Nate Hagens (00:00:02):

You are 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):

Hello, today's conversation is with my friend and colleague Daniel Schmachtenberger. Daniel and I met a couple years ago. Turns out he's working on what he refers to as the metacrisis, how climate and geopolitics and artificial intelligence and everything fit together into this collective of risks. I had never heard of him and he had never heard of me or my work or my network looking at energy, money, growth, ecology. And we talked on the phone and the first time I talked to him, I'll never forget it, we talked for three hours.

(00:01:12):

And at one time in the conversation I got goosebumps on my left arm because he connected ideas that were in my head that I had never connected. And those of you that know Daniel and listen to his podcast know that he often does someone's thinking for them. He's that sort of an intellect. Daniel's current main focus is on the risks that social media and artificial intelligence pose as this exponentially growing function that's hijacking our minds as individuals, and at a cultural level is impeding or even negating our collective ability to orient and adapt to our current challenges. Daniel and I always talk for hours. I wish I would've recorded our previous long phone conversations, but we decided to start recording with this one. Our intent was to lay the foundation of what I refer to as the energy blindness of our culture and how many people miss the relationship between technology, energy, money, and growth, and what that means for our future constraints.

(00:02:25):

What we intended on doing is merging my story on the macro superorganism that we self-organize towards profits. The profits are tethered to energy, which are tethered to carbon, and there's a growth imperative in there. And merge that with his story of an AI induced profit seeking, call it micro-organism, capturing our attention into a grand synthesis of the human predicament and how we can steer society in the future towards bending instead of breaking in the coming decade. In an unexpected way, Daniel ended up interviewing me in this podcast, so it was a bit weird. But I hope you find it helpful and interesting background to the part two in the series in the near future, which is going to be taking a deeper dive of how these things fit together. And part three will be the bend versus break, how we should think about this, what we should do as individuals and as a culture. I hope you enjoy the conversation. Daniel, good to see you my friend.

Daniel Schmachtenberger (00:03:41):

Good to see you, my friend. Happy to be in this discussion with you today.

Nate Hagens (00:03:44):

We scheduled this three weeks ago and I've had three weeks to think about creative ways to shape my beard to compete with yours. And I decided I'm just going to settle for some beard compersion and be in awe of your beard. And compersion is a word that you taught me, which is instead of being jealous, you can be happy for other people's magnificence, wellbeing, et cetera. So, welcome.

Daniel Schmachtenberger (00:04:10):

I shaved off my giant COVID beard before we did our podcast, so.

Nate Hagens (00:04:14):

Is that right? Okay. Okay. So Daniel, you and I have known each other on two years now. I found you because many of my friends were sending links to your talks saying you guys have to join forces and have a conversation. We've now spent a couple weeks in person working on various projects, dealing with technology, social media, risks to governance and sense-making, et cetera. And I just feel a deep bond with the fact that you were living your life in a similar way to I am, not knowing all the answers, but striving for some pro-social, cultural transition and educating and inspiring people. So, I'm very happy that you're on the program.

Daniel Schmachtenberger (00:05:08):

Yeah, I was really happy that you were starting this podcast and I'm excited about the things we get to talk about today.

Nate Hagens (00:05:16):

So real briefly, so for people in my network that don't know about you, could you briefly describe your work, a little bit of Consilience Project and what you're trying to do?

Daniel Schmachtenberger (00:05:26):

Yeah, roughly I have been, as a kid, was interested in environmental topics, social justice topics, animal rights topics, all different kinds of activism and also then had a deep interest in kind of system science and looking at how all of those problems had certain interconnections where you could solve one problem but display some of the problems somewhere else, or had common drivers like perverse economic incentive and collective action issues. And started forecasting and seeing that many of those problems were reaching critical tipping points of global catastrophic risk. And that just kind of got me thinking about how do we make a mature civilization that can be a safe steward of exponential tech, the power that exponential tech gives, and what is a civilization that makes it through its technological adolescence look like? And so that looked like catastrophic risk and existential risk kind of assessment, and rethinking our social systems, governance, economics, law, rethinking our kind of cultural and value systems, educational process, and obviously also rethinking our technological systems.

(00:06:42):

How do we make a techno-sphere and a social sphere that are in harmony with the biosphere long term? And so what we're focused on with Consilience project right now towards those kind of big picture goals is how to frame up the actual state of the world, the metacrisis, that so many different environmental issues and exponential tech mediated X risk issues and economic and supply chain issues are all part of. That there's a profound interconnection of these things, there's some core underlying stuff that has to get addressed. How do we frame up the metacrisis well enough and what the design criteria of its solution, not one solution? There'll be lots of different things that have to happen, but what the right design criteria are that a lot more of the world can start innovating in a well-informed direction. And that's through papers, through kind of strategic education of people in specific institutions and verticals and discussions like this.

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And obviously this is how we got connected from my side was, a friend connecting us because of you having a big picture story on what the kind of metacrisis and overview of the state of the world is, what some specific near term catastrophic risks that are pretty fundamental are that are being really under-addressed, which I'm excited to actually dive into today even though it's a subset of the whole topic, the energy blindness topic, because it really is something that you emphasize well and clearly that it is so underrepresented in the overall assessment of state of the world. So yeah, that's a bit.

Nate Hagens (00:08:24):

I was happy to discover that you and I both use the same anthropological reference to frame some of our work, the work of cultural anthropologists, Marvin Harris called cultural materialism. He frames all historical human cultures have something in common. They have a superstructure, which is the ideologies, the beliefs, the memes, the stories that the culture tells. In the middle is the structure, which is the institutions and the rules and the laws and the economic system. But underpinning it all is the infrastructure, which is the energy and the throughput and the waste streams and how the system functions. And so you and I both agree that what's coming in the coming decades is we're going to have to solve all three of those. We're going to have to move them together. And I think that's what we're going to talk about today, is a lot of people work on just one of those areas and we're going to need all synthesized, but the energy materials, growth, money, technology story, when we talk about cultural transitions that is not as fluent and as frequently dove into as social cultural change. And so I thought today you and I could kind of take our version of a deep dive into that.

Daniel Schmachtenberger (00:10:00):

Though it is a bit of a strange thing to do, this being one of the early shows in your new podcast. I like the idea of me getting to ask you some questions regarding your core frames in this area since we've dialogued a lot and I happen to know them and I think they're important. And it's always tricky when you have expertise in a topic and you host the podcast, you're holding context for other people's content. This might be a nice way to get some of the core content through so that your listeners and maybe future people coming on the show will have that as some of the context to speak into. So, I would like to talk with you specifically about the bend not break model as you propose it and energy blindness and why that is both near term and central. Though that is obviously a subset of all the things for us to talk about and hopefully we'll do more of these. Does that sound good?

Nate Hagens (00:10:54):

Yeah. Great. So I have a elevator pitch about the human predicament and how we got here and then there's a lot of components there, but maybe I'll just start with that and then you just dive in and interject and push back and ask questions. So, energy is fundamental to nature. Energy is the currency of life. In natural systems organisms and ecosystems that self-organize around energy capture have an evolutionary advantage. If you don't have surplus energy as an animal, you can't reproduce and have misses and have homeostasis and everything. So, the ratio of energy return to the energy invested as caloric pursuit in nature is a huge driver. And that also applies to human systems. And we've been a species for 300,000 years and for 290,000 of those years, we were hunter-gatherers. We worked 20 hours a week and the rest of the time rested and told stories and everything.

