PHOTOGRAPH: DAN WINTERS

MARIA STRESHINSKY BACKCHANNEL MAY 4, 2023 6:00 AM

Where to Find the Energy to Save the World

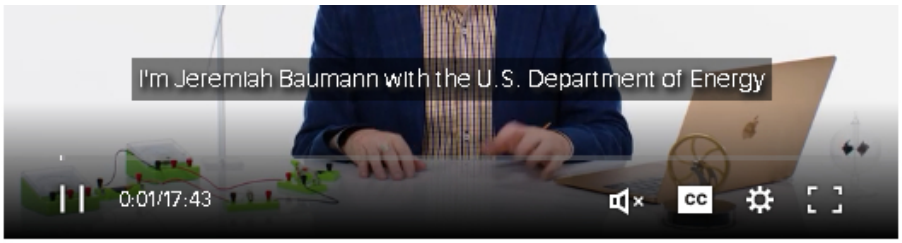
Jamie Beard is pouring everything into a singular vision: Tap into the awesome potential of geothermal power in Texas, and beyond. She has no time to lose.

JAMIE BEARD WAS worried. She was at the wheel of a black

Toyota Prius, multitasking at 80 mph down the Hardy Toll Road out of George Bush Intercontinental Airport. Just before picking me up, she had been interviewed for a national TV news show. Now, swerving through lanes, she was running through various shit scenarios: What if something she said pisses off one of the oil and gas executives she had come to adore, or one of her fellow climate activists?

As she was ruminating and driving, a Ford F-150 with tires higher than the Prius is tall squeezed by us in the fast lane, so close that Jamie gripped the wheel tight to keep the little car steady. One side of her hair was buzz-cut; the other was a bob. It, like the rest of her, was steady and roiling at the same time. "Welcome to Texas," she hollered. A grin spread across the small oval face that makes her look more 24 than 44, and she turned her attention to our destination: "Just wait until you see the Woodlands. The cops patrol the streets on white horses!"

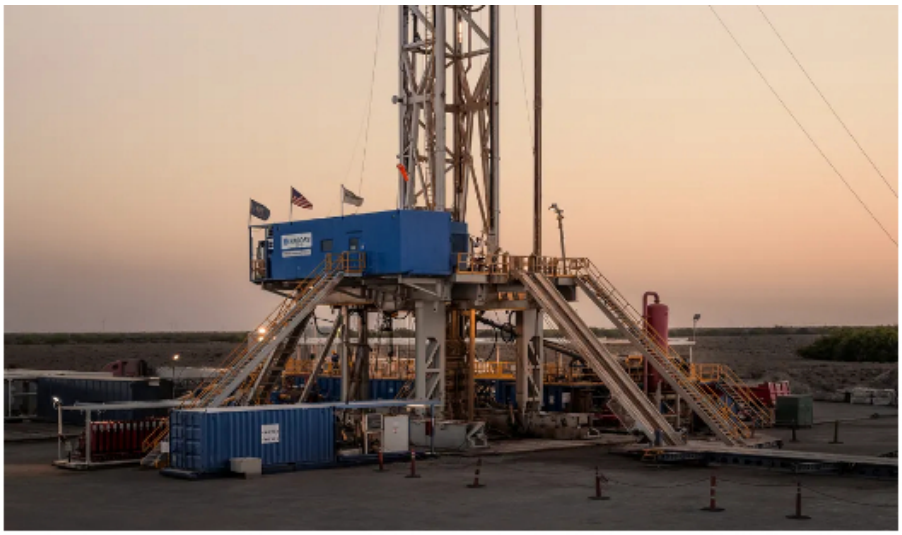
The Woodlands is a self-described master-planned destination about 30 miles north of downtown Houston, developed in the 1970s by George Mitchell. A Texas legend. He's the guy who made it financially viable to fracture rock and extract natural gas from shale. Now, nearly 50 years on, the suburb is a bonanza of luxury homes, hotels, woods, condominiums, and fountains with musical water shows—and offices of some of the biggest oil and gas companies in the world. Big Oil Palooza. As we sped closer to our hotel, home base for this whirlwind trip, Jamie started rolling through our tightly packed schedule of meetings with current and former oil industry folks: drillers, startup founders, geologists, CEOs at multinational corporations. When she took a breath, I asked her about the new Earth-piercing technologies that she was excited about. And I asked her about fracking. Then she remembered her worries. And got anxious again.



