

You've Been Warned Podcast with Joshua Rhodes

Joshua: [00:00](#) So my view on things is like we are going to do best in terms of fighting climate change, if we can make clean energy cheap. And so the things that we can do that make clean energy cheap are going to be the fastest drivers towards starts cleaning up our energy system.

Intro: [00:21](#) Ladies and gentlemen, You've Been Warned, it's time to figure out the climate crisis with the top scientists, activists and entrepreneurs helping us get out of this mess. Now let's welcome your host, Dragos, in three, two, one.

Dragos: [00:48](#) Today on You've Been Warned I speak to Joshua Rhodes a research fellow at the Energy Institute and the Weber Energy Group at the University of Texas, Austin. Joshua's research revolves around smart grid energy efficiency, resource planning, and distributed generation and storage. He's also interested in policy that can help us implement clean energy as fast as possible, particularly policies that utilize market forces to increase efficiencies. Joshua also consults on a broad range of energy topics and he sits on vetting committees for companies looking to enter technology incubators in Austin, Texas. It was quite a spontaneous decision to do a podcast episode sparked by an interaction that we had on Twitter. Now on the episode, we went in depth on the main issues behind using renewables to a larger extent and that is mainly the infrastructure capabilities that need to be developed in order to be able to transmit the energy from various points across regions in the US but also in Europe. We also covered smart grids, how demand and supply interact when it comes to energy grids and how battery technology is evolving. Finally, Joshua also shared technology innovations that he finds interesting in the climate change space along with his take on the politics versus business versus science versus society question and a little chatter at the end of the episode. All right. Without further ado, let's bring Joshua on. I'm joined now by Joshua all the way from Austin, Texas, I assume.

Joshua: [02:26](#) Yeah, so I'm currently in Boulder, but I do, I do split time between both Colorado and Austin, Texas. Yeah.

Dragos: [02:31](#) Gotcha. I knew that and I didn't ask you before, so I just thought I had to hazard a guess, but it seems like I got it wrong. So yeah. How's your, how's your morning been so far? It's quite early for you and quite late for me.

Joshua: [02:42](#) Oh yeah, it's been, it's been fun. I got some good strong coffee already, so we're good to go.

Dragos: [02:47](#) Cool. Cool. So for those who don't know, we kind of, it was kind of a spontaneous thing with the way we jumped on this podcast. We kind of had an interaction on Twitter, on climate, Twitter, where a lot of action happens. We got a, I wouldn't call it a disagreement, but we had some like differing points of view on coal being phased out in the US and that's part of discussion I just asked you, Hey, do you wanna cause I saw your profile and I thought it was really interesting with everything that you do. So just ask you, Hey, you want to jump on a podcast? And you were kind enough to give your time for it. So I just wanted people to kind of know

and me as well, kind of how you got into, into studying energy, researching SmartGrid's energy efficiency and all the stuff that you study.

Joshua: [03:33](#) Sure. So I've always been, I've always been one to be. So I've always been interested in like conservation and not wasting things. Like I've always had like kind of this, this kind of moral knee-jerk against, you know, wasting resources and so that from a kid. And you know, as I went to college and was studying first studied math and then studied engineering, I really kind of figured out like that all so many of our systems from water and energy and climate, there's, they're all related. You know, they're all inner, they all interact with each other and you know, deficiencies in one can lead to deficiencies in the other. And you know, everything from major conflicts and Wars being driven by resource scarcity and all of these things. All these, you know, all of this, basically the human condition, you know, kind of driven by.

Joshua: [04:33](#) You know, either the want for resources and the not having them and then I just looking around at like, you know, as societies mature and like, as you know, people well as size mature, you know, they want to consume resources, they want to have energy. There's billions of people in the world who want to live like Americans and Europeans who don't have the ability to do so right now. Or they just don't have the resources but they want to. And if they can, they will. And so trying to figure out, you know, how do we give them that energy, the mobility, the ability to to do things without destroying the planet in the, in the process. And so it all comes from not wanting to waste things, but also like, you know, wanting people to thrive. And then just trying to figure out, you know, how do we do that with a limited set of resources we have.

