

Financing the Geothermal Transition



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Geothermal energy can supply reliable, sustainable, baseload power by accessing the heat stored below the Earth's surface.¹ Its potential is significant but commercial deployment has been limited by insufficient financial and technological support.²

During New York Climate Week, 1GT co-hosted a roundtable discussion with Extantia, Elemental Impact and Energy Impact Partners focused on financing the geothermal transition. We brought together key stakeholders across industry, finance, and government to discuss future pathways and current issues in the sector.

Below is a summary of the conversation.

Enhanced Geothermal vs Super-Hot Rock

Geothermal energy is a naturally occurring abundant supply of heat within the Earth's surface.³ Accessing this resource at scale is arguably critical to the transition however, when considering the barriers to expansion, it is important to distinguish between the potential solutions.

The most prominent new technology being developed is by Enhanced Geothermal Systems ("EGS") companies. These companies inject fluid into known areas of high temperature rock to create a more permeable system. The subsequent permeability allows more fluid to circulate, bringing heat to the surface for use.⁴

EGS companies present themselves as having proven technology which now needs to scale. Their wells run at ~200°C and build on innovation and practices from the oil and gas industry. Some significant players are already producing, and their focus is now on driving operational efficiencies to unlock

¹ IEA World Energy Outlook, 2024

² US Department of Energy Commercial Liftoff Report, 2024

³ US Department of Energy Commercial Liftoff Report, 2024

⁴ US Department of Energy Geothermal Technologies Office

AUTHOR



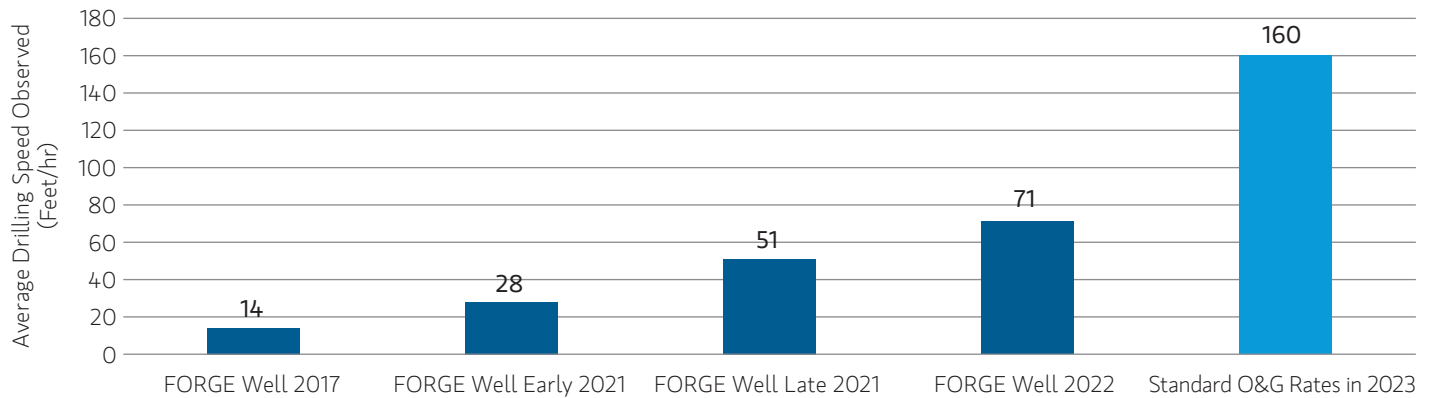
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KEY TAKEAWAYS

- Enhanced Geothermal Systems and Super-Hot Rock companies are two differing geothermal energy solutions each with their own unique scaling challenges
- Time is a critical resource and collaboration is required to displace incumbent energy sources
- Private market capital can only go so far and broad engagement is vital

DISPLAY 1

Onshore North America Drilling Speed at Department of Energy Test Site (FORGE) vs Oil & Gas Incumbents



Source: US Department of Energy Pathways to Commercial Liftoff Report, 2024

capital. Their ongoing goal is to lower drilling costs and improve speed to production.⁵ While progress is being made, they still lag the typical drill speeds of their oil & gas peers.⁶

An alternative solution is provided by Super-Hot Rock companies which look to exploit the significant potential of deeper rocks with temperatures over 375°C. At double the temperature, it is possible to extract 10x the energy which increases efficiency of the electricity generated. To put this in context, the output of 3 wells operating at 400°C would likely exceed the output of 40 wells at 200°C.⁷ Despite these clear benefits, extracting this heat has significant challenges and new techniques must be developed, especially as very few companies have ever drilled that deep or at that temperature. These players are still looking to prove the viability of their technology to investors and peers in the sector.

