Andrew Saintsing: Hi, you're tuned into 90.7 FM KALX Berkeley. I'm Andrew Saintsing and this is The Graduates, the interview talk show where we speak to UC Berkeley graduate students about their work here on campus and around the world. Today, I'm joined by Chris Keckler from the Department of Nuclear Engineering. Welcome to the show, Chris.

Chris Keckler: Thanks.

Saintsing: It's great to have you here.

Keckler: Yeah, I was excited that you reached out to me and asked me to come on the show.

Saintsing: Yeah, I'm really interested to hear more about nuclear energy. I, I feel like my experience learning about nuclear energy is mostly, well, now Chernobyl has a few things, or The Simpsons.

Keckler: Yeah, that's pretty typical of what I hear from people.

Saintsing: Yeah, do you… and, I guess that's pretty problematic, right?

Keckler: It's not great. It… you know, like anything people come in with their own biases, and it's just with nuclear, almost everybody comes in with a negative bias.

Saintsing: Right.

Keckler: So, you know I guess almost part of the reason that I was so excited to come here to talk to you today is because I like to try to dispel that wherever possible.

Saintsing: I guess first off, like, should… nuclear energy is not that dangerous, right?

Keckler: Well, so, so nuclear energy is, should be viewed – the way I like to think of it – should be viewed in the context of any other energy source, so in the same way that we get a lot of energy from coal or natural gas, those have drawbacks, right? And, the same thing goes for – people don't talk about them as much, but – the same thing goes for solar and wind and definitely hydro, especially big hydro has a lot of problems, and nuclear as well has its own potential issues, so really I always like to, kind of when I talk to people, I like to frame it from that perspective: nothing is perfect, you know? We don't have a silver bullet for the energy problem, which is why we still have like seven different energy sources contributing majorly in the United States.

Saintsing: Right. Fair enough. So, why is nuclear energy better than other energy sources?

Keckler: When you, when you kind of go and do a very apples-to-apples comparison of a lot of different important metrics, some thing's come out on top for some categories. Like, for instance, nuclear energy has the smallest footprint of land or total resource usage, and that's just purely because of the physics of how nuclear energy works. It's about a million times more energy dense than other types of fuels. Especially, I mean that's like solid fuels. When you start talking about wind and sun, it's significantly higher in terms of its energy density, so that allows it to be very compact and to use very little resources. So, that's one really good thing about nuclear. People – the population is obviously increasing, and the competition for resources from, from people, from industry, whatever is also increasing at an enormous pace, so when we start to look at things like environmental, a lot of environmental concerns can be boiled down to, we have a very large population, and therefore, we need to have, you know, 7 billion of every item in the world, and nuclear energy in my view is almost uniquely suited to be able to support that sort of population growth and population density because of the energy density that it has and the small footprint that it requires and also the unique – this is not something people typically think of, but – the unique safety characteristics of nuclear energy.

Saintsing: You're saying it's safe?

Keckler: I'm saying it's very safe.

Saintsing: OK.

Keckler: It's extremely safe. If you look at the historical record of all different forms of energy, nuclear actually comes out on top in terms of, you know, key metrics. Like, it's a very morbid thing to talk about, but like the number of deaths that can be attributed to energy generation from whatever source you're talking about, it's well known at this point that coal, you know, contributes to a lot of deaths around the world primarily through things like air pollution and then like the, the slag and ash that comes off of burning that. Other things, you know, like hydro, you might think of as being generally pretty safe but when there is a failure, like a dam failure, lots of people often die, so you know we have, at this point, many years of historical data of energy generation and the negative consequences of that and when you really stack them up and nuclear is actually about the best. Now it's ironic that you know the few accidents that there have been in nuclear, first of all, cause very little harm in terms of actual impacts on human populations, but they are – you know, you saw this Chernobyl TV show that we've mentioned earlier – they're just highly broadcasted, you know? Everybody knows about them. They know three words, right? If you, if you're an anti-nuclear person, you say Three Mile Island, Chernobyl, and Fukushima, all right? And, that's enough usually to stop the conversation, but if you take it one step deeper and actually understand what happened in those situations, the toll on human health and the environment is extremely small.

Saintsing: Why do you think those disasters have such, like, a place in our collective psyches? Like, is that just because…

Keckler: That's a really good question. I wish I knew the answer to that because then I think I could do more to try to fight it.

Saintsing: Yeah.

