The Great Simplification

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[00:00:00] **Jean-Baptiste Fressoz:** You don't do an energy transition. Energy transition is just a slogan. It's not a serious scientific word. What you do is you decrease the carbon intensity of the economy. We have been here before. Technological progress and solar panels is part of the history of technological progress. It is an old story.

[00:00:15] We are not on the threshold of a complete revolution. Bonjour.

[00:00:23] **Nate Hagens:** Today, I am joined by historian of science and technology, Jean Baptiste Frézeau, for an overview on the history of energy. Jean Baptiste is a senior researcher at the French National Center for Scientific Research, as well as professor at the National School of Bridges and Roads. He is the author of several books, most notably his recent titled More and More and More, an all consuming history of energy.

[00:00:54] Which is the subject of our conversation today. Jean Baptist unpacks the common misperception in the field of historical energy dynamics that have led our popular, memes and stories about the false possibility of the energy transition to a world entirely run on renewables, which longtime listeners of this show know as one of the core precepts, of the great simplification.

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[00:01:39] So we appreciate your subscribing and sharing with that. Please welcome professor Jean Baptiste Fresseau. Jean Baptiste, great to see you. Hello Nate. Publis has sent me your book more, more, more, boy, we have a lot in common, Mon ami. so let's get into it. In your book, you describe the history of energy.

[00:02:04] which is a topic that is central to this podcast, not in terms of transitions, which is commonly perceived, but as each type of energy building on

top and becoming interlinked and entwined with the others, we're going to talk about that. But can you start by describing the first moment that you personally.

[00:02:25] recognized these misunderstanding, misunderstood patterns in, in human history with respect to energy.

[00:02:32] **Jean-Baptiste Fressoz:** Yeah. the book is really a book of history mainly. And I was surprised when I was reading, history book on energy. I mean, books written by colleagues, working at universities, that for incentive, I mean, they had a very classic, kind of, way of presenting the different times you, you had, the first chapters are going to be about food and hydro hydraulic energy about the 18th century, the pre industrial times.

[00:03:01] Then you've got the 19th century chapters, industrial revolution, coal, and the 20th century will be about oil. But as everybody knows. I mean, we consume much more coal now that, anytime in the 19th century, right? I mean, the great century of coal is, of course, the 20th century, even the late 20th century.

[00:03:20] so I think there was, I mean, there, there was really, something wrong in the history of energy, which is very. I mean, typical of history of tech in general, they were focused on the new at each epoch at each time. so there is a whole bunch of work on cold Britain in the early 19th century. Right.

[00:03:39] It's not that very important, you know, I mean, Britain and call is over done in the, in the 19th century, I think. So, I mean, the I had this feeling that there was something really wrong about the general framing of these very general histories of energy, from the like 10 years ago. And then I was, working on the history of light production in the 19th century.

[00:04:03] And of course, mines are places where a lot of artificial lights, was, where, what was consumed. I mean, because of course it was, done in darkness. And, looking at the, all the inputs that went into mine, and coal mines, I was amazed by the enormous quantity of wood, of timber, going into coal mines in Britain in the, in the 19th century.

[00:04:27] And then I started to realize that actually Britain in the 20th century used more pit props, more wood. In forms of pit props, then it burned in the 18th

century. What's a pit prop? Yeah, it's, well, timber mining. You know, you need timber to, support the roofs of the, of the coal mines. And I mean, coal mines are huge infrastructure.

[00:04:50] There are thousands of kilometers of underground tunnels. So you have to, to support the roofs. And the quality of, of food was really staggering. I mean, if you take the case of Britain, Britain consumed like 4. 5 million cubic meters of pit props in the 1900 in the early 20th century, Britain burned only 3.

[00:05:10] 5 million cubic meters of firewood in the 18th century. So it means that I mean, for its energy production, Britain used much more wood in the 20th century than it did in the 18th century. So all sorts of narrative that you find in this geography about the Industrial Revolution being a transition from, from wood to coal, or being an escape from an organic economy, all this is really deeply wrong.

[00:05:35] I mean, Britain used more and more forest to produce energy in the 20th century than it did in the, in the 18th century. So. I mean, I, I really, I really think there was something really deeply wrong in the, in the historiography of, of the energy and why I think it is extremely important. It's because history has a key ideological role in the discourse about the energy transition.

[00:05:55] I mean, it is amazing when you, when you're a bit, cautious about that and, you've got like a, an historian here. It's amazing the amount of rubbish that is being told by politicians about the history of energy. And so like John Kerry. You know, the U. S. Envoy on climate change and, the failed candidate against George Bush Jr is following this issue of climate change since the 1980s.

[00:06:23] So he should know about that, right? And recently, he said in the Financial Times, the energy transition is like a new industrial revolution. As if there was something, you know, as if there is something analogous between the industrial revolution and, and what we have to do for in the face of climate change, all these, integration of what we have to do inside a kind of historical narrative is really very common.

[00:06:49] I mean, it's not only John Kerry. I mean, I can give you dozens of examples like this.

[00:06:54] **Nate Hagens:** I have so many questions. let, let me start with this, the pit props today and coal mines. What are those made from?

[00:07:01] **Jean-Baptiste Fressoz:** I mean, today we don't use, I mean, normally in modern mining, you don't choose pit props. You use a complex system of roof support, hydraulic roof support.

[00:07:12] This is the kind of technology which is not very well known, but it's of tremendous importance because, I mean, coal mines have been thoroughly modernized after the 1950s and 1960s. In Europe and in the U. S. And all this new technologies most of the time they actually invented more in Western Europe in Britain.

[00:07:33] Mainly, it's like new coal cutters, huge machinery, which had tremendous importance for the modernization of coal mines in China. So I think it's kind of interesting because these technologies are not, you know, considered as so important, they are not very visible because they were invented in, coal mines or, or industrial, I mean, industrial mining that were in decline, like in Britain in the 1960s, 70s, 80s, but in fact, These were immensely important for economic growth of the of the early 21st century, because these machines built by obscure British engineering firms were sold massively to China in the as soon as 1960s and 1970s, and especially after China opened up in 1978.

[00:08:21] And that a tremendous importance in the growing production of coal in China. So I mean, it's an example of, you know, this kind of technologies that are not central in our vision of the 21st century, but which are materially extremely important, I think.

[00:08:35] **Nate Hagens:** So in your book, you explicitly state that you do not separate separate out historically the production of energy.

[00:08:43] From the production of materials in effect, using wood for construction or steelmaking in your analysis on this is especially relevant when looking at that wood and timber. Why did you make that choice? And what was your observation that energy and materials are so linked?

[00:09:03] **Jean-Baptiste Fressoz:** Yeah, I mean, it's actually quite impossible, I think, to have a proper history of energy without a history of material.

[00:09:08] And when you separate the two, you reach very strange conclusion, for instance, the fact that Britain didn't choose any, wood to produce energy in the 20th century. I mean, it's because they, of course, pitch props, timber mining is considered as construction timber and not as, wood energy, but in fact, it's wood, which is used to produce energy.

[00:09:29] So it's just a statistical convention, which is highly debatable, right? the other reason is basically to understand, for instance, the history of oil, you need to have the history of steel because All the oil infrastructure is dependent on steel. I mean, you extract oil with steel tubes. You burn it in motors that are made of steel and the power machines that are made of steel.

[00:09:55] So you, you really need to, to, to, to put all this together to have any clear on the Understanding of what is the materiality of the the history of the materiality of the of the 20th century in the same way with cement. I mean, oil without cement to be quite useless, actually, because you had you would have no modern roads, right?

[00:10:14] Bridges and so on. So, yeah, I think it's crucial to to to really think that together. That would be my answer. I mean, basically, what what strikes me in the previous historiography that, you know, my colleagues tend to be very specialized. You've got experts on the history of coal, experts on the history of wood, experts on the history of oil.