Both EGS and Super-Hot Rock companies need to scale but the challenges they face are different. Market participants must recognize this and ensure they are engaging with the right opportunities for their capital and resources.

More Input from More Entities

In the US, there is strong engagement in the geothermal sector from entrepreneurs, early-stage investors, companies looking for energy offtake agreements, and governments.⁸ Together this group forms a strong capital cycle with companies getting funded, contracts being signed, and skills coming in from incumbent industries to scale projects. Unfortunately, we believe it is not strong enough for the sector to reach scale.

1GT believes the sector has yet to see meaningful engagement from the energy majors, large scale infrastructure investors, project financiers and lenders, oil field services players or insurance companies. The participation of these groups together drove previous step changes in new energy sectors (e.g., the US shale boom) by reducing uncertainty for all parties.

Each of these players makes capital allocation decisions on a global scale and don't appear to view the risk/reward in geothermal as appropriate.⁹ They also rarely bet on single project outcomes and typically prefer to spread risk across either a portfolio or a geographical area.¹⁰ We believe geothermal developers, or their backers, must align their demands and potential outcomes with these incumbent structures to access broader pools of capital. This may even include considerations of their site value outside of geothermal energy production, a key step for project financing discussions.

Separately, the lack of supply chain modularization which enables more interchangeability of components is limiting. We are yet to scaled original equipment manufacturers ("OEMs") with comprehensive hardware offerings emerge, such as

⁵ Fervo Energy Technology Day Highlights, 2024

⁶ US Department of Energy Commercial Liftoff Report, 2024

⁷ Clean Air Task Force Geothermal Report 2024

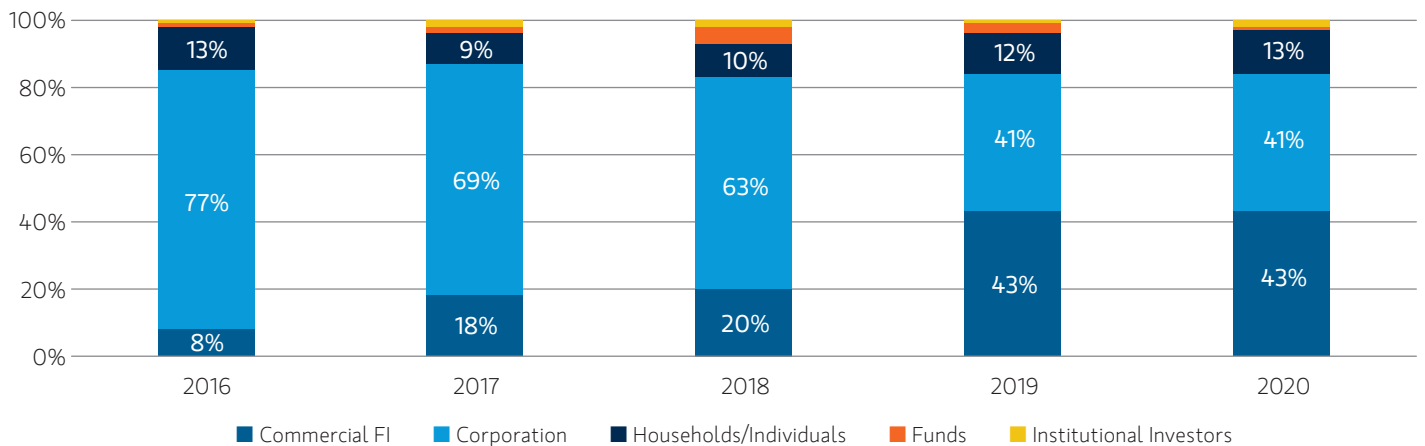
⁸ "Meta Platforms Signs Geothermal Energy Deal to Power US Data Centres", Reuters, 2024

