**Back in October 2020 the International Energy Agency published their annual World Energy Outlook report, and in that report they stated that solar power now offers the cheapest electricity in history.**

**It’s quite a bold statement from what is undoubtedly one of the world’s most influential energy analysts.**

**They also said that because solar power is somewhere between twenty and fifty percent cheaper now than was anticipated in their own 2018 report, there could be as much as forty three percent more solar output by 2040 than that earlier report projected. Overall, they say solar will be the main driver of growth in global electricity supply, followed by onshore and offshore wind.**

**But it’s not all plain sailing. Demand for gas could rise by thirty percent over the next two decades too as it gets used more and more as a bridging fuel in the transition to renewables. That’ll slow down the rapid peak and decline of fossil fuels that the world so desperately needs if we’re to stand any chance of hitting the targets of the Paris agreement.**

**And that’s why so much research and development is being focussed into the energy storage solutions that will be absolutely crucial to dealing with the intermittency of renewable technologies as they come to dominate our national grids.**

**It’s becoming a pretty crowded and competitive field, and now there’s one more technology to add to the list that looks set for a bright future, not just as a supplier of grid balancing power but also because of its ability to feed direct heat energy into industrial processes and municipal heating systems. And like all the best new technologies, it’s got a nice funky title. It’s called Nano-coated Salt technology.**

**So, what does that mean?**

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

**For most of us, the word ‘salt’ conjures up the Sodium Chloride that we sprinkle on our food every day.**

**But in the chemical industry, salts encompass a wide range of different compounds.**

**And in the energy world, the term ‘molten salt’ gets bandied about quite a bit too. There’s molten fluoride and chloride salts that get used in Thorium Nuclear reactors as both a liquid fuel carrier and as a coolant for the fission process.**

**Then there’s sodium and potassium nitrites that make up the molten salts in a Concentrated Solar Power plant or CSP. Those CSP systems typically aim to make use of the energy stored in the heated salts within a period of about twenty-four hours. Essentially, they act as a thermal battery as opposed to an electrochemical battery like lithium Ion.**

**But what if you could use thermal or electrical energy to actually change the chemical composition of a molten salt so that it transformed into a new compound that would sit almost indefinitely in that state until the process was reversed to release the stored energy. What you would have produced is a sort of hybrid between thermal batteries and electro chemical batteries. A thermochemical battery if you like.**

**Well, that’s where this new nano-coated salt, or NCS technology comes in.**

**The system was pioneered by a Swedish firm called SaltX.**

**To find out how it all works I spoke with Head of Technology at SaltX, Corey Blackman. Corey explained that in its discharged state, the salt in question is Calcium Hydroxide - an abundantly and commonly available compound usually in the form of a white granular powder. Its already in everyday use in all sorts of applications from making up lime mortars for building restorations to pickling cucumbers in fancy restaurants. The crucial element that SaltX add to the mix is a proprietary nano coating technology that they’ve been developing for over a decade now.**

**Corey couldn’t divulge precisely what that material is, but the effect it has on the salt particles is to break down something the science bods call Van der Waals forces, which help particles to adhere to each other. I’ll come back to why that’s important in a moment.**

**To charge the system up, electrical energy from renewable sources, or waste heat generated by industry, is run through the Calcium Hydroxide to increase its temperature to about five hundred degrees Celsius, which causes it to dehydrate. The steam released is then captured in a separate storage tank and the salt that’s left behind at the end of the reaction is Calcium Oxide, better known as quicklime.**

**So now you’ve got a stable compound in one tank, which eventually cools back down to room temperature, and plain old water in another, and as long as those tanks are well sealed then the two components will happily sit like that for hours or days or even weeks or months.**

**Then, when you want to release energy you simply add the water back into the Calcium Oxide. That causes a reverse reaction transforming the Calcium Oxide back into Calcium hydroxide, and because that reaction happens to be exothermic, a whole bunch of heat energy is released in the form of steam as a result. In fact, the reaction temperature reaches something like four hundred and fifty degrees Celsius.**