Dragos: [05:33](#) Gotcha. I really, really sympathize with that because I'm actually speaking to one of the African activists later today and she does a lot of activism around the dish around Lake Chad, which I wasn't aware of until I saw her. But basically there's something like I think 12 to 16 million people that are affected just because of the fact that Lake Chad has been shrinking in size because of global warming. And that's how many people either don't have food or they're in areas affected by violence, stuff that usually in Europe and the US we can't really conceive because that kind of stuff doesn't happen here anymore. But that's fight for resources is super real there. And it's happening now. So yeah, I get what you mean. So what do you, what do you specialize in when it comes to your studies?

Joshua: [06:25](#) Yeah, so I mean, I specialize in energy systems in general, so like, you know, 30 8,000 meter views, let's say 30,000 foot, but I'm not, this is your being by guest. So very high level looks at the energy system. So everything from flows, oil and gas to the electricity sector and the electricity sector is mostly what I focus on. The reason I like electricity is that, you know, at its point of view, it is zero emissions and electricity can, you know, give us all the things that we want. It can give us motion, it can give us heat, it can give us cooling, it can give us information, it can give us light that we can study. It can give us all of these things. And at the point where we're using it, it's not producing carbon emissions.

Joshua: [07:17](#) Now upstream, it definitely is. And historically, you know, the fossil fuels that we burn in order to generate that electricity and continue to burn our, you know, causing this problem. And so I focus on the electricity sector, you know, how do we get more renewables on the system? How do we get more zero carbon sources on the system while also keeping the system reliable? Because, you know, the wind doesn't always blow. The sun doesn't always shine. And, you know, there are things we can do to mitigate those issues. We can, you know, connect

larger, vast parts of, you know of the continents. And so when you know, the winds stopping in one area, maybe it's coming up in another, in the sun, you know about the same, but also, you know, how are we smarter about how we use energy so that we just get all of the services that we that we want. So I'm trying to clean up the grid while also keeping the lights on. Which sounds simple but it's a really hard thing to do.

Dragos: [08:22](#) Yeah, that's the, that's the tricky dynamic, right? Because basically fossil fuels, as far as I understand that are what we call baseload power source. So you can burn them at any point in time and kind of scale up and down depending on demand. Right. And nuclear as well. Whereas renewables, as you said, they're not active all the time. They vary season by season and we don't, as far as I know, we don't have an efficient way to store them so far. So I get all, I guess all of that kind of connecting to the smart grid which is my next question. And kind of that's where your area of expertise revolves around, right? Like everything revolves around the smart grids.

Joshua: [09:04](#) Right? Yeah. So you know the nice thing about you know, fossil fuel generators or nuclear generators is we can turn them off and on at will. And so whenever, you know, people are wanting to energy, we can provide that energy in real time because it was electricity. You have to supply demand and supply has to be perfectly safe. They have to be at all times. Otherwise the grid will go down. And so, I mean, every time you flip on a light switch or turn on or fire up a computer or streaming stream, Netflix or something, some power plant somewhere is turning up to provide more energy to the grid to meet that service. And that has to be done in real time. And so matching, you know, people's desire for energy services when we have, you know, energy from, you know, solar and wind can be tricky.

Joshua: [09:50](#) Now we were getting a lot better at that because we're so much it's so much easier for us to forecast and predict when they're going to happen. And so we can get the more we can predict things, the more we can trust them. And so, you know, we see that in different, you know, grids across the US and across the world, you know, integrating, you know, larger amounts of renewables because, you know, the grid operators are more comfortable that they're going to be able to match the supply and the demand.

Dragos: [10:18](#) Gotcha. What are the main challenges right now when it comes to that and integrating all these renewables?

Joshua: [10:24](#) So one of the main challenges, particularly in the States, and I think we've also seen this in Germany and some other in some other areas, is actually building the transmission to move the move the the renewable energy, the solar, the wind from where it is produced to where it is consumed. Because unfortunately a lot of times the places with the best resources like in the sun, like the Sahara desert or in the US that's in the Southwest. Or in the U S the middle of the country has the best wind, but no one really lives there. And so moving that energy to the major load centers, the major cities is, is tricky. Because it's just, it's becoming harder and harder to build things. As you know, people don't want to look at them, they don't want to see him. And particularly in the U S because we don't have a federal oversight or like a national level oversight of citing transmission lines, you have to go to each individual state and sometimes each individual County and deal with, you know, sometimes hundreds of stakeholders.

