

Marshall here. Welcome back to the realignment.

Everyone happy Friday. I want to keep this short and sweet so we get to this really excellent episode. I'm speaking with Brett Kugelmass. Brett is the CEO of Last Energy, the company that is working to commercialize nuclear power. Because he is building in the nuclear power space, it's cool to speak with a practitioner rather than just the kind of think tanker or researcher or writer who's looking at this topic from a different angle. Brett has a variety of genuinely surprising hot takes about the potential of nuclear energy, why the industry has struggled over recent years and how his approach is actually really differently from before. He also is the host of an excellent podcast called Titans of Nuclear. So if you're interested in the nuclear power topic, as I know many of you listeners are, and you like hundreds of deeply focused issues with experts and other folks who are interested in the field, I definitely recommend you check that out as well. I've included the link to the podcast and a bunch of other things that Brett has put out recently that are incredibly helpful. This is obviously going to be an episode that's going to be very thought provoking. So I'm looking forward to following up on the topic with Brett and other people as well too. Because it's Friday, I also need to shut out the sub stack. It's going out later this afternoon. So definitely click the link in the show notes to check out the work that's going out there as well. Also, quick reminder that we put out a Supercast Q&A episode session on Wednesday. So if you'd like to get access to that episode, you can go to realignment.supercast.com or click the link in your show notes. Last but not least, huge thank you to Lincoln Network and hope you all really enjoy this episode.

Brett Kugelmass, welcome to the realignment. Thank you, Marshall.

I'm really glad to speak to you on 15 different levels. A, your company is cool. I like talking to founders. B, I like talking to podcasters and then C, I like talking to people who are experts, deeply interested in space. That's all great. We can combine these three into one. So let's just start here. I want you to disabuse me of a notion that may come off as entirely cynical, but my just opening take when it comes to nuclear is that the pro nuclear conventional wisdom has gone too far in that direction. We went from the 2000s where the West Wing is having whole plots for the presidential election swings off of massive meltdowns. Chernobyl happens. All those like very anti nuclear moments and by Chernobyl happens, I mean like the TV show, not the actual terrible event in the 1980s. To now we're in this space where he always people who are directly in tech saying things like, man, nuclear is so simple. It's crazy. We're not doing it. And you're like, I don't know, man, my DC bullshit detector comes in because DC, I'd love to hear what DC teaches you about this because you're DC based because DC actually teaches me that rarely, if ever, our things actually straightforward. So rarely is it as simple as nuclear is this perfect solution. And you know, we're just all these nimbies in these environmentalist hypocrite libs who just won't accept it. So like, that's just kind of my take. I want to find balance. So help me find balance. That's a ramp. But I've been, I've been, this has been building within me for like the past year, ever since basically the natural gas, Ukraine war conversations started. So yeah, let's just hear it. What's the balance look like? Yeah, so you're probably not going to get balanced from me, but you are going to get a very heterodox opinion that disagrees with virtually all other pro nuclear people. So what I mean, like listen, if you just think of what nuclear is,

nuclear is an exploding star that was stored inside little batteries that are known as atoms. Okay. Like the amount of energy that is within an atom when you split an atom is like six orders of magnitude greater than when you release a chemical bond. So the and then people in the 60s when they talked about like, you know, everything going nuclear and this like in the world like the Jetsons like world that they portrayed like based on nuclear energy, like it was was foundationally principally like correct in the sense that you can't even come close to doing as much in the physical world with so little stuff unless it is nuclear powered. Okay. So all that is what you talk about what that 60s vision would have looked like. It's always helpful to ground it. I mean, I heard somewhere I've not been able to validate this and I've heard it one way with JFK and one way with Nixon that like as part of their like opening salvo like campaigns was we are going to go 100% nuclear. We're going to build 1000 nuclear plants in this country. Like that was their vision. Once again, not verified, but I've heard that several times. Um, yeah, enthusiasm was incredibly high. We just, you know, dropped the bomb at, you know, in World War II, you know, people realized that like what, you know, like the fundamentals of this power and then Eisenhower was like, okay, but there's so much more we can do with it. Like let's turn it into like power production and not just have like the negative side and also used it as a diplomatic tool around the world. We gave and like we gave like high enriched like research reactor material to does it. I mean, more than like, yeah, dozens and dozens of all sorts of countries develop, not develop, you name it. We invited people here. We use this as a tool for diplomacy was awesome. And I have a funny like personal story about this as well. But I ended up like through my podcast Titans of nuclear where we've interviewed like 400 people so far. I interviewed this guy named Conmo Chung once. And like, so when, when South Korea was like super poor after their war, I like everything, their economy was just totally devastated. But as part of this cultural exchange scientific academic exchange program, they sent their best and brightest students to America to learn about nuclear technology and then bring it back to their country. And like, if you look at what's going on in South Korea today, their industrial growth was powered by having that consistent cheap base load power. And like Conmo Chung was responsible like for his country's success through nuclear energy. But just to, I guess I lost track of where we're going because there's just like so much interesting to the history of it. But if we look at what happened, you asked me about what did that picture look like? Yeah, I mean, the picture is, they used to say too cheap to meter. And then now that like that comment is like derided in like in today's culture is oh, like how silly were they. But no, that was the correct vision. And by the way, that is the vision that we can still have today. So yeah, once again, you're not going to find balance for me, you're going to find the claim that we can have energy 100 times cheaper than it is today, 100 times cheaper than it is today. And we can increase the abundance by orders of magnitude as well. That's the future that we should all be aiming to create because that is a future of wonderful human flourishing. Okay, so this is great then. Let's talk about the period between the 60s, basically today, because if we're going from too cheap to meter to me angrily ranting at the top of podcast, a lot happens there. Hey, like, just give us your telling like how do you understand that history? Like what happened? Yeah, so I blame and I'm the one probably the only person in the planet to do this, but I blame the nuclear industry solely for its own demise, for people's negative perception of nuclear and for its own economic hardship, I blame the nuclear industry

