The Great Simplification

Nate Hagens (00:00:02):

You're listening to The Great Simplification with Nate Hagens. That's me. On this show, we try to explore and simplify what's happening with energy, the economy, the environment, and our society. Together with scientists, experts, and leaders, this show is about understanding the bird's-eye view of how everything fits together, where we go from here, and what we can do about it as a society and as individuals.

(00:00:33):

I'd like to welcome my friend and colleague, Art Berman, back to the podcast. I think this is his fifth appearance on The Great Simplification. This is a very important and serious topic we discussed today, which is the fact that shale oil, responsible for most of the growth in world oil output in the last decade, has been high-graded and cannibalized to other wells, and we just hit a new peak in US production. But Art will explain this is coming at a cost of massively declining well productivity, where wells are producing 50% less per well than they were just three or four years ago, and that this will manifest in both shale oil peaking and global oil peaking. Art says that we have effectively used a larger straw and are much closer to that slurping sound at the end of a milkshake.

(00:01:44):

Of course, we're already a couple 3 million barrels below the all-time peak in the end of 2018, and the world economy has continued to grow, stock markets are near all-time highs. A few million barrel decline in oil does not portend the end of civilization, but it has major implications for coming decades if oil supply, even if we wanted it to grow, is no longer able to grow and will be in effectively permanent decline starting about now. Very important conversation. Please welcome my colleague, Art Berman. Art, great to see you.

Art Berman (00:02:41):

Nate, always good to see you too.

Nate Hagens (00:02:43):

This is our fifth podcast together, I believe.

Art Berman (00:02:47):

Wow.

Nate Hagens (00:02:48):

What you may not know, but my phone told me today is this is our 3000th time of talking. No, I'm…

Art Berman (00:02:55):

Is that all?

Nate Hagens (00:02:56):

No, I'm kidding.

Art Berman (00:02:57):

I know.

Nate Hagens (00:02:57):

I think… Well, it's probably about right.

Art Berman (00:03:00):

Yeah.

Nate Hagens (00:03:02):

You have been hard at work on some new very important oil related research, which we're going to unpack today. For those people that have not heard our previous episodes, let me do a brief recap of assertions, and please chime in if I'm missing something. We talked about what is oil, it comes from ancient oceans and seas buried under geologic time and pressure, how important it is to our economies. Energy is incredibly important, and oil is effectively the hemoglobin of our modern system. We are nearing, metaphorically, the bottom of the barrel because we found all the conventional plays and now we're adding unconventional, including shale oil. There's plenty left, but the ability to extract it and grow what we have now is at issue and how fast they decline might be another issue.

(00:04:10):

We also talked about how, in a barrel of oil, there are many other products in addition to gasoline including and especially diesel fuel, which is one of the most important products in the global economy, and that we have to refine those products off sequentially. In other words, you can't just divvy up a barrel, every barrel into all the pieces and extract less per se. We also talked about how increasingly what we call oil by the Energy Information Agency and other analysis is not really oil. In the United States, our growth in production has increasingly had a larger fraction of what's called natural gas plant liquids, which get processed into... You use the term baggies quite often. What we call oil is not necessarily the oil of the past generation, and lots of economic implications of all that. Is that a fair two-minute recap?

Art Berman (00:05:23):

Excellent. Yeah, that's perfect, Nate.

Nate Hagens (00:05:26):

When we talk about how much oil is there, we talk about global oil production, which of course is a misnomer because it was produced long ago, we're extracting it and refining it and turning it into products that humans use. Is it fair to say that that is a composite of three things? One is all of the wells that have been drilled in the past and the technology that's still getting oil from those wells and fields? Stacked on top of that is the new wells that are drilled and then the technology that's involved in that. Then, the third would be what is this stuff we're getting out of the ground? What is the composition of it? How useful is it? Is it a lot of sulfur? Is it heavy? Is it light? Is it natural gas plant liquids? Do those three things kind of tell the story of how much oil we're extracting?

Art Berman (00:06:28):

They do, and I would simply call category three oil quality.

Nate Hagens (00:06:33):

Oil quality. Good, good. Tell us about your new discovery in that you've been working around the clock to analyze the past month or so, and we're going to unpack it together.

Art Berman (00:06:49):

Sure. I was asked to help on a project. A mutual friend of ours up at the University of Texas asked me if I would help him put together a US oil and gas production model going back to where the data begins for convenience around 1950, and to give him the necessary parameters that he could use to model that for a much bigger macro analysis. Now, I should be embarrassed, but I'm not, that I have never gone back that far and done anything more than just look at production. But what I had to do for Carey King was to actually look at what was the well performance like in 1950, 1960, and 1970. Having done that, it gave me some really new perspective on the peak oil movement, if you want to call it that, that you and I were both involved in the early part of this century.

Nate Hagens (00:07:57):

And are still involved in.

Art Berman (00:07:59):

Well, and we still are, right? Some of us don't give up. We continue to believe that a finite resource eventually will become scarce.

Nate Hagens (00:08:09):

Well, if someone's hair was on fire, we would feel compelled to continue to tell them their hair was on fire, which is a metaphor for our preparation as a society for coming decades, but go on.

Art Berman (00:08:21):

For sure. What I learned, first of all, was how right we were that the productivity of the average well in the United States, and let me just say I'm not being US centric here, but I mean 1950, the US produced something like 70, 75% of the oil in the whole world. I mean, particularly back then, it was really important. We are still today the largest producer, and it is our recent production increase, say from 2010 to the present of which all of the growth in oil production has come. The United States is not just important, it's kind of critical in the mix. But what I discovered was that back in the 1950s and 1960s, the average well was a pretty darn good well in the United States. It

was 150, 200,000 barrels per well on average. By the late part of the 20th century, that had dropped down to about 20,000 barrels a day.

(00:09:33):

Now, 20,000 barrels a day sounds like a lot of oil, and it is as a consumer, but there's hardly a company in the world that can afford to produce a well that only makes 20,000 barrels in its lifetime. I didn't realize exactly the magnitude of how urgent it was to find new reserves, and so that was an aha. Then, when the tidal oil, the deep water, and the offshore Gulf of Mexico started coming on, those average wells were from five to 50 times more productive than even the really good wells back in the mid-part of the 20th century, and the shale wells were in the same category. On the one hand, what it showed me, it really emphasized how dire our situation was in 2000, 2005. We were living off of wells that weren't commercial to produce for all intents and purposes.

(00:10:46):

It also emphasized all this unconventional oil; offshore, deep water, shale, what a step change it really was on a per-well basis. I mean, it was huge. Back in the peak oil days, I was one of the people that was saying, "Oh, this stuff is... It's never going to be commercial, and if it is, it can't contribute all that much." Well, I was very wrong, we were all very wrong. That was kind of the problem with peak oil. But the real jaw-dropper in the study, I guess, was looking at US production today, it's declining at a very precipitous rate, and the shale plays, again, the average well performance is declining at a really concerning rate. What that says is we're heading back to where we were in the 1990s and early 2000s, unless I've got something very, very wrong. In other words, the unconventional plays bought us about a decade or a decade and a half, and now we're probably looking at something... Well, nothing's ever the same as it was, but a situation that's potentially similar to when we were worried about peak oil the first time around.

