**Here’s a little statistic that I predict will get the fingers of avid YouTube commentors twitching right from the get-go. According to a report called the Kelley Blue Book, in twenty-twenty-three the United States added a record one-point-two million new electric cars to American roads.**

**BUT instead of putting extra strain on the country’s electrical grids, total US electricity consumption actually went DOWN last year not up!**

**Why? Well, because devices and appliances continue to get more and more efficient as technology improves. In fact, according to the US Energy Information Administration or IEA, overall US electricity consumption has barely changed at all for the last twenty years, largely due to better building codes, the nationwide roll out of low energy alternatives like LED light bulbs, and the widespread adoption of heat pumps.**

**Just as well really, because the three main US grid networks are old and have been creaking at the seams for a long time. But America, just like the rest of the world, WILL need additional electrical capacity at some point, and adding that capacity to those ageing networks is a full-on modern-day nightmare of land appropriation, rights of way negotiations and permitting bureaucracy that can take years and years and cost millions of dollars to get through.**

**So, if there was some way to eliminate those hurdles and save a good chunk of that cost then surely, we’d be onto to a winner, right?**

**Well, there is a way. And it’s been staring us in the face all along. It’s called ‘reconductoring’**

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

**Just like most developed nations, the United States is covered with a vast network of pylons supporting big thick cables taking the electrons from where they’re generated to where they’re needed. The pylons often run across privately owned land, and in most areas the idea of adding more of them is greeted with very strong local opposition, and requires extensive environmental assessments, all of which can mean that permitting and construction can take ten years or more to complete – time we don’t really have if we want to get all that additional renewable energy capacity factored in before the end of the decade.**

**But here’s the thing. There’s nothing really wrong with the EXISTING pylons. It’s the wires that are strung between them that are the problem. They’re typically quite antiquated and made of a relatively inefficient mix of materials that were perfectly adequate back in the days when wasting electricity really didn’t matter because coal was dirt cheap, the atmosphere was an invisible open sewer for greenhouse gas emissions and most homes were only running a tiny television, a twin tub washing machine and a single light bulb in each room.**

**So, while clever engineers at the consumer end have been using modern technological advances to vastly improve the efficiency of the myriad everyday devices that you and I now take for granted, other similarly clever boffins at the distribution end have been developing materials that will allow them to send far more electrons through their cables.**

**A recent online webinar hosted by CTC Global explained in some detail how these new conductors differ from existing technology and what sort of impact they can have on project costs and timelines. The webinar itself is an hour and a half long, but the salient points are worth summarising here. And by the way I’ve left a link in the description to the full presentation if you want to get the information straight from the horse’s mouth.**

**Anyway, here’s the potted version. The wires used for the last hundred years or so consist of an aluminium conductor with steel wire armour protection. More correctly known as Aluminium Conductor Steel Reinforced, or ACSR. In the seventies that technology was improved a little bit with something called Aluminium Conductor Composite Reinforced, or cable, which provided more capacity and less sag on the cables themselves. Sagging is not a small problem by the way, as those of us of a certain age know only too well. On an electrical grid it’s more than just an unsightly irritation though, it can be a very dangerous hazard. In extreme cases lines can come close enough to adjacent tree canopies that they can cause a significant fire hazard. They can also interfere with each other. In 2003 there was a major blackout on the East coast of America, predominantly as a result of excessive conductor sag that tripped out the entire North East grid. That event arguably accelerated the development of composite materials to further increase strength and reduce the weight of those long cable runs between pylons. That led initially to Aluminium Conductor Fibreglass Reinforced, or ACFR cables being introduced, and then to Aluminium Encased Composite Core, or AECC cables, using carbon fibre in the conductor.**

**The latest iteration of the technology is Aluminium Conductor Composite Core or ‘A triple C’ cable, using a carbon and glass fibre composite core encased in aluminium. The composite core provides superior strength and the lighter weight of the carbon fibre allows for about thirty percent more conductive aluminium to be added. That not only provides much more capacity – up to twice as much in fact - along the same cable run, but it also lowers the electrical resistance, reducing the dreaded line losses and making the cable much more efficient. These modern cables can operate at higher temperatures with much less sag, as this chart shows. The red line at the bottom represents the old ACSR wires and the blue line right at the top represents the modern A triple C technology. You can see that after about a hundred degrees Celsius, ACSR and all the other older versions start to droop quite alarmingly, reaching more than seventy inches or about one-point eight metres at the higher end of the temperature scale. So, it’s pretty clear from this that ‘A triple C’ wires are an ideal candidate for reconductoring projects.**