itself. So sorry, there's gonna be a lot of interruptions because I'm learning a lot of this stuff. So it's me just like inquiring, we're doing kind of like back and forth. When you say the nuclear industry, can you define the nuclear industry? Because for example, because this is actually really key. Is the Soviet Union running a horrible practice in, you know, then Soviet Ukraine? Is that the nuclear industry? That plays a huge role in public perceptions of nuclear. So define when you say it's their fault too. Okay, that's perfect. That's perfect. Okay, so let's like look at what the nuclear industry was back in the late 1960s when it was most successful. When it was most successful, a utility like Duke Energy had a bunch of power plant engineers on staff, they would design a power plant, it could have been a coal plant, you know, or oil burning plant or any of the plants that they were building at the time, or a nuclear plant. And then they would go to a nuclear vendor and OEM who would like give them a reactor or sorry, sell them a reactor and that reactor was only worth let's say like \$50 million. And when they had this model in 1968, you had the cheapest, fastest, easiest to build nuclear that ever existed. So the nuclear industry at that time was very small. They were building nuclear reactors. And then there was the broader electricity industry, the utility industry that was responsible for building generating assets. Okay, now it's actually the market incentives that are the most key here. So utilities at the time, due to the way that the regulations were set up, they were on a cost plus basis. And so their profit was capped at let's say a fixed percentage. And therefore they were incentivized to build as much infrastructure as humanly possible in order to increase the amount of revenue that would come in. So they didn't want to keep prices low. They wanted to spend as much money as they could get away with. Okay, this is like part of the downside to when you have, you know, certain types of regulations set up in certain industries that are historically monopolies, if it's not done correctly, you incentivize the wrong behavior. So from the period of 1968 to 1978, they just kept building the nuclear plants bigger and bigger and bigger to in order to spend as much money as possible. Okay, so the cost went from in today's dollars, roughly a billion dollars for a gigawatt to \$10 billion for a gigawatt. However, this market system did have safeguards in place. The public utility commissions could say no, this is going too far. And so in 1978, by the way, this is the year before Three Mile Island, in 1978, the public utility commissions across the country started canceling all the contracts that existed. So 200 contracts were canceled before Three Mile Island. So anyone who says that Three Mile Island is responsible for the demise of nuclear industry has their time on totally backwards. But it was key to now defining your exact question, what is the nuclear industry? So the nuclear industry, as we knew it, the one that sold a widget, the one that sold reactors, died, died in 1978. And a new nuclear industry was born, one that did not sell nuclear reactors, but that sold fear of nuclear. Quick pause. I know this is deeply unfair to you because you're telling this story here. But once again, I have so many questions that I kind of want to like, take it like that. Go for it. So let's pause there, right? So 1979, 1978, new industry, key point is they're selling fear of nuclear reactors. So you're basically telling this story that's very American centric, right? You're talking about Duke Energy, talk about those places. But me being Marshall, the generalist, podcaster, if I think of my image of nuclear reactors around the world, they all seem to be the same size. And the dynamic that you're describing is one where there were specific market dynamics in the United States

that drove the construction of those underlying dynamics into a certain direction that made it cost too much. But a, like, the Soviet system was like a military one, wasn't like, so like, let's put aside like the market for a second, that's like a military project that had civilian applications, French have their own system is obviously like, you know, the Iranians, the South Koreans, why would it be? We better revise this. Basically, what my understanding, though, is that everywhere, this expensive dynamic occurred. But you told the stories of it's about American market dynamics. Correct my understanding. Yeah. Yeah. Okay. So let's get to, we'll get to part two of the story, which explains how costs increased everywhere, because actually, in many different countries, their first two nuclear buildouts were cheap. It had, nuclear is this weird, very weird thing, but we explained it with this market incentive. It has a reverse learning curve. Normally, when you build more of something, it gets cheaper and cheaper. With nuclear, it got more and more expensive virtually everywhere you went. The first few that anyone built, like fully operational, fully work, no problems, were the cheapest, and then they just kept getting more and more expensive. Here's what happened. So it's like, it's a public, it's like, it's a public good. It has, it has the dynamic that healthcare in the education system has, which is a disaster. Yeah. And then also, by the way, keep in mind, there's a phase lag between what happened in the US and what happened elsewhere, because there was a lot of licensing of nuclear, of nuclear technology from the US companies around the world. And so there's just always this, like, we would do something and then it would go abroad, like usually by a decade. Okay. So here's what happened in 1979. So you have Three Mile Island, and all of a sudden, there's like a call to action. There was a new nuclear regulator that was in place just five years prior, which, which now the incumbents saw as a tool for regulatory capture to support their other what was a small business, and we would soon dwarf their earlier business. So in addition to selling nuclear reactors, these companies, as is often the case for OEM manufacturers, is they would have another business selling services, long term service contracts, operations and maintenance. So they still had a relationship with the utilities and the physical assets that they previously sold their original widget to. Okay, now once their contracts died for selling widgets, this was their only business, the services business. And so how do you drum up more services? Well, then accident happened. So now what they did was they went in and they said, we need to refurbish, we need to rebuild, we need to add all of these additional protection systems to the plants that we sold you. So if you think about their total earning potential for the first, let's say 150 units that they sold at \$50 million apiece, their new earning potential post Three Mile Island was \$300 million apiece. Okay, they were so successful at this. And not only did they use regulatory capture to up the NRC standards, they went to the international standards bodies for radiation protection to and just started cranking up the dial without any scientific evidence that any scientific proof actually, in refutation of the existing medical evidence as to how dangerous radiation was, they just kept cranking up the dial made the radiation standards 10 times lower, another 10 times lower. And they kept doing this. And they went around the world, not just to the 150 plants in the US, but the hundreds of plants as they were being built, implementing new standards that drove what their business would be safety services, fear of radiation, that was what the nuclear industry became first with Three Mile Island. Then Chernobyl was another blessing for them.

It's a terrible tragedy. But they went around and sold another \$300 million to every plant. Then September 11, another \$300 million to every plant, then Fukushima. This was the game that they played every decade. They'd find another reason to increase the regulatory standards, cannibalize the economics of the existing assets and increase their current business 10 fold.