Nate Hagens (00:12:14):

Lots of questions. First of all, you just said US production is declining. Didn't we just hit an all-time slightly new high?

Art Berman (00:12:25):

Well, I didn't say US production was declining, I said the performance of US wells is declining. But you're absolutely right. The US just barely exceeded 13 million barrels of crude oil and condensate a day, which was the pre-COVID peak back in early 2020. Some of us probably did not expect that to happen. I didn't rule it out, but I was a little surprised when it did. What's more surprising is that the experts in the US government, the Department of Energy, believed that the average production for 2024 is going to be a little bit more than 13 million barrels a day. They may be right, I'm not saying they're wrong, I'm simply saying that if I'm right about the per-well performance dropping off, and it's not just dropping off, it's been dropping for several years, it's going to be increasingly difficult to maintain that level of production. I want to underscore I'm not saying that the EIAA, the Energy Information Agency Administration, is wrong. I'm just saying that there are some challenges that go into that forecast or projection that I wasn't aware of until I did this work.

Nate Hagens (00:13:49):

What does that actually mean, US well performance? Does that mean the total amount of oil that has ever gotten from a well or the per-day, or can you explain?

Art Berman (00:14:01):

Yeah, so there's a lot of ways to measure it, but the simplest way is what we call estimated ultimate recovery, which is how much oil and gas, of course, an average well makes over its commercial lifetime. At some point, I mean, the well might go on making three barrels, four barrels a day forever and ever, but at some point you don't get enough revenue from what's being produced to even break even on your operating expenses. I mean, you have to operate a pump, you have to run electricity, you've got to pay staff in the office and in the field. At some point you reach a level where you just say, "Okay, that's it. At least for our company, we can't afford to produce this well anymore."

(00:14:52):

That's what it is. It's simply a projection. You take all the production history that you have, the data, and you project it out at some defensible rate that's consistent with the previous historical data out to an economic limit, and you add it up, integrate under the curve, and that's your EUR, Estimated Ultimate Recovery. To go back to

where I was before, if an average US well, let's just say in 1990, made 20,000 barrels of oil in its lifetime, the average US well in 2020 made 325,000 barrels so...

Nate Hagens (00:15:37):

So 15 times as much more oil per well?

Art Berman (00:15:41):

Yeah, per well. The better your individual well is, the fewer new wells you have to drill in order to maintain the level of supply that the country and the world needs. The poor...

Nate Hagens (00:15:54):

So that's good news?

Art Berman (00:15:56):

It's good news, it's excellent news. The bad news is that well performance, that average lifetime production per well is declining. Now, there's another component, and I'm going to circle back to your question about how come US production is at a new peak. The answer is that there are two parts; there are rates and reserves. Reserves are the estimated ultimate recovery for all practical purposes, how much the wells going to make or the field's going to make or the state's going to make or the country's going to make over a certain period of time. The other component is how fast does it come out of the ground? What I saw, and this doesn't surprise me at all, is that even though the new wells are not performing as well in terms of how much oil they'll make over their lifetimes, their daily rates early on are much, much higher, and so we're getting a whole lot of that production early on.

(00:17:03):

That's what technology has done for us. It's like I'm sucking on a milkshake and suddenly you gave me a straw that has a bigger diameter, I could suck more faster. It doesn't add anything to the well. The well still produces the same amount as before, but I get it out sooner and faster. That's what's responsible, I believe, for the 13.1 million barrels a day is even though the wells are going to perform more poorly in

terms of their lifetime recovery, they're front-end loaded and we're getting exceptionally high rates early on, and that's what's boosting US production.

Nate Hagens (00:17:48):

The disconnect here between this view and the conventional extrapolate today forward into the future financial view is that this new high production brings us much closer to the slurping sound of depletion in these wells. Whereas looking nominally at busting through 13 million barrels a day, again, people could just look at the growth from 2020 to now and extrapolate that forward to 2030, and that's not going to happen.

Art Berman (00:18:28):

Well, that's my sense of it. I've been wrong before, but as I said a little while ago, it just gets increasingly difficult to do that. We add to that, the fact that investors are not too keen on giving oil and gas companies money these days. Back not very many years ago, 2015, 2016, investors were lining up to throw money at the oil companies. That's not the case today. There are a lot of reasons for it, but mostly the oil companies are having to get by on the internal cash they generate, which is substantial at the moment because oil prices have been up to $100, $120 a barrel, but it's very difficult to grow any business without getting some money from the outside.

(00:19:26):

Right now, investors just... I mean, nobody's lending... I shouldn't say nobody, but effectively nobody's loaning oil companies money. Maybe that'll change if the urgency starts to get more severe, but for right now, that's not the case. I think most people, the market particularly thinks, "No, we're transitioning to an electric economy. We're going to hydrogen, nuclear, and renewables, and that's what's going to power the future, not oil and gas."

Nate Hagens (00:20:02):

Do oil and gas companies want money, need money for drilling and upstream investment?

Art Berman (00:20:08):

Oh yeah, they desperately... I mean, an onshore well in Texas or New Mexico in the Permian Basin, and we're talking 6, 7, 8, 9, $10 million per well, depending on how deep it is and how...

Nate Hagens (00:20:28):

If we need 6, 7, 8, 9, $10 million, what would be the kind of minimum EUR, Estimated Ultimate Recovery, of a well to make that financially plausible?

Art Berman (00:20:41):

Again, it's a combination of rates and reserves. But to give you a simple answer, today we need pretty nearly 300,000 barrels per well at around $100 spot price to break even. That includes all the operating costs, the overhead, the interest on debt and everything like that, plus an 8% discount out into the future.

Nate Hagens (00:21:09):

Is this known in the industry, I would assume?

Art Berman (00:21:13):

Yeah, absolutely. I mean, you can't book a reserve unless you can show that it's commercial at current rates, current prices, and that it includes... I think the SEC actually requires a 10% return to book a reserve.

Nate Hagens (00:21:30):

How much of that 300,000 barrels... Can you just give me a rough estimate of if that well is drilled, how soon with conventional technology and the current kind of well performance, do we get 70 or 80% of that out in the first year or two, or does it take 20 years to get it, or what's that like?

Art Berman (00:21:50):

No. If the well hasn't paid itself out in three or four years, it never will. These wells are, again, front-end loaded, they're going to decline 40, 50, 60% over the first year or two, and that's not a bad thing. I mean, there's a lot of people that criticize shale plays because they have high rates of return. Well, unfortunately, I've got news for them,

and that is that all the really commercial plays in the world have high rates of decline. You want as much cash early on as you can get to pay out your gigantic upfront expense. It's the time value of money. There's nothing intrinsic from a financial standpoint. High rates of return are fine. It's just for the rest of us looking forward to, "Well, what are we going to do for an energy supply in 10 years or 15 or 20 years?" that it starts to look a little bit concerning.

Nate Hagens (00:22:54):

Let's look at some of the graphs. You sent me some slides, which we will share to the viewers. Can you walk me through-?

