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[00:00:00] **Nate Hagens:** In the last video, we explored what oil is and how it is effectively acting as an invisible fossil pixie dust through many of our lives. But here's the parallel associated risk We've built everything, our institutions, our governments, our stories, our expectations about the future on this cheap energy input.

[00:00:21] And now its scale and affordability is no longer guaranteed.

[00:00:37] When energy prices spike, entire systems can become fragile and often break because oil has been so cheap, pretty consistently. The economic logic has been to imagine and then engineer thousands of mechanical processes around that cheapness. The industrial evolution is really the story of adding hundreds or thousands of units of fossil energy to tasks that humans used to do by hand.

[00:01:09] A dairy farmer milking cows by hand was limited to a few dozen animals. Modern industrial dairy applies enormous quantities of diesel, electricity, refrigeration, and transport to the same basic task producing. Orders of magnitude, more milk at a much lower price and higher profits, but importantly at a very different cost sensitivity.

[00:01:35] The energy payoff of processes like this is terrible in pure physics and efficiency terms because lots of energy is wasted. However, the financial payoff has been enormous because the primary input to the process is energy. That effectively costs almost nothing. This is why energy price spikes hit so hard in the global economy.

[00:01:58] Our processes around the world were designed around cheap energy, especially oil. Even at $500 a barrel oil would still be a remarkable gift for the work it performs for us. But our current industrial system could not function at anything close to those prices because every margin, every business model, every supply chain was calibrated.

[00:02:23] To cheap, stable energy inputs. The margins were always thin and with cheap energy turns expensive, the margin disappears and often turns negative and nowhere would this be more consequential than in the thing we all do three times a day. Eat. To some of you, this might sound like an exaggeration, but when we sit down for a meal, what most of us are really eating is processed fossil fuels.

[00:02:51] Contrary to all of human history, our food system now runs in energy deficit and a huge one. At that, roughly 10 calories of fossil hydrocarbons go into every one calorie of food on your plate. The tractors run on diesel. The fertilizer comes from natural gas. The pesticides come from petrochemicals and the food is packaged and shipped on trucks and container ships and kept cold the entire way.

[00:03:19] And here's the truly staggering part. Roughly half the nitrogen in your body today carries a chemical signature from the Haber Bosch Industrial Process, which makes synthetic fertilizer from natural gas. That single industrial process is what allows Earth to feed roughly 4 billion of our 8 billion humans.

[00:03:41] And beyond food, our clean water pumping, treating, desalinating, and distributing also all requires fossil fuel inputs. So when people say oil and gas most think of our cars, we should also be thinking of groceries and dinner. But even food is only one part of the story. Oil is woven into virtually everything we touch.

[00:04:06] Only about 40% of a barrel of oil becomes gasoline. The rest is diesel, jet fuel, heating oil, bunker fuel, asphalt, and feed stock for roughly 6,000. Other products like medicines and plastics. And surgical devices, synthetic clothing and electronics, and contact lenses and tents and kayaks, and the interior of our cars, and the list goes on.

[00:04:35] The assumption that electric cars would eliminate our need for oil misses the overwhelming majority of what non gasoline oil actually does. And these products are woven into global supply chains now of extraordinary complexity. Tiny invisible components. Each with its own petrochemical ancestry, each manufactured somewhere, shipped somewhere else, assembled somewhere else, and only then is it shipped to the stores and to us.

[00:05:05] When people talk about supply chain disruptions, what they usually mean at the root is energy and material disruptions, which brings us to why a geography is destiny. The United States sits on ancient ocean beds once filled with water and life millions of years ago, ultimately resulting in immense reservoirs of oil and gas, which is a primary reason why the USA has produced and consumed more oil than any country in history.

[00:05:37] But remaining conventional reserves are mostly concentrated elsewhere. Around 60% of the world's remaining conventional oil sits inside a 600 mile triangle in southwest Asia, AKA, the Middle East, much of it around 20% of global supply, which is around 40% of what's actually available for purchase internationally, passes through as we're becoming aware the narrow strait of Horus.

[00:06:04] Which has become the center of the world's attention for the last few weeks, and as we're quickly realizing there are no alternative routes at anything close to that capacity, and now we're seeing a war for its control. A side note

here, people like to blame Exxon and Shell and the like for both oil price spikes and climate change and what have you.

[00:06:28] The reality is only around 12% of global oil reserves belong to publicly traded oil companies. The other 88% belong to. National oil companies, Saudi Aramco, Rosneft, the national companies of Iran, and Iraq, and China and Venezuela. So swapping out Exxon's executive for Greenpeace leadership would change almost nothing about global oil production.