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And then when the climate changed around 10,000 years ago, it warmed and stabilized, in no fewer than seven places on earth did we stop our hunter-gatherer ways and start more agricultural ways. And what we were doing there is spending... We were time minimizing, we were accessing more energy surplus and we were able to store it. It wasn't just meat that would go bad after a week, it was grain which we could store and that would even out the feast or famine in coming months. And what that allowed to happen is we had excess so we could have higher population, we could trade with other areas, we could devote other people to be warriors or priests or accountants or guards or whatever. And so the agricultural revolution changed everything about humans and fast-forward to nation states and beyond, and we started to expand around the world.

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And then we happened upon a vast bounty of energy surplus that was stored underneath the earth. And since the 1800s or so, we have been drawing down this energy battery, which is the stored carbon and hydrocarbons in the form of oil, coal, and natural gas 10 million times faster than it was sequestered by the daily trickle charge of photosynthesis in the deep past of earth. And our economic system is treating this as if it were interest when it actually is our principal. These fossil hydrocarbons are unbelievably powerful relative to what humans did with muscle and animal labor before then. One barrel of oil, Daniel, and I'm sure you know this, has 5.7 million British thermal units worth of energy, which translates to 1700 kilowatt hours of work, potential. You or I digging ditches or hauling hay bales or planting potatoes generate around six tenths of a watt of power in a workday versus 1,760 kilowatt hours.

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So one barrel of oil does around five years of our work and all we have to do is pay for the cost of extraction from getting it out of the earth. So, if it costs $50 for us to get it out of the earth, we sell it to the market at $60. And our economic system treats that as if it were just the same as any other $60. An expensive haircut or some food or some ear muffs or whatever it is. And energy is needed for absolutely everything in our economies. There is no substitute for energy other than another form of energy. So basically we have now, we need energy for everything that results in a good or service in our GDP. So right now, it doesn't have to be this way in the future, but right now GDP cannot decouple from energy because it's a measure of how much stuff we burn, it's goods and services and there's energy that is required to refine, deliver, maintain, run, and dispose of every product on earth.

(00:15:46):

And we can get into that a little bit, but let me finish the thesis. So, we now are in a culture that optimizes for growth and we as individuals, as families, as small businesses, as corporations, as nation states, we are trying to maximize financial surplus, money, profits, which are tethered to energy, which are tethered to hydrocarbons. And we can't stop or slow down because the system requires growth to continue and to pay off the financial claims from the past. And so what we're doing is we're kicking the can with various rule changes, with debt, et cetera, and we have to continue to grow, but the growth is tethered to energy. And the only way that we're continuing this right now is by central banks and governments blowing up their balance sheets in order to keep goods and services flowing to large populations. So, what has happened is the market or the downward causation of a higher level system than human individuals is imposing rules on our behavior that are out of our control.

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And so we are defacto, the human species right now is functioning as an energy hungry superorganism, it's not like a hive mind, like the Borg, it's that we as individuals are individual cells of a larger entity that is compelled to grow. And you brought up the word energy blind, most people think that technology is what drives the human progress machine. And it's really the combination of technology and energy that has brought us to this point. But technology is dependent on energy. So, one day when we don't have this amount of cheap energy at scale, technology is going to play a much different role.

Daniel Schmachtenberger (00:17:54):

I think all of the really important points are touched on there. And I just want to take this time and unpack them. Kind of start from the beginning. We could say that this is a kind of thermodynamic perspective that is focused on the fact that for an evolutionary perspective to exist, the traits that are going to get selected for involve an animal moving, involve some kind of metabolic process and of course all of that is the ability to harvest energy from the environment. One of the deepest definitions of life is actually an entropy pump. Something that can take more energy from the environment and externalize its entropy. And so then you're looking at the way that human technology starting with stone tools and then agricultural tech and then industrial tech allowed us to harvest more energy from our environment than other animals to be able to do future surplus stuff and then to be able to compete with others over the future surplus and grow populations faster.

(00:18:51):

And how fundamental of a defining characteristic this thermodynamic combined with competitive or it's a thermodynamic and then evolutionary theory together where the tech ends up evolving our capacity to extract energy and use energy for more stuff, which increases our kind of ability to win at wars and economic wars and whatever else. Driving an arms race of the ability to extract, externalize, et cetera, faster. Driving ultimately fragility of the planet writ large.

Nate Hagens (00:19:26):

I don't think we've ever talked about this, but have you heard of the fourth law of thermodynamics loosely defined called the maximum power principle?

Daniel Schmachtenberger (00:19:35):

Please explain it.

Nate Hagens (00:19:37):

So, in nature, organisms and ecosystems that self-organize around capturing energy surplus, as I said earlier, have an evolutionary advantage. So, they've taken aerial views over a forest transect and the hottest place is the road where nothing's growing. The coolest place is where an old growth redwood tree is growing because it's dissipating more energy. So in nature, those ecosystems that are able to capture more energy have an advantage. And it ends up resulting in a scaling law called Kleiber's law, which is that animals' energy use scales to the three-quarter power of their size. And this works for mice all the way up to blue whales. And so the size of the organism dictates how much energy it uses. Well, lo and behold, if you aggregate all the countries in the earth, the slope of global GDP is right around the size of the GDP to the two-thirds power. It's not exactly the same, but the relationship holds even as a biological organism, the whole human economy.

Daniel Schmachtenberger (00:20:59):

So, you mentioned initially two types of surplus and extraction, both of which were hydrocarbon, the first one being grain with the advent of the plow and baskets, kind of early agriculture revolution. The second being oil and coal, hydrocarbons, that time. I think it is kind of interesting that they're both calories, they're both measures of energy. They're both hydrocarbons, they're both sun impounded by plants turned into hydrocarbons as stores of energy. And one of them is being generated every season or kind of in real time, the agricultural one. The other one is from tens or hundreds of millions of years of storage. But they're both about developing more technology. One case, the plow. The second case, like the oil drill and refinery to be able to extract stored sunlight.

Nate Hagens (00:21:52):

Yeah. I call it current sunlight, which is crops, old sunlight, which is trees. Maybe you'll chop down a hundred-year tree. And then ancient sunlight, which is tens to hundreds of millions of years ago. And you're right, you can use technology to access those pools of potential energy.

Daniel Schmachtenberger (00:22:12):

So, to go back to the agriculture revolution, going from hunter gather to an agrarian culture and the plow, you were mentioning the key thing being that grains were more storable than, say, what you could hunt and gather, meats and berries and stuff. More storable means you can make it through the famine and grow the population faster. And then if you grow the population faster, you can win a tribal warfare. And now you also have more stuff that is worth invading for another tribe. So now you have to do defense and military and all the things that go along with having that surplus. And now for the first time, the economics of needing to deal with surplus come about. So, private property ownership and inheritance and all those things. It was like it was a big deal that particular transition.

Nate Hagens (00:22:56):

That was when our species ate the apple in the Garden of Eden.

Daniel Schmachtenberger (00:23:00):

Yeah, it's interesting just if it's not clear, that was also kind of in one way the beginning of the Anthropocene.

Nate Hagens (00:23:07):

Yep.

Daniel Schmachtenberger (00:23:08):

Because before that, you want nature to be pretty much the way it is to hunt and gather from. This is the first time you want to start clear cutting an area to turn it into agriculture land for lots of grain. Because in a gatherer environment there's not enough grain to be useful. You've got to row crop it to then be able to drag a plow behind it. So you can kind of consider the beginning of the Anthropocene and the beginning of extraction of stored energy corresponding together.

Nate Hagens (00:23:32):

Yeah, no. That's right. And what also happened is that's when inequality really started to occur. We were always unequal in terms of status and respect and things like that, but we were always incredibly equal in terms of consumption because we didn't have anything, we didn't have stuff to carry around with us. Everyone's actual consumption of outside of the body calories was pretty much the same.

Nate Hagens (00:24:03):

But once we started storing surplus, that's when the hierarchies started.

