meetings, advertisements are placed in the local *The Beaver County Journal* (Figure 7). The County and City also include the notices on their social media platforms and websites. Additionally, individual key stakeholders are personally invited via email. These stakeholders include landholders, regulators, elected officials, and other interested parties. At the meetings any individuals present are encouraged to ask questions and express their concerns directly to the Utah FORGE team. At every meeting, the commissioners and councilmen continue to express their support for the project. Although there is a livestream of these meetings, to ensure stakeholders who cannot attend the meetings, the Utah FORGE team provides them with links to the recordings.

Figure 6: Dr. Joseph Moore and Christopher Katis giving an update on the project's activities at the Beaver County Commission meeting.

Figure 7: Ad taken in the Beaver County Journal announcing public meeting.

By embracing the local culture, the team has been welcomed as *de-facto* members of the community, allowing for ongoing trust and continued open dialogue, thus mitigating potential opposition and cultivating deeper community support for the project. For example, the team staffs a booth during the annual Beaver County Fair in Minersville, Utah, providing information, answering questions about geothermal energy in general and the project specifically, listening to concerns and comments, and interacting with the fair attendees of all ages (Figure 8). At past fairs,

young people received their own rock kit packet, which included a piece of granite rock, an information sheet, and a magnifying glass. They could also "win" their choice of Utah FORGE branded promotional products by answering geothermal questions. Each year, over 300 individuals stop by the booth. During the recent Enhanced Geothermal Shot Summit, Beaver County Commissioner Tammy Pearson mentioned how excited her grandchildren were to receive the rock kits.

Figure 8: Young booth visitor learning about geothermal energy at the Beaver County fair.

In all public events, the public is strongly encouraged to provide feedback and ask questions directly to the project representatives. Historically, a wide range of comments have been made that are overwhelmingly positive and supportive (Table 1).

Table 1. Comments received from elected officials and public

A sampling of comments made from elected officials and the public
"This is really great for the Community," Commissioner Tammy Pearson.
"Thank you for the invitation to come visit the site during the stimulation," (former) Commission Chair Mark Whitney.
"Yes, that was really cool," Commissioner Wade Hollingshead.
"You've also stimulated our local economy," Commissioner Tammy Pearson.
"It was fascinating; very cool stuff," Commission Chair Mark Whitney.
"I have a lot of friends involved in mining and I received a bunch of texts from them asking what Liberty trucks were doing in Beaver County. They saw them from the road!" Commissioner Tammy Pearson.
"We need to continue having this funded so we can continue moving forward," Commission Chair Mark Whitney.
"I think being at the Fair is good because even though we talk about you and all you do, people forget what you're doing," Commissioner Tammy Pearson.
"We always appreciate your updates and we're happy to help anyway we can," Commissioner Wade Hollingshead.

"We really appreciate you keeping the funds in the community," Commissioner Wade Hollingshead.
The following comments were made by visitors to the Utah FORGE booth at the Beaver County Fair in Aug 2022:
Thank you so much for coming.
Oh yeah. I've heard about this before.
I'll be watching what you guys are doing!
This is so exciting.
This is really exciting stuff. I would love to see this come to fruition.
I think this is neat. (Made by a child)
I think this is awesome.
Wow, this is really interesting.
This sounds like a really great idea.
Oh, Utah FORGE. I worked out there! We did the garbage service.
Remember when Mom worked cleaning those buildings out by the windmills? That was for this group.
Hey! I remember you from last year. (Made by a child.)
I remember you guys. You gave me a rock. (Made by a child.)
The rocks you gave us last year were so fun. (Made by a child.)
Thanks again for the iPad; I use it more than my phone now. (Made by one of the winners of the song parody contest.)

7. Fostering Public Trust

As Majer (2016) has stated, transparency about seismicity is an important component of an outreach and engagement program of an EGS project to build trust and support. It mitigates the fear of the unknown around seismicity.

