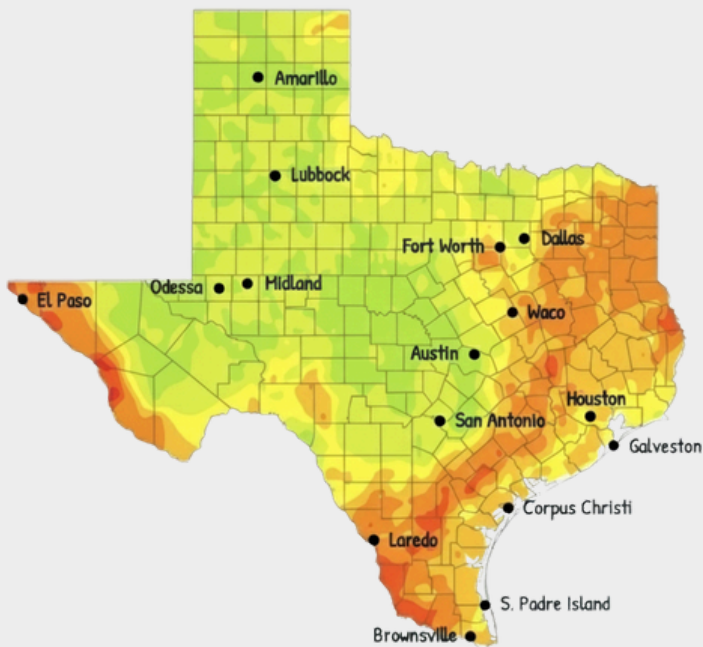


THE TEXAS GEOTHERMAL LANDSCAPE

A brief overview of the innovators, milestones, and barriers to expansion in the Lone Star State



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TEXAS
GEOTHERMAL
ENERGY
ALLIANCE

Report by James Gray, Texas Futures Coalition

texasfuturescoalition.org



TEXAS LEADS THE US IN GEOTHERMAL INNOVATION

The Lone Star State has become the global epicenter of geothermal development and innovation. Geothermal energy has been explored here since the 1960s, but the cost of drilling and the relatively lower subsurface temperatures compared to other parts of the country kept it from breaking through as a major source of energy for the state.

Over the last decade the situation has changed significantly: engineering breakthroughs and a rapid increase in demand driven by data centers, electrification, and population growth are making this “old” technology new again. Paired with a skilled workforce and a thriving innovation ecosystem, Texas is primed to lead the way in this clean, cost-effective and reliable base-load power source. Emerging technologies in drilling, well stimulation, and subsurface characterization are projected to reduce costs by 6-25% in the near term with potential for 20-43% in cost reductions as they mature.

Today, Texas is home to the most geothermal companies in the world thanks to an unprecedented combination of technical capacity & expertise, native geothermal resources, and supportive infrastructure and policies. Oil & gas industry expertise has directly transferred to geothermal drilling and operations, taking advantage of subsurface development capabilities accumulated over more than a century of hydrocarbon extraction (over half of the Texas geothermal founders have backgrounds in oil & gas).

The scalability potential in Texas is extraordinary: just 60,000 geothermal wells could supply the equivalent of all electricity and industrial heat currently served by oil & gas. Texas currently drills that many wells *every four years* for legacy sources; that development experience can be translated into a global deployment of Texas-grown geothermal solutions.

\$1.82 BILLION

STARTUP FUNDING

44

ORGANIZATIONS

1.63 BILLION

EQUIVALENT OIL BARRELS OF
POTENTIAL GEOTHERMAL ENERGY

19

PROJECTS

GEOTHERMAL (R)EVOLUTION

New frontiers are opening due to recent innovations in drilling, materials, extraction, and conversion. These innovations overcome the existing limitations of geothermal that made it viable only when high heat was easily accessible very near to the surface.

Limits of Traditional Hydrothermal Systems

COSTS: Uncertainty in finding viable locations

RELIABILITY: Uncertain flow rate limiting energy output

LONGEVITY: Mineral scaling can clog pipes and reduce well life



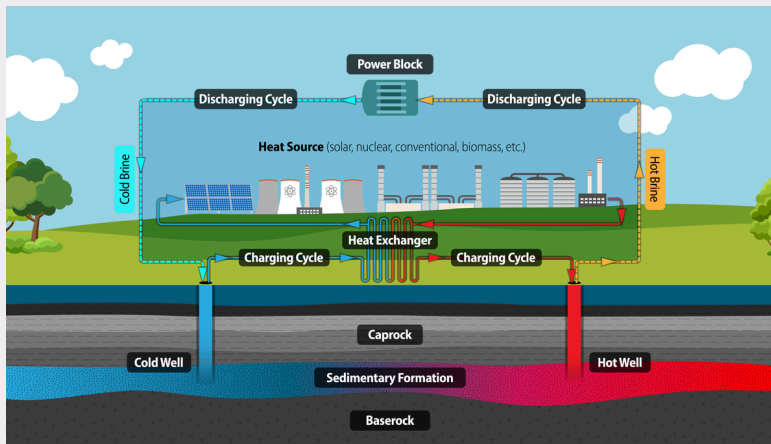
Pipe scaling

Homegrown Innovations

Geothermal innovation in Texas is multi-dimensional: from drilling to finance and everything between. Here are some key new innovations that are unlocking the power beneath our feet.

