Episode 1,486: Want Abundant, Clean Energy? We Need Thorium, Not Wind or Solar

Guest: Kirk Sorensen

WOODS: I've had a couple of listeners who have been pleading with me for years to have you on the program. And at first, I just didn't want to not because of anything having to do with you, but because I felt like I don't have a scientific background. I've covered — I mean, you know, I took the AP classes in high school, kind of thing, but that's as far as it goes. And I've covered a lot of different topics. A wide variety of topics. And one thing that pleases me about this podcast is that I feel like I can speak intelligently to a lot of people about a lot of different things because of all the reading I've done over the years. But here, I feel like I'm not so sure. But then I keep reading about you and watching your videos, and I think, well, I'm going to give it a shot anyway.

So we're talking today about thorium. I would venture to guess that a majority of my listeners are not going to even know what this is or what the relevance of it is. So start by giving us your one-minute elevator pitch about why we should care.

SORENSEN: Okay, here's what's really neat about thorium. Thorium is a naturally occurring material. There's some in your yard. There's some just about everywhere you've been. It's part of the earth. It's been around for a very long time. It's going to be around for a very long time. It's three times more common than uranium. But the real magic of thorium is, if we use it the right way, it can be the world's greatest energy source. And this was discovered back in 1944. Unfortunately, it was discovered right in the middle of us being very busy in the middle of a war. It wasn't the best time to figure out that there was a new energy source, also one that didn't have any application to nuclear weapons. So that's kind of why thorium got pushed to the back of consideration for many, many decades.

There were people working on it, though, and they made some remarkable progress. I came on it about 20 years ago and learned about it and just thought, *Why aren't we shouting from the rooftops?* which is what I've been kind of trying to do for a while now, that we don't have to have energy wars anymore, that we can be energy independent, and so can everybody else for as long as we can imagine, because the earth is full and to spare with thorium, and it's very easily accessible. It's just developing the technology to bring it to fruition, which is what me and my company work on.

WOODS: Is it inexpensive?

SORENSEN: Right now, it's a waste product. We mine rare-earth materials mostly to produce very high-quality magnets. Often some of these end up and things like windmills. And thorium just occurs because of its chemical nature. It just kind of comes up with a lot of these rare-

earth materials. And so right now, it's a waste product of rare-earth mining. It's actually kind of a bit of a pain, because it's very, very mildly radioactive. It has exceptionally long half-life, which means it just has just very, very, very little radiation. But because it is radioactive, it complicates just throwing it away, putting it back in the earth from whence it came. So people who mine it right now kind of would really love for us to use it for power and kind of take it off their hands. That would be great for them.

WOODS: All right, so this really is the key question. So given the advantages to it — and in a minute, I want to talk about any disadvantages. But given the advantages, the question would be: why isn't it in wider use, and why was it not used? And you were suggesting that, because it's not easily weaponized, it was overlooked on purpose, in effect, by government. Can that can that really be the story? And if so, couldn't the private sector say, *Well, governments are full of it. This is obviously the way to go. We're going to develop it independently*?

SORENSEN: Yeah, and that's exactly what our company's doing. But to take you just back, I wrote my master's thesis at the University of Tennessee on this very topic of trying to get to the bottom of what happened to thorium. In the Manhattan Project times during World War II, people were looking exclusively like, how can we use nuclear energy to create weapons? And they figured out how to use plutonium, how to use uranium. They looked at thorium, and they wanted to turn it into a weapon too. And they figured out, well, it was going to be very, very difficult. Not impossible, but very difficult. And so they set it aside, and they said we have to focus on the war. And even after the war, we were so focused on building our nuclear arsenal, that making a nuclear power was very, very much a second-order effect. We weren't really worried about it. And because of this great technological advantage that uranium and plutonium had had, we put hundreds of billions of dollars of effort into learning about them and working with them and making them into various metallic forms and processing and so forth. So when the time came to make commercial nuclear energy, even though the advantages of thorium were known, they took a backseat to uranium and plutonium. Our government in large part in the 1950s wanted nuclear technologies to be developed that would be compatible with the weapons program. In other words, they would make some of the materials a weapons program with need, and they might even receive some of the byproducts from the weapons program, and thorium didn't really fit into this. So thorium kept getting pushed to the back of the line.

