I'm Steve LeVine, I wrote THE POWERHOUSE: America, China, and the Great Battery War (Penguin), a real-time thriller about the worldwide race to perfect the next engine of economic growth, the advanced lithium-ion battery.

$Steve_LeVine^1andr/ScienceAMAs^1$

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April 17, 2023

Abstract

Hi Reddit, I'm a writer at Quartz. My beat is the intersection of geopolitics, energy, science and technology. Today, oil prices are around $33 a barrel, and most analysts think the highest they'll go this year is another $10–up to $43, which is much lower than it was when I started looking seriously at advanced batteries. That was around six years ago. Batteries caught my eye because I kept seeing the presidents and prime ministers of countries assert that they–their nation–was going to dominate what they predicted were big battery or electric car industries. That was the US (Obama), China (Hu), Japan and about a dozen more, and the numbers they tossed around for how much these industries would be worth were enormous. They were the size of Google's annual revenue at the time. The kind of wealth that could move geopolitics. I persuaded one of the federal US labs–Argonne, near Chicago–to let me sit with its battery team for a year while they worked on creating the big breakthrough that would bring on this age. Argonne's credential is that its battery material–NMC–is in the Chevy Volt. It stretched to two years. By the end–and through today–Argonne did not create the big breakthrough (nor did anyone else). The electrics and hybrids that have been introduced have not gone viral. And, as we started with, oil prices are about 75% lower than they were when it was thought that economy–saving gasoline–would be a big impetus for the electric car age. So was the battery and electric car talk back then a bunch of hype? In some cases, definitely, and we can get into that. I've done some work on a couple of the hypesters. But my own theory–and it's based on what I'm watching–is that we are entering a natural, second stage of the mainstreaming of electric cars. Batteries are one thing–the researchers I talk to don't have a lot of confidence that they are close to a big leap. Nor do they see anything on the horizon that creates the big electrochemical advance. They are still at the bench, working away. But–and we can get into this–the manufacturers are going ahead anyway. The pure electric Chevy Bolt, introduced a couple of weeks ago at CES in Las Vegas, was an example of this. It will go 200 miles on a charge and cost $30,000 after the federal subsidy. That is mainstream distance and price. It's based on advances on the factory floor–engineering with the cars, and tinkering with the batteries. So I see the possibility that the last half of the decade proves to be a tipping point for electrics. A wild card is Apple. It's stealthily building its pure electric Titan, aiming for launch in 2019 or so. If it does launch, that will mean serious resonance for mainstream electrics. I will be back at 1 pm EST (10 am PST, 6 pm UTC) to answer your questions, ask me anything! Endnote: It's after 3 pm now. I am going to sign off for a couple of hours. I'll return this evening and answer more questions if they are there. Meanwhile, thanks so much for signing on. I really enjoyed the experience. Best Steve

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Science AMA Series: I'm Steve LeVine, Washington correspondant for Quartz Magazine, I wrote THE POWERHOUSE: America, China, and the Great Battery War (Penguin), a real-time thriller about the worldwide

STEVE_LEVINE R/SCIENCE

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READ REVIEWS

WRITE A REVIEW

Why do you think that so many people see the future of transportation in electric vehicles? Is there any reasonable possibility to obtain a reasonable energy density in two decades? If no, why all the hype?

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lucaxx85

I do think that electric cars have captured people's imagination in a not-entirely rational way. But that is because of the payoff if they are successful--the environmental payoff, but also economic and geopolitical. I do think you can obtain the right economic formula in two decades, whether that is because of energy density or advances in the factory, such as the Gigafactory. Adaptation will be another matter. It can take two decades for major technological adaptation to take place, and when it comes to a big splash in the context of the 1 billion cars on the road across the planet, it could be three decades. But it is coming.

How actively would you say China is pursuing battery research (including private sector)? More or less so than the US? Would breakthroughs in batteries significantly affect US-China relations?

Do you think the Middle East will become a "ghost town" if fossil fuel is made uneconomical? What about Russia, since a huge chunk of their economy relies on oil?

brouwjon

Very actively. China desperately wants to lead in batteries. For the usual reasons, there is more confidence in China's capacity in manufacturing innovation than at the bench. I'd say the US is well ahead on the research side. I do think that energy technology is part of the US-China geopolitical struggle.