Okay, so more questions come from that. So number one, I'm going to defend the brave men and women

of our 1970s era nuclear industry by just asking a follow up to what degree, obviously, they have like a profit incentive, they would want to do these things, it's a good business. But to what degree though, were they actually responding to political market conditions by the focus on safety? So for example, nuclear power is unique, and then it's deeply tied into once again, in the case of like the Soviet Union, obviously, like the military in the US, like the Department of Energy, etc, etc, etc. So I could just see a war where someone says, look, like, are we making money off of these increased standards? But like, let's get real for a second, permitting, nimbyism, the public and the people who actually do the public's will, regulators are demanding that we increase things like I remember, after September 11, someone just saying like casually, this is kind of what I personally became like politically aware, it wasn't this incident, but it's when I was starting to pay attention, someone said, man, like, what if they'd flown a plane into a nuclear reactor? Now, I don't know if that would cause anything to happen, but that that's an organic example of how important Oregon people, civilians are just talking about like danger. So what's your, so how do you how should the industry have balanced the demands for safety, given the public facing nature of their business, with the profit incentive your critique? Yeah, so by the way, I don't think any of this was intentional. I don't think there are board members sitting around in a room saying, Hey, let's like pivot our business model to this. I think this is all just like a natural response to incentives.

Fascinating. And it took place over the course of decades. So slow. And I don't think anyone really even knew what was happening. I just think they started seeing one of their business is start growing the more that safety regulations were in place. And so they naturally started lobbying for higher and higher safety standards. And by the way, you're absolutely right. They're responding to there's a public component as well. But what would a normal industry do or what would

an industry do whose incentives were the other were otherwise, they would combat public perception

or misperception, because quite frankly, the fear of radiation is just like totally distorted based on the actual health impacts of it. You know, I'm gonna ask you a follow up about that after you give this answer. Oh, I would have you happy to get into that. Yeah. But they, but they were just but so yeah, instead of finding a way to quash it or counter market against it to sell more of their widget, it was just that that part of the business was long dead. They don't even have marketing people that would even suggest that at the company. All they know to do is say, you want any part of the public says they want it safer, even if it's a small minority, they would amplify that message because that was their business selling safety systems.

Okay, so then the next question, let's actually just talk about once again, let's go back to the 70s, like, what would you define as the state of nuclear safety in the 70s? Because once again, like, this is the problem with the timeline, right? So you have

three things you have, like, the China syndrome movie, you have Chernobyl, and you obviously have three mile islands. So like, there is just this specific time period where I think it should be noted this concerns happen. So what just assess how unsafe and safe were things in that context. Yeah. So I'm going to say something that's gonna be like rather shocking to your audience as well. So first, let me like just peel off Chernobyl, which is like this big graphite block, totally different physics and dynamics. And it's actually, we had some of those here in the US too, by the way, and also ran that exact same experiment in the US like a week prior. So we can talk about that later. But totally different reactor system, it's actually used to make plutonium. And a consequence is making electricity, as opposed to like a true power plant. So let's just look at water based power plants, what they call light water reactors, you know, or heavy water reactors. And within that, you got pressurized and boiling. Okay, but most nuclear power plants are water based reactors. Here is my claim, which is going to shock you and your audience. There is no potential hazard from the meltdown of a water based nuclear power plant. Zero potential hazard. I am not saying that it is safe or not safe. I'm saying it was never dangerous to begin with, even if you remove every single safety system. As was the case, empirically demonstrated by Fukushima, where we had three core meltdowns after one of the biggest tsunamis in the world took out every single safety system, including the roof. And there wasn't a single injury due to radiation. So what happened to Fukushima then? What happened to Fukushima was there was a tsunami that killed 20,000 people and a nuclear and three nuclear reactors that had total meltdowns and couldn't manage to hurt a fly. This is where I am grateful that I no longer work at PBS. So I don't have to like, imagine that the horrific nature of the internal back checking every single thing, just like, which is how it actually works in that context. So you're saying your claim, and what listeners here are actually your homework, your claim is that there were no serious physical consequences to animal life, animal life in the Fukushima. You're saying not even a blade of grass was negatively affected by the radiation that spewed out of three gigawatt scale core meltdowns at Fukushima. And the reason that who's back you up on this Wikipedia, any like any study, the UN like helping you in skier, like any of the major organizations, like anyone can do the research and find there were zero deaths. There was one payout for for a death that happened four years later from a worker who had lung cancer, but zero attributable injuries to Fukushima. And by the way, it makes perfect sense. It totally defies our cultural wisdom, by the way. If I found it shocking as well, and took me a year to even develop a thesis is like how we could all feel something so different looking at the exact same set of facts. So I sympathize like with anyone or empathize with anyone who feels that this just can't be right. But yeah, any research will show you every single safety system failed, not a single person got hurt. The very concept of safety in the nuclear industry is totally backwards. So what does it look like to make it face forwards? Well, if so the in the nuclear industry itself remember kind of coming back to like how that business model and what the nuclear industry is totally shifted around 1980. And so the nuclear industry is the worst like perpetrators of the myth that a meltdown could actually even ever hurt anyone. And then the new nuclear industry like the next gen reactors, they they promulgate this exact same myth because what are they doing? They're selling a quote unquote safer reactor, some new chemistry, material science, fuel combination. Oh, it's meltdown proof. Oh,

it can withstand higher temperatures this that that all because it's quote unquote safer than something that has never hurt anyone and could never hurt anyone to begin with.

So what's the technical and this is actually why putting the Chernobyl example to the side is important. Let's bring it back in. What are the technical because you were very precise about this? What are the technical differences that explain the obvious death, disaster, destruction caused by Chernobyl and the type of plants that we use today? Yeah, two types of deaths at well not not saying that we use today. I'm actually claiming the 1960s light water reactors couldn't possibly hurt anyone, even in the case of a meltdown. So I'm not saying that we've invented new safety systems. I'm saying fundamental physics of a core meltdown are non hazardous. So I just want to make that claim very clear. But I've been Chernobyl was was very different. So Chernobyl, and even so not as bad as people think, there were two types of deaths and injuries from Chernobyl. There was one from the acute radiation, very high radiation, when you jump on top of an exploded nuclear reactor. So the material inside of a nuclear reactor is extremely radioactive.