(00:23:03):

To the viewers, can you walk me through what we're looking at in slide number two?

Art Berman (00:23:07):

Yeah, slide number two, this was actually a slide that you asked me to make and I've updated-

Nate Hagens (00:23:14):

Because I think it's real illustrative of what's going on, but please explain it.

Art Berman (00:23:19):

This is US production going back to 1900, pretty much. And what I've done here is to divide it into, the green is conventional, like onshore, bread and butter kind of oil production. That peaked in around 1970, peaked for the first time. And then Alaska came on, mostly Prudhoe Bay, that's the yellowish orange. And that brought us up to pretty much the same level again by the mid 1980s. And the offshore then started actually after the war, that's the blue. The second World War. And all of that then was in fairly serious decline by the time period I was talking about. You can look at 2008 on the graph. We were down from nearly 10 million a day to half that amount, 5.1 million barrels a day, and that's when shale came in. That's the Mount Everest in red that says tight oil. And that boosted the US production up to where it is today, pretty nearly 13 million barrels a day.

(00:24:36):

And so what this graph shows is just how incredibly dependent the US supply is on this relatively new source of oil, called tight oil or shale oil, and everything else, with a few additions here and there, is still on the same depletion trajectory that it was beginning in 1970.

Nate Hagens (00:25:01):

Okay. Let's stay in this graph. I have several questions. First of all, the yellow, which is not a contiguous part of the United States, but is part of the 50 United States. It looks like it's, unless it's a spanned rail of your graphic technique, it looks like it's approaching zero.

Art Berman (00:25:27):

Well, it is, and this is not an incremental chart. These are actual values. And so the Alaska production, despite the best efforts of the companies that produce that oil on the North Slope and the Alaska State government are struggling to even keep the pipeline that brings it from the north part of Alaska down to where it can be marketed. I mean, that pipeline is going dry. They've largely depleted the supply. Now companies are up there drilling and it's not like it's gone to zero, but a company can make money, but it's not contributing a lot to the overall US supply.

Nate Hagens (00:26:20):

Okay. And then stripping out the red section, which is the tight oil, which I'll get to in a second, the rest of it, the conventional, the Alaskan, the offshore, are all looking a lot like cantorale or something that... I mean, the whole amount is in decline and seemingly accelerating.

Art Berman (00:26:45):

That's what the data says. Yes, exactly right.

Nate Hagens (00:26:48):

So how much of our oil in the United States that we extract is tight oil versus the rest, roughly?

Art Berman (00:26:56):

70%.

Nate Hagens (00:26:58):

70% is tight oil?

Art Berman (00:26:59):

Yes.

Nate Hagens (00:27:00):

And so what do we drill next after tight oil?

Art Berman (00:27:05):

No one knows, Nate. This is where we were in 2005 before the tight oil came on the scene. It's like, okay, what are we going to do next? The answer up until that time had been, well, let's go explore elsewhere in the world. Let's drill wells offshore Brazil, or off of West Africa, or let's try to find some new frontier areas in the onshore basins of Africa.

(00:27:37):

And at this moment, I mean, we never know what's still out there, but it seems as though we pretty much know what's commercially available and what's not. And the answer is, we don't know. We don't know where we're going to go. Are there more tight oil plays? Well, somewhere in the world there are, and they're being worked on and developed. But in the United States, we've pretty much tried all of them. I mean, there was a big flurry of let's try every tight oil play and shale gas play that we can imagine. This was back in 2010 through '15, and most of them proved not to be very commercial. And so we're kind of down to the three shale oil plays, the Permian, the Bakken, and the Eagle Ford that worked. And of those three, two of them are pretty much in decline, and the Permian still growing slowly.

Nate Hagens (00:28:42):

But your analysis of the Permian Well performance suggests that the Permian too is about to peak and decline.

Art Berman (00:28:49):

The average well performance has peaked and declined, but it's being held up by exceptionally high rates and the large number of wells that have already been drilled.

Nate Hagens (00:29:02):

We're making up for it on volume.

Art Berman (00:29:05):

That's exactly right. That's what we're doing. And so I'm not saying that the people should be looking for the Permian Basin to roll over and decline in the next three months, six months, nine months, 12 months. It's certainly possible, but it's not that simple. I mean, there's 40 or 50,000 tight oil wells out there, and there's a considerable lag between drilling, bringing them online and actually having them build to some respectable level of a couple of years. So there's a window in which we don't quite know what's coming next, but we do know that the average well performance in terms of what it'll make over its lifetime is lower.

Nate Hagens (00:29:56):

So staying on slide two, then looking at the red, which is the tight oil, there was a peak, which I guess was 2019, before COVID or something. And then we had a decline and then a new peak just recently. Is that correct?

Art Berman (00:30:15):

Right. So that first peak was just as COVID began. So again, there's a lag. All of the production in the United States... well, yeah, for several weeks, I mean, almost all of it got shut in because there was simply no place to store the oil.

Nate Hagens (00:30:33):

Yeah, I remember. I remember.

Art Berman (00:30:35):

But it took a while for that to show itself on this scale. But then after COVID in 2021, in 2022, money came back in, there was storage that was freed up, and it's pretty

well-built since then. But again, the build has been in the Permian, the Bakken and the Eagle Ford and there's a couple of other less important plays, the Niobrara and the Woodford, et cetera. Those are sort of baseload. Those are just kind of flatlining. So this is mainly Permian based in West Texas and Southeastern New Mexico that have accounted for this increase, recent increase.

Nate Hagens (00:31:21):

And looking at the graph without understanding everything you just said, if this were a stock price and not a measure of geological provinces stacked together, one would say all time high, we're going to off to the races. It's a buy.

Art Berman (00:31:41):

Yeah, exactly. Yeah, we're going to the moon, right.

Nate Hagens (00:31:44):

However, and I learned this from you, the tight oil, the shale oil, shale where it is is where all the other oil migrated from. It is the source rock. There's nothing left after that except perhaps oil shale, which is not fully cooked. Can you comment on that?

Art Berman (00:32:09):

Right. So we've known about what's called oil shale for, I don't know, a hundred years at least. These are source rocks that are a lot of them at the surface in places, in Colorado and Utah mainly. So these are rocks that if you walk up near them, you'll smell the oil. You hit them with a hammer, and there's oil. They're saturated to some extent with the oil. But as you said, they haven't been buried deeply enough, they haven't been cooked, they haven't been in the kitchen long enough so they're immature source rocks for the most part. And what has to happen is for us to use it, and there were great schemes back in the 1970s to mine the stuff and heat it, cook it in giant ovens or to even use nuclear energy to somehow heat it up to try to hasten the thermal maturation process. There are obvious environmental problems that got in the way, and despite several false starts, I mean, that's not going anywhere, as far as I know.

Nate Hagens (00:33:26):

But if you had to bet and US oil production declines as you are inferring, and we're going to get to some projections on that, would you guess that, well, we could either find other tight oil plays in addition to the Permian and the Eagle Ford. Are there any of those? And if not, are we going to try to do oil shale?