Daniel Schmachtenberger (00:24:11):

Yeah, the beginning of the thing we call civilization that started scaling well beyond the Dunbar number, which equaled how to domesticate wild type humans that would've otherwise been Dunbar tribal.

Nate Hagens (00:24:24):

Right. I bring that up because there is, and we could talk about this another time, but just briefly, there's a lot of binary discussion about human nature, and I strongly believe that one of the generator functions of civilization is who we are as evolved organisms and our evolutionary psychology. We are incredibly plastic and our cultural plasticity is even greater than our individual plasticity, but to say that humans are this way, there's thousands of examples of how cultures and humans lived in the past. We just look around us and think this is how humans are and we are living an anomaly with this massive, massive amount of exosomatic energy. Before I forget to say the point, exosomatic energy is energy that we consume, but not by eating. It's outside of the body.

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So inside the body, the average American consumes like 2,500 calories. Outside the body, the average American can consumes over 200,000 kilo calories per day in the lights and the airplanes and the shopping centers and the libraries and the buses, et cetera. So we're the only species that massively uses energy outside of the body, and that is only made available by the fact that we're accessing this pool of stored hydrocarbons. So I can get back to that, but it's just we completely are blind to the fact that our current global culture uses 100 billion barrel of oil equivalents worth of coal, oil and gas. We use around 30 billion barrels of oil, and the rest is coal and natural gas, but that works out to, at five years per barrel, that means we have a global labor force of 500 billion human equivalents relative to 5 billion real human workers excluding children and old people. So we have a hundred to one armies of fossil workers standing behind us. The economic system only treats their value as the costs of extracting them from the earth. So economics textbooks have completely missed this. Economists aren't dumb. They just told the wrong story as we were going up. This moonshot of growth that we've had this last century, they have all kinds of complicated formulas that explain it. Most of the story is now capital and labor, that we apply those two factors to our economy and then this resulting riches and progress and productivity when the reality is a good deal of that can be described by this additional labor that is in the form of fossil carbon and hydrocarbons, which is energy.

Daniel Schmachtenberger (00:27:41):

So it's easy to see once we have oil that is running industrial engines and the tractor replaces the plow and the automated or the industrial mill replaces kind of human labor. We can see the labor there. But if we go back to the earliest examples of what you're calling extrasomatic or extracorporeal energy, there's the storage for human consumption, which was the grain. But then there's also the usage of it for things other than just human caloric consumption, but that are part of our life. You can see that going all the way back arguably to harvesting fire, that you could kind of see that as the beginning of starting to use energy, probably mostly in the form of wood, drive entropy to meet human needs in a way that was totally different than the rest of the animal kingdom.

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To just kind of finish out that early part of the story, before hunter-gatherer ended with kind of agrarian, or before the agrarian mark of being able to do agriculture, stored grains, there was the stone weapons and the fire going all the way back to pre-sapien, homo habilis kind of time, where the stone weapons meant that we could hunt. We increased our predatory capacity relative to the animals faster than they could evolve, increasing their capacity to evade it in a way that didn't happen for any other animal because they weren't evolving their tools. They were just evolving physically and there's a symmetry of that evolution.

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So we were able to over hunt an environment, and then rather than have our population get checked, move to the next place and over hunt that one. So even in that long hunter-gatherer time and burn stuff up for the usefulness of fire to make cold environments hospitable to us and food that wouldn't have been. So you can see we kind of started doing that with the beginning of fire and stone tools. Then we did it way more with agriculture then we did it way more with industrial and then way more again with kind of information, but they're all steps in that same story.

Nate Hagens (00:29:48):

Absolutely. Absolutely. We are an innovative, creative, curious, problem-solving, can-kicking species. But the big two movements were the agricultural access of grain and storing it. We had been couple million individuals and down to a hundred thousand individuals many times over the last several hundred thousand years. Then agriculture within a few millennium we were 200 million. Now we're sometime next year we'll cross 8 billion. But if you think about-

Daniel Schmachtenberger (00:30:25):

Now this is where the oil story becomes so big, which is where you're going to emphasize is because before oil, we were half a billion people.

Nate Hagens (00:30:34):

That's right.

Daniel Schmachtenberger (00:30:34):

Right? We went from half a billion to 8 billion in that much time because of the industrial revolution.

Nate Hagens (00:30:45):

So 10,000 years ago, animals, mammals relative to humans we're like 99% of the biomass. Now humans and our livestock, if you weigh all of us, we are 98% of the mammalian biomass on the planet. But if you look back now versus 10,000 years ago, the amount of total animal biomass on the planet today is 700% what it was 10,000 years ago. How can that be? Because we've added that enormous bolus of fossil productivity to the food supply. So the agricultural revolution was when we used technology to use the Haber-Bosch process to take natural gas and create ammonia fertilizer, which added nitrogen to the fields. 60% of the nitrogen in our bodies today has a chemical signature coming from natural gas. So we've massively boosted the food supply directly from fossil carbon and hydrocarbons.

Daniel Schmachtenberger (00:31:57):

So not only did we originally gain extra storable calories hydrocarbon-wise with grain, and then we started getting extra hydrocarbon in the form of oil, we used the oil ones to be able to increase the manufacture of grain and other agriculture products by orders of magnitude.

Nate Hagens (00:32:16):

Yes. There's a common stat out there that's actually slightly incorrect, but for most of our history, our agricultural system was a net energy producer. We would spend a certain amount of calories with our muscles and our animals and we would get more calories than that back. But now our food system is a massive energy sink. We spend 10 to 14 calories for every calorie that we produce. The misnomer is that 10 calories of fossil fuels are added to get one calorie of food. The truth is it's like two calories of fossil, but then the 10 to 14 comes from the processing, the packaging, the delivering, the cooking. So our entire food system uses 10 times the energy that it produces in full cycle. This is due to oil and natural gas. We just look at the end product and don't think about the full system that created it.

Daniel Schmachtenberger (00:33:31):

So when you're mentioning that the energy is pretty pegged to the economy, that the total GDP of the world and total energy use are pretty closely correlated, because lots of things that we make out of one material we could make out of another material.

Nate Hagens (00:33:50):

Yes.

Daniel Schmachtenberger (00:33:50):

There's a lot of different types of conductors and insulators and whatever, but they all require energy. That's pretty fundamental, and that whether we're moving that value in the economy is moving atoms around in the physical world or bits around in the virtual world. Both of those require energy. This seems to be also very fundamental to where you're going in terms of the viability of the economy, that the embedded growth obligation is in the economy, but that creates an embedded growth obligation in the extraction of energy. We're getting to diminishing returns on the earth's stored ability to keep giving that and that that's really fundamental to what the near term future portends. Can you unpack that a little bit?

Nate Hagens (00:34:29):

Yes. Lots of things to say there. So no matter how you make a cup, whether it's a coconut or gold or ceramic or glass or aluminum, you need energy, no matter what. So you can get better and you can get more efficient over time, but energy is required for any process. Well, before 1970, the relationship was almost one for one. Every time we grew our GDP, we grew our energy use at around the same percent. Then we started to get efficient in the 1970s. For instance, a lot of places were using oil in power plants and burning natural gas is much more efficient. We started to use coal in a smarter way. We started to do new inventions that would use a little bit less energy to get the same product. So in the last 50 years, there's two trends.

