**So, we’ve got all these shiny renewable energy resources coming online now, and everyone, including me, is getting little bit giddy with anticipation and optimism as we look forward to the brave new world that these sustainable technologies appear to be promising us.**

**But hold on a second say the scientists and economists – we’ve got these things called Integrated Assessment Models that we’ve worked jolly hard to develop and that are even included in those big important reports from folks like the Intergovernmental Panel on Climate Change. They tell us that the cost of renewable technologies will initially be very high compared to the existing mature technologies of coal oil and gas, and that those costs will only fall very slowly over several decades. Moving too fast into renewables, they say, could therefore cause some unforeseen and very unwelcome economic impacts.**

**Yeah! That’s right say the fossil fuel brigade – you go down the road towards a hundred percent renewables and you’ll have bankrupt nations like Venezuela all over the industrialised world and civilisation will break down and there’ll be riots in the streets, and before you know it we’ll be back living in mud huts and walking around bare foot chucking spears at anything unlucky enough to wander past us on it’s way home, so… is that true?**

**Is it really a huge economically existential risk to go head long down the road towards full decarbonisation? Are we really cutting off our nose to spite our face, as the naysayers would have us believe?**

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

**Integrated Assessment Models, or IAMs are an attempt by our global policymakers to throw a bunch of real-world variables into one big melting pot, mix them together, and then pull some sort of socio-economic and climate related projections out of the resulting data soup. The variables chosen can vary from model to model, but they all include economic processes, and processes producing greenhouse gases, and many of them also sprinkle in other aspects of human development like governance and regulation, infrastructure, education and health. That’s where the Integration part of the title comes from. The assessments coming out of the mix don’t pretend to accurately predict the future, they really just offer a range of possible scenarios that lawmakers can then use to make their policy judgements on behalf of you and me.**

**A couple of recently published research papers, both led by Michael Grubb of the Bartlett School of Energy, Environment & Resources, at University College London, have analysed how these IAM models work, in an attempt to better understand how accurately they’ve been representing the true cost of what the boffins call ‘emissions abatement’, and therefore whether those models have been influencing the right decision making in our wise and noble leaders.**

**Most Integrated Assessment Models tend to be quite good at including factors that stimulate innovation at the front of the process. Things like government research and development funding that gradually push new technologies along and help them come into existence. What they’re not so good at is factoring in the variables on the other side of the supply and demand equation. The unknown unknowns if you like. The things that can suddenly expand and improve existing markets or even create completely new markets that nobody had even thought of.**

**So, the researchers on this paper trawled through no fewer than two hundred and twenty-eight previous real-world studies of these so-called ‘demand pull factors’ in our global energy systems going back more than half a century. What they found was in the key sectors of industry, electricity and transport, demand, or market pull forces like carbon pricing and other cost incentives drove a greater increase in patents for novel designs than technological push forces like basic research and development.**

**They also found, perhaps unsurprisingly, that in pretty much all the technologies they studied, costs declined as deployment increased. But as deployment increased, so the costs declined still further, and that set up a sort of virtuous feedback loop that often drove exponential expansion into a particular technology. In their words,**

**“overall innovation is cumulative, multi-faceted and self-reinforcing”**

**Technology push is still important of course – you do still need good old-fashioned research and development and policy incentives that provide the confidence for companies and individuals to speculate their hard-earned cash on new and unproven ideas, but evidence from the hundreds of patents that this team catalogued in their studies points towhat they call *‘*strong path dependence’, with patents buildingon the shoulders of earlier developments and cross overs between different innovations leading to an acceleration in getting products successfully to market, followed by rapid market adoption that results in a precipitous fall in prices for consumers.**

**And that’s not something that’s generally well reflected in most Integrated Assessment Models, which almost always show very high initial costs of any new technology, dropping gradually over time, with little or no consideration of these sometimes exponentially accelerating factors.**

**In its recently published report called A Roadmap for the Global Energy Sector, the International Energy Agency, or IEA, shows an increase in clean technologies over the coming decades, and in fact it drew sharp criticism from the fossil fuel industry for its suggestion that there should be no new investments in coal plants and no new oil and gas fields approved for development with immediate effect. But even so, the IEA still suggests that fossil fuels will make up about twenty percent of global electricity generation even in twenty fifty when we’re supposed to be a net zero emissions world. And it projects that half the world will still be driving fossil fuel powered vehicles by that date too.**

**Based on it’s in-depth analysis, the IEA provides a couple of projections for overall emissions reductions by the middle of this century. One of them, called the Announced Pledges Case, or APC apparently represents their optimistic view of our world in 2050. The other projection, which they call the Stated Policies Scenario or STEPS reflects a rather more pessimistic outlook based on existing legislation. Both those scenarios show a pretty big difference between the emissions drop we need, and the emissions drop we’re likely to get. To make up for that deficit the IEA, and for that matter, just about every other major agency in the world, including the Intergovernmental Panel on Climate Change, all say that the world will have to adopt carbon capture technologies capable of sucking tens of billions of tonnes of CO2 out of our atmosphere and storing it somewhere safe and secure forever. There are a few companies currently working in that field, capturing a few thousand tonnes of CO2 per year, but there’s absolutely no certainty at all that those capture and storage technologies can really be ramped up by a factor of thousands in a quick enough timescale to really make a difference. And there’s no guarantee that the captured carbon dioxide will genuinely be sequestered and not converted into hydrocarbons that can then be reburned as fuels instead– something that is after all, a very economically tempting prospect for the commercial companies involved. And even if we do find somewhere large enough to store many gigatons of CO2, like in depleted oil and gas seams under the North Sea for example which is a project currently being pursued here in Europe, we don’t really know with absolute certainty that the gas will stay put or whether it’ll leach out into the water causing yet more acidification, or even eventually de-gas back up into the atmosphere. So, if these major international agencies are to be believed, then by not acting much more aggressively to reduce emissions in the near term – like the next few years, then we’re really kind of stumbling blindly into an unknown future with unknown long-term economic impacts and environmental consequences.**