Energy Expert Answers Energy Questions From Twitter

The anxious energy, the worries, they were because Jamie—an energy lawyer and entrepreneur and lifelong environmentalist ("the kind that would have chained myself to a tree")—was desperate not to screw up the delicate plans she'd been orchestrating for the past six years. They're big. Too big, and she knew it. But she was certain that if she could put in all the days and hours and minutes she could possibly spare, and if she could get the right people talking to each other and help raise the money for a bunch of startups and better tech, she might, just might, just *maybe* help harness all those people to actually, fabulously, fairly *cleanly* solve the world's energy needs. Yeah.

So Jamie talked fast. She didn't waste time. As we walked to dinner near the Woodlands Waterway Marriott, her sentences piled up: "We can't sit around and twiddle thumbs and try to have working groups and retreats with environmental organizations and oil and gas. There's just no time for that shit. It's going to have to get on an exponential curve now. *Now*." The word came out as if shot from a cannon: Now!



Sage Geosystems used a Nabors F-35 drilling rig at its geothermal test site in Starr County, Texas. It can drill to about 25,000 feet and lift and suspend 1 million pounds. PHOTOGRAPH: DAN WINTERS

I met Jamie at a TED conference in August 2021, where she gave a talk called "The Untapped Energy Source That Could Power the Planet." As she paced the stage, her sentences, tinged with a gentle Southern drawl, rose up, then softened, then lifted again with enthusiasm: "What we're talking about here is a pivot from hydrocarbons to heat," she said. She talked about this awesome abundant green resource, and how we (right now!) have this mighty industry that knows how to get it. She was also, for sure, making some people in the room squirm at the thought of sleeping with the enemy. She seemed undaunted: "If we want to turn the ship, we recruit the sailors."

After the conference, we talked, then started emailing, her energy ricocheting out of my inbox. *Ping!* She invited me to meet her in Texas. Come see! I was tempted. "I wish, but my life is too complicated," I told her. Husband, cancer, medical appointments. He and I were on year four of what we'd been told might just be two.

Within minutes she responded, "My life is complicated too." She attached a picture of herself lying on a floor, reading a book to her young son. He looked like he was in a hospital gown. "I hear you," she wrote.

So there I was in Texas—while my husband was at home sorting his morning and nighttime meds. And Jamie was racing through the world with the relentless intensity of a person whose life, the minute they slow down, will be consumed with

personal trauma, and the only viable thing to do was to run fast at something that matters enough to dull the existential ache inside. For Jamie, that meant harnessing the heat from below the Earth's surface in the form of geothermal energy. And she was hell-bent to start in the heart of the hydrocarbon industry, the kingdom of crude, Texas.

IF YOU'RE NOT one of the half million people on an airplane or 10 astronauts in space at this very moment, you are standing on a giant nuclear ball. There's a truly monstrous source of heat below our feet. For a long time, people have been gathering that heat and using it to warm nearby buildings or turn turbines that generate electricity. Iceland gets about two-thirds of its energy—and nearly 100 percent of its heat—from geothermal sources. The city of Boise, Idaho, uses geothermal to warm some downtown buildings, and it has for more than a century. The first geothermal power plants built in the United States, put online in 1960, can send about 835 megawatts of electricity onto the California grid in a place called the Geysers. That kind of geothermal power—which a lot of engineers call hydrothermal, and which the folks in Texas call "your grandma's geothermal"—is harvested in places where tectonic plates have left fissures. Those fissures offer easy pathways for steam to rise to the Earth's surface. This easy energy, grandma's, is only a tiny fraction of what's possible.

What Jamie was aiming to do is the hard part: create geothermal *everywhere*. That meant figuring out how to corral the heat from all of the dry rock below ground. That heat could provide a reliable, abundant, always flowing source of power. No need for the sun to shine or the wind to blow. No need for batteries to store it all. And it wouldn't be geopolitically volatile, subject to complicated supply chain disruptions.

> Jamie was living in a crisis already. She was not deterred. To her, there are problems in everything big. being afraid of them helps nobody, and the climate doesn't have time.

