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GeoBridge: Unearthing Insights from Connecting Communities to Geothermal Information and Opportunities

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ABSTRACT

Knowledge is essential for overcoming obstacles in the development and adoption of geothermal technologies, and the geothermal community is home to numerous tools, events and organizations dedicated to sharing knowledge. However, many of these tools can be difficult to find, their resources undiscoverable by search engines, available only to members, or hidden away behind pay walls (Weers et al., 2024). The Department of Energy's (DOE) GeoBridge was developed by the National Renewable Energy Laboratory (NREL) to help bridge gaps in information and connect the geothermal community to the resources it needs. Launched in October 2024, GeoBridge aspires to expand the pool of geothermal stakeholders by providing in-roads to geothermal information, tools, and community resources. It helps to make these resources available to the broader geothermal community as well as those looking to join, such as entrepreneurs or innovators in adjacent industries looking to expand into geothermal energy.

This paper explores a post-launch analysis of GeoBridge including data from analytics, feedback from GeoBridge users, the geothermal community, and the GeoBridge Advisory Group as well as an analysis of efficacy of various promotions for GeoBridge.

1. INTRODUCTION

The U.S. Department of Energy's (DOE) GeoBridge serves as a launch point, directing users to existing data and tools, events, educational resources, STEM programs, permitting and regulatory information, and other resources that can be used to evaluate, promote, and discover geothermal opportunities. Developed by the National Renewable Energy Laboratory (NREL), GeoBridge was launched in October 2024, to create additional pathways to geothermal information and help those outside of the established geothermal community find information on networks, events, opportunities, and other resources within the geothermal industry. One of the primary objectives of GeoBridge is bringing communities together. The GeoBridge team aims to bridge the gap between the geothermal community and those outside it by creating inroads to geothermal information, analysis and expertise (Weers et al. 2024).

Gaps in information were identified by NREL researchers, the Geothermal Data Repository (GDR) team, and an advisory group composed of industry professionals, utility operators, academics, event organizers, and representatives from national labs, the Department of Energy (DOE) and states government offices (Weers et al. 2024). Working together, the GeoBridge team and the Advisory Group organized these gaps by community needs (below). Not all gaps represent a lack of information. In some instances, key information was available online but was behind a pay or membership wall, difficult to discover, or otherwise inaccessible to outsiders. GeoBridge improves the discoverability and accessibility of these resources through the addition of critical context, the creation of strategic links to other information portals, and through search engine optimization (SEO) to ensure salient information appears in search results.

Identified information gaps organized by communities and their respective needs (Weers et al. 2024):

- **Entrepreneurs** looking to drive innovation in the geothermal space
- **Professionals** looking to find and build careers in geothermal, including workforce development and training for the next generation of geothermal workers
- **Homeowners** and **Businesses** interested in saving money with Geothermal Heat Pumps (GHPs)
- **Students** looking for undergraduate and graduate programs that will set them up for a career in geothermal
- **Organizations** looking to generate more interest in geothermal projects and job openings
- **Communities** looking to develop cost-efficient, resilient heating solutions
- **Teachers** and **Educators** looking to integrate geothermal learning into their lesson plans
- **Decision Makers** looking to introduce geothermal options into their communities
- **Utilities** looking for guidance on how to incorporate geothermal energy into their portfolios
- **Regulators** looking for assistance and best practices for approving and monitoring geothermal systems

The information gaps and community drivers outlined above were used to inform GeoBridge's information architecture. GeoBridge intentionally provides multiple pathways to key information. This is best illustrated by the tiles on the homepage (Figure 1, bottom) as well as discovery opportunities embedded within the content itself (Figure 2). These mechanisms have been designed to align with the specific community needs discovered during the information gap analysis.