You don't want to go anywhere near it. You know, certain types of radiation such as neutron radiation

can create like make other metals radioactive. Okay, so I'm not claiming that radiation isn't dangerous. And especially in high concentrations, it is deadly. However, you have to like be right on top of it in order to get hurt from it. And that's what plant workers and the response, the response team, the firefighters at Chernobyl suffered from acute radiation.

Then you have another type of injury. And those are the long term or latent cancers that develop from the distribution of radionuclides. The industry calls this source term.

What happened at Chernobyl, since it was a graphite reactor that didn't melt down, didn't melt down, it exploded, like almost like a little nuclear bomb, is that the graphite that surrounded the core both burned and aerosolized, fine particulate of source term of radionuclides. Even so, there was only one radioisotope that could have hurt anybody. That's iodine 131.

It sits in that Goldilocks zone of being, you know, because if something is a very short half-life, it's very radioactive, but it's not around for very long. If something is a long half-life, it's not very radioactive, even though it's around for a while. So you look at those Goldilocks to see what can actually cause hazard to human health. And even so, that one, iodine 131, the only one that is in that medium half-life zone, and that can also

volatilize, so it can be carried with water, and it can bioaccumulate, so it can re-concentrate in the thyroid. Even that one only affected kids, now this is very sad, of course, but affected kids in a very narrow age range in a poor area that had thyroid that were under-iodized, because they didn't used to put iodine in the salt in Soviet Russia back then.

And we're in that one age range where it bioaccumulated to a concentration that could cause thyroid cancer, and so there are about 5,000 of those cases,

and most people didn't die from it because thyroid cancer is pretty easy to treat, in fact.

Still, a shame. We don't want that to happen, of course, but not necessarily the catastrophe that even a building collapsing in Miami is in terms of total amount of deaths.

So, here is the real question where this comes to. You said something really interesting earlier when you were referring to the industry doesn't do any marketing, and it seems to me, because I actually want to get to your actual company.

Though, this is good though, the timing here is perfect, it's like half, here's how we got here, what's going on. The reason why people don't do marketing is you're very learned, this is very interesting, you're very compelling, you're the first guest by the way, so I'm going to shock you, and you actually like shocked me. Like when you said that, so I want to say, I've done 350 of these, so that's an actual, that's actually very impressive to shock me at this point, but I'm thinking, okay, that's marketing, right? And not in a bad way, because this is like nuclear power is good, like the things that you're directionally describing, power, clean, we'll talk about climate change in a bit, these are all good things. So, it's not like you're not Don Draper selling us lucky strikes, that's not what I'm alleging, but it's still like marketing, like obviously you're going to say that it's like less dangerous, how do you just think about marketing? Oh, I'm marketing, because I'm trying to sell nuclear power plants, for sure. So, like my incentives are structured that I am trying to brand nuclear as non-hazardous. Now, I happen to have the facts on my side also, but that is in contrast with most other industries that are competitive generating sources, and the nuclear industry itself, which prefers to cannibalize existing assets rather than sell new ones. So, it's like me and maybe a couple other like loan advocates out there that like hold this position, but oh hell yeah, marketing, and not all my marketing now, like going on these podcasts, like as we become a much more successful company, we're going to do what every other company does and pump millions and then billions of dollars into marketing our position. That's fascinating. And quick thing, nuclear waste, like what's your take there? Never heard a single person place their thing in all of human history. So, remember that one radioisotope that is dangerous, right, the I-131? It has a half-life of eight days, okay? So, yes, nuclear waste lasts millions of years, no doubt, but the component, the constituent isotope that actually has a biological hazard profile is all gone, is 99.9% gone in just three months. So, it's like, yeah, I mean, listen, you, by the way, you, you personally, your body is also radioactive for millions of years because of the carbon-14 in your body. This is how we do radio, radio that's like comes from radioactive carbon dating for all living things. So, this notion that nuclear waste is radioactive for millions of years doesn't tell the whole story, doesn't talk about its hazard profile. Yes, it is true, but so is virtually everything you've ever seen or touched is radioactive for millions of years. So, here's one more question before we get to the company. Who, who's someone who disagrees with you? You're very, you're very, you're very, you're very, very confident and I think that's a good thing. People should be confident, right? But like, but we're, but you know, it's like, I'm not in this conversation because what's interesting is that like, in a book, I interview a lot of like web three founders, so I'm used to people who are very confident who are telling me something I don't inherently agree with, but you're clearly like very studied on this topic and you are confident in your company, which is an interesting, which is an interesting, you know, you could be a think tank, right? Like you're in DC, you get how that works. This is a unique combination, but who is someone who is in your mind, like you, you respect who it's like, yeah, I think he's all about. So, so not everything, right? Because it's a component book. Who disagrees with you? Rather than give names, do you just want me to steal me on the other argument? Yeah, which, yeah, which, whichever you're comfortable with. Yeah. Yeah. Yeah. Yeah.

Yeah. I mean, essentially, listen, if, if you're looking at Brett and saying like this one guy has this one opinion and nobody else resonates it versus like every radiation standards body that exists out there, right? And the nuke and all other nuclear experts, right? Like the entire nuclear industry that might disagree with me, you can say like, it would be totally illogical of me to be compelled by Brett's argument or like just agree that Brett's argument is correct versus 99.99999% of other professionals in this area. And the only way I can explain that is through the history and through the incentive structure and through also just encouraging people, hey, go back to the root data. Like don't trust, do not trust me. Please don't trust me. Instead, just go to any single radiation study that's ever been conducted, read the report, and then see that our standards are three, in some cases, four orders of magnitude more severe than they need to be based on the actual medical evidence.

Okay, so let's actually talk about your company then. So, you know, we're in the state we're at, we see the disasters for the industry, 70s, 80s, and then kind of like the long slide into financialization. What is your unique contribution beyond just like your opinions to this? Because that's what makes it really interesting. Like what are you adding to this status quo, which in many ways doesn't work in your perspective?