[00:10:35] But in fact, many important things happen at the intersection of these materials and these energies. And what I was interested in is really what, what happened at the intersection of this, of this materials and energies. I mean, you understand. Not so much the history of coal, if you don't have the history of timber that allows you to, to extract the coal.

[00:10:53] **Nate Hagens:** A major focus in your book is wood, which I think the average person thinks has been phased out as an energy source. Can you give us an update on the state of timber, as both an energy source and a material resource in the world today?

[00:11:09] **Jean-Baptiste Fressoz:** Well, I mean, huge topic, but basically, you know, the idea that it is phased out is really, really wrong.

[00:11:14] I mean, the, the production of timbers in the world has doubled in the 1960s from two gigatons to four gigatons. Half of this timber Is used for, for producing fire, firewood. So, today we use 2 gigatons of, just to burn it, right? wood is a key energy source for 2. 3 billion people on the planet. A key source of heat, domestic heat to cook food, basically.

[00:11:49] So, wood is extremely modern in a way. We have never used as much wood as today. I mean, the strange statistic that really I had to check twice to, to, to really, be sure of my fact, but wood energy today is twice. nuclear energy, right? I think this is a striking element of the, I mean, demonstration that we live with old sources of energy.

[00:12:12] I mean, despite more than 60 years of, of nuclear engineering, wood energy is much more important than nuclear energy, right? another interesting case is charcoal, you know, charcoals in old fashioned. I mean, you know, in the olden days, we were doing still with charcoal, but in fact, charcoal has expanded tremendously with the organization of the poor world.

[00:12:37] in sub Saharan Africa, charcoal consumption has been multiplied by six. It's in the 1960s and charcoal is really an urban technology. It allows you to use wood energy in an urban urban setting in large cities, large cities of the poor world, like Lagos, Kinshasa, burn two million tons of charcoal per year.

[00:12:59] This is more than all the wood burned by France in the 19th century, for instance, you know, it's really a huge amount of, of, of wood. So really we have to, to get rid of this idea that there are old sources, sources of energy, new sources of energy. This is really, really a deep, a wrong way to, to look at the, at the, at the, at the history of energy.

[00:13:18] **Nate Hagens:** I don't know how much you know about my work, but I've told the story of, emergent, at, Large scales phenomenon that I refer to as the economic superorganism, which humans, in aggregate seek out, profits, which are linked to energy and there has been no energy transition. There's only been an energy addition is a phrase that I commonly use.

[00:13:46] So renewable energy is just adding, an appendage to the organism. It's not yeah. We're getting rid of this and we're using this new thing. It's additive. So let's, let's take that story back to the 19th century. What happened to wood use once we found coal, like in the decades after?

[00:14:08] **Jean-Baptiste Fressoz:** Okay. First of all, globally, firewood has increased despite coal, right?

[00:14:13] I mean, as you said, this is just an addition, right? First of all. And secondly, I think, but it's more than, more than an addition. It's a symbiosis. I mean, because of coal, you need. more and more wood for the mines, but also for the railway ties. I mean, to, to, to, to, to, to have the railway network, you need, you, you need a huge amount of food for, for packaging.

[00:14:36] Packaging is an enormous consumer of wood and construction. I mean, just with the expansion of cities, you need more and more wood. I mean, for all sorts of reasons, of course. So, yeah, I mean, no, really, it's much more than an addition. It's a symbiosis of all these new energies and materials. And this symbiosis goes on and on and on.

[00:14:56] If you take the case of oil and wood, I mean, you've got, with oil, you've got much more wood. Because suddenly wood is cheaper because you've got chainsaws, trucks, and so on, which makes wood much more accessible, much more economically available. And because of oil, you've got an expansion of the economy, so you've got more and more goods to package, so you've got an expansion of the paper industry to produce all this, cardboard, and the paper industry is an enormous consumer of energy.

[00:15:25] You know, it's a fourth industrial consumer of energy, and it is mainly an energy derived from wood. So because of the growth of the economy, you've got more and more wood energy, even in rich countries, because like two minutes ago, I was talking about the poor world and so on, but rise of food energies.

[00:15:43] Also true in the rich world. I mean, in Europe, wood energy has more than doubled in the early, 20th century in, in, in, in the U S has expanded a lot in the, since in the, in the 20th century, especially in the industry. I'm

[00:15:58] **Nate Hagens:** nodding and I'm sighing, because I know that the longtime viewers of this podcast who care about the environment are, are getting a growing pit in their stomach from hearing what you are, unpacking.

[00:16:14] So keep going though. I have lots of questions, but I want you to unpack your core thesis. So does this symbiosis also happen? on top of wood and coal, but then with oil and, and on top of that, on top of that.

[00:16:29] **Jean-Baptiste Fressoz:** Basically, if you've got, oil, oil depends on, on coal and coal depends on wood in the 20th century.

[00:16:36] So all these expand together, right? I mean, there is no reason to think this energy is in a position. This is really the wrong way of saying it. I mean, it's, it's because we have this vision, then I can explain where it comes from, where you imagine energy is like in competition. You know, like Darwinian history of energies being in competition, but this is just wrong.

[00:16:55] I mean, in certain limited sectors, you've got this kind of competition. Let's say, all displaced coal for running motors because steam engines are extremely inefficient. They are dangerous. So you get rid of them and you put diesel engines that that is true, perfectly true. But these diesel engines, the power shift that are made of steel.

[00:17:15] So they consume a lot of A lot of steel, right? I mean, I'll just give you another example, which I think is clear. In the 1930s, Ford needed seven tons of coal to produce a car. This is more, in terms of mass, than the oil that this car would burn in its lifetime. So when you think about car, you have to think about coal.

[00:17:38] I mean, car is always connected to, of course, oil. I mean, which is natural. But in fact, car is also a coal technology. And today in China, you need 2 to 3 tons of coal to produce a car. I mean, even today, coal is the main ingredients, in a car in effect.

[00:17:55] **Nate Hagens:** But China is making electric vehicles in order to help emissions and air quality, but they're using coal to build the cars.

[00:18:04] **Jean-Baptiste Fressoz:** Yeah, I mean, to build a car, to power the car as well, because they have got, I mean, coal is still a very important, provider of electricity in China. I mean, the case of the electric vehicle is interesting because it is touted as a green technology, as a climate friendly technology, especially in Europe.

[00:18:22] I mean, the fact that more than half electric cars are in China and the fact that 60 percent of electricity in China is produced from coal show that the electric vehicle. I mean, historically, and first and foremost is probably a technology of national sovereignty for China, which is heavily, I mean, for, for, for, for, it needs to import lots of oil and it depends on the goodwill of the US to let this, all this oil flow.

[00:18:51] So yes, I mean, the electric vehicle is extremely important in strategic terms for China because it reduces its dependence on oil and coal is very abundant on the other hand in China. Yeah.

[00:19:01] **Nate Hagens:** Yeah. Yeah. I assume your analysis historically is a global one. Are there exceptions at, at a local level? for instance, some countries in, especially in Europe have reduced their coal demand.

[00:19:15] England just closed its last operational coal plant. So in England's case, there is a transition away from coal, even though there is not globally. What are your thoughts on that?

[00:19:27] **Jean-Baptiste Fressoz:** I would say that in England, in the electric sector, there has been a transition. You know, the electric sector of Britain is no more or very little, I mean, hardly any coal.

[00:19:35] But I think we have to relativize the importance of this transition because most of the discourse on transition are centered on electricity and electricity production, but I mean, electricity production is, I mean, importance. It's 40 percent of the emissions. Okay. So on these 40 percent of emissions, we, we have rather good technologies to decarbonize, but it is not new.