Art Berman (00:33:53):

Wow. So as I said a little while ago, I think we've pretty much sampled all the tight oil plays and shale gas plays in the United States, including places like Alaska. And at some price, some very much higher oil price, some of them may actually become commercial, but none of them were successful. There are deeper horizons within the Bakken and the Permian that certainly, I mean, I would go to long before I tried to artificially cook the oil shales of Colorado and Utah. Again, the environmental concerns out there are just overwhelming.

Nate Hagens (00:34:46):

Okay. So back to this graphic. I remember when I asked you to make this, it was four years ago because the US had just peaked and we were talking about global oil peak. So the US just made a new peak of around 13 million barrels. And we still consume what, 20, 21?

Art Berman (00:35:09):

Well, yeah, that's refined products.

Nate Hagens (00:35:12):

That's right.

Art Berman (00:35:13):

So we're comparing apples and oranges a little bit. But yeah, so this is crude oil and 20 is gasoline, jet fuel, kerosene, et cetera.

Nate Hagens (00:35:24):

But has the world made a new peak? Because I think the world peak of all liquids, to my knowledge, is still fourth quarter of 2018.

Art Berman (00:35:35):

Yes. And so we are still a couple of million barrels a day below that. As of the latest data that I have is May of 2023, we can project that forward and say, well, we're on track to beat that peak too. But we'll see about that.

Nate Hagens (00:35:59):

Except if the US is imminently peaking because of the well performance issue that you just outlined. And the Permian, the US has long ago peaked, if you exclude the Permian. Actually, maybe you sent me a graph on that. Would you like to describe graph number three?

Art Berman (00:36:19):

Yeah. Number three shows four things. The blue is all US crude oil and condensate production, including the November 2023, 13.1 million barrels a day, which will be a little bit lower, just below 13 million, the EIA says in December. Then the orange line is all the tight oil. That's about 9 million barrels a day, a lot of it. So that's where the 70% comes from.

Nate Hagens (00:36:52):

Right, nine out of 13. Okay.

Art Berman (00:36:54):

Yeah. And then the next line down, the red is Permian. So six of that nine is-

Nate Hagens (00:37:01):

Six of that nine comes from just one of the shale oil regions.

Art Berman (00:37:05):

It's the granddaddy. It's the big one. Yeah, it is. And then the gray line at the bottom is that orange tight oil minus the Permian. So it's a little bit less than 3 million barrels a day. But back to where we were a bit ago on the first graph, this just shows how incredibly dependent the United States is on tight oil and the Permian, in particular.

Nate Hagens (00:37:31):

And the world though too, right? Didn't you say the majority of oil production increase in the last 13 years is just from this red sliver here?

Art Berman (00:37:43):

Right. And there's a graph that shows that as well. And I think that's our slide five. And so on this graph, I'm showing world, conventional in green, deep water and oil sands and other kinds of dribs and drabs of less conventional supply in orange. And then the tight oil is in blue. And you can just, in your mind, draw a flat line across there, starting back in 2005 or '10 at the very most, and see that all the other oil in the world, except for tight oil, has at best been flat. And so all of the growth in world supply has been the blue since at least 2010. And someone might say, well, it's only 7 or 8 million barrels a day. How important is that? And the answer is, it makes all the difference in the world.

Nate Hagens (00:38:44):

Why?

Art Berman (00:38:46):

Because, I mean, even 1 million barrels a day of deficit in supply is enough to drive oil prices up to $120 a barrel. I mean, that's what OPEC has been doing here for the last couple of years. They've been withholding oil to try to keep the price up. We use so much oil to keep the world running, to keep our factories and machines and houses, and I mean everything we do relies on oil. And so if we're down 1%, we're screwed.

Nate Hagens (00:39:24):

I don't think a lot of people understand that. And I think when we talk about oil peaking, and real simply, peak oil means that we're dependent on a finite resource that has incredible energy density and work potential that replaces what humans used to do manually. And it will one day hit a maximum and then decline. That is a given. But when we talk about that, we're not running... there's two implications I think, and I'll ask for you to chime in.

(00:40:02):

One is we're going to have to figure out in coming decades and century what we're going to do when we have 80% as much oil, 60% as much oil, 40% as much oil, 10% as much oil, down into the future. That is an important question that society really, if we had wisdom and foresight, would be addressing. But the second, which is more of the focus of my work with this podcast and my organization, is once we stop growing and start declining, that calls into motion all sorts of deltas, differentials between society and finance and government expectations of extrapolating the past forward to a reality. So what do we do about our financial claims once energy, especially oil, start to decline? That's a separate question, and one with hugely important consequences.

Art Berman (00:41:07):

How do we fight our wars? We use a awful lot of oil just to move all that equipment around. But you said that oil is hemoglobin. Think about it as oxygen. Think about if a person's oxygen saturation dropped 5%, what would happen? I mean, it's only 5%, right? But I mean, very likely you might collapse. You would certainly have to sit down. You couldn't function with a couple of percent less oxygen saturation in your blood. And that would be the effect of losing just a couple of percent of oil supply for the world's metabolism.

Nate Hagens (00:41:59):

Let me put you on the spot here. You mentioned war. Is it possible that the powers that be actually understand everything that you've presented today, and this may be one of the reasons that the United States is aggressive in Ukraine and Russia and the Middle East, et cetera, because now is the time when we do have a abundance, quote, unquote, as we're looking at production. But underneath that is the well performance, which is in decline, and that implies a much different next decade.

Art Berman (00:42:39):

The military is always extraordinarily mindful of and sensitive to their energy and oil supply much more... if politicians and the State Department have the same perspective as the military, we would not be in the situation we're in today because they know what it takes to run an army, and it takes a hell of a lot of oil. I mean, one of the reasons that the United States, that Franklin Roosevelt made a bargain with the king

of Saudi Arabia in 1945 was because he believed, he knew, that one of the main reasons the United States was victorious over Germany and Japan was that the United States and its allies had better access to oil. I mean, period. You can't run an army, all those Jeeps and all those supply lines and all those tanks, you can't run an army without oil.

(00:43:41):

And so he, at a time when the United States was the Saudi Arabia... it was the OPEC Plus of the world, 1945, Roosevelt, he talked to the king of Saudi Arabia on his way back from the altar. He just got done dividing up the world between Churchill and Stalin, and oil was so much on his mind that he had a meeting with the king in the Red Sea in the Suez Canal to talk about how Saudi Arabia could help us and we could help them.

(00:44:19):

Of course, in 1945, Saudi Arabia was just... it wasn't on everybody's mind. It was a relatively new kingdom, and I think it had been founded in 1932 or something like that. So he was way ahead because he was listening to his military guys. He just got done fighting a big war, so he was attuned to the military perspective on energy and oil.

Nate Hagens (00:44:45):

So I want to get back to the global perspective in a second, but let's drill down on your findings. So you've basically, with your analysis you did for Carey King, showed that the Per Well EUR estimated ultimate recovery in the Permian has dropped by 50% in the last few years. Is that correct?

Art Berman (00:45:11):

Yep, that's sadly correct.

Nate Hagens (00:45:13):

And other than we drilled the best first, and now we're going after other ones, what can explain why that happened?