Yeah, so okay, so like five years ago, I set out to solve climate change. I just sold my previous company and was like, all right, now I have like the resources and the know how to go after big problems. So let me do that. And so I started a research center. That's when I first discovered nuclear, like five years ago, I'd never met a nuclear engineer in my life, had no affiliation or interest in the industry whatsoever, but just started talking to people throughout the energy industry and realized just something was so wrong here. Then I started the Titans nuclear podcast to be able to like get access to the industry and figure out like exactly what was wrong.

I took 865 meetings, the first year subject matter expert interviews. And then we created 400 podcast episodes based on those people and others over the years as well. And then I started, I was invited to give lectures at universities that second year meet with heads of state in some countries that were doing nuclear rollouts because I'd established myself as an authority through the podcast. So I started saying, hey, this is what I've discovered. Like, can someone please do this? Nobody was doing it. And so I'm like, all right. And sorry to quote, what is this? Do this? Yeah. So tackle. Yeah. Sorry. I didn't actually explain that. So the thesis I developed is that if you want to make nuclear way faster and way cheaper, by the way, those are the problems to solve and good criticisms. So by so the speed of constructing a plant and cheaper. Okay. Yeah. And cheaper and cheaper end state of electricity delivered electricity cost. Those are the problems to go after. Do not try to make it safer. Do not try to address the waste issue. Don't try to address the perception issue, especially the way that people have been doing it. Instead, just tackle construction complexity and cost and timeline and build whatever system like is directed based on trying to solve that problem. Nobody was doing that. So I decided I had to raise some venture capital and build a company called Last Energy, which is now the most commercially successful next gen nuclear company that exists. We've sold we have 55 projects under development across Europe.

We have 12 priced PPA contract or 12 units worth of price PPA contracts across Poland, Romania, the United Kingdom. And what we are doing is we are factory building micro nuclear reactors using the existing technology and using that factory building process just like forward did back in

the day in order to mass manufacture and bring costs down that way. And explain the significance of the mini aspect. When you say mini, I think about committee Cooper, I don't think we're talking many, maybe we're talking many Cooper sized, right? Like how should we think of the significance of the

miniature aspect? Yeah. So if you go to lastenergy.com, you can see a cool scrolling animation that shows exactly how the plant comes together and the size. It's about 75 shipping containers that are stacked, you know, three rows high, essentially. And then we've just buried the nuclear reactor underground. It's a little more expensive, but is the simplest way to overcome any licensing obstacle in terms of proving that you don't have movement of source term, movement of that radioactive material, even in the worst possible case scenario. It seems pretty obvious just buried underground. Teller said, Hey, let's just bury nuclear plants on your ground. But the new nuclear companies don't want to do that because then they can't sell their fancy reactor that's quote unquote meltdown proof. So this is helpful because like I think there's a lot of discourse around how there's like a nuclear renaissance without requiring you to talk to anybody. What are the like alternate models that other like like sort of for example, the way you're describing this, it sounds as if there are a series of companies or your Tony's or whatever who are basically unveiling big reactor 2.0 safer, easier than ever. Is that basically what the contrasting vision for what this is? Yeah, the contrasting vision is you have to radically reinvent the physics, the chemistry, the material science, the reactor itself, you start with the reactor, you reinvent the reactor, it's going to have all of these great attributes and this is going to be what resuscitates the nuclear industry.

And in fact, I think that they're shooting themselves in the foot by disparaging the old nuclear industry because you don't make people feel that something is safer or better by telling them it's safer, better. As a matter of fact, all you do is reinforce the underlying notion of a hazard by constantly referring to safety. What they're all doing is taking tons of government grants, we will not touch government grants as a policy. They take government grants, they live off of that for sometimes decades, sometimes it's hundreds of millions of dollars. Occasionally, they get a billionaire philanthropist to back them even further. And they just keep that paper reactor vision going for as long as they... What do you mean by paper reactor? Paper reactor is a term used in the industry to describe a reactor that works perfectly on paper, but is never realized, it's never built in the real world. Because a combination of too slow, too expensive, is that the... Once again, that's the gap you say?

Well, I think... Listen, not to... Yeah, I do want to offer a caveat on my seeming disparagement of the competition because I know many of these people and I really like them.

And I think they have great intentions and they're brilliant. And I'm sure the reactors will work. The problem is when you first sketch something out on paper, it doesn't include so many practical realities, let's say about supply chain. It's like, okay, you just say you're going to pump molten salts, but where's the supply chain for that? Where's the pump for molten salts? Oh, you're going to invent it? Do you know how hard it is to invent a pump on top of a reactor? Water-based pumps have been around for 150 years operating power plants. Like billions of dollars of R&D have gone into something as simple as a pump. And by the way, needed to go into something as simple as a pump. Millions of these pumps

have been built and that is why you can just get a pump off the shelf and it is relatively cheap. You want to change any chemistry, any material science, any physics, you are throwing away billions, if not trillions of dollars in industrial R&D for the standard supply chain.

I guess the next question would really be, could you just like, I feel like Michael Scott, you explain this to me like I was A, explain to me like I'm five.

Why is this, from your perspective, like a venture scale opportunity, right? Had Mark Entry's on the podcast. What you're articulating is very interesting. Also, I think in your terms of your story, there's something there in terms of like, you started like this other company, you sold it, now you're focusing on like the hard tech, the deep tech, the quote unquote hard stuff. It's hard. And the reason why a lot of your competitors are getting the grants, because traditionally, this was not a space that anyone outside of the public, good space, like, hey, government ruined a fund, like, how does that work?

Yes, we would have this way. This, and this is how life works. This seems so simply obvious.

But once again, my warning sign as a narrative, like, watchers like, okay, make them smaller, which makes them quicker to build, which makes them cheaper, and use technology we already have. I feel like someone should come up with this in the 2000s, right? Yeah. And by the way, most of the things that I am saying are not original ideas. These are things that I learned from my contemporaries, both in the nuclear industry and both lessons learned from failed startups, and also from parallel industries as well, and seeing how they've worked and how they've transformed. And like, even things as simple as how data centers are built now versus how they were built 20 years ago, pharmaceutical plants, how they're built now versus 20 years ago. I mean, what I attribute the reason that we're the only ones doing this is because I took two years to study the industry, just tried to keep like a blank mind throughout the whole process, not try to fall in love with the technology, like I have a very need pull versus tech push mentality. And if you just look across the landscape, and by the way, it is so hard to break into the nuclear industry. If you don't come from the nuclear industry, if you haven't been going to conferences, like for decades, which I suspect you don't have, right? Which I don't have. Yeah, exactly. Not many things in attack. I'm just like at a credential perspective. Oh, I don't see it as an attack. I see it as a compliment.