WOODS: You must have heard about Andrew Yang's more or less endorsement of thorium, which I found interesting. Now, probably he'll want government-built reactors or something for all I know, but given that this is not something the general public is crying out for and almost every other politician — I'm not a Yang supporter, but almost every other politician is just saying what the focus groups tell them to say. There's no focus group that says: talk about thorium. So I found it very interesting the other day that he did make mention of it. Did you see that?

SORENSEN: I did. I did, and I had exactly the same response you did, that I was very surprised to see it and found it fascinating. Probably a different development strategy than I would necessarily espouse, but I give him full marks for promoting the idea, certainly not something that came out of a focus group, as you said.

WOODS: Now, one thing that my, let's say, free market people can agree on about Trump, while they are endlessly frustrated by many things about him, they will say that when it comes to energy issues, he's been very good from their point of view. So I'm curious about —

maybe Trump and thorium is too specific a question because maybe there's been nothing, but what about Trump and nuclear power? Are there any policy changes that are favorable?

SORENSEN: Well, yeah, and Trump has definitely asked the Energy Department to open their aperture, so to speak, and to engage more with the commercial community. I actually have pretty good things to say about the Obama administration in this respect, as well. They kept their heads about them when a lot of other countries were saying no more nuclear, no more nuclear. The Obama administration was not talking that way at all and did always preserve the nuclear option. So I think it's something where there's been a lot of bipartisan support. I think both parties recognize that nuclear is reliable, clean energy. It's energy that is domestic in its origin and its use. Its' energy that's good for job. It's energy that has a lot of other benefits too. And unfortunately, although the support is bipartisan, I would say it's not terribly deep on either side, which is probably the real challenge.

WOODS: I know this is a dumb-guy question, but I just need to ask. I understand your point about it being a byproduct, but that still makes me want to ask the question: how abundant is it? I mean, in what quantities is it being produced, and would this be sufficient to provide the power that we would need?

SORENSEN: The amounts of thorium that are already mined and above ground sitting in warehouses would power the world's entire energy demands for probably a decade, just what we've already got sitting around waiting to be thrown away. If you actually tried to get it, you would effortlessly be able to get the material you needed to power the entire world every year. I mean, we have enough thorium on earth to last about 30 billion years, which is about six times the remaining lifetime left in the sun. So I like to point out that if you consider solar energy sustainable, then you should consider thorium energy sustainable.

WOODS: I saw a video where you were talking to people who seem to be, let's say, coming at this from a different angle. And you were addressing all their concerns and objections, and they kept talking to you about solar and wind. Now, if you're describing a clean energy source where we have 30 billion years' worth of supply, and somebody is still saying we should somehow try to channel the wind to provide energy, you must be really trying to restrain yourself in giving a polite answer. Now, what is your polite answer?

SORENSEN: Well, at different times in my engineering career, I have been big fans of wind and solar, but I am a mechanical engineer and I can run the numbers. And the overwhelming answer I always came to was: society depends on reliable, constant, controllable energy. Our grid has to be balanced within the millisecond. It is simply irresponsible to put energy sources on our grid that cannot be controlled. Now, I believe that if you really want to put wind and solar on the grid, you ought to have them completely integrated with an energy storage system, that to not have them that way is just foolish. But they know that that's going to run up costs, and so that's why they're unpopular.

So right now, they use the grid essentially as their battery, and that's not the way the grid works. Nevertheless, when you have low penetrations of wind and solar, it's one thing. You can kind of get away with it by controlling other forms of reliable energy like gas, coal, nuclear, etc. But as you push for higher and higher penetrations of wind and solar onto the grid, that becomes increasingly difficult, and the utilization factor goes down and down and

down. And a lot of countries are seeing this, particularly Germany, where there are times when the wind is just going like crazy, and they can turn everything off, and they say, *Rah, we're running on nothing but renewable energy*. And you say, okay, just give it an hour or two. And then the wind dies out, and suddenly they're dependent on all their neighbors to give them hydro, coal, gas, whatever it takes. That's no way to run a society. That's certainly no way to run America.