[00:19:59] I mean, I mean, in, in, in the electricity sector, 40 percent is already decarbonized actually, thanks to hydroelectricity first and foremost, and thanks to

nuclear and more and more thanks to, windmills and, and, and solar panels. So I, I mean, Lot of lot of reasonings about the energy transition actually comes from our obsession with electricity, and we have projected ideas that were quite well about electricity to do to the whole economy, and that is not the right way to do because many sectors are extremely difficult to decarbonize.

[00:20:36] Everything that involves material productions, cement, steel, plastic, agriculture is also difficult to decarbonize. And just to come back to the case of Britain, then you have to see that Britain is part of a global world and it has a very large commerce, international commerce, and it imports a lot of goods that are made from coal, right?

[00:20:56] There is a huge difference, especially for the cases of Britain and France, countries that are. that have really disindustrialized in the 1970s, there was a huge difference between the, the, the national carbon footprint and the total carbon footprint for the case of France, it's almost a double. I mean, France, if you look just at the, at the national emission, it looks pretty good.

[00:21:18] I mean, like between four and five tons per. Perceive of CO2 per capita per year. It's pretty good. but if you take all the imports, then it's more like nine to 10 tons. It's almost a double, you know? So, I mean, all these make me very, suspicious of the discourse that's, you know, We are, I mean, we are the first to, to really, like Europe is so much in advance.

[00:21:42] No, like all rich countries, European countries depend on global flows of materials, goods, and so on. That depends on coal, gas, and oil, obviously.

[00:21:54] **Nate Hagens:** I had a French woman on the show last year, Olivia Lazard, who has a very concise statement that decarbonization of the energy sector will lead to a re materialization, which sounds like you're aligned with that logic, that if we try to improve.

[00:22:13] Thank you. 100 percent decarbonize our electric sector, which granted is only 20 percent of our total energy use, that that will require lots more of the symbiosis that you discuss, with materials like copper and lithium and, and all the things. What, what are your thoughts on that?

[00:22:33] **Jean-Baptiste Fressoz:** I mean, I think we have to differentiate between electricity production and all the machine that are going to consume this electricity.

[00:22:39] And I think for, of course, solar panels and windmills do consume steel, silicium, so they emit CO2, but it's not that much. We have to recognize that pretty efficient, actually, in terms of CO2 versus the electricity they produce. They're pretty neat way of producing electricity. But the key problem is rather what we're going to do with this relatively clean.

[00:23:02] Electricity. If it is to power exactly the same world, the same material world made of 1. 5 billion cars, which are driven on road that consume cement and that, foster the expansion of cities, of, more and more houses, bigger houses and so on. Then I'm not sure that We're going to, I mean, to, to go very far with this, with the solution.

[00:23:28] So, I think we really have to differentiate between the, the, the, the, the solar panels and the electric cars. For me, there are two different technologies. One is extremely useful. one has to be really, seen as kind of, you know, environmentally friendly compared to, to a gas plant or a coal plant, even worse.

[00:23:46] But the electric car is much more debatable.

[00:23:48] **Nate Hagens:** Well, I mean, that's what I've been saying lately is the energy transition is not changing one type of energy for another. If we're ever to really have an energy transition, it would have to be changing our relationship with energy, what we use energy for our relationships with each other and with the natural world because it's not just going to happen from technology.

[00:24:09] **Jean-Baptiste Fressoz:** And it's also, we have to shift our relationship with the organization of capitalism. I think this is a key topic. I mean, a topic we should not be shy to talk about.

[00:24:18] **Nate Hagens:** But isn't capitalism the real driver of the title of your book, More More More? And even underpinning capitalism is the maximum power principle in biology of humans, which are biological organisms trying to access an energy gradient.

[00:24:35] **Jean-Baptiste Fressoz:** No, I agree that, I mean, the problem is even deeper than capitalism, that I agree with you. I mean, it's going to be, it's much easier to imagine a world without capitalism than imagine a world without CO2, I think, and without carbon, you know, but what I meant by capitalism is because I'm quite angry about the way economists have been thinking about what we have to do with climate change.

[00:24:56] They have fostered this idea that we're going to decarbonize everything. All sectors, all technologies are going, we're going to have exactly the same or more or less the same world, but carbon free with green innovation. This is really wrong. This is rubbish. This is, this pertains to a very, I mean, very simplistic technological utopia.

[00:25:18] So I think what bothers me is that because of this idea of going to decarbonize everything, we haven't talked about the quantity of goods we produce and the repartition of goods.

[00:25:27] **Nate Hagens:** I totally agree with you. And I'm just wondering if. If you, in your scholarly, position and observing all this, if you believe that those people truly believe that we can decarbonize and keep today's economy going with close to zero carbon, or if admitting that that can't happen, implies much deeper, more serious, politically awkward, questions and inferences, therefore it can't be stated.

[00:25:59] **Jean-Baptiste Fressoz:** I'm not in their minds, so I can't answer your question, honestly, but most of the production is aimed at showing that, yes, you can have carbon neutrality by 2050 or 2070 without any kind of degrowth, without having any hard choices. And I think this is, this has been a very powerful message, you know, which has been very, I mean, of course, it's, it's very palatable to politicians, government, and even to the population in general.

[00:26:26] I mean, you should not blame stupidly the politicians. We are part of it. Right. So I think that they have played a role of, you know, disinhibition. Yeah, it seems to be under control because we can't do an energy transition. All this, all these things seems to be under control. And, and, and I want to come back to this idea of repartition.

[00:26:46] I mean, CO2 can be useful. I think we should not demonize carbon. It's ridiculous. Like cement, for instance, cement is not bad per se. I mean, there are good use of cement. If you see, if it's. To build a bridge, where you need a bridge. Okay, let's, let's admit the CO2. If it's to, to build a proper, water network in a poor city, in a city of the poor world, it's certainly worth emitting the CO2 that, this cement, entails, but if it is to build another skyscraper in Manhattan, Yeah, you can discuss that, right?

[00:27:22] But when I was talking about capitalism as, as, as one of part of the problem, it's because in our world, building a skyscraper in Manhattan seems to be more useful because there is so much money to be made. Of the skyscraper, because the square meter is very expensive, it seems more useful than building a water network in the pool world, because there is little money to be made.

[00:27:43] Right. So, yes, I think because of that, we don't have the discussion, which is where do we want to put our little CO2 left in terms of CO2 credit? Where do we want to put it? You know, where, where does it maximize the welfare? On a global scale, I think that the economics of climate should be about that. And it is not,

[00:28:03] **Nate Hagens:** I agree, but of course it's more complex than that.

[00:28:08] I believe that we're at or near the top of the carbon pulse because I track what's going on with oil, globally. And there's lots of oil. Don't get me wrong. but. The easy stuff, the cheap, high quality stuff has mostly been drilled, extracted and burned. And so what's left is harder to access, more complex, costlier in countries that don't necessarily like, the current unipolar world.

[00:28:38] So what would happen with that in mind? What would the decline of oil supply or even a flat period in oil supply mean for the availability of all the rest of the, industrial energy sources given your symbiosis thesis?

[00:28:55] **Jean-Baptiste Fressoz:** I think the main problem Is that there is so much, fossil fuels that we can burn the planet before really having to face the end of the carbon pulse.

[00:29:07] And the, I mean, the, the, the, the, the end of all fossil fuels, because you have to think coal with oil at the same time, I think it's a question of century. It's

not a question of decades. So I think there is a different time frame here, which we really have to, to keep in mind.

[00:29:21] **Nate Hagens:** The end of the carbon pulse is a very different thing than the peak of the carbon pulse.

[00:29:26] **Jean-Baptiste Fressoz:** Yeah, exactly. The peak is that when we're at

[00:29:27] **Nate Hagens:** the absolute top, which I would, I think is this decade. I mean, so far, November, 2018.