Really? That's interesting. Yeah. I mean, because listen, my other critique of all the other approaches,

it's like, the founders have never built anything in their lives, right? If you'd ever built anything physical or like corporate, you would realize you want to change as little as humanly possible, like the best businesses, the ones that are like most likely to succeed, or when you take one little variable, it could be a business model change, it could be a customer, you know, niche change, like, and that's all you change to get your toehold, you build up a business, and then you can start innovating and doing more. So, yeah, I mean, that's that's my philosophy on building a business. And if you just look at every other nuclear startup, they come from nuclear PhDs, who only learned the business model of grant writing through their academic studies. And so that is the business model of their nuclear companies. And the key thing is, you said you only want to take venture capital, you don't want to get grants like what's, you have quasi libertarian tendencies, so maybe there's like a limited government thing here, I can kind of see, you said the word human flourishing, so obviously, that's gonna like

raise, not raise a flag in a negative way, it's just you said certain like lingo things, is this like ideological thing, or is there like a, and maybe the ideology relates to business, like, is there a cost to doing both? I'm on your board, I'm like, well, dude, it's free money, and you've got money from VCs, go for it, right? Now, yeah, I think there is a cost. I mean, I see grants, government grants as institutional poison, like literally poison, it's not necessarily a personal philosophy, though, yeah, I mean, like, I guess I do lean a little bit libertarian, but from a commercial philosophy, how to run a business philosophy, I see government grants as total poison, right? Like, it actually influences who you hire, what they do, like how you decide to spend money, what problems you choose to go after. I just think it is so important to be like customer centric or stakeholder centric. In the case of like nuclear development, who are the key stakeholders? Okay, they're the customers of power, right? So electricity

purchasers, it's government, because it is so heavily regulated, no matter where you go in the world, you need a government to back you. And then the capital markets, like, how do successful capital markets fund infrastructure projects, right? So those are the three key stakeholders we went to. And over the course of four years, interviewed them, and we have the Titans nuclear podcast that we did for nuclear stuff. We also ran that same playbook spun up a second podcast called energy impact, which we used to interview financiers, project finance, like institutional investors for energy infrastructure to say, Hey, what are the criteria that make a any energy project investable from your perspective? And what they told us is no science projects. Okay, so before I even started a company, that became one of the starting criteria of what we would build no science projects, because otherwise, we can't access \$400 billion worth of dry powder that is dying to put it into energy projects. And so yeah, I'm just I'm terrified.

Wait, talk away. Talk about that for a second. \$400 billion worth of dry powder.

Talk about that, right? Because once again, the conventional wisdom, as a podcaster, is that it's difficult to fund these sort of projects. What's this bill? What's this one of these billions? Yeah, yeah, it is extremely difficult to fund any project that isn't going to be like profitable or like, like reduces the risk to the investor like these types of investors don't take technology risk, they don't take it on any risk. So you have to prove to them that you are not innovating too much. And that's like hard for an entrepreneur to wrap their mind around because usually entrepreneurs talk about how innovative they are. I mean, all of our marketing material, and it's true, we try to talk about how not innovative we are, like we are changing as little as humanly possible in order to bring down the cost of nuclear power by orders of magnitude. And at a core level, just, you know, if I'm giving away proprietary secrets, obviously, just beyond me saying it's a smaller reactor, so it's cheaper. Translate that into what you're actually doing. Like, why is this cheaper? Yeah, so in some ways, it's more expensive, by the way. So like, when you go smaller with like equipment. Oh, scale, right? Yeah, yeah. You say it out loud. It's like, oh, yeah. Obviously, it's not that simple.

Yeah, so what we do mini, mini, mini Hummer, and it's super cheap to do that, right?

Yeah. So we have a long term vision. And so what we say is, hey, we're going to go after the, like, we're going to have to hire value customers early when we are more expensive. And so just like, you know, you sell the Roadster to people who have, you know, a billion dollars, you sell the Model S to people who have millions of dollars, and then you, you know, you sell the Model 3 to

people who have hundreds of thousands of dollars, you can do that same thing with our product too. So we go after the highest value customers, those that because of their region, or the, you know, other market, the other markets, whatever electricity market structure they're part of have extremely high costs of power and are maybe even capacity throttled. So we go after them, we sell them the highest cost energy that we can for our first few units, which will be more expensive than they should be on like a per kilowatt basis. And then we build more and more more of them. And then we get to take advantage of economies of scale of many instead of economies

of scale of size. And so every order of magnitude, number of plants that we're building, we get to reduce the cost by 20, 30, 40%. And then we get to access a larger customer base as we go. So that's more of like a business model innovation or anything else. Yeah. And the key thing is, okay, so that's helpful. So then I think the next question would really be execution. So if you've given us the Elon model as a mental favorite, the metaphor doesn't perfectly fit, right? Because there's no, at least it doesn't sound like there's a Cybertruck or even like at the mono X or Y, because it's still like, because your point is like simplicity, you're not claiming you're doing this, this or that. Is this purely that an execution plan?

Do you have any ideas as in like, is the question of whether this business works a matter of, okay, so we've got the tech, we've got the process, we need to sell, execute, execute, execute, execute, execute versus, you know, 10 to 15 years from now, a guy in a lab or a gown lab is going to have this innovation and the game changes, which is kind of funny because that's typically, you would think of this space for a VC perspective. So yeah, like, is this execution or what?

I would say yes. Like, I've designed the business to be totally an execution play. And however, it is an extremely complex, like, we have to perform across like government, like, you know, policy and also having like sustained government support, across like the business model and contracting and sales, across, you know, executing on the manufacturing and the engineering, it's there's still a lot of engineering, don't get me wrong, we're just engineering using all off the shelf components, but so is an iPhone. And that is still very complicated, especially the first time that you try to build it. So yeah, we have to execute across engineering, across policy, across regulations, across legal, there's so many ways in the nuclear industry, you can caught up legally, and it can just totally sink your business, like export control. So we have to execute there. And then, and then financing, we got to execute that. So yeah, so yeah, there's like five domains that are all extremely difficult to execute on, but that we are not trying to do anything too radical in.

