

The Great Simplification

[00:00:00] **Chris Keefer:** I love hearing well articulated arguments that are, that I absolutely disagree with. I don't know, it hasn't always been that way again, coming from even the hard left, the romantic left, the Marxist Leninist left, I wouldn't say I was ever a, again, I'm a member of the disgusted party, I've never really felt at home in any ideology, but on the extreme or hard left, as on the extreme or hard right, I think there's an idea that like, people that don't agree with us are just kind of stupid.

If they only knew, if we could just explain to them, they'd be converts. And then those that don't agree, I mean, in, sort of Stalinist Russia, they should go to the Gulag or, get lined up against the wall. There's a total intolerance on both sides of the political spectrum for free speech, for diversity of opinions.

And it cripples societies.

[00:00:46] **Nate Hagens:** I'd like to welcome my friend, Chris Keefer to the program. Chris is a Canadian ER doc, somewhere near Toronto, I believe. He's also the president of Canadians for Nuclear Energy, as well as the host of the very popular Decouple podcast, which examines how science, technology, and politics can hopefully allow us to decouple the benefits that humans receive from modern industrial societies from our ecological impacts.

This was a no holds barred, wide ranging discussion, starting with Chris's experience as a wilderness trapper, talking about nuclear energy to podcasting, to healthcare, and many other things. Chris has a podcast of his own and he and I share kind of a similar philosophy of educating and inspiring people to understand how our global system is interconnected.

And I'm also going to be on his show in the near future. Please welcome Dr. Chris Keefer.

[00:01:58] **Chris Keefer:** Dr. Chris Keefer. Welcome. Nate. It's good to finally be here. It's been wonderful corresponding with you over the, it feels like years now, but...

[00:02:09] **Nate Hagens:** It feels like it. I think it's probably one year, but, sometimes weeks happen and, or what's the word?

Decades happen within weeks.

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[00:02:19] **Chris Keefer:** You're quoting our friend, Vladimir Ilyich Lenin there. Absolutely. Yeah.

[00:02:24] **Nate Hagens:** Oh shit. I didn't know that. Inadvertent, but you are. Let's restart, restart. No, I'm sorry that we've had to reschedule so many times, but here we are, I respect your work. you host the Decouple podcast.

You are president, correct me if I'm wrong, you're the president of an organization called Canadians for Nuclear Energy. You are an emergency room physician. And offline you've kind of told me about some of your things that you've done in the past. You were a trapper. You had an intentional community. Tie this all together and bring me to the current moment.

What is your path and how did you arrive here? And contrary to most of my guests, you also are a podcast host, so I think there's a fraternal handshake here of sorts because we both deal with similar challenges in communicating to the public. So, you have the mic, my friend. Bring us up to date on the life and history of Chris Keefer.

[00:03:36] **Chris Keefer:** I will aim for brevity, but as you mentioned, there's a lot of stopping points along the way. And, it's interesting, when you apply to something like medical school, you have to kind of create this narrative arc and make sense of it all in a compelling way to claw your way into medical school.

So I've done this before, but I'll try for The Great Simplification here. I'll try to simplify it. Yeah, I mean, without being self indulgent, like going way back into my youth, awkward kid spent a lot of time in the woods sort of just to deal with not being terribly socially gifted. I think we probably share some commonalities there, just a deep love of nature.

[00:04:11] **Nate Hagens:** The woods or the not socially gifted?

[00:04:13] **Chris Keefer:** Wow, probably the woods more than anything. I won't make any deep commentaries there. Nate, don't know you well enough.

[00:04:18] **Nate Hagens:** I spent a lot of time in the woods as a young person.

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[00:04:21] **Chris Keefer:** And, I was really a neo luddite. I saw technology as kind of the root of all evil, of social stratification, really romanticized our hunter gatherer past a time of greater equality, a time in which we could basically all manufacture that toolkit that we needed.

And I took that so far.

[00:04:40] **Nate Hagens:** A time, a time of greater equality, except for the animals, maybe.

[00:04:44] **Chris Keefer:** Yeah, and a time of maternal mortality and early child mortality of at least on the child side, a good 50 percent up until, kind of the hockey stick of the industrial revolution. But we'll get into that later.

At the time, really romanticize that. I was actually not a survivalist in terms of a prepper, but I learned how to make a bow drill fire, making fire with friction. I was a survival instructor for a summer camp. But that wasn't enough, Nate. That wasn't enough.

Those canoe trips and things like that. I wanted to take it further. I was quite a romantic and a bit of a privileged kid so I could afford to start university late, or even think I wasn't going to go to university. Ended up in the Yukon Territory. I'd spent some time, my high school English teacher's uncle was a trapper in northern Ontario and I found his knowledge of the land to be just extraordinary.

There's conservation biologists that go out for a field trip, maybe a month a year and they cordon off a small piece of prairie grass and they know every species in there and that's very admirable. But seeing the way this guy understood sort of sustainably harvesting his trap line, the behavior of animals, and almost a spiritual connection to the land, that really touched something deep in me in terms of, and again, these are partially kind of romantic aspirations, but a pretty credible history we have as a species, scraping an existence and out of pretty meager resources.

Anyway, so that took me to the Yukon territory, where I decided I was going to go and meet a trapper, I'd learned how to make fire with sticks, I'd learned how to gather wild edibles, but I didn't come from a hunting family, and I figured that was part of learning how to kind of survive in the wilderness.

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So, yeah, managed to pull that off. Ran a trap line for a winter, and then ended up getting a job never having ridden a horse before as a horse wrangler and hunting guide, in a remote concession in the Yukon Territory. And, basically we did everything off of horseback. Not the hunting part, but you know, pack animals, things like that.

It was a pretty primitive life, but you know, still complimented by airplanes that would bring in supplies. And, this was an outpost of a fossil fuel civilization where you got a bit of a taste for pre modern life.

[00:07:06] **Nate Hagens:** So I'll just add an interjection there. I've been to Whitehorse and

I talk on, as you know, about the disparity between humans and our farm animals relative to wild mammals. That we outweigh them 50 to 1 in the world. Not in the Yukon. The Yukon is the opposite. Yukon is one of the few places that megafauna far outweighs humans.

[00:07:32] **Chris Keefer:** Right, right. No, I've seen and well I've killed and eaten my fair share of that megafauna, as our ancestors did.

Not to the point of extinction though, Nate, it was pretty sustainable. Yeah. Moose, caribou, mountain sheep. Anyway, I promised I would try and be brief in this, but I think that question of sort of how do you go from being a romantic neo luddite to an advocate for one of the most complex technologies that we have is probably an interesting one.

Yeah, I ended up deciding I wanted to get myself an education after a while or a non kind of mountain man education. And, yeah, I was very inspired by an amazing doctor named Paul Farmer. I've always had a sort of humanist trend, a humanitarian trend and figured I'd like to get some tangible skills to be able to serve my fellow humans as you want to call them.

And so, yeah, I got inspired and got into medical school. That definitely was an education in I guess the beauty of complexity. This healthcare system, we'll probably talk about this later, but there was a time when almost every human being was involved in energy, as you know, I mean in terms of agriculture, in terms

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of growing food, harnessing photosynthesis, something like 90 percent of us were farmers, remotely.

And now, 15, 16 percent of us are health workers. it's incredible what our wealthy societies are able to devote to human well being, often there's a bit of inefficiency there and we could talk about the US and Canadian healthcare systems. But, yeah, it was interesting and I think I started to shift my perception of technology, and really appreciate the benefits and that's obviously been strengthened by my own son surviving very premature birth and an incubator saving his life.

We talked earlier about childhood mortality sitting at 50%. I've learned not to romanticize that and have some appreciation of the modern world. After finishing my emergency medicine fellowship, I took out a big loan, bought a farm on the border of Canada's largest indigenous reservation, with the attempt of kind of setting up a bit of an embassy between progressive Canadians and indigenous people and a sort of permaculture community trying to solve some local problems with water supply, food sovereignty, healthy food, that kind of stuff.

So, most intentional communities disintegrate within about two years and we definitely fit the mold there. It was a very interesting, romantic project. Learned a lot from it. So you're, seeing me sort of go through the hunter gatherer period, the agricultural revolution, and when my son was born five years ago, I started to think a lot about climate change and get pretty worried about it.

Got very doomy, wasn't any fun at parties. My ex-wife at the time said, "Can you just stop talking about this, shut up and do something?" And she probably meant sort the recycling better, take out the compost. And I think thank God I'd gone back to even high school to get my core sciences in order to get into med school.

And I had that sort of empiric training to start looking around and say, hey, what are the solutions to climate change? And discovered I lived in nuclear powered Ontario. We're about 50, 60 percent nuclear powered. We have one of the lowest emitting electricity grids in the world, despite not being blessed with tons of hydroelectricity.

And so that really intrigued me. And I discovered this technology that's much maligned. I've sort of always fought for the underdog and my 16 year old neo Luddite self, again, might've put out a contract on the life of my 37 year old self as

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I got into this. But for whatever weird dopamine reward system I have, I've been pretty obsessively interested in this space, definitely matured in it from seeing nuclear energy as a kind of absolute sort of panacea.

Being educated by 232 guests now and being involved in advocacy within Ontario for more nuclear has taught me a lot of lessons about the kind of pace and scalability possible. But I'll wrap it up there, Nate. Hopefully that wasn't too self indulgent.

[00:11:48] **Nate Hagens:** No, no. We're gonna drill down into each of those things.

You have a picture, I recall, on your Twitter feed, you and Justin Trudeau. So you've actually brought up this to the political level in Canada, yes?

[00:12:03] **Chris Keefer:** Yeah, I've had the opportunity to speak. And this is truly bizarre. Again, I've, my previous sort of advocacy and activism was in the health space.

I founded one of Canada's first seasonal agricultural worker clinics serving Mexican and Jamaican workers. I worked at the Canadian Center for Victims of Torture. In that advocacy you develop a social network. It's interesting. But yeah, the nuclear thing has been absolutely mind blowing, as yoU.S.Aid, meeting the prime minister, leaders of the opposition, the premier of Ontario, the heads of all the big labor unions here, the CEOs and the executive suite of the big nuclear companies and supply chain companies, so it's been, and as the social capital of a podcast, it's been absolutely a wild ride.

[00:12:47] **Nate Hagens:** So I have covered the basics on nuclear just once or twice on this channel. And again, you're an ER doctor, that is your profession, but you have a podcast that's called Decouple. By the way, what's the origin of that word? And because I can think of about 20 ways of decoupling in our world.

What, was the origin of your choice of that word?

[00:13:15] **Chris Keefer:** Well, I started the podcast very shortly after my divorce, and so a lot of people assumed it was a relationship advice podcast. I am in no position to offer relationship advice, although I have a wonderful fiancée now, so maybe that rests in the future.

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A lot of people think about

[00:13:30] **Nate Hagens:** Well, we'll see if you rename it ReCouple.

[00:13:33] **Chris Keefer:** There we go. There we go. Well, I'm in that process, again, wonderful fiancé. But, yeah, no, it definitely, I was inspired by the eco modernist tendency, which again, wrestling with that question of, okay, it's fine to kind of romanticize the past, but there's a reason that the human population was stable really up until the industrial revolution.

And that's because the average woman had five to six children. And yeah. 2.2 of them had reached reproductive age. A lot of kids died, right? And so appreciating, starting to appreciate.

[00:14:08] **Nate Hagens:** Was this just in the last a thousand common era to 200 years ago, or does this go way

back?

[00:14:16] **Chris Keefer:** This goes way back.

I mean, at least according to paleo demographers, who look at Peru 400 BCE, for instance, or I think Mallorca, Spain, even further back. I'm not in a position to assess these paleo demographers' methodology, but I'd assume this is pretty solid. And again, I think it's borne out.

You can look at skeletal remains, but you can also just look at, if you have a stable population and your birth rate is pretty 5 or 6 kids, that infers that, again, only 2 of them are reaching reproductive age. Maybe 3 and then some die off in their 30s or something, but, that's dark, and so kind of coming from a romantic, lefty, progressive, maybe kind of degrowth mindset, certainly came to appreciate the nuance, and especially being in healthcare, of the wonderful world we live in which very few parents have to mourn the death of their children.

It's 0.3 percent now in modern industrialized countries. So how do we keep the gains, the good things that have come from development, from industrialization, while minimizing the ecological impact? So essentially that was the question, sort of decoupling human well being, a lot of it's, maybe a lot of the environmentalists out

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there don't want to admit maybe the basis for this, but I think the trends are quite clear, has to do with increasing energy consumption, increasing wealth.

And again, yeah, so how do you navigate that contradiction? And I think some of your work, quite frankly has put me in a little bit of crisis about the actual potentials for decoupling, that tight linkage between energy use and GDP or material use and GDP. There's not a sort of dematerialization of our economy as much as we'd like to imagine it.

But, a few technologies really stand out. Nuclear, obviously capable of decoupling at least electricity production from carbon emissions. And the environmental case being that because it is such an energy dense form of energy, that means we can use less mining.

It's less land intensive, et cetera. So the podcast has been pretty nuclear focused, but we've also looked at biotechnology, ways of producing more food on less land so you can rewild. These are some of the sort of tenets of eco modernism, which is an ideology, which I'm not completely on board with.