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There's GDP has been growing and energy use grows almost the same rate, but at around 99%. So on average we get 1% more efficient, and that matters. After 50 years, you're using 50% less energy than you were 50 years ago. But no matter what next year, if you have a factory where you make 100,000 cars and you decide to expand your business and you want to make 200,000 cars, you're going to use almost twice as much energy. So defacto, they're incredibly linked. But here's where there's a couple of misunderstandings. Some countries have decoupled their economic output from their energy use. There's something called the energy intensity of GDP, which is how much energy we need to generate a dollar of GDP. The United States, the United Kingdom are service-based economies. So we actually have gotten much more efficient generating GDP by using less energy. But the important thing from the superorganism vantage point, which is our future sustainability, our ecosphere, our climate, our oceans, is what the whole human system does. The whole human system is extremely tightly tethered, over 99% because the United States and the United Kingdom... in America, the average American consumes 57 barrels of oil worth of fossil fuels per year. But we import another 17 or so from China. We don't import the oil from China, we import the televisions and the plastic salad bowls and things like that. The energy was burned in China. We pay dollars for it and it comes here. So it's part of our consumptive footprint. But the bottom line is that globally energy and GDP are tightly linked.

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One other caveat I would say there, the last five to eight years, it seems to be globally a little bit more decoupling, and this is an artifact of this massive blowoff in the financial markets due to central banks because of the way that pension funds are treated in the GDP calculations. When and if, I would say if, or I would say when stock markets recalibrate, that relationship will tighten back up around the 99 plus percent.

Daniel Schmachtenberger (00:38:16):

Okay, so that second point equals I would just call it financial manipulation, where you can make more dollars that are not actually indexing more goods and services and that'll end up recorrecting. But insofar as the dollars are indexing goods and services, you're going to get a pretty tight correlation. I want to come back to, and it's important because sometimes people will see a financial manipulation and treat it as if they're decoupling and then change our forecasts of energy viability, and you're like, "No, not really. You're kind of missing the point here." So I think that's really important. I want to underscore it.

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But I want to come back to the nation's one for a moment, because what you're saying is, okay, so this kind of wealthy nation that doesn't do its own manufacturing and production and waste management and largely exports kind of tech services can make it seem like it has a higher GDP relative to its own domestic energy use, but it's bullshit because it's just exporting all of its really high energy intensive stuff to the manufacturing that's happening somewhere else it then imports the products of. I find this for so many things. You can take a country that has a good Gini coefficient but it's just because it exported all the cheap labor to somewhere else that it depends upon to get its stuff. So you're like, "You don't really have a good Gini coefficient. Your economic inequality that's needed to make your civilization run is still very high because you just buy your shit from cheap labor from somewhere else."

Nate Hagens (00:39:39):

Yeah. Well, this gets to your whole objective of your work is sense making and information, because on all these issues, you can draw your boundaries somewhere and come up with an answer. What humanity needs is wide-boundary thinking. We need to look at the larger boundaries because then we know what doors are shut and which ones remain open. So yeah, we need to look at the wider boundary.

Daniel Schmachtenberger (00:40:06):

This is why I think your superorganism perspective is really important because of course you can have what looks like a local improvement in one area, that actually is and now it's cool, we should understand that as a prototype. But oftentimes it's not really a local improvement. It's just externalizing the harm somewhere else and then measuring inside of a boundary, something that crossed the boundary. So this is where we have to say, okay, for the superorganism as a whole, the countries that have to do the agriculture and the manufacturing and the cheap labor and the whatever, now let's look at the metrics and say for a civilization that depends upon the whole thing, because the countries don't depend on themselves, they depend on six continent global supply chains and they depend on the commons of the oceans and all like that.

(00:40:46):

So we really have to look at the super organism writ large to really make any sense of it that doesn't involve externality. So if people haven't read your paper on the superorganism issue, I think it's fundamental. But I want to come back to this other thing that you were saying about increases in efficiency. That energy does get slightly more efficient. Can you explain the Jevons paradox to people for people who aren't familiar with it? Because it seems like a lot of people have hope that we're going to solve the energy issue by increases in efficiency.

Nate Hagens (00:41:22):

So William Stanley Jevons was a 19th-century economist who paradoxically predicted that the massive beneficial invention of the steam engine, which made things way more efficient than horses or what came before, paradoxically would end up having humans use a lot more energy even though it was more efficient. That's because more people could afford things, things would be done faster, they would build more of these steam engines, and that is of course what happened. Let me first sidetrack and talk about the two types of technology. So first of all, technology is deflationary because the market system and innovation and people are incentivized to make better inventions. So over time, things that are tech heavy, like flat screen TVs, will get cheaper and cheaper until the asymptotically you just can't get them any cheaper. But so tech is deflationary.

(00:42:35):

Counter to that is depletion, which is that we've accessed the best fossil hydrocarbons that are the main input to our economies, and then we have to access the next harder tranche, et cetera. Eventually, there's nothing left, but we're not there yet. So these two forces between technological deflation and resource input inflation are battling. So when we think about technology, there's really two categories of technology. The first category is ways to make our energy use, our energy capture more efficient. For example, we could develop new solar voltaic cells that are more efficient, or we could take a power plant and the amount of energy that we input, we get more electricity out of that.

(00:43:27):

The second type of technology is inventing new ways or ways that humans use energy that we used to do manually and now we have machines do it, or new ways like Facebook that we never had before and now it's a new vector for energy use. So it's that second category of technology that dominates our global technology portfolio, which ends up building more and more things that are a vector for more energy use next year. Now, Jevons paradox means that if something gets more efficient, the people will buy more of it or the savings that they have from saving money on that thing will be spent at Walmart on some things that they bought from China.

(00:44:19):

So what ends up happening is efficiency is in service of the superorganism to a large extent. So efficiency, as long as we have GDP as our cultural goal where the market system and individual and corporations and businesses optimize profits via GDP, efficiency will just feed more money into that system in a positive feedback loop and we'll use more energy in the future. Did that make sense?

Daniel Schmachtenberger (00:44:48):

Yeah. I want to go a little bit deeper here because I think people really having an intuition for this paradox is so important. The idea that there's stuff that we do that mediates our current quality of life and we can make it more efficient, it seems like that is a way to be able to have less impact on the planet. We can do shit more efficiently so we can use less stuff and still have the same quality of life, except that's never what happens, right? The Jevons paradox-

Nate Hagens (00:45:12):

That would be true if the scale was capped.

Daniel Schmachtenberger (00:45:16):

Right. So the Jevons paradox says, you were kind of mentioning from the demand side, people buy more shit at Walmart, but also from the supply side, there are certain products and services that are just not profitable to make yet, but if I drop the price of energy enough is one of the inputs, whole new market sectors open up. There's whole new businesses and industries that can now be profitable. So what you're calling the fourth law of thermodynamics, it's almost like an evolutionary theory. The idea that any niche that exists will get filled. If there is some energy to extract in a place, something will evolve to extract that energy.

(00:45:54):

We're saying now faster than biology can evolve to do it, humans will innovate to do it. We will innovate how to extract the extra energy in the place. So anytime you get an increase in efficiency, you get whole new profitability potentials that weren't there and we end up going into those. So the idea that efficiency is a way of being able to become sustainable doesn't work as long as there is either an embedded growth obligation or an incentive around net growth.

Nate Hagens (00:46:29):

Exactly. Now, there potentially could be ways around that. If you had a Jevons paradox dividend or something like that where you had an invention and you created all this efficiency gains which were monetized, but you had a rule that that bolus of new capital that came from efficiency was devoted to some process or some future outside of the superorganism, like building a local ecological watershed with renewable energy or something that was full cycle, then you could short circuit the efficiency, the rebound effect of the efficiency profits going into the global monetary energy hungry superorganism.

Daniel Schmachtenberger (00:47:21):

The thing that you're saying right now is so fucking consequential if people get it because you're saying we have to go to a post-growth economic system, that as long as the economy and dollars are coupled at all, whether it's one for one or 99% or 80%, even if there's efficiency, if they're coupled at all, an exponential growth capital system, there just aren't an exponentially more amount of hydrocarbons. We're already at the point of diminishing return on the quality of hydrocarbons. Fracking is shittier oil than the first oil was, right? It's harder to get to, it takes-

Nate Hagens (00:48:00):

After fracking, there's nothing. That's the source rock. There's nothing left after that.

