Can Fracking help prevent Climate Change?

A look at how 3 North American Companies are using a vilified oil and gas technology to produce carbon free electricity.

Irony, it's the spice that makes life worth living. And in perhaps one of the most implausible twists of fate, the climate movement may have to turn to companies backed by Chevron, Haliburton, and British Petroleum for a source of electricity that has the potential to support the 100% renewable energy grids of tomorrow.

Now, I am certain that a lot of my friends in the climate and environmental movement just reached for their metaphorical torches and pitch forks, but you'll just have to hear me out on this one. We all should know at this point that fossil fuels are the principal driver of man-made climate change and that we need to move away from their use as quickly as possible.[(1)] However, I believe that finger pointing, virtue signaling, and demonizing the people and companies who produce those fossil fuels is a waste of time. None of us is innocent in this looming but still avoidable catastrophe and this means we can't and shouldn't turn down help from *anyone* who is coming forward with solutions. Enter 3 fracking companies who are working on a new form of geothermal electricity that will support the grid when the wind doesn't blow, and the sun doesn't shine.

So, what is fracking and why does it get a bad rap? Fracking is a drilling technique that injects water, chemicals, and sand under high pressure into rocks containing oil and gas. Those rocks will ordinarily not give up their stored bounty easily. So, the high-pressure liquid mechanically cracks (fractures or fracks) or chemically dissolves them. Then the oil and gas they contain can be easily pumped to the surface.[(2)] This differs from conventional oil and gas drilling, where underground reservoirs of liquid oil or gas are tapped directly without the need to significantly break up the rock where they reside. Fracking is the reason for the American shale oil and natural gas boom which began in the early 2000's[(3)] and which turned rock formations, previously deemed unproductive using conventional drilling, into an oil and gas bonanza.

However, fracking is also associated with its severely negative and unintended consequences: earthquakes in Texas,[(4)] water pollution,[(5)] and flammable tap water,[(6)] to name but a few. On top of this, is heaped the cloud of secrecy under which the industry has operated since Congress exempted fracking from the Safe Drinking Water Act as part of the Energy Policy Act of 2005. This allowed companies to drill without disclosing what chemicals they are using in their fracking fluids and as it turns out, it isn't Evian! Current reports under disclosure laws in 23 states show that *"from 2014 through 2021, 62% to 73% of reported fracks each year used at least one chemical that the Safe Drinking Water Act recognizes as detrimental to human health and the environment."*[(7)] Additionally, companies can still keep chemicals they deem proprietary off the reporting lists in many states, and this understandably has environmental watchdogs and residents very nervous. But it doesn't end there, the use of fracking derived natural gas is having significant climate impacts, especially because of infrastructure leaks.[(8)] In fact, one

study has concluded that fracked gas production in North America may have contributed to approximately one-third of the total increase in methane globally over the past decade.[9] To say this is not the record of a climate champion is an understatement!

However, it must be remembered that technology in and of itself (with proper regulation and safeguards) is neither malevolent or benevolent. And certainly, fracking's past and origins are seemingly no indication of what its future may be. You see, we've learned a lot from drilling into the planet we live on. Including that, because of the earth's molten core, the deeper we drill the hotter it gets. That average rate of heat increase is about 25°C per kilometer of depth, or about 72°F per mile of depth.[10] The US Department of Energy (USDOE) believes that that heat, known as geothermal energy, can be converted to up to 132 gigawatts (GW) of carbon free, domestic, and renewable electricity by 2050. [11] To put that in perspective, 1GW is enough energy to power 100 million LED light bulbs,[12] so we're talking about a lot of juice!

Traditionally, that energy has only been available in the most geologically active areas across the United States and globe. There molten rock from the earth's core is closer to the surface and this allows geothermal power plants to harvest steam from naturally occurring underground water reservoirs or to pump in water to create steam. That steam is then dried and forced through turbines to create electricity before being condensed back to water and returned to the ground. *For example:* the Geysers field in California sits above a large molten rock chamber only 4 miles (6.4 km) beneath the earth's surface and has several geothermal plants that operate on these and similar principles.[13]

However, what the USDOE is currently envisioning doesn't rely on the happenstance of geologically active regions but instead on the thermal energy that rests in rock formations everywhere. To that end, USDOE selected three projects in February 2024, to receive $60 million to demonstrate the efficacy and scalability of enhanced geothermal systems (EGS).[14] USDOE defines EGS as a *"subsurface circuit of multiple wells and fractures containing a fluid heated by a geothermal resource through direct contact with the resource."*[11] Or in other words, the fracking technology developed in the oil and gas industry. This origin is reflected in the 3 recipients of those funds - oil giant Chevron, and startups Fervo Energy (who's CEO, Tim Latimer, is formerly an oil and gas drilling engineer in the South Texas, Eagle Ford Shale region), and Mazma Energy (who list fracking pioneers Haliburton as a technology partner).