I think there's some interesting ideas from it. But anyway, this was the perhaps kind of romantic origins of the podcast.

[00:16:41] **Nate Hagens:** What ideology are you completely on board with?

[00:16:45] **Chris Keefer:** None. I have a friend who talks about sort of his political allegiances and he says I'm not a Democrat, I'm not a Republican, I'm a card carrying member of the disgusted party.

I don't really, I don't really find a home anywhere I think because I'm just really restless, but I do really genuinely appreciate good arguments that I disagree with. And so, nuclear has been a big part of that because again, we have a set of sort of unexamined beliefs, the kind of package deal of the politics perhaps that we grew up with, right?

So being on the progressive left, I was anti nuclear. I hadn't done my research. But that's part of the package deal. I used to kind of hold my breath when I drove past one of our nuclear plants, which is really hilarious because it was built instead of a four gigawatt coal station where I really needed to hold my breath.

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But realizing that my tribe had really gotten it wrong and needing to listen to other voices, often on the political right, which tends to have a little bit more engineering discipline, a little bit more literacy in math and the understanding of the built world. It didn't mean that I accepted all the kind of positions that come along, maybe the unexamined beliefs of the political right, but I did appreciate certain analyses that were there.

And so it's really helped me to have a much broader appreciation for the need for robust debate and a whole number of opinions. And that's obviously, we're really suffering in this social media dominated, hyperpolarized landscape to navigate the human predicament, as you call it, and partially it's because of that.

So I kind of owe that to nuclear, strangely enough.

[00:18:22] **Nate Hagens:** I want to take a deep dive in your insights on nuclear, but before we get to that, maybe you could just start by laying out, since you don't claim to be a nuclear expert but you've had 200 guests on your podcast, many of which are nuclear experts.

So you're a very qualified layperson, ER doctor, on nuclear issues. Please lay out for us the breadth of opinion on the nuclear issue, from both extremes and kind of what's in the middle and we'll go from there.

[00:19:01] **Chris Keefer:** Well, Nate, as you probably noticed, most of it is the extremes, which is a little bit frustrating.

People either love nuclear or hate nuclear, or I guess they're indifferent. And perhaps we'll just acknowledge that they're not sure, they don't know.

[00:19:17] **Nate Hagens:** So why on the extremes, let's steel man the two extremes. Why people love nuclear and why people hate nuclear.

[00:19:25] **Chris Keefer:** Sure.

Well, let's start with the hate. I think this is fundamentally a dual use technology. This is swords and plowshares. And this goes back to the beginning of time. Every technology has a sort of beneficial application, a productive application and a

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destructive application. And, the famous metaphor would be swords and plowshares.

And, the problem is that the sword of nuclear is apocalyptic. I don't know about life on earth, but certainly in terms of any kind of life that human beings would want to live. There are several men in the world that can put in some codes and essentially initiate the destruction of human civilization.

That's a potent reason to be scared shitless, frankly, about all uses of nuclear energy and sort of lump them all into one basket. And so a lot of those apocalyptic fears are in my opinion misplaced onto the peaceful uses of nuclear energy. And that's not just energy production, that's the production of medical isotopes, which absolutely enable modern healthcare.

Our candor reactors here in Canada have a quirk of being incredible mass production machines for medical isotopes. 40 percent of the world's surgical, sorry, single use medical devices are sterilized with medical isotopes we produce here. So there's a lot of positive applications, but the sort of edge case fears that people have about nuclear are really a transference of those fears about nuclear annihilation.

So that's, I think, what drives it. My dad did duck and cover drills during the Cuban Missile Crisis. I'm deeply empathetic to people that are, again, scared shitless about nuclear energy. The environmental movement really kind of latched onto it. And again, maybe just going back to the weapons thing, the fear of radiation was a vital tool in stopping say atmospheric weapons testing.

For instance, the insanity of sort of where we were heading with nuclear weapons. Like if you look at the actual data in terms of the atomic blast at Hiroshima and Nagasaki, the vast majority of the deaths and injuries were blast injuries and burns and good old fashioned explosive trauma injuries. But the radiation induced injuries were a potent motivator of kind of shock and horror around the use of these weapons.

And so there's a kind of long history of how our fear of radiation has been exaggerated. Certainly, high dose radiation is absolutely deadly, but our kind of fear about low doses I think is greatly exaggerated. And again, these physicians, primarily actually, who are really involved in getting atmospheric weapons testing

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prohibited partially by looking for a few atoms of decay products that you only get from weapons testing in the milk teeth of babies, right?

Finding some strontium 99, for instance. That was a potent motivator to have politicians say, okay, we're going to just do the test underground now, basically. But there's a temptation to try and put the nuclear genie back in the bottle and stuff it in. And I think I understand the motivations there.

That's the anti side. On the pro side.

[00:22:27] **Nate Hagens:** Hold on just a second.

What about Fukushima and the fact that they're storing all this stuff and some of it leaches into the ocean and is that too diffused to worry about? Is that overblown or do you have any comments on that?

[00:22:42] **Chris Keefer:** Fukushima is really interesting because it's kind of pretty close to the worst case scenario.

Three gigawatt scale nuclear reactors melting down essentially simultaneously. And the health impacts from that are really, I don't want to sound blasé, but they're negligible. People will hear that 20,000 people died as a result of the Fukushima accident. Those 20,000 people that died as a result of the Tohoku earthquake and the tsunami that followed it.

In terms of deaths from radiation from Fukushima, there have been none. There was a single worker who got a still fairly low dose who was compensated, a 50 year old guy who was also a smoker who got lung cancer several years after the accident. Most serious epidemiologists don't think it was caused by it, but hey, it's good that he got compensation and maybe had a more dignified end of his life because he had some extra money and his family had some money. But really, we have not seen any radiologic injury from this worst case scenario. And I think what you're probably discussing there is the Fukushima water. So a lot of water got onto the site, got contaminated with radionuclides, has been filtered.

The only significant radioisotope left is something called tritium. It's a very weakly radioactive element that ends up binding to water and creates essentially a water molecule with a heavy form of hydrogen.

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[00:24:02] **Nate Hagens:** That's the only one left? The half life of all the others has already dissipated?

[00:24:06] **Chris Keefer:** No, they've been filtered out with resins and things like that. So in terms of the water they're talking about releasing into the Pacific, they're diluting it down to, and again, this is the issue with radiation, you have to go down a huge rabbit hole to understand dose and even the way it's measured. The units involved are hugely confusing, but I like to sort of put it money values like dollars and cents, but essentially the safe drinking water limits, say, in Canada are 7,000, we'll say becquerels per liter, atomic decays per liter for tritium, they're getting it down to 1,500.

So you could drink the stuff, in terms of the way that it's being diluted to and be well, well underneath the safe drinking water limits that we have established around the world.

[00:24:51] **Nate Hagens:** So 16 year old Chris Keefer would not have drank that water, but 37 year old Dr. Chris would have?

[00:24:58] **Chris Keefer:** Well, some of the nuclear advocates have jokingly suggested we have a Fukushima drinking team.

There was a Japanese politician who did drink some of the water. He did look like he was a bit hesitant in the moment. So there was some reports on that. And again, I don't mean to be blasé about this, the Fukushima accident caused an evacuation. People died because of the evacuation.

It's not to be taken lightly, but I think in terms of people's apocalyptic fears, we have there the example of, as I said, a triple meltdown with absolutely negligible health impacts, particularly from

radiation.

[00:25:33] **Nate Hagens:** So you're at least confident in saying that drinking that filtered water from Fukushima is healthier than drinking Roundup.

[00:25:41] **Chris Keefer:** Yes sir. And alcohol. And we could come up with a whole number of sugary drinks, glucose, fructose.

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[00:25:47] **Nate Hagens:** You're an ER doctor. Do you drink alcohol?

[00:25:49] **Chris Keefer:** Occasionally. Occasionally. Yeah. Occasionally.

[00:25:53] **Nate Hagens:** I used to drink quite often. I, well, I was at a Bioneers conference last week and I had wine for four nights in a row.

But other than that, I haven't had a single thing to drink in many, many months. And I actually feel quite better. It's just, it's a culture, especially United States, especially Wisconsin, where I live. I digress. And by the way, my dad is also a doctor and he was the chief of surgery for a while and has had lots of ER stories.

I'm sure you've seen quite a lot of things being in a big city emergency room.

[00:26:30] **Chris Keefer:** I have. I won't bore you with all of the objects I've taken out of people's bums throughout my career, but.

[00:26:36] **Nate Hagens:** Oh man, I wasn't going to bring that up, but seriously, you've done that?

[00:26:40] **Chris Keefer:** It's a part of the job in the emergency medicine world.

People do weird things, Nate.

[00:26:45] **Nate Hagens:** Oh my god, yeah, I heard those stories from my dad too. So it's Canadians, too. So, okay, on to the pro nuclear.

[00:26:58] **Chris Keefer:** Right, right. So, I think people get pretty religious, they find religion. People that, again, have the unique set of cognitive biases that lead them to this advocacy camp. There's a really compelling narrative with nuclear energy.

Again, in terms of that incredible energy density, the promise of a very minuscule land footprint, environmental impact, and frankly, this wasn't as present before, the extreme situation that we find ourselves looking down the barrel of climate change. And so, we have, in the best case or in the hopes of this class of advocates, a solution to climate change, a solution to an existential problem.

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It's a fascinating technology, and there's certainly some sort of techno fetishism that goes on. But I'd say really it stands from people probably who are a little bit contrarian, and who look at the available options on the table in terms of replacing fossil fuels and are probably a little overly generous in terms of the potential of nuclear energy to shift things or replace fossil fuels.

There's certainly some fossil fuel services nuclear energy is great at replacing, stationary power generation, low grade process heat for some district heating, desalination, there's some applications that are important, but yeah, it's not a panacea, but I would say that folks on the extreme pro nuclear side are probably guilty of thinking that this is essentially energy too cheap to meter if done right.

But of course it's never really happened and that was just one statement by a guy that's been quoted far too often.

So we have the two extremes, the people who love nuclear power and don't miss a chance to advocate it as the answer to society's problems, and the people who hate nuclear power and think it's the devil in disguise because of its long term potential to destabilize and pollute the environment. And those people account for the majority of commentary that we see in social media and a lot of people including the people who are energy blind, who just look at the cost of energy at the pump or on their utility bill and that's the extent of energy's influence on our economy, rather than looking how everything the entire scaffolding is built on the complexity powered by machines that are fueled by fossil and renewable energy. So the vast majority of people are kind of, as yoU.S.Aid earlier, indifferent to nuclear because they don't know that it's needed or that it's relevant and they just haven't been educated, would yoU.S.Ay?

Well, I mean, let me give you like a case study of Ontario, right? If you live in a jurisdiction with a lot of nuclear plants, it tends to poll very well, particularly in the communities around the plants. They have the best equipped sports teams around, they got the best swimming pools, they usually kick the ass of the surrounding communities because they got better coaches, et cetera. I'm being a bit facetious but the benefits are there. And you don't have the smoke coming out of the stack, frankly poisoning people, that you do with coal plants or to a lesser degree natural gas plants. Over the lifetime of a nuclear plant the power is very cheap and really underpins a lot of economic well being.

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In the case of Ontario, so, and this is a little bit similar to France, which is another famous case study of a jurisdiction with a lot of nuclear. That the saying in France was, "We do not have gas, we do not have oil, but we have ideas." And very similar situation in Ontario.

No gas, no coal. We had water, which my great, great, great grandfather referred to as "white coal," which might tell you something, but we were dependent on importing a lot of coal from Pennsylvania and elsewhere in the U. S. across Great Lakes that sometimes froze, mined by miners that often went on strike.

It was an energy insecure situation and it was costly energy. We accidentally sort of found ourselves as a real center, probably the second greatest center of nuclear research outside of the Manhattan Project, in Canada because a lot of European scientists and the heavy water that they kind of snuck out of Europe as the Nazis chased them and tried to get it, came to Canada and we ended up developing our own indigenous power reactor design.

But basically, we tapped out our hydroelectric. We built a lot of coal stations, including the largest in North America in Anticoke. And in 1973, when the OPEC crisis hit, the price of coal doubled and we had a power reactor that was ready to go in the form of the CANDU and we just started stamping those things out.

We never built another large coal plant after that. We just built big nuclear plants. We have the largest operating nuclear plant in the world. And ultimately, in the early 2000s, we were able to completely phase out coal, which had been 25% of our electricity grid. It would have been probably 75% had we not gone nuclear, and thinking the implications of that in terms of energy security, economic well being, human well being in terms of the enormous amount of pollution that's estimated around a thousand people died prematurely per year because of our coal fleets, there's a really compelling story there.

So that might be a window into sort of, not my fanaticism, hopefully my nuanced, appreciation for this power source.

[00:32:31] [Nate Hagens](#): Other than personally liking you and us having similar hobbies or vocations with our podcast, I do really value your balanced view and you're not a fanatic. And nuclear is not a topic I know well, which is why I'm really

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glad that you're here because I'm going to ask you a bunch of questions that will be easy for you, but that I don't know the answers to.

[00:33:00] **Chris Keefer:** Sure.

[00:33:01] **Nate Hagens:** So, let's go. In no particular order, here's some questions. So to my knowledge, Ontario is 15 million people, which is the population of Michigan and Wisconsin combined. Most of the people live in and around Toronto, I would imagine. How many nuclear plants are there in the province of Ontario, give or take, do you know?

