

The Great Simplification

Nate Hagens (00:00):

Greetings. Last week I said that this week I was going to talk about what I learned in India. I'm going to postpone that to next week, because over the weekend two things came to my attention. Number one, that we just recently pierced the November 2018 peak of what is called "oil production" in the world. A new all-time high. And number two, and this is as of Monday night, March 4th. Nvidia is worth 1.3 times as much as all of the energy companies in the S&P 500, valued well over \$2 trillion, in anticipation of AI being a productivity, world-changing technology. And I want to talk about peak oil and what AI may mean for peak oil, going forward. That'll be today's topic. Okay, brief recap. Many followers of this show know that energy is incredibly correlated with economic output. Over 99% correlated. And if we grow a 100 units of GDP, we'll need around 70 units of energy globally that are incredibly linked.

(01:41):

Of all the energy we use, oil is perhaps the master resource, because it is liquid at room temperature, it's incredibly energy dense, it's storable, it's transportable, it's versatile, and there's thousands and thousands of products we make from it. So, a barrel of oil has 1700 kilowatts of energy, a human has around six tenths of a kilowatt. So we get massive economic benefits from this stuff that we just pull out of the ground. Now, humans are more efficient at directing their muscles to energy, so the 1700 to 0.6 ratio isn't quite exact. But historically, the carbon pulse, which is humans drawing down ancient carbon and adding it to our economies, has been supported by adding more and more of this incredibly productive energy to our economies.

(02:49):

If you think about it historically, I've been showing this purple graph that is the carbon pulse, but carbon is oil, coal, gas. And so the oil is a core part of this, but it isn't the entire pulse. So this has resulted in massive economic productivity in our economies. But, the GDP growth in the developed world, the OECD countries, has been increasing most years, but increasing at a declining rate. Our productivity has generally been declining. Actually increasing, but at a smaller rate. And in fact, our productivity hit its maximum growth rate in the 1970s and 1960s, which is when oil production growth was growing at 6 or 7% a year, and has been growing much smaller since then.

(03:56):

The Great Simplification

So many of you are familiar with the concept of peak oil, which is actually not talked about much anymore. Peak oil is the time when all of the oil production, or technically extraction, in the world, hits its maximum point, and then forevermore we'll have less. M. King Hubbert was a Shell geologist back in the day, and this was a graph that he predicted, based on historical production and reserves, and future discoveries, and he predicted that global oil would peak around the year 2,000.

(04:40):

Well, this graph shows that oil production peaked in November of 2018, and the latest data just out in October of '23, five years later, showed a new high. But a new high in what? I will highlight a phrase here from my very first essay from The Oil Drum, which was 18 years ago. "What we are currently calling peak oil will be obfuscated and delayed by increasing amounts of alternative energies that are now being definitionally included as oil.

(05:25):

The logistical heuristic used by M. King Hubbert was not intended to include corn and sugar cane derived ethanol, tar sands, natural gas liquids, in its predictive theory of basin depletion. The concept of peak oil already not widely believed will start to be very confusing and probably even more combative." So when we talk about oil, and Art Berman and I have had several conversations about this, we are increasingly morphing the definition to include things that are not really oil. So for instance, 26% of what we count as oil, is least condensate in the United States. Which isn't oil, but it largely functions as oil, except it's very, very light and can't be used for heavy machinery and distillates and things like that. But it's pretty similar to oil.

(06:27):

On top of that though, we have natural gas plant liquids, ethanol, biodiesel, and all sorts of other liquids that do not have the same heat content, do not have the same properties, have much less economic value. That is what just hit an all time high. In fact, crude and condensate is still almost 3 million barrels lower than it was a few years ago. So if we look at the importance of US oil production, around two thirds of this is shale oil or tight oil, and this tight oil which was enabled by fracking, and financially enabled by a lot of Wall Street debt, actually conventional, what is oil, peaked 20 years ago in 2004, and has been on this flat to slightly declining plateau since then. What has been increasing is deep water and oil sands, and particularly

The Great Simplification

tight oil, and particularly the Permian, which my colleague and friend and provider of many of these graphs, Art Berman, has showed that they are starting to cannibalize and high grade themselves.