Nate Hagens (00:48:03):

... there's nothing. That's the source rock. There's nothing left after that, but go on.

Daniel Schmachtenberger (00:48:05):

So we're at this place where there's this pegging between GDP and energy. We're getting a diminishing return on our energy source and there's an exponential requirement on capital, simply because of interest, right? We have to have more capital next year than we have capital this year for the nature of how we set up the financial system. So then there starts to become this larger delta of need to keep having more capital, which means need to keep having more energy, have less and less easy to access energy. So I have to technologically innovate offshore oil drilling and fracking and things. But eventually, you run out of that and then there's a great reckoning. So this is the what you call-

Nate Hagens (00:48:44):

Well, there's not yet a great reckoning because the intermediate step is you paper over that with central bank guarantees and bailouts and things like that. But yes, eventually there's a great reckoning, which I'm referring to as The Great Simplification. And yes, eventually, by definition, we will have to have a post-growth economy.

Daniel Schmachtenberger (00:49:05):

If just increased efficiency isn't the answer because of the Jevons paradox, what about just move to renewables? Why is that not good enough? We replace all the hydrocarbons with solar and wind and geothermal.

Nate Hagens (00:49:17):

That's a whole two hour podcast on its own, but let me give you some of the high points. You often use this phraseology, the difference between potential and kinetic energy. Potential energy is unbelievably powerful because it's sitting there untapped and you can move it, especially oil. Oil is akin to hemoglobin in our arteries and veins of our global system because it's liquid at room temperature and we can move oil everywhere, which is much different than wood or coal or human muscle for that matter at that scale.

Daniel Schmachtenberger (00:49:53):

Meaning oil can go through pipelines a lot faster than coal can go over railroads.

Nate Hagens (00:49:57):

Exactly. Exactly. And oil is incredibly energy dense, which is the amount of energy you get per unit volume or unit mass. Renewables are like you have to go to the grocery store and buy a bunch of ingredients to create a meal, whereas the fossil hydrocarbons, the meal is already created. So that's a little bit of the difference between kinetic and potential. The energy return is huge from the scale of the industrial infrastructure that's been built. If you think about it, we have 500 billion human worker equivalents in the form of fossil hydrocarbons and so we can't just say those are going to go away and then replace it with renewables. First of all, we need those fossil hydrocarbons to build the renewables. And renewables is not even a good term, right? Because an oak tree is renewable, if there's an acorn. One of my chickens is renewable, as long as the rooster has a fertilized egg with the hen.

(00:51:09):

But renewables require rebar, steel and complicated clean rooms to make the silicone wafers and things like that. At best they're rebuildable because every 20 years or so we need to rebuild them. What they do is they are rebuildable machines that can harness the renewable flows of the sun and the wind. But from the superorganism vantage point, we are optimizing growth and growth requires more energy, whether it's fossil hydrocarbons or renewables or some combination. So in 2019, we grew the amount of electricity demand in the world of all kinds. Just the amount of growth and electricity demand was more than all of the solar voltaic power generation capacity built since the dawn of time. So far, all the renewables are growing very rapidly, especially in the last year, but the amount of fossil fuels underpinning our society is around the same as it's been 50 years ago, which is 83%.

(00:52:26):

So we're just growing a bigger system. We switched from wood to coal and eventually oil and gas 150 years ago. Even now today, we are now using more wood for human fuel, et cetera, than we were 150 years ago. So we keep adding more energy to the system. So renewables, I am in favor of renewables, but the current stories that are being told are that we're going to continue to grow by plug and playing renewable technology for fossil fuels. That's not going to happen. So I think renewables can power a great civilization. It's just going to look very different than the one we have now.

Daniel Schmachtenberger (00:53:14):

My understanding is that there's three primary reasons that the current renewable tech path is insufficient. One is this topic of the hydrocarbon energy it takes to make the solar cell and the batteries, the return on energy investment. Calculus is not good, and I want you to get into that. The next is that the energy quality is not comparable, whether we're talking energy density or transportability. And the third is that there's stuff we do with hydrocarbons that isn't just energy that is hard to replace, in terms of chemistry and manufacturing. So when we start thinking about getting off of oil and coal, we have to think about each of those factors. If there are more, please let me know. Those seem like the primary ones.

(00:54:05):

So if we have diminishing return on hydrocarbons and we need them for manufacturing, ongoingly, then we have to get off of oil even before we run out of it for energy. If we were going to try to replace our current energy, including the exponential growth of the energy with renewables or rebuildables, we just don't have what it takes to do that yet. Since they're not easily transportable, we'd have to build them everywhere. What it takes to do that requires more hydrocarbons now to build all of that.

Nate Hagens (00:54:38):

Okay, so just like a cheetah chasing a gazelle, there's an energy payoff there. All of our current energy technologies have an energy input versus an energy output. Historically, we would get a hundred to one ratio from oil. We would invest one barrel of oil to find a hundred, sort of thing. That went down to-

Daniel Schmachtenberger (00:55:03):

If it's not obvious for anyone who's not used to thinking about industrial capacity, to drill oil requires running a machine that runs on oil. So you've got to use some oil to get the oil. And now what we're talking about is using some oil to make the solar cells, which means mining the material and manufacturing and building the batteries and all that stuff.

Nate Hagens (00:55:22):

Right. And there is no way right now of using purely electricity to go deep into mines. It's diesel fuel and machines. So yeah, there's so much to unpack here, Daniel. So first of all, the energy return on renewables is viable there. It is a decent energy return. Let's take some of the recent optimistic reports that say that solar and wind are 12 to one return, and let's take the depleting coal is an eight to one return. So there's a lot of-

Daniel Schmachtenberger (00:56:01):

And explain the difference of what those numbers mean.

Nate Hagens (00:56:04):

Well, that means that if you take the life of a solar panel and you use lifecycle analysis that people say, and this gets back to that boundary question, where do you draw the boundaries? This is what I wrote my PhD thesis on back in the day, but that you will generate 10 times more energy during the lifetime of a solar photovoltaic layout than the energy that went into it. So that's a pretty good deal. Not as good as oil, but pretty good. Now coal is bulky and dirty, but you just throw it in a power plant and you burn it and it generates electricity. So the story that is the optimistic renewable story is that on the surface, renewables have a higher EROI, energy return, than, for example, coal. But what they're not taking into account is the full system cost of the energy because the wind doesn't always blow as is evidenced the last six months in Germany, which is one of the reasons that electricity prices are so high because their wind, basically, didn't blow for a month.

(00:57:29):

So if you handicap for intermittence and variability, the full system EROI or energy return on those renewable systems, is down to four to one. Our economic system couldn't function at a four to one return. Now this is a really deep conversation, but we could overbuild wind and solar and use the extra when it's really windy or really sunny. We generate way too much that we don't need and we put that into electrolysis and create ammonia or use that for other economic products, so we could boost it back up to five to one or maybe six to one. But full system cost, fossil fuels are completed meals and we can't replace that with renewables.

Daniel Schmachtenberger (00:58:24):

Just to make sure that's clear for everyone. One way of thinking about that is that because of the intermittence, you don't have that with oil or coal because you have the oil stored on site and you can just burn more of it or the coal stored on site. You can burn more as demand goes up in real time. So it is a storage mechanism. It's its own battery. It's already stored energy.

Nate Hagens (00:58:44):

Well, it gets back to the-

Daniel Schmachtenberger (00:58:46):

And a photovoltaic cell has to also have the batteries.

Nate Hagens (00:58:47):

Exactly.