[00:29:32] **Jean-Baptiste Fressoz:** I agree. I agree with you. But the problem is we have more like a plateau, after the, after the peak of the, of the, of the carbon pearls. I think the, the main problem is for the, the first of, first and foremost for the people in the poor world, because the, the, if, if oil becomes more expensive, I mean, the first effect of that is the rising of food.

[00:29:54] Right.

[00:29:54] **Nate Hagens:** Yeah.

[00:29:55] **Jean-Baptiste Fressoz:** And it has dramatic consequences on the life of billions of people, not necessarily in the, in the rich world. So I think that that would be really the first, the first effect. I wouldn't worry so much about the end of plastic or the end of salmon because it's a more faraway problem, I think, than just the rise of, of the price of very common goods, such as, such as food.

[00:30:15] **Nate Hagens:** Can you explain one more time, so that I understand or, and the viewers understand the linkage between coal and oil and the symbiosis between those two, because they seem very different energy sources on the surface.

[00:30:29] **Jean-Baptiste Fressoz:** Yeah. Well, well, as I, I mean, to, to extract all, you need lots of steel tubes, but really a lot of steel tubes.

[00:30:36] I mean, if you take the figures of the amounts of steel tubes of oil steel tubes in the U S. Around the year 2000, they consume more still to, to extract oil than the whole us economy in 1900. So the old industry, yeah, no, it's, I mean, when

you've got a kind of history of this, when you compare a few years of the nine 19th century, which figure the 20th century, the 20th century seems so extravagance in the quantities, right?

[00:31:04] I mean, it's, it's a different world, really completely different world. So, Oil is completely dependent on coal because of steel, right? I mean, you, you really can't have, oil without all the steel. So with all this coal, as I said, I mean, oil is re, I mean, basically the, the first use is to power a car in the 20th century.

[00:31:24] And so you need to have roads. I mean, otherwise cars are not very useful. So you need to have cement. And cement is, I mean, depends on the country and the time. It's, well, and

[00:31:33] **Nate Hagens:** asphalt. Asphalt comes asphalt from, from oil.

[00:31:35] **Jean-Baptiste Fressoz:** Yeah. Yeah, that's true. Yeah. But there are, there is cement everywhere in road infrastructure.

[00:31:39] Even if it looks, black on the surface, there is cement everywhere. there is cement slab on the bridges and I mean, you, the half of the cement is used to produce infrastructure and many roads and the other half is buildings. So really the history of cement is completely linked with the history of road construction in the U.

[00:32:00] S. I mean, really the, Cement was quite small, small scale production until the 1920s when the U. S. started to invest in, in roads. And suddenly the cement industry became huge and, and, the rotary kiln became enormous machines, which they were not before. And like in the, in the 1920s, I get, I get the figures in my book.

[00:32:22] I might not be sure of them now, but like half of the cement in the world was produced by the U. S. And many for the road, for the road construction, right? And in China, China in the right now is like producing half of the cement globally. For 50 percent it is for road construction. So yeah, I mean, cement is competing with automobile.

[00:32:44] So what will be using with cement and coal, right?

[00:32:46] **Nate Hagens:** How do energies like nuclear and natural gas fit into your, no energy transition?

[00:32:55] **Jean-Baptiste Fressoz:** I mean, I, I would take the nuclear gas. I don't talk a lot about gas. Honestly, I haven't talked so much about gas. It's really connected with oil. So it's not such a different story.

[00:33:05] I think, it's really the same. Yeah. Yeah. So it's really the same industry. So, but nuclear energy is very interesting, of course. why? Because it has played. not such an important role in the history of energy in the 20th century. I mean, we produce little electricity with globally with, with nuclear energy.

[00:33:25] There are a few countries which are, and France is part of them, but Japan too is important. when nuclear energy does play a role, but on the other hand, nuclear energy has played a tremendous ideological role and scientific role. In all the story I tell about the history of the way we have thought upon energy dynamics, I mean, you are mentioning the carbon pulse, you know, this idea that fossil fuels is just a very short, stage in the history of humanity.

[00:33:54] This idea comes from a very impressive graph. Or by, by May, king Hubbard, you know, may King Hubbard, the, the big oil, theorist. I know the

[00:34:04] **Nate Hagens:** graph. I know the graph.

[00:34:05] **Jean-Baptiste Fressoz:** The graph is amazing. I mean, you look at the history of humanity on a timescale of 10,000 years, and it's true that on this timescale, you know, yeah, fossil fuels, they last a few centuries.

[00:34:16] It looks very small. But why does he look at the, at, at this timescale? Because it compares all the amounts. of energy contains in oil and, and, and coal. It compares that with the theoretical amount of energy that you can reach if you have the breeder reactor, the nuclear breeder reactor. And it's, so there is a really an impressive gap where you've got this very, I mean, carbon pulse is really a great, a great phrase.

[00:34:44] I mean, congratulation that it's really exactly that very, very short burst of energy, and then you've got an enormous. A limited plateau that can last for

thousands of years, thanks to the, to the breeder reactor. So it's really this idea of the, very short time limitation of fossil fuels comes from the nuclear energy media.

[00:35:06] I mean, nobody cared about 10, 000 year timescale, except the, except people like our bet or a nuclear scientists, us nuclear scientists in the fifties, right? I mean, it's really, in the nuclear milieu that the idea of energy transition, was born. And by the way, energy transition is a phrase from nuclear technology and nuclear science.

[00:35:30] It is first and foremost, the change of an electron around its nucleus historically. And then it was recycled by, atomic scientists. in the 60s to talk about the future of energy. So when you say energy transition, paradoxically, you are actually using a phrase from, from, from nuclear technology, which I think is, is quite funny because in France, at least nuclear energy transition was rather seen as anti nuclear, right?

[00:35:56] It was the shift to renewables. Anyway, so that's why people were not so happy about my book. but, yeah, I mean, this nuclear milieu was really key in all our way of, you know, framing the issues of Peak oil, peak resources, and even climate change. I was amazed by the fact that as early as 1953, the Atomic Energy Commission to the main body producing nuclear expertise and nuclear technologies in the US said there was an issue about climate change, 1953.

[00:36:25] I mean, it's 20 years earlier than almost any other, you know, institution, right? So the, yeah, I mean, nuclear energy is really important, but more as a scientist, as a provider of scientific ideas and imaginaries, I think.

[00:36:38] **Nate Hagens:** But if we were able to develop a breeder reactors or fusion energy, wouldn't that just be an energy addition to everything else that we would use that?

[00:36:50] cheap energy and we would need all the, the fossil hydrocarbons to do all the other things in the society that that nuclear energy powered, if we had more and more and more.

[00:37:02] **Jean-Baptiste Fressoz:** I think I do. I mean, if we had nuclear fusion, it wouldn't change a lot. I mean, to be honest, because to be extraordinary expensive,

probably there would be one nuclear reactor in the U S perhaps another one in Europe, another one in Japan, but I mean, basically the problem with climate change, it's a global issue and it, it includes not just electricity, but.

[00:37:19] Everything else. And that's really the, the, the, the, the key limitation, I think with nuclear energy. I mean, very early on economists were, I mean, you know, like in the 1950s, us economists were explaining, you know, nuclear energy is not that revolutionary. All this blah, blah about the nuclear age is rubbish for one simple reason is.

[00:37:37] Basically, it's not very useful to all sorts of sectors to power cars. It's difficult to use nuclear energy in the 1950s to produce aluminum, steel, cement, plastic, and so on and so forth. Nuclear energy is useless. So it's just for the electricity, basically. But yeah, we know how to do electricity. You know, we were doing electricity very well with coal, with hydraulic energy.

[00:37:57] So It's not that revolutionary and it's the same problem with climate change. I mean, it's, it can be, I mean, it can help. I'm not saying it is completely useless, but it's not at the scale of the problem. that's, that's really, I think the key, the key point.

