**Ambri Liquid Metal Battery – An American Success Story?**

**Back in January twenty-twenty-one I made a video about a liquid metal battery technology that was being hailed as a potential market disruptor in the energy storage sector. Unlike many of the other start up battery technologies that also claimed to be ‘game changing market disruptors’, this one did actually appear to be quite an interesting proposal for large utility scale stationary energy storage. And the company that made it, Ambri Inc. based in Massachusetts USA, boasted Bill Gates as their largest investor, so it looked like all we needed to do was just sit back and wait for the revolution to transform our electricity grids and accelerate the mass adoption of wind and solar power.**

**We haven’t seen much about Ambri in the mainstream media since then and eighteen months or so further down the road, quite a few of you good folks out there have been asking me what’s happened the company, and whether the dream of cheap, safe, large scale, long duration energy storage is still alive.**

**So, I thought it was about time we took another look.**

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

**The Ambri liquid metal battery was the brainchild of this guy. He’s called Donald Sadoway and he’s a charismatic Professor of Materials Chemistry at the Massachusetts Institute of Technology.**

**Sadoway has been working on the technology for more than a decade, since setting up the Liquid Metal Battery Corporation in 2010 using seed money he received from Gates. Since then, the company has overcome setbacks and disappointments that would have deterred lesser entrepreneurs from carrying on, but Donald and his colleagues were convinced they had something that could fundamentally work in principle and that could be scaled up, if they could just find the optimum combination of materials and operating parameters.**

**So, let’s just have a quick recap on how the liquid metal battery works.**

**Two different elements, Antimony, which melts at about six hundred and thirty degrees Celsius, and an alloy of Calcium, which has a melting point of more than eight hundred degrees, are combined with a solid electrolyte and put inside a sealed chamber insulated with a ceramic material. The whole thing is encased in a positively polarized stainless-steel case with a negative terminal at the top.**

**At room temperature the internal elements are all in their solid states and it’s impossible for them to react with each other, which makes the batteries completely safe to transport.**

**To initially charge up the system, the contents are heated to five hundred degrees Celsius, at which point the metals and the salt electrolyte become a single molten mass. Then gravity separates them out according to their density. The antimony sinks. The molten salt stays in the middle and the calcium alloy rises to the top.**

**Antimony is much more electrically negative than the calcium alloy, so there’s a potential difference or voltage between them.**

**As the battery discharges, the calcium alloy breaks down into calcium ions and electrons. The ions move down to the antimony layer and the electrons flow out through an external circuit to do some useful work.**

**The result of the discharge phase is a completely homogenous new alloy of antimony and calcium inside the battery, with the electrolyte sitting on top. After that initial start-up blast of energy to get things going after installation, the reaction generates its own heat, keeping the battery at optimum working temperature and eliminating the need for an external heat source. That means everything stays in a molten state, which eliminates problems like deformation and dendrite formation that electrochemical batteries tend to suffer from over time.**

**To recharge the system, an electrical current is passed through the battery to reverse the reaction and place the calcium alloy and the antimony back in their original positions.**

**Liquid metal batteries need to be worked hard, ideally being fully charged and discharged twice a day to maintain their constant high temperature. Under those conditions, Ambri claims an overall end-to-end efficiency of eighty percent, and tens of thousands of cycles with negligible degradation or capacity fade. And that self-maintaining temperature means the batteries will work just as safely and effectively in very hot or very cold climates around the world.**

**In May twenty-twenty-one Ambri commenced a project with a company called TerraScale to provide two hundred and fifty megawatt hours of liquid metal battery storage for their Energos data centre out in Reno Nevada, at the Tahoe Reno Industrial Centre next to other existing data centres operated by Apple, Google and Switch, and close to Tesla’s Nevada Gigafactory. The Energos project will be developed over ten years and will cover fourteen hundred and ninety- seven hectares, including five hundred megawatts of renewable power capacity generated onsite and distributed via a microgrid, backed up by Ambri’s technology.**

**Ambri’s chief commercial officer, Adam Briggs, said**

**“The Ambri systems are particularly well-suited for the project’s high-desert operations, for shifting of its large amounts of renewable solar load and for its grid-system peak shaving capacity,”**