Daniel Schmachtenberger (00:58:48):

And so now we're looking at the cost of the photovoltaic cell, the batteries and that whole storage creation and distribution system.

Nate Hagens (00:58:55):

So natural gas is the perfect fuel for power plants because no matter what happens, you just flick a switch and you burn it, whether it's windy or sunny or in the middle of the night or the middle of the day, whereas these other fuels have bells and whistles that are required. If you want to make sure that the grid is on, natural gas is the perfect fuel for that. Of course there are emissions that come from it, and that's one of the other stories embedded here. But let me tell you another big problem with renewables is that around 20% of our energy used globally is electricity and the vast majority of renewable technology is used to generate electricity. There are tons of ways that humans use energy that can't easily be replaced by renewables generating electricity.

(00:59:56):

For example, the big bunker fuel ships that carry things around the ocean, liquid fuels, heating, things like that, some of those things can be replaced but at a cost. And remember, the whole dynamic underpinning industrialization was this giant trade that we did, kind of a Faustian bargain in retrospect, where we replaced things that humans used to do by adding thousands of units of energy more than the humans did. Because it was nearly free, that was horribly energy inefficient because we used tons more energy, but it was incredibly economically efficient. So when we started that trade 200 years ago by adding huge amounts of energy to processes that humans used to do manually, that raised our wages, it raised our profits, it reduced the price of stuff and it ended up growing with more people. So from the year 1500 to now, if you take the number of people and multiply that by the average goods and services per person, the human economy is a thousand times bigger than it was 500 years ago because of this adding energy to technology to grow the system.

(01:01:24):

Now you of all people, probably you, the only people that would say this, it is true back in the day there were things that we enjoyed in our lives a few hundred years ago that weren't counted by goods and services in the economic system. So is it really a thousand times bigger? Yeah, there could be some wiggle room there that we bartered and things like that that were not included in the economic system. But by and large, it's three orders of magnitude, the scale difference.

Daniel Schmachtenberger (01:01:56):

So you were starting to mention that there are emissions associated with the natural gas that would otherwise be perfect, if there was an unlimited amount of it. So probably the central environmental story of the world today is climate change and climate change from anthropogenic greenhouse gases, which is not only CO2, it's methane and some other things, but mostly it's a CO2 story. So that's the other side of the energy story that you're talking about is the CO2 comes from burning those hydrocarbons. So the excessive CO2 equals changes in planetary biosphere, so everybody's very focused on the need to reduce carbon consumption because of not wanting all the CO_2. You're talking about this whole other side, which is we're actually running out of the hydrocarbon stores.

(01:02:51):

Also, of course, there's massive environmental impact on the front side of the materials economy, whether we're talking about mountaintop removal mining to get the coal, or we're talking about oil spills associated with getting the oil, or we're talking about wars over oil in a whole geopolitically tent system based over where the oil distribution is. That hydrocarbon system has environmental harm on the extraction plus environmental harm on the waste that's associated. But neither of those are factored into the cost of the oil, which is your point, that when we're paying for the barrel of oil, we're paying whatever it costs some oil company. What does it cost them to get it out of the ground plus whatever margin they put on top of it, which does not include what it would take to make more hydrocarbons or to deal with the environmental impact or certainly to deal with the wars and geopolitical destabilization as a result of the location of it. So this topic of why the cost of extraction is core to what's wrong with economic theory, can you unpack that a little bit more?

Nate Hagens (01:03:58):

Yeah. So we have underpaid for the main resource input to our economies for over a century, and we've not paid for the cost of the pollution at all. So the prices of everything are wrong, but they're not wrong from a sense of maximum power that we're trying to get the evolutionary emotional states of our ancestors in the cheapest way possible to the most amount of people. That's what our economic system is doing right now. The problem is, and you know this very well, is a lot of our, you call it our attention seconds or how we get dopamine in these other things is mostly by frivolous means that don't give us long-term meaning or whatever. So we're defacto turning billions of barrels of ancient sunlight into microliters of dopamine and calling that an economic success. But there's basically two broad categories of environmental impact. One is, as you point out, the metabolism downstream of human energy use.

(01:05:12):

My friend, Tim Garrett, has a chart showing GDP since the 1940s and CO_2 in Mauna Loa, and they're one for one tracked. So you can look at the CO_2 in the atmosphere and without knowing anything about the size of our economy, you can interpolate the size of our economy from that. So we are functioning as a heat engine and the oceans and the atmosphere are absorbing this excess CO2. The other big environmental category is what we do with the energy, and that would be mountaintop removal or killing elephants for ivory or overfishing the oceans or those two things. Neither of those categories do we pay for in the prices of things. Part of that is a metabolic equation and part of it is a value equation of what humans care about and what we want to include. But our prices do not include the negative externalities.

(01:06:17):

If you were to include, Daniel, the negative externalities full, wide boundary of our energy use, there would not be a single industry on the planet earth that would be profitable. For instance, there was a paper written that shows the full cost of coal if you include climate and other things. It was like 18 to 20 cents a kilowatt hour when we actually only pay four cents. So if you were to include all the negative externalities in our prices, our economic system would be much smaller. I think one way out of this, I personally have decided we are not going to voluntarily degrow. It will never happen. There's too much momentum in the system. There's too much inertia, political, geopolitical...I mean, look at what's happened with COVID and the pandemic. We have to print money and bail people out to keep the economy going.

(01:07:26):

We're not going to voluntarily shrink, but I think we will eventually shrink when we run out of the ability to paper over these biophysical phenomenon with debt and central bank guarantees and too-big-to-fail and artificially low interest rates and things like that. So this gets to your original premise. I think we have to anticipate what might happen and try to have our system bend and not break because break gets into many of the categories of the X risk that you are so fluent in. Bend means it gives humans another pathway forward towards a saner, longer-lasting, more meaningful culture. One of the ways we could do that is get the prices right on the main input to our economies. If we were able to, not only carbon, but all non-renewable inputs have a tax on anything that's on human timescales, so that would be natural gas or copper or fossil water aquifers or sand or anything like that.

(01:08:43):

And then simultaneously, remove tax on humans. 95% of our taxes right now are on human labor. So if we removed all those, you make $50,000 a year, you keep your 50,000. You don't have to pay any taxes. But if you bought an iPhone, which has all kinds of complicated, expensive machinery, metals, and minerals in there, it might cost $2,000 or $3,000 relative to $500 today. So if we had the prices right, we would be better able to innovate in a way that is aligned with our future. And we would probably conserve. We wouldn't just fly to The Bahamas on a junket or Vegas or just buy shit from Amazon every day to give us a little bit more dopamine. So I do think changing the prices is one avenue, but there's one area that I think we skipped over that I think is important is the material side. So I talked about the linkage between energy and growth. There's also a linkage between material or atoms and growth.

(01:09:55):

So for the last 50 years, that relationship has almost been entirely one for one. So every dollar of GDP requires about two pounds of non-renewable materials. An American baby born today will be expected to use 3.1 million pounds of non-renewable materials in his or her lifetime, extrapolating the past forward. So this energy, it's not just energy, it's energy combined with materials to develop technology. So even if we had abundant energy, there would be material limits on earth with many of the... Especially look at what's going on right now with lithium and some of the inputs to electric cars. And by the way, I will tell our listeners right now that because of your busy schedule, it is 9:05 PM right now when we're recording this, so I might be getting a little slap happy with my comments. But here's another problem with renewals, Daniel.