[00:38:10] **Nate Hagens:** That's my conclusion too. Although I think especially this, this podcast is being recorded on, November 6th, the day after the election in the United States.

[00:38:19] And I think with Trump, administration, nuclear energy is going to have a new, awakening and they'll fund it and invest in it. But I, I don't think it solves our problems because it's just adding to the symbiosis of humans, energy and materials and growth.

[00:38:36] **Jean-Baptiste Fressoz:** Yeah, I mean, and I mean, why it's not going to solve the problem because it's going to be a rich tech, I mean, ritual technology, it's complicated.

[00:38:42] It is slow to be constructed. I mean, in France, there is a, an important nuclear reactor, which took more than 20 years to be built with enormous overcost. Now we are talking about decarbonizing the economy in 30 years. Yeah, nuclear

energy is, you know, too slow, too cumbersome, too expensive. It cannot globalize so easily.

[00:39:05] **Nate Hagens:** But if we were able to change our aspirations and depart from capitalism as you Suggested earlier, although that itself is a really complex conversation. Couldn't nuclear energy play, play a role?

[00:39:19] **Jean-Baptiste Fressoz:** Honestly, I, I don't want to enter into this debate about, you know, is nuclear energy or renewables. I think both can be useful.

[00:39:26] I'm not going, but the fact is that, solar panels are so much easier to, to install. So, so much cheaper that it's, and actually it's what is happening. You know, there is a huge growth of solar energy, especially in China. And China is also developing nuclear energy. I mean, they're developing everything and it's much smaller.

[00:39:45] **Nate Hagens:** This is the, you know, I think another phrase that since you don't know my work real well, I've

[00:39:51] **Jean-Baptiste Fressoz:** seen the video that you made, which is really beautiful. I was very impressed by the, by the, by the drawings. I mean, it's, it's beautiful.

[00:39:57] **Nate Hagens:** Yeah, the, I, I lucked out. There was like a 23 year old, kid from New Zealand that read my mind and what I wanted when I described these things and he did all the artwork.

[00:40:08] I'm like, yeah, yeah, yeah, that's beautiful. thank you. Thank you. But the phrase I use is energy blind that our culture is just naive about, what energy does for us. But in addition to the scale, yeah. Of what energy provides to society. I think we're also energy blind about energy properties and how one type of energy is different in what it can provide for us than another.

[00:40:34] The pollution, the spatial, density, the power density, the E. R. O. I. The, you know, all the different characteristics, the intermittents, the storage. So, I agree with you that just taking this Pile of, of jewels and sending it over to here to where jewels are needed. It's a lot more complicated than that.

[00:40:59] **Jean-Baptiste Fressoz:** You have to take into account the different characteristics of energy and the case of China and solar panels is very interesting because it's also another example of energy symbiosis. I mean, part of the huge expansion of solar energy takes place in the Western part of China. So, kind of, very arid, desertic places, and they sell the electricity 2, 000 kilometers, in the east, where the people live, on the coast.

[00:41:25] So, the main cost, actually, is the connection, the interconnection, this large scale connection, the electrical network, the grid, sorry. So to, to, to recoup on the capital investments, they built at the same time, a solar panel, windmills, and power plants, coal power plants, because there is cheap, easily accessible coal at the same place, right?

[00:41:49] And I've read, I mean, I came across a really very interesting article by a Chinese scientist saying that like, once again, I don't want to give wrong figures, but it's in the conclusion of the book, like 40 percent of solar power was bundled, that the word, the phrase he uses, with coal. yeah. You know, so it's not a one to one substitution, obviously, because of the problem of, of, of variability of intermittents.

[00:42:13] as you said, I mean, you, you shouldn't think solar energy as necessary in competition with coal. Sometimes they work together. Of course, I mean, they're in competition as well, but sometimes they work together. And in the case of China, where there is a growing demand of electricity, they keep working together for the moment.

[00:42:29] **Nate Hagens:** So in your book, you, I use this word a lot as well. Complexity. in your book, you apply the story of complexity, not only to the supply chain and the entangled, global order, but also to the actual products that we create. can you unpack this a little bit, Jean Baptiste, and why is it important?

[00:42:50] **Jean-Baptiste Fressoz:** Yeah, it's not a key topic of the book. It's really the conclusion. I just mentioned the fact that's. Of course, there was technological progress. I'm not a kind of, you know, moderate or technophobic person. There is huge technological progress. There has been huge increase in energy efficiency of all sorts of things.

[00:43:10] like the carbon intensity of the world economy has been divided by two since the 1980s. No, it's, it's very impressive, you know, and it is. Because of technological progress, but this technological progress depends on more and more complex objects object that more that that that intertwines materials more and more finally, I mean, like the, of course, the cell phone is the perfect example.

[00:43:31] The result of that it is extremely difficult to recycle them. There is a very tiny amount of gold in our cell phones, but. I mean, trying to get this gold back is just impossible. It's simpler to just mine gold elsewhere because the

[00:43:45] **Nate Hagens:** energy costs would be much cheaper to mine new gold than to get it out of ourselves, which is

[00:43:50] **Jean-Baptiste Fressoz:** quite amazing.

[00:43:51] I think, and that's really a very strong historical trends. I mean, I give you a few examples, like the number of material in a car of the 1930s. Is lower than the number of materials in a tire nowadays, you know, telephones, telephones in the 1920s, they use in total 20 materials, cell phone, they use 60 different metals and then there's all the other materials.

[00:44:16] So yeah, the material complexity of the world of the technological world is really a key aspect of technological development. It makes machines more efficient. it makes the world economy more. I mean, less carbon intensity, but at the same time, there are huge problems of recycling and so on.

[00:44:31] **Nate Hagens:** What about human energy, and human labor?

[00:44:35] Does that follow the same, no energy transition theme in the past? Like presumably when we found coal, we, it was so amazing what it could provide for us that we would have to work less. and then the same thing with oil, but how does, how does human labor fit into your story?

[00:44:54] **Jean-Baptiste Fressoz:** I think, I mean, I, I wanted to make a chapter on human labor, but it's a more complicated story.

[00:45:00] And, you know, I had to, it's a whole not a book project actually, but when you think about it, because of fossil fuels are more humans. They're better fed, so there is more human labor in the world economy. I mean, I, just a few figures, the number of peasants has passed probably its maximum point recently.

[00:45:23] Like in, it's difficult to know, but like 2010

[00:45:26] **Nate Hagens:** perhaps. How do you define peasants?

[00:45:29] **Jean-Baptiste Fressoz:** Like, family peasants, small agriculture, I mean, very small and, and, without tools, I mean, without tractors and so on. if you take the number of coal miners, it has peaked in 2015, right? If you take the number of miners, there's many more miners now than in the 19th century.

[00:45:49] I mean, another order of magnitude. Right now there are 40 million artisanal miners in the world. Half of, half of them are digging gold. Right? Half of all the

[00:45:58] **Nate Hagens:** miners in the world are digging for gold?

[00:46:01] **Jean-Baptiste Fressoz:** Yeah, because some small scale mining is really, turned to gold. Gold is really the, the key, the key mineral here.

[00:46:10] It's, I mean, after 2008, there was a huge expansion, I mean, huge increase in the price of gold. Because of the financial crisis and so on. So suddenly you've got millions of people, especially in Africa, getting shovels, getting wheelbarrows and extracting gold. And, and, and this gold rush is much bigger than the US gold rush of the 1950s.

[00:46:31] It's another scale of, another magnitude, yeah.

[00:46:34] **Nate Hagens:** John Baptiste, you are a historian. You're a scholar. do you ever just have a couple glasses of wine and look at all this and think, what a species? Looking at human history,

[00:46:50] **Jean-Baptiste Fressoz:** I shouldn't encourage wine drinking, but yeah, it's part of a, of a, of a culture in France is that the excuse for drinking wine is, you know, it's not, it's not really alcohol.