(07:58):

But tight oil in the United States accounted for around 10% of all oil production in the world. And as I've said before in this longish introduction to where I'm headed with this Frankly, we are on this red queen treadmill where we have to drill more, drill deeper, and get more wells, just to offset the increasing decline rate of what has been drilled before. Every year, the new wells that were drilled in that year have an aggregate decline rate that is faster, steeper than the year before. So shale oil and debt, and modern monetary theory and other regulatory things, function as a larger straw. So they do get a little bit new oil out, but the majority of what they do is they just bring us closer to the slurping sound, because the straw that accesses the resources, and by the way, the pollution, the ecosystem services of the world, is wider.

(09:17):

So Nvidia is selling gold prospecting equipment to the miner 49ers in the California gold rush. It is selling chips that are used for artificial intelligence around the world. So what does this mean about energy? I have a lot of thoughts on this, and this is the core of this Frankly, though I'm going to bring it back to peak oil near the end. So AI can help get more energy. There's that. So in fact, AI is being used right now to do simul-fracking and tri-fracking in the Bone Spring, in the Wolfcamp, and other shale plays, where the operators feel confident that the perfing and the processing in real time is safer, it's more efficient, and they're able to drill two or three wells in the same spot, simultaneously, which has not happened before.

(10:29):

Yes, this may have happened without AI, but AI actually is accelerating this. Of course, it's also simultaneously accelerating material use, because these frac jobs require one ton of sand per lateral foot, and a lot of them are 10,000 feet or more. Which means there are 10,000 tons of sand per well, and I think there's 10 tons per truckload. So it's thousands of truckloads of sand. So this is a little bit of an example of a Mordor economy that we're getting more energy, but we're using a lot of other stuff to get it.

(11:17):

The Great Simplification

I mean, here's the thing. For Nvidia to maintain a \$2.3 trillion market cap, what is going to have to happen in the world to justify that? A lot more productivity and industrial use of AI, and demand for more chips, and basically another internet boom, which will demand more energy. So, there's the micro view of how much energy AI chips use. And Elon Musk recently said that AI energy use is going to increase tenfold in the next six months, and another tenfold in the following six months, which is clearly unsustainable. We're going to need nuclear fusion or some energy invention, because we don't have that amount of energy and there's going to be blackouts and brownouts, and electricity shortages, which by the way won't be evenly distributed.

(12:16):

So when we talk about AI and energy, it's, how can AI invent new ways of getting energy? How can AI get the existing energy and shale plays, for instance, out more efficiently? But then there's the massive amount of predicted, expected, hoped for, productivity gains throughout society. Except, we are running into peak oil constraints. Yes, AI possibly might be able to increase the amount of the original oil in place that we get out of the ground, which is now between five and 8%. Maybe we'll go to seven to 10% or something like that. In which case it is both a larger straw and a larger reservoir. I'm skeptical that that's going to happen. I think human knowledge and ability and expertise in this field are super specialized. So I think AI is going to help but not dramatically change the shape of the oil curve. If we look back to the last major productivity bump in the world, it was in the late-1990s with the internet, and it boosted our productivity for several years, shown in the blue and red curves on this chart.

(13:54):

But then once everyone had computers and such, it kind of equilibrated and slowed back down. So as massively potent crude oil is, relative to human labor, AI is the same magnitude or more, cognitively, relative to the human brain. And we just don't know what the eventual impacts of that will be. But I think we are going to run into the mother of all Jevons paradoxes, which is the...and please look at my Frankly from a few months ago, Artificial Intelligence and Real Ecology. AI is going to demand more energy, and in the areas of society that it makes more productive and more efficient, that savings is going to be funneled into more Walmart, Home Depot, Disneyland trips, et cetera, and it's going to demand more energy, in the same way that we used

The Great Simplification

to have kerosene and whale oil and then town gas, and the development of incandescent light bulbs, and eventually LED lights, and we got more and more efficient in lighting.

(15:16):

Well, guess what? We demanded more and more electricity for more lighting. This same sort of dynamic is going to happen. So, if we look at a long-term chart of oil production, the peak in crude and condensate, which is largely considered oil, was in 2018. And I think the peak oil crowd, 15-20 years ago, which I was a part of, had kind of a naive view that as soon as oil peaked, that would be the end of economic growth, and everything would go downhill from there. I think the reality is much more complex than that. And here's what I think. I think it's reasonably likely that 2018 will be the peak, despite this all liquids recent thing. But a lot of that goes to plastic baggies and other plastic precursors, and ethanol and such. But I could totally envision that we bump around this 85 million barrel a day of crude oil and condensate for a decade, and then have a more precipitous decline after that.