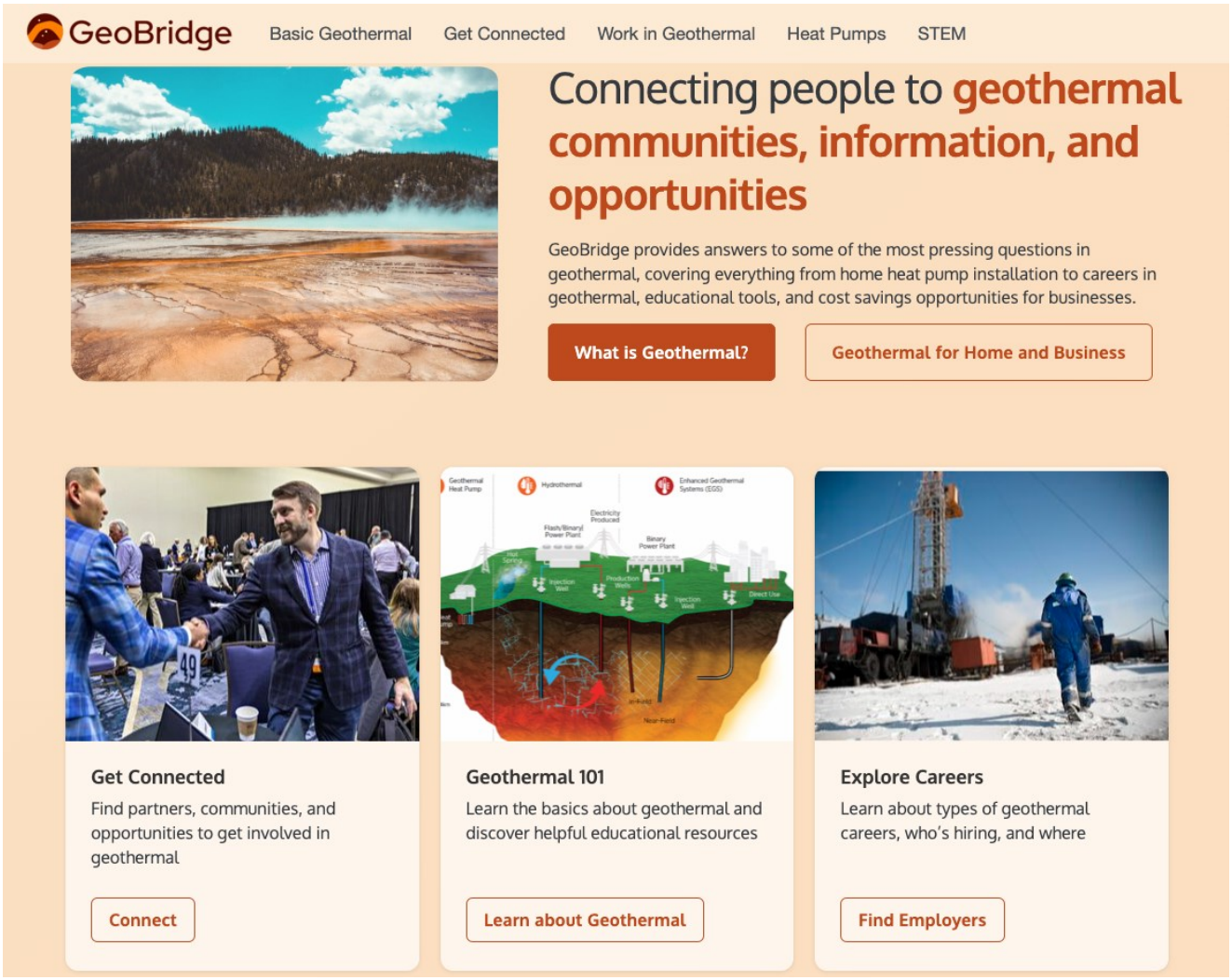

Figure 1: GeoBridge home page showing site navigation (top) and common topic "tiles" (bottom).

