**Heating stuff up and keeping that stuff hot in a well-insulated receptacle is an idea that I am quite sure will not strike you as either groundbreaking, or game changing. Many of you, for example, will no doubt have memories of sipping slightly metallic tasting tea or coffee from one of these things - a thermos flask - at various points in your life.**

**But making really massive thermos flasks that are super well insulated with materials that can handle temperatures of several hundred degrees is a different level altogether, and it’s a principle that is being exploited in an ever growing number of ways as industries, commercial entities and grid operators all focus their attention on finding the cheapest most effective way to decarbonise their operations by storing vast quantities of energy that can be called off whenever it’s required, either to produce steam to drive turbines and electrical generators, or to simply provide heat for industrial processes or for district heating systems.**

**A giant flask containing hot water is certainly a good way of looking at this kind of thermal energy storage, and in fact, that’s more or less precisely what the good burgers of Berlin in Germany constructed in their city centre last year… I’ll tell you more about in a moment, but regular viewers will recall that we’ve looked at several other materials over the years that lend themselves nicely to the task of storing heat for relatively long periods of time. From sand to salt and from iron to ceramics. You name it – if it can be heated up, you can bet that someone has had a go at making an energy storage device from it.**

**One of the leading exponents of this kind of technology is an American company called Rondo Energy. They’re using nothing more sophisticated than brick for their contraptions, and they recently announced that they’re building a new production facility that’ll be two and a half times the size of Tesla’s Gigafactory. So why do they think their particular brand of industrial heat storage is the winning formula then?**

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

**I promised you I’d tell you about that giant water cylinder in Berlin didn’t I, so let’s start with that shall we? It’s a fifty million Euro project commenced in twenty-twenty-two by the German utility company Vattenfall. It’s about forty-five metres, or a hundred and fifty feet tall and forty-three metres in diameter. It holds fifty-six million litres, or 15 million gallons, of water, and it can keep that water at about ninety-eight degrees Celsius for very long periods indeed. Apparently, that equates to a thermal capacity of two hundred megawatts – which is a lot! In fact, it’s enough to meet roughly ten percent of the hot water requirements of the entire city of Berlin, and it can be continuously discharged for up to thirteen hours when it’s needed.**

**In July twenty-twenty-three, the contractors began filling the finished cylinder with water which was then connected to Vattenfall’s power-to heat plant at the Reuter West power station and heated by excess renewable energy from wind and solar. That energy will then be used to heat Berlin homes and businesses during the winter months. Vattenfall say it’s a significant milestone in their efforts to decarbonize heat production in Berlin and to phase out coal-fired power generation there by 2030.**

**A very clever application for what is basically a very large, very well insulated kettle!**

**A single massive tank in the middle of a city is not the solution for every situation though of course, and more often than not, it’s a more flexible, modular system that operators are seeking, which brings us to the folks at Rondo Energy.**

**Not much is as basic as water, but arguably a brick comes pretty close!**

**Just like the Berlin kettle, the Rondo system starts with excess energy generated from renewable sources like solar panels or wind turbines. That energy drives electrical resistance heaters that heat up air which then flows up through precisely configured stacks of bricks to get them to a temperature of fifteen hundred degrees Celsius. It’s very similar to the way a toaster works, except on a massive industrial scale! The precise delivery of the heat is automated and controlled by a clever piece of artificial intelligence (of course!) that Rondo has patented as part of their USP. These aren’t actually common or garden house bricks though. They’ve apparently been quite carefully developed in partnership with a Thai company called Siam Cement Group to be precisely the shape, size and density to optimise their ability to store and release energy. In terms of actual material though, they are essentially just refractory brick, which is a technology that’s been used in industrial heat storage for centuries.** **The tanks the bricks sit in are obviously extremely well insulated, so that once everything is up to temperature, the system loses less than one percent of its energy per day. When the heat is needed, new air is sent into the container where it gets heated by the bricks to as much as a thousand degrees Celsius. The precise temperature is actually dictated by whatever application the heat is being sent into at the other end. It’s all controlled by the speed at which the air is allowed to flow across the bricks, which again is all worked out and calibrated by Rondo’s clever AI system.**

**Once it’s delivered its heat, the air is eventually recycled back through the system to minimize heat loss and optimise overall efficiency.**

**The heat batteries themselves are designed to be very easily dropped into site and integrated with existing plant. This one is Rondo’s first small scale demonstrator, installed at Calgren Renewable Fuels in California, delivering two-point three megawatt hours of heat energy on each charge cycle. At the time of installation, the project was the first commercially operating electric thermal energy storage system in the US, and, according to Rondo, the highest efficiency, highest temperature energy storage of any kind anywhere in the world.**

**At full scale, a basic Rondo module will actually be about the size of four shipping containers and will have a storage capacity of a hundred-megawatt hours. They also plan to produce a larger module capable of storing three hundred megawatt hours of energy.**

**Industry uses more energy than any other part of the world economy. Industrial processes making every commodity from steel to baby food are powered by high temperature heat that consumes a quarter of all world energy. It’s one of the so-called hard to decarbonise sectors that are now starting to be tackled, not just by commercial investment but also by central government incentives like the Industrial Heat Shot Initiative recently outlined by U.S. Secretary of Energy Jennifer Granholm, which aims to help cut the carbon emissions of industrial heat by as much as eighty-five percent in the coming years.**

**Rondo reckon their system is a simple, drop-in, zero-emission replacement for industrial boilers powered by fossil fuels. And that means it could potentially be put to use in more than ninety percent of those industrial processes, as well as municipal applications like district heating systems.**

**The modular nature of the battery means larger industrial facilities can install them relatively easily, hook them up and start producing heat more or less straight away. As well as being relatively simple, there’s some other good points to note about this set up. The whole system uses readily available materials like silicon, aluminium and iron with no toxic or combustible substances and none of the occasionally problematic materials like lithium, cobalt and manganese that we’ve talked about so many times in previous videos. Plus, Rondo claim the batteries are robust enough to keep performing in industrial environments for more than forty years with little or no significant degradation, and they say that studies carried out at existing customer facilities are showing fifty to ninety percent reductions in emissions. They also claim their batteries can store energy at half the cost of other technologies like green hydrogen and chemical batteries and that operators are achieving reductions in operating costs of thirty percent or more.**

**So, what’s the latest news then? Well, Rondo already has two-point-four gigawatt hours per year of production capacity up and running with Siam Cement Group, and they plan to build that up to a whopping ninety-gigawatt hours per year over the next few years. That’ll effectively make it by far the largest battery manufacturing facility anywhere in the world.**

**In August twenty-twenty three the company announced a further sixty million dollars of funding from investors including Microsoft’s Climate Innovation Fund and Bill Gates’ Breakthrough Energy Ventures to grow its international operations and to develop and build storage projects around the world.**

**As I mentioned earlier, heavy industrial processes have proven to be one of the most difficult sectors to decarbonize so far. According to Our World In Data they make up about twenty four percent of all global greenhouse gas emissions. If Rondo Energy does manage to achieve ninety gigawatt hours of production capacity, that could equate to a reduction in CO2 emissions of as much as twelve million tons annually. That’d be like taking four million internal combustion engine vehicles off the road each year, which would surely be an improvement worth having wouldn’t it?**

**But then again, you might not agree with me. So, what IS your view? Go on, I’m sure you’ve got one! And if you have then, as always, the place to leave it is in the comments section below.**

**That’s it for this week though. Thanks, as always to the channels’ fantastic Patreon supporters, who enable me to keep ads and sponsorship messages out of my videos and out of your way.**

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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.**