Keckler: But, yeah, a lot of it’s historical. At least that's what a lot of people chalk it up to, you know? We started the nuclear world with nuclear bombs, right? And, for a while that's all anybody liked associated with that, and then, kind of in the early stages of, of nuclear power there was Three Mile Island, which led to no deaths, no human suffering almost at all except for like the town of Harrisburg kind of freaked out for a bit, and I don't know. It's just, it's just left a permanent stain on, on nuclear, and there's a lot of people that are older, I think, that are more passionate about that than are a lot of younger people right now. That seems to be, at least in my view, the trend.

Saintsing: Right, so it's kind of just like maybe that it's wrapped up in ideas of war and that we've seen like, when it is used for the purposes of war, it can be very effective in that?

Keckler: Sure, yeah, but then a lot of people who are younger, more my age and even younger than that, you know, they're looking at the world that we face coming up: of climate change, you know, energy scarcity, poverty around the world, and they're kind of reassessing the situation a little bit, I think, with more of a level head.

Saintsing: Right.

Keckler: At least that's, that's my viewpoint.

Saintsing: Yeah, for sure.

Keckler: And, trying to you know reevaluate: is nuclear something that we should be keeping on the table or even expanding? And, you know someone like myself came to the conclusion that: yes. Yeah, that is the case. Some people don't. That's fine, but I think that's, I think climate change is probably the primary reason why a lot of people are really weighing that question recently.

Saintsing: Right, and it's gonna be way more effective like you were saying than wind and solar which would obviously be clean energy sources?

Keckler: Sure, yeah, well, wind and solar I have, I have no problem. I think a lot of people that get labeled as pro-nuclear get labeled anti-wind and solar. I think that's a thing that should be avoided because there's no real inherent, at least the way I look at it, there's no real problems with wind and solar. It's just that the – I don't think that they can do it alone, and so, I'm all for expanding clean energy and I think the clean energy includes nuclear. I think, I think it by definition includes nuclear, so, but wind and solar are in there, too. So, if you want to put a solar panel on your house, do it. You know? It messes with the grid a lot, but it's uh ultimately will be good, I think.

Saintsing: Okay, so I guess, what, what are people doing in terms of research in nuclear energy? I mean, is it… are people trying to make nuclear energy more efficient and safer? Where are you? What are you trying to do?

Keckler: So, in, in the nuclear energy world, I think there's kind of two rather large camps right now in the United States. I don't know if you know this: the amount of electricity that's generated from nuclear is about 20% of our total electricity.

Saintsing: I did not know that. That's like a decent portion, I guess. More than I thought, yeah.

Keckler: Yeah, it's, it's more than almost anybody realizes because these nuclear plants are typically not things you see very often, so you don't realize that there's a hundred of them in the country right now producing a lot of energy.

Saintsing: They're just like far away from…

Keckler: Yeah, usually they're, I mean, they're not in downtown, right? And, they're usually kind of more in like the farms on the outskirts of big cities, and they're not typically like right next to the highway, so you don't see them.

Saintsing: Right.

Keckler: You know, when I'm driving on the highway, I know where they are, and I'm looking for them because I'm just a loser, and I, I'm like, you know, craning my neck out the window trying to see these things, but if you're not looking for it, you won't see it.

Saintsing; Yeah.

Keckler: So, they're out there, like silently generating about 20% of our electricity in the United States. There are a lot of people that are focused on trying to keep those 100 nuclear plants operating for as long as we possibly can because they're a, they're an investment which has already been made and they're doing a very good job as is. Eventually they'll need to be shut down just because they get old, you know? The average age of a nuclear plant in the United States right now is something like 50 years.

Saintsing: It… they just, like because the way nuclear energy…

Keckler: No, it's not that, but almost no industrial facilities in the world operate for any longer than, you know, 80 years.

Saintsing: Right.

Keckler: When you think about when the Industrial Revolution really began in the United States it was like 1900, you know? Late 1800s. So nothing is that old. Things, even just mundane things, will degrade over time, you know? The integrity of your building…

Saintsing: Right.

Keckler: It's not, it's not, it has nothing to do with nuclear power. It's just a building you happen to put it in.