[00:46:58] It's culture. but, no, I mean, what strikes me is the naivety of, of the histories that we have on the human species. I mean, this idea of homo deus, of artificial intelligence, of, of a space fearing species. I think I'm amazed by the, the feebleness of, of, of our narratives on, on, I mean, what has happened in the world in the, in the, in the 20th century.

[00:47:26] I mean, that's what amazes me.

[00:47:28] **Nate Hagens:** Well, given the, the erudition of your book and your knowledge on human history and energy use, what can you speculate? What, what is your objective rebuttal to the plans of colonizing outer space and going to Mars and building civilizations in, in the galaxy? Like, what's your rebuttal to that?

[00:47:51] **Jean-Baptiste Fressoz:** it's really, an old future, a future that we heard so many times in the, since the 1950s. Basically, we have not put a man on the moon since, I mean, the U. S. has not, has not put a man in the moon, on the moon since the 1970s. So yeah, I mean, all this seems extremely far fetched and I don't know if they believe it or it's just a discourse for the, for the general public just to, you know, to, to motivate people.

[00:48:17] I don't know. I have, I'm not in the mind of. People like Elon Musk.

[00:48:20] **Nate Hagens:** I actually think it's at the core of the title of your book, more, more, more. It's why so many humans want to climb Mount Everest and they get there and some of them die and they get to the top. And it's an accomplishment. It's like this, we are really curious, ambitious, clever.

[00:48:38] Apes. And this is what we do. And we've, we've replaced our wisdom with cleverness boosted by the energy from the carbon pulse. And it makes us feel invincible without understanding that the foundation of what we stand on is energy and materials and a viable ecosystem on the one planet. We know, that life exists on.

[00:49:03] **Jean-Baptiste Fressoz:** No, I agree with you. And at the same time, I saw that, Elon Musk said there's so much red tape, in the U. S. that won't be able to be a space faring, species. So basically, environmental agencies in the U. S. are going to be responsible for the end of the human species if a comet arrives. So there is, you know, all sorts of discourses which are extremely political, and, and utter rubbish.

[00:49:28] that's not, it's not the point, but once again, I don't know how serious we should take these people. I mean, are they clowns or they're very wealthy clowns, of course.

[00:49:40] **Nate Hagens:** They're very, very powerful and about to be more powerful. and this gets back to the drivers of this. Now I know you're an energy historian and not a biologist or an evolutionary psychologist, but why do we want more and more and more?

[00:49:57] and is it not even a want, is it not a human individual thing? It's just a, a process that happens when humans get together at scale and find a bonanza of energy and materials.

[00:50:08] **Jean-Baptiste Fressoz:** In a previous book called The Shock of the Anthropocene, I tried to reflect on this question. I mean, how, how come that, the Anthropocene came about?

[00:50:21] I mean, can we give a proper history of the Anthropocene? I'm not entirely convinced by what I had done with Christophe Beaudet, actually a colleague of mine, 10 years ago, more than 10 years ago now, but to try to politicize We try to, to show that, you know, it's not the, simply the history of the human species.

[00:50:38] It's, it's, it's a much more historical phenomenon where imperialism play a role, where capitalism play a role, where war techno, I mean, war and, and, and, and military technologies play an enormous role. So I don't know if it is a completely convincing, but when you really think about seriously about the problem, like Like the very polluting technologies, the most environmentally damaging technologies, most of the time, they come from the military, for instance,

you know, like pesticide, they come from, from gas combat, I mean, gas for the, from, from the first world war at the beginning.

[00:51:16] if you take, the, the, the fertilizer industry. First of all, it was invented for explosives. you could say that all the aviation industry is closely connected to the history of the Second World War and also the First, actually. so, I mean, I think it's, it's, it's, of course, the human species is a, is a, is a It's an attractive story, but you can be more specific than that.

[00:51:44] And, and, and, and I think it's important to notice the fact that for most of human history, we were not that damaging, and many countries are not that damaging. So there is also something which is closely connected to the historical trajectory of Britain and the US. Sorry to give names, but I think it's important to, I mean, when you look at the figures, like until the 1970s, half of the CO2 came just from the, from Britain and the US.

[00:52:09] In 1970, right? So for a very long time, the Anthropocene was an Anglican, actually, and, and other countries were far more agricultural. They were, they were, they were like still very traditional economy.

[00:52:20] **Nate Hagens:** So the question there is, is there something particularly, vile and destructive about the United States, or is it a power loss sort of thing that no matter what country?

[00:52:32] Was in the pole position at that time, they would have accessed energy in the same way that the United States did. I don't expect you to have an answer to that.

[00:52:40] **Jean-Baptiste Fressoz:** No, and I don't want to be, but I would rather sympathize with the second solution. I don't think there was anything intrinsically violent to the U S of course.

[00:52:47] And it's linked to simply, simply, they are like the, I mean, they were the only power, say use military power between 1990 and, and, and, and now basically. But, no, there was no, nothing intrinsically violence. no, no, certainly not. Yeah.

[00:53:01] **Nate Hagens:** So in your book, you, a couple other things I noticed is you focus on the ideas of creative destruction and disruptive innovations as kind of red herrings, in our energy, energy history.

[00:53:15] Can you explain briefly what those concepts are and why they aren't applicable to the future of energy as is commonly discussed in our media and in the academy?

[00:53:26] **Jean-Baptiste Fressoz:** Creative destruction is a phrase that was invented by an Australian economist living in the U. S. called Joseph Schumpeter, who was extremely influential in climate economics.

[00:53:38] Basically, to solve the climate problem, we have to unleash the power of Destruction, destructive creation and under this idea of destructive creation, you have a very simple idea and simplistic idea. The fact that new technologies are going to replace all technologies. And so it's really comes from a reflection on the diffusion of innovation.

[00:54:01] It's really what, what was really at the core of, of, of this, climate economics. And then it was applied on the energy problem, but that doesn't work at all. And that's really something I, I, we put right at the beginning of the book because I think it's a key problem. history of technology, indeed, you can see replacement substitution.

[00:54:21] It is true that new technologies in certain domain have replaced the old technologies, but in the history of materials, it's just completely wrong. What you said about this addition, additional nature of the history of energy, it is true actually for all materials, not just for energy. I mean, When we talk very lightly about innovation as the solution, I think we forget that the 20th century has been enormously innovative and it's a raw material are never obsolete.

[00:54:50] I mean, it's very difficult to find raw materials that have decreased, not even disappeared, but decreased. It's when there is a prohibition, like for abscetos, because there has been, it's toxic. So there has been a prohibition. So that there has been a decrease, but the only example where you've got a kind of obsolescence, it is a wool, sheep wool, a very mundane material, which has been

replaced by, in parts by synthetic fibers, which is not good news for the environment, by the way.

[00:55:20] so, I mean, another example, which I found striking, you know, like, the, the carers and lamp, the oil lamps of the, of the late 19th century, the first use of, of petroleum, actually. nobody use these lamps to, to, to produce light nowadays because we've got electricity, but in fact, we have never used as much petroleum to produce lights than nowadays.

[00:55:43] Because of the cars and, the headlights of the cars and the headlight of the cars today, they consume twice as much oil at the world economy, 1900s, where everybody was using, cars and lamps,

[00:55:55] **Nate Hagens:** just the headlights today.

[00:55:57] **Jean-Baptiste Fressoz:** Yeah, because it basically consumes a one to one between one and 2 percent of the, of the oil that's running your, in your car.

[00:56:05] And this is enough to be more than the whole. economy in 1900s, you know, it's, when I say it's an expansion of everything, that's really one of the good example. I think the difference between the history of tech, where you say, yes, electricity is the revolution that has just displaced the old oil labs and the history of materials, which is completely different.

[00:56:25] It's, it's not the same story.