So I'd love to just take a step back and ask you a couple of broad questions. So anyway, what do you think our country's broad nuclear slash energy slash environmental policy should even be like that's an incredibly huge scope, but take that question wherever you want to take it based on your background and interests. Yeah, my claim is that nuclear already has so many inherent advantages that if you just put it on like a level playing field from a regulatory perspective, it doesn't need any subsidies. Like I do not advocate for like subsidies for nuclear power, like give them all to renewables. I don't care. Nuclear will still sweep the floor of any other clean energy technology or fossil technology based on its merits alone. If all you do is don't put up impossible regulatory roadblocks. So the kidding understand, right? So these are businesses. So it's not as if this world where there's rejiggered regulation, there's still private

capital, right? So you're still going to need direct raise, you still need to invest. Like your point is because what happens now is you have all of that. And on top of that, there are subsidies. Your point is that this will operate as traditional energy businesses do, correct? Is that the way to understand it? I think there's room to innovate on the energy business model in general. But yes, like what we are doing isn't any different than what a commercial solar developer might do when they go out and find a factory and sell their PPA and run a private wire to their business. What's PPA? Sorry, I hate when other people do acronyms. You've been good about acronyms, but I have to call you on that one. No, please do call me out every time. So power purchase agreement, it is a contracting structure that the renewables industry pioneered and is used to essentially sell 20 years, let's say, worth of energy to a customer fixed fixed rate. And the way it is so good, like the way that it divvies up the like who's at risk and the incentives is just like perfect. So your customer can say, I will pay this rate of power looking forward in my business and like seeing what rate of power I want to pay, but not take on any risk for the build. Like if you don't deliver that electron, I don't pay for the electron. Okay, so that's great for them. And the developer or the technology provider in our case, we take that contract and then we bring it out to the capital markets to institutional investors like private equity. And we say, hey, listen, we've got this power contract. Why don't you do the diligence on our technology, right? You hire your own independent engineers, look over all of our schematics, so you feel confident that we can deliver at the cost that we say we're going to deliver in our financial models. And then you front load the cash for development. So it's very capital light from our perspective. So they'll give us \$120 million after and then we sign up, let's say, \$130 megawatt hour contract with the customer, we get \$120 million from the investor, we execute on that and two years later, we start selling power. And those investors get a lion's share of the electricity sales, but it's also very profitable from our perspective as well.

I think a couple last big questions, let's just pivot away from nuclear for a second. I'd love just to hear. Because you've got a lot of energy, obviously, at a liberal level, but also you're thinking about these spaces into your board, like after you sold your first company, you want to focus on big problems, like let's just talk about like the big problem space, right? So had Catherine Boyle on a couple of times, had Marco, we talked about American dynamism, congrats on the American dynamism 50. It's just a listing of companies in these spaces.

I just find the American dynamism framework about chasing kind of everyone's part of side, just like an interesting one.

I know a lot of people do like, what are your thoughts around just like America where, I mean, you're young, like you're a little older than me, but you're still young-ish. Where do you think about where people should be putting their talent and their energy, just like kind of stuff like that? Because I think the other reason why the framework is interesting and compelling to folks is the kind of point is there's this 2020s period where there's like a whole set of really deep, really hard problems that if executed on the right way, could lead to a lot of great things like in the 2030s. That's all I'd like to think about it. So just like respond to that framework and how you kind of place yourself within this vortex. Oh, man, that is a broad question. Yeah, wherever you need to. Well, you interview people so you know if something is to cop up. But actually, I just want to know, like just what do you think, man?

Listen, I don't think we struggle enough. I think we've gotten really soft.

I don't think we expect enough out of people. I think like the way the culture is gone is that like we make excuses for people not working very hard. We like try to give people like too much money. We make life too easy for people. And I think from a very young age, like life should be difficult. And what that does is that prepares people to solve hard problems. And so if we want to have like a country that is extremely productive, that is able to like, you know, listen, how much of our talent is wasted on like this software thing or that software, like brilliant, brilliant people, right? And then like, I mean, yeah, we've heard other, you know, we've heard other figures, you know, criticize this as well. This isn't a new thought. But I just feel like if from an early age, we expect a lot out of people, we put them in hard situations, then over time, we are going to have people that are able to just tackle incredibly complex and challenging problems and and maintain our worldwide supremacy, which if we don't, if we don't actively work to maintain it, we do risk losing it.

So I have to ask this, because I am a full time podcaster, one of the softest jobs in the history of Sasha, I even work from home, sorry, I don't have to commute, right? It's not even the 1990s version of me like goes into CNN on the weekdays, and there's at least a subway and there could be danger there. So I'm at the peak softness as a media character. So I have to ask the follow-up. What does putting people in hard situations look like? In a way, it doesn't just do like masochistic, right? Because like, for example, like, and I'm, this terrorist politicized by me, like you and I both lead like privileged, like cool lives, we get to like put our time focusing on things that are interesting to us. So what is a way that like making things hard that doesn't just sound like out of touch? Do you know what I mean? Yeah, no, I mean, like, let's say in early education, people should fail. Okay. Like there should be, like people should receive Fs and like, you know, like test, like the test should be hard, like our expectation, I use test, but I really just mean like, we should set our expectations much higher to create a greater distribution of outcomes, and then give people the tools and the chances to climb up that like distribution to higher levels of performance. So because, yeah, I appreciate the follow-up because I had an image of, you know, sending children to the fields and I know I thought what you were saying, I wanted to, I was guessing that wasn't quite, or maybe it would be your saying.

Well, I mean, I would apply the same. Yeah, I mean, no, I don't mean like hard labor, but I think difficult physical situations. Yeah, I would subscribe to that philosophy as well.

So what's, let's get your closing thought, like why, you know, as you've really set up, right, you're, you're, you're out on, you're not out on live here, because like you have an actual company and you have like investors, so like, let me just tell you what Charlotte did, but you're definitely taking a contrarian stand in terms of your vision and your approach.