There were, of course, hurdles. Big hurdles. Just a few: (1) Investment. Like most big energy projects, geothermal demands huge up-front funding, but the federal government hasn't provided consistent support like it did with solar, wind, even fossil fuels. And private markets didn't want to touch it. (2) Information, even the basics. We don't know enough about the conditions below the surface—exactly what kind of rock is where, how hot it is, what kind of pressure it's under—and what drilling methods to use. (3) Salability. Given the costs of the tech and construction for a geothermal power plant, it isn't yet obvious that an operator could sell the electricity at a reasonable price.

This is to say, the financials have been driving stakes into the heart of geothermal projects for years. "Early return on investment is miserable—half of the investors would be dead before they made money on it," Tony Pink, a VP at a drilling company, told me.

Add to all that, a lot of the people who are in powerful enough positions and care deeply about the health of the planet might have to get on board with something else: hydraulic fracturing. *Fracking?* Forcing cracks into subterranean rocks to get at the heat inside. Forget it. The word brings worries about contamination from chemicals pushed into and out of the Earth (lead, salt, acid, more) and "seismicity," or earthquakes. Then, talk about geothermal with lawyers and bureaucrats and all they can think of are the regulations you need to write, legal issues to parse.

But Jamie was living in a crisis already. She was not deterred. To her, there are problems in everything big. Being afraid of them helps nobody, and the climate doesn't have time.

THE WORDS THAT pour from Jamie form their own little electrical charges: enthusiasm, exclamation, expletive. ("Have you heard this whole narrative about oil rig electrification? That's fucking greenwashing. Don't give me that shit. Right?") She was born in Georgia, raised in southern Alabama. In undergrad at Appalachian State University, she got a degree in industrial technology, focusing on alternative energy. By 2004, after chapters as a climate activist and rock-climbing

instructor, she was living in Massachusetts, getting a law degree at Boston University. After that, she took a job at a giant law firm in the environment and energy department. She thought she'd be able to make a difference as an insider. Turns out, not so much. On April 20, 2010, the Deepwater Horizon rig exploded, killing 11 workers and spilling 4 million barrels of oil into the Gulf of Mexico. Jamie watched the live feed of the spill for a week from her comfortable office. Big Oil hired companies like the one she was working at for its defense. She resigned.

Around the same time, Jamie met an engineer ("You know, crazy mad-scientist dude") who'd invented a new kind of ultracapacitor—a device for storing and delivering energy, like a battery but with different guts. He was starting a company. She signed up. Early on, the idea was to use ultracapacitors in electric vehicles. Theirs also happened to work well in extreme conditions—like when a hulking drill is boring into intense heat, pressure, and violence underground. Jamie started spending a lot of time on oil and gas rigs in Canada, Denver, West Texas.

One day, while reading about green energy technologies, she came across a report from MIT and the US Department of Energy called *The Future of Geothermal Energy*. It made the case that we could vastly expand our use of heat from the core of the Earth. She was riveted: You could power the entire country 2,000 times over. Wow. But something else really stuck for her, she says. "This is a set of engineering problems? And then energy is *solved*? Holy shit, we should do this."

"It was a little bit pie-in-the-sky," she admits, "pretty moonshot." She kept working with the ultracapacitor, getting out in the oil field. And she moved to Texas. It just so happened that the industry was in the thick of the shale boom, and engineers were working to quickly iterate. Jamie saw engineers refine, say, directional drilling technology that could shave thousands of dollars off every foot to grind. She realized she was now alongside the very people who could make geothermal everywhere happen. "I was like, dude, it's going to need to be the oil and gas industry." So Jamie quit the ultracapacitor.

She was also excited because she was pregnant.

She convinced the University of Texas at Austin to hire her into a role as the director of an entrepreneurship center. She went after a $1 million grant from the Department of Energy for the school to start a program focused on geothermal—and got it. She called it the Geothermal Entrepreneurship Organization, or GEO. Her aim was to build a thriving geothermal ecosystem within the oil and gas industry. Texans already had all the skills: They were engineers, geologists, rig operators, oil-field roughnecks.

The future seemed so *possible*.

WHEN HER SON was a few weeks old, Jamie knew something was very wrong. He cried for days. He would quiet for an hour, then cry again. She just sensed he was in pain. For two years, doctors handed her a litany of possible diagnoses, including that it was in her head. Finally, she found a neurologist who—maybe just to get this intense single mother out of the office—offered to do a genetic test.