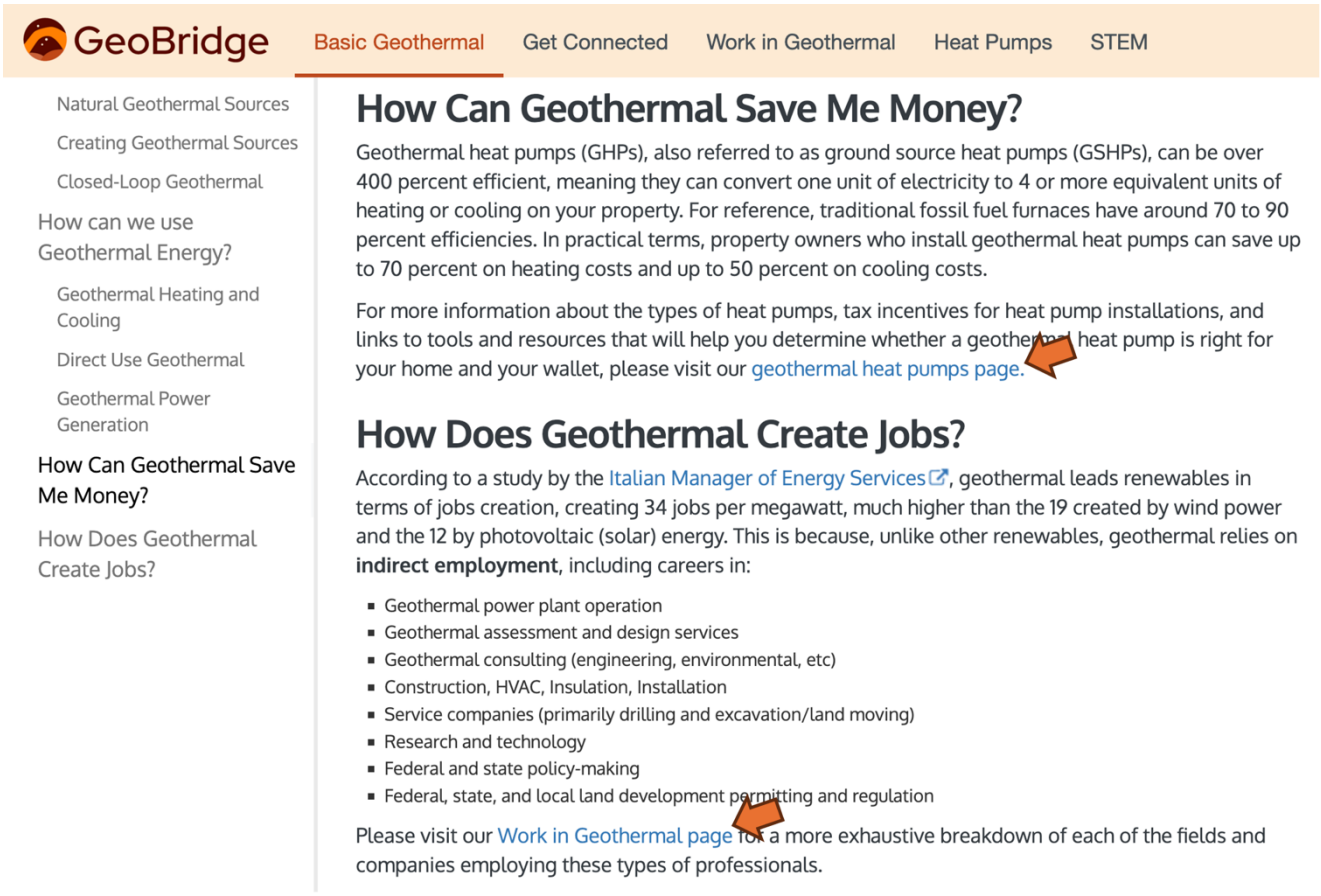

Figure 2: Discovery opportunities embedded in the content (indicated by the orange arrows) direct users to related content.

1.1 GeoBridge Launch

GeoBridge was formally launched at the 2024 Geothermal Rising conference in October 2024 and is available online at https://openei.org/wiki/GeoBridge. In addition to the conference paper and presentation, the launch was announced on social media, featured in several news articles, and publicized during a launch webinar hosted by NREL and DOE on December 3, 2024.

In an effort to determine the impact GeoBridge has had, as well as the efficacy of engagement and outreach events, NREL has been collecting metrics on the use of GeoBridge since its launch.

2. MEASURING IMPACT

The mission of GeoBridge is to bridge the gap between the geothermal community and those outside it seeking geothermal information, analysis and expertise. Its success could be defined as an increase in connectivity between outside stakeholders and the geothermal community, or the expansion of the geothermal community to include these information seekers. However, the impact GeoBridge is having on the geothermal community can be difficult to measure quantifiably. Part of GeoBridge's origin story includes the receipt of numerous questions emailed directly to geothermal experts or GDR's Help email, often as a last resort from individuals and organizations seeking information but presumably otherwise failing to find this information easily online (Weers et al 2024). One measure of success could be a decline in the frequency of questions received via email or an evolution in the nature of the questions being asked. As more relevant geothermal information is made discoverable online, seekers of that information will be more likely to find it through simple searches and the need for them to resort to emailing their inquiry should decline. And while the GDR team has observed a decline in these types of inquiries since the launch of GeoBridge, it's too early to draw any meaningful conclusions. A more immediate and quantifiable metric of success is to measure the usage of GeoBridge and its ability to drive users to the information they seek.