WOODS: Tell me about your company. What's the name of the company, and what are the precise activities you guys are involved in?

SORENSEN: Our company is Flibe Energy. We've been in business since 2011. We are working to develop thorium reactor technology. We are conducting a broad campaign of efforts to increase the technological readiness of this and to bring it to a point where it can be built and developed. And this is what we work on. There's about 15 of us in different offices, and we have been fortunate to win several awards from the Department of Energy that are enabling us to go forward. We have partnerships with universities as well as national laboratories, and we're really trying very hard to make this happen.

WOODS: Well, how close are we?

SORENSEN: Well, our growth in our company has been substantial in the last few years, and I project at this rate of growth, that we're going to be able to have thorium technology at a commercial scale by the end of the next decade.

WOODS: I read that India and China are interested in and maybe even moving forward with it. So what can you tell us about that?

SORENSEN: Yeah, that's really interesting. India's the only country that has consistently talked about thorium being the future of energy. I mean, you'll see everybody from their prime minister on down saying, we're going to run India on thorium someday. India has remarkable thorium reserves, which is great, although everybody has enough to get by. And they have really funded research into thorium for many decades. The technological approach they've chosen up to this point, though, I think is pretty slow, and I would recommend doing something closer to what we're doing.

About not quite ten years ago, the Chinese embarked also on an effort much closer to the effort that we're proposing. And the effort that we're proposing is based around what's called a molten salt reactor. This is technology that was developed in the United States at Oakridge National Laboratory back in the 1960s and shown to be very safe and very effective. But it was shelved in the '70s because of its inability to work with some weapons materials that were favored at the time. And we looked at this and thought, my goodness, all the reasons we didn't do it are obsolete. This is great tech. It's very safe. It's very efficient. It's very effective. Let's go make it happen again.

So the funny name of our company, Flibe, comes from the salt that's used in the nuclear reactor, this molten salt nuclear reactor. It's a mixture of flooring, lithium and beryllium. You put those letters together from the periodic table, you get this word Flibe. So that's sort of the nickname for the salt that we will use in our molten salt reactor to utilize thorium.

WOODS: All right, Kirk, I don't want to drag you into politics, and you feel free to pass on this question if you prefer. I respect that you want to be a scientist who works with a lot of different kinds of people. But I have to ask: this seems like — if we are to take environmentalists set their word about what they what they claim to want, this seems like an environmentalist's dream. And maybe you have some environmentalists who are on board with you for that reason, but I bet not all of them are, and I wonder if you might speculate as to why that might be.

SORENSEN: Well, I'm glad you mentioned that, Tom, because I feel exactly the same way, that this really does solve the issues that are brought up by environmentalists. And if an environmentalist is somebody who cares about the earth being clean and sustaining us, then I'm very much an environmentalist, because I'm very concerned and active in those things, and it's big part of why I'm doing this.

I have gone to some really interesting places. In 2011, I went to visit the Friends of the Earth in London. I mean, you're talking about really some very anti-nuclear folks. And I thought, my goodness, they're going to tear my head off. And by the time I was done explaining, these guys were patting me on the back and cheering me. So I've had some really, really good experiences with people when I'm able to explain the story to them.

A lot of people who are in what we call the environmentalist community have grown up being taught that nuclear is bad, nuclear is evil, nuclear is inextricably tied to weapons, nuclear is dangerous. And when you can go in there and say, let's peel all that fear back, and let's take it from first principles, all right? Nuclear energy is natural energy. This is what's kept the earth warm inside. This is what's kept the earth's magnetic field going. This is what's powered plate tectonics. We would not be here on a living planet without nuclear energy.