Geothermal Energy Storage

Companies like Sage Geosystems take heated water and pump it to shallow depths to increase heat and pressure to drive turbines.



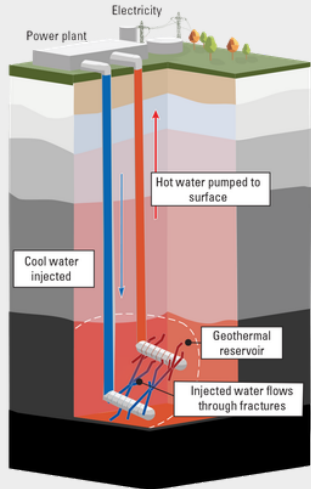
Source: [U.S. Department of Energy](https://www.energy.gov).

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GEOTHERMAL (R)EVOLUTION

Enhanced Geothermal Systems (EGS)

Advancements in fracking technology have opened up areas to geothermal development that otherwise lacked the permeability and fluid to get the heat to the surface. Companies like Fervo Energy are developing new techniques for horizontal drilling to radically drive down the cost of geothermal development across the country.



Source: [U.S. Geological Survey](https://www.usgs.gov).

Superdeep Drilling Technologies

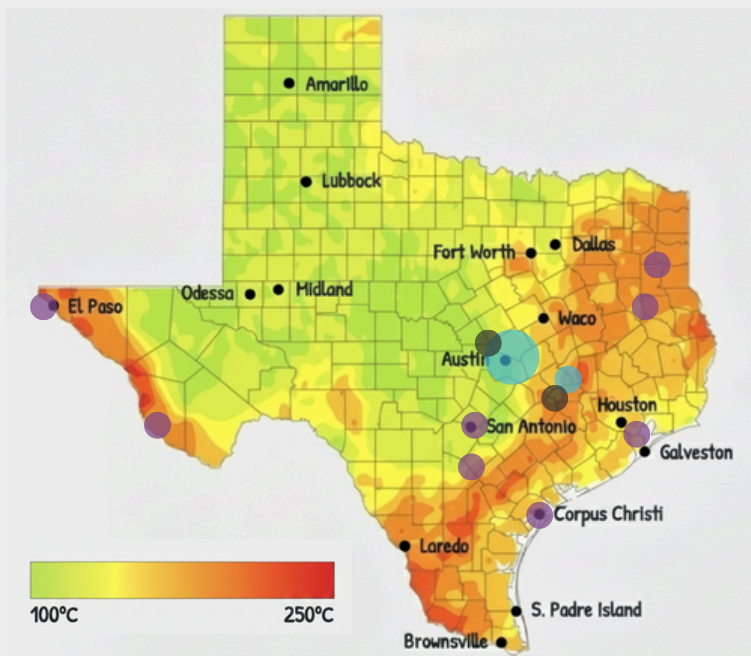
The site characteristics for a geothermal well are often fairly distinct than for oil & gas. Drilling deeper allows developers to access higher temperatures which yield greater thermal efficiency and better economics per well. These depths and temperatures come with challenges related to harder rock formations, longer trip times to replace worn-out drill bits, and equipment fatigue. Quaise Energy is addressing these by using millimeter-wave pulse technology to vaporize the rock, which enables it to go operate at much higher temperatures and previously-impossible depths.