I guess my main final question would be like, what, what are some other areas? So like, because I don't know, I'm really compatible with what you're doing, because like, I've always books behind me and I'm a full-time podcaster, so I always think like, dude, like you should be spending most of your time just like reading and learning about things. So it's actually really compelling that you sort of your company and just become like a lazy bum. And just kind of like do, I'm sure you know this, like, what should we mean to Austin, but Austin has a not too undecided number of like

lost 30 something tech founders. And it's genuine kind of just like, oh man, just get the job at Facebook again. It's the nomadism isn't that helpful for you. But now I've been way too rude to way too many people. What's your advice for anyone who just advised me? I want to learn more about things, study deeply. This is the more personal section, like what should people be doing? Like, how did you do that?

Well, I mean, you and I probably don't have to tell you this, like, this whole podcasting, like I cannot advocate strongly for it enough for anyone in any business, like spend a year and talk to literally as many people as is possible. And what you will realize you've done is not only narrowed in on the right problem to solve, which is probably the most important thing. But at the lowest cost possible, have front loaded your business development, your government affairs or any other stakeholder relationship that you need to have in an extremely like non salesy way, you have developed real meaningful relationships, you'll learn from them, and you'll have this huge network of people that you can go back to and call on when you need them. I would do this for everything, like especially the medical industry, which is just so complicated. Like I have fantasies of like, you know, someone that I've mentored or talked to, like, go apply, like go do the same thing for cancer, like interview every oncological researcher you can out there, like put things together that researchers even with their own space aren't putting together by talking to thousands of people, you do not have to have a formal education in a space to know the most about it after just a few years. There are a lot of college students, this will be the final question who listened to this podcast. And when I hear what you're talking about, I'm like, man, I really wasted college. In terms of like having the time to your point, like when we're talking about almost five years, that's basically college. Like what would you what would be if you could go back or like advisor mentee someone college kids, what would you tell they should be doing if they're interested in this type of stuff? Once again, that's the other great thing about podcasts is like you don't in order to get extremely distinguished, important intellectual people to talk to you, you don't have to have like a huge career if you invite them on a podcast. Like it was a little harder maybe five years ago when people didn't even know what podcasts were. But in some ways, it's kind of like harder though, like you can't do like the virtual thing like buddy, buddy, buddy. Well, COVID helped in that way. Everyone all of a sudden was comfortable.

What's funny is like the first few hundred podcasts I did in person, I would literally fly to meet that's crazy. I'm serious, like so many props for that because like, I still talk about triggering experiences. Sometimes I think about man, like, remember when you had to have people come to an office, and then Megan McCartle was 30 minutes late because her scooter, her scooter like broke down. And that was your fourth episode. And you're like, Oh, man, like it's just like, it was the worst. I know it's better to do it in person. But I'm going to have to be wish we wouldn't do this. The real line is that the much more firmly capitalized to me being able to like pay a lot of people to make sure things don't blow up to do it on my own that way. Yeah, I mean, that's what when like, we were talking about this before the show started, I used to have this like professional like microphone setup that I would travel with and

just too many things can go wrong. Yeah. So at some point, I just took my iPhone, like front facing camera, like on a little tripod, like little gorilla pod and like it was a terrible angle, terrible audio quality. But it worked every single time. And I always had it on me. And that that made it a lot easier too. But no, then we switched to like the zoom era. And yeah, you can scale up that way also. And so yes, so there's no excuse for anyone in college, if you are passionate about a subject, reach out to literally everyone in that space, off what you're doing. So here's what people don't understand. It's literally a very like interesting exchange because okay, normally, if you were just to interview someone just to learn about stuff, they would put up a guard, they would be defensive, they wouldn't know what your motivations were. And they would also feel like you're wasting their time. But with a podcast, you are offering something exchange, you're offering a platform, you're offering like a boost to their ego. So it is a very fair trade, like their knowledge you get and their relationship you get in exchange for like, like allowing them to more widely spread their philosophy. And so it's a fair trade, it's the best trade. And so I would encourage everyone who's interested or passionate about a subject, just go just become a podcaster and talk to everyone in the sector. Yeah, and the last closing advice, because this is actually great news people can use, the key thing, what made your early episodes were like your quality, but obviously was degraded, you're in a niche, so it's still valuable. So if you're if you're if you're if you're covering a niche for your providing value, we put this right, the weaker and more general your podcast is talking to creators and builders and people who are trying to find your quality better be like HBO max level at this stage in the game, because you're just so not obviously providing value at this point, that if you're actually doing and this is this is because this is this is what students can do. Students have the time to go niche, they have time to like find people. And I've because I'm also talking about this, so a bunch of students have reached out about podcasts lately. I think it's like, dude, not enough kids have cornered the I'm a young inquisitive kid in college. So I'm building a podcast for my issue years. I keep telling like, no one's done that. And it's so obvious like, I went to college in the early 2010. So I wasn't quite a thing, but like, I was like, no, you could pretty much do this show now. Because like, you could do those different things. So yeah, those are, I'm glad we could close, we could we could both solve nuclear safety and offer podcasting advice. But this has been super, this is amazing. Can you give people some links to where they should go? The you mentioned two podcasts, you've got a website, all the good stuff. Yeah, sure. So yeah, last energy.com is for the company, Titans of Nuclear is our podcast where you can learn from hundreds of nuclear experts. Energy Impact gets more is another podcast that gets more broadly into any topic around like building energy infrastructure from the policy or the financial side. So these are some of the places that you can find us online. And yeah, just stand by to keep hearing more and more announcements. And yeah, we recently just got a big spread in Forbes about a project we built in Texas, so we didn't even talk about that. That's okay for next episode AP. So we're getting a lot of media coverage to just stand by to hear, keep hearing more and more. Awesome. Thanks for coming on the realignment. Thank you. Hope you enjoyed this episode. If you learned something like this or a mission or want to access our subscriber exclusive Q&A bonus episodes and more, go to realignment.supercast.com and subscribe to our \$5 a month \$50 a year or 500 for a lifetime membership

race. See you all next time.