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Legal Commentary on Advanced Geothermal Projects

Pillsbury Winthrop Shaw Pittman LLP

Enhanced Geothermal Energy Could Be the Next Zero-Carbon Hero

This article first appeared in *Gravel2Gavel*, May 9, 2024
by Sidney L. Fowler, Robert A. James and Clarence H. Tolliver

Hydrogen, solar, wind—and even **microwave beams from outer space**—are a few of the alternative energies being explored as the world strives to cut the cord on carbon emissions. Recently, advancements in geothermal energy technologies appear poised to significantly expand geothermal's reach. These new methods, varyingly referred to as enhanced, engineered or advanced geothermal systems (collectively referred to here as EGS), have recently made strides in scalability and grabbed the attention of changemakers. If successful, EGS may play a major role in the clean energy transition. The technique creates no emissions and is virtually limitless (it pulls from heat generated by the Earth's core), and can provide constant baseload power, making it appealing to green-minded investors. This article calls attention to the progress and variety of EGS projects and proposals that Pillsbury sees as part of the ongoing energy transition.

People have long been drawn to geothermal energy, with Paleo-Americans settling at hot springs some 10,000 years ago. In 1892, Boise, Idaho, became the first town to establish a district heating system that piped naturally occurring hot water from underground and into homes. It would take another 70 years for other cities to replicate the feat, but now 17 U.S. districts use such systems, along with dozens more worldwide.

Despite these successes, traditional geothermal systems are geographically limited to areas with naturally occurring hydrothermal resources, where natural heat, subsurface water, and permeability converge near the Earth's surface. As a result, despite its potential as a source of clean baseload power, geothermal energy currently represents only about 2.5% of U.S. renewable electricity generation. These limitations have, traditionally, also hampered interest and investment in the sector.

In answer to these limitations, researchers have worked since the 1970s to develop man-made versions of geothermal systems, which in theory could be located just about anywhere in the world. Essentially, these new technologies seek to overcome the need for geothermal facilities to be located near hydrothermal resources by drilling deeper, and extracting heat from dry, less permeable rock. Some companies are even pursuing development of **superhot rock energy**, a high-temperature form of geothermal energy.

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These companies plan to go kilometers deep, where rocks reach extreme temperatures. This would allow geothermal plants to extract heat with a much higher energy density, making these theoretical plants even more efficient. With a **2022 $74 million DOE initiative** aimed at championing new generation geothermal systems while also reducing their costs, many companies are actively pursuing projects in this arena.

There are also potential ways geothermal energy technologies can provide additional services. Pillsbury is currently assisting clients in **finding ways to extract lithium and rare earths**, useful in storing and producing renewable energy, from the brine left at the end of certain types of geothermal processing.

If all goes as investors and boosters hope, EGS has the potential to be a win for safe and abundant green energy. Ahead, we look at the need-to-know details about this emerging resource.

- **How it Works**. A naturally occurring geothermal system (hydrothermal energy) needs heat, liquid and permeability in order to energize a power grid. All three components only exist together in regions with active volcanoes, hot springs and geysers—but hot underground rock is present all over the place on its own, often a couple of miles or more below the surface. Engineers aim to create man-made geothermal systems by drilling deeper into the Earth than traditional geothermal systems and supplying fluids in order to capture heat from dry, less permeable rock.
- **Feasibility**. The DOE says that the United States has more than five terawatts of heat resources under its soil, which would be enough to meet the electricity needs of the entire world if tapped into. A perk of EGS is that unlike wind and solar power, it is completely unimpacted by weather and does not require sunlight. The energy could be available 24 hours per day and requires a minimal land footprint.

  Drilling deep enough to tap into the needed high temperatures makes for a more fraught, and also more expensive, process than tried-and-true resources like natural gas—at least in the early stages of development. The further down pipes go, the more heat is available; with higher temperatures, EGS becomes more viable and cost effective, particularly in superhot rock scenarios where heat is extracted at much higher densities. But such deep vertical and lateral connecting pipes are new territory.