Saintsing: But, you could – they, they could repair the existing…

Keckler: They do a lot of that. So, that's, that's kind of the primary area of work and research in the older side of nuclear is how can we maintain our existing investments to maximize the productivity that we can get out of these things. So, that's a huge area of research and work. A lot of it in industry, and they've done a really good job with that. The other area which is more where I work is advanced nuclear. So, it's like how can we design the new set of nuclear power plants to be better than the old set because we know that there are drawbacks to the things that we've built before, we know we can improve it in a number of ways. So, how can we realize those improvements which we know are possible and do it affordably? So, that's really kind of like where new nuclear, what a lot of people would say advanced nuclear, is going.

Saintsing: I guess, what are the big trends or like what specifically are you looking at?

Keckler: So, a lot of these things are actually not new ideas. They're just things which we've struggled with for a long time or there's never been really the right opportunity to implement them. A classic example of which is what's called breeding. So, nuclear fuel breeding

Saintsing: Interesting.

Keckler: All right, so basically in, in uranium when you go out and you mine some uranium out of the ground – which is what we're using in a nuclear reactor.

Saintsing: Right.

Keckler: Only a very small part of that uranium is actually useful in the current reactors that we have right now because there's two what are called isotopes.

Saintsing: Right, so what are isotopes?

Keckler: For a particular element, two different atoms of the same element can have a different number of neutrons.

Saintsing: Right.

Keckler: And, depending on that number of neutrons that they have, it is either useful in a nuclear reactor or it's not, so a lot of the uranium is not just because of how it happens to be, so, but, but the thing is about that the stuff, that is – you know I'm, I'm doing air quotes right now – the stuff that is “not useful” we can actually turn it into very useful stuff for burning inside of a nuclear reactor, so for producing lots more energy, and the way we do that is we allow some of the uranium 238 isotopes (so it has 238 protons plus neutrons), we allow that to absorb one more neutron, and…

Saintsing: You allow it to absorb one more? It's just like: it didn't know it could do it before and now it can?

Keckler: That's a good question. So, you know in the, in, in the room we're sitting in right now, there's not like a bunch of neutrons flying around. There's, there is some very small amount, okay?

Saintsing: I didn't even know… I thought it was like neutrons are in atoms. I didn't even know they were flying around.

Keckler: Yeah, yeah, so they're, um, we get all sorts of radiation produced from particles in space coming into Earth and interacting with the atmosphere, so this is producing like a cascade of radiation that is constantly interacting with everything – yourself and everything around you. But in a nuclear reactor we have lots of neutrons moving around okay because that's how we're unlocking the energy from the fuel by interacting the isotopes with neutrons, so if we take the uranium 238, the “not useful” isotope, and put it inside of a reactor, even though it's not going to produce energy for us, we can (I said allow before), we can force it to absorb a neutron.

Saintsing: Right.

Keckler: And, that will turn it into an isotope of plutonium which is another element which is actually also extremely useful inside of nuclear reactors for producing energy.

Saintsing: Wait, you, you turned it into plutonium?

Keckler: So, what happens is that uranium 238 gets a neutron. For like a fraction of a second, it will be uranium 239. That then undergoes what’s called a radioactive decay.

Saintsing: Okay.

Keckler: So, one of those neutrons then is going to turn into a proton and a neutrino, and because it now has an extra proton, the element has changed because the proton is what determines the element.

Saintsing: Right.

Keckler: So, there's actually a middle step, but if you undergo two of those radioactive decays, you'll end up with plutonium 239.

Saintsing: Okay.

Keckler: Which is, I mean, it's, it's very good at unleashing energy which is why most nuclear weapons are made out of plutonium 239, but it's also an extremely good fuel for producing electricity.

Saintsing: This is, this is what makes up the green glowing rod on the Simpsons and stuff?

Keckler: I'm sure the Simpsons have no idea what's in there, but that is what they depict as a green glowing rod.

Saintsing: Does it… it doesn't glow, would you say? Or, it does?

Keckler: Nuclear, if you look, if you could look inside of a nuclear reactor as its operating (there are some like research reactors where you can do this, you can just look through the water from on top of it) it glows blue.

Saintsing: Interesting. Okay.

Keckler: When it's, when it's operating. So, it's not actually the fuel, but it's kind of like a, just a halo kind of look around it where the water looks blue.

Saintsing: Cool, it's a nice-lookin?

Keckler: It's quite pretty.

Saintsing: Pretty, yeah.

Keckler: So, that, that's one area of like advanced nuclear is, you know, to wrap that all up, it's called breeding.

Saintsing: Right.