Her son had a metabolic disorder called mucopolysaccharidosis (MPS) type II, or Hunter syndrome. That meant he was missing a snippet of DNA that codes for an enzyme necessary to break down cellular waste. He'd inherited the deletion from her. "His cells just get progressively damaged," she told me over dinner, glancing away. "They're not able to take the trash out." His organs were being slowly destroyed. Her son's version of the disease was both rare and severe. "Maybe one in a million," she said. She found out he probably had about 10 years to live.

When she managed to calm her boy, get him to sleep, or have a

nanny help out, Jamie started interviewing doctors and reading everything she could about MPS. Then she came across a paper out of Japan, a study of stem cell transplants on MPS II kids. Doctors had rebuilt the children's immune systems. "Kill your blood factory, replace it with a new one," Jamie explained. Duke University was doing a related study.

By the time her son was 3, the damage done to his organs was profound. He was never going to be verbal; his development essentially stopped somewhere around 18 months, and then started declining. The transplant, docs explained, had a 10 or 15 percent fatality rate. Step one was basically destroying the patient's entire immune system with chemotherapy. Jamie's choices were excruciating: Go for the fences and do a science experiment, or watch him die for 10 years. Jamie went for the fences. She packed up her things in Texas. Her son became one of the first MPS II kids in the US to undergo the transplant.

For every detail Jamie told me, I could see pain. But she also spoke in technical, clinical terms—language I recognized from my husband's years in and out of hospitals. During the six months Jamie and her son lived in the Duke hospital, she became habituated to speaking in crisis terms and moving at crisis velocity.

In the between moments—between doctor appointments, treatments, finding food her son would eat—Jamie kept her mind from spiraling into despair by calling anyone in Texas who would talk to her about a geothermal future. She'd met the former CTO of Halliburton at a conference. She called him. He told her to call Lance Cook, a former VP of technology and chief scientist at Shell. Geothermal sparked Lance's curiosity. Jamie kept calling. The kind of geothermal she was after was spectacularly expensive. He got used to saying to Jamie, "That'll never work." Each time she hung up, she'd go read more, talk to more Texans. Then she'd call Lance again.

After a while, after talking to so many people, she ran up against a roadblock: The folks in oil and gas didn't want to be the first to talk about geothermal; they were nervous about jumping in. So to get them talking to one another, and publicly, Jamie turned her energy to planning a five-day virtual conference, and she invited everyone, including experts from

grandma's geothermal. She put a lot of different people on panels together. She called it Pivot2020: Kicking Off the Geothermal Decade. She hoped 1,000 people would log in; 4,000 showed up. A year later she did it again. 14,000 people. Folks were now talking, publicly.

FOR OUR SECOND night in Texas, Jamie invited a bunch of former oil guys to meet us at the Baja Cantina and Fiesta, perched above a man-made waterway in the Woodlands. We ordered piles of nachos and quesadillas and wings and beers. As the guys (yeah, they were all guys) showed up, it became clear they had met at the Pivot conference. Now they were working in geothermal startups. Jamie was helping them however she could: advice, chasing grants and other funding sources, contacts, data, information.

As the beers arrived, I asked the engineers and scientists, why geothermal? For climate change, sure. For other reasons too. Spencer Bohlander, a former deep-water drilling engineer and a company man (who designs wells), expanded: "Our entire world is about heat. Bring heat up. Use it. Power something." He added, "It's a no-brainer." (Jamie yelled from the far end of the table: "Don't burn shit to make heat. Just use heat for heat.")

The guys chimed in to lay out the two hefty ideas the industry was chasing: "closed loop" and "enhanced geothermal systems" (EGS in the vernacular).

Spencer explained: Closed loop pretty much means drilling pipes straight into hot, dry rocks, then circulating fluid down and up the pipes. The rocks heat the pipes, and the liquid absorbs the heat from the pipes. (And no fracking!)

Simon Todd, a baby-faced, curly-haired Irishman and geologist who'd been at BP for 25 years, worked at a company called Causeway GT that was pursuing closed-loop systems for perhaps the most obvious idea: direct-use heating. His company aimed to tap right into the hot rock below large industrial buildings or regions—a big data center, a military base—to heat and cool those spaces. (Kind of like massive, available-anywhere versions of the geothermal heat pumps that some people use to heat their homes.)

