**On the twelfth of April twenty-twenty three, an independent energy industry think tank called Ember published** [**this**](https://ember-climate.org/insights/research/global-electricity-review-2023/) **in-depth analysis of the global energy market. The study found that the amount of fossil fuel used around the world will be lower this year than it was last year. That’s a very simple sentence for me to say, but it carries huge significance. It’s the first time, outside of a worldwide recession or a pandemic, that global fossil fuel use has ever reduced year on year, and the study’s authors suggest it could mark a genuine tipping point in the transition to renewable energy.**

**Solar and wind, plus nuclear and hydropower produced thirty-nine percent of global electricity in twenty-twenty two, making last year the cleanest energy production year on record.**

**But thirty-nine percent isn’t a hundred percent is it. It’s generally agreed that nuclear and hydropower are both extremely limited for various socioeconomic and geographical reasons, and of course wind and solar are intermittent, as our friends in the fossil fuel industry are keen to remind us at every opportunity.**

**If only mother nature had provided us with an alternative natural source of energy that was a bit more...you know…constant. Well of course, nature has provided us with that energy source. It's right beneath our feet in every part of the planet. And no, it's not fossil fuels. It's the effectively infinite supply of heat in the earth’s crust that we call geothermal energy. The problem is we’re just not very good at getting at it. Current technologies are only economically viable in areas of high volcanic activity or where there are breaches in the earth’s tectonic plates, like Iceland. As a result, geothermal energy currently only accounts for about one percent of total global electricity generation.**

**But buckle up people! Because all that could be about to change!**

**Hello and welcome to Just Have a Think,**

**It’s reckoned that heat contained in the first ten kilometres of our crust contains fifty thousand times more energy than all of the world’s natural gas and oil resources combined. The challenge so far has been how to get at it in any kind of economically viable way. There are currently two main ways of extracting thermal energy. The first is to locate an underground aquifer full of hot water and devise a way to bring that hot water back up to the surface, just like we do with oil and gas. The trouble is, as I mentioned earlier, the geological conditions for this kind of simple extraction just don’t exist in many parts of the world, so the whole thing is extremely limited in its scalability. Enhanced Geothermal Systems or EGS are a way of reaching less accessible pockets of water by opening up natural rock fractures to create underground reservoirs of water in a process that is not all that dissimilar to fracking. But there’s no guarantee that the costly drilling operations will succeed. When the pressurized fluid is pumped in, it might not open enough decent fractures to make the project economically viable. Plus, the fluid can be contaminated by minerals like quartz and limestone in the rock formation, causing scaling and fouling that can lead to failures in components like pumps and heat exchangers. That, in turn, can lead to expensive delays that can make a project unviable.**

**The alternative is to forget about finding naturally occurring pockets of water and instead drill boreholes deep into rock formations anywhere on the planet, send your own fluid down a network of closed pipes, and allow heat from the rocks to radiate into that fluid before bringing it back up to the surface again. It’s a technology currently being commercialised by a Canadian company called Eavor, and I caught up with their Chief Technology Officer, Matt Toews via Zoom recently to get a better understanding of how it all works.**

**MATT : Our system operates on a natural thermal syphon, and its driven basically just by the density difference between cold water in the inlet well and hot water in the outlet well. That drives a pressure difference. And that exists in all forms of geothermal, but in our system because we just have a network of pipes, we’re not forcing water to squeeze through cracks and porosity in rock. It’s just a network of pipes. Its more than enough to circulate at our required flow rates for the whole life of the project. And so that removes some of the classical challenges in traditional geothermal approach, like the cost of installing the pump, maintaining the pump and the parasitic power demand to run the pump. Those are some of the highest operating costs and account for a huge portion of the levelised costs over a lifetime of regular geothermal, which are simply eliminated in our design.**

**DAVE : So rather than relying on… some systems rely on passing through hot water and getting the heat from the hot water and shoving that back up to the surface, you’re actually, effectively radiating heat into your tubes and then that heat gets sent back up to the surface.**

**MATT : Correct, yeah. So, we just circulate water through a network of closed well bores, and it’s a radial conductive heat transfer. So, the heat is being extracted slowly from the rock over time in this kind of radial fashion away from each well bore.**

**DAVE : So, in your thermodynamics video it says “there is a well- defined predictable thermal gradient in the rock that enables an Eavor Loop system to operate for thirty years.” So am I right in interpreting that that after 30 years that thermal gradient has diminished somewhat so that that particular installation isn’t going to be as effective as it was at the start?**

**MATT : Our system has all these multilateral wells and what happens is you extract heat via conduction and there’s an expanding radius where you’ve taken heat out of. And eventually those radii interfere, or they ‘meet’ the adjacent well bores. And we designed that so that happens after 30 years. It doesn’t mean that the system just stops producing but you get an increased decline in the energy output of about 0.2% per year. So, the system will still produce energy for a hundred years, two hundred years, maybe longer.**

**DAVE : So, one of the virtues of your system I guess is that it could potentially provide what we hear a lot about in the news today, which is this need for baseload power, or some people call it dispatchable baseload power [] can you just talk to that need for dispatchable baseload power and how your system addresses that need?**