Art Berman (00:45:23):

It's a very good question, Nate, and one that I have struggled with, and my most likely explanation is that we've over drilled it. That we have drilled our wells too close together. And so what's happening is that the wells are cannibalizing one another's production. There's a radius away from each individual well to which or through which oil will naturally flow to the lower potential energy in the well bore. And if you drill another well within that drainage radius-

(00:46:03):

If you drill another well within that drainage radius of the first well, both wells are going to go on producing, but they're going to be cannibalizing each other's supply. And so both wells will end up producing less in their lifetime, if that makes sense to you.

Nate Hagens (00:46:21):

It makes sense. Like when I was eating a pizza with my brother, same sort of situation.

Art Berman (00:46:29):

Exactly.

Nate Hagens (00:46:30):

But let me ask you this, are those competing wells drilled by the same company or are they sometimes different companies even that have different leases that are adjoining?

Art Berman (00:46:43):

In the past, back in the days of the black and white movies, the gushers and all of that, everybody was drilling trying to steal his neighbors' oil. But today it's not the case. More often than not, it's the same company that's drilling these kinds of pitchfork patterns of wells that are all coming off of the same drilling pad. And why are they doing that? Well, the answer is, I don't know.

Nate Hagens (00:47:23):

Maximum power principle.

Art Berman (00:47:24):

Well, yeah, "Let's get as much out as we can right now." But I remember back 5, 6, 7 years ago, reading Society of Petroleum Engineers papers in which they had analyzed all sorts of great new technologies, microseismic data, and they were saying, "Look, we can't have these horizontal wells much closer than 700, 800, 900 feet apart, because if we do, they're going to cannibalize each other's production or interfere with each other's production." Now, in the Permian Basin, we've gotten a whole lot closer than that, and the Permian, because it's such a monster of productivity, has rewritten a lot of the rules about what works. But my sense is, is that we've gone too far. I can't say that categorically, but that's my most likely explanation.

Nate Hagens (00:48:24):

To simplify it, to help me understand it, let's say that a company or two companies have two adjoining properties, property one and property two, and they look at all the seismic and the mapping, and both of them say, "We're going to get 10 units of oil out of here." And so they build all their expectations on that. But then what happens is they drill them both at the same time, and because underneath the ground that oil is liquid and flowing and permeable, that they actually, neither one of them gets 10. They might get 9 and 9, respectively, because the two plots are right next to each other. Is it something like that?

Art Berman (00:49:08):

It's actually worse than that, Nate. What it is, is that these companies, if you have a square-mile of land, 1 mile by 1 mile on the surface, they will plan to drill six, seven, eight wells, the same company in that square mile, all from the same surface location. And it looks like a rake. The map of the horizontal wells underground looks like a rake. It's got all these tines coming off of it. And so they know ahead of time that they're going to drill at least half a dozen or more wells that are going to end up being much closer to each other than the 1000 feet apart

Nate Hagens (00:49:56):

Because they're not optimizing for ultimate amount of oil from that region, they're optimizing for getting it out of the ground faster to sell it for monetary return.

Art Berman (00:50:08):

Well, I'm going to give them credit and say that I think that somebody said, "Hey, we can get even closer than we thought before because this basin is so special, because we're using all this really great new technology and our fracks are..."

(00:50:25):

But let me finish where I was going. They will drill, let's just say, eight wells per square mile. They'll drill all eight of them before they complete any one of them because you use a rig to drill and you bring in a different rig to actually do the fracking and the completion. And so they'll drill all eight wells, they'll move the drilling rig off, they'll move a completion rig on, and they'll run the pipe and they'll do all the things they do. They'll do the fracking, and then all eight of them, pretty much, will start producing at the same time. And part of the idea there is actually to frack in between them to get the maximum amount of contact with the reservoir possible. And so I'm willing to say that I believe, I mean, the guys that run these companies, they're smart and I think that they were convinced, maybe they still are convinced, that what I'm saying is wrong.

Nate Hagens (00:51:32):

Or they really believe that what you're saying is right, and if you're right, they're just going to go and find another shale play and develop that one in the same way.

Art Berman (00:51:42):

Well, perhaps, but let's keep perspective on this. Part of the reason that investors don't want to give these shale companies any more money is because their view is that those guys destroyed a lot of capital over the last decade.

Nate Hagens (00:51:56):

And there's a very prominent climate change story out there too, right?

Art Berman (00:52:03):

Definitely, definitely. But the first strike against them was, "Hey, we've been giving you money for a decade and you haven't made us any kind of decent returns, so we're not giving you any more money." I think that happened before the climate awareness

started growing, but they kind of coincided. So the companies have a reputation and a history of doing things that are not good for investment investor returns.

Nate Hagens (00:52:32):

And still, we look at all the sectors in the S&P 500, and the irony is that energy is the most important sector to our lifestyles and our future, perhaps not to the environment, but to the way our economy works today, and it has among the lowest returns.

Art Berman (00:52:51):

And is among the lowest of the sectors in terms of its percent of the S&P 500. It's like 4-4.5%.

Nate Hagens (00:53:04):

Can you talk about rig count?

Art Berman (00:53:09):

Yeah, rig count.

Nate Hagens (00:53:11):

What is rig count and why is it important, and how can the current rig count situation inform the prognosis that you're laying out here?

Art Berman (00:53:22):

Well, on a very simplistic and logical basis, you don't produce any oil unless you drill a well. And so there ought to be pretty much a 1:1 correlation between how many rigs are working drilling wells and how much oil you should expect to get out of the ground sometime in the near future. And that's always been. Rig count is something that, for all of my professional career, when that data comes out, usually on a Friday, everybody pays attention. "Okay, did the rig count for oil go up or did it go down? Did the rig count for gas go up or go down?" And investors, they don't worry too much about what happens this week or that week, but over time, "Hey, it's gone down for the last four weeks. That's looking bad for supply."

Nate Hagens (00:54:19):

Longer term supply, though, right? Because there's a lag from when the well is drilled to when the first production comes out?

Art Berman (00:54:26):

Well, yeah, and part of that is because of what I just described, that you're going to drill six, seven, eight wells before you even go in to complete them. And so if it takes you, let's just say for argument's sake, a month to drill each well and let's say you got eight wells, then you spend 8 months drilling the wells, you got a rig working all the time, one rig, and you drill eight wells and it takes you 8 months, let's just say. And then you got to go in and complete all those wells, and maybe that takes you another month and a half. Then you got to get them hooked up to production. And by the time, it's easily a year or so before any oil is flowing at all. And by the time that rate builds up to the point that it actually makes the difference, you're talking 18 to 24 months. So the rig count is increasingly disconnected from the production itself.

Nate Hagens (00:55:27):

So right now, this 13.1 million barrels a day that we are seeing in late 2023 as a record that everyone's like, "Look at the USA record production in oil," is an artifact of the rigs that drilled in early 2022 and late 2021.

Art Berman (00:55:50):

Yeah, generally. It's going to vary from operator to operator.

Nate Hagens (00:55:55):

Right.