[00:33:23] **Chris Keefer:** Yeah.

So there's three nuclear stations. They're all multi unit stations. So two of these, two of these sites have eight large candor reactors and one has four large candor reactors.

[00:33:34] **Nate Hagens:** And so what about the transmission of nuclear power? Can those reactors you just mentioned get electric power all the way to the west of Ontario?

[00:33:48] **Chris Keefer:** Yeah. Yep. So we have an efficient grid, and that's another thing about nuclear is we call it a expensive way to make cheap electricity. And renewables, in contrast, a cheap way to make expensive electricity in terms of all of the supporting infrastructure, nuclear is very efficient in terms of transmission.

[00:34:05] **Nate Hagens:** Okay. So spend a few moments unpacking that statement that you just made.

[00:34:11] **Chris Keefer:** Yeah, I mean, so your listeners have probably heard of the levelized cost of electricity. It's a way to compare, really, it should be used to compare like with like in terms of this coal station versus that coal station or this natural gas station versus that.

It gets really skewed by renewables, which have sort of a zero marginal cost in terms of their operations. But the problem with renewables is that they're intermittent, and they require backup and often they're located far from

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population centers, and transmission is a major cost. I don't want to get too sort of sidetracked off these kind of nuclear fast questions.

[00:34:49] **Nate Hagens:** I have 14 of them.

[00:34:50] **Chris Keefer:** So to try and answer succinctly, and then I'm quite a tangential speaker. We, our nuclear plants, I'd say in terms of the far north of the province, we do have a biomass generating station up there. But, suffice it to say, yes, these three nuclear stations, are near population centers and do a good job.

[00:35:11] **Nate Hagens:** But getting back to the levelized costs of electricity, how would nuclear compare with solar and wind? And what was your critique of the levelized costs of electricity? That it's a narrow boundary metric that it doesn't include the actual full cost of getting the energy services to the household.

[00:35:31] **Chris Keefer:** So, there's nothing cheaper than jiggly electrons coming out of a solar farm, for instance, when it's producing, when conditions are perfect. But electricity is a service, not a commodity.

You don't go to a solar farm and bring your little bag and say I need to get 300 jiggly electrons and I'm going to put some like coins into my toaster sort of when I need them. It's a lot like healthcare, which is, again, I would argue a service, not a commodity. It's something that needs to be reliable, something that needs to be there for you 24/7, something that needs to be able to adapt to surges in demand.

The kind of narrative that I'd use or the comparison I'd use is if we were to have wind and solar doctors and nurses, kind of fair weather friends, they're a little bit prone to packing it in when the weather changes and they can do so sort of on very short notice, I would say, a solar doctor, some clouds would go over, he might just drop the scalpel and go off for a prolonged break or call it quits for the day.

[00:36:26] **Nate Hagens:** Which would be a real problem if you're operating on someone's bum.

[00:36:30] **Chris Keefer:** Right, right. So suffice it to say that requires a really costly backup network of reliable doctors and nurses. You might have to pay a premium to that have to come into the hospital to keep your reliable services going nonstop, right?

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And so LCOE, levelized cost of electricity, ignores those system costs and therefore is not a good tool to compare unlike with unlike in terms of an intermittent renewable source to a dispatchable source of energy.

[00:36:55] **Nate Hagens:** I ask you because there is the Lazard graphs that always get touted around that so many people truly believe that solar is the cheapest energy source on the planet.

And it's only a matter of time before it scales and completely replaces fossil fuels, which is so completely misleading, for many reasons. But a main one is what you just said. It's only the marginal cost of generation that they're talking about it, not the 24/7 access to the service.

[00:37:29] **Chris Keefer:** I will say in order not to sound like a fanatic here, I think there is a role for solar, probably at pretty modest penetrations in terms of carving off load, say, in terms of the, air conditioning peak in the middle of the day. Too much solar, you get into this duck curve where it cannibalizes its own value and you need a crazy ramp in the evening to keep your grid stable.

But a moderate amount can shave that and the other application a friend of mine recently convinced me of is solar as a power source for desalination because you're producing something that is very storable, which is fresh water.

[00:38:02] **Nate Hagens:** What would yoU.S.Ay, in reply, people like Mark Jacobson frequently tweet, he tweeted the other day that, in California earlier this month, wind, water, and solar together combined for 106 percent of the electricity demand over some of the days, earlier this month.

[00:38:24] **Chris Keefer:** I believe that the quote was 0.25 to 6 hours per day. So what that means is with a 100 percent wind, water, and solar system in California, they would have had Absolute, black start style blackouts every day for the last 38 days.

[00:38:40] **Nate Hagens:** Are people pro nuclear in Ontario? I would imagine they know a little bit more about it than the average American.

[00:38:46] **Chris Keefer:** Yeah, recent polling, and we're on the verge of a major nuclear expansion. We're going to increase our nuclear fleet by about 50%. And

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when polled on that, as much as you can trust polling, 70% of people are in favor of not just keeping our existing assets but expanding the nuclear fleet.

About 18% are against and 12% undecided. So it's pretty favorable.

[00:39:08] **Nate Hagens:** So you've had 200 episodes on your podcast, and I feel like I'm getting long in the tooth here and I'm at like 120. So, good on you. How many of those have been directly or indirectly related to nuclear power?

[00:39:24] **Chris Keefer:** I'm probably embarrassed to say, but I would say probably about 180, 190 of those.

[00:39:29] **Nate Hagens:** Okay. So I have questions, and unfortunately one of my skills and that of my network of systems ecologists people is I'm good at saying what won't work and less good at saying what might work or what will.

So I have some ideas that I want to ask you of things on nuclear that I am skeptical about, but let me preface that, and I don't want to spend this entire time talking about nuclear because you're kind of a renaissance man. And I do want to talk to you about the podcast and medicine, and other things.

And I think we should just agree that this is a first conversation, and that you could come back and take a deep dive on something else. But, what would you say in your considered expertise and in discussing and focusing on the issue of nuclear, what are the best three attributes of nuclear power that people should be aware of and what are the three constraints or limitations that people should be aware of?

[00:40:44] **Chris Keefer:** Okay, so top of mind, in terms of being a climate hawk, is the low life cycle emissions. Actually the lowest of any power generation source, as confirmed by recent work by the UN Economic Committee of Europe. So 4.8 grams of CO₂ per kilowatt hour. For reference, I mean, that's pretty close to wind and solar,

[00:41:07] **Nate Hagens:** And almost all of that 4.8 grams is in the construction of the plant?

[00:41:12] **Chris Keefer:** And so the longer you run the plant, the better that number gets. And we're really seeing economists and engineers sort of put an arbitrary

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lifespan of 40 years on really for economic planning reasons. But a lot of plants are getting licensed out now to 50, 60 years and our CANDU plants we can do kind of engine swap out.

So they're going to 60, 70 and maybe 100 years. So nuclear is a lot like a hydroelectric dam, but I'll try not to get tangential here. So, the life cycle emissions, and again, this includes the mining, the milling of the uranium, the construction of the plant, the maintenance of the plant, the storage of the waste, incredibly low emissions.

[00:41:51] **Nate Hagens:** And, by the way, Chris, I'm not in your podcast, you're on mine. So you are allowed to go tangential if you'd like.

[00:41:58] **Chris Keefer:** Fair enough. Fair enough. Okay. So number two, I'd say it's really a question of minimizing that ecological impact. And again, why it's such a theme in the Decouple podcast.

Certainly because of that incredible energy density of harnessing the strong nuclear force of the atom, which again is so destructive in the sword application of nuclear, but I would argue so constructive in the the productive side of nuclear power, is again, that we have a nuclear sector, which the mines, the factories, the power plants occupies about 30 square kilometers of land in Canada.

To give you a sense of that's a little larger than the Toronto Pearson Airport. So a very small impact on nature and when you compare that to more dilute forms of energy, particularly wind and solar, they consume vast amounts of lands and really industrialized landscapes and we may be sort of conditioned by compelling narratives and aesthetics to sort of see wind turbines as almost like trees naturally growing into the landscape.

They do have ecological impacts and one of the biggest problems with the biodiversity crisis is trying desperately not to transform land from wilderness into agricultural land or otherwise industrialized. So, I guess that'd be sort of number two compelling reason. Number three, and this kind of, I guess, goes back to my lefty politics.

I'm wearing my union proud t shirt here, union strong t shirt. Nuclear, it's very efficient in terms of the number of jobs created because it's so energy dense. You

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don't have sort of sprawling numbers of workers needed. But the workers that are employed are high skilled, craft labor, really high levels of education. To me, one of my sort of Myers Briggs personality type features is I love seeing people kind of lean into and achieve their full potential and be unleashed to do that. And nuclear is something where you can start working with a high school degree. I was going to call it a diploma and sort of on the job training that's available can get people up to incredibly high levels of education, not to mention the sort of the Ph.D reactor physicist. The, again, the skill trades people, there's a lot of really amazing employment opportunities and traveling to a nuclear community, I was kind of joking about that earlier, but you really see a vibrant, healthy community. So and again, sort of contrasting that with wind and solar, in particular, the other sort of main sort of climate solution in terms of electricity generation,

we see really questionable labor practices, particularly within the solar supply chain with forced Uighur labor and pretty credible allegations coming out of China. You have workerless facilities with very low wage, low skilled construction jobs available basically just in the installation, in Canada anyway.

[00:44:54] **Nate Hagens:** But we need a lot more people in solar and wind per kilowatt hour generated than in

nuclear, right?

[00:45:02] **Chris Keefer:** I mean, there's no parking lots outside of wind farm or solar farm. So there's no long term employment. You need a lot of people in the construction phase. And I'll give it to solar. I mean, we've gotten really good at building solar farms very fast, very cheaply.

But, no, there's not a lot of long term jobs in it.

[00:45:20] **Nate Hagens:** But at the end of the day, this is kind of what we talk about, which is net energy and energy surplus. The fact that we have fossil, gas, and coal, and oil, and nuclear plants means that there's less of us that need to work in the energy field.

The rest of us can be librarians or doctors or inventors or whatever.

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[00:45:44] **Chris Keefer:** 15 percent of us can be basically in allied healthcare, whether it's doctors, nurses, personal support workers, occupational therapists. I mean that, you can have lots of critiques of modern industrial societies and the kind of wasteful spending that occurs.

But I think that's a really powerful statement. I was just, in preparation for this podcast, looking at U. S. government spending. Military spending by the U. S. is 800 billion dollars. Medicaid and Medicare, 1.6 billion. And again, there's a lot of inefficiencies and I'd argue particularly within the U.S. system, that's not talking about the insurance money spent as well, but just that commentary of, again, 15 percent of people in a modern society have jobs looking after other people. That's incredible to me.

[00:46:27] **Nate Hagens:** In our ancestral time it was 100 percent of people had jobs looking after other people.

[00:46:34] **Chris Keefer:** I don't know that I would put it that way. I think you'd probably have some few shamans and healers, but I think most people were pretty occupied and trying to scrape together the calories necessary to kind of maintain.

[00:46:46] **Nate Hagens:** For their clan. But that's what I meant. That's what I meant.

Yeah. Okay. So those are the three positives. What about the three negatives or the three constraints or the things that would give you pause when in a debate with the people who love nuclear as a fix all solution?

[00:47:04] **Chris Keefer:** So I would say nuclear is probably the most challenging, the most difficult form of power generation.

A lot of category errors occur. There's this great quote, recently it was attributed to me by Euripides. I don't think it was him. I've been trying to Google the source of it. But, "man is blind until he finds a metaphor that allows him to see." And with nuclear, I would make the comparison,

the best kind of category error you could commit would be to say it's a lot like hydroelectricity, this massively capital intensive, high risk construction project. It's an expensive way to make cheap electricity. It's an asset that lasts for decades,

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maybe even up to a century. Once it's amortized, it produces very cheap, low carbon power, provides good jobs, underpins a lot of economic wellbeing.

But it's expensive upfront. There's no getting around that. I think there's a lot of folks, particularly in the sort of venture capitalist arena, that commit a category error of thinking that nuclear is a lot like tech, that there's a lot of opportunities for incredible disruption, that these dumb nuclear engineers just haven't thought about using molten salts or sodium fast reactors or burning waste.

Nuclear is difficult. It's hard. You don't do it unless you have to, and Ontario is a place that had to. We didn't have coal, we didn't have gas. France is a place that had to. They were burning oil from Algeria in the Middle East, and then the OPEC crisis came along, and they needed to do move fast in order to not bottom out their economy.

Japan, right? Burned through its fossil fuels for the Meiji restoration and incredible breakneck industrialization there, but it was going to come to a screaming halt if they didn't find a ways to import fossil fuels and a way to sort of become more energy secure was a big nuclear fleet. South Korea, I know the list goes on.

It's generally an energy security play. I'd say the one exception would be maybe Russia where you don't get high on your own supply. You free up natural gas for export by using nuclear. There's some sort of soft power diplomatic reasons. But basically the underlying driver is energy and security.

So you don't do it unless you have to because it's technologically complex, requires the best of the best people. And that's a limit. That's complexity. Great Simplification. I don't know. We were building good nuclear plants in the 70s. When people talk about a Great Simplification, or when you do, I'm not sure what you imagine if it's kind of Václav Smil saying, hey, things weren't so bad in the 50s and 60s.