Joshua: [11:28](#) And getting that many people to agree on anything is extremely difficult to do. A friend of mine, Russell Gold, who's a reporter for The Wall Street Journal, just wrote a book. It's called super power about like this guy trying to build this transmission line. Like he had already built, he was already had on the books. He was going to be able to build probably the biggest wind farm in the world at that time, but he could not get the extension, the power line to move it to load. And so I think that's one of the biggest things. There are plenty of developers that have projects all around the world solar, wind projects, things like that. But just sometimes getting them hooked up to the grid is just really hard to do.

Dragos: [12:09](#) And is it expensive?

Joshua: [12:12](#) It can be. It definitely can be. If it's got to say, you know, go underground or something like that. Underground lines can be pretty expensive. Although the costs are coming down, which is great. But sometimes the expensive part just comes in dealing with people. It's not, it's not that it's expensive to actually, you know. But the concrete and steel in the ground, it's, you know, dealing with any lawsuits or anything like that that you know, that you that you see or, or that that happened when you want to build these projects. Unfortunately, you know, one of the, one of the things that I've been kind of noticing, kind of come back up again and been seen and kind of macro level is that the old school like the 1970s environmental movement, well, it's kind of a movement of stopping things from getting built.

Joshua: [13:06](#) We want to stop this oil pipeline. We want to stop this power plant. We want to stop, you know, these, excuse me, these transmission lines from getting built in order to save nature, but with climate change and the extensional threat that that provides. I mean, we have to build stuff these days. And so the solution, you're one of the solutions, do you know, climate change or it changes building that clean energy infrastructure, but that's becoming an odds, you know, sometimes with the, you know, the, the prevailing or the old school notions of the environmental movement together. And so it's, I guess the hardest thing is just building stuff cause we need to build stuff because people are going to want to use energy no matter what. We try to get people to put sweaters on, they want to keep the, you know, they want to keep their homes comfortable or they won't lie. It's where they want, you know, mobility. They want this energy. And so if we don't provide it though, you know, cleanly they'll get it dirty.

Dragos: [14:00](#) Interesting. So then I guess it's harder in the U S because it's such a big country and as you mentioned, a lot of the places where it can get wind are in the center of the country. We are not too many people are live. I guess it's easier in, I don't know, some of the pioneers who, who are the leading countries in renewables. Like maybe Scandinavian countries. The UK I know is doing quite well with renewables. It's probably easier for them because the size of the countries are kind of comparable maybe to a state in the U S whereas you're kind of dealing with an entire continent. Right?

Joshua: [14:34](#) Yeah. And I think it's, you know, there's a combination of having, you know you know, federal bodies that oversee you know, the, the production of energy, a lot of that in the States is delegated. A lot of that in the US is delegated down to the state level or down to the private sector. And so that can become harder to deal with cause you have so many people to you know, to get into the to get into the room. Also, you know, the U S has historically had very low energy costs. It's been one of the, you know, things is let the economy grow. And I think we're just used to energy costs that are quite a bit lower than some, some European

countries. And so I think all are willing to Oh or yeah I would just use the higher prices anyway. You know, anyways. And so, but it's harder. It's a harder sell sometimes over here when you know, to, to raise prices for like fuel taxes and things like that.

Dragos: [15:31](#) I didn't want to ask this now, but I kind of feel the discussion is going that way. So in terms of policy, I guess that's, I guess investment is necessary both from the government and maybe from private investors, but I guess it differs from state to state. Cause I know you have completely deregulated energy markets like in Texas. I guess with other States it's completely different. Like in California I think the state intervenes much more than it does in Texas. I might be mistaken with that. So then what's the, I know it's a tricky question, but like what's the solution? Like what kind of mix are you looking for to get things going if you have to build all that infrastructure? Cause I know people are talking about a green, new deal and lot of people that are more market-driven, like they believe market efficiencies don't like the green new deal that much. So they kind of, what's your take on that?