⁹ "ExxonMobil CEO talks Geothermal", Axios, 2024

¹⁰ "bp and Chevron invest in geothermal startup Eavor", Eavor Press Release 2021

DISPLAY 2

Global private investment in renewable energy by investor type, 2016-2020



Source: IRENA Global Landscape of Renewable Energy Finance, 2023 Report

Vestas and Siemens in the offshore wind sector. These producers standardize equipment, lower costs, and arguably create accountability of individual components which incrementally reduces the risks for financiers and purchasers.

Time is the Critical Resource

The first modern oil well was most likely drilled in Poland in 1854 and since then the global economy has consumed at least 1.4 trillion barrels for various uses.^{11,12} As such, investors and companies operating in the oil & gas sector can leverage up to 170 years of experience and data when funding, developing, and operating projects.

This information extends beyond drilling to cover a vast range of data points across asset quality, productivity, maintenance costs, lifespan assumptions and alternative land use options, much of which has been learnt from experience and actual outcomes.

Commercial geothermal does not have this extensive data set because it is a relatively nascent technology. However, its criticality to a low carbon future is widely accepted. The sector must therefore use all available resources to bridge the time gap which includes a sharing of data between parties who may view themselves as competitors.

Demand from Companies Can Only Go So Far

Private & public companies, most notably the hyperscale data center developers, are providing significant support to the industry through contracted offtake agreements for energy.¹³ This indicates they have recognized the industry's ability to deliver clean, reliable, scaled base load power at a range of locations, something wind/solar/batteries still struggle to produce.

With grid connections and capacity an increasingly prevalent issue, the attractiveness of geothermal energy only increases as shown by META's recent Sage Geosystems deal or Google's partnership with Fervo Energy and NV Energy.^{14,15} 1GT believes demand for this resource is there if it can be delivered at scale.

Despite these issues, disintermediating the grid remains difficult given the security and optionality it provides. Running a microgrid, or behind-the-meter facility, for the amount of power a data centre demands is arguably impractical especially when it includes a new technology.

¹¹ Poland Museum of Oil & Gas Website

¹² US Energy Information Administration

¹³ "Meta Platforms Signs Geothermal Energy Deal to Power US Data Centres", Reuters, 2024

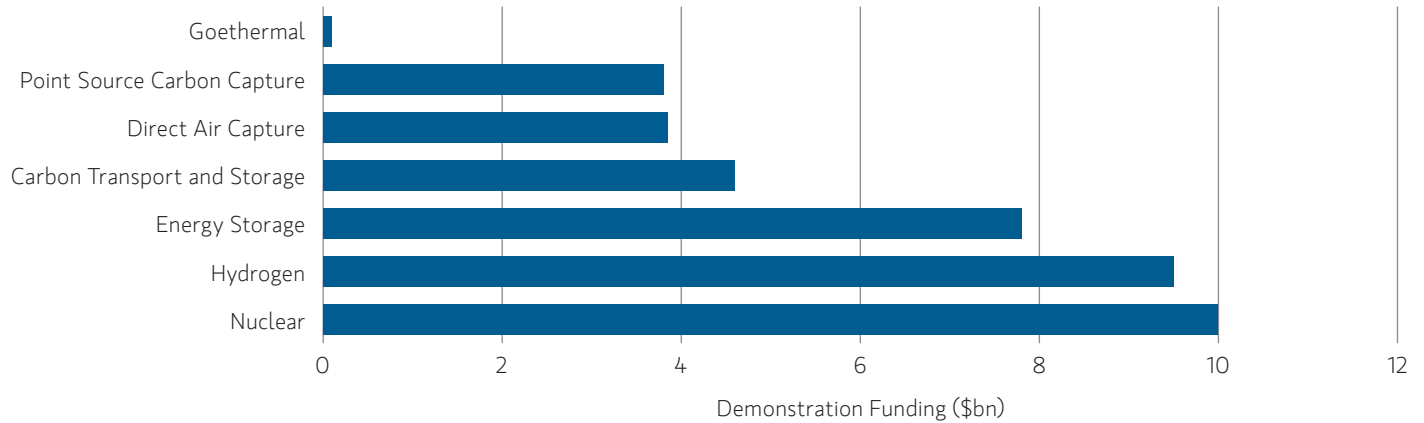
¹⁴ "Meta Platforms Signs Geothermal Energy Deal to Power US Data Centres", Reuters, 2024