Maybe we can sort of shrink back to that level of GDP and things would be more sustainable. We could do nuclear, sort of sixties and seventies. That was one of the kind of great build outs were. But yeah, open question.

[00:49:43] **Nate Hagens:** No, I mean, simplification is something between a collapse and a Mordor economy of continued growth.

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And it's after we run out of the ability to paper over our financial claims and the decoupling between how much people think they own and what our material substrate is to do that. It doesn't mean that we go back to the dark ages necessarily but there's going to be a transition and we're still going to need a lot of energy, not as much as we need today, probably, because there's this financial disconnect. So it's, you know this, most of our technology has created a complexity, which has required more energy. Artificial intelligence is now a huge demand and about to get huger. A lot of people that follow this show think that AI is overhyped.

I'm talking to a lot of people very close to it that give me the impression that it's actually underhyped. And a lot of the really pro nuclear people I talked to in the U. S. investors are really high on nuclear right now because of AI that we're going to need so much more power demand that they're looking to nuclear as an answer.

[00:51:11] **Chris Keefer:** Certainly, if they want to meet their 24/7 clean energy targets, baseload's back, baby. I mean, AI data centers require that baseload 24/7 power, and the U.S. grid is becoming increasingly unstable, for a variety of reasons, what my friend Meredith Anglin calls the fatal trifecta of reliance on intermittent renewables, just in time natural gas, and just trying to import electricity from elsewhere.

With the glut in natural gas prices and that surplus for the foreseeable future, they could power those data centers and they may end up powering those data centers with combined cycle gas turbines. But certainly, if you're trying to be low carbon nuclear would be the way to do it. I am not a nuclear for nuclear sake kind of guy.

It's a means, not an end. So yes, there's a lot of pre nuclear advocates that are sort of celebrating this new surge in demand. And maybe it's a way to kickstart the nuclear industry so it can meet other needs and decarbonize. But right now AI is a carbon problem.

It's not a solution. Yeah.

[00:52:09] **Nate Hagens:** Yeah. And I'm gonna have more on that in the very near future. Okay. I interrupted you and you were gonna tell me your third constraint.

[00:52:21] **Chris Keefer:** That's a good question. And this part of sort of betrays, probably my--

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[00:52:25] **Nate Hagens:** If you run out, I have 10.

[00:52:27] **Chris Keefe:** Why don't yoU.S.Tart, just cause I'm drawing a blank and that reflects poorly on me actually, but go ahead.

[00:52:33] **Nate Hagens:** So there's only two constraints to nuclear.

Okay. Fuel is a concern right now. I mean, nuclear, it's real selling point should be, fuel security because, in terms of storage, you have two years of fuel inside the reactor. It's such a dense form of energy. You can stockpile nuclear fuel on site, or on the national level. But due to an underinvestment in uranium enrichment and most of that uranium enrichment actually happening in Russia, 46% of the world's uranium enrichment occurs there.

There's questions right now of fuel insecurity. A lot of the advanced, so called advanced reactor designs, actually require a higher level of enriched fuel, and a lot of the aspirations of that sector are going to be limited by that not being present until we potentially have the sort of policy solutions to upscale enrichment, say in the U. S. for instance. So that's, another constraint.

That's one of my constraints, is peak uranium. I mean, the fact that the mineable, concentrated ores, if the world were to dramatically scale nuclear power, and there's issues with that without which I'll offer in a few minutes, that we maybe have 50 or 60 years left.

I think probably because we've not tried, and if we tried we could extend that quite a bit, but what are your thoughts on the amount of uranium needed and available for tripling to 10x ish nuclear in the world?

[00:54:12] **Chris Keefe:** I mean, first off I'd say it does sound a lot like yoU.S.Aid, peak uranium. I mean, there was concerns about peak oil going back, I believe, to the 1920s. Haber Bosch, who invented the Haber Bosch process to fix ammonia also were involved in the Fischer Tropsch process.

And I remember before I think the Texas oil field started gushing, there was concern amongst the automotive industry in the U.S. there wasn't enough oil. And so these guys were actually trying to start a business model of, I think, coal

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conversion. So I think, part one is there's a lot more uranium than we know about in terms of reserves versus resources, but fundamentally you're right.

And the early history of nuclear was we really didn't think there was a lot of uranium around. And so there's a lot of interest in a reactor technology called a breeder reactor, which actually produces more fuel. You put a fuel load and you create more fuel in the process through the alchemy of nuclear power. Breeder reactors have not really gone far partially because there hasn't been the need because uranium is dirt cheap right now in terms of if you're an investor in uranium you're pretty happy because the price has gone up a lot, but I mean, relative to the energy it puts out, I'd say it's the most undervalued, commodity in the world.

So with breeder reactors, you can extend, I have a friend, Nick Turan, who is not a fanatic. I'd say he's very reasonable, middle of the roader type guy, but he's done calculations where you're getting out to millions of years. There's uranium present in seawater. I haven't looked at the efficiencies of extracting it, but

for all intents and purposes, with breeder technology, I wouldn't say that's a limitation, except that breeder technology is a bit harder.

[00:55:49] **Nate Hagens:** Give me a one to two minute overview of the mechanics of what a nuclear breeder reactor, how that would work and what it would accomplish. And, are there any? I don't think there are, there?

[00:56:03] **Chris Keefer:** There are, so it's, I'm stepping out of my wheelhouse definitely, right? But we're getting into slow neutrons versus fast neutrons. So the current kind of thermal reactors that we have, in order to split more uranium atoms we moderate the neutrons that are being released as part of the chain reaction, slow them down, and that is a bit of a limitation in terms of using what are called fertile elements, where if you maybe add a neutron to them, they become fissile and you can split them again.

So a breeder reactor, in my understanding, again, as a medical doctor, but with lots of expert advice, is able to use that fast neutron spectrum blah, blah, blah, blah, blah, and make these fertile elements that are present into fissile elements, thus generating more fuel. Are there breeders active right now?

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Certainly a lot of countries have poked around in it with this interest of closing the fuel cycle. I'd say the Russians are probably the furthest along. They have a sodium fast reactor program that's 50 or 60 years old. They've scaled that up to, I believe, 800 megawatts recently. Have they felt a need to expand that?

It's not as economic as their light water fleet? Frankly, it's more of a sort of, I think, research and development arm with the goal of maybe closing the fuel cycle at some point, using waste within those reactors, but also extending the uranium reserves that they have. So I'll cut it there because I'm going to acknowledge the limits of my expertise.

[00:57:28] **Nate Hagens:** Well, also, I have so many questions and there's a lot of other topics too that I want to cover. What about the cost and complexity? One of my beliefs is we're kind of out of time. We have a decade before this geopolitical, financial system kind of unravels. And so I think there's so many times that a nuclear plant is over budget and over deadline.

And even if you agree with all the positive attributes, yoU.S.Aid to do a crash course, nuclear, thing only would make sense if AI and productivity or some genie, for our culture is able to extend our timeline. So what do you think about

that constraint?

[00:58:16] **Chris Keefer:** I'd say the timeline constraint is pretty much universal in terms of looking at really any technological solution to our predicament. I agree things are moving quite quickly. That's not a dodge, by the way. In terms of the ways that nuclear can improve, really it has to do, again, it's like a hydroelectric dam, we got to get better at project management and construction.

The fastest built nuclear plant was done in just over three years in Japan by a highly competent supply chain workforce and excellent project managers.

[00:58:46] **Nate Hagens:** They built a nuclear plant from scratch in three years?

[00:58:49] **Chris Keefer:** Yeah. From what they call the kind of concrete base mats of the of the reactor itself to grid connection.

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We've got Canada reactors that in China went from shovel to a breaker in just over four years. So it's possible to build these things quite quickly. The innovation, again, the venture capitalists are going, again, probably coming with that Silicon Valley tech bias of listen, I've made billions creating a social media platform where you had to click less and then everyone went to it.

And like I'm not trying to minimize some of the disruptions that have happened in tech. That's a bit pejorative, but there's been some pretty big things. Nuclear is far more slow moving. And the innovations, if you look at the cost of building a nuclear plant, only about 20% of it is in the actual reactor.

80% of it is in the civil works and the balance of plants. And so the place for innovation is really in project management being more like those Japanese project managers. Nuclear plants are the most robust structures that human beings have created. Maybe you could say the pyramids are a little more robust.

But, because of A, the dangers, which I think are a little bit overhyped, again, the kind of culture of excellence in nuclear engineering that was called the defensive depth is wild, right? Every potential thing that could go wrong is considered and obviously earthquakes are part of that story.

So in terms of preparing a nuclear power plant, you're digging a hundred feet down, you're putting in certain types of fill that can absorb seismic shocks. You've got the kind of a base mat of concrete. Again, I'm not a civil or structural engineer, but those civil works are a lot. The water intake channels, it's a lot of concrete and steel.

That contributes, as we were saying earlier, to the life cycle carbon. And that's really the main source of life cycle carbon emissions for nuclear. But that's what I refer to there.

[01:00:41] [Nate Hagens](#): All right.

So one of the biggest concerns that I personally have had with regards to nuclear power is the assumption that civilization will always continue and that there won't be a hiatus due to an EMP pulse, or a solar flare, or a war, or some massive reduction in complexity that causes the 500 odd nuclear plants to then have their environmental costs all be backloaded and Chernobyl on steroids.

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I watched the TV show Chernobyl. It was like a four part series. I thought it was excellent. Of course you see the other TV shows that show the wolves and the wildlife are thriving now where Chernobyl used to be, but you also hear stories of cows with five legs and other things like that. So, given the followers of this podcast are at least emotionally and cognitively aware of the systemic possibility of diesel fuel that is used in the backup generators at a nuclear plant suddenly being unavailable even after two weeks of backup diesel supplies and that people then don't go to the nuclear plant because they can't get there or their ATM cards don't work because of some loss in complexity.

And so what are those risks, that in such a scenario and we could debate whether that's 1% or 20% possible in the next century. But under that scenario, what are the nuclear waste, radiation, et cetera, risks to the areas around nuclear plants. What can you do about that?

[01:02:44] **Chris Keefe**: Right, right.

So first off that electromagnetic pulse scenario has been factored in since the eighties into this defense at depth mentality that nuclear engineers have. And so nuclear plants are designed and hardened with that in mind.

[01:02:58] **Nate Hagens**: Narrow boundary though. They're looking at the EMP to the plant. I'm talking about the EMP to society.

[01:03:03] **Chris Keefe**: No, no, they're looking to the whole system.

[01:03:05] **Nate Hagens**: Oh, really?

[01:03:06] **Chris Keefe**: Yeah, the way that's magnified through electric lines. Well, trust me, these are some of the smartest people on the planet and they're thinking through every eventuality and one way to generate an EMP is a stratospheric nuclear detonation in terms of a nuclear weapon.

So that has been very carefully looked at. The experts I've talked to is that it would lead to a scram in terms of just a reactor shutdown, all the control rods going in. And then the emergency coolant systems running. So not to say it's a nothing burger, but you know, and this is a familiar territory in terms of because of people's apocalyptic fear of nuclear weapons and that transference to nuclear energy, these

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kind of edge case scenarios are often brought up to imagine, well, how can this turn into a nuclear apocalypse, as we would see with weapons. As we saw with Fukushima, again, the simultaneous meltdown of three large boiling water reactors, and you can look at this because you're going to hear, but I heard a study that this many people died from radiation from Fukushima. That's more of the case with Chernobyl studies that you'll hear, say Greenpeace, a million people are going to die from Chernobyl or the Green Party of Europe commissioned a study that said 50,000 people will end up dead because of Chernobyl, prematurely dead. The quality of that literature, you get to the UNSCEAR reports, this is eight UN agencies, three countries participating, consensus decision making, hundreds of scientists, and they're going down to 50 confirmed deaths and a possible 3 to 4,000 from thyroid cancer.

So you get these huge kind of disparities, but Chernobyl is even like far worse than Fukushima. I mean, this is a reactor without containment that blew its lid, that caught on fire and burned for 12 or 13 days with a radioactive plume that went across Eastern Europe, and into Europe.

And again, if you use, this is something that's a big part of medical education right now, critical appraisal skills, right? As we saw with COVID, you find all kinds of studies, preprints, and we, in terms of the way that social media amplifies things, if you find something that fits your cognitive bias, you don't read the paper, you don't look if the methodology's any good, yoU.S.Hare it.

And that is a big, I would leave it to people to critically appraise the studies in terms of the health impacts of nuclear accidents. Even Chernobyl, which is far worse than Fukushima, and we don't build nuclear plants like that anymore. The safety culture is totally different.

The health impacts, very minimal and less than running a coal fleet, certainly, where you're just constantly putting out, PM 2.5 particles that even in what we consider to be good air quality conditions, have a four to eight percent increased mortality rate from things like lung cancer and cardiovascular disease.

So, in terms of imagining these kind of worst case scenarios, it'd be really bad if the world's 430 nuclear plants all simultaneously lost the ability to cool themselves. As you mentioned in a war zone, this is not great, right, but the Zaporizhia nuclear plants, I believe it's four large gigawatt scale reactors, they've been, they're in cold

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shutdown now, but they manage those despite a war zone type event. Not a Chernobyl style plant. And so, the ability to keep the reactor core cool for as long as possible, like the reactivity comes down exponentially, but I'm not saying it's a nothing burger.