Nice. And these systems are straightforward enough to build. But models and tests were showing that wellbores generally didn't have enough surface area to collect the necessary heat. Which could mean deeper, longer drills. Deeper rocks, though, can be dauntingly hard, and the intense temperatures down there will melt a lot of stuff. You could end up drilling as slowly as 6 feet a day, and you might be going tens of thousands of feet deep—even 60,000. At the high end, that could cost $40,000 or more a foot.

That leaves us with EGS. The method depends on fracking: You bore a hole (first down, then usually horizontally too) and force pressurized fluid into the rock. The rock cracks, creating fissures. Then you fill the fissures with more fluid, which picks up heat from the rock. Now, when you switch your pumps on, your system is circulating liquid through a much bigger surface area—not a loop, but a reservoir. But again, fracking means environmental and political resistance, and no one yet knows if EGS can work commercially.

So what would it take? "Money," Spencer said. "And not just money but guaranteed money." Jamie nodded vigorously. The others backed him up. Money to get through the hurdles, to test and fine-tune the tech, to build the power plants. To get things going so the costs can come down. Leon Vanstone, a British scientist whose company was trying to improve drilling into hard rock, added, "Money and certainty."

In her relentlessness to get this industry off the ground, Jamie had been beating on the doors of multinational oil-field-services companies like Nabors and Baker Hughes—the very companies that had been improving hydraulic fracturing—to get them to help. They had started to throw funding at some of these projects. But considering the massive up-front costs, it wasn't yet enough.

> The sketch of the whisk got Lance thinking about how you might be able to build a geothermal system with just one well. And that would change everything about the

> price tag. Lance looked at the drawing and thought, "Holy shit. We can do this."

As the beers drained and the nachos got soggy, the guys, now kind of deflated, reinforced the point: Without the promise of, say, government investment to absorb the riskier startup costs, it was hard to see a thriving future.

On our walk along the waterway back to the hotel, Jamie told me how, back in the '70s and '80s, the feds had maddeningly started and stopped research in geothermal—even creating demonstration projects just outside of Houston. "The federal government R&D for geothermal is in total maybe $100 to $200 million," she said. "Solar and wind get billions." You had people fighting for crumbs. "And venture capital won't engage." Now agitated, she added: "You have fucking fusion startups that have been doing the same thing for 10 years and getting a billion dollars. If you had a billion for geothermal, you'd have so much. Then you'd get on a learning curve. From there it's a snowball."

Jamie understood that the budding industry was making decisions from a place where the baseline was bad. But failure wasn't in her lexicon. "To really cut into world energy demand by 2050 means there can't be friction points," she says. "There can't be frack bans. There can't be lawsuits. There can't be half-assed geothermal projects. It literally needs to just go."

BEFORE JAMIE'S SON had the stem cell transplant, the doctors warned her how vulnerable he'd be as he recovered. Any infection could be dire, deadly. Not long after the treatment, in the hospital, a problem with his feeding tube caused an infection. Then his chemotherapy left him with serious respiratory issues. For weeks he struggled to breathe, so much so that instructions for how to resuscitate him were taped to his crib. To push her fears from her mind, Jamie, lying on an air mattress beside the crib, would pencil out drawings for how she thought an enhanced geothermal system might work.

One day she sent Lance Cook some of the sketches. One of them looked like a whisk. Another was drawn on a postcard

them looked like a whisk. Another was drawn on a postcard promoting a program for kids with cancer. By now, Lance had been pretty used to, well, accommodating Jamie. ("It was that or *Tiger King*," he joked, "and she wasn't annoying.") But that day, when he looked at the lateral lines and loops she had sketched, he saw something else. With all other EGS proposals he'd seen, the idea was to build two wells, one to pump fluid in and the other to get it out, with an expanse of hot rock in between. The drawing got Lance thinking about how, with geothermal, heat could be gathered from all around a wellbore. A bunch of loops through the rock, all emerging from and converging back to the same place. (The fracked reservoir is a whisk-ish shape.) This meant you might be able to do it with just *one* well. And that would change everything about the price tag. Lance looked at the drawing and realized, "Holy shit. We can do this."

As he thought about it all, he called an old Shell colleague, Lev Ring. At the time, the Russian-born physicist and engineer was running a software company. Lev told me the call went like this (please imagine this with an elegant, discernible Russian accent): "Lance said, 'Who cares about your software company, OK? I met this lady. You really need to talk to her.'" So Lev did. And the two guys decided to start a company.

