This Essential Tech Will Make Global Energy Sharing Possible

Today, I'm going to eat humble pie. I knew about a crucial technology – and I overlooked just how important it was going to be. This energy-storage device is nothing new – but recent advances may mean it's a rising star. It could ultimately replace the battery for many applications (and **we've covered one before**). That gives you a huge opportunity to profit from investments in this sector.

If you've been following *Exponential Investor* for a while, you'll know that we're really big on new energy technologies. The price of solar is plummeting. These predictable cost falls are known as "Swanson's law" – akin to "Moore's law", which has governed the pace of computing improvements during recent decades.

This kind of cheap solar is going to drive an energy revolution, as we switch our infrastructure to fit this new economic reality. These exponential cost reductions give predictability and confidence, as we make an inevitable transition from fossils to renewables.

However, solar is very different from fossil fuels – for two obvious reasons. Firstly, it only works in the daytime. Secondly, it's only optimally economical in sunny places. Accordingly, we've got a bit of a job to move all this energy around the world, and to store it until needed.

Improved electrical transmission is well understood – and involves upgrading our AC power network to DC, which works much better over longer distances. **We've covered this before**, in *Exponential Investor*.

Storage, however, is rather more complex. Two technologies I regard as particularly promising have been covered in quite a bit of depth in *Exponential Investor*. Firstly, we looked at **battery storage** – of which Tesla's Powerwall product is a great example. This tech is great for night-time use – storing enough energy to let you watch *Strictly* after sunset. We're already seeing this technology make an impact in the UK. In recent weeks, we've seen the UK's first *unsubsidised* solar+storage plant – near my erstwhile stomping ground of Flitwick, Bedfordshire (pronounced Fli'ick, by the locals).

The other critical technology is **power-to-fuels** – which gives us the ability to store solar energy for winter use. It also allows us to inexpensively make chemical fuels in sunny locations, for transport globally – just as oil is now moved. **ITM power** is a promising firm in this field. (We also previously looked at **compressed air**, which is good for storage over a few days or weeks.)

But I missed something crucial…

I thought we'd done enough on energy storage. I thought we were getting a bit nerdy. I thought we'd covered the key technologies.

How wrong I was

I'd actually pulled my plans to cover in-depth an alternative storage approach. It's one that's been around for decades, but is currently winning a new lease of life: capacitors.

If you've done any electronics, you'll be very familiar with capacitors (AKA condensers). The smaller ones often look like little brown Smarties, standing up out of circuit boards. These consist of a couple of conductive plates, with an insulating plate (dielectric) between. Bigger ones look like small, blue AA batteries – think AAAAAAA batteries. In this type, the "plates" are rolled up together, rather like a roll of camera film.

The job of a capacitor is to store charge. When you get a static shock after removing a pullover, you've acted a bit like a capacitor. You've stored some charge, and that energy has been released when you've touched something that's earthed – such as a metal tap. The job of the insulating layer – the dielectric – is to ensure that this uncontrolled release of energy doesn't happen. Instead, the electrical energy is pushed into a circuit, to do something useful.

Capacitors are spectacularly good at releasing energy very fast. We call this ability "power density". By contrast, they're generally rubbish at storing energy in the first place – which is called "energy density". Accordingly, we tend to use batteries to store a lot of energy in a compact form – such as in your smartphone.

But there's a problem with batteries, as you will already be aware – they tend to have a very short life. Batteries' energy storage

process works using chemistry, and there are various forms – eg, when one type of material (eg, lithium-ions) is pushed into another (eg, graphite). This approach is rather like trying to make a currant bun by pushing currants into an ordinary bun. After a few attempts, you've got mostly crumbs, and not much bun.

Similarly, rechargeable batteries tend to wear out quickly

Furthermore, batteries are made from materials which may be expensive, rare, or toxic. That's not good news, if you're trying to use them to support energy's New World Order.

Capacitors have no such problems. If we could get the energy density problem cracked, we'd be laughing (tomorrow, we'll look at how that can be achieved).

But even with fairly ordinary performance, capacitors still have a lot of applications. They can be used for buses (eg, Chariot Motors). A few such systems exist around the world (Shanghai; Moscow). An urban bus doesn't need to store much energy, because it can charge at every stop. Capacitors can also be hybridised with batteries – giving big improvements in peak power output, without compromising too much on energy density. Ioxus uses this technique, to ensure that heavy vehicles can still be started, even with clapped-out batteries.

There's a lot more to capacitors. Do check back tomorrow – when we'll be examining exciting new markets, in detail. We'll feature some astonishing new technologies – and some attractive-looking firms.

Has this subject got you charged up? Let us know: **andrew@southbankresearch.com.**

Best,

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