It's not a problem. But in terms of these apocalyptic fears, both for humanity and for the biosphere, I can't think of anything that's more grossly exaggerated.

[01:06:34] **Nate Hagens:** So let me ask a follow up to that, Chris. So let's say that there's two different scenarios. There's one scenario where something happens that none of us can anticipate.

And these 430 plants don't have any warning and then they react. The second would be that we have a month notice of something happening. There's a big war and, or whatever it is, and the operators of these plants have time to shut them down properly. Is there a big difference then in the radioactive externality pollution risk between those two scenarios?

[01:07:19] **Chris Keefer:** I mean, definitely the longer you can keep the core, and Fukushima, to be clear, they were able to keep the cores cooler. I think it was, on the scale of hours, but even hours, you're dropping the level of reactivity massively in the amount of heat and energy that core is producing. But again, in terms of that, Chernobyl esque, far worst case scenario, the health impacts we see are very small.

So I don't want to minimize and say there's no difference. Obviously, you can get the plant, I think, pretty close to cold shutdown after a month in which it's really not much active energy required to kind of maintain that core as it finally cools down into a state of cold shutdown.

But, in that worst case scenario, I don't want to minimize that, but in terms of, again, our apocalyptic fears of what did yoU.S.Ay, five footed moose or something? There, there was really, because this is a big, this is a big story, right? I mean, there's a whole Chernobyl's children charity, which brings children from Chernobyl, often with congenital heart defects and other problems, to Ireland, to Canada, and gives them sort of a radiation retreat and respite.

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And it's a beautiful organization in terms of these disabled children getting to live in a wealthy country for a few weeks, and be cared for, and maybe get specialist care they couldn't back home. There is absolutely zero evidence that Chernobyl caused these congenital heart defects and other things.

Indeed, there was a whole genome sequencing study that came out a couple years ago, which looked at folks that got some of the highest doses at Chernobyl and looking for germline mutations between parents and kids in a large sample of people with high radiation exposures in the general public. No increased germline mutations were found whatsoever in this study.

They did find germline mutations in if the father smoked, for instance, right? So this gives you a sense of, sort of, I don't want to say that radiation is a nothing burger, like for instance, nuclear waste, that irradiated fuel fresh out of the reactor, if it's not shielded, you'd get a lethal dose in seconds and die, a horrible death.

And yet, in the history of civilian nuclear energy in terms of storing and handling spent fuel, not reprocessing it, but storing it, there's not been a single incident in terms of someone dying as a result of exposure to radiation. And that's because radiation is very easy to measure and it's very easy to shield.

So, there is a danger there. But we're able to manage those risks very well, as that 70 year track record of, for instance, handling spent nuclear fuel is demonstrative of.

[01:09:44] [Nate Hagens](#): So, here's my last question on this, and you could use this as a segue to a follow up question, or my last kind of constraint, is, I got a lot of criticism when I had my Great Simplification video, the animated video that we put out last year, people are like, ah, he didn't mention nuclear.

That means he doesn't know what's going on. So there's energy properties and different energy qualities. And, if we are worried about oil peaking and declining, which is inevitable, I think AI may prove to extend the peak. We don't know yet. But we're at or close to the peak. Many countries have peaked already and most of what we plan on consuming in the future is in countries like Iran and Iraq, which we may be at war with in the near future, who knows?

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But, one of the things that I'm curious about is nuclear is generator of electricity like solar and wind are when only around 19% of global energy use right now is electricity. So there's a mismatch with the end services of what humans currently are using. And there's a lot of decentralized transportation and cars and trucks and things like that.

So that's something that I call attention to, but I'll let you comment on that, but then you can follow by answering this. Assuming that there are different energy facilities in the future that use nuclear power, what would be the three or four or five best use cases for if we're able to scale nuclear plants?

What should that baseload power in those plants be best used for in our current society? I'll let you answer any way you would like there.

[01:11:49] **Chris Keefer:** Yeah. I mean, I'm very aware, partially through your work and others, this question of like energy fungibility or energy quality. Just because we have units like kilowatt hours, that disguises the kind of utility of each form of energy that we use.

And, for instance, liquid hydrocarbons, I think you're very right to be concerned about peak cheap oil. You've mapped out supply chains in your book which I have here on my table. It's incredibly complex and we have complexified the hell out of our... we have six continents supply chains. I mean, I was just reviewing, there's a famous essay on how to make a pencil, right?

And it's like graphite mined in like Brazil, India, China, right? Need like aluminum and copper alloys for the little eraser stub. You need petroleum products for the eraser. This is a major concern. And nuclear does not solve that issue, that service that liquid hydrocarbons provide, whether it's agriculture, running tractors, whether it's the vast majority of marine propulsion, that's not aircraft carriers and nuclear submarines, whether it's diesel trucks, which we're so dependent on diesel power, diesel electric trains.

So that is a major limitation. I think the problem with a lot of the energy transition debate is that we have this existential problem, and we're trying desperately to make, I always forget if it's round pegs fit in square holes or square pegs in round holes. I imagine they don't go well into either.

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But there's this forcing of we've got to make it work. And yoU.S.Ee that, I think, in some of the really, frankly, bullshit models from the IPCC in terms of bending that emission curve down. And often it relies on insane amounts of bioenergy carbon capture and storage, for instance, to kind of force the model to work.

But similarly, amongst the nuclear is a panacea folks, they'll say, listen, this is essentially limitless, abundant, clean energy, we can use it to run a number of processes to make synthetic hydrocarbons, so don't worry about it. I'm not of that mindset. I think that similarly to yourself, we are running a red line. Energy is the economy. I'm not going to repeat all your talking points here, but you know, if the price of oil goes to 150 or 200 a barrel, that risks really tanking our economy. And our, I'm not going to... people who are listeners of this podcast are familiar.

So no, I don't think nuclear can do that. But what it's useful for, I mean, so stationary electricity generation. And you could argue, you'd mentioned about 19 percent of the world's energy use is electricity. You could argue that we have a global electricity shortage if we were serious about decarbonization.

For instance, high temperature process heat, that's provided very well by electric arc furnaces. But we don't have enough electricity to dedicate to that, for instance, right? that's kind of hard path, big hydro dams and nuclear plants that kind of would allow that use of energy to get around some of those fossil fuel services.

[01:14:38] **Nate Hagens:** We either have an electricity shortage or a complexity longage.

[01:14:42] **Chris Keefer:** Or, like a surplus use of fossil fuels. And I know you'd probably say, listen, every time we discover a new form of energy, it's just additive. Right. And yeah, that's probably true. Right.

[01:14:51] **Nate Hagens:** So far it has been.

[01:14:53] **Chris Keefer:** There's no biological organism that will go, wow, there's a sweet concentration, I'm gonna bypass that.

[01:15:00] **Nate Hagens:** Which is why I'm not so sanguine on AI's possible optimism on developing nuclear fusion as an answer to all our problems. Do you have any thoughts on that?

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[01:15:11] **Chris Keefer:** I'm incredibly bearish on fusion. I mean, from the first splitting of heavy elements, nuclear fission, 1932, to commercial nuclear power, 1956.

That's a really short timeline. Our first sort of induction of fusion, basically in bombs until now, we are still nowhere close to getting a positive Q value in terms of the energy out versus energy in. And the engineering, these machines I've talked to, ITER physicists running the Tokamak in Europe.

And they say this machine is eating itself. The kind of neutron bombardment of the materials, the complexity there. If we're struggling to build a very complex nuclear plant, like the AP 1000s we just built in Vogtle. Multiply that complexity by tenfold and tell me that you're going to deliver that project more easily.

And a lot of the hype around fusion is it solves the so called problems of nuclear, these intractable problems of, say, waste and proliferation and accidents. And it really doesn't. I mean, do you think that fusion research is not critical to thermonuclear weapon development? I've got friends who work in big laser laboratories, like Lawrence Livermore, and most of that research is for making sure the bombs will go off, right?

There's a total link there. There's kind of more intermediate level waste that's created, not so much high level with fusion, but the biggest issue is, these are engineering solutions to communications problems. Nuclear waste is not that big of a deal. We don't need to develop a technology, I mean, that I just frankly don't think we're going to harness anytime soon. If we are able to get that positive Q value out, are we going to be able to build the goddamn thing? The project management, the construction skills that are evasive to us in a much simpler, easier to force, harnessing of atomic energy?

I don't think so, but there's my position.

[01:16:58] **Nate Hagens:** And that doesn't even get to my point, which is, let's assume we have too cheap to meter or even free electricity, given our current cultural value system aspirations and scoring metrics of GDP, we would fry the planet by bringing in lots of other non carbon or carbon resources with that energy underpinning it.

[01:17:23] **Chris Keefer:** Yeah. I don't disagree with you, Nate.

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[01:17:25] **Nate Hagens:** So nuclear fusion, if it ever arrives, would have to also arrive with a better form of coordination, governance, and cultural values, in my opinion.

[01:17:35] **Chris Keefer:** And to take it to extremes as your guest, Thomas Murphy, has shown, I guess eventually with this limitless clean energy, we'd have to find a way to get all the waste heat off the planet before we boil the oceans.

[01:17:46] **Nate Hagens:** That's right. With a few more doublings, we, I forget how many, we would boil the oceans, just from the waste heat.

[01:17:52] **Chris Keefer:** 400 years of 2-3 percent growth.

[01:17:54] **Nate Hagens:** So, I have a lot more to ask you. One more thing on nuclear. What about the small modular reactors, and SMRs, and molten salt, and some of the things like that versus the tried and true conventional, large conventional plants, that we know work today.

What is your sense on that landscape?

[01:18:20] **Chris Keefer:** So the nuclear industry is, as an anthropologist of it, having met lots of people that work within it, it's absolutely fascinating. It's mostly these really nerdy, smart engineer types and they're brilliant engineers and the way they think is engineering.

And so they come up with engineering solutions to social license problems and communications problems, as is mentioning with waste, but also--

[01:18:39] **Nate Hagens:** What's a social license problem?

[01:18:41] **Chris Keefer:** Well, if nuclear is unpopular, right? Then you rebrand it as a small modular reactor. You don't even use the N word in there. And maybe you can convince people this is friendlier, it's different, it's better, it's shinier, right?

Or, another issue, another reason that SMRs were in vogue, and I'll really argue they're falling out of vogue, was this idea that government will never finance nuclear anymore. So you need to get a plant down in terms of the financing to about a billion dollars if you want the private sector to finance it.

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So there was a whole sort of paradigm that's a little more than a decade old that went against everything and the entire track record of nuclear. The big cost reductions that we see in the first 10, 20 years of nuclear are absolutely from scaling. From these 20 to 100 megawatt reactors up towards the gigawatt scale.

Where, you know, the grid size permits it, we have always scaled to a gigawatt because economies of scale are real. The SMR advocates are big fans of Wright's law, which is basically an economies of multiples. If you double the amount of units then you should get a sort of positive learning rate and it should reduce by whatever percentage it is.

We often don't see that a nuclear that's really evaded us in terms of those positive learning rates that are remarkable with things like wind and solar. And again, even the use of the term SMR, it is, like renewables, an incredibly imprecise term. It's this massive grab bag. Probably what your listeners, in terms of those who kind of imagine the best case for SMR is they're like, oh yeah, these are, plants you can deliver on the back of a truck and there's minimal civil works and they just snap together like Lego, connect them to the grid.

And that's certainly, I think the industry and the trade associations are guilty of selling that story and they've really over promised and they're about to under deliver. So scale, scale is, very real within nuclear. And, the imprecision of SMR. So again, we're lumping together, so called advanced technologies, things like molten salt reactors, sodium fast reactors, anything that's not sort of water moderated and water cooled is now kind of considered an advanced reactor, despite the fact that these reactor concepts were attempted in the 50s, 60s, and 70s, and for economic reasons they didn't make it. It's not to say that we shouldn't research them more and maybe develop them, but they really need to be a side project of proven nuclear, which is already struggling, right?

But, again, there's this narrative that's really exciting, because hey, you can breed more fuel than you use, maybe these things can consume nuclear waste. I mean, these aren't real priorities to us in the here and now, at the moment. And so you know, I've consistently in my podcast, and I've been a bit of a contrarian in this, been an advocate for, again, focusing on the project management, focusing on the construction skills, the boring stuff of nuclear, right?

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And embracing the high value, long term asset that is a nuclear plant, just like a big hydrodam is a long term kind of low carbon asset. It's a bit more of a boring narrative, it's less inspiring, but it's certainly what's proven and what we know works. And in places that have sort of followed those rules of a building a standardized gigawatt scale reactor over and over again, at least we don't see a ton of negative learning curves.

We see, in France, for instance, 56 reactors commissioned in about 20 years. And now, essentially decarbonizing their electricity accidentally in the 70s and 80s. A similar story in Ontario. I mean, there's really kind of cool and inspiring stories here with doing what we know.

And, in terms of what has risen to the top, what has actually advanced in terms of nuclear technologies, it's done it for a reason. These things are easier to operate, easier to maintain. We've been handling high pressure steam as a working fluid and pressure vessels since the dawn of the industrial revolution.