¹⁵ "Google Partners with Nevada Utility for Geothermal to Power Data Centres", Reuters, 2024

DISPLAY 3

Funding allocated for large-scale demonstrations, manufacturing and supply chains, and supportive infrastructure

Bipartisan Infrastructure Law and Inflation Reduction Act



Source: US Department of Energy Pathways to Commercial Liftoff Report, 2024

Utilities will therefore play a critical role in scaling geothermal and providing those companies who are willing to commit to low carbon solutions the safety net to do so.

More Stakeholders in the Ecosystem

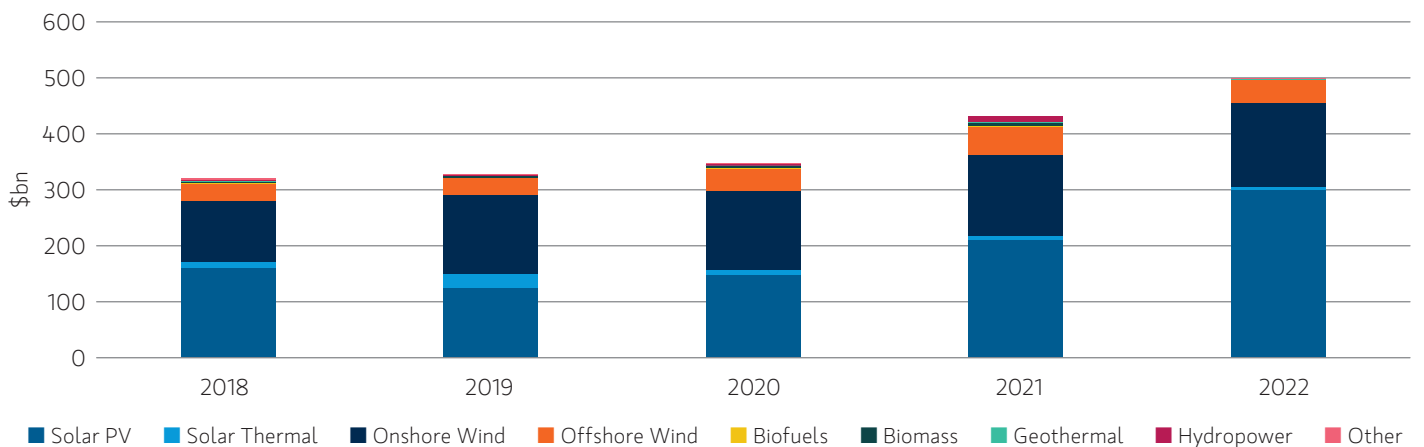
Disrupting significant parts of the energy ecosystem likely requires more resources than any single entity possesses, even when the potential is as clear as it is for geothermal.

We believe industry needs more players involved at early stages to put structures in place which align better with the broader sector. This will be achieved through proof points, such as detailed well decline rates or higher temperatures achieved, and alternative approaches to diversifying risk such as the engagement of services providers or the support of insurance markets.

The scale of wind and solar markets indicate it can be done.¹⁶ However, the steps taken to lower cost and reduce risk in those sectors will likely need to be accelerated for geothermal to deliver on its promise.

DISPLAY 4

Annual financial commitments in renewable energy, by technology, 2018-2022



Source: IRENA Global Landscape of Renewable Energy Finance, 2023 Report

¹⁶ Global Wind Energy Council - Global Wind Report 2024

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