Jamie, ecstatic, added them to the list of new geothermal enthusiasts she was hell-bound to support. Her first quest: help them raise money. Venture capital wasn't interested. Wall Street wasn't interested. She went after climate philanthropy. Chris Anderson, of TED, leaped in with support from Virya, his climate impact fund. Nabors, the multinational drilling company, gave Lance and Lev a cheap lease for office space and $9 million. Now the two needed the right engineer, someone with a lot of drilling experience. They needed Cindy Taff.

Cindy is an unprepossessing, unflappable mechanical engineer who was born near Dallas and grew up moving around oil country. Her dad was a geophysicist with Mobil Oil, and when she was about 10, the family settled in New Orleans. She stayed local for college—Louisiana State. She got a job at Shell and as a young drilling engineer ended up working for Lance. She loved it. She stayed at Shell for more than three decades, the last seven years as VP of "unconventionals." Cindy also

the last seven years as VP of unconventionals. Cindy also happened to have managed the drilling of wells all across a region that was super promising for geothermal: southern Texas. When Lance and Lev asked her to come work with them, she lined up her retirement paperwork.

Cindy Taff, 61, has been working in drilling since pretty much right after college. She's known around southern Texas as a badass. PHOTOGRAPH: DAN WINTERS

As soon as that was done, the trio set about building the company. They often hopped on the phone with Jamie. They also often heard strange noises in the background. From time to time, someone would ask her where she was. Jamie finally let slip that she was at a hospital, and she told them a little bit about her son. Cindy, Lance, and Lev happened to be in search of a name for their new company. Now, it was obvious to them: It had to be her son's name.

Jamie protested. Then she cried. And she was scared. She slipped into her energetic anxieties: What if someone thought she was on the payroll? Or playing favorites? She sent them a list of other names. She felt she had to remain neutral in her support for all her geothermal projects. She was also frightened for a more superstitious reason: "What if they fail?"

Right, right. We hear you. But the trio was adamant. The new company would be named Sage, Sage Geosystems.

THE GULF COAST of Texas has, for a very long time, been dotted with oil and gas wells. That means we actually know a lot about the conditions below the surface there. In the '70s, when the feds were exploring geothermal resources, they ran a bunch of programs along the state's southern border. They shuttered them in 1992, but the reports that came from those projects left behind a pile of data. It pointed at two counties—Hidalgo and Starr, down in the very tip of Texas—as damn promising. The subsurface conditions, sedimentary rock (so not that hard) with a good amount of heat, were ripe for geothermal, the report said. Which is why, early on a Friday afternoon, Jamie and I left Houston on an hour-long flight toward the Rio Grande and disembarked at McAllen International Airport, 5 miles from the Mexican border.

Back when Cindy was at Shell, she'd helped build a gas well 19,000 feet deep on the Rancho Santa Fe, a truly sprawling windswept property where prized Akaushi beef cattle roam. The well was one of the deepest around. ("They found gas, but it was too expensive to bring it up, so they dumped the project," she tells me. "They probably spent $10 million.") Cindy knew Rancho Santa Fe was a perfect location to see whether their ideas about doing EGS with a single well could actually work.

Saturday morning, Jamie and I followed Cindy, Lance, and Lev in Cindy's F-150 (her other car is a Prius) out of McAllen, about 45 minutes along flat, flat, flat roads past miles (and miles) of massive wind turbines. When we turned in to the ranch, a guy at the gates made us promise to drive under 10 mph to avoid hitting the prized cattle. About a mile along, towering over all the sagebrush around, was a tall black rig, thumping out a consistent, clanging beat.

By then, drillers, derrick men, and roustabouts working for Sage Geosystems had dropped new pipes down to 11,200 feet. The team took me on a walk around the site, hard hats and steel-toe boots and fireproof coveralls on, a light rain falling. If their plans worked, Cindy and Lev said, wells like this could be drilled in a lot of places, without a very big footprint. Their aim was to build a system and plant that could supply, at first, 3 megawatts of power—enough to power about 3,100 typical homes for a year. Once they made sure it worked, they'd go for 50 megawatts.