Adding fission into that wasn't a huge leap. Molten salt reactors, having a fuel that's melted, all the alchemy of a nuclear reaction happening as a kind of liquid that's all throughout the reactor versus contained in a fuel pellet and a fuel element, I'm getting into specifics here.

But I'm not particularly bullish on advanced or small modular reactors as you can hear from this brief diatribe. There's not an easy fix, Nate. There's not an easy fix to this.

[01:22:47] **Nate Hagens:** There's a lot more I want to ask you on nuclear, but we might have to save that for a round two because I want to give a whole view of Chris Keefer, renaissance man, podcaster, in this first interview.

One final nuclear question though. How does the political attitude towards nuclear differ between your country, Canada, and mine, the United States? And is there a heavy political divide, left versus right, on this issue?

[01:23:16] **Chris Keefer:** So I will say looking from Canada south of the border, I can identify one and only one issue that seems to have bipartisan support right now.

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And that is nuclear energy. So the Biden administration is all in on nuclear. The loan programs office, Jigar Shah, the Department of Energy, they're all in. They're frustrated with the nuclear industry. They're trying to push it along. There's massive incentives in the Inflation Reduction Act for nuclear. I think, production tax credits that approach 50%

if you build on a brownfield site, use union labor, which basically is a sort of goes without saying, and use a local supply chain, which nuclear tends to localize its supply chain. So, the social license is big. What's different between Canada and U.S. is the nonprofit industrial complex. So there's a beautiful tax avoidance mechanism in the U.S., which is if you're a very wealthy individual, lots of generational wealth, you start a foundation and you can decide how you want to essentially spend that tax burden.

You can move it into your pet causes. And so, if you look at the value of the nonprofit sector in the U.S., it's a larger economy than some pretty respectable economies around the world, and particularly, the combined revenues of Sierra Club, of Greenpeace, of Friends of the Earth, is approaching, not into the double digit billions, but I think at last I checked, five or six billion dollars.

They've been resolutely anti nuclear. They've been very influential. A lot of staffers that are sort of cultivated with the environmental movement become political staffers, and have been very influential. And so, in Canada, we don't have that same strength of a nonprofit sector, the anti nuclear activists have been less influential and have really waned in terms of influence, partially as they've just greyed out, because there's not a lot of young people that are enticed by an anti nuclear narrative anymore, but again, partially just because not the same kind of money as that at play, in terms of influencing politics.

And I will say the anti nuclear, or the NGOs that have been pouring a lot of money into anti nuclear, even the Rocky Mountain Institute has really softened its views on nuclear, and I think the Sierra Club recently defunded their main sort of legal branch that was fighting for the closure of nuclear plants, for instance.

It's a remarkable transformation in the last five years.

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[01:25:25] **Nate Hagens:** Thank you. That was a pretty good whirlwind overview. So Chris, please now shift hats. Put on your podcast hat. Is your podcast audio only or are you on

video on YouTube as well?

[01:25:40] **Chris Keefer:** First 40 episodes audio only, biggest mistake of my podcasting career. Yeah, I know YouTube is a great place for a lot of the conversations happen in the comment sections on YouTube for whatever reason. That's where a lot of interaction happens. And yeah, it's both.

[01:25:52] **Nate Hagens:** So knowing what you know about our spectrum of societal narratives, what do you anticipate will be the comment section on this podcast so far on what you've said on my channel?

[01:26:11] **Chris Keefer:** I think it's gonna be interesting because I think you have a pretty varied audience. Certainly, I think you attract, for better or worse, kind of certain degrowth audience, probably sort of progressive environmental audiences is a sort of core listenership, and I know it's much more diverse than that.

And I think they'll probably take issue with the blasé way that I've probably talked about nuclear risks as they would perceive them. So I imagine there'll be some of that. I think as well, in terms of, again, you've, I think, elucidated very well, a nuanced perspective on what you imagine a Great Simplification to look like.

That this isn't us going back to the Stone Age perhaps. But, I'm not sure about your listeners in terms of, and there's a lot of romanticization, and I even, I won't accuse you of it, but in terms of your question about child mortality, was that just the last kind of, was that just since the agricultural revolution that it got bad?

Or, was there some kind of illustrious hunter gatherer past when we lived in harmony with nature? One of my favorite physicians, Hans Rosling has a great quote. He says, humanity never lived in harmony with nature. We died in harmony with nature. And it was mostly women and childbirth and children under five.

So I think that's a fundamental tension to wrestle with and these gains in terms of, early childhood survival are recent. This is the last 50, 100 years. I mean, Somalia,

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it's still 14 percent of kids. Used to be 50 percent and that's kind of throughout human history.

I think that's the thing to wrestle with because I think some people, I mean, we might get into this later, but Cuba provides a really interesting example of an economic shock when they were cut off from their Soviet sponsors and their GDP shrunk by 35% over a couple of months. And I used to be a sort of Cuba solidarity activist, it's a very, you have to be very careful of discourse around Cuba because ideologues are drawn to it on either side of the political spectrum like moths to a flame, but I imagine the comments section of this podcast might wrestle a little bit with these questions of like, how bad is it going to be?

The doomers will probably be all over that. But I think romanticization, this idea, even in terms, I know that you touch on agricultural topics from time to time. Vandana Shiva has been a guest several times. I think there's an idea based upon if we imagine this simplification future, we may think of like a camping trip and we're like camping trips are great,

I love cooking over a fire, and you forget that you drove there and you had a great tent made in Pakistan with really waterproof fibers. Or you think about like a transition village you visited or a permaculture farm you went to. And these again are islands in a sea of a fossil fueled civilization and often have enormous fossil fuel inputs into them.

So I think we have a really hard time imagining, and there's a lot of sort of idealism of sort of, oh, this industrial society is really terrible. Why don't we simplify it to something that's nicer? And I don't think you share that delusion, but I think that might be a theme.

[01:28:57] [Nate Hagens](#): So I do want to ask you about healthcare and medicine, approaching during and after The Great Simplification.

But let's stay on the podcast theme. Since 180 of your 200 odd episodes have been on the topic of nuclear, presumably you have attracted an audience that is very interested in the nuclear question. Whereas I'm covering anthropology, neuroscience, climate, biodiversity, debt, energy, properties, geopolitics, everything, and invariably, and it's getting worse, whatever episode I cover, the ideologues will show up and criticize.

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I mean, it's not everyone. There's more positive comments than negative. But my question to you as a podcast host is, in this polarized social media, ideological, tribal, identity-laden world, how do we have a conversation and integrate the broader societal narratives, and suppress our identities, at least temporarily, in order to have a discourse on the things that matter?

What have you learned and what are your core insights on this?

[01:30:11] **Chris Keefe**: I mean, I've really learned to sort of depersonalize and not take anything personally and also delight in ideas that, well expressed ideas that, trigger all of my cognitive dissonance, and that's, maybe it's like a training process, but I love hearing well articulated arguments that are, that I absolutely disagree with. And, I think, as a society--

[01:30:36] **Nate Hagens**: Explain that

[01:30:37] **Chris Keefe**: I don't know. It hasn't always been that way. Like, again, coming from like even the hard left, the romantic left, the Marxist Leninist left, I wouldn't say I was ever like a, I'm a member of the disgusted party. I've never really felt at home in any ideology, but on the extreme or hard left, as on the extreme or hard right, I think there's an idea that like, people that don't agree with us are just kind of stupid.

If they only knew, if we could just explain to them, they'd be converts. And then those that don't agree. I mean, in sort of Stalinist Russia, they should go to the Gulag or get lined up against the wall. There's a total intolerance on both sides of the political spectrum for free speech, for a diversity of opinions.

And it cripples societies. One of the reasons that I think, there's many reasons that the liberal capitalist system won out in the Cold War. I don't want to simplify this too much, but the free exchange of ideas is just so vital. We're in a whole number of different predicaments, and if we don't have a breadth of opinion, and maybe I hate to kind of weigh into COVID because it's so politicized, right?

But, this is potentially an illustration, and I'm sort of drawing from Jonathan Haidt's work, in *The Righteous Mind*. We are a species that's evolved as a social species. In terms of a sort of selection pressure, we always see within, basically every human

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society, people on the left, people on the right, conservatives, liberals, authoritarians, communitarians, libertarians, right?

And that might frustrate us in our various political polls, but when we recognize that all those voices are really necessary, that's a good thing. So let's take COVID for instance. When I'm working in the emergency department in Toronto and we're seeing these tsunamis right. in Iran, for instance, in Italy, in New York, right? Doctors, freezer trucks outside in terms of for dead COVID patients, doctors intubating in scarves. We were terrified in Toronto. I was a huge advocate. I was messaging my MP and saying the military should be out in the streets enforcing lockdowns.

Right? And that kind of authoritarian impulse in the face of a threat that, we thought there was a case fatality rate of 5 percent with COVID, that 10 percent of people would end up in the ICU, that 20 percent of people would be hospitalized. And I ran the numbers in my emergency department and I was like, we're going to lose 15, 20 people in this department, right?

There's going to be 40 of us that will end up on ventilators. And in that context, with the limited information we had, an authoritarian impulse, I think absolutely appropriate. As both natural immunity, vaccine induced immunity, and an attenuation of the virus occurred, there was a kind of hangover of that authoritarianism that went on too long, and so libertarian voices came in.

They didn't necessarily, they weren't sort of savory voices per se, maybe have a different opinion, or there's a diversity of opinions on say the truckers protests in Ottawa, but I would argue that authoritarian impulse was stale, it had gone on too long, it was no longer appropriate, it was causing damage. You only have so much sort of public health social capital until you burn through it. There was a hangover there.

It needed a course correction. And so the libertarians came in and that was, this is just one example where it's, I think, important we're faced with novel challenges and a sort of diversity of opinion is super important in terms of both understanding the new predicaments and how to engage and deal with it.

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[01:33:50] **Nate Hagens:** So, more important than being able to suppress your identity and be a good listener, what I'm hearing from you is the ability to change your mind.

[01:34:01] **Chris Keefer:** Absolutely. And again, just to reference Jonathan Haidt for a second, he had this great example, right? If a farmer is trying to get the most eggs out of a chicken, if you select an individual, you find that hen that just lays like crazy and you try and breed her, you end up with less eggs because alongside that trait for laying more eggs is aggressiveness and they peck each other to death and the overall production goes down.

So what you do is you grab groups, you segregate chickens into groups of 12. Whichever group lays the most eggs, that's your breeding stock. And it's I think a lot like humans, which have all, and I'm just quoting Haidt here. This isn't my original thoughts, but we evolved collectively in small groups of hunter gatherers, 25, 50, a hundred,

and there's a reason genetically, I think, why there's this political spectrum. Like in every society around the world, there's liberals and conservatives. Like why isn't there some country or some village where everybody is super liberal? I think there's a reason for that. And I think there's an evolutionary advantage to a diversity of opinions.

And again, this contradicts my sort of hard left past, but I'm really glad for that nuance. And again, a big journey of myself, not into the political right, but for appreciation of certain arguments and elements and viewpoints from the political right is that understanding that we do need a diversity of viewpoints to identify and understand the problems that we have and to generate solutions. And for our solutions to change over time as the facts on the ground change, as in the sort of COVID example I gave.

[01:35:26] **Nate Hagens:** So, given your experience as a podcast host, in addition to your emergency room role and as the president of the Canadian Nuclear Society, how do you think we can change that? How do you think we can change the discourse in the direction that you would aspire to? Is there anything you've learned that gives you some hints or clues or avenues that give you hope?

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[01:35:58] **Chris Keefer:** Well, you have this magic wand question, that I know you ask your guests.

[01:36:01] **Nate Hagens:** Right, well, I'm going to ask you that.

[01:36:04] **Chris Keefer:** Maybe if you had, well, maybe I'll intercept it early on, but if you had a magic wand maybe you could make Twitter disappear or make TikTok disappear.

[01:36:11] **Nate Hagens:** So you think social media is the cause of our polarization?

[01:36:14] **Chris Keefer:** It's not the cause, right? But Nate, I think, like we all have a window into reality. We all have cognitive biases. I think you've elucidated very well in your work. We all have blinkers. Again, we can't see the world until we have a metaphor that explains it and the metaphors that we have are all constrained by our individual experiences of the world.

So everything is very narrow. And now, the way in which we perceive the world is largely, and the information we gather is largely through our smartphones and the screens we have, and then the platforms that present us the information. And the platforms that are trying to keep us on them as long as possible by presenting us with information that suits our cognitive biases and makes our little dopamine receptors fire, right?

So that's incredibly damaging to, again, a diverse, robust, tolerant environment that's prioritizes free speech. So. I think that's a major barrier. It's not that the root cause, right? The root cause is just our basic kind of, paleo psychology that persists today.

But your question of how to overcome that, I think the podcasting medium is really interesting. Like everything has become short attention span, right? TikTok is down to a minute or whatever, right? And people probably, if you look at the metrics, people probably only watch the first 20 seconds before they're distracted and move on.

The emergence of long form podcasts that are popular. It speaks to something. It satiates something, I think, in people that crave nuance and want to go deeper. So I think it's a great medium.

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[01:37:40] **Nate Hagens:** I'm actually shocked by that myself. Like I don't listen to podcasts unless I have to for prep reasons or they're really exceptional.