2.1 Usage Metrics

NREL has been collecting metrics on GeoBridge since its launch on October 28, 2024. All metrics are recorded anonymously. GeoBridge does not require a login, nor does it capture information associated with any individual person. Usage metrics collected from launch through January 23, 2025, were analyzed by NREL with the goal of answering the following questions:

- Who is using GeoBridge and how can we better cater to their needs?

- Which methods of community engagement or outreach were most effective?
- Which areas of GeoBridge do users find most engaging?
- How successful has GeoBridge been in directing users to geothermal resources and information?
- What gaps remain in GeoBridge and how might we address them?

The metrics collected and analyzed are defined as follows:

- **Views** (also referred to as "page views") describe the number of times a page on a website has been viewed by a user. This metric is useful for identifying trends in which areas of a site are attracting the most users and which may need more refinement. (Google Analytics 2025)
- **Users** measures the number of active users who interact with a site within a given period of time from a unique combination of device and location (Google Analytics 2025). This means that an individual accessing GeoBridge from home on both their mobile phone and desktop would count as 2 users. Similarly, the same person accessing a site on their phone from both home and work would count as 2 users. For GeoBridge, measuring active users is important as it correlates to the number of people using the site and it lends important context to "Views", enabling the GeoBridge team to differentiate between different user behaviors and providing insight into how many pages different users of GeoBridge might visit in a single session.
- **Sessions** begin when a user interacts with a website and ends when they stop interacting with the website, such as closing the tab or navigating away from the site (Google Analytics 2025). When combined with Users, it becomes possible to tell if people are accessing the site multiple times, which may indicate that they found the site useful enough to return.
- **Views per Session** describes the number of pages a user viewed during their session (Google Analytics 2025). This metric directly indicates how deeply users engage with GeoBridge during each visit and can indicate whether users are actively exploring the site or quickly leaving after only viewing one page.
- **Session Duration** describes the amount of time a user spends on a site during a single visit (Google Analytics 2025). It can be used to provide insights into how engaging users find the content or how long it takes them to find the information they are seeking. Longer sessions could be either good or bad, depending on the pages visited and the purpose of the visit.
- **Page Referrer** is a webpage that sends traffic to your site (Google Analytics 2025). Capturing Page Referrer data can provide insights into where GeoBridge users are coming from and the efficacy of our engagement, outreach and SEO activities. For example, an increase in referrals from search engines could indicate better SEO while an increase from partner sites could indicate better interoperability between the sites. Page Referrers can also be used to understand how many users are being sent from one page in the site to another, which in the case of GeoBridge, can help analyze the impact and effectiveness of different pathways to information.
- **Outbound Link Clicks** capture the number of times a GeoBridge user clicks a link that leads them to another, external site (Google Analytics 2025). Part of GeoBridge's mission is efficiently directing users to resources spread out across the internet, to connect them with geothermal information, organizations, and events on multiple sites. Measuring Outbound Link Clicks can help quantify how effectively GeoBridge is accomplishing its mission.

3. ANALYSES AND INSIGHTS

Since its launch in October, GeoBridge has been viewed 3,624 times by 740 users during 817 distinct sessions. Sessions lasted 4 minutes and 12 seconds on average and included 2.54 views per session. This tells us that most users that arrived at GeoBridge are looking around for a few minutes and visiting more than 2 pages. These numbers can help measure exposure and user engagement, but on their own they are not a good indicator of impact. Because GeoBridge serves as a launch point, often driving users to information on other sites or contained within external tools, one measure of success can be the number of outbound links clicked on by users. Combined with more traditional web stats, such as page views, users, and sessions, the GeoBridge team can get a picture of how GeoBridge is being used and the impact it is having.

3.1 Analysis of Users and Views

GeoBridge users per day peaked with each engagement and outreach activity (Figure 3). This is an expected response to the presentations, stories, webinars, and news articles announcing GeoBridge as people visit the site to see it for themselves. These usage spikes often indicate the efficacy of the engagement and outreach activity more than impact of the site itself. To measure the impact GeoBridge, is having we look for the staying power of new usage metrics by measuring the relative growth of users per day as a baseline average following these "peak" events. This is complicated slightly by the holiday season in late December, early January. In any given weekly cycle, GeoBridge users tend to peak mid-week and fall off to near zero on the weekends. This is typical of most business-oriented sites as users tend to access this sort of information during the work week. The same behavior can be extrapolated over the holidays. Assuming the dip from December 23 to Jan 2 is due to the holiday season, the baseline trend of GeoBridge users per day is increasing over time, potentially indicating return visits and increased impact. This may be evidenced by the mid-January increase in traffic, as users return from the holidays, prior to subsequent outreach efforts (Figure 3).