Art Berman (00:55:56):

But yeah, it's an artifact of something that happened a fair amount of time ago. And so things could be looking really kind of dire, and yet it would be 12, 18, 24 months before we started seeing the effect of that in production.

Nate Hagens (00:56:15):

So then there's two things that we can speculate on. Well, one thing we can know, and one thing we can speculate on. Today, we can look at the rig count, which in a second I'm going to ask you what it is. But then also, the well productivity you are saying is a 50% decline in the Permian in the last few years. So to stay flat, we would need to have twice as many wells if the production is only half of what it used to be. Yes?

Art Berman (00:56:52):

Yeah, you're exactly right.

Nate Hagens (00:56:54):

And what is the rig count doing these days?

Art Berman (00:56:58):

The rig count today is, let's just say it's 500 or 600 wells for oil. I'm just kind of guessing that. For the U.S., we're talking about something like 800, 800 wells overall.

Nate Hagens (00:57:25):

800 rigs or 800 wells?

Art Berman (00:57:26):

800 rigs, I'm sorry. US and Canada is 800, US is like 600, 625.

Nate Hagens (00:57:33):

And how does that compare to a couple of years ago, just roughly?

Art Berman (00:57:37):

Oh, well, before prices collapsed in 2014, we had several thousand wells drilling all the time, but there was a revolution in technology that took place after that collapse in prices and we went to a completely different kind of rig that was much more efficient, could drill wells a lot faster. And so everything we thought we knew about rig count had to be recalibrated in 2015 and 2016. And what's happened here in the last, well, since COVID, really, in the last 2 or 3 years, is that the rig productivity, the amount of oil that can be attributed to the drilling by one rig, has increased yet again.

(00:58:28):

Now, a lot of people get that confused. They look at this drilling productivity report that the EIA puts that every week, and they say, "Oh, it keeps going up. That's great." Well, yeah, you need to drill a well to produce oil, but rigs don't produce oil. Wells produce oil. I think a lot of people either confuse that or lose sight of that. So having a very productive rig is good for costs, but it isn't necessarily doing anything for the kind of oil supply that you need in the future.

(00:59:06):

My point is that just like when I bought my first car, if it wasn't performing the way I wanted to, I could pull over and open the hood on that VW Bug and take a screwdriver and adjust the timing in 5 seconds, close it, get back in the car, and it performed better. I can't do that today because the technology in my car is so complex that I don't even know where to find the timing in my car. And that's what's happened with the oil rigs, too, that the technology has just gotten so sophisticated that to make that direct connection, "Oh, my car's not working very well, I'll turn a screw," or to say, "Well, we've got 600 wells and we used to have 700," I don't even know what that means anymore because the rigs are more productive. So there's an increasing disconnect between how many rigs you have and what oil you're going to be producing in the future. I always tell people, look at the number of wells that are producing wells that are being added every month. That's what we need to know about.

Nate Hagens (01:00:13):

We have reached the end of the easy part of this interview. Now it's going to go into the hard questions.

Art Berman (01:00:24):

Oh no, maybe my dog will bark and interrupt us.

Nate Hagens (01:00:30):

Let me summarize first.

Art Berman (01:00:31):

Yeah, sure.

Nate Hagens (01:00:32):

You've laid out that shale oil, tight oil, is 70% of US production and its existence forestalled a peak in US production and world production earlier this century. We, just in the US, hit 13 million barrels, which was an all-time high, but that was largely from wells that were drilled 18 to 24 months ago, and your recent research has shown as not only of the Haynesville and the Eagle Ford and all the other shale plays peaked and are in permanent decline, but the Permian, which is the granddaddy of them all, is still growing, but that you are seeing the EUR, the well productivity, has dropped 50% from 2019, and you think the most likely reason to this is they're cannibalizing to get more oil out now without really a plan for the future. I think you mentioned that today, given the data that you're seeing, is that we would need a $100 a barrel oil at some reasonable discount rate for new drilling to make sense in these plays. Is that a fair summary?

Art Berman (01:01:56):

It's a fair summary, and let me give the necessary caveat here, and that is to say that there is uncertainty, particularly in evaluating recent production. You don't have a tremendous amount of history in a new well. So when I'm looking at 2023 production, I don't even yet have a year of monthly production to look at. So I'm having to say, "Well, it looks like it's declining pretty much the way 2022 and 2021 did, but I could be wrong." But what I'm not wrong about, Nate, I'm not wrong about the fact that 2019 was higher than 2020, which was higher than 2021, which is higher than 2022. I'm very confident that there is a progressive decline in well performance over the last 4 or 5 years.

Nate Hagens (01:02:56):

In the Permian.

Art Berman (01:02:59):

Well, in the Permian and the Eagle Ford and the Bakken, they're all doing the same thing. And what I'm reasonably confident, but less confident, in is that the most recent

data, the 2023 data, is following that same decline trend, and that's what'll be 50% of 2019. If I'm wrong and I have to revert and say, "Well, actually I'm only confident back to 2022," then I'm going to say, "Oh, okay. So the decline, instead of being 50%, is 38% percent or so." It's still pretty severe, so I have to be careful here. I don't want to overstate the certainty of the very recent data, but it's looking like 50%.

Nate Hagens (01:03:50):

If we played this podcast to a boardroom of oil executives like Harold Hamm and other long time US Energy, ENP experts, how much of them would agree of what you're laying out here and where might they disagree?

Art Berman (01:04:11):

Gee, that's a great question. Well, Harold Hamm just recently told Bloomberg or somebody that we really need to start thinking about, what he called, tier three reservoir, which is, he called it the really rough rock. Scott Sheffield, who is the CEO of Pioneer Natural Resources, which just sold itself to Exxon, he said the Permian is going to peak in 5 years. And he said that several months ago. So my sense is, is that if those boardroom doors were closed tight and there was no press in the room, my sense is, is that Scott Sheffield and Harold Hamm would say, "Yeah, we pretty much agree with you." I don't know that, of course, but they wouldn't say that publicly.

Nate Hagens (01:05:04):

I know that your analysis working on this the last month or so, because we've been talking about it, is kind of a backward-looking. You're looking at the EURs and the well productivity of the last decade or so in these regions, but could you hazard a guess where that 13 million production might be in 5 years or 10 years or 20 years?

Art Berman (01:05:30):

Yeah. Well, the future's tough.

Nate Hagens (01:05:36):

And of course there's above ground reasons, and the geology and the oil situation is its own thing.

Art Berman (01:05:46):

Exactly.

Nate Hagens (01:05:46):

Let's, for the moment, leave out Saudi Arabia and Iran and war and credit and financial issues. Just on a depletion geology standpoint.

Art Berman (01:05:57):

Well, but there is another factor that doesn't have anything to do with geopolitics, and that's money. Capital. I've already set the stage for this. I sat next to a mezzanine banker, you were in the same room back in January down in The Bahamas, and he kept leaning over to me and saying, "Yeah, nobody will lend these guys any money. Nobody wants to lend the oil companies any money."