**In AUGUST twenty- twenty-one, Ambri announced it had secured a hundred and forty-four million dollars-worth of financing from a group called Reliance New Energy Solar, with Bill Gates also chipping in a bit more of his own capital. The money was earmarked for the design and construction of high-volume manufacturing facilities in the U.S. and around the world to meet what Ambri sees as a growing demand from grid-scale energy storage markets and large industrial clients.**

**Reliance New Energy Solar plan to work with Ambri to build out a network of liquid metal battery storage across its facilities to secure a domestic source of energy for its supply chain.**

**Reliance chairman, Mukesh Ambani, said**

**“Reliance Industries sees this strategic partnership with Ambri as an important step in its journey of achieving its decarbonization goals. Our investment in Ambri is part of our broader plan to develop the Dhirubhai Ambani Green Energy Giga Complex, which will be amongst the largest integrated renewable energy manufacturing facilities in the world and the epicentre of India’s Green Economy movement.”**

**Since then, Ambri has continued the search for new partners. In June twenty-twenty-TWO, the company secured a deal with an independent South African renewable energy provider called Earth & Wire. The contract will see Ambri supply a battery system to serve a three hundred -megawatt, twelve-hundred megawatt-hour, combined wind- and solar-powered generation site in the Eastern Cape, which will be the largest battery energy storage system in South Africa.**

**As demand for energy in South Africa increases, and the publicly owned electricity utility Eskom decommissions its coal-generation fleet, Ambri are well placed to support the introduction of renewable energy resources that can connect effectively and supply consistently into the South African national grid. Ambri will begin shipping batteries for this project in 2024 with installation completed in 2026.**

**Then in JULY twenty-twenty two Ambri achieved a landmark accreditation , when it received certification for UL 1973, which is the Standard for Batteries for Use in Stationary and Motive Auxiliary Power Applications.**

**"This is an important milestone for our company” said David Bradwell, Chief Technology Officer at Ambri, “it sends a strong and positive message to the market about the safety and resilience of our battery technology."**

**That was followed by news just this month that Ambri is now using some of the investment money from Reliance Industries to expand its manufacturing capacity at a new facility in Milford, Massachusetts. The new facility, which Ambri is calling its Innovation Hub, will enable the company to significantly broaden its manufacturing operations to cope with what looks to be some pretty rapid growth in the size and scope of its operation. The facility has a footprint of a hundred and forty thousand square feet, which is more than triple the size of the current manufacturing facility. That will allow for a production capacity of two hundred thousand battery cells per year, which Ambri will start installing into customer systems in twenty-twenty-three. The new facility will support up to 200 jobs when it reaches full volume production in 2024.**

**"This exciting next step in commercialization marks a major moment for our company and its future," said Ambri’s Adam Briggs. "Expanding our operations makes it possible for us to continue to innovate and produce with the speed and the scale needed to deliver quality, cutting-edge products that meet the growing demands for safe and affordable long-duration energy storage.”**

**It's all starting to sound a bit like a PR video sponsored by Ambri themselves, isn’t it? But you guys did ask for an update, so I’m just reporting what’s happened since we last took a look at the company, and in this case, it really does look like there’s some positive progress. And just for full disclosure I have absolutely no ties to Ambri and no stake in their business, and no, this video is not sponsored by them either.**

**So, can YOU sink your retirement fund into Ambri and join Bill Gates and the others as an investor? Well, apparently not just yet. Ambri isn't available to retail investors right now because it’s not currently traded on the public stock exchange, which means only venture capital funds or other major investors are able to invest. At the time of researching and writing for this video, there haven't been any IPO announcements for Ambri, but with an energy storage market projected to be worth at least fifty billion dollars by 2030, I’m sure it’s only a matter of time before the lure of Wall Street proves impossible for the company to ignore.**

**So, what’s your view? Do you think this liquid battery system has a promising future? Maybe you even work at Ambri, and you can give us a bit of additional insight. Either way, as always, the place to leave your thoughts is in the comments section below.**

**That’s it for this week though.**

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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**