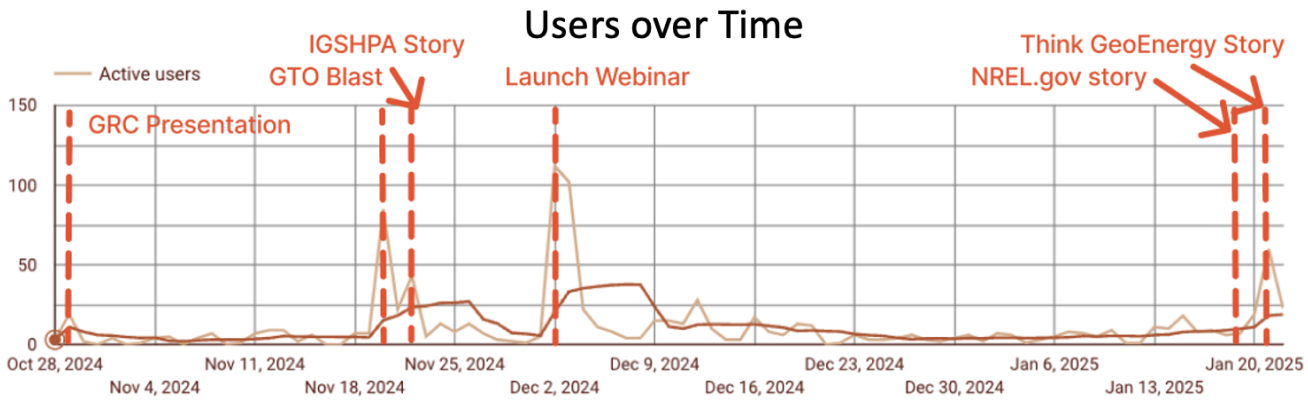

Figure 3: Graph of GeoBridge daily users over time, from October 28, 2024 – January 23, 2025.

An analysis of views per session further supports this theory as it shows a visible increase in the depth of user interaction with the site during mid-January (Figure 4, highlighted section). While the initial, elevated view levels in November corresponded with the GTO 'Drill Down' announcement and likely indicate new users 'exploring' the site, the spike observed on January 11th did not correspond to an engagement or outreach activity and marks the beginning of a slight trend in views per session that persists through the remainder of January. However, it remains to be seen whether this trend will continue. The GeoBridge team will continue to monitor this metric over time.

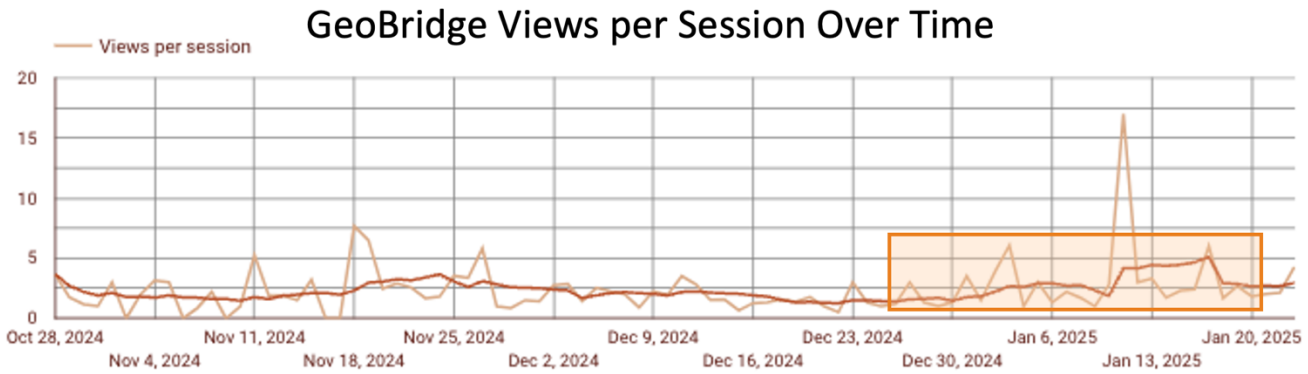

Figure 4: GeoBridge views per user session over time, from October 28, 2024 – January 23, 2025.

