**If you’ve been kind enough to put up with my Sunday evening ramblings over the years, you’ll know that I’ve made quite a few videos extolling the virtues of renewable energy technologies like wind turbines and solar photovoltaic panels,**

**comparing their rapidly falling cost curves to the fairly static lines of competitors like nuclear power or fossil fuels. But wind and solar are of course both intermittent, which means they need some form of energy storage to back them up, and therefore the cost of all that storage and additional infrastructure also needs to be factored in to get a fair comparison with so-called baseload power producers.**

 **That’s a not insignificant piece of research and number-crunching that was embarked upon back in twenty-twenty-two by a PhD student called Robert Idel while he was at Rice University’s Baker Institute for Public Policy.**

**In his peer reviewed research paper Robert came up with a measure that he called the Levelised Full System Cost of Electricity, or LFSCOE, which he defined as the cost of providing electricity by a given generation technology IF the grid had to be ONE HUNDRED PERCENT supplied by that source, backed up by energy storage systems.**

 **It was a theoretical extrapolation of logic – a kind of no hiding place, worst case scenario for green technologies if you like. Robert’s calculations suggested that even if the cost of energy storage dropped by NINETY percent, running a grid ENTIRELY on renewables with absolutely no dispatchable power sources at all would still be more expensive overall than running it entirely on dispatchable baseload power like nuclear, biomass, coal or gas,**

**ASSUMING… assuming NO carbon tax had been applied to the fossil fuels. So, is this research the ‘coup de grâce’ that the fossil fuel propaganda machine was looking for? Game over for the ‘100 percent wind and solar’ proponents? Well, according to a twenty-twenty-FIVE analysis by the well-respected industry think tank EMBER…maybe not!**

**So, who’s right and who’s wrong?**

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

**Right, lets get stuck into this week’s little conundrum then, shall we?**

**Robert Idel’s number crunching wasn’t confined to comparing a one hundred percent renewables grid with a one hundred percent baseload grid. The paper also assesses a grid running on NINETY-FIVE percent renewables as well. Now you might think the difference would be negligible, and in fact in the case of baseload generators like biomass, coal, gas and nuclear, it is. But in the case of renewables, Idel found that the overall LFSCOE costs were slashed by no less than FIFTY percent, making them much more competitive, especially in places like Texas and California. Why? Well, because for 95% coverage, you can use reasonably sized batteries and efficient mixes of wind and solar. But Idel explains that to cover that last five percent requires massive overbuilding just to cover a few days or even hours per year. In Idel’s models that additional capacity sits unused most of the time, effectively making the electricity they produce super expensive. If a dispatchable power generator was allowed to fill that last five percent with very low-cost power, which Idel reckoned could be as low as eighteen dollars per megawatt hour, then the overall cost of the system would drop dramatically. Now, if you’ve heard of a guy called Tony Seba and an organisation called RethinkX you will know that all that overbuild of solar, wind and batteries would not necessarily HAVE to sit idle at all– it could in fact be put to all sorts of useful and very profitable purposes when it wasn’t needed for the grid, but I’ll come back to that a bit later in the video.**

**Idel’s PhD research paper is now more than three years old, and as we’ve seen in previous videos on this channel, battery chemistries, system efficiencies and unit costs are changing at an astonishing rate, which brings us to this new piece of research from EMBER.**

**The report compares different cities around the world to see how close each of them could get to 24-7-365 electricity generation just using solar PV and battery energy storage, while still remaining cost competitive with dispatchable power generators. So, there’s no wind power factored into these numbers at all – it’s just solar and batteries.**

**Unsurprisingly the most successful candidates in the data set were the sunniest cites like Las Vegas, Mexico City, Muscat and Johannesburg. In these locations the economics stacked up very well at a cost of somewhere around a hundred dollars per megawatt hour to get above ninety-seven percent. According to Ember that’s twenty-two percent less expensive than it was just twelve months previously. It’s also cheaper than coal in many regions and far cheaper than new nuclear.**