Joshua: [16:24](#) So I mean, I tend more towards the market side of things, but I admit that the markets don't have all of the information that they need. So I mean the markets don't have, they're not taking into account the externalities, the pollution, the you know, the flu, carbon pollution, other types of pollution. And if the market was forced to bear those costs, I think it would make, you know, much better decisions than it currently is. But some, you know, at best, we live in a second best world and a carbon tax is dead on arrival. You know in the US under most cases. And, you know, people tend to like carrots versus sticks, right? So in the, in the U S we have you know, tax credits instead of tax. So we give tax credits to clean energy versus, you know, taxing the pollution that comes out of dirty energy and those tax credits have been rather successful. We just,

Joshua: [17:25](#) You know, last year the U S reached over you know, a hundred gigawatts of wind and has over 70 gigawatts of solar and it's going to grow pretty, I'm pretty heavily, you know, one of the things that actually I think is going to drive more clean energy in the U S on the, on the policy side is you have because the States can chart their own path. That means they can chart a greener path if they, if they want to, you know, absent any kind of know federal oversight. And so many States have these renewable portfolio standards where they say, we're going to either get this much of our energy from renewable energy or we're going to have this, much of our capacity's going to be you know, renewable energy generators and not only States, but you're starting to see utilities within States.

Joshua: [18:15](#) And so, you know those that actually provide the generate the electricity and provide it to customers. It seems like almost every week there's another utility that's coming out to say we're going to be, you know, 100% clean by 20, 20, 40, you know, or 100% renewable by 2050 or something like that. And I think it's by at least 20, 50 almost over. I believe it now it's over half of electricity that will be provided in the U S has been pledged to be, you know, clean. And it's it's a lot easier, I think for utilities and States to do, to make those pathways and to go with and to go that way than it is to get, you know, the federal government really well to do anything, frankly at this moment. But they're you know, they have their own distractions right now. And so it looks like a disaster from the federal level, but it's starting. But I mean, at the state and local level, it's we're a lot of the decision making in the States is actually made. It's not, it's not looking too bad at this point.

Dragos: [19:23](#) Got it. And I assume there are, I mean, there must be an advantage because clean energy is getting cheaper and cheaper. There must be an advantage to be a first mover in this kind of stuff. Right? I mean, do companies see profit opportunities?

Joshua: [19:37](#) I mean, they do. So there's, you know, there's a lot of, there's a lot of companies that are, you know, doing it for moral and marketing reasons, frankly, but I don't care why they do it. But if a, but you know, that, you know, corporate acquisitions of renewable energy have really been driving development in, in the States and they've helped drive down the cost to make it cheaper for everyone. Mmm. And and yeah, and the, you know, the nice thing about, you know, solar and wind is, you know, 99% of your costs is getting your concrete steel and Silicon in the ground. And then you basically know how much electricity is going to cost you for the next 30 years and be, and okay. Because we have, you know, dynamic markets for electricity, you know, locking in, you know, a cost for decades. Mmm. You know, even if even if it is higher than the current cost today, but just having that certainty in the future is valuable. And so you see a lot of companies that are, you know, they're doing that, you know, the world's uncertain markets are uncertain and they're able to lock in part of their inputs. They see that as quite, you know, valuable these days and plus they're just coming cheaper than everything else. So that doesn't hurt either.

Dragos: [20:51](#) Yeah. Correct me if I'm wrong. I kind of get this feeling after talking to a lot of people in the space that anything that has to do with clean energy and tackling climate change over the next 10, 20, 30 years is going to be both very needed, obviously. And a lot of times it's mission driven, but I also think it's going to be quite profitable if you get into space. Because even if we have, let's say we have a financial crisis, which probably is looming in in about a year or so max, you will still need to make these investments. Like there was still need to be investments in this area because otherwise we will stagnate and I don't know what your, what your take is on us achieving to under two degrees of warming, but we'll still need to do our best to stay underneath those levels or limit warming as much as possible.