  Advances in horizontal drilling and magnetic sensing that have propelled the oil and gas industries forward **could now be adapted for geothermal techniques**. A distinctive challenge is creating tools that can withstand extreme temperatures so deep in the Earth's crust. At Utah's DOE-funded Frontier Observatory for Research in Geothermal Energy (FORGE), **operators have dealt with melting equipment**.
- **Legal Challenges**. Developers also must contend with federal and state environmental laws, permitting and other potential legal hurdles. In the United States, complex legal frameworks for both subsurface mineral and water rights have traditionally impacted geothermal industry developments. Regarding subsurface mineral rights, key statutes like the Mining Law of 1872 and the Mineral Leasing Act of 1920 have both facilitated and constrained the development of geothermal energy. By allowing the separation of mineral rights from surface land ownership, these laws have opened pathways for geothermal energy developers to lease or acquire rights to exploit heat resources beneath the land. However, these laws may also require that developers navigate complex federal and state regulations while dealing with such agencies as the Bureau of Land Management and the U.S. Forest Service. This can in turn create bureaucratic hurdles, raise costs, and ultimately stifle progress of geothermal energy projects. For example, geothermal projects on federal lands or that need permitting from a federal agency may require an extensive review under the National Environmental Policy Act.

  Regarding subsurface water rights in the U.S., both the Doctrine of Prior Appropriation in the West and Riparian Rights in the East collectively exert a nuanced impact on geothermal energy development. In regions where geothermal resources are abundant, the allocation and use of water for geothermal power generation must align with state-specific water rights doctrines, which can either enable or limit the viability of such projects. Thus, state regulations and the oversight of state agencies are crucial in determining how geothermal energy can be sustainably and equitably developed within the complex legal landscape of water rights.

- **Projects**. In February, the DOE announced that it will dedicate up to $60 million to three pilot projects by Chevron New Energies, Fervo Energy and Mazama Energy. Using funding from the Bipartisan Infrastructure Law, the agency wants to demonstrate the potential of EGS to power the equivalent of 65 million homes across the United States. A second-round funding opportunity is still on the horizon for EGS programs in the eastern United States.

  Google announced in November 2023 that it is now pumping geothermal electricity into the Nevada power grid and, in turn, to its data centers in the region. The tech company partnered with Fervo for the smaller-scale, next-generation project and is exploring how to expand these capabilities. Fervo has also broken ground on a new **facility in Utah**, expected to begin delivering power by 2026 and be the world's largest geothermal energy plant. Additionally, in June 2023, **Chevron New Energies Japan and Mitsui Oil Exploration Co. finalized plans** for the pilot testing of advanced geothermal systems in the Niseko region of Hokkaido, Japan, to explore the possibility of commercial-scale heating.

  Eavor has several deals in progress, including $96 million in grant financing from the EU Innovation Fund for a **project outside Munich, Germany** (where the company says it will generate its first wave of power by the summer of 2024); a **contract with the U.S. Air Force** to provide geothermal energy to the Joint Base San Antonio facility in Texas; a **Getech partnership** aimed at identifying advanced geothermal sites in Latin America; and more.

  Alongside the DOE, the National Renewable Energy Laboratory (NREL) **is also researching** approaches and marketability for advanced geothermal.

  On a smaller scale, companies like EcoSmart Solutions are building communities of homes **heated and cooled entirely by geothermal infrastructure**.

As Pillsbury has **separately detailed**, the Biden administration wants to halve greenhouse gas emissions by 2030 and, by 2035, fully transition to a carbon-free grid. The EU aims for at least a 55% reduction in greenhouse gas emissions by 2030 (as compared to 1990 numbers) and intends to direct 30% of its overall budget to climate action between 2021 and 2027. The push to hit these goals means that public and government interest have begun to expand beyond low-carbon energies like solar and wind, and into next-generation ideas. Advanced geothermal is still a young solution amid a transitioning legal landscape—and some potential engineering challenges—but with funding to get it off the ground, it may prove to be a key piece of the zero-carbon puzzle. Pillsbury visualizes success for many applications of geothermal energy as an integral component of the energy transition.

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Lithium for Batteries from Geothermal Brine

This article first appeared in *Gravel2Gavel*, June 10, 2024
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If all goes as planned, solar, wind and other clean energy technologies will help us abandon carbon emissions for good. But many green power sources perform their best only when nature cooperates, so an important (and sometimes overlooked) component of the energy transition is the ability to store electricity for a rainy or calm day. Lithium is the ingredient of choice for electric vehicle batteries, solar panels and grid elements. As these innovations ramp up, lithium demand is expected to **soar by 90%** over the next two decades, driving a surge in production efforts. Some experts predict a **deficit** in the mineral by as soon as 2025.

Predominant mining and extraction processes can be detrimental to the surrounding air, soil and water, in contrast to the environmentally friendly intentions of the lithium applications. But another type of renewable energy may be able to provide a solution. Hydrothermal brine, a high-saline water mixture found deep within the Earth's crust, contains lithium-rich deposits that have leached from heated rocks into underground water. Geothermal power players employing hydrothermal brine are spearheading plans to extract the valuable resource in a cleaner and more sustainable manner.

Why Lithium?

First commercially developed around 1985, the lithium-ion battery **quickly overtook** other types of batteries due to its high storage capacity. Its creators even won a Nobel Prize in 2019. As electric vehicles have come to the forefront of the energy transition, technological breakthroughs have only made these batteries more efficient and versatile. Clean technologies like wind farms and solar plants, some of the fastest growing energy sources, rely on lithium-based storage. The International Energy Agency (IEA) reported that compared to 2010, **50% more minerals** are now needed, on average, per new unit of power generation capacity—due in major part to the rising use of low-carbon innovations.

The United States has responded to the demand with the Department of Energy's (DOE) 2021 **National Blueprint for Lithium Batteries**, which states that "by 2030, the United States and its partners will establish a secure battery materials and technology supply chain that supports long-term U.S.

economic competitiveness and equitable job creation, enables decarbonization, advances social justice, and meets national security requirements." The Biden Administration has also cited **over-reliance on foreign supply chains** as a reason for boosting domestic lithium production. Meanwhile, the EU recently signed **strategic partnership agreements** with 12 countries for rare minerals, and in March, it finalized the Critical Raw Materials Act (CRMA). The law named 34 critical elements, and lithium is among the 17 elements specified as being of absolute strategic importance.

A New Extraction Plan

Lithium is found in a handful of sources: minerals, clays, oceans and brines (salt flats, geothermal brines, and oil fields including the Arkansas Smackover), with brine sources **accounting for 66%** of the world's present supply. It is extracted in the form of lithium carbonate, which is then processed so it can be used in our modern gadgets. South America is a major producer; in the region's salt flats, or "lithium deserts," saline groundwater is pumped to the surface and evaporated in large basins, where the water leaves behind salts that include lithium. The process is water-intensive and the lithium recovery rate is low. Australia and China are also leading producers and primarily use open-pit mining of hard rocks, including the lithium-bearing material. With current supplies coming almost entirely from China, Australia and Chile, U.S. leaders have set their sights on accessing domestic lithium via sites like California's Salton Sea region. And under the CRMA, Europe aims to produce 10% of lithium domestically by 2030. Currently, the region's only active lithium mine is in Portugal.

So far, evaporated and open-pit lithium extraction processes have been the "greenest" options available. But now, geothermal plants could offer a more sustainable possibility through a process known as direct lithium extraction (DLE). **Geothermal** energy, a rising star in the green energy movement, has a small physical footprint, virtually no carbon emissions, is not weather reliant and, as it turns out, can do double duty as a lithium resource. Geothermal electricity works by pumping hot salty water, or brine, up from thousands of feet below the Earth's surface and turning it into steam that powers turbines. The water is then recirculated into aquifers. That same power-producing brine contains lithium that can be extracted before reinjection of the liquid, and the process can be repeated over and over until the brine is too diluted to continue. Though lithium exists in small concentrations within the brine, the large scale of geothermal power production could yield a significant output. By one estimate, California's existing geothermal plants can produce enough lithium to fully meet **U.S. demand**, with plenty more to spare for exports.

Projects on the Horizon

On a global scale, projects and research that aim to take advantage of the lithium in geothermal brine are well underway.

- **Europe:** A **2023 study** published in *Advances in Applied Energy* reported that pilot plants in the Upper Rhine Graben region of France and Germany, an area with natural geothermal reserves, show promising results. The study noted that while geothermal operation costs will likely not drop as low as solar or wind, the revenues from lithium can offset expenses, offering a cost-effective and energy efficient solution. Vulcan Energy Resources has announced plans to start phase one of its geothermal and lithium extraction plant in this region of Germany. In addition, in the famously beautiful, coastal county of Cornwall in the United Kingdom, companies **are collaborating** on a demonstration project that will combine hydrothermal power with lithium extraction. The pilot will focus on a range of DLE technologies.

- **United States:** The Salton Sea region, a swath of California lake and desert that is brimming with rich geothermal activity deep below the surface, is home for at least a dozen geothermal power plants. The existing plants mean that a significant portion of the infrastructure is already in place to extract lithium. In January 2024, Controlled Thermal Resources **began construction** of a new facility in the area that will output both power and lithium, starting with 25,000 metric tons of lithium and ultimately producing up to 175,000 metric tons. At the John J. Featherstone geothermal plant in the Salton Sea, **EnergySource Minerals** has partnered with Ford to produce lithium in a closed-loop, sustainable process; the new approach is projected to allow the company to tap into an existing geothermal plant and remove lithium from brine that has already been used to generate geothermal power.

On a national scale, the DOE recently awarded its $4 million **Geothermal Lithium Extraction Prize** to five teams who will use the funds toward increasing market viability for direct lithium extraction from geothermal brines. The National Renewable Energy Laboratory also reported that additional lithium extraction technologies are approaching **commercial-scale demonstrations** by operators in the Salton Sea.

The chief obstacle for American brines is that impurities such as magnesium and calcium interfere with DLE lithium recovery. Recently, lithium extraction technology, using chemical reactions different from DLE, has been developed in South Korea and its efficiency and economic feasibility using the American brines has been validated. This **CULX** technology is expected to produce substantial additional quantities of lithium to support American energy transition demand.

Looking Ahead

A California State Legislature **commission on lithium extraction** reported in 2022 that the Salton Sea region likely contains the world's highest concentration of lithium in geothermal brine, a finding that could be a major boost to zero carbon goals for the United States and beyond. Researchers across the globe are also looking to tap into geothermal technology for lithium recovery, but innovating and scaling up such operations pose challenges. As Lawrence Berkeley National Lab researcher Dr. Patrick Dobson **noted**, "The key challenge now is to develop the science of extracting lithium from geothermal brines in a cost- competitive and environmentally friendly manner." Environmental impact studies, paired with development of technologies that will make DLE economically viable, will be key steps to moving forward. The two-in-one nature of geothermal resources—electric or thermal power plus a key mineral for electric power generation and storage—is an appealing energy transition solution for governments and entrepreneurs alike.

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Subsidence from Geothermal Operations: Navigating the Regulatory Landscape and Potential Claims

This Client Alert first appeared in *Pillsbury's Alerts*, July 26, 2024

by Sidney L. Fowler, Robert A. James and Clarence H. Tolliver

The subsidence risk in geothermal projects needs to be effectively managed by careful review of site conditions and legal and permitting precedents.

TAKEAWAYS

- Production of geothermal fluids can lead to subsidence of the land surface if not managed properly.
- Actual cases and prior permit applications showcase the types of subsidence risks and how they are addressed by operators and regulators.
- Diverse regulatory requirements and common-law causes of action for subsidence highlight the importance of managing risk exposures.

Geothermal projects in the United States and abroad face scrutiny of their potential impacts on the surrounding environment and communities. Seismic activity, noise and water contamination are commonly cited concerns.

Subsidence—the slow sinking of the land surface—is a frequently discussed risk. Indeed, the possibility of subsidence was the subject of long delays in the development of Southern California's Imperial Valley geothermal fields. Those fears were motivated in part by the 50-year experience at **Wairakei, New Zealand**, where the ground subsided as much as 14 meters (over 45 feet). There, claims of subsidence-induced damage to several nearby houses were refuted by independent assessments.[1]

Understanding Subsidence

Subsidence can be a consequence of large-scale geothermal development and operation, although its potential magnitude varies significantly between fields. The overall phenomenon is not peculiar to geothermal projects, as it can occur wherever fluids, such as water or hydrocarbons, are withdrawn

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from underground reservoirs. Unless properly managed, the withdrawal results in a reduction of pressure supporting the reservoir rock itself or the rock overlying the reservoir.

Reinjection of fluids withdrawn for geothermal operations can help reduce the effects of subsidence. Subsidence mitigation plans that incorporate reinjection are commonly established early in field development and should be flexible enough to handle changes with time. If subsidence does occur, it can be reduced through adequate monitoring and reservoir management.[2] Reinjection may be required by regulating authorities as a condition of operating permits.

Subsidence claims have not been common for U.S. geothermal operations, but claims in other countries suggest that American developers should pay attention to this issue. Planning for geothermal projects should include a thorough understanding of the evolving regulatory landscape, and the impact subsidence-related evaluations may have on the necessary environmental assessments. While some **advanced technologies may mitigate the risk of subsidence**, projects involving these technologies may still face regulatory and permitting challenges due to concerns over subsidence, particularly before the technologies are sufficiently proven. Further, operators should be mindful of the possible legal claims involving subsidence, and the claimants who might be willing and able to make them.

The Regulatory Landscape

Geothermal projects are subject to numerous regulatory requirements at different project phases and levels of government. The regulatory landscape can be challenging to navigate, and it is not easy to address all necessary issues adequately and expediently. Knowledge of and compliance with the relevant federal, state and local regulations can help minimize the risk of legal action.

Federal

A typical geothermal project will raise environmental issues that may impact permitting or regulatory approvals from federal agencies. Nearly 90% of **geothermal resources across the United States** are located on lands managed by the federal government. A project that entails a "major federal action"—which can include operations on federal land, those receiving substantial federal funding or support, or those requiring a federal permit—will trigger review under the National Environmental Policy Act (NEPA).[3] The level and scope of NEPA review vary by project and federal involvement, ranging from categorical exclusions for actions that have minimal environmental impacts to a full Environmental Impact Statement (EIS) for actions that have significant environmental impacts.

NEPA review for geothermal projects is often conducted multiple times for a given location, including during land use planning, leasing, exploration, drilling and operation. Subsidence analyses can be introduced at different stages in the review process. For example, surveying for subsidence before and during resource operation is required for operators with leases from the **federal Bureau of Land Management** (BLM). At the **Fourmile Hill Geothermal Project in California**, the BLM reserved the right in the event of incipient subsidence to reduce production rates, increase reinjection rates, or suspend production entirely.

Even when subsidence is not expected for a geothermal project, a monitoring program may still be required. The U.S. Geological Survey noted that geothermal fluid extraction was not anticipated to cause subsidence at the **Casa Diablo IV project** in California. However, because "a degree of uncertainty" existed, the project established a monitoring and mitigation plan that included subsidence tolerances and prescribed actions in the event the tolerances were exceeded. This precedent suggests that even advanced geothermal technologies, which claim to mitigate subsidence risk, might still encounter permitting and regulatory issues until they have been sufficiently proven in practice.

State

On top of federal authorities, geothermal operators must comply with state environmental laws and regulations. Many state policies align with federal regulations, while others expand on them.

In Hawaii, the state's Public Utilities Commission recently revised its interpretation of "state land" to include geothermal fluid, triggering state environmental review for projects, such as the **Puna Geothermal Venture Repower Project**. The subsequent study found that subsidence had progressed at a minimal rate of less than half an inch per year since 1958. The commission did not institute a mitigation plan because there was no evidence that the geothermal operations increased subsidence.

Other states with active geothermal fields similarly monitor subsidence over the long term. Nevada's Dixie Valley has shown localized subsidence rates of up to 0.3 feet per year. Lowe, *supra* note v, at 8. The Geysers Geothermal Field in California was found to have subsided at approximately 0.15 feet per year. With increasingly extensive monitoring networks, states have focused on assessing and mitigating subsidence as needed. Arizona's reviewing agency, for instance, is granted explicit statutory authority to mitigate subsidence. See Ariz. Rev. Stat. § 27-652).

Lastly, state-level subsidence analyses have revealed the importance of reinjection as a measure to stem subsidence in geothermal field development and operation. The long delays in the development of California's Imperial Valley geothermal fields stemmed in part from a study of the consequences of reinjecting only some of the water produced from the geothermal reservoir. Partial reinjection was modeled to accelerate **the risk of subsidence** by up to three times. Full reinjection was determined to be an appropriate mitigation response to any evidence of subsidence.

Local

While the primary avenues for regulating geothermal operations occur at the federal and state levels, some local governments, especially in tectonically active regions where geothermal operations are common, have developed subsidence regulations. Harney County in Oregon is one such authority. There, geothermal resources must be designed and operated to minimize subsidence, and surveys of subsidence and mitigation measures must be submitted to the appropriate county authority. Harney Cnty., Ordinance § 6.020 (2014).

Legal Causes of Action

Several causes of action could be applied to instances of subsidence. In addition to understanding a complex regulatory landscape, planning for geothermal operations should include the identification and assessment of potential legal claims.

Subjacent Support

Subjacent support is the support that surface land receives from its underlying strata. The general rule is that those with a possessory interest in the surface land have an absolute right to subjacent support. *Evans Fuel Co. v. Leyda*, 77 Colo. 356, 361 (1925).

To make a claim, the surface owner must allege that the defendant's actions caused the subsidence and that damage resulted from the subsidence. Because the right of subjacent support is absolute, it persists unless explicitly waived or contracted away by the surface owner. See *Breeding v. Koch Carbon, Inc.*, 726 F.Supp. 625, 649 (1989).

Lateral Support

Lateral support is the support that surface land receives from adjacent land. The common law rule establishes liability without fault for withdrawal of lateral support. *Wharam v. Investment Underwriters*, 58 Cal. App. 2d 346, 349–50 (1943). State law may excuse a landowner from common law liability for withdrawal of lateral support by complying with the statute's notice, ordinary care and reasonable precaution provisions when conducting excavations.

Trespass

Trespass is the intentional interference with a plaintiff's right to possess land. The requisite physical invasion can occur without the defendant's physical presence on the property. In some cases, trespass can result from physical invasion of subsurface rights, not just surface rights. See e.g., *Cassinos v. Union Oil Co.*, 14 Cal. App. 4th 1770, 1778 (1993) (damage to mineral estate by injection of offsite wastewater into oil well).

Proving trespass requires demonstrating essential elements, which can vary depending on the jurisdiction and context. Generally, the defendant's conduct must be intentional and cause injury to the plaintiff. See generally *Wilen v. Falkenstein*, 191 S.W.3d 791, 798 (2006). The plaintiff can be anyone with a possessory interest in the affected land.

Nuisance

Nuisance is generally an activity that interferes with the use or enjoyment of property. Unlike trespass, nuisance requires no physical invasion of a property right.

Nuisance claims have been successful for other activities that modified the flow of fluids onto property of others. A defendant's cut-and-fill operation that diverted water and silt onto the plaintiff's property during rainstorms was found actionable. Such claims also result from water seeping into the plaintiff's property due to a neighbor's paving of previously grassy surfaces. *Shields v. Wondries*, 154 Cal. App. 2d 249 (1957).

Negligence

Negligence requires the plaintiff to allege that the defendant failed to observe the applicable standard of care for a particular activity, and that failure caused harm to the plaintiff. See, e.g., *Grabowski v. Smith & Nephew, Inc.*, 149 So.3d 899, 908 (2014). In the absence of an otherwise clear duty, the plaintiff generally must show that the injury was reasonably foreseeable. Negligence actions can include injury to either persons or property.

Interference with Prospective Economic Advantage

Intentional interference with prospective economic advantage involves intentional actions by the defendant which are designed to disrupt the plaintiff's interests. See, e.g., *Korea Supply Co. v. Lockheed Martin Corp.*, 29 Cal.4th 1134, 1153 (2003). Generally, the plaintiff must prove several elements, including:

- an economic relationship between the plaintiff and some third party, with the probability of future economic benefit to the plaintiff;
- the defendant's knowledge of the relationship;
- intentional acts by the defendant designed to disrupt the relationship;
- actual disruption of the relationship; and
- economic harm to the plaintiff proximately caused by the acts of the defendant.

State law may also recognize a tort of negligent interference with prospective economic advantage. For this cause of action, the plaintiff need only show that it was reasonably foreseeable that the interference would result if the defendant failed to exercise due care. *J'Aire Corp. v. Gregory*, 24 Cal. 3d 799, 804 (1979).

Misrepresentation

Fraud, or intentional misrepresentation, is based on the defendant's false or materially misleading statements made with the intent to induce the plaintiff to alter his or her position to his injury. Generally, the plaintiff must show:

- false statement of material fact;
- knowledge of falsity;
- intent to defraud, i.e., to induce reliance;
- justifiable reliance; and
- resulting damage.[4]

In the geothermal context, statements made in the course of negotiating leases and operating agreements or applying for permits might be invoked as representations and exposed to liability.

Looking Forward

Geothermal operators must navigate a complex landscape to mitigate regulatory and legal risks related to subsidence. To reduce the legal exposures, the development and operation team must conduct appropriate due diligence; be mindful of environmental and tort laws, regulations, and permit and contractual obligations; and engage in transparent community relations.

For additional information on geothermal transactions and operations, please contact your regular Pillsbury attorney or the authors.

The authors gratefully acknowledge the contributions of Andrew Jacobs to this Client Alert.

Endnotes

1. See A. Bloomer and S. Currie, *Effects of Geothermal Induced Subsidence*, in Proceedings of the 23rd New Zealand Geothermal Workshop 3 (2001).
2. Mike Lowe, *Subsidence in Sedimentary Basins Due to Groundwater Withdrawal for Geothermal Energy Development*, Open-File Report 601, Utah Geological Surv. 4-6 (2012).
3. Kristen Hite, Cong. Rsch. Serv., IF12560, National Environmental Policy Act: An Overview 1-3 (2023).
4. See, e.g., *Bacon & Bacon Mfg. Co., Inc. v. Bonsey Partners*, 62 So.3d 1285, 1288 (2011).

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