Okay, when you start to see that nuclear energy is natural energy and that we have taken our mines and managed to extract that energy much more effectively — unfortunately, we started out with weapons. That's a terrible thing. But now, why can't we go forward and utilize it for the greatest good? You can take steel and you can make guns or you can make plows. You can take ammonium nitrate and you can make fertilizer or you can make a bomb. I mean, everything is about what you choose to do with it. We can take uranium, and we can make a weapon or we can power a city.

And these are the kinds of choices that we as intelligent human beings have to make and not be drug into fear and uncertainty and the relics of the past. I mean, if we are to have a clean and healthy and sustainable world, we're going to have to use all of our intelligence to bring that to pass. So I look at the gift of thorium, and I think this is marvelous. This is incredible. I can't believe this exists. My goodness, we need to use this.

WOODS: What would you say are the drawbacks that people have identified with thorium? When I tried to look into this, they all seemed very technical, and they all seemed solvable. *Well, thorium doesn't work in the as well in this kind of context, but it can work over here.*

Oh, all right, well, then, what's the problem? Yeah. So can you describe for a lay audience what the alleged drawbacks are?

SORENSEN: You put your finger on it really well. I mean, thorium is a fuel in the molten salt reactors, the machine in which we propose to use the fuel. If you took diesel fuel and you put it in your gas-powered car and suddenly the car was on the side of the road not working, you don't blame that on the diesel fuel. You say, I need to put the diesel in a diesel car; I need to put gas in the gas car. So thorium, in a similar manner, needs to go in a machine that's designed for thorium. Today's nuclear reactors really aren't those machines, and so a big drawback that's often levied against it is people will say: well, hey, it doesn't work very well in today's nuclear reactors. To which I say, yep, that's true. It doesn't really work that well in today's nuclear reactors. We need a new kind of nuclear reactor. And that's going to be some work. I mean, that's what we work on. That's what we're trying to develop.

The good news is this new kind of nuclear reactor has incredible performance advantages over the kind we have today. And furthermore, the kind of nuclear we have today is kind of shutting down. I mean, we are closing — these older kind of nuclear reactors are called uranium-pressurized water reactors. We're closing these faster than we're building them. So this entire older way of doing nuclear is really on its way out. A few years ago, Westinghouse, which is one of the main developers of this technology, went bankrupt.

And it's funny how, I've believed this for a while now, but it's becoming more and more the conventional wisdom, that the old way is shutting down, and we're going to have a new way. This same thing happened in the natural gas industry over the last 15 years. I remember back in the mid 2000s when they were saying we're going to run out of gas in the future, because they were looking at conventional gas. And the truth was, they were right. We did have less and less conventional gas, but because of fracking, we had new gas supplies, all new gas supplies that more than made up for the reduction in conventional gas. So here we are today, we've got lots of gas, and it's been a great thing for our economy. But it did not come about because the old way continued. It came about because a new way was implemented.

WOODS: I do want to address some of the objections, let's say, that I heard growing up as a kid. I grew up in Massachusetts. We were not terribly far from the Seabrook nuclear power plant in New Hampshire, and there were a lot of anti-Seabrook activists around. And the main complaints that I heard as a kid involved safety and the problem of nuclear waste. What are the answers to those?

SORENSEN: Well, the way we do nuclear today means we run at really, really high pressure. And when you have water under very high pressure, if there's a breach, then that water can flash to steam, and then the fuel rods are potentially uncovered and not cooled sufficiently, and you can get a meltdown. So that's the fear there. The fear is that you've got a system where something can go wrong. Now, we keep nuclear very safe today, because we've got great people working on it, and they work very tirelessly to keep things safe.

The system we're talking about with molten salt does not operate at high pressure. There's nothing to rupture, there's nothing to break, and there's no fuel to melt anyway. It uses a liquid salt as the fuel, so the whole notion of a meltdown becomes meaningless in this technology.