Joshua: [21:41](#) Yeah, and I mean it's, yeah, I mean even if you know, electricity to bend, you know, go slats or doesn't grow anymore. I mean the power plants we have in the ground, they only last so long. I mean, it's like a, you know, it's like a car or train or anything. It only runs for so long. They have to be replaced at some point. And you know, we're, we're seeing that, you know, happened in the States. There's not a single coal plant under construction in the country right now. And so, and the average age is, you know, pushing 45 years, which is about the time that they, you'll retire. So that, you know, that self also is a reason that we're seeing a lot of you know, coal retire in the States is just flat out just old. And it's being replaced with with cheaper, you know, alternatives. And so we, you know, even if we do have a downturn, people are still going to consume resources. They're still going to consume energy. And you know, we will have to, or [inaudible] there will be profit to be made in, you know, providing, you know, that energy.

Dragos: [22:45](#) You're doing much better than Germany when it comes to coal.

Joshua: [22:49](#) Yeah. Yeah. Jeremy's gonna shot themselves in the foot a little bit, you know, retiring their nukes so fast. I think it's, you know, and they, and they're having trouble building transmission too. I think they're ha, you know, they've got a lot of winds up in the Northern side, in the Northern half of the country. But you know, most of the populations in the South and building that transmission through the black forest has been really hard if not impossible.

Dragos: [23:12](#) Interesting.

Joshua: [23:14](#) The nice thing about Mmm, you know, Europe is pretty, pretty well connected. You know, countries can, you know, move electricity around quite a bit and then you see that quite often. And so [inaudible] cause I yell and more densely populated than, than in the States. You know, we, the U S is populated on the East and the West coast in the middle where a lot of the resources are. There's not that many pop. There's not that many people. And so it's and we have, you know, a couple of mountain ranges on either side of that and it's just, you know, it's just harder move that energy around over these vast spaces. That's also the reason we drive more is we just like, we have big open spaces to get from point a to point B. Mmm. And it's just, you know, harder to make Mmm. Your trains work when, when you have no one getting on and off in the middle, I guess.

Dragos: [24:02](#) Yeah. That makes complete sense. What about, so you mentioned the infrastructure is really tricky to get done. What about batteries sign? I know the costs of batteries are declining every year by 10 to 15%. What's your outlook like from your vantage point, what's the outlook on batteries?

Joshua: [24:22](#) Yeah, I think, I mean, I, I do think batteries are going to continue to decline in price pretty well. And then in some areas particularly in, in some instances we're already seeing them compete with other resources. And so there are some locations in the States, particularly in sunny places like Arizona where solar and storage systems have beat out natural gas. In terms of for, for peaking plants. Now, you know, these are only, you know, providing a little bit of energy but a lot of power for certain hours of the day, particularly in the summertime when that's when demand is driven by air conditioning load. And so we're, you know, we're starting to see it come in and beat in you niche, Mmm. Areas of the market. Now, the peaker market only provides 1% of total like electricity to, you know, consumers.

Joshua: [25:15](#) And so it's, it's still. And it's just not at the point where you know, it's able to shift bulk amounts of electricity around. You know, at this, at this time, I think we're going to deploy a lot more. Particularly solar in the U S before we before, before we deploy the, this similar amount of batteries. But we are starting to see a lot of projects, you know, hybrid projects come in that are no small batteries connected to large plants that are able to still kind of take advantage of some of those higher price peak hours. But, you know, in the next 20 years, 2030 years, I mean, I'm pretty bullish on, on batteries and how cheap they're going to get. A lot of our research, shows that the the key factor in getting energy storage to be, to be really competitive or to be, you know, really useful and cheap is getting the energy component. Cheap. And so, you know, on a, on a battery you have a power component and you have an energy component. Okay. The power components have already gotten pretty cheap cause they're similar technologies. So what we've to like solar PV inverters. And so we've installed a bunch of those, you know, power electronics. But getting that bulk, that kilowatt hour, you know, price down is going to be really, really key to you know, to the deployment of, of, of technologies. I think we'll get there. I wish we'd get there sooner. But yeah, I, I do think we will. We won't get there.

Dragos: [26:59](#) Okay. That's very interesting. And I've seen your sentiment echoed by a lot of people on Twitter, especially with the batteries. I wanted to ask you, since you mentioned technology, I know you, you sit on, on vetting committees for tech companies that want to get into the, the Austin tech accelerators. So what are some of the most promising

domains? And if you, if you're allowed to or if you want to mention some companies that you think are interesting, what do you kind of seen that area that you think will contribute massively over the next five to 10 years?