3.2 Analysis of Engagement and Outreach Activities

The NREL and GTO teams leveraged many channels while announcing the launch of GeoBridge including news stories, webinars, in-person events, social media and more. Our most significant spikes in user traffic to the site coincided with announcements in the GTO 'Drill Down', the GeoBridge launch webinar, and an NREL news story that was then reiterated in a Think GeoEnergy article (Figure 3, vertical dashed lines). The correlated spikes in user counts emphasize the impact of these outreach efforts. Another way to quantify community engagement is by measuring the number of users coming to GeoBridge from these and other sources (Figure 5).

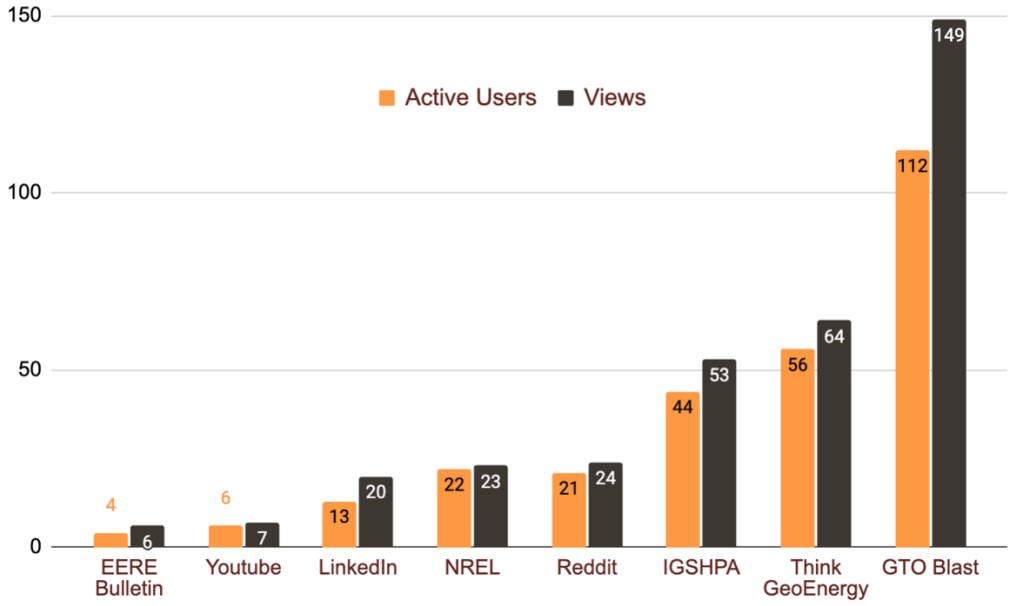

Figure 5: User traffic spikes mapped to corresponding sources

GeoBridge's most impactful community engagements were GTO's e-blast (the Drill Down newsletter), a Think GeoEnergy news story, and an IGSHPA news story. Having access to reputable partners with wide audiences was by far the most effective method for announcing the launch of GeoBridge.

Our initial hypothesis was that social sites such as LinkedIn would enable us to reach more users in communities adjacent to geothermal by leveraging personal networks to traverse social boundaries. However, announcements on Reddit slightly outperformed LinkedIn in both views and active users. This could be due to Reddit's user experience, which is based more around shared interests and discussions rather than shared personal networks and may indicate that there is an opportunity to reach more communities that exist outside of pre-existing networks than through other social media channels.

News stories outperformed all other channels, presumably because their inclusion of the GeoBridge mission provided useful context and helped inform new users' motivation to explore GeoBridge content. While inclusion of GeoBridge's mission in future outreach efforts could help increase community engagement, a better measure of success would be a shift over time from reliance on public announcements and news stories to users discovering content on GeoBridge through discussions and peer recommendations, or through organic searches (i.e. search engine recommendations). An increase in new users coming from search engines and Reddit, for example, could indicate increases in the adoption of GeoBridge by external communities and its efficacy as a reputable source of geothermal information. The GeoBridge team will be monitoring these metrics over time as potential indicators of impact.

3.3 Analysis of Engagement by Content

An analysis of traffic by page revealed a relatively balanced distribution of views and users across key pages, including *Basic Geothermal*, *Work in Geothermal*, *Get Connected*, and *Heat Pumps*. The *STEM* page had the lowest usage at just 50% of average, which could be the result of fewer target communities in initial engagement and outreach activities, or could indicate an issue with the page name (Figure 6). Feedback from the community also indicated that users don't expect to find information about geothermal undergraduate and graduate programs and courses on a *STEM* page. This may partially explain the relatively low view and user numbers for that page and could indicate a need to change the location of GeoBridge's content on geothermal programs and courses, revise the site navigation, or both.