**The report’s authors point out that the capital expenditure cost to buy batteries has fallen by more than FORTY percent since twenty-twenty-three, not least as a result of an industry shift away from Lithium NMC batteries that contain nickel, manganese and cobalt, towards LFP or lithium iron phosphate batteries that don’t contain any of those costly elements. Prices as low as seventy-two dollars per kilowatt hour have been seen by the Ember crew, and industry analysts that I spoke to as part of my research for this video have pointed to prices as low as sixty-five dollars per kilowatt-hour for 20-year LFP battery systems already under auction in China. They also point out that Sodium-ion batteries are coming online at pace in that country. Sodium is an extremely abundant commodity already traded heavily in global markets at relatively inexpensive prices. Sodium-ion batteries are perfect for stationary storage systems, so they look set to disrupt that sector in the next couple of years, causing overall system costs to fall even further.**

**Now, obviously there are many parts of the world that don’t receive the levels of sunshine that the good folks of Las Vegas enjoy. To provide an example at the other end of the scale the EMBER team plumped for Birmingham. For clarity, we’re not talking about Birmingham Alabama here, which is mostly very hot and very sweaty, we’re talking about Birmingham in the West Midlands of England, which is mostly very dull and very damp. And for those of us who LIVE on this soggy little island, this quote from the EMBER report will be all too familiar**

**“even in less sunny locations, some days can be very clear, providing a lot of solar generation to flatten the curve. In Birmingham’s case, it just does not happen that often.”**

**Even so, our friends in Brum could apparently supply themselves with more than sixty percent of all their electricity demand just using solar and battery storage systems for a cost of around a hundred and sixty dollars per megawatt hour. And let’s not forget that here in the UK we’re blessed with some of the largest OFFSHORE WIND farms in the world, so a fairly decent chunk of the remaining demand would be mopped up by that resource. Plus, we’re connected to the continent via interconnectors, so we can share electrons with nuclear plants in France, and hydroelectric facilities in places like Norway.**

**But I digress.**

**The point is that the direction of travel is very definitely taking us TOWARDS that holy grail of one hundred percent renewable grids, BUT the EMBER team does arrive at a similar conclusion to Robert Idel when it comes to that last three, four or five percent or so. They concede that this is where things get very expensive indeed, because of the massive overbuild that would be required to cover all the periods where solar panels were not generating any power. It’s not months and months over winter though, as some naysayers would have you believe. It’s more like several days at a time, but nevertheless, the short dark winter days in latitudes further from the equator are a real thing that will need to be catered for, which brings us briefly to the man I mentioned right at the start of the video – Tony Seba. Seba, along with co-founder Jamie Arbib and their colleagues at RethinkX argue that to build a one hundred percent renewable electricity system based on solar, wind and batteries, you absolutely MUST massively over‑build capacity – probably as much as five times existing levels. The difference in their vision of the future though is that all this additional capacity will never be wasted, it’ll get used for other applications. Amazon already applies this principle to its data centres. They expand to cope with Christmas shopping traffic and then that storage space is rented out throughout the rest of the year at a very nice profit thank you very much. Well, you can do the same with solar, wind and batteries. The RethinkX team call it ‘super-power’. They argue that once the system is built out, all the surplus clean power will be available for things like hydrogen production, heavy industry, desalination, and even the dreaded crypto-mining, as well as all sorts of other energy-hungry applications, all at near‑zero marginal cost. In other words, what most analysts see as a problematic and costly “over‑capacity” in their cost modelling is transformed into a value‑creating asset in the RethinkX projections.**

**Now of course we’re only talking about electricity here, which is just one piece of the broader decarbonisation puzzle. Nevertheless though, the findings of the EMBER report and the projections of RethinkX do seem to underscore the transformative potential of renewables—particularly when deployed rapidly and at scale like we’re seeing in many parts of the world right now, not only reducing greenhouse gas emissions from power generation but potentially decarbonising other sectors like transport, heating, and industry through electrification. That’s especially critical in the Global South, where fast, distributed renewable energy deployment could leapfrog fossil fuel dependency, IF our global leaders pull their fingers out, stop throwing stones at each other and start concentrating on the job in hand.**

**Anyway, that’s my take on it all. You may have a different view of course and, as always, the place to leave your thoughts is in the comments section below.**

**That’s it for this week though. If you found this video useful and enjoyable then you really would be helping to support my work by hitting the subscribe button and clicking on all notifications.**

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**Most important of all though, thanks very much for watching! Have a great week, and remember to just have a think.**

**See you next week.**