So let's talk about waste. Today's reactors use about one half of 1% of the energy content of their original uranium. So they're not efficient in terms of fuel utilization. Would you go fill up your car at the gas station if you thought you were going to get to use one half of 1% of the energy in that gas? No, you expect to use all of it. With these molten salt reactors using thorium, we can approach nearly 100% fuel utilization. And that means now you've just about eliminated the production of waste. You don't have that waste that you have in today's reactors, because you used all the fuel. Again, the secret: liquid fuel, just like we use in our cars. We don't put solid fuel in our cars; we put liquid fuel in our cars. Why don't we do that in nuclear reactors? I talk to chemical engineers, and they're like, of course, it makes perfect sense to me. But in nuclear, for some reason, we've been on solid fuel for 70 years, and I think that those days are coming to an end. But there's a new day dawning with liquid fuel and thorium fuel, and that's going to be the way we go forward.

WOODS: I think a lot of the fear associated with it has to do with radiation, because we've all thought about what would happen if there were a nuclear war and people would be prowling the earth as zombies because of the effects of radiation if they hadn't died already. And so people have a special terror in their hearts because of radiation, quite understandably. And I saw an interview you did where you talked about the phenomenon of hormesis, which runs somewhat counter — doesn't say that you want to endure a nuclear blast, obviously, but at the same time, it challenges the idea that any level of radiation, artificial radiation is dangerous to your health.

SORENSEN: Yeah, let me let me tackle that, because I think you really put your finger right on the problem. People are terrified of radiation, and see, you used the phrase right there: artificial radiation. The truth is, to your body, your body has no differentiation between artificial radiation or natural radiation. And the truth is, there is phenomenologically no difference whatsoever between those two. It is very, very important to protect yourself against radiation. The biggest danger to you every day as you're going outside is the sun The sun is hitting you with ionizing radiation. And so what do we teach our kids from day one? Cover up, use sunscreen, don't stay out in the sun too long.

Those are the three principles of radiation protection, with the exception of one. We say time, distance, and shielding. You want to have shielding. That's your sunscreen and your clothes. You want to have time considered. You don't want to be in the sun too long. Now, we can't change the distance to the sun, but we can change the distance to a radiation source. It kind of blows people's mind when I say: Do you know what a sunburn is? Sunburn is a radiation burn, and there's no difference whatsoever between a radiation burn and a sunburn. And just the same way, if you laid out in the sun for 12 hours, it would kill you. We all know these things, and yet we have a special terror of this thing that we call artificial radiation.

So a long time ago, actually right after the Hiroshima nuclear blast, they took data from the people that had been exposed in the blast, and they decided to simplify their modeling of this. They essentially drew a line through the data, and they said, well, if this many people got this much radiation and died, this many people got this much radiation and died, let's draw a line down to really low doses of radiation far below any ability to measure. And this was called the linear no-threshold hypothesis, which became the basis of our entire system for characterizing risk and radiation.

And it really is one of the things that sounds like a good idea, but turns out to be a really stupid idea. It's sort of akin to saying, if 100% of people who fall off a 100-foot building die,

and if 50% of people who fall off a 50-foot building die, then if you drop one foot, then you have a 1% chance of dying, and if you do that 100 times, you're going to die. I mean, that's about how absurd linear no-threshold is. Because we intuitively recognize, okay, if I jump one foot, I'm not going to die because my legs can accommodate that. I have a threshold. Your body can accommodate it. Your body has radiation repair mechanisms. If it didn't, it would have died a long time ago, along with every other form of life on earth. Your body knows how to repair radiation damage to the cell. And radiation damage to the cell, which again, I mentioned mostly comes from the sun, isn't even the biggest damage effect in the cell. It's actually oxygen. Free oxygen is doing more damage to your cells all the time than radiation is. But nevertheless, your body fixes this. Your body fixes this.

So the whole principle of radiation and hormesis is the idea that when you're exposed to small amounts of radiation, it stimulates your body's repair mechanisms, and they actually go in there and fix the cells and leave them better than they found them. It's the same way exercise works. Exercise has a hormetic effect. If you go and push your muscles and break them down, they'll grow back stronger. That's the way things work. Now, you can't overwhelm that system. You can't give it too much radiation, or the repair effect is beaten by the damage effect. But there is a line up to a point where we are seeing the people who are exposed to radiation in doses tens, even hundreds of times greater than what's normal actually have less cancer.