(01:06:25):

So the geology is one thing, but it takes capital to drill the wells. And if we start to see the kind of thing that I anticipate, and I'll answer your question in just a second, that the production starts to decline, then the next question is, where are we going to get the money to do it? And the question that comes after that is, how long will this take to correct? We don't know where we're going to get the money to do it right now, but I just told you that there's like a 2-year lag from actual drilling to getting any oil out of the ground. Well, that assumes that you've already made the decision to drill, you've got a rig lined up, your leases are all set to go, and you have all your permits in order.

Nate Hagens (01:07:15):

So one implication from the sentence you just uttered is the amplitude of change in the next decade could be wild, because when we're faced with scarcity and shortages and a recession, or worse, because oil price, it's unavailable at the quantity we wanted, so the price has to go up, that's when they send out the rigs and the investment, and we're going to have to wait 18 to 24 months to get a meaningful increase. But that meaningful increase is not going to come from a snap of a finger. There's now a cap that's going to be declining. This is the real deal. The slurping sound is upon us.

Art Berman (01:07:56):

Right. I imagine that most of the people that listen to this podcast don't pay daily attention to the oil markets, but they're probably aware of the fact that, hey, prices are lower than a lot of people, a lot of producers, would like them to be right now. That's why OPEC is about to have a meeting in Vienna to figure out how much to cut so they can get prices back up. So oil prices today are in the low seventies. Well, it wasn't that long ago at the peak of the Ukraine invasion that they were $120. So how does oil price vary, $50, over a relatively short period of time? And the answer is that we're forever in a tug of war between, "Oh my God, we need more supply. We're feeling really urgent about supply. But oh my God, oil prices have reached a level at which it's slowing down the economy and demand."

(01:09:03):

... The level at which it's slowing down the economy and demand is therefore weak. And then you add in the interest rates that the Federal Reserve and other central banks have had to use to get the inflation, or try to get inflation under control, which by the way is related to oil price also. And it gets to be a very heady and complex mix. But the dichotomy, the struggle, the fugue, if you will, is between how the economy is performing and the demand that results, and the urgency of supply, which needs higher price. And the two are always in conflict. And just about the time that we think we're making progress on getting wells drilled, sentiment turns really sour. And the market says, "Oh my God, demand is weak. We got to stop drilling wells." And I know very credible analysts right now who think that oil price is going to stay around $80 for the next two or three years. Now, that seems difficult for me to accept, but that's what they say.

Nate Hagens (01:10:07):

So getting back to the... Can you give us a best case, medium case and worst case, given the implications of what you're saying here? And I'll point out that if you're right about this, the geology all of a sudden perhaps becomes the least important aspect. Because if this is recognized and the reality unfolds, then it opens up a huge systemic can of worms in the world.

Art Berman (01:10:39):

It certainly does. And looking at the world, my best case, I would be very surprised if oil production increases in the next, say six months or into 2024, my guess is that it will increase very, very slowly and essentially be on a plateau and then start declining off into the future. And by 2040 or 2050, I would not be surprised if production were 20% lower than it is today. And I'm not basing that off of the kinds of peak demand kinds of concerns that, oh, we're all going to be driving electric cars, and I'm not basing it on that at all. I'm basing that on my sense of a combination of the geology, the commercially available, low hanging fruit, if you will. And there's very little of that and the finance side, the capital side that says, okay, if we need more oil, here's the money, let's go after it. I'm very, very concerned that the second part is not there. It's just not there.

Nate Hagens (01:12:02):

Well, one of the reasons it's not there is because of the next question I'm going to ask you. A lot of the followers of this podcast, which I'm quite proud of, have a value system beyond the human sphere. And they deeply care about the natural world and the sink capacity of our biosphere and our oceans. And they might be listening to you saying, this is-

Art Berman (01:12:28):

Good news.

Nate Hagens (01:12:28):

This is all good news, except for what you just said. Because if we're only down 20% or 30% in oil in the next 10 or 20 years, we need to be down a hundred percent. What do you think about all that?

Art Berman (01:12:43):

Well, if you're down 20% on blood oxygen, you might be dead, is what I think about that. Now I'm in that camp, Nate. I mean, I'm totally in the camp that says that we need to decrease our consumption of all energy, not just fossil fuels, but particularly fossil fuels. And we need to do that in order to stop destroying the ecosystem of the planet from which we get all our wealth. Some of it is certainly... A lot of it is because I

love nature. But on a purely pragmatic basis, I mean, if we continue to destroy the ecosystem on which the entire food chain, ours included, if we are destroying it, then we are going to destroy our own prosperity, our own so-called human flourishing, if you will, to use an expression that's kind of in common use out there. That we cannot separate ourselves, our fate, our prosperity from that of the planet. But the concern that I have, and I know that you share, is that our entire society's metabolism is based on an oil economy.

(01:14:13):

And if we stop that supply too quickly, then things collapse. And that results in levels of chaos and social and civic disorder, governance problems, geopolitical strife, that just makes life almost impossible. So the people that want to get off oil, I'm with you a hundred percent. And in an ideal world, I'd like to get off oil too, but not at the cost of having the Frankenstein mob outside my house wanting to come in and take everything I have. And I don't think anybody wants that. It's a very difficult balance to try to maintain, between being able to carry on a life that has any quality to it and also not destroying the planet. I don't know what the answer is. My guess is that we're not going to get a lot of choice in how that answer unfolds. We're going to have to live with what happens.

Nate Hagens (01:15:23):

So you're kind of calling peak oil as likely 2018 to now plateau, with a decline coming in the coming years.

Art Berman (01:15:36):

I am.

Nate Hagens (01:15:39):

What about shale plays, tight oil plays, arctic plays? You mentioned it briefly on a prior podcast, but could you briefly recap why the US experiment is unlikely to be repeated as a global extension of oil supply in the coming decade?

Art Berman (01:16:02):

Sure. There are a lot of overlapping spheres that have to be considered. Yeah, there's a ton of shale in the world. But only marine shale, and this is purely empirical, only marine shale has ever worked for a tight oil play. And of that marine shale, let's just for argument's sake, let's say 25% of the shale in the world is marine shale. Of that marine shale, some of it is uncooked, like what we just talked about in Colorado and Utah. So if we take what percent of that marine shale has been buried deeply enough, has experienced enough heat and pressure to generate the petroleum, maybe we're talking 25% of that. Now of that, how much remains buried at a depth that has enough pressure to be produced by some means, fracking or whatever, to the surface. And just for argument's sake, let's say 25% of that. And of that, how much of it is in an area in which we can actually access and drill, that we're not in the middle of New York City or the Grand Canyon or at 30,000 feet.

(01:17:28):

And then we layer into that, that very few parts of the world have a fiscal system in which the owner of the land actually gets paid for having somebody produce the oil under his land. That's a very unique situation to the United States, Canada, Argentina, and a handful of other countries. In most parts of the world, a rig moves onto your property and you don't get squat in return. And therefore people say, no, we are not going to allow that. So you take all those overlapping spheres and say, well, where is all the overlap occurring? And the answer is, we've already identified most of those places. They're in North America, they're in parts of Argentina. There are areas in Russia that seem to fit that comparison. There are very few places actually that actually meet all those overlapping criteria for shale.