(01:11:06):

Every barrel of oil and natural gas is not just used for gasoline. Gasoline is only 40% of a barrel of oil. The rest of it is heating oil and diesel and fractions that get converted into naphtha and asphalt and tar and 6,000 other products like aspirin and football helmets and plastics and fertilizers and condoms and tents. It's unbelievable how many products are made from these fossil hydrocarbons. So if we were just conceptually able to replace all the internal combustion cars on the planet with electric cars, in order to save climate change, it wouldn't reduce our demand for oil at all. It would reduce our demand for gasoline, but we would still have-

Nate Hagens (01:12:03):

... Would reduce our demand for gasoline, but we would still have all the other products, the 60% of the barrel of oil, that we would have an economic system and requirement for. So, what would we do with the gasoline then, flare it or dump it in a river? Yes, we could at some cost change the refineries to use some of that and divert it towards those other products, but not all of it. So, that's also something that gets glossed over in this massive shift towards electric cars.

Daniel Schmachtenberger (01:12:34):

So, you mentioned mining a couple times and getting electricity down to do the mining is pretty difficult, so that that's done in stored forms of energy like diesel and whatever, and that you were mentioning that there's a correlation of energy and dollars, but also a correlation of material and dollars. From the point of view of waste, I think when most people who haven't studied the topic well think about waste, they think about what they put in trash at their house, the municipal solid waste, and they don't think about the total waste coming out of industry and just even mining, just the toxic tailings coming out of the fact that the nice metals in all the things that we use were a part of a rock and ore where most of that was useless, but actually pretty toxic.

(01:13:20):

By the time you smelt it, you get tens or hundreds of parts of useless toxic mining tailings for each part of the thing that is useful and those just go in these massive, not landfills, but dumps that then every once in a while break and go into rivers and oceans and mess things up at scale. When people start to understand the waste management issue at large of which CO2 going into the air and ocean is one tiny little thing, which is all of climate change and is literally a tiny little thing and microplastics going into the ocean is a tiny little thing. When people start to think about that our materials economy is depleting unrenewably from the earth on one side and turning it into waste on the other side and that all the planetary boundaries are the result of that, and the whole thing is using energy unrenewably.

(01:14:03):

So we're using atoms unrenewably, moving them by energy unrenewably. We have to move to a closed loop economic system where the new stuff is made out of the old stuff. We don't require an exponential amount more stuff and all of it is on renewable or rebuildable energy. The transition from here to there is fundamental and it requires a totally new economic system because it can't be based on the same type of embedded growth obligation and there's the huge question of what does that new system look like? And then also, how do we get there from here with the embedded growth obligations and the competitions in the system? Because if we try to create a tax nationally and some other country doesn't, they benefit relative to us in terms of their extraction capability, which will end up meaning geopolitical and military capability, which means everyone says "Fuck it," and it's just a race to the bottom.

(01:14:54):

First, I just wanted to say because you're a teacher, you probably have already done this, almost nobody has a sense of the computer that I'm talking on right now, what it took from a supply chain perspective to make this fucking thing. I think every high school should have a class that is, what does it take to make one of these cell phones? From the oil to make the plastics to the materials refinement and the lithography to make the chips-

Nate Hagens (01:15:19):

No single human being knows how to make it. It's a collection of processes and components. Could you imagine 1,000 years ago you just showing up with one of these things. They would've thought it was magic, absolutely.

Daniel Schmachtenberger (01:15:35):

Even Taiwan has come to the center of public news recently and TSMC because of the South China Sea's issue, but the fact that we are so dependent on Taiwan because making computer chips is so goddamn hard that the US has not been able to do it, to able to reduce its dependence on Taiwan. You get a sense of the manufacturing that we take for granted is mind-bogglingly complex and it really is like six continents worth of supply chains to make anything.

Nate Hagens (01:16:08):

And that's why I am an advocate for continuing open-ended globalization for luxury things and things like that, but for very key ingredients and key things like food and shoes and pharmaceutical inputs, how long can we have these six continent supply chains? Can we have more regional local supply chains for some things? The market is giving us the signal because of the financial response to the pandemic that globalization and profits and everything will continue forward, but I do think that's a big risk.

(01:16:52):

Getting back to your point, your question, I have a couple of asterisks there. First of all, right now, yes, on the global level, we recycle around 9% of the material input and that's actually gotten worse rather than better. And ultimately yes, we have to have a closed or more closed loop system, but how could that evolve? Because I think a system away from economic growth and like you say, there's no way that in a system right now that requires debt and central bank support and rule changes and deficit spending by governments, they're not going to add a big tax on non-renewable inputs right now because that would hurt the system.

(01:17:44):

So I think we have to anticipate, and this is what I'm working with our colleague Dick Gephardt on the concept of advance policy, which is interventions and plans and blueprints that our society are going to need in the next decade, but that are politically or socially impossible to happen now to do the research and build constituency into them. And one of them is this untax project and we're doing research with Imperial College in London on looking how this would actually manifest and it's really complicated.

(01:18:22):

One of the long shots, but one of the trajectories and destinations we should go for is, let's pay the right prices for the long term to spur innovation in the right direction of the real futures we're facing. And we are just underpaying for all these things which said differently is we're over-consuming based on the long-term viability of this stuff, which is a one-time endowment that we're burning through 10 million times faster than it was sequestered. That is not a happy thing to say that as a culture we're going to have to consume less and we're going to have to have some sort of redistribution that accompanies that because a tax naturally would be regressive.

Daniel Schmachtenberger (01:19:09):

Everyone is familiar with what it means for the government to subsidize a corporation that's not profitable because it's critical. What you're basically saying is the market as a whole is being subsidized by nature on a savings account that's about to run out and the entire market for the most part is mostly not profitable in a way that would be sustainable because of the total amount of costs that are being externalized, and as soon as we run out of the stored free cheap stuff and stop being able to handle the consequences of the pollution, the cost of everything goes up so much that it forces a restructure of the market and what we think is profitable and possible by multiple orders of magnitude what it currently is, and that's the break scenario.

Nate Hagens (01:19:54):

Well, the break scenario is that... The bend scenario is that we have a smaller economy and we change our cultural objectives away from GDP towards wellbeing and social capital and community and other things rather than gadgets, the break scenario is that this all happens without planning, without blueprints and airbags and the global supply chains and/or the geopolitical kinetic warfare is the response to these sorts of crises.

Daniel Schmachtenberger (01:20:25):

Well, it seems like bend is us try to proactively avoid the break of fundamentally not being able to have energy keep up with dollars and if energy can't keep up with dollars and we keep making fake dollars, at a certain point the dollars will start to inflate so much and lose buying power that faith in them will be lost, and whether it's speculation against them or a run on the banks or a downgrade of the bonds, when you start losing the dollar's purchasing power, then that can break a bunch of different ways. It can look like shutdown of supply chains, it can look like wars over resources, but the they're all pretty ugly.

Nate Hagens (01:21:03):

So, we are growing our monetary claims like this and the underlying energy and materials that we're going to need to turn those claims into real wealth is going like this. So, the delta between those two is widening by the year and the game is the plan. The way to keep the system going, we're kicking the can and we're not planning for five or 10 years from now when that recouples.

Daniel Schmachtenberger (01:21:31):

So, how do you see being able to realistically do a proactive bend model, factoring what it would take to come to global agreement between the major players to do so because there is a disadvantage in the near term of anyone who bends relative to anyone who doesn't, and so unless you can get all of the major players to do it, nobody's going to do it?

Nate Hagens (01:22:00):

This is why I'm talking to you, Daniel, and others. This is a really fricking serious moment for our civilization, for our nation, for our culture. I know the problems and the constraints very well. I'm not as fluent in the answers. I think the answers are a combination of top-down, that we have to have plans in place for this sort of a economic trajectory and bottom up, that people have to start waking up, realizing the time we're alive, how much energy we use, what really matters in life. If you ask a bunch of your friends what are the five best experiences of their life, it's unlikely to be huge exosomatic energy use. It's going to be something with their family or in nature or their friends, and so we have to re-tether how we measure success in our lives as individuals by more social capital and less tech heavy stuff to be pilots of what's possible.