So how do we know this? How do we run this experiment, because it would be unethical to expose people to radiation and see this effect? There are places in the world where the natural background radiation is tens, hundreds, even thousands of times the normal background radiation. So if the linear no-threshold effect was true, we would see linearly more cancers in these large populations. Actually, what we see is less cancers, which seems to prove the hormetic effect is real. So populations in places that have naturally high background levels of radiation, which some places in Florida, Denver, places in Iran, people have lower rates of cancer, which just cannot be explained by the theory that any level of radiation will cause an increased rate of cancer.

WOODS: I venture to suggest that after listening even to this brief conversation, there'll be a lot of people who are interested and want to know more. So I have two things I want to close with the. First is, what can people read? I mean, even if it's just links online, what can they read or watch, indeed, to learn more? And secondly, once they've done that, is there anything that the general public can do to assist you in getting the word out or promoting this idea?

SORENSEN: Well, there are some really good books out there. I mean, one just pops to mind is *Radiation and Reason* by Wade Allison. I mean, there's people who are very, very knowledgeable in this field that are trying to help people understand that, here's the world as it really is rather than the world as our fears might generate it. And so I think, please understand the nature of the world we live in, what a radionuclide is, what the different kinds of radiation are, how easily they're shielded, that kind of stuff. I mean, I would love it if we were learning this in school instead of some of the other things we've learned in school. But that's a good place to start. We've never been at a time in history when it's easier to get smart than right now, because there's so much information out there.

As far as helping, I think if you are interested in this, reach out to your leaders. Reach out to your mayor, your congressman, your governor, and say I would really like to see this energy go forward in my state, my town, my city. And I think when people get that, I know that

these people reach out to us, and they say, come talk to us. I just went up to a governor's meeting in Kentucky last week. It was based on citizen interest who reached out and said, we want to know more. And they invited me, and I was able to tell them what it could mean for the Commonwealth of Kentucky. So I know those things really do work.

WOODS: All right, so is there a link you'd like to leave with us for people to learn more, for example, about your company?

SORENSEN: Well, our company's website is Flibe-Energy.com, and there's resources there. I think probably a lot of people will be interested in learning this, like you did, on YouTube, just search on thorium, search on Kirk Sorensen, search on molten salt reactor. I think you're going to find an awful lot of good information there that will help you learn and learn quickly about where this technology is and where it can go.

WOODS: And if what you're saying is true about it, and I see no reason not to believe that it is, it's astonishing that, in effect, the solution to our problems is staring us right in the face here. It almost boggles the mind. It almost boggles the mind you even have to argue with people about it.

SORENSEN: Tom, I had exactly the same response 20 years ago. I'd love to tell you guys that I invented all this stuff. I didn't. It was invented long before I was born. It was figured out by people who are my grandfather's age. But you know, I feel like my job is to blow the trumpet and say, *Hey, let's all wake up and let's not be bound by the mistakes of the past. We have a world that we're going to be inheriting, and we're going to have to make it the kind of world we want. What kind of world do we want? Do we want a clean world, a plentiful world, a world where we will have the energy to raise all of humanity to Western standards of living, while at the same time reducing the impact humanity has on the earth?* Because ironically, when people are poor, they make a pretty big demand on the earth. We don't use sanitation and other things quite like we should, and people suffer. I would like to see the whole world brought to Western standards of living. And that is simply not an option with a lot of the energy sources that other people are putting on the table. With this energy source, we can bring the entire human race to Western standards of living while reducing all of our impacts on the earth, primarily co2. And I think, wow, that's pretty incredible. We can do it.

WOODS: Well, that is astonishing, and so I'll have the links that we've talked about up at TomWoods.com/1486 for people who would like to know more. And Kirk, I appreciate your time today so much. This is an extremely anticipated episode, as I say, for some folks, and I'm so glad we were able to make it work. Thanks again.

SORENSEN: Thank you, Tom. I really appreciate it.