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search Projects Agency to further develop Full Bore Millimeter Wave technology. See photos. Their project partner Quaise is an MIT spin off that was founded in 2018. Together they are adapting the millimeter wave cutting technology that was developed at MIT's Plasma Science and Fusion Center. The boring apparatus that was developed in Woskov's laboratory, see photo 1 again, uses a Gyrotron radio

Millimeter Waves Can Bore Geothermal Wells

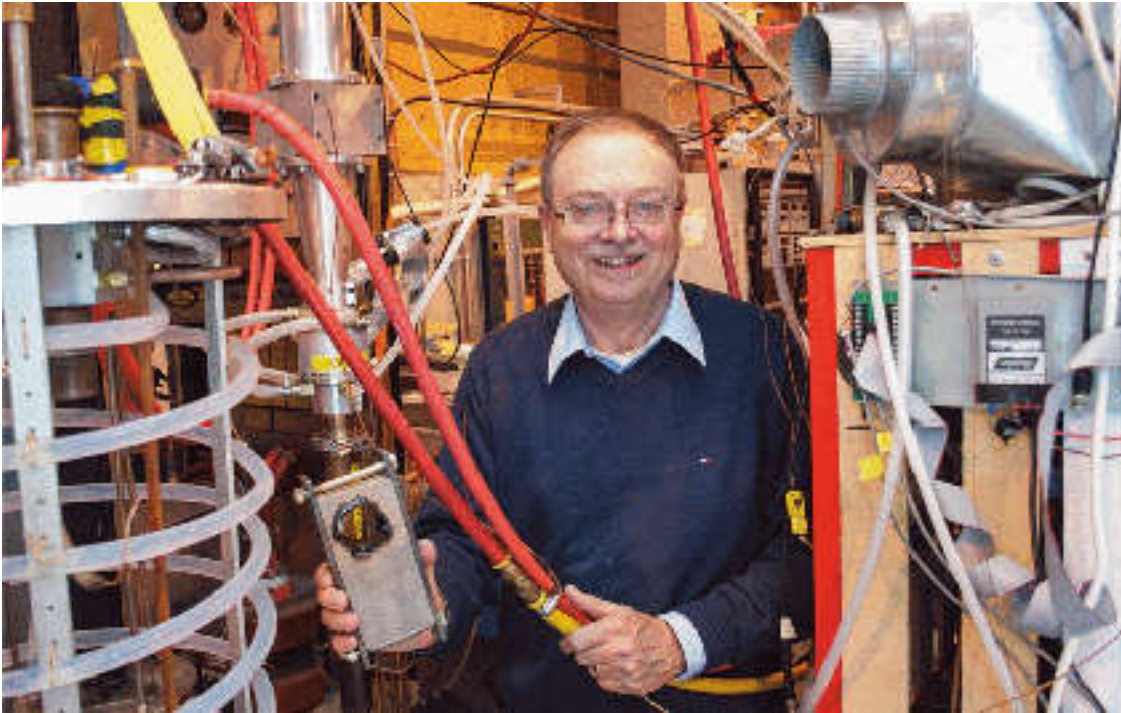


Photo Credit: MIT Paul Rivenberg

frequency wave generator to melt and even vaporize rock. In his videoed lecture Dr. Woskov said, "it cuts through stone like a hot knife through butter". Woskov further indicates what makes full bore millimeter wave technology extremely significant is that "there is plenty of heat beneath our feet, something like 20 billion times the energy that the world uses in one year...an enormous reserve of energy, second only to fusion: base energy, available 24/7". If fully realized geothermal energy could become our greatest source of green energy. This 5 minute video, of a Woskov presentation, fully explains how millimeter waves can be used to bore geothermal wells. You will find the video online at <https://youtu.be/qkJnrMirE>. The full 45 minute presentation is extremely technical and perhaps a good fit for professors rather than students. Online at <https://www.youtube.com/watch?v=J0Zk6sVxKbI>

If you could bore a hole straight down into our planet to a depth of 6 to 12 miles you would reach hellish temperatures; the perfect depth to tap geothermal energy. "Geothermal energy is heat within the earth. The word geothermal comes from the Greek words *geo* (earth) and *therme* (heat). Geothermal energy is a renewable energy source because heat is continuously produced inside the earth." (eia.gov)

Tapping it where it is most needed means drilling a well many miles down from the earth's surface. To reach the desired depth you need to penetrate a few miles of extremely hard rock. Basically the cost of using



standard drilling equipment is too prohibitive because the boring cutters dull extremely fast during the drilling process and the heat and pressure miles below the earth's surface is too high for boring equipment to work.

AltaRock Energy recently received a 3.9 million grant from the US Department of Energy Advanced Re-

Taking it a Step Further

1. Online research – Where and how deep is the world's deepest geothermal well?
2. Why is geothermal considered a green renewable source of energy?

Alan Pierce, EdD, CSIT is a technology education consultant. Visit www.technologytoday.us for past columns and teaching resources