While each of these companies has a slightly different process, they all employ a similar principal.[15][16][17] They drill multiple boreholes or wells into "hot" rock formations (between 4,500 and 12,000 feet down). Then using the fracking techniques from oil and gas exploration, they extend those wells horizontally (up to 5,000 feet). Because of the thermal gradient we discussed earlier, those rocks have temperatures of up to 375^0F. The fracked rock resulting from those wells creates conditions where there is sufficient surface area to recover heat. Using water and other fluids injected into the wells, that heat can be returned to the surface and converted to electrical energy or directly used for heating or cooling applications. The rock formations beneath the surface are then reheated by the earth's core thus creating a long-term source of carbon free renewable energy.

And that energy source has caught more than the eye of USDOE. Fervo Energy has already signed two power purchase agreements totaling 320 megawatts (MW) with Southern California Edison, the company that supplies Los Angeles with electricity.[18] It has also entered a partnership with Google to indirectly power its Nevada offices and data centers,[19] and raised over $200 million to build a 400 MW power plant in Utah.[20] But, US companies are not alone in this space. Using a slightly different technology, Canada's Eavor, has received a billion dollars in investment to build 5 EGS power plants in Europe and North America.[21] It has also signed a cooperation agreement with Sonoma Clean Power to supply up to 200 Mega Watts of electricity in California,[22] and received a 91 million Euro grant from the European Innovation Fund to build a power plant in Bavaria, Germany.[23] Eavor, backed in part by another oil giant, British Petroleum, has pioneered a closed loop geothermal system, which relies on long totally encased pipeline loops drilled horizontally underground to recover heat from rock formations.

So, big money and big companies mixed with an inexhaustible, renewable and carbon free source of power – what's the catch? Well, there are two – first, the upfront costs of well drilling are high, and second, once dug there is a chance that the well doesn't return the advertised energy. On cost, individual well bores are running between $13 and $5 million to drill. The latter cost only having been achieved in recent large-scale pilot projects.[11] Additionally, the current costs to develop a 30 MW facility, including all above and below ground infrastructure, are approximately $450 million – more than 10 times the cost of an equivalent wind or solar installation. In fact, to reach the commercial take off stage, USDOE estimates that the entire ESG industry will need $225 to $250 billion in investment over the next few decades.[11] On the return on that investment, up to 20% of conventional geothermal projects fail due to incorrect characterization of the underground resource.

However, USDOE is confident of overcoming these barriers and is investing to improve the characterization of thermal resources, using techniques from the oil and gas industry in part, but also new engineering technologies. Their goal is to reduce the overall costs of drilling by 90% in 2035.[25]

And there is more good news for ESG. Because of the nature of the resource, it is dispatchable on demand, and this means it can cover generation gaps in renewable grid systems, when wind and solar generation are not available. ESG systems can therefore command higher prices when it comes to power purchase agreements. Electricity buyers have shown themselves willing to pay between $70 and $100/MWh for the procurement of new geothermal power in markets like California. There, electric utilities must satisfy clean electricity mandates while maintaining grid functionality at the least cost.[11] While, as previously mentioned, that is still a lot more than wind or solar power (their levelized cost of energy (LCOE) is between $25 and $35/MWh), it does compare favorably with nuclear and natural gas LCOEs. And if ESG reaches its full potential, its LCOE could hit the $45/MWh mark by 2030, at which point it will really be a no brainer for grid operators or industries seeking to be 100% renewable. ESG may also provide many of the "just transition" jobs for oil and gas workers envisioned by states like California, environmental activist groups, and Unions. Workers from that sector understand the

technology and drilling techniques needed to make this energy source type successful. In fact, USDOE estimates the ESG industry at scale could employ as many as 30,000 of today's 46,000 oil drilling industry workers by 2050.[11]

Finally, what about all those negative and unintended consequences related to fracking? USDOE's Pathways to Commercial Liftoff Report again points out that "*groundwater contamination has never been connected to conventional geothermal development, and despite the technological alignment between oil & gas hydraulic fracturing and EGS, many of the water contamination risks associated with oil & gas hydraulic fracturing do not apply to today's EGS developments.*" That is largely because the chemicals used are not the same and USDOE is determined that they should not be harmful to human or environmental health. Also, the well casings used in ESG are fundamentally different from those in oil and gas fracking, having an extra layer of steel casing to prevent impacts to drinking water. Further, ESG wells are dug deeper than conventional oil and gas wells, adding a larger safety margin relative to the possibility of ground water impacts. Further, ESG fluids do not have the same risk of inducing earthquakes. This is because, unlike in oil and gas fracking, the fluids introduced into the subsurface areas are also removed by the ESG system. To date no induced seismicity has occurred because of a USDOE-funded project.[11]

Conclusions

ESG is an exciting and expanding energy field that promises a unique and valuable domestic carbon free source of energy. However, developing that energy source won't be cheap and will require us to have open minds about the technology purveyors in this space. It will perhaps be fitting, if some of the companies who helped get us into the climate mess, are the same ones who get us out of it. But there is a long way to go here.

About the Author:

Damian Breen is the founder of Environmental Communication Strategies and former Deputy Executive Officer of the Bay Area Air Quality Management District. He has worked at the crossroads of the environment, people, business, and future technology for over 29 years. For more information on this article: damian@ecs-ca.com

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