[00:56:27] **Nate Hagens:** I'm really surprised that I've only recently discovered your work, because of our, our mutual friend, Chris Kiefer, because what you're saying is just totally aligned with my observation of the economic superorganism. so tell me again, how linked, renewable energy like solar panels and wind turbines are.

[00:56:49] To hydrocarbons like oil and coal to create them because there are people that are working on electric arc furnaces to create the steel, which could, in theory, be used to extract oil instead of coal. or is it possible that 10 or 50 years from now we can use electricity to mine all the materials that we're currently using oil and coal for?

[00:57:12] **Jean-Baptiste Fressoz:** Okay, electric arc furnaces are old. I mean, it's an old technology. Basically it uses scrap steel and it's indeed, it's very, very efficient because you have already have taken off the oxygen, atom, which is, completely, linked with the iron, atoms. so it's an old technology. What is new is like the hydrogen steel, which is really like the, the high tech way to produce, iron from, steel, sorry, from iron.

[00:57:40] Iron ore. I mean, in theory, it is possible, like all these proposal, you know, yeah, you can do that. But on what scale at what cost? That's really the key problem.

[00:57:51] **Nate Hagens:** And at what objective and at what environmental impact?

[00:57:55] **Jean-Baptiste Fressoz:** Yeah. So if you take the case of hydrogen steel, I made very rough calculation, but to produce the 1.

[00:58:02] 7 gigatons of steel that we use today, every year in the world, you would need a certain amount of hydrogen. And it is So you need electricity to produce this hydrogen via electrolysis electrolysis. And this electricity would be more than the U. S. production of electricity, for instance. So we are talking about enormous quantity of hydrogen and enormous quantity of, of, of, of electricity.

[00:58:27] And on the other, and then the other problem is that hydrogen is very cumbersome. To, to produce, to store, to use, and there is very little demand for hydrogen. Actually, hydrogen is useful for refining oil and for producing fertilizers. But as an energy carrier, it's, it's really, it's not very useful and not very practical.

[00:58:48] So if,

[00:58:48] **Nate Hagens:** if the reality of our energy history doesn't actually include energy transitions, what does that mean for our plans to address climate change and other ecological, impacts, which in the narrative. In politics and in the news is entirely predicated on the energy transition. So what are, what are your thoughts on, on that?

[00:59:13] **Jean-Baptiste Fressoz:** I mean, very obviously we have to change the narrative, and we have to talk. I mean, what we do when we install solar panels and windmills, unless the, when you use electric cars, you reduce the carbon intensity of the economy. You don't do an energy transition. Energy transition is just a slogan. It's not to see you scientific world.

[00:59:33] It's really an invention. It's what you do is you decrease the carbon intensity of the economy. And once again, history is important to understand the limitation off off off off what you're doing. I mean, just sorry, another example. But when you get rid of the old steam steam engine and you replace them with electric motors, You divide by 10 the carbon intensity of industrial force in the industry.

[00:59:58] Very impressive, right? When you get rid of a gas, gas plant for electricity and you replace that with solar panel, you divide by 10, the electricity we have been here before, you know, technological progress and, and, and solar panels is part of the history of technological progress. It is an old story.

[01:00:17] We are not on the threshold of a complete revolution. We are just continuing the history of technological progress in energy production consumption, basically.

[01:00:26] **Nate Hagens:** So yesterday podcast with Jeremy Grantham and I'm probably misquoting him, but he said in ancient Egypt, the economy was growing at 1 percent a year.

[01:00:36] And if you grew at 1 percent a year to today, 2024. The economy would be 9 trillion times bigger. So we know that there is a limit, as to how much we can grow. And we know that growth requires additional energy and materials. So is a sequel to your book more, more, more than less? or what, what, like, what is the pathway?

[01:01:02] What is the default pathway? I think it's logically inferred, but what have you thought about that?

[01:01:08] **Jean-Baptiste Fressoz:** I think, yeah, degrowth should be part of the discussion of the political discussion, which is not the case. It is really constrained in kind of marginal ecological thinking, and it shouldn't be the case.

[01:01:20] It should be the key issue of economics, I think. Or a very important issue in economics, and it's not the case. I'm not saying it's going to solve everything. It's not the case. I don't think there is a solution, actually, or even I mean, even with a panel of solutions, I don't think we're going to decarbonize the economy in time.

[01:01:37] Right? So, I, and, and, and the conclusion of the book, I'm really shy on that. And, you know, there is so many work saying that I'll read this book and there is a solution. I didn't want to write that. I want you just to have a kind of empirical. outlook on, on the problem. It's not, not, it's not solution oriented.

[01:01:58] **Nate Hagens:** That's what I'm trying to do with the podcast. first of all, I don't know the solutions, but we're trying to describe what's happening, but I believe degrowth for reasons that you've outlined is what we should do, but post growth is what we're going to have to do. We're going to have to respond to, eventually there's going to be some limits in the energy and material symbiosis at a global complex level that you've described.

[01:02:22] And there's going to be a stair step down. And the question then is, can we stabilize and have some wisdom and foresight on what happens then? Or is it an all the way that down sort of moment? you know, I don't know, but those are also part of the conversations because we cannot continue to use more and more and pull other things from the periphery into the center materials that we weren't using before energy sources we weren't using before.

[01:02:51] nothing left of an ecosphere.

[01:02:53] **Jean-Baptiste Fressoz:** Yeah, no, I agree. I mean, the limits will be the not so much. I think the exhaustion of the resources, but the effect of pollutions off climate change off biodiversity, destruction. I think that would be the real limits and the and I think it's I mean, it's quite a different limit from resource because in the book, I was amazed also by the fact that the elites, industrial elites in the rich world were really scared in the 1970s with the energy crisis.

[01:03:22] You know, they took the issue seriously. I mean, you have to look at the, on YouTube, the video by, of Jimmy Carter in 1977, you know, it's, it's very bleak, right? In Europe, there was a very, senior employee of the European, the vice president of the European Commission called Sikko Mansolt. You read the limits to

growth report of 1972, he's horrified and he says, we have to reinvent the European project.

[01:03:48] It's not about more consumption. It's not the issue. I mean, we should, there was really this, I mean, the exhaustion of resources is easily integrated by the. By the government and by, and by the, and by the elite. I think climate change doesn't scare people that much. At least, I mean, it doesn't seem so.

[01:04:09] And biodiversity even less. Nobody They don't care so much about the disappearance of insects and so on. I mean, which, which is just amazing when you, anyway, like in Europe, in, in France or Germany, like 70 percent of, of flying insects, 1980s. It's an amazing transformation of the natural world.

[01:04:30] Nobody cares. Yeah. so I'm sorry, it's not very, it's not really an answer to your, to, to, to, to, to your point, but, I think the limits that we, that we are overpassing, they are very, I mean, soft limits, you know, you can, you can overpass them very, very deeply and then feel the effect of the, of the, of the problems and the overpassing of the limits much later.

[01:04:58] And that's the, the, that, that the problem, probably

[01:05:00] **Nate Hagens:** there's a lag effect of all of our bad behaviors and it's starting to come due. So are there any misconceptions about pre industrial energy use and humans, and. Part two question. Are there anything we can learn from past past human societies and their energy and material use?

[01:05:23] Any positive lessons or warnings that we might apply to our current situation?

[01:05:29] **Jean-Baptiste Fressoz:** To be honest, I don't think there is any historical lessons. to be taken. And I think that would be very naive to say, Oh, we have to learn from the history to solve the problem. No, I, I mean, we are really facing a completely unprecedented situation.

[01:05:42] I mean, then what we have to do as no historical, analogy, possible. I think, I mean, I can give you examples that, but they will look futile to do. I just give you an example. Cuba, after the fall of the U. S. S. R., their flow of oil was radically,

d d diminished, and they had to, yeah, to reinvent the economy, because, I mean, agriculture had to change, all sorts of things had to change, and they were under U.