As for the second question, yes the low oil prices are a message to all the petro states to diversify their economy, for the very reason that you raise.

Hi Steve, I'm wondering how far you think we are from large-scale battery technology, the size needed to store renewable energy generated at a utility scale? I know the home batteries are close with Tesla's recent prototype, but do you think it will be possible to store solar and wind on a large enough scale that it could become a base load power source? Thanks!

hurray4kimchi

What is going to happen first is that batteries are built into utilities in order to flatten out peaks; most experts I talk to see that happening on a wide scale relatively soon. To become base power, costs need to come down considerably. A lot of people are working on it. Maybe in the 2030s?

Do you see an energy crisis coming in the next ten years? For example, if the battery boom really comes and there won't be plants out there to fill the electric needs of all the people who constantly want to charge their batteries? (including small and big ones, ofc)

Broject

There could be an energy crisis, but not because there is insufficient electricity for batteries; propelling ourselves and running our homes using battery-stored electricity will be much more efficient than our current systems. But that said, energy is such a volatile industry--as you see now in the world, unexpected economic mayhem has erupted because Saudi Arabia has declared war on US shale oil. The oil industry has postponed $380 billion in investments, which, if they stay postponed, could result in an oil shortage in the 2020s. Lot of variables out there.

I'm a relatively young (23 y/o) business graduate from an Eastern European country who found true passion with batteries and electric cars 3 years ago when I first found out about the Model S during my exchange in San Francisco. Even though I didn't study an engineering major, I read about batteries all the time and have an electric car blog for a year in my country. It's pretty much the only electric car source in our language yet. I'm trying to learn as much as I can and I can say that this is my life's passion. I've never been more excited about a subject than EVs and batteries.

I was approached by one of Tesla's suppliers and might have a chance to move to California in less than a year as a rep. for that company. (Let's hope so) What would you reccommend for a guy like me to get into the battery and EV industry and contribute to this revolution I believe is bound to happen? (call me a hopeless romantic but I agree when they say the auto industry will undergo more change in the next 5 years than the last century)

Follow up; would you agree if I were to state there's more opportunity in improving pack designs and fast recharging abilities in the short run assuming we'll keep at an 8% per year cell level density increase? Last but not least; cylindirical or pouch? I know back in the day Tesla's 18650 were in abundance and more dense and made sense but I also read that the gap was closing. Isn't it more difficult to design pack with thousands of cells anyway? Will pouch make more sense in the short term? (<5 years)

Sorry for a long post but couldn't miss the opportunity. Thanks in advance if you answer.

floydian5

Hi, short answer is -- categorically yes. You should go out to California. Your intuition about the benefits of achieving better pack design and other manufacturing advances is spot on, too--and what I think the industry understands, too. The battery researchers continue to toil away. But this coming five-year period of new mainstream electrics is all about innovation on the factory floor. Cylindrical or pouch? Musk says the former is the way; everyone else says the pouch. Let's keep watching.

Are there any credible moves being made in creating a single hot-swappable battery standard?

I have had it in my head for a while that batteries should be a collectively held and managed resource, a bit like the natural gas cylinders where you can swap empties for fulls in minutes.

A battery swap station would allow you to drive over a spot on the ground where an automated process unclips your empty battery & swaps it for another charged battery in a few seconds. The stations charge and may hold a reserve of them so that surges in demand are met.

Although we will of course at the same time charge our vehicles at home and at work, the hope is to take away the pinch points involved in managing the charge of a single, leased battery of your own and let people drive continuously for thousands of KM.

To get there, though, we need a standard form factor, and this is what worries me- is there any hope of one on the horizon?

stunt_penguin

Agree! But, as with all technologies, it takes time and blood on the floor before rivals agree to a standard. They will get there though. Swapping is a terrific solution to a bunch of hurdles.

Hi there, I'd like to know your opinion on the growth of cold fusion tech. Once it's perfected, do you think lithium ion tech will be irrelevant?

GodMode_Activated

Yes. But as of now, fusion is theoretical.