Keckler: So, we take things that were not useful as fuel before and we turn them into useful fuel

Saintsing: And so, you're just trying to make that process more efficient?

Keckler: Yeah, and it's, it's kind of difficult to enable that for a lot of kind of convoluted reasons, but it's something that we know is possible, that's been demonstrated as possible in full-sized nuclear reactors that have operated, so we know we can do it. It's at this point a matter of like refining this principle working it into something that will be attractive to like utility companies that want to purchase it, so…

Saintsing: Right.

Keckler: So, it's, it's, it's an idea that's been around for a very long time, okay, but one that has kind of so far eluded commercial implementation. Okay, so another, another area of advanced nuclear is just improving things like the safety characteristics of nuclear reactors to make them cheaper and again more attractive to utilities, and I do, when I say improve the safety characteristics, I don't want to imply that that means current reactors have bad safety characteristics. They have good safety characteristics, but they require special attention actions by people that work, they're called operators you know, to do things, and there's a lot of very complicated machinery and equipment that goes into these things and if we could make it simpler so we don't need all these extra systems to make the reactor as safe as it is now that would be desirable because it would make it cheaper and it would make it smaller. All these things. So, these are… that's, that's one big area.

Saintsing: You're listening to The Graduates. I'm speaking with Chris Keckler from the Department of Nuclear Engineering. So, your research falls more into making, improving the safety characteristics of nuclear reactors, right?

Keckler: Yeah, I do. I kind of do work in both of those fields that I mentioned before, but so kind of the idea is that the way that we control a nuclear reactor typically is through what's called control rods and basically what these do is they are pieces of material that we move inside and out of the reactor which absorbs neutrons preferentially to the fuel absorbing them, so what that means is then we have less neutrons to go on and produce energy, so by putting in the control rods we, what people call, we poison the reactor, so we shut it down basically because there's no more neutrons anymore.

Saintsing: Okay.

Keckler: So, that's, that's, you know what's been done forever.

Saintsing: Right.

Keckler: And, that requires somebody or some sort of computer system to identify that there's a problem and then push a button whether it be real or a virtual button if a computer is doing this to flip the control rods into the reactor, and it requires, you know, a motor to push the, you know, to spin a bunch of gears and the control rods go inside the reactor. The idea behind one of the projects that I work on is that we can maybe do, have this same type of process occur but without having anybody do anything or a computer do anything, just relying on physical principles in order to make that happen. The idea is that you could, you know, control rods are typically solid, in, in solid state, but the properties for absorbing neutrons, it makes no difference if it's in solid state, if it's in liquid state, if it's in gaseous. It just depends on the material itself, so an idea is that you could have like a liquid reservoir of some sort of like control rod material but it's in liquid form this time below the reactor, and when the reactor, say the reactor starts to, you know, get out of control going to a higher power, we don't like that then that's going to cause the reactor to heat up because it's producing more power than it was before. So, it's going to cause the temperature of the reactor to go higher than we want and when anything increases in temperature, most things when they increase in temperature, they actually thermally expand.

Saintsing: Right.

Keckler: So, kind of the idea here is that if we can allow this poison control rod material to thermally expand in the right sequence when the reactor starts to go out of control, it will thermally expand in such a way that it will be pushed into the core. It will like push itself into the reactor core and then absorb the neutrons that we want it to.

Saintsing: Okay.

Keckler: So, instead of somebody like pushing a button that triggers a motor that causes the control rods to go in we just run want to rely on purely passive aspects of physics, you know. This is actually very elementary physics that I'm talking about here.

Saintsing: Right, so you have to identify material, so you have to like make materials that can perform this function?

Keckler: Most of the trick in this type of work is putting the materials into a proper configuration that will allow this process to you know unfold in the way that I described. The materials to do this are already clearly identified. There's not that many materials that are really good at absorbing neutrons, so we're pretty limited from that perspective, especially when you pair that with: we need it to be liquid at the right at the temperatures that our reactor is at.

Saintsing: Right

Keckler: So, you know that's kind of not that many choices from there, but we need to be able to incorporate that into the reactor. Like, for instance, we don't want this liquid to just go into our, into our reactor uncontained because then it will contaminate everything and if we want to start the reactor back up we still have a bunch of control rod material inside the reactor.

Saintsing: Right.

Keckler: So, we need it to be able to go in but also to come back out cleanly.

Saintsing: Right.