**And by the way, if you’re keen to delve deeper into the IEA report, then I can highly recommend following the link up there to jump over to a great up and coming climate communication channel called the Beckisphere, where Becky goes into much more the detail on all the data sources that the IEA use to draw their conclusions.**

**But then, there’s this guy, who I suspect many of you already know well. He’s called Tony Seba and he’s the founder of an energy consultancy called RethinkX. I’ve been keeping an eye on their publications for a couple of years now and their analysis is disrupting the way that markets perceive the risks involved in ignoring the rapid rise of renewables like wind and solar coupled with energy storage.**

**In its latest research, RethinkX has revealed a large and rapidly-expanding global financial bubble that they say exists around conventional coal, gas, nuclear, and even hydro power energy assets.**

**They argue that this bubble has, in part, been created by mainstream energy analysis from the likes of the IEA, and all these other very well respected mainstream organisations,all of whom, according to Tony Seba and his team, have been significantly underestimating the industry standard comparison tool called the Levelized Cost of Electricity, or LCOE from conventional power plants.**

**That’s because they assume those plants will be able to successfully sell the same quantity of electricity every year for at least the next couple of decades despite the fact that in reality their utilization potential will continue to decrease as competition from near-zero marginal cost solar, wind, and energy storage continues to grow exponentially worldwide.**

**Here in the UK the capacity factor of our coal plants has more or less completely collapsed, dropping from fifty eight percent in twenty thirteen to just eight percent in 2019.**

**The average capacity factor of coal in the United States has fallen from sixty seven percent in 2010 to forty percent today. Partly because of the fracking boom, but increasingly now because of solar, wind and batteries. Nevertheless, the US Energy Information Administration numbers still assume that coal power plants entering service today and even those being commissioned in twenty thirty-five will have a capacity factor of eighty five percent for their entire operational lifetime. That allows them to show the LCOE of those plants as about 7.5 cents per kilowatt-hour. But if you plug in the real capacity numbers, which RethinkX suggest will be more like ten percent by twenty thirty-five, not eighty five percent, then the cost of electricity from those plants would be more than ten times higher than the U.S. EIA’s published estimate.**

**Because LCOE figures and asset valuations are very sensitive to these capacity factor parameters, conventional energy assets have been made to look much more attractive than they actually are, which means they’ve managed to bring in far more investment than they should have done – according to RethinkX the actual number is more than two point two trillion dollars of investment in fossil and nuclear energy in the global electric power sector since 2010.**

**As Tony Seba points out,**

**“investment in an asset class above and beyond what the fundamental value can return, based on shared and widespread false assumptions, is the very definition of a financial bubble.”**

**The full RethinkX analysis shows how the disruption of the energy market from solar, wind and battery storage will rapidly drive the capacity factors of all conventional coal, gas, nuclear, and hydro power plants towards zero over the rest of this decade, making the majority of them financially unviable and their assets stranded sometime around twenty thirty.**

**And that means if governments don’t confront the issue right now and put in place very strong policies to manage the decline of these power sources in an orderly manner, while at the same time facilitating the widespread roll out of the unsubsidised renewables that will replace them, then they may well find themselves having to make market distorting interventions in the future to prevent electricity supply shortfalls in their national grid systems.**

**And by the way, those investors I mentioned earlier, aren’t just venture capitalists who can afford to lose a few billion here and there, they also include institutional pension funds and other asset managers representing ordinary folks like you and me, who might find themselves holding stranded assets, not only in the power plants themselves but also in the infrastructure that supports them, like pipelines, ports, and railways.**

**The future of global energy provision could be bright if the right decisions get made by our current national administrations now, but that future could quite literally be very dark if those policymakers fail to grasp what’s really going on under their noses.**

**I’m quite sure this one will generate some very strong views on both sides of the argument. I wouldn’t have it any other way of course, so if you feel the need to chime in with your feedback or experiences, then dive down to the comments section below and leave your thoughts there.**

**That’s it for this week though.**

**A big thank you, as always, to the folks who make these videos possible by supporting my work via Patreon. They allow me to remain completely independent, and they enable me to keep all my videos completely ad free. And I must just give a quick shout out to those people who joined recently with pledges of ten dollars or more a month. They are**

**Richard Campbell**

**Ian Murdoch**

**Tom Regino**

**Gerald Hoag**

**Michael Stephens**

**Mark Hoefling**

**Robert Dean**

**Ronald Akkerman**

**Phil Fuchs**

**Robert Kane**

**Simon Morrish**

**Mike Bianchi**

**Tatsuo Okaya**

**Lisa Friedman**

**Todd**

**And**

**James Evason**

**And of course, a big thank you to everyone else whose 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.**