(01:23:10):

I don't think that's going to happen culture wide, but it could happen with a good number of people that act as kind of a scout team towards a different way of humans using less energy. So I think these things, because of human behavior, that we are not good as a culture at deferring the second marshmallow. I think we will largely sleepwalk into these moments, which is why working with you and others, I want to educate and inspire individual humans to maybe simplify first and beat the rush and act as examples in their community, in their family, in their neighborhood to start living differently in a way that we're going to probably have to live regardless of what we choose in the near future.

Daniel Schmachtenberger (01:24:04):

So, as we go back to what you referenced in the very beginning of the model that a civilization can be thought of in terms of its infrastructure, its social structures and its superstructure. The superstructure being how it defines what the good life is, what is fundamentally desirable, what the ordinating values of it are, culture is a way of talking about that. You're saying right now, hey, we actually have to change and deepen culture as the basis of what we're orienting the whole society to. Obviously, you and I've talked about a number of these things and then as we're talking about the game theory between nations where none of them want to do the thing that is good long term that disadvantages them in the short term if everyone doesn't because then they lose to whoever wins in the short term.

(01:24:54):

And so, you get these just fucked up collective action problems, these kind of race to the bottom scenarios, so how do we solve those? It's so complex, mostly people find one part that makes sense, give up on the rest, hope that the market, a place of ideas will solve it, meaning that other people solve other parts, they focus on their part, but then how all the parts fit together, how the whole works, nobody's really paying attention to. And so, there are people who are just like, I'm just going to focus on making renewables better and hope that they get there in time.

(01:25:24):

And other people that are like, I'm just going to focus on turning some waste streams into new materials or I'm just going to focus on some aspect of culture. I think one of the places that you and I identified shared agreement is that there is critical stuff in our technosphere, in our infrastructure, critical stuff in our social structures, or economics, governance law and in our superstructure, our culture and our values that all need to evolve together and that they all inter-influence each other, each of those can inter-influence each other.

(01:25:52):

So it's not a solution, it's a whole ecosystem of solutions that we have to work on, but they all have to be informed by understanding the problems and the interconnection of the whole well enough that you don't advantage one part while externalizing the cost to the other areas. So I think we've got to do... And I appreciate you being available late at night your time, I think we got to do the beginning first part of this thing that is I found meaningful in your work and was valuable for me to make more central of the embedded growth obligation in finance being coupled to diminishing returns in energy that are not easily overcomeable through the current renewable technologies and process or the efficiencies in process and that being a major fucking thing that we have to deal with and that being connected to so many of the other things. I think we did a good job of starting that and maybe starting to get to what some of the transition looks like, some of the cultural parts, some of the advanced policy parts can be our next conversation.

Nate Hagens (01:26:54):

That sounds good. Let me cue up the next conversation because I know you well enough as someone who deeply understands the human predicament and you also have what I refer to as wide boundary empathy, but you're also incredibly productive, you're a good friend, you do things for people, even if it means more of your time and you just seem really balanced to me. So one question, how do you manage to hold all this existential risk and the depth of the implications of the conversation we just had in your head and still manage to defer the marshmallow and stay sane, focused, present and be a good human being to the people in your life? Because I think that whatever you do, that's a formula that a lot more people are hopefully going to be able to find. Do you have a couple minute summary of that and then we'll expand on that next call?

Daniel Schmachtenberger (01:27:56):

I read some of the books and watched so many of Krishnamurti's lectures as a kid and one of the things you would see him almost getting frustrated with when he'd be talking to the audience so many times and he's like, "Let's really take this seriously." He was looking at how do we live without conflict and what is the fundamental basis of conflict and can we overcome it, especially as we're becoming a nuclear and then exponential tech-empowered species where the conflict gets more and more consequential. And why he's asking that, how can we take this seriously, is because he knows the people are sitting there in the audience listening and then they go home and they just completely fucking forget because they've got a mortgage to pay and they got children to tend to and they got Joneses to compete with and they got whatever.

(01:28:36):

And it's like, "Wait, are we actually taking seriously the fucking topics we're talking about?" Because if we do, we have to change our life to say... It's like the Death Star is about to take the planet out and you're on the planet and you realize the Death Star is going to take the planet out and you're like, "we're we're going to build a community garden and we're going to work on the making a better after school program with the PTA." And you're like, " Wait, that's all cool stuff, but the Death Star is about to take the planet out." Join the Rebel Alliance, we've got to fucking do something about this. There's something to be able to take the scope urgency magnitude of the things seriously enough to be transformed by it. And then it's easy to just go into existential angst and either want to kill yourself or just go into hedonism as a solution because hedonism is actually a reasonable response to nihilism.

(01:29:34):

We're all going to die, so fuck it, let's have some fun, but to be like... That's just not an acceptable answer. I can die failing, trying, but I can't not be applying myself to see if there is a way through, and it does end up looking like threading a needle. That quote in the book of Romans, something about the path to heaven is steep and narrow and the path to hell is wide and many, so I was just exposed... It might have been similar for you. I was exposed to these things young enough that all the other ways of living that don't ensure that living gets to keep happening for everybody, it just seemed nonsensical. They couldn't even compute as a thing I could do.

Nate Hagens (01:30:20):

No, I feel the same way. I feel now is a time on this planet that being alive and being aware of these things, we can make a difference, and for me, the things that keep me going are conversations like this. I have six or seven people like you in my network and it's like a shot of social adrenaline when I talk to you. That's what I want to try to scale is to make people aware of how the big picture fits together. We use 100 times more energy than we need in America. In Europe, it's 50 times more. This isn't a red line disaster. We have to navigate a glide path that humanity and Earth's ecosystems make it through this, and for me is sharing this goal of an era with other humans is what allows me to cope and be fired up to work on it the next day.

Daniel Schmachtenberger (01:31:15):

I remember when I was a kid, there was this famous saying in activism, I don't remember who it's attributed to originally, that if you aren't outraged, you aren't paying attention. And it's true, if you go to a factory farm or you go to a sweat shop, or you go to an open pit mine or a landfill, fuck, you'd be pretty outraged. And then it's like, how do you do your normal stuff in face of that? And then at the same time I would read Gibran or Hafez and the artist and the poet and the mystic would say, "If you aren't overwhelmed by the beauty of life, you aren't paying attention." And it was like, how to hold both of those at the same time because it's because life is beautiful that I'm outraged that it's not being respected. But if I'm only outraged, I'm not actually connected to what is deeper than the outrage, which is the love of life that other emotion is in relationship to.

(01:32:07):

So then it's like, okay, if I'm outraged all the time, I'm actually not honoring the thing itself and yet the outrage serves a function. And so it's like, how do I hold my connection to the beauty of life to just appreciate it right now? Because we might all get taken out by a super volcano or an asteroid or a Carrington event tomorrow, so how do we just be with the beauty of it now in a way that's honoring and have that motivate us working on how to ensure the highest quality of life for all life now and into perpetuity simultaneously? That's part of the dialectic personally for me.

Nate Hagens (01:32:42):

Perhaps because I'm a little bit older than you, I think you do that better than I do. I've been outraged for over 20 years and the superorganism has gotten stronger during that time, but friends, dogs, and nature are what keep me going and let's try to change some hearts and minds. Thank you for participating in this. Definitely to be continued, my friend, and I hope to see you in California soon.

Daniel Schmachtenberger (01:33:10):

I look forward to that. I'm so glad you started this podcast. I think it's going to be fantastic and I'm glad we got to do this first talk.

Nate Hagens (01:33:16):

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