**Now if you just did that to your standard Calcium Oxide salt, what you’d find is that after about fifty cycles you’d end up with a congealed glob of nothing very useful at all. But because SaltX pre-coat their salt with the special Nano material, that congealing process is prevented from happening and as a result the system can be cycled many thousands of times. And, as a bonus the coating makes the salt non-corrosive as well, so it can be used in any application where steel tanks and pipework are involved.**

**And as an added bonus, even after thousands of cycles, when the material comes to the end of it’s useful storage life, it’s still perfectly useable as a component in cements and mortars, so it can easily be recycled back into the building industry.**

**The inherent energy density of the salt is pretty impressive too. Compared to these other energy storing materials it’s head and shoulders the best, even beating lithium ion batteries.**

**So now you’ve got a couple of options for what to do with all that lovely, newly converted energy.**

**One option is to send the steam at high pressure across a standard turbine to drive an electrical generator. If you added enough storage tanks to get to utility grid scale, then you’d have yourself a long-term energy storage solution. The main constraint on the system would be the conversion efficiency of the turbine and generator, which is typically around thirty five to forty percent.**

**OR… you could divert the steam directly from the salt reaction into a district heating system or into industrial processes that use steam and would otherwise have to heat water using fossil fuels.**

**Using the SaltX system in this way takes full advantage of the 90% efficiency of the original process.**

**It’s easy to get pre-occupied with finding ways to directly replace fossil fuels for electricity generation, and of course that is a vitally important challenge, but heat represents three quarters of industrial energy use worldwide, and well over half of all energy used in buildings.**

**New York City, for example has the largest steam network in the world, providing heat energy from it’s fossil fuel fired power plants to thousands of commercial buildings. In its drive towards sustainability and renewable energy, the city is now rapidly deploying offshore wind. The SaltX technology could easily be integrated into that system to maintain the vital steam supply that so many buildings and industries rely on.**

**In Europe and other parts of the world where renewable energy is growing rapidly, operators often have to curtail power generation from wind and solar because the grid can’t use it. The SaltX system could store that energy at times of day when it’s very cheap to produce and then release it, either to run steam turbines or directly into high temperature district heating systems at peak demand times.**

**China has a similar challenge. Huge wind farms have been built in the northern regions that are now causing the country’s coal fired combined heat and power or CHP plants to close down. As the name suggests, those power stations don’t just supply electricity. They also provide heat to the local population, and as they shut down one by one, that task is becoming more and more problematic.**

**The nano coated salt system is perfectly suited to meet these heat energy requirements, and its completely scalable. The storage tanks are a standard construction. No exotic or rare materials are required in any of the processes and units can be integrated into existing technologies in whatever number is required to meet the volume of output. In fact yet another bonus of the SaltX technology is the very fact that they’re utilising already existing and widely available materials and infrastructure, with their own unique tweak, to produce very large and potentially transformative quantities of heat energy, taking a large burden off our already over worked electricity grids.**

**In 2017 SaltX partnered with Swedish power firm Vattenfall to develop a pilot plant at Vattenfall’s CHP facility in Berlin, Germany. This system is designed to be charged for ten hours and then quickly discharged directly into Berlin’s district heating network at peak demand points in the morning and evening.**

**And late last year SaltX also announced that they’re working with Japanese firm Sumitomo to combine their nano coated salt system with a technology designed by Sumitomo called a fluidized bed reactor, which allows the salt and water mixing to take place at very large scale. The pilot plant for that partnership is due to be commissioned in 2021 and should allow SaltX to ramp up to a 1 megawatt system in the short term. In the medium term though, the plan is to get to systems with a fifty megawatt capacity. The main driving factor in the SaltX team is to provide utility scale storage solutions as well as smaller standalone systems where necessary. Energy storage will be needed at both ends of the scale in the coming decades, and proven technology like this are well placed to fill that gap.**

**Now, you may have already been thinking of other applications for such a versatile technology. If you have, or if you’ve got direct experience of working with these sorts of solutions, then dive down to the comments section below and leave your thoughts there.**

**That’s it for this week though.**

**A big thank you to the channel’s Patreon supporters who keep us independent and ad-free. And a quick shout out the folks who’ve joined since last time with pledges of ten dollars or more a month.**

**They are**

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**And of course, a big thank you to everyone else who’s joined since last time too.**

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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**