Granite borehole drilled by Quaise



Geothermal Deployments & Resource Development Potential



Geothermal Energy

- 137MW in development
- Four test/pilot sites at military bases

Geothermal Heating & Cooling

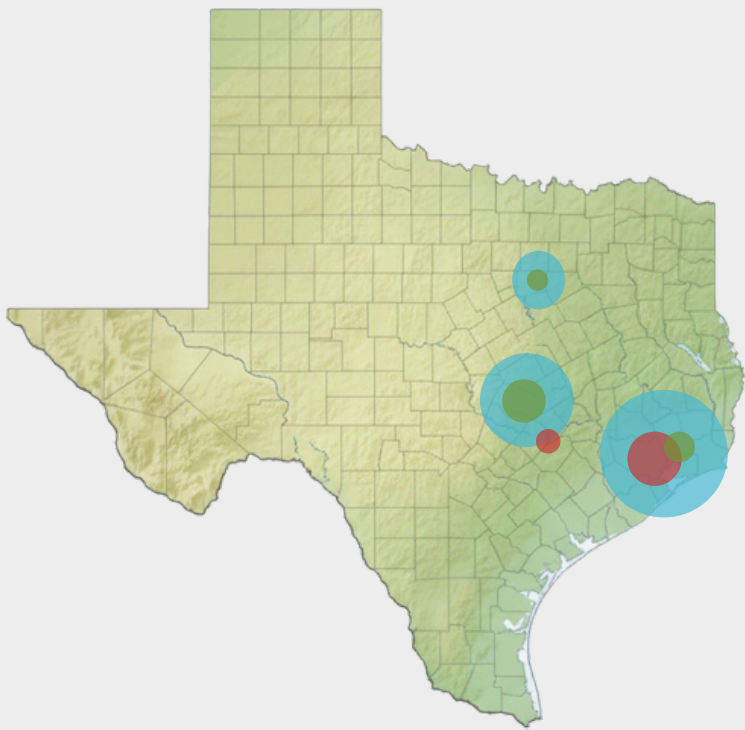
- Two active sites in the Austin metro area
- One site in development in College Station

Advanced Drilling Tech

- Two pilot/test sites by Quaise and NOV



Innovation & Development Ecosystem



Startups & Developers

- 20 Houston
- 7 Austin
- 2 DFW



Research, Data & Policy

- Project InnerSpace
- HotRock Geothermal Research Consortium
- Texas Geothermal Energy Alliance
- Bureau of Economic Geology
- SMU Geothermal Lab
- Geothermal Rising



Drilling Services

- Baker Hughes
- Halliburton
- SLB
- Helmerich & Payne
- Weatherford



MAJOR DEVELOPMENTS IN 2025

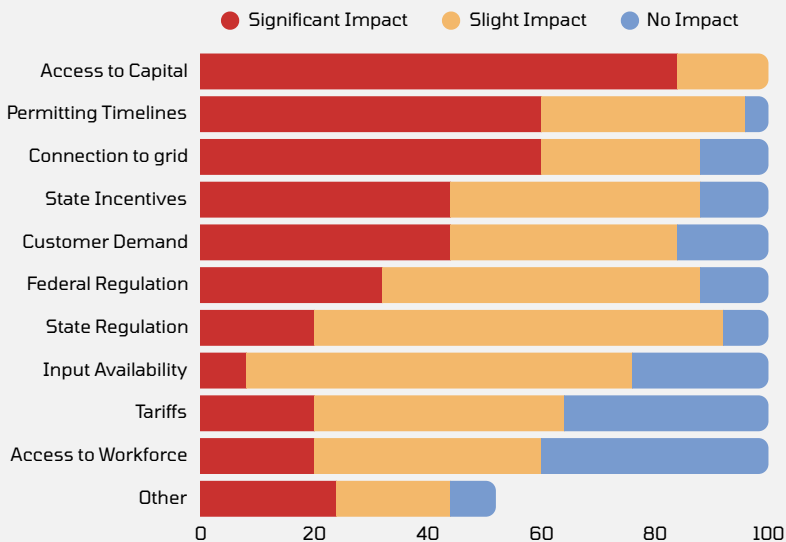
- January
- SLB and Star Energy sign partnership to expand geothermal development in Indonesia
- February
- NOV drills 3,500-meter closed-loop geothermal test well
- March
- Railroad Commission of Texas permits first geothermal well with Sage Geosystems
 - BEG launches Texas Imperative assessment of geothermal resources
- April
- Project InnerSpace publishes new data showcasing potential for geothermal-powered data centers in Texas
 - Shell Energy signs 31-MW PPA with Fervo
- May
- Renascent Energy successfully tests depleted shale wells for geothermal use
 - Presidio signs 110-MW PPA with Exceed GeoEnergy
- June
- SB 1762 makes geothermal projects eligible for TEF Bonus
- July
- Halliburton wins contract to design GeoFrame Energy wells
 - Ignis Energy raises \$13.6 million Series A
- August
- Quaise Energy achieves 100 meter milestone with millimeter wave drilling technology
 - Ormat & Sage Geosystems sign commercial partnership
- September
- SB 879 reduces red tape for closed-loop geothermal
 - HB 4370 authorizes public entities to undertake thermal energy network projects
- October
- Railroad Commission of Texas releases regulations for shallow geothermal injection wells
- November
- Fervo Releases "Geothermal Sustainable Development Pact" to establish standards for geothermal projects
- December
- Fervo Energy raises \$462 million Series E



BARRIERS AND OPPORTUNITIES

TxGEA and Texas Futures Coalition surveyed 26 of the top geothermal developers, researchers, and policy experts across the state about the barriers to progress and potential vectors to move past them. Access to capital, permitting timelines, and interconnection to the grid stood out as the chief concerns.