Keckler: And, we need it to do it at the right time in the right sequence with the proper amounts. It's quite a complicated like engineering problem.

Saintsing: Yeah

Keckler: From a physical perspective, it's actually pretty simple and extremely elegant.

Saintsing: Okay, so physics, yeah, you got it. Yeah, it's the engineering you're spending like all your time on, and like what do you, are you modeling it? Or, like how are you actually trying to solve this problem?

Keckler: So, all of my work is computer modeling.

Saintsing: Okay.

Keckler: That's a pretty normal sequence of steps in like the nuclear engineering world is if you have a new idea first thing to do is model it because at this point we're pretty good at simulating a lot of different physical phenomena and doing it relatively accurately at least to the point where we can say this is either a good idea or it's not. Once you have you know the green light that this is a good idea based off of all the simulations then if somebody is interested enough they'll pay for the experiments to be done to actually verify that what you think is going to happen is what's going to happen, and because in nuclear a lot of things are very expensive, the experiments typically don't get done until after a lot of computer modeling has been done.

Saintsing: I gotcha. So, outside the scope of your PhD?

Keckler: Yeah, yeah, yeah, it's definitely, it's definitely not in my PhD, but we actually we think we've gotten to a point where the, the simulations tell us that this is a good idea.

Saintsing: Oh cool.

Keckler: And, that it should be pursued, you know, if the interest is there.

Saintsing: What's the career kind of look like for nuclear engineer?

Keckler: It's, right now there's kind of a big sea change going on in the nuclear energy world and that is, I think, motivated mostly because what we talked about earlier. There's a lot of younger people that are very interested in solutions to climate change. Solutions? Something that can mitigate climate change.

Saintsing: Right.

Keckler: So, there have been actually a lot of startup companies related to nuclear power, nuclear energy has historically been dominated by a couple companies (General Electric and Westinghouse). Those are huge companies, and they've done the same thing for very long time, so there are, you know, handful of companies that are interested in changing that and doing something new. So, a lot of people are going into this kind of like startup industry that's forming right now. There's still a lot of people going to, into national labs because you, it's kind of a weird middle ground between academia and industry in the national labs at least in the nuclear energy part of the national labs.

Saintsing: All right.

Keckler: So, a lot of people that get PhDs might not want to be a professor, but they still probably like doing research or else they wouldn't have gone to grad school in the first place.

Saintsing: All right.

Keckler: So, the National Labs can kind of like offer them a halfway point.

Saintsing: I see. Yeah, why did you want to get into nuclear energy? Did you always know that you were gonna be a nuclear engineer, engineer?

Keckler: No, but I definitely always knew I would be an engineer.

Saintsing: Okay.

Keckler: When I first started out my undergrad, I was a chemical engineer for one year, and chemical engineering is so outrageously broad, so you can do almost anything with a chemical engineering degree, but that wasn't exactly shown to me based off of just the people that I happened to interact with. It was kind of like: there's the oil industry, or there's, you know, like, I don't know, just things that I think are trivial. Like, like coatings on cars or something.

Saintsing: I mean that's pretty useful.

Keckler: It's important. It's useful, but it's not gonna change the world.

Saintsing: Oh, yeah.

Keckler: I was very interested in energy for a long time, and I kind of did this – what I was talking about in the beginning of this interview – like assessing different energy sources on an even basis and trying to think what might be the best way for me to go, and nuclear energy was just something that appealed to me from, from that process, and, you know, I should say right here that chemical engineers can totally be involved in nuclear engineering. It would… We have, we have skillsets that overlap to such a large degree.

Saintsing: You got to pull back all that shade you threw at chemical engineering.

Keckler: My dad's a chemical engineer, you know? I have no problem with it, but uh, it's just kind of, I just didn't get the greatest impression when I started out.

Saintsing: Right, so is that kind of maybe why you wanted to go into engineering? Your dad was a chemical engineer and that's…

Keckler: I think my dad, definitely. It's not be… you know, I didn't look at him, and I said he's a chemical engineer, I should be an engineer, but the things that he was interested in and therefore like involved me in as a kid were so engineering. I mean like looking back on it, it's like I definitely was going to be an engineer just based off of the things that I did when I was younger.

Saintsing: Like what kind of things?

Keckler: You know, anytime something needed to be fixed in my house, it was, it was the stupid process of let's just like break it even more first because we like need to really thoroughly understand what's wrong with this thing, and then we'll fix it, and we'll fix it ourselves, so…

Saintsing: Right.