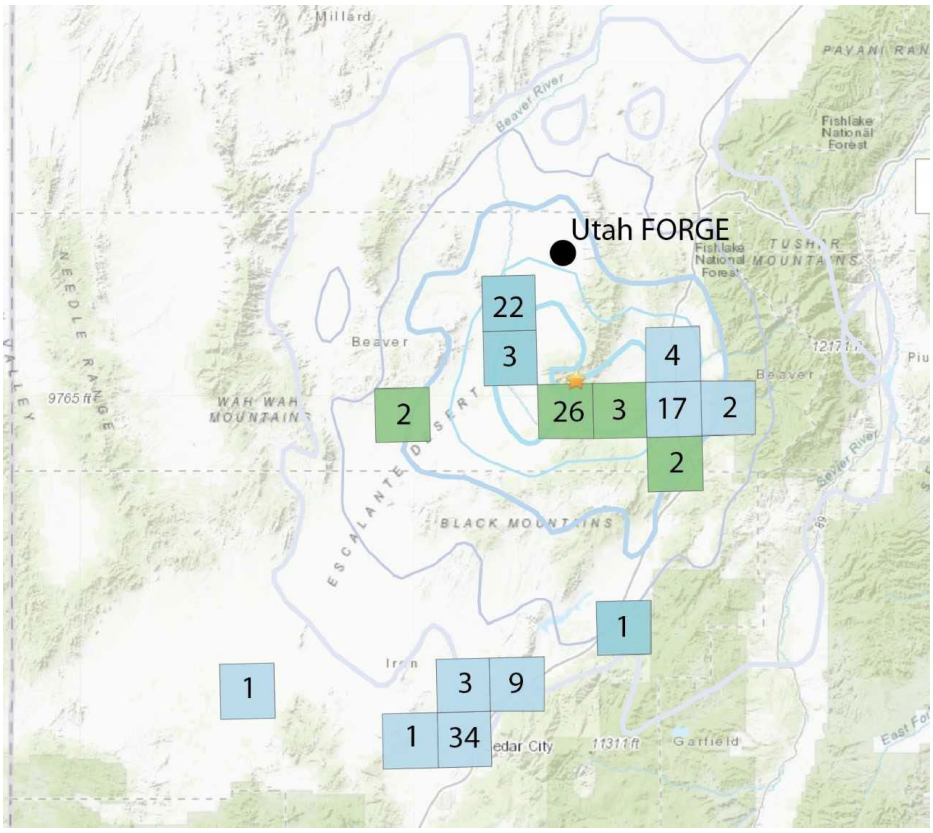
The team is consistently open and frank about seismicity and its role in the creation of an EGS reservoir. For example, to prepare the community for the stimulation of April 2022, the team included focused education about EGS and induced seismicity during meetings with the Beaver County Commission, Milford City Council and Beaver County Planning Commissions, all of which were open to the public. Topics in the presentations included:

- Why is seismicity associated with EGS activities: The formation of an EGS reservoir involves the release of energy (stored strain) in the form of microseismicity (very small earthquakes). Since these earthquakes are the result of industrial (manmade) activities, these earthquakes are referred to as induced seismicity.
- The cause of induced seismicity: The fundamental causes of induced seismicity are generally well understood. They include changes in pore pressure, thermal stress, volume change, and chemical alteration of rock slip surfaces.
- Monitoring for Induced seismicity: All drilling and stimulation activities will be monitored using an extensive network of very sensitive seismic monitoring instruments. The

instruments can monitor microseismicity long before it reaches a level that can be felt. A detailed plan, referred to as a Traffic Light System (TLS) has been developed to mitigate against the generation of larger earthquakes. The plan defines mitigation measures. These measures may include ramping-down or stopping activities associated with the EGS operations entirely.

- How the public can follow the seismic monitoring: Microseismicity can be followed in real time on the Utah FORGE website. It is important to note that the communities of Beaver County are experienced with naturally-occurring seismicity. Since the residents are used to some degree of natural seismicity, as well as man-made seismicity associated with a blasting pit and train traffic, having the ability to ascertain the source and the size of the activity in the same manner seismologists and other scientists do, provides a real sense of equality. Utah FORGE has provided tools for the community to monitor seismicity in real time using the same means as the project: the University of Utah Seismograph Stations. This was accomplished by placing in each of the county's three libraries a computer set to the UUSS monitoring site.

  A USGS website hosts an interactive app called 'Did You Feel It?' where individuals can report felt earthquakes in their area. Most recently, on January 17, 2020, the 3.9 magnitude Minersville Earthquake, a naturally occurring event unrelated to Utah FORGE, occurred 12 km southeast of Milford. No damage was reported. Following the earthquake, 189 individuals (mostly from the area) proactively logged onto the USGS page to contribute data to its "Felt Report" (Figure 9). Despite the locals' familiarity with seismicity, it is still paramount to openly discuss the possibility of triggered or induced seismicity frequently.