SURVEY RESULTS





TOP BARRIER: ACCESS TO CAPITAL

Survey respondents had a lot of ways to address these challenges. Starting from the top category rated as the most significant - capital access.

- New types of investment and investors needed beyond VC
- Better transparency and communication for investment and alignment with state and federal incentives
- Funding for more of the up front risks like wild cat drilling
- Better and more vocal support from state government and organizations
- Positivity around improved access to capital as newer technologies mature

ACCESS TO CAPITAL

- "Rapid access to grid and competitive PPAs would help to attract capital faster"
- "Allow them to apply for the [Texas Energy Fund]. We need to add more than just natural gas in the mix of the incentives going to new gas plants"
- "For state incentives, it is a mixed bag across states. Some states do incentives for shallow geothermal (ground source heat pumps) but not for deep geothermal. Some do incentives for aspects of deep geothermal but only if it connects to an electrical grid via a microgrid system."
- "The biggest hurdle is money. It requires good transparent communication and easy access to state and federal incentives"
- "Tailor government grants to support small to mid-cap organizations that have real solutions for energy independence and lower energy costs"
- "Investors are shying away from Texas due to a lukewarm expression of support (especially financial) from the legislature and the governor - if there [is] full-throated support for geothermal (including \$\$\$), then VC, etc. will follow"
- "Even at the university level, receiving funding for research and outreach is a significant effort. We could do much more to assist the industry if funding was available"
- "A coordinated government plan with appropriate incentives"
- "Access to capital will improve as next-generation geothermal technologies mature and start delivering commercial projects"



TOP BARRIER: GRID INTERCONNECTION

- Separate Geothermal from the queue for other energy sources
- Policy improvements to unify the patchwork grid management systems
- Different approaches for behind the meter or microgrids to accelerate a wider variety of projects
- Positivity around the fact that Texas has some of the shortest interconnection timelines - even though they are 2-5 years today

GRID ACCESS & CONNECTION

- “Encourage behind the meter projects to avoid the interconnection bottlenecks at ERCOT. Legislative mandate for accelerated preference for geothermal in queue.”
- “Geothermal is competing with natural gas, coal, solar and wind in a queue that extends between 2-5 years for a connection depending on the state and site. There needs to be some federal-level policy to ensure the patchwork of Regional Transmission Organizations (RTOs) or Independent System Operators (ISOs) follow similar requirements to enable geothermal access to the electrical grid. Without a taker and without a path from the taker to the market, geothermal will continue to lag behind other energy sources”
- “Grid connection timelines need to improve... there is so much that could be simplified in the process and/or done in parallel to shorten the overall timelines”
- “Texas is one of the shortest timelines for grid interconnect, though even this is a headwind to projects... micro grids are a possible mitigation”



TOP BARRIER: REGULATION & PERMITTING

- Too much chaos and uncertainty in both policy and permits
- Texas' availability of private lands and permitting through Railroad Commission is an advantage here
- More off-grid opportunities (i.e. data centers)
- Need a consistent voice from the industry for permitting challenges

PERMITTING

- "Less chaos, more certainty. Capital hates uncertainty. You know what that means"
- "This applies to the industry more broadly and is a constraint on federal lands; Texas' lack of private lands and RRC involvement is a plus"
- "Generate power for off-grid opportunities"
- "Permitting challenges... require industry to speak with one voice"



Thanks & Recognition



Source: [Quaise Energy](#).

This report was possible through the generous contributions and feedback from our peers across the geothermal industry. Special thanks in particular to the following:

- Matt Welch, TXGEA
- Barry Smitherman, TXGEA
- Shuvajit Bhattacharya, Bureau of Economic Geology
- Cindy Taff, Sage Geosystems
- Ajit Menon
- Jacob Borgeson, Texas Futures Coalition

For those wanting to dig deeper we highly recommend [The Future of Geothermal in Texas](#); the report and the team behind it were instrumental to our research.

Looking for More?



The Texas Futures Coalition is a non-profit and Texas' leading force dedicated to supporting the home-grown, market-based solutions driving the future economy. In addition to research, we conduct a variety of programs:

- Monthly Innovation Meetups
- Newsletters
- Podcasts
- Future Summits

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Interested in more research? We have an expanding database of investors, innovators, partners, and experts to engage. Reach out to discuss:

- howdy@texasfuturescoalition.org