Keckler: We're not calling the… I don't even think I ever saw a repairman in my house as a kid. Like any item, the cars at my house were constantly being taken apart and like just destroyed before ultimately being fixed.

Saintsing: Did they always get fixed?

[Laughter]

Keckler: The answer to that question depends on if my dad is listening to the radio show or not.

Saintsing: I guess, I guess that’s your call.

Keckler: Definitely we had a lot of very old stuff because we could like always somehow scrap it back together.

Saintsing: Right.

Keckler: So, we had a lot of things that were just hanging on by a thread for like ever, you know?

Saintsing: Okay.

Keckler: It was interesting, but it definitely made me curious about how, how things work, and not just how things work, but how practical things work. I think it's one thing to be interested in pure physics, to just want to know about, for instance, space because you know some beautiful mysterious reasons, but that's never been the case for me. Like I've kind of… as I've gotten older, I've kind of looked back on my childhood and been like, "Why wasn't I interested in dinosaurs?" You know? Like dinosaurs are really cool, but as a kid I just didn't care. I was more interested in like taking apart my, my Bop It. You know? Like just for fun.

Saintsing: Right.

Keckler: So, I don't know. It was, it was clear that I wanted to know how things worked but only things that like were of use to me.

Saintsing: Right.

Keckler: Not just like these esoteric concepts.

Saintsing: Okay.

Keckler: So, I think it was very clear that I was gonna be an engineer.

Saintsing: Yeah.

Keckler: Also I had about 10 billion Legos.

Saintsing: Is that, like every engineer had Legos as a child?

Keckler: I don't, I don't know if it's that way, but it's definitely the other way. If you had that many Legos, he's definitely an engineer at this point.

Saintsing: I got you. Okay, so you went to college thinking you'd be a chemical engineer and then you decided that nuclear engineering was just like way more useful.

Keckler: Oh yeah, I just thought it was more directly applicable to what my ultimate goals were, which were to do something useful in, in the climate-environmental-energy intersection.

Saintsing: You – what school did you go to?

Keckler: So, I actually started at the University of Cincinnati for one year. That was, I was actually the fourth generation of engineer to go to that school. My dad and then his dad and then his grandpa, but I transferred after one year because Cincinnati didn't have a nuclear program.

Saintsing: Okay.

Keckler: So, then I went to the University of Illinois for the rest of my undergrad.

Saintsing: So, then you graduated with your nuclear degree in nuclear engineering, and then, did you go straight to the PhD?

Keckler: Yeah, I came directly here. I'm originally from Chicago, so Illinois was close to where I grew up, I could have gone there for grad school. I'm sure I would have had a great time. I just was like, I should go somewhere else.

Saintsing: Yeah.

Keckler: Just to… I think it's always good to have a different perspective on a lot of stuff, so me and my girlfriend at the time, we both went to Illinois, and we both came here for grad school and now we're married.

Saintsing: Nice. You met through…

Keckler: We met in undergrad in, in nuclear engineering.

Saintsing: Nice, nuclear engineering brings people together.

Keckler: Honestly, maybe.

Saintsing: Well, this has been a lot of fun, but we're running out of time on the interview, so typically at the end of the interview we just offer a chance for the guests to address the audience.

Keckler: Because I came here or, or because my reason for agreeing to do this was because I like to spread the word about the benefits of nuclear…

Saintsing: Right.

Keckler: I'll end on that.

Saintsing: Go for it.

Keckler: Bring it full circle.

Saintsing: Yeah.

Keckler: You know, pretty much the one, the one message I'd like to get out is just for people to have an open mind about nuclear power because it really is in my view the biases that people have coming in that are preventing more people from being interested. If you go into something thinking inherently that you're not interested, you're not even going to listen when somebody talks, but if you have an open mind about energy in general, I think there's a lot to be learned, and it's not as easy of a question as people might think it is. People think, just build wind and solar, we're done.

Saintsing: Right.

Keckler: I think the answer is going to be a lot more complicated than that. Therefore, go nuclear.

Saintsing: Keep an open mind. Go nuclear. All right. Thank you so much for being on the show.

Keckler: Sure

Saintsing: Today I've been speaking with Chris Keckler from the Department of Nuclear Engineering. We've talked a lot about the value of nuclear power. Tune in two weeks for the next episode of The Graduates.