**MATT : Our system has basically two markets, or solves two problems. One of them is heat, which is, you know fifty percent of energy used in Northern Europe and fifty percent of CO2 emissions. 7:06 And then the other one is, as you put it dispatchable… we call it flexible… or baseload power. So flexible means that our system can actually ramp up and down. And that’s actually a very needed feature in energy systems now rather than just baseload. So, baseload, meaning flat continuous operation, that’s kind of dead in the market. The markets don’t need that. What you need is to be able to pair with intermittent renewables and be able to ramp up and down as required, which is what our system allows.**

**DAVE: And you‘ve got a couple of demonstration projects up and running, is that right?**

**MATT : We designed and built successfully two demonstrations [] one of them – we call it Eavor-Lite. It’s in Western Alberta. And that is proof of concept. It’s a loop with two multilateral heat exchange passes. And to put that into context, our commercial designs have twelve, so it’s a scaled down version of our commercial design. And it was designed and built to demonstrate three things – That we can drill and intersect the well bores down a hole; that we can seal them with a chemical sealant without using a casing; and that we can validate the thermodynamics, you know, that we can predict the thermal output of this, which is the revenue side of course, and that we can predict that reliably and accurately for a long time. And we checked all those boxes. And that was built in 2019 and it’s been operating exactly as predicted ever since. Then we did another demonstration last year in 2022, and that was to test some drilling technology associated with our ambitions to go deeper and hotter and place these heat exchangers, these loops, deeper and hotter over time in hard, basement, granitic type rock. And that was also successful in checking off the technical boxes we wanted to check for the drilling side.**

**DAVE : And then the plan is to go out to the commercial world and find sites [] by definition there are far fewer limitations to where these things can be situated?**

**MATT: Our whole business plan relies on two features of the system. One is that we’re not searching for a resource, we’re not searching for an aquifer. We’re not creating a reservoir down there with stimulation technologies, we’re just … so we can go onto pretty much any rock type and any geography. It’s very geographically scalable. And the other feature of it is that it’s very predictable and reliable [] both on a day by day and annual basis. And so, our commercialisation strategy is to start in the two markets, which are basically the district heating market in Europe and the power market in the west of the US. [] 10:26 In Europe there’s a lot of existing district heating networks that are fed by fossil fuels and so we just have to replace that centralised boiler, essentially. And a single one of our loops can heat 16,000 to 20,000 homes.**

**DAVE: I did hear recently John Redfern the company’s CEO talking about a little bit of a frustration with getting institutional finance in place in the US and actually the company’s ended up with a couple of the investors being BP and Chevron which, to the layman’s ear, is a little bit ironic. Whereas in Europe I think there’s ninety-one million Euros coming from the European Union [] to get you started. So, is that something that you’re seeing as a difference in attitude between Europe and the States, or North America and Europe, and has the IRA made a difference to that in North America?**

**MATT : Yeah, absolutely I think the IRA…until the advent of the IRA there wasn’t a lot of large-scale commercialisation capital available from government in North America. [] Whereas in Europe, I mean we received the ninety-one-million Euro award from the European Commission, and they’re putting out billions of dollars annually, specifically for this stage of the development process, the first commercial demonstration projects. That’s the hardest one to finance. After that it’s easy to finance. But that’s the hardest one to finance and that’s where I think the EU has really taken the lead. [] I think we’re at a really exciting stage now. We’ve de-risked all the technology, we’re building our first commercial project, funded partly as you mentioned by the European Union. And then after that project is up and running, which will be next year, then we expand massively into our two markets. We have a huge project pipeline. We have over two hundred projects in our project pipeline, and about eight of those are at an advanced or more advanced stage that we’re doing engineering and contract work on, and so we’ll be expanding through that. [] We want to sell this technology and that’s the only way to scale it up very quickly [] so, we’re looking to partner with all different manner of energy firms, utilities and oil and gas companies as they face the energy transition. Our technology allows them to use their skillsets and what they’re best at in a new avenue. [] All of them are looking at geothermal and it is a needed requirement in the universe of policies and technologies for energy transition. There is a need for geothermal and it can scale up massively, and I think the time is now.**

**I’ve said many times on this channel that while politicians and lobbying groups waste valuable time squabbling about the climate emergency, scientists and engineers all over the world are quietly getting on with the job of developing technologies that can actually solve the problems that are facing us in the twenty-first century. The Eavor Loop design is arguably a prime example, and if it's implemented to its full potential then this system could become a lynch pin in the green transition. The question is – do you share my optimism, or do you foresee challenges that we haven’t addressed in today’s video? Either way, the place to leave your thoughts is in the comments section below, and I’ll be very interested to hear your views.**

**That’s it for this week though. Don’t forget to book your tickets for the Fully Charged LIVE events in Farnborough from the 28th April and Harrogate from the 19th May. I’ll be having a one to one fireside chat with Robert Lewellyn on Saturday the 129th April and I’ll be appearing on discussion panels at both events. And you can get twenty percent off the cost of tickets with this special discount voucher exclusively for views of the Just Have a Think channel. Hopefully see you there**

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**As always, thanks very much for watching, have a great week, and remember to just have a think. See you next week**