A few weeks later, the engineers pumped fluid down into the wells to try to get a big enough, workable reservoir. When I called Cindy to see how it went, she was nearly giddy. The frack had been a success. It created a reservoir "10 times what we expected," Cindy said, laughing. The team ran fluid through the fracture to confirm it was all connected. (It was.) And their seismic monitors held steady; no earthquakes. It was super good news—not just for Sage, but for a small constellation of people who were deeply, emotionally invested in geothermal in this tip of Texas.

BECAUSE OF THE promising conditions in Starr and Hidalgo Counties, Jamie had been helping a handful of people there. The Sage team, of course. The public utility manager for the city of McAllen, who desperately wants to build a geothermal plant for his city. She'd been talking to Dario Guerra, a local water engineer who had been preaching the gospel of geothermal for years. One person she hadn't met, though, was James McAllen.

So, late in the afternoon, Jamie and I headed about an hour northwest from the city of McAllen to the 50,000-acre San Juanito Ranch, widely known as McAllen Ranch. We were buzzed through an inconspicuous gate, and James—thin, tall, with an ivory cowboy hat on his head—strode up to meet us, a big smile on his face. We made our way to the ranch headquarters: the Rock House, a low-slung stone building that's more than a century old. Yep. James' great-great-grandfather gave the town its name. The ranch has worked cattle and horses since before Texas was a state. But, he explained, there's no more profit in cattle.

The McAllen family ranch includes a cattle farm and a hunting lodge. But James McAllen's central focus is the stewardship of the place for his heirs, so now he wants to build a geothermal plant there. PHOTOGRAPH: DAN WINTERS

"My job is to see how we can get this ranch down the road for the next 100 years," he said. "And we aren't going to do that with livestock." Instead the family looks to every single resource, "from the sun to the wind to the grass to the dirt to the gravel." About five years ago, James and a partner installed an array of solar panels. The ranch happens to share a property line with an energy substation, and they now sell power back to the electric company. He was planning to build four more solar arrays.

But one of his nephews, who was studying at UT Austin, had recently called him up. "Hey, you know, Uncle Jim," the kid said, "I just had a class about geothermal. And McAllen Ranch was all over it." Turns out, in the late '70s, when the government was looking for places to test out geothermal, they had approached James' dad to see whether he wanted to work with them on a demonstration plant. "It was kind of science fiction technology," James explained. So, no.

After his nephew's call, James got to thinking. He talked to the utility company he sells solar to; they were excited by the prospect of buying geothermal energy, because it's a baseload —always available—source. So he called his friend Dario Guerra (the very same), and Dario told James about the Sage crew and their work nearby. Pretty soon, Cindy and Lev and

Lance showed up for dinner with bottles of tequila. Within a few weeks, James signed a joint-venture agreement with the team: He'd work on raising the $27 million or so they'd need, and Sage would begin planning for wells on the ranch.

Jamie had been sitting a bit quiet, for her, on the far side of the table as James told us this whole story. But during a pause, she busted in with enthusiasm. "Wait. Is your nephew in petroleum engineering?" she asked. "That class exists because of GEO!" she exclaimed—GEO being the program she had started at the university. "I feel like I'm in a simulation," she said. The kid's professor was the first instructor Jamie had recruited to UT.

> Jamie is, of course, just one of a group of evangelists, people who don't have clear job titles like CEO or director, but who—while they can—are on relentless missions to try to make something better, something livable happen.

On our last morning in Texas, I found Jamie in the dining room of the hotel, some cereal and yogurt on the table in front of her. She was watching a video of her boy. Tears on her cheeks. She handed me her phone so I could see Sage. He was at a table eating breakfast. He's a gorgeous child: wide smile, fabulous curly dark hair. He communicates via sweet grunts and laughs. She missed him. But she was also crying because she was exhausted and overwhelmed. That's because after seeing how far Sage Geosystems had come, and meeting James McAllen, it was sinking in that after all the hours and days and minutes she'd spent pushing this project along, the quest for geothermal had taken on a life of its own.

WHEN I GOT home from the Texas trip, my husband and I had to face new test results, and horrible conversations with our doctors. Then he had the first of two major surgeries. In the moments between ER visits and desperate phone calls, I filled up as much space in my mind as I could to keep my thoughts off of the inconceivable. But as the scaffolding of the life we had built began to shudder, facing the simple requirements of

had built began to shudder, facing the simple requirements of getting through a day became hard. Then harder still.