Like I watched Tristan and Daniel Schmachtenberger on Joe Rogan, for instance.

[01:37:55] **Chris Keefe:** Yeah.

[01:37:55] **Nate Hagens:** But I'm shocked that so many people have the appetite to listen to a 90 minute conversation between two people. I really, it actually is heartening to me because I think most people, like you say, have a two minute or less time span.

So maybe that is an emergent phenomenon of nuance and complexity and context that our society needs.

[01:38:20] **Chris Keefe:** Well, you don't have the patience maybe to listen to many podcasts, but you engage in hour, hour and a half, two hour long conversations on a regular basis. And that's also, and again, in terms of the social capital of podcasting, I mean, I love going to parties where there's really cool people,

and I generally pick one or two of them and we just go deep for an hour. These are weird parties, right? This is not your average party goer, right? So maybe we do that in our natural life, but it's very rare to. We're kind of looking each other in the eyes across this platform and having a deep conversation, exploring each other's work and thoughts.

So even though you're not a listener, like you're engaging in this, the same thing, you have a thirst for it as well. And that's why we, do this insane thing of putting an episode out every week, or I think you do more than that, but.

[01:39:04] **Nate Hagens:** Well, maybe if I was far less busy I would listen to a lot more podcasts.

I just don't have the time. So that was a good answer. I like that. And I need to think about that more. Okay. Switching hats again, because I don't want this to go three hours. I mean, to be honest, Chris, I have so many questions I'd like to ask you. Let's just do what we can on this and have you back for that one to two hour party deep dive on something.

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So, wearing your emergency room physician hat, I've been very concerned about this. I've had a former governor of Oregon, John Kitzhaber on, I've had Robert Lustig on talking about the healthcare system. The United States healthcare system is 20 percent of our GDP. Americans have 50 percent of the world's, the entire world's medical prescriptions, which implies we're either sicker, our doctors are prescribing them more for some kickback back thing, or we're babies or some combination of the three. But I do not believe that our current growth based system and, by implication, our medical, complicated, just in time, throw this plastic tube that you used once out system is sustainable. So it's my belief that in the not too distant future, and I can't put a date on it, we're going to have to gradually or suddenly go to getting 80 percent of our healthcare and medical needs with 20 percent of the resources that we do today.

And I'm sure you've thought about it, especially from your trapper, intentional community, Cuban solidarity past. What insights can you merge with your Decouple hat and your medical knowledge, knowing about a potential Great Simplification in the future? What are your thoughts?

[01:41:10] **Chris Keefer:** Well, I mean, first off, I think, we'd be unlikely to see sort of this 80/20 rule playing out. I think 10 percent of the population would continue to get outstanding healthcare and ... That's what we see, right? And if we want to talk about like more sort of simplified societies, I mean, there's an upper crust elite, usually with the private healthcare system that gets U.S. style or similar sort of levels of care and there's MRI machines and everything else.

[01:41:36] **Nate Hagens:** Okay. So if society has 20 or 30 percent less resources, your view is the accordion

just stretches. So, got it.

[01:41:45] **Chris Keefer:** Absolutely. But, you know, I do think it's a really interesting question. I was looking at some Medicaid data recently and I don't have a photographic memory for numbers, but there's this idea of super utilizers, right?

So, something like 3 or 4 percent of people on Medicaid use 25 percent of the resources, right? And these are people with a lot of comorbidities, diabetes, heart disease, et cetera, that predispose them to be sicker and who need a higher level

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of care. So how do we manage that? While still, I hope, maintaining an idea of sort of universality, universal respect for human rights and human health.

And this is where I do not want to romanticize Cuba or the Cuban system. I've done that in the past as a kind of 20 year old Cuban solidarity activist. I think there's really interesting things about the system. A lot of nuance there, right? But, in Cuba, for instance, which the health spending would be a fraction of what they have in the U.S., they have pretty similar life expectancy stats, child mortality stats as the U.S. on a much smaller dime. How do they accomplish that? There is a huge element in terms of preventative care. Things are stretched now because they send a lot of doctors on humanitarian missions to earn foreign exchange to prop up the economy.

It's actually most of Cuban foreign exchange is earned through export of pharmaceuticals that they've got a biotech sector, but also human resources, doctors, right? They're kind of like the Philippines in that way, I guess, in terms of, not remittances, this comes back through the government, but they have a very interesting healthcare system that was constructed after the 1959 revolution.

And what it consists of is about 12,000 family doctor offices. It's a family doctor and a nurse. They live embedded in the community and they make health house visits. Every Cuban is labeled with a number one to five. And one means you're healthy, you got no issues, and you might get a doctor's visit a couple times a year.

Five on the other extreme is, again, you're diabetic that's had one of their legs cut off, their glycemic control's terrible, they've had a heart attack. You're getting a visit a couple times a week or every week. Are you taking your medications? These are the super utilizers, right? And so there is a very aggressive preventative medicine side of things and chronic disease management side of things, which occurs because of a highly structured and centralized and organized healthcare system which does value universality. And I'm not romanticizing it, again, because Cuban resources have been stretched thin. It has the highest doctor to patient ratio in the world, something like one doctor for every 200 people, but about 50,000 of those doctors are off on medical missions earning the government foreign exchange.

Talk to the average Cuban, just like any person in the world, they're going to bitch about their healthcare, but--

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[01:44:33] **Nate Hagens:** One doctor for every 200 people and that's the highest amount of doctors in the world?

[01:44:38] **Chris Keefer:** Yes, sir. Per capita.

[01:44:39] **Nate Hagens:** How much is it in Canada or the US?

[01:44:42] **Chris Keefer:** We're talking one per, I don't have the data in front of me, but high hundreds, one per 700?

There's countries where it's in the thousands, obviously, right? So anyway, so you have this primary care network, doctors and nurses embedded in the community. Again, how do you achieve really low neonatal mortality? Well, you're on top of your prenatal care, right? And their schedule for prenatal care puts us to shame, maybe it's even excessive, but you're getting blood pressure checks frequently to detect something called preeclampsia, pregnancy induced hypertension. You're getting a lot of health surveillance throughout your pregnancy. People don't fall through the cracks partially because, hey, this is kind of a police state that has information on everybody. But there is a kind of nanny state element where people are looked after and preventative medicine is really essential.

So, the health system is organized, again, with these primary care clinics dispersed right throughout the country, right? There's not areas where there's, rural areas in particular really prioritized. And then you have this next section of they're called polyclinicals, probably about 500 throughout the country, and they have basic specialties, internal medicine, pediatrics, obstetrics, gynecology, and they're kind of referral centers for those primary care doctors. And those are also really dispersed throughout the country. And then you have 13 specialist hospitals, so, neurology hospitals, trauma hospitals, transplant hospitals. So they have very specialized care available in terms of doing complex, congenital, cardiac malformation surgeries, but the focus is really in terms of getting the bang for the buck on that preventative care, that chronic disease management. And I will also say if you go to Cuba everybody plays an instrument or plays sports.

It is insane, the sports culture. The number of Olympians that Cuba produces is absolutely nuts, and again, I'm starting to sound like a blathering Cuba solidarity activist, and I really want to acknowledge complex society, a lot of nuance, a lot of

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stressors, internally imposed and externally imposed, but the health system is fascinating.

I've been to Cuba seven times. I did a research project with American scholarship students studying medicine in Cuba. Fidel gave, as a bit of a "f you" to George Bush, he gave 500 scholarships to mostly black, Chicano, and indigenous Americans who couldn't afford to study medicine in the U.S. and they went to what's, I think, the world's largest medical school, which is a scholarship school for the global South, apparently, to come study medicine in Cuba for free. And they were really interesting windows through which to see Cuban society. Because they're Americans, they shared, my cultural formation and background and questions and curiosities, and they were embedded very deep into Cuban society,

providing healthcare. Nothing puts you in touch with human beings like providing healthcare to them. As an Emerge doc, I see kids, I see elderly, I see women, I see men, I see the whole spectrum and it's an amazing window into life. So anyway, so they've been really useful at giving me sort of a nuanced sense of the Cuban reality.

Some of them had kids down there and could comment on that obstetric care. So anyway, just to sort of, I guess, give you context for these opinions.

[01:47:49] **Nate Hagens:** So, as an ER doc, although you just said something different than ER or emergency, you said you're an emerge doc, which is kind of an interesting--

[01:47:59] **Chris Keefer:** That's a Canadianism. Yeah.

[01:48:00] **Nate Hagens:** Is it? Okay. Well, I would think that there are emergent things that happen in those facilities. So, like how much of our medical system is just treating the symptoms and not the disease? And how much of our effort as a society, as a culture, as individual responsibility should be towards prevention and sports and music and all those other things?

Because once you get to the hospital it's almost too late. You're in the system and all that. Do you have any words of wisdom on that front?

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[01:48:36] **Chris Keefe**: I mean, we're really, like one thing you didn't mention is infrastructure, right? We talk about social determinants of health, things that make people sick. And there's biologic determinants, like maybe just have really bad genes, right?

Philadelphia chromosome and you're going to get leukemia as a child or something like that. But there's social determinants. And some of those again are sports or diet nutrition. Mental health is a product of living in an alienating environment, but some of them are just infrastructural, and maybe that's to the environmental crowd, less sexy.

There was a really interesting study done in Mexico, as a health intervention, and it was giving families a few bags of cement. And this had a huge impact on local health. So, if you have a dirt floor, you have worms and parasites on that, you have kids crawling around on it, you have kids infested with worms, they're anemic, they're having diarrhea all the time, they can't go to school, the moms are looking after them, the moms are depressed. Being able to pour a cement floor, I don't have the stats right in front of me, but dramatically reduced diarrheal illnesses, like by 70%.

[01:49:43] **Nate Hagens**: But I also read that those people that spend a lot of time in the soil and the dirt when they're kids don't have allergies when they're adults and that we should take our shoes off and walk in the bare soil and such.

[01:49:56] **Chris Keefe**: And get hookworms. Yeah. No, I mean, there is something called the hygiene hypothesis.

The IgE immunoglobulin branch of our immune system is targeted at parasites, at things like worms. And so if it's got nothing to do cause we live in such a hygienic environment, then yes. I mean, allergies are the price to pay for kids not having anemia. And like almost all kids, right?

And again, this is where the hunter gatherer lifestyle, you know, there would be different sort of health challenges, right? But humans living close together with animals presents all kinds of zoonotic diseases. Like where does the flu come from? Where does smallpox come from?

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All of these infectious challenges, not all of them, but a lot of them are from concentrated humans living with animals. And so no, crawling around on a dirt floor where there's animals and everything else, like roundworms are, let me tell you about the roundworm life cycle. It's horrific, right? So they come in usually through your foot, they bury themselves, embed themselves in your skin, and you'll see this long little, it looks like a little bit of rope or something under the skin surface, they get into a vein, they ride the vein up into your lungs, right?

It causes a bad cough, et cetera. Then they crawl up your trachea and then they get swallowed down your esophagus. Right? And then they lay their eggs in your intestine, they hatch some worms, etc, which leach off your blood supply, you poop out eggs, they get back in the soil, and the beautiful cycle continues.

I mean, it's like a, it's a disgusting sort of tour de France through your body. And so, yeah again, there's romantic ideas that it's nice to play in the dirt. And to a degree, yes. And particularly for kids in nice industrialized countries where the dirt's not, where we keep our animals in factory farms, I don't want to, I'm not going to go that far, but you know, where we're not living piled on top of our animals and the soil is not full of parasites.

Yeah, it's great. Let your kids crawl around in the dirt.

[01:51:40] **Nate Hagens:** So, clearly you have a lot of wisdom on this topic and we can't do justice in this conversation, but do you have any advice or at least directional thinking on medicine and The Great Simplification or healthcare in general?

[01:51:58] **Chris Keefer:** Yeah, I think the Cuban example is insightful.

Is it replicable? Not really, right? That's the product of a unique moment in time of a series of political ideologies and sort of social values that became encoded in a system that I think did really well in education and healthcare and screwed up a lot of other things. We're not about to have a sort of centralized government in the U.S. that rationally distributes health care according to the needs of the population on the values of sort of universal equality, et cetera. But I do think, again, that question of if we want to reduce health care costs, a big thing is we have something called an acceptable miss rate, right?

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So in emerge, we order an insane amount of diagnostic tests because our tolerance to miss a heart attack is something like 1%. If you have a kind of, it's, this isn't how lawsuits happen, right? But like we want to get people down using some Bayesian reasoning to a risk level of around 1 or 2 percent with something as serious as a heart attack.

And so, basically every single person with chest pain gets a troponin drawn, which is a blood test that looks for an enzyme that should only be inside heart muscle, if we see it in blood, then some heart muscles of, cells have broken open and spilled troponin, so that is an enormous burden.

And we also have medical interventions that, frankly, don't have a big payback. A lot of actually cancer screening has very poor evidentiary base in terms of, on a population level, actually saving lives. That's not a popular thing to say, but it's objectively true. There's a lot of therapies.

I mean, there's cancer drugs that extend life by a month or two, right? That come at great cost. I mean, I just lost my dad to cancer. He wasn't on one of those really expensive drugs, but I get it. I absolutely get it. Very interestingly, just as a sort of side note back to nuclear, my dad got a medical isotope that's produced in a CANDU reactor, It's tagged to a molecule that specifically finds a receptor on prostate cells, binds to them, and it's kind of like a radio pharmaceutical that radiates just the cancer cells in that way.