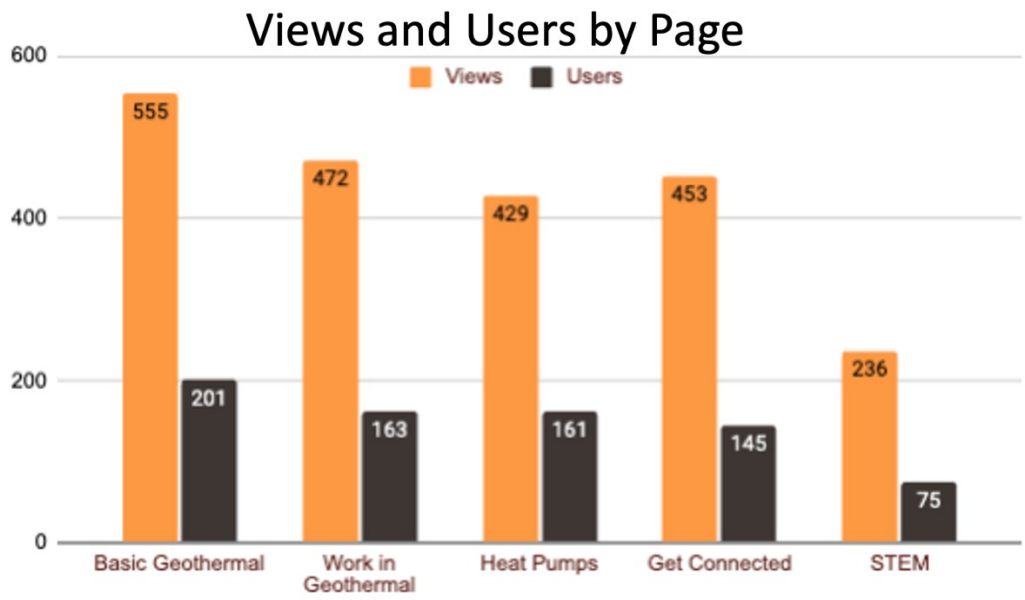

Figure 6: GeoBridge views and users by page from initial launch, October 28, 2024, through January 23, 2025.

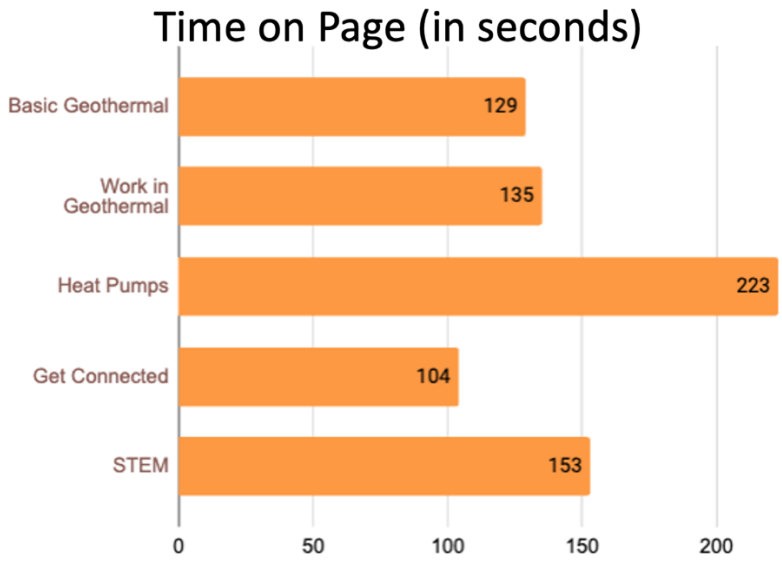

Figure 7: GeoBridge time on page (in seconds) per page from initial launch, October 28, 2024, through January 23, 2025.

Interestingly, an analysis of the average amount of time users spent on each page paints a different picture (Figure 7). Despite having the lowest user counts, both the *Heat Pumps* and *STEM* pages have the highest time on page, meaning the amount of time users spent on each of these pages compared to the next most engaged page (*Work in Geothermal*) was 65% and 13% longer, respectively. This could be an indicator of richer or more complicated content demanding more of a user's time or could be an indicator of users having to spend more time reading through a page to find the information they are looking for. One way to determine if increased time on page is a positive indicator of impact is to measure whether GeoBridge has been successful in directing users to the geothermal resources and information they seek.