[01:06:09] S. embargo, that doesn't help. Anyway. Is it similar to, to, to the issue of climate change? No, it's completely different. I mean, it's just a crisis, just a very deep crisis, but it's just a crisis. so I don't think, no, I don't think history can really help us to, to, to reflect on that. Yeah. Sorry for that.

[01:06:25] **Nate Hagens:** What do you do every day? Are you a teacher or are you just write books?

[01:06:30] **Jean-Baptiste Fressoz:** both. No, no, it's a, it's a dual work. I teach, I give conferences and I write books and articles. Okay.

[01:06:37] **Nate Hagens:** And what do you teach?

[01:06:39] **Jean-Baptiste Fressoz:** I teach history of environment, history of tech, history of energy. so basically this is something that I have taught to my students for several years.

[01:06:46] Yeah.

[01:06:46] **Nate Hagens:** And are you writing another book? Do you have a sequel or what's prominent in your mind now that you would like to, apply your erudition to?

[01:06:55] **Jean-Baptiste Fressoz:** Yeah. What I would like to do is to come back to your question, the human muscle, the human energy. I'd like to write something on that, with this symbiosis framework, which I think could enlighten stuff about agriculture, about also studying.

[01:07:08] Tools that are not, you know, they're not important in the historiography of tech, but I think are very important. Like the shovel, the wheelbarrow, this, you know, very basic technology, which I've expanded in the 20th century. We are using more and more 20th century. The modernization of the human muscle, I think is an interesting topic.

[01:07:27] And it is linked, of course, with, fossil fuel energies. I mean, anyway, so that's, that's something I would like to do. Yeah.

[01:07:34] **Nate Hagens:** Well, it wouldn't need to be though, because we've created shovels before we had fossil fuels.

[01:07:39] **Jean-Baptiste Fressoz:** Indeed. No, but I mean, I mean, the modernization of the human muscle is linked with technological advancements.

[01:07:48] Which I inherited from, I mean, the history of fossil fuels, to have like, I mean, the shift from tools made of wood shift, to tools made of, of, of, of steel, like the ball bearing, interesting technology to ball bearing, the rubber wheels, the flat cement floor in the factories. I mean, I'll just give you an example.

[01:08:10] The big invention of Ford, like the, how do you say the chain, the production chain. No, the assembly, assembly line, sorry, assembly

[01:08:17] **Nate Hagens:** line, assembly line for cars. Yeah,

[01:08:20] **Jean-Baptiste Fressoz:** exactly. It's absolutely central in historiography. It seems to be like the key invention of the 20th century, like the assembly line. But in fact, the way you move goods in factories today and in the 20th century is very basic technology that allows you to move.

[01:08:34] pieces around and materials and so on. It's not the assembly line. The assembly line is very, it's very strange. It's very original. That's why people are fascinated by this, but it's very small compared to the way you move goods in, in, in the factory. Just the handling of goods is, it's certainly not the assembly line in general.

[01:08:51] So, I mean, yeah, I'm interested in this kind of, of, of, of object here.

[01:08:55] **Nate Hagens:** If you do write a book on the human muscle and modern technology, please come back on the show. Maybe you put a picture of a Homer Simpson on the, on the, on the cover page. So, I asked some questions to all of my guests, Jean Baptiste, at the end of the show, I think.

[01:09:14] the details that you described in the last hour, we haven't heard, but the general theme that we're adding more and more and more, and that it's unsustainable, both from what resources we have access to in the carbon pulse and from our sink capacity, this is known to our viewers and, we, we don't.

[01:09:36] We don't know what to do. I mean, my work is on, categories of bending, not breaking, but with someone listening to the episode right now, what are some personal recommendations or advice you have to the humans around the world watching this program?

[01:09:52] **Jean-Baptiste Fressoz:** I mean, I would recommend to, to think about the utility of things they consume.

[01:09:57] basically the end of the, you know, do they really need that? Is it really improving their, their life so dramatically that it's worse, the, the climate cost and the, and the environmental cost. Well, I think it's very useful. It's a very individualistic, recommendation, but then if you want to, that to be generalized, you have to.

[01:10:18] To have the political organization that encourage you to do so. So you also have to organize politically too, so that it becomes a kind of general rule. Yeah.

[01:10:28] **Nate Hagens:** What specific recommendations do you have for young humans, becoming aware of climate and, and energy and geopolitical issues? Do you have any, issues or recommendations for like your students age 18 to 23?

[01:10:43] **Jean-Baptiste Fressoz:** I recommend them to, to really think about the, the way you're producing. The material you used, I mean, to, to have really a kind of materialistic outlook to the, to the economy, energy and materials. I mean, the, the, the, the question of production should be much more central in our understanding of the, of the economy and of society.

[01:11:03] We tend to, to think that we are, we have become consumer society, but in fact, we're also massively. Producing societies. And yeah, that would be my recommendation. Yeah.

[01:11:13] **Nate Hagens:** What do you care most about in the world, Jean Baptiste?

[01:11:16] **Jean-Baptiste Fressoz:** Oh, that's a personal question. I'm not sure. I mean, like every human being, I think it's my close, network of relations of people that I like.

[01:11:26] I mean, obviously, and it would be. quite pretentious to say that I care so much about humanity and, and, and, and what will become of humanity in 20, 22, 22, 22nd century. I don't really care about that to be honest. I mean, I care about what's happening to my kids, my, my friends and so on. Yeah.

[01:11:43] **Nate Hagens:** I really appreciate, your honesty and I think you are such a scholar, you're not going to like this next question, but if you had a magic wand, what is one thing you would do to improve human and planetary futures with, if you had no personal recourse to your reputation or any risk?

[01:12:02] **Jean-Baptiste Fressoz:** I think that would be the, the end of nationalism, of People thinking that because they are in this country, the only point is, you know, to make this country great again, or because they have this color of skin, that's really, you should be afraid of the other, I mean, that all this parochialism, nationalism, just get rid of it, to be extremely liberating.

[01:12:25] It's very utopian and kind of stupid, but yes, that would be the magic wand probably, yeah.

[01:12:29] **Nate Hagens:** Do you have any closing comments, especially summaries, of what you've said today that you want to impart to the listeners? Any closing words of wisdom?

[01:12:39] **Jean-Baptiste Fressoz:** If, I want to, I mean, just to give a few, few last comments.

[01:12:43] Basically, the idea that energies have added up, to each other is very trivial and it is known since the 1930s. I mean, people never talked about energy transition until recently. Ends. I mean, the second part of the book is really how come that we have started to talk about energy transition? Where does it come from?

[01:13:04] I mean, it's really, really a strange, strange story. And I hope that people that perhaps will listen to this podcast and perhaps will read the book, I would convince them that this idea of energy transition is really weird. It's a very old idea. And for a very long period of time, experts knew that it was, I mean, they don't talk about energy transition until the 1970s, basically, that's really something that I want, that I want to emphasize the way we talk about energy is very strange and it is based on a very, very strange history of, of energy.

[01:13:38] Yeah, that

[01:13:40] **Nate Hagens:** John Baptiste Fraiseau, thank you very much for your time today and for your work and good luck with your, your next book. And I hope to have more conversations with you.

[01:13:50] **Jean-Baptiste Fressoz:** Okay. Thank you very much, Nate.

[01:13:51] **Nate Hagens:** If you enjoyed or learned from this episode of The Great Simplification, please follow us on your favorite podcast platform.

[01:13:59] You can also visit thegreatsimplification. com for references. And to connect with fellow listeners of this podcast, check out our discord channel. This show is hosted by me, Nate Hagans, edited by No Troublemakers Media and produced by Misty Stinnett, Leslie Batlutz, Brady Heine, and Lizzie Sirianni.