**The benefits don’t stop there though. Reconductoring existing supply routes costs about half as much as a full upgrade rebuild. It’s also a much faster process too because it quite neatly circumnavigates one of the most time-consuming aspects of any energy infrastructure project, which is the permitting process. Because reconductoring comes under the category of ‘maintenance’ and not ‘new build’, there’s no requirement to get new permits for the work. That means what can potentially be a decade-long process can be reduced to just eighteen months to two years. That’s a big win for grid operators. This recent study from the folks at Berkeley Lab found that there were no fewer than ten thousand supply projects waiting for grid connection permissions at the end of twenty-twenty-two, ninety-five percent of which were from zero-carbon sources. That’s enough to double the capacity of the United States Electricity grid- if they could just get themselves connected. So, the ability to restring existing networks in the meantime while we’re waiting for new projects to cut through the red tape will be a crucial part of the race towards decarbonisation of energy.**

**Reconductoring has several other UPSTREAM benefits too. According to the numbers presented during the CTC webinar, reduced line losses and improved efficiency achieved by the reconductoring that CTC has ALREADY INSTALLED in over eleven hundred projects in more than sixty-five countries around the world are now saving more than ten MILLION megawatt hours of energy every year – enough to run almost a million US homes or charge nearly two and a half million electric cars. They’re also saving about a hundred billion gallons of water used at thermal power plants, because those power plants now produce much less of the useless energy that used to just get lost along the journey to the customers property. And perhaps most importantly of all, those efficient new wires are reducing CO2 emissions by more than four million metric tonnes. Every year. That’s like taking nearly a million internal combustion engine cars off the road. And as a final bonus, taking steel out of the wires and replacing it with carbon fibre composites helps to resist a phenomenon known as cyclic load fatigue and it massively reduces corrosion, especially in agricultural and coastal areas. In simple of terms, that means the wires last much longer in operation – which is another thumbs up from Jeremy and Colin in the finance department.**

**Reconductoring can’t solve all the infrastructure challenges involved int the green energy transition of course. New capacity will still need to be built out as the prodigious consumption requirements of a globally expanding population exceed even the remarkable efficiency improvements we’ve talked about today.**

**And as utility grids include an ever-increasing amount of renewables like wind and solar onto their systems, a lot of that generation will be located in areas that are not conveniently close to the towns and cities that will house more than seventy percent of the human population by twenty-fifty. America is a actually quite a good example. These two maps from the US National Renewable Energy Laboratory, or NREL show where the wind blows the most and sun shines the strongest across the country. And this third map shows where the most densely populated areas are. Not a great match, is it?**

**Similar logistical issues exist in many countries around the world. Here in the UK for example, we have vast offshore wind farms around our coastlines. Over in Germany, the majority of wind is generated in the north but mostly needed in the south, and of course the logistics get even more difficult in regions like Africa, Asia and Australia where transmission distances can be enormous.**

**The advent of these new super materials will not only make those new supply lines much more efficient, but if countries can effectively double the capacity of EXISTING networks at a fraction of the cost, and in a quarter of the time it takes to complete new build projects, then it provides an extremely important buffer zone while nations sort out the bureaucratic complexities of their existing regulatory systems, and may just make the difference between hitting our net zero targets or missing them.**

**If you’ve worked with this technology yourself, or if you’ve just got news and views on electrical grid systems or the energy transition more generally, then why not jump down to the comments section below and leave your thoughts there.**

**That’s it for this week though.**

**A massive thank you to our Patreon supporters, without whom this channel quite simply would not exist. And an extra special thank-you to the folks whose names are scrolling up the screen beside me here, all of whom celebrate an anniversary of Patreon support in March.**

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**As always though, thanks very much for watching! Have a great week, and remember to just have a think.**

**See you next week.**