SHAKING	Not felt	Weak	Light	Moderate	Strong	Very strong	Severe	Violent	Extreme
DAMAGE	none	none	none	Very light	Light	Moderate	Moderate/Heavy	Heavy	Very Heavy
INTENSITY	I	II-III	IV	V	VI	VII	VIII	IX	X+

Figure 9. Number of reports and intensity levels logged on USGS 'Did You Feel It?' website following the M 3.9 Minersville earthquake. (https://earthquake.usgs.gov/earthquakes/eventpage/uu60356907/dyfi/intensity)

8. Giving Back to the Community

Equally as important to fostering public trust, is giving back directly to the community (Smith et. al., 2018). Depending on the scope of the geothermal project and funding sources, this can include preserving cultural sites, developing housing, building infrastructure, creating scholarships and sponsoring community events.

Given restrictions associated with the grant awarded to Utah FORGE, the team endeavors to use local goods and services at every opportunity. During site activities such as well drilling, stimulation, crews are housed at area hotels, eat at the restaurants, and visit the shops. Although temporary, during times of activity, jobs are also created – from cleaning crews to night watchmen. When the project reaches completion, it will leave behind infrastructure such as previously unpaved roads.

9. Lessons Learned from Utah FORGE Outreach Efforts

Ensuring public awareness and increasing geothermal literacy within Beaver County and Utah is an essential part of the Utah FORGE Outreach and Communication Program. During the life of the project, significant and innovative expansion of engagement activities has been realized, while groups of stakeholders have been expanded.

These efforts have allowed for several important best practices and lessons to be learned.

1. Younger students are eager to learn about geothermal energy. Although middle and high schoolers are a logical target, younger students proved to be enthusiastic to learn about the topic. A preexisting, albeit rudimentary understanding of plate tectonics aided in their ability to grasp basic geothermal concepts. Following the success of the contest, fifth and sixth grade teachers inquired if Utah FORGE would be willing to return to their classes during the following academic year to repeat the program.

2. Hands-on, interactive modules are incredibly effective for engagement. Students and adults alike enjoy these, and the modules serve as physical connection to the concepts being taught. The Utah FORGE team utilized hand boilers, a thermal camera and Peltier modules, which proved wildly popular. The team is currently collaborating with the University of Utah Department of Chemical Engineering to create new modules.

3. Participating in community events creates familiarity and recognition. Hosting a booth at the annual Beaver County fair has helped to create a sense of belonging. Several attendees have mentioned remembering the team from previous years and wanting to hear an update on activities. Moreover, during the visits to schools, students recognized the team from the fair, making us a known entity and creating legitimacy and trust. Building from this familiarity, Utah FORGE has been invited to participate in the fair's academic session the day prior to opening in 2023.

4. Existing outreach products can be used to generate new forms of engagement. Stemming from the existing Word of the Week, a geothermal glossary, the team launched a new interactive crossword puzzle game, based on geothermal terms. Additionally, these terms will be used for future products for educators.

5. Reaching beyond Beaver County yields benefits. Traditionally, Utah FORGE outreach has been limited to Beaver County. Attending Welcome Week at the University of Utah and the Midvale Harvest Days proved to be a cost-effective means to engage with larger audiences no previous familiarity with the project or geothermal energy.

10. Conclusion

The success of the Utah FORGE outreach program stems from a consistent open transparency, regular engagement with the community in creative and beneficial ways, and recognition of the value both sides provide. These efforts have led to an unwavering support of the project by residents and an enviable level of personal investment by them in it. This in turn has resulted in a palpable level of acceptance of the outreach members by the local residents, who have welcomed the team as extended members of community Having established a level of successful outreach we remain committed to growing our outreach, engaging with all local, regional, national and international stakeholders within and outside of the geothermal community, by providing them

with the latest news, updates, developments, advances, and findings at Utah FORGE. Additionally, we will continue to build our relationship with new and younger audiences through educational opportunities, all in support of achieving the overarching vision of increasing geothermal and EGS literacy.

Acknowledgements

Funding for this work was provided by U.S. Department of Energy under grant DE-EE0007080 "Enhanced Geothermal System Concept Testing and Development at the Milford City, Utah FORGE Site". We thank the many stakeholders who are supporting this project, including Smithfield, Utah School and Institutional Trust Lands Administration, and Beaver County. The Bureau of Land Management and the Utah State Engineer's Office have been very helpful in guiding the project through the permitting processes.

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