[00:06:53] Oil is a story of nations and geology, not corporations. So the oil is concentrated in a few places, many of which are the center nodes of global conflict today. But there's a deeper problem. Earth's crude oil isn't running out well, technically it's always been running out, but today's availability and low priced oil is running out faster than most people and our financial system realizes most people are unaware that depletion the rate at which we're drawing down and drying up oil fields and wells.

[00:07:29] Accelerating, especially in the United States, conventional oil globally has been on a production plateau for about 15 years. Exxon itself shows existing global production will decline to 10 to 20% of its current level with no new drilling or tertiary extraction. The growth in global oil of the last decade or so mostly is from US Shale, but shale is fundamentally different beast.

[00:07:58] We widened the straw with fracking technology, so it looks like plenty is flowing, but we have to drill more. We have to drill deeper and faster just to keep production flat, and then that brings us so much closer to the eventual slurping sound. From the straw because shale oil is found in the source rock, which is where all the other oil migrated from, and after that, there's nothing left.

[00:08:27] Okay. Some of you might be thinking that I've been ignoring other forms of energy throughout this brief analysis, hydro and nuclear, and especially

solar and wind, but there's a reason substitutes can't simply step in. Energy quality matters almost as much. Energy quantity oil is liquid at room temperature, energy dense, portable, and storable.

[00:08:50] And these qualities are what made modern civilization possible. Replacing it isn't a matter of just matching kilowatt hours from another source. Our entire mining, shipping, rail, trucking, and personal transport system runs on. Oil. And despite the headlines about solar and electric vehicles, that is likely not going to change.

[00:09:13] But here's a key distinction. Energy is the total amount of work available. Power is the rate at which you get that energy per unit time. Biological creatures on earth do not optimize for energy. We optimize for power organisms and economies that get more energy sooner. Outcompete, those that don't, oil and its products, gasoline and diesel and heating oil and jet fuel contain unbelievable.

[00:09:44] Power wind burned. They give us ginormous work fast, and importantly, whenever and wherever we want it. Wind and solar deliver energy intermittently when the sun shines and the wind blows. Sometimes giving enormous power burst, but sometimes giving us nothing. Especially depending on your location. Nuclear power can give us a constant stream of high power, but it's difficult to ramp up and down and requires connection to a larger grid and is capital intensive and costly.

[00:10:19] Alternative energy sources will play a role in the human energy portfolio, but our current system was built around the qualities. Price of oil. These time, land and material dimensions are almost never discussed, but they're some of the main reasons. Direct substitution is so much harder than people assume, and why There are now warships in the Persian Gulf.

[00:10:46] So if oil is this hard to replace, what is this energy transition? We keep hearing about solar panels and wind turbines do not reproduce themselves. The sun and the wind are renewable, but the technology we use to harness them is best labeled Rebuildable, not renew. Because they require massive inputs of material and energy and complexity to build, and they need to be rebuilt every 20 or 30 years.

[00:11:14] Most alternative energy tech only produces electricity, which is very important, but represents only a fraction. Currently, around 20% of what fossil hydrocarbons do in the world. Diesel for shipping, jet fuel, for aviation, petrochemical, feedstocks. None of these have clean substitutes at scale. But beyond these limits, there is a deeper pattern.

[00:11:40] The current popular stories of an energy transition are really built upon a myth, a false narrative about the history of humans and energy. The reality is we have never in human history fully transitioned off an energy source. We always add, there's a name for this pattern. It's based on Jevons paradox.

[00:12:00] When we find a more efficient way to use a resource, we don't use less of it. We use more coal efficient steam engines didn't reduce coal consumption. They made coal available for more things, so demand exploded. The same pattern is played out with almost every energy efficiency gain since LED light bulbs use less electricity per bulbs, so we put them everywhere.

[00:12:25] Fuel efficient engines made driving cheaper, so we drove more and built suburbs further out. Paradoxically in the same way that you will spend most of your pay raise. Energy efficiency doesn't shrink our demand. It expands the bounds of what we can extract. It actually feeds our demand. This is why technological efficiency alone cannot solve an energy and resource problem.

[00:12:50] So the deeper question is about what happens when there might be less energy overall. And here's where we are. Cheap energy builds complex systems. Complex systems depend on cheap energy. When energy gets tight. Complexity unravels current alternatives cannot replace what cheap oil does at the scale and speed our current system requires.

[00:13:18] In the final video of this trilogy, I'll explain what all this means for money, for civilization, and for what comes next for us as individuals and societies living through the down slope of. The carbon pulse.