Joshua: [27:38](#) Yeah, so I, I think the, the companies that I think the companies that stand the best a chance of making a difference in the sh in the short term anyways, are those companies that can you know, provide something that kind of easily segues into existing markets. And so like there's a, there's a company I've done a little bit of of work for that is that's looking to converts basically sewage into oil. They buy this hydro faction project process. I'm pretty sure I said that word wrong, but basically heating it up to a point where you get all the volatiles correct. And you can basically have a drop in substitute for petroleum, then you can like diesel will make gas and all, Oh, all kinds of things. From it. So taking one waste stream and turning it into something valuable. Now, on the flip side of that, you know, when you, when it's burned, it's still going to produce you know, carbon emissions. But it is you know, somewhat CMA closing the loop.

Joshua: [28:49](#) And so there's a, there's a company in sound is looking you know, to to do things. Mmm. Like that there's a, and I, they also in the, I don't know that this'll be necessarily a climate solution, but there's a lot of companies that I'm particularly indexes that are looking to and the water recycling. Because, you know, we use a lot of water in the fracking process and we frack for natural gas. There's a lot of water, there's a lot of flow back water that comes up. I'm with oil and gas extraction. [inaudible] You know, figuring out something to do with that is going to be you know, is challenging and sometimes can slow production down, which companies don't like. So there are companies doing that kind of thing. Mmm. You know, there's you know, there's a, there's a company in well the auto solar that's you know, kind of incorporating, trying to figure out how to you know, deploy you know, batteries with with commercial solar installations.

Joshua: [29:59](#) And I'm using the batteries as a ballast for the system because when you, when you put the panels on a roof, you have to weigh them down. You have to put 'em because these are typically light weight panels and so they're looking to you know, see if they can use batteries, which are heavy as the, as the ballast itself and, you know, some kind of safe space and things like that. And then there's, you know, there, there's a, there's, there's a ton of data companies out there that are trying to better you know, figure out how to you know, utilize, you know, data streams that are coming off of our energy system and how to better incorporate, you know, those types of things into 'em. Will you, if you want to call the smart grid or the smarter grid or whatever you want to call it.

Joshua: [30:48](#) You know, because I, you know, those, those flows of energy are still pretty dumb. And if we can, you know, get better about, you know, knowing, you know, when they're coming in, you know, utilize them better. We can increase efficiencies in the system. Like there's and this maybe beyond companies in the accelerator. But you know, companies like you know, you know, for solar of, of developed the ability to or they've piloted a project where they use a PV arrays or their a PV installation to provide ancillary services to the grid. So basically, Mmm [inaudible] there's power plants supplying energy to meet demand. But then there's also power plants that are kind of [inaudible] waiting in the wings in order to provide more energy in case there's a spike in demand or a power plant trips offline or something like that.

Joshua: [31:50](#) And they call these ancillary services. They're getting paid, even though they're not producing electricity at that point, but they're getting paid, be

able to step in really quickly. And that's one of the issues with wind and solar agreed dominated by wind and solar as you, you can sometimes have these you know, these, these large fluctuations in supply and you need these you know, backup power plants if you will, to be able to you know, step in. If that's the case, we used to think that that had to be a one-to-one backup, not really the case. We don't need, you know, one megawatt of natural gas for every one megawatt of wind or something like that. But Mmm. You know, having the, you know, knowing exactly what the sun's going to do in the next five minutes, the next 10 minutes and using that data to know what production I will have in my facility, lets me let's me, you know, be a stabilizing force on the grid versus like a destabilizing force sometimes. And so using these data streams, Mmm. It was also, Mmm. You know, something that that is, this is getting bigger. I mean, there's no shortage of data analytics companies out there.

Dragos: [32:59](#) Interesting. I saw a company and I was wondering what specific use cases they bring to businesses because they, they, they have a, a suit of analytics around the weather and what the weather is going to be like. But now that you mentioned that, it makes a lot of sense. And also, I know, I mean, I've spoken to a company, I think they're based in both California and Texas called evolve energy. And they do some, you probably know them, right?

Dragos: [