3.4 Guiding Users to Reputable Content

A key part of GeoBridge's mission is efficiently directing users to reputable resources spread out across the internet. One way to measure whether GeoBridge has been successful in doing this is to count the number of times users have clicked through links on GeoBridge to external information or sites. These clicks represent users whose internet search led them to GeoBridge where they found enough descriptive context to guide them to the information they seek, even if it exists on another site. To date, users have clicked 372 external

links during 819 sessions. GeoBridge users that clicked external links did so 2.31 times on average per session, which equates to a 19.7% conversion rate. This means that nearly 1-in-5 users visiting GeoBridge end up clicking on a link to an external resource. The majority of these clicks are navigating users to resources maintained by reputable organizations (Figure 8). A higher conversion rate and an increase in external clicks over time would indicate that GeoBridge is having a greater impact by helping to connect more users to the geothermal resources and information they need.

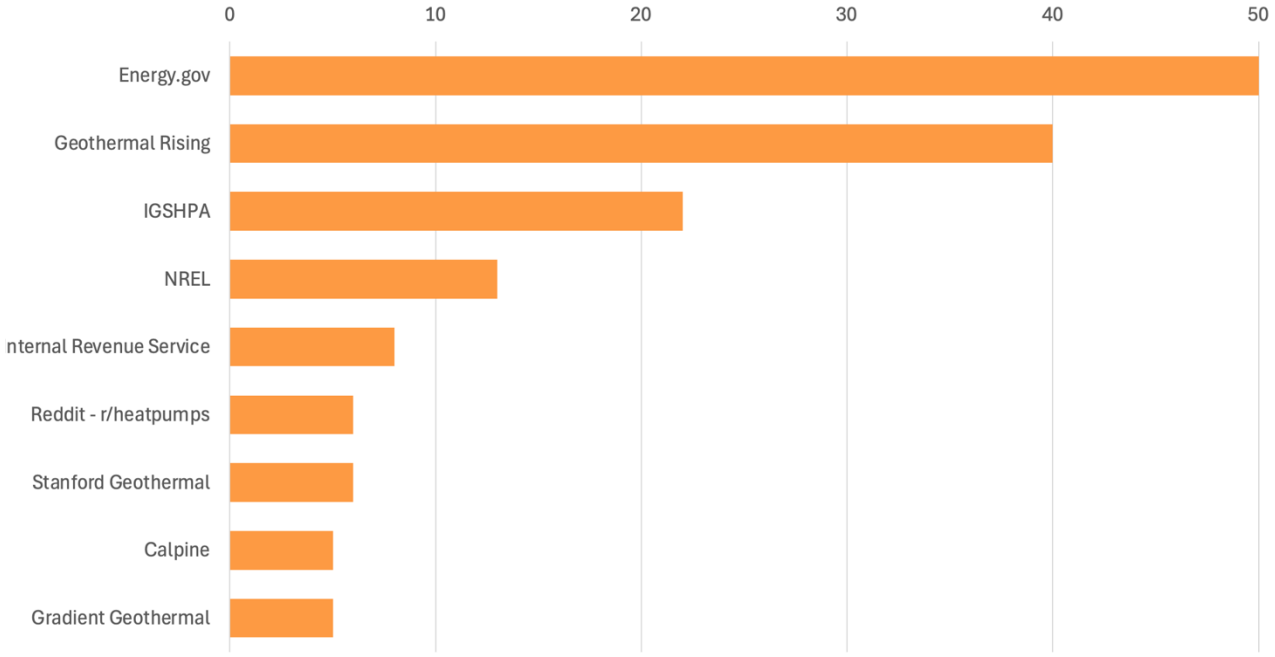

Figure 8: Number of outbound link clicks from GeoBridge to the listed sources/organizations.

4. CONCLUSION

While GeoBridge has shown initial positive indicators in its ability to engage and assist users on their quest for geothermal information, it is still too early to tell from the data whether GeoBridge has succeeded in achieving its intended impact. Usage of GeoBridge has remained steady and is trending upward with notable increases in user engagement. GeoBridge appears to be a useful addition to the digital ecosystem for geothermal and initial feedback from the community has been quite positive. The overall volume of users, positive trends in page views per session, and the nearly 20% conversion rate for users clicking through to outbound links represents measurable impact and movement towards achieving its mission of connecting external communities with geothermal information and resources, to expand the pool of geothermal stakeholders and accelerate the rate of innovation in geothermal technologies.

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