(16:46):

Bringing up Art Berman again, he and I have looked at a lot of different EIA, IEA, Rystad Energy, Shell, and different projections, and of course anyone's guess. But I think this chart shows a plausible below ground limit of oil extraction in the world. So we have a peak around now and then a slow decline to 2050. That's below ground. But there are increasingly above ground risks. Because if you look at a chart of world GDP and energy history, 50 years ago, everyone could just try to cooperate and trade, and innovate, and the whole global economy was growing. But now, we see we're running into biophysical limits, and so there is a zero sum game and a game theoretical collective action problem. Look at what's happening right now with Russia and Ukraine and the Middle East. This is all because the great game is afoot. People in control know how central natural gas, energy, oil are.

(18:11):

So it's unlikely to me that this curve will manifest, because this is kind of a best case geology. We also have the financial overshoot that I'll be talking about more in the near future. So AI will function also as a larger straw. It's going to enable more oil extraction, and then it's going to also enable more oil demand in the world, if it succeeds. Of course, the challenge is, if AI extends the plateau of oil, and my recent

The Great Simplification

realization is with AI, we are going to possibly extend economic growth enough that the ecosystem damages to the oceans, the Earth, the climate, are themselves going to become the limiting variable to economic growth, which I didn't think would happen before a financial simplification, and still may not, but AI at least is making that possible. And by the way, if we think about the Carbon Pulse, DJ White and I who created that term for our Reality 101 materials, meant it to mean how much carbon humans pulled from the earth and burned for our economies.

(19:54):

But from a wide boundary sense, the carbon pulse also should include the carbon that is liberated from biological systems due to the higher heat and global climate heating that is releasing carbon from shallow oceans, methane hydrates, permafrost. And so the total Carbon Pulse is actually much higher than oil, coal, gas. It's all these biofeedbacks as well. And this suddenly becomes very prominent in my mind, as I was going to say risk, but I almost feel inevitability, unless something massively changes.

(20:47):

So here are my brief conclusions of this wordy Frankly. Energy, especially oil, is central to our way of life. I think we can become more efficient, use some fuel switchings like natural gas, some renewables, so that peak oil happens with a whimper rather than a bang, and will largely be forgotten until it's well, well in the rearview mirror. And I've long thought that. But AI is this new wild card, because AI is going to demand more energy, and by the way, it makes no sense that Nvidia is worth more than all the energy companies in the S&P 500, because we're going to need energy for AI to validate. So one of the two isn't right, or both aren't right.

(21:56):

AI is going to function as a larger straw, which is going to draw down our energy stocks faster, it's going to draw down our ecosystem health faster, it's going to act as a straw sucking from the bottom three quarters of society towards the top. And my biggest fear of AI is not a biophysical thing, it's a cultural human thing. My fear is that AI will act as a straw on our humanity. Already people are sending me emails crafted by AI, and they advertise it on the bottom. You can see these unbelievably targeted videos of cute golden retriever puppies that are going to have them not spend as much time with their real golden retrievers. Not in my case. Not yet, anyways. People will end up being captured by AI, which will gray out our humanity.

The Great Simplification

(23:07):

Artificial intelligence, or I actually prefer simulated intelligence, is an amazing discovery by our species, that could in theory dramatically alter human and our planetary future for the better. But as it stands today, it is lower, not higher, in the hierarchy of human behavioral drivers. And I think on the present course, it's going to be owned and used by entities and human beings on route to maximizing power and profits. And under that scenario, it is going to complete the human journey to left-brain dominance in our culture, and leave destruction in its wake.

(23:58):

Long live peak oil. It is a complex subject from a wide boundary sense. Peak oil in our lifetimes is going to be one of the most momentous moments in human history, but is not a date that's going to trigger it. It's going to be a plateau, and it's going to influence finance, geopolitics, everything else. AI is the new kid on the block. I don't think anyone knows what's really going to happen. I think the risks far outweigh the reward. You kind of know where I stand on that. I will give periodic updates on this going forward. Thanks. Talk to you next week.