Anyway, I don't know if your loved one had a really complex medical condition and needed an expensive treatment, I think it's hard to say no to that. So I'm not sure what it looks like, but certainly there's a lot of excessive testing that goes on and borderline treatments like, again, like things like, and I'm not about to give medical advice on your podcast here, but like a lot of people have this concept that one intervention, one cure, right?

It's called the number needed to treat. So if you have appendicitis and either we can manage it sometimes just with antibiotics, but if I do surgery on you and I take out your appendix, I've done one intervention, I've saved you I've saved one life, right? There's things like trying to manage cholesterol to prevent heart attacks, right?

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And then the number needed treat goes from maybe one for appendicitis up to sort of three, four hundred to prevent a single heart attack, you might need to be on that anti cholesterol medication or you might need hundreds of people to be on an anti cholesterol medication for five years, diligently, to prevent one heart attack.

On a population level, is that worthwhile? Maybe. And with antihypertensives, we certainly think so, right? So, there's a lot of nuance here, but if you were going to ruthlessly develop a cheaper healthcare system, you'd probably look at the numbers needed to treat, the numbers needed to investigate to prevent bad outcomes.

There's a way that the math whizzes could do that. I'm just not sure that we'd, just as we won't willingly sign up to degrowth, I don't think we're going to willingly sign up to sort of degrow therapeutic options.

[01:55:32] **Nate Hagens:** No, we're not. But I think as much as our society is unsustainable, our current Western healthcare model is unsustainable.

So, maybe we come back and do a deeper dive on that sometime. So, in lieu of asking you medical recommendations for my viewers, what about just general lifestyle behavior? Polycrisis, human predicament, preparatory recommendations for my viewers. Do you have any?

[01:56:02] **Chris Keefer:** Oh, man, it's going to be very generic, right?

I mean, eat well, get good exercise, stay fit. I mean, I think, stay positive and I'm kind of, because I listened to your podcast so much, Nate, I do know some of the questions that are coming and a big part, I think a biggest part of if you're wrestling with this question of a Great Simplification and I wrestle with it,

sometimes I discount it altogether, I look at it as a kooky idea, I come back to it, I read your book, I read your work, et cetera. But, it's certainly, it's doomy. It can provoke a doom reaction, right? And I know that's not your intention, but certainly I think a lot of people come across it and they go, "We're fucked. We're in big trouble." And what's the psychological reaction to that and the sort of mental health reaction? I think very important that this message is coupled with an idea of agency. The kind of climate concern amongst western youth, for instance, is crippling. People commit suicide over this stuff.

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People fall into it. They see therapists about it for years. The antidote to anxiety is empowerment, right? And, I would, me and a couple friends have thought about this but never taken it on, so I'll spill the idea out here and if someone wants to run with it I'd be very happy if they did, but this kind of 50 careers for climate book we were thinking about. For myself, when I was thinking about getting into medicine, or as a youth, if you're looking into, I don't know what I want to be when I grow up, teacher.

Okay, but there's so many uninspiring teachers. When you find that one teacher, that one role model that just blows your socks off, that makes you want to be a teacher. You want to be like them. You want to identify someone who's done something heroic in an otherwise, medicine could be a really boring profession.

There's a lot of mediocre doctors or uninspiring doctors or unfriendly doctors. You need to find someone who inspires you. But I think like really having a culture of try, of excellence, like yes, we have a brutal crisis ahead of us. Equip yourself, empower yourself so you can help your fellow humans, right? Like I think that's a vital part, in terms of trying to answer your question there about how to stay healthy in this kind of coming metacrisis, if your predictions are true, Nate.

[01:58:09] **Nate Hagens:** I totally agree with you.

[01:58:10] **Chris Keefer:** What I don't want to see is the sort of, and what I do see all the time is the tune in and drop out.

Right? I guess, is that like Timothy O'Leary? I can't remember my drug culture, this 1960s drug culture lore well enough, but in terms of the kids out at the climate protests. It's yeah, okay, we get to quit school for a day. Awesome. And we don't make up for it by studying more on Saturdays so that we can become whatever it might be, like one of these careers for climate.

Maybe you become a biotechnologist and you're able to genetically engineer a crop that's heat tolerant or saline tolerant for instance, right? I mean, you can do everything. Maybe you become an artist or musician and you raise people's spirits in a difficult time, but don't tune in, drop out.

Try, and let's organize our society. I mean, like in response to the Cold War and the space race, there was a massive effort in the states to have rocketry clubs and a

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big investment in education because we didn't want to fall behind on the missile gap. I mean, the motivations might have been terrible, but like when you face a crisis, empower your youth, right?

Invest in them, provide them with compelling narratives, because I'm just worried that with some of the reactions people might have to your message, they get depressed, they get deactivated, they get disempowered, and so I think that's that challenge of how to communicate realistically as you see it, a bit of a, well, frankly, pretty pessimistic future, how to couple that with, humanity's been through brutal dark times, fuck, we've been through the Holocaust, we've been through World War II, we've been through... the last 40 years have been pretty amazing.

[01:59:37] **Nate Hagens:** Some of us have been through the Holocaust, but I get your point. I totally agree with you. A few follow on comments and clarifications. I'm not so much predicting the future as I'm laying out the different scenarios that I see and neither one is good. Business as usual headed to a Mordor economy fueled by new productivity increases continue to widen the size of the straw that draws down our finite natural capital and the ecosystem sink capacity of the Earth will eventually itself lead to a simplification.

Or if that doesn't manifest, we have the musical chair situation of our financial claims not being supported by the underlying resource access. So it's more of painting the scenarios, but I will say if the result of this podcast is generally tune in and check out, I will have failed.

[02:00:40] **Chris Keefer:** No, and I'm certainly not suggesting that, but that is a common reaction.

[02:00:44] **Nate Hagens:** I mean, it's not in my control. It's in control of the viewer's response. And I guess I have a responsibility, as do you, as a hosting of public conversations, to steer towards the empowering of people, but I'm just a guy.

You're just a guy. We're just trying to unpack with the nuance, complexity, and context a very complicated, emergent evolving situation. And it's not easy. So, I really recognize the potential for getting mental stress from hearing these topics. And so far, I still fall on the decision that that is much better than the alternative, which is some sort of toxic positivity.

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Oh no, that's doomer stuff. Ignore that. We've always solved problems before and we will again. In order to solve our problems we have to understand the system that we're a part of, which is your work and mine.

[02:01:56] **Chris Keefer:** Well, and Nate, that's exactly where this question of having diverse viewpoints is so important.

One person can't take on the burden of like, hey, my message is a bit worrisome. I'm going to make a few people anxious. And you're one voice in a wilderness of different voices and your voice is, it's been very influential and powerful for me and I think many others that follow the podcast. But you don't need to take on all that responsibility.

There's a number of other voices, and thank God, there is a diversity of opinion. Like the super abundance people drive me totally crazy. This is an example of sometimes when well articulated, I'm like, oh, that's interesting. That makes me think about it a bit differently. But I mean, just to kind of summarize the thesis, it's listen, Julian Simons was right.

Paul Ehrlich was wrong. They bet on a bunch of commodities. They got cheaper, not more expensive, despite resource quality going down. It's all about human ingenuity. The more humans, the better, as long as there's a free market and kind of liberal democracy or whatever, right? And humans are the master resource.

And it's interesting, and it does point to the importance of technology, but as I've come to see it, there are three sort of fundamental variables to how long we can ride this roller coaster we've been on and there's kind of materials and we know that we access the best first, ore grades are declining, we're in a bit of trouble there in terms of materials.

We're papering over that with still very abundant and relatively cheap energy and technological innovation. So the super abundance people are right, like the technology, the human ingenuity part's really important. They're delusional because they're ignoring those other two factors.

They're saying they can just be papered over.

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[02:03:30] **Nate Hagens:** And the ecosystem thing, which is a big part that's missing.

[02:03:34] **Chris Keefer:** Yes. Yes. I tend to, like Nate, like I'm definitely in camp human. I'm definitely like on the humanist side, like if I'm in the zoo with Harambe and the kid falls into the enclosure, I'm sorry, I'm going to shoot the gorilla, right? And part of that comes out of being a father. Like again, I'm just anticipating your questions. What's most important to you? I guess like my son, right? My fiancée is right up there, too. I don't know if she's listening. Mom, et cetera. But like we are social creatures in the social web.

I think there's a temptation amongst people that probably don't like being called Malthusians, of, ah man, we're a virus. There's too many of us. And of course that always sort of begins at the end of your moral community, of your social network, of your family, friends, when you get to sort of being able to dehumanize people because you just don't have any social relations with them.

But that's a really, for me, this is like the most difficult thing to disentangle because yes, I love the natural world, right? And we need to also just for the benefit of humanity, maintain biodiversity and pollinators and insect populations and stuff like that. But I'm not sure what I'm willing to sacrifice in order to do that.

And I don't pretend to have an answer, but I think, again, part of me is like, I'm confused. I haven't reached a conclusion. Why should I be talking about this? But this is the discourse that we need. And we need those delusional super abundance people. We need people that are saying, hey, there's firm limits.

We need people to say, yeah, but we've overcome them before. I mean, people will say, yeah, but that ends somewhere. And maybe that ends because of material constraints or energy constraints, right? Cause technology ain't going to keep soaring if we don't have these other two and I'm leaving with the middle finger, you know what I'm saying?

[02:05:09] **Nate Hagens:** I'm going to take your previous answer on removing Twitter as your magic wand answer, which leads me to the final question. If you were to come back to this show, and I expect you will, what is one topic that maybe we touched on or didn't even cover today that you would be interested in taking a deep dive on that you think is relevant to human and planetary futures?

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[02:05:39] **Chris Keefer:** Again, like I'm someone who's not siloed. I don't have, like medicine might be kind of an area where I've got a bit of deep depth and knowledge because of all the years put into studying it. Like I find it incredible. Sometimes my influence, specifically kind of politically, like we've had really enormous success in terms of the long shot campaigns we've run in Canada to save a nuclear plant called Pickering, for instance.

And I'm like, why are people listening to me? I'm a doctor, hobbyist, podcaster, and it's because I'm able, I think, to kind of weave compelling narratives and tap into a incredible network of experts, while not being an expert myself. So, sometimes I'm a little insecure. If I'm coming on your podcast and we're going to deep dive something, I got to confess to you, I'm not an expert on really any one thing.

It's more sort of pulling together the information that I have into narratives. I do think this question of trying to, like for you and for your project, there's a lot of time spent in, well, imagining a future of what a Great Simplification looks like. I think that needs more voices.

Again, I haven't listened to every episode, right? But I think the people that you generally have on to kind of imagine that with, if I'm frank in terms of my judgmental opinions, which are under researched, I'll be fair, but tend to be folks from the kind of progressive environmental left, permaculture sort of crew.

And I would like to see, and maybe could contribute as someone offering a bit of a different perspective that doesn't, it's not that I don't appreciate those voices. And I think it's important that there's people that study some of those concepts, but anyway, so I don't know if that answers your question, but I don't know that I'd be able to come on and talk, deep dive a topic, but like everything we've touched on today has been

interesting. And we've scratched the surface, so there's more depth.

[02:07:21] **Nate Hagens:** Okay. So, we'll have to think of a title for this episode, but the title for the episode that you come back will be something like a non progressive lefty permaculture view of The Great Simplification.

[02:07:35] **Chris Keefer:** Yeah, I don't, I'm not in the permaculture camp, unfortunately, so. See? Disgusted party.

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[02:07:41] **Nate Hagens:** The disgusted party. Dude, this has been great. I really appreciate your authenticity and the fact that you're not siloed and the fact that you're nonpolitical and the fact that you deeply care about all these things. Do you have any closing words for the viewers and listeners?

[02:08:00] **Chris Keefer:** No, I mean, Nate, again, your work sent me on a bit of a rollercoaster of my own in terms of, I was like, should I keep calling my podcast Decouple? Is decoupling even possible? For brand recognition I've definitely kept the name. But, yeah, I've really enjoyed, and I'm not just trying to fluff your ego here, I've really enjoyed your contributions to this question of the human predicament. It's shaped me quite deeply. So I don't know. I just, I want to express some gratitude. I would love it if people from, in terms of some shameless self promotion, I'd love it if people who were interested in this conversation wanted to jump over and check out the Decouple podcast.

Actually the very first episode, the audio is not the best, but it really sort of, it's a time capsule. It kind of elucidates my thinking from 2020. This idea of decoupling, which I think has holes in it now. But yeah, I mean, let's just keep learning together. Let's be tolerant. Let's really pursue free speech as a core, core value.

And let's fuddle through this and make the best of it that we can.

[02:09:05] **Nate Hagens:** Thank you, Dr. Keefer. To be continued, my friend.

[02:09:08] **Chris Keefer:** Absolutely.

[02:09:12] **Nate Hagens:** If you enjoyed or learned from this episode of The Great Simplification, please follow us on your favorite podcast platform and visit thegreatsimplification.com for more information on future releases.

This show is hosted by Nate Hagens, edited by No Troublemakers Media, and curated by Leslie Batt-Lutz and Lizzy Sirianni.