(01:18:33):

The Arctic, I mean that's a whole nother rabbit hole of cost and expense and geopolitical conflict. And when people say Arctic, I'm thinking, okay, best case scenario, we might start producing something up there in 25 years. That's a really best case. So people who think, oh we're just going to make it happen. No, I mean, we've got territorial disputes between Russia, the United States, China, I mean that's so far removed that it's a future possibility, but it's not going to meet our urgent needs in any kind of reasonable time period.

Nate Hagens (01:19:19):

I know you're not an expert on this, and I don't know of any experts on this, but how could artificial intelligence change the story that you've laid out here?

Art Berman (01:19:31):

Right. And you're correct, I'm not an expert on artificial intelligence. I'd like to say that for all the reading I've done, I should be, but I'm not, because this is a really hard thing to know if you're not on the inside, and I'm not. But artificial intelligence is not going to change the geology of planet Earth. Artificial intelligence is most likely to change, in a good way or in a commercial way, the technology that we use to produce the oil and natural gas and God knows what else, lithium.

Nate Hagens (01:20:10):

So an even larger straw, perhaps?

Art Berman (01:20:13):

Yeah, a larger straw. And ideally, you would think that artificial intelligence would help us make better decisions. Perhaps decisions, not to drill wells 300 feet apart when our best science tells us it should be a thousand. But we knew that. We already knew that, and we did it anyway. So to me, the idea that artificial intelligence is going to find ways of adding new reserves, I'm very skeptical of that because I think maximum power principle… And I mean humans are very good at knowing what it is that's useful and how to find it. They don't always know how to get it in a way that makes sense. But I think we know an awful lot of that.

(01:21:04):

So AI could do a lot for technology, could do a lot for decision making, and I can't begin to say how important that is or is not. But for the leaps and bounds that I understand that AI is making, I still suspect we're talking about many years before it actually could make a difference in our energy supply. Now maybe I'm wrong, but my fear is that people are going to start using it to find better ways of fighting wars or displacing humans from factory floors. But I'm probably wrong on that.

Nate Hagens (01:21:51):

Well, I don't think you're probably wrong. You might be wrong, but I don't disagree with you. So once this is all realized, five years from now we have lower production, the Permian has passed peak, there's economic crises. Knowing humans will probably blame all that on some exogenous factor and not on geology, and the fact that we've used a larger straw to take out a finite resource central to our economic institutions. But on that trajectory, I've asked you this before and I'll ask it again given your new research. Does it make sense for AI or some external body to coordinate the drilling in the oil that we have remaining in this country, and in other countries for them, in a more planned way so that we don't cannibalize and we actually increase the EUR because we're not taking someone else's pizza as it were, under the earth? Is there a role for some sort of a coordinated strategy beyond the lots of little pin cushion dots owned by different corporations?

Art Berman (01:23:14):

Well, there's always room, yeah. But I mean, when was the last time we ever had a coordinated effort to meet any of our needs except in wartime? I'd like to be more optimistic here, except that it just doesn't seem that humans are very good at that. And let's just say that the AI agreed with me, which is that the best forward strategy for humanity in the earth is for humans to use less energy. Nobody wants to do that.

Nate Hagens (01:23:53):

Well, because AI is here, but the market, GDP and profits is above it in the hierarchy. So at least for now, that's not going to happen. What is-

Art Berman (01:24:03):

But we already know that though. I mean, that's my point. And I know there are lots of people out there who will disagree with this, but I think they disagree with it because of ideology. But I mean, I look at the world and like you, I go around and I give talks and people say, "Yeah, but Art, I mean, what's the solution? I mean, you got to tell us what the solution is." And I say, the solution's easy use less energy. Well, they don't like that. That's not a solution to them. They want to know, well can't we use hydrogen? Isn't nuclear the solution? They want something that allows us to keep on growing the way that we have, that doesn't cause any fundamental discomfort in their lifestyle,

and I just don't see that those things are compatible. That the solution is one that will create considerable, not unbearable, but considerable discomfort in our lifestyle and our economic prosperity.

Nate Hagens (01:25:05):

As you know, I agree with that. I think there are no longer any non-radical pathways out of this, and we're going to have to use less. But it's the systemic implications of a peak and decline in oil that I am focused on. This has been very enlightening. I want to ask you one final question, but is there anything that you would like to summarize and hit a harder tone on, on anything you've outlined today?

Art Berman (01:25:43):

Probably not on anything that I've outlined. We came close to it when you asked me, do I think that our political leaders are fighting these wars right now because they're aware of what you're talking about. I don't know what they're aware of and what they're not aware of, but I think anyone who believes that the war in Ukraine is about territorial or ideological differences between Russians and Ukrainians, really needs to… Well, probably needs to listen to Helen Thompson's podcast that you did a little while ago. Anyone who thinks that what's going on between Israel and Hamas right now is some secular issue that ultimately revolves around forming a two state solution in Israel, I think really needs to study, well listen to Helen again. But study the history of the Middle East and how it's fit into the geopolitics of the world since at least the beginning of the 20th century. It's all about resources and energy. All these wars ultimately are.

Nate Hagens (01:26:59):

Well, just to put a fine point on that, we're talking about decline of US production because of what you've outlined and discovered on the Permian well productivity, a reminder that half to two thirds of the world's remaining oil reserves are within 600, 700 miles of Israel. So there's a reason that we're over there.

Art Berman (01:27:28):

There has, and US foreign policy has always been focused on the Middle East, as has the foreign policy of the United Kingdom and France and Russia, and I mean Germany. I mean, this is not known to everyone, but look at history and you will see it very clearly. It's not lost on anyone.

Nate Hagens (01:27:54):

So you sent me supporting slides for this conversation, which we will share as we always do in the show notes on the main site, thegreatsimplification.com. On our last podcast, I asked you what you would like to come back on the show and discuss, and I believed you said you want to talk about renewable energy, energy properties, energy density, nuclear, and how those are not going to replace the energy quality of oil and gas. Is that still what you would like to do on our next conversation? This was a little research thing that you just came upon with Carey King, and so I wanted to give you a podium to highlight this. But what would you like to talk about next time?

Art Berman (01:28:42):

No absolutely, and not from the perspective of, oh, renewables are no good and we need to... No, it's not that at all. I think that renewables, nuclear, all these things are... Certainly, they are part of the energy landscape and they will be an increasing part going forward, but I really would like a platform to explain why a lot of the popular conceptions about what they can do are going to be hugely disappointing. We cannot run this civilization on renewable energy, and I think that's important to understand. Because we either then have to say, well, we're going to have to continue with fossil fuels, or we're going to have to change the kind of civilization that we live in, one or the other. Maybe there's a third option I'm not considering.

Nate Hagens (01:29:41):

Yep. I look forward to that conversation. That will be after your trip and after my taking January off from recording. So February, March, we will have you back and continue to be energy pitbull curious analysts, trying to figure this all out. Thank you for your analysis and wisdom and insights, Art Berman.

Art Berman (01:30:05):

And thank you for the opportunity to have this discussion, Nate Hagens.

Nate Hagens (01:30:11):

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