When Jamie got home, she left the GEO program at the university. It didn't need her anymore. She'd been living back in Boston for a while now, closer to her parents, but Sage wasn't doing too well. He'd had multiple brain surgeries. He would only eat a few things. She moved across town to get him into a school where he (and she) might get better support.

When Sage was sleeping or at school, or when a nanny was giving her a break, Jamie threw even more of herself at geothermal everywhere. She scrapped for more climate philanthropy and launched a program called Project InnerSpace—to chase missing subsurface data and more accurate maps, to start a competition to focus engineers on the lingering tech problems, to spread geothermal globally. And she turned to publishing a huge report about the state of geothermal in Texas.

Then, things took a strange turn: When the Inflation Reduction Act was signed in August 2022, it finally—*finally*—offered good tax-based incentives for geothermal projects. Companies could now get a 30 percent tax credit for their projects, maybe even more. If the equipment were made in the US, they could add another 10 percent. Great, amazing! But the law wasn't really set up for geothermal; it was built much more for solar and wind. Which meant it had terrific incentives for the holy grail of solar and wind—energy storage.

It also happened that for many months, Cindy and Lev and Lance had been wondering whether the reservoirs they were creating underground could be, essentially, pressurized storage tanks. Use the excess energy from the grid to fill it up with fluid; when you release the fluid, turbines turn. "Same well design, and same power plants," Cindy said. Months later, she added, test results showed that they could, in some scenarios, rival the cost of lithium-ion batteries. Sage was diversifying.

Right, nothing happens in a straight line. But there was one conversation I kept remembering from the trip in Texas that seems worth mentioning. Over Italian food, Cindy and Lance and Lev started talking about their kids, all adults now. Their children, they said, were *finally* proud of them, proud of their

children, they said, were [illegible] proud of them, proud of their work. Lance's kids joked that they could, for the first time, tell people what their father did for a living. Cindy said her 23-year-old daughter knew there was no future in oil and gas. In fact, Cindy's daughter is now a mechanical engineer working at Sage, using technology that was born out of her mother's and grandfather's industry for wind and solar storage, and for a geothermal future.

OF COURSE IT'S delicious to think the industry that's been at the heart of such a massive problem, a massive accomplice, could be transformed into a massive solution. No one is that naive; Wall Street is too powerful.

But things are certainly different than when Jamie started. For sure, the thing that she glimpsed when she was at the ultracapacitor startup was coming true: The oil field had accomplished so much that could get us closer to geothermal everywhere. Some big oil companies—Chevron, Shell, Ecopetrol—started in-house programs. And the feds doubled their funding to leverage tech and workforce from the oil and gas industry to expand geothermal. The report Jamie was working on, a 15-chapter, 350-page collaboration between five Texas universities, the International Energy Agency, and a bunch of other organizations, laid out a hopeful picture of how to scale geothermal in coming years. All of it was, in part, because of every hour she put in, every call she made, every dollar she raised.

Jamie is, of course, just one of a group of evangelists, people who don't have clear job titles like CEO or director, but who—while they can—are on relentless missions to try to make something better, something livable happen. At that Italian dinner in Texas, when she left the table for a moment, Dario Guerra told me, "Four years ago, when I tried to push this, there wasn't a Jamie. Four years makes a huge difference."

Cindy added, "There'd be none of this without Jamie."

This past fall, Jamie came through San Francisco, trying to raise more money. On a dark, wet night, we met for dinner before she got on a red-eye back across the country—she wanted to be home to take Sage to school. She seemed more exhausted than ever. Tears came easy. The new school district wasn't

working out too well. Sage had never been around other kids. He was struggling. His needs were so intricate that even the complex care department at Boston Children's Hospital would soon tell her Sage was too complicated for them.

By then, my husband's cancer had taken the turn I'd dreaded for four years. I lost him. Finding strength to just get through a few hours or a day, much less do any work at all, became excruciating. From that vantage, as I watched Jamie move through the night, I worried about what seemed true: Maybe it was going to take the kind of driving, roiling energy she uses to be able to breathe in a heartbreaking world to do the really big things. The things that really need to be done.

Before she got into a taxi, she told me once more that she thinks Sage's illness is probably still terminal. I understand, deeply. We need to temper hope in the face of a scary and maybe inevitable future. And we need the energy of that fear, too.

Jamie Beard's hair and makeup by Pepper Pastor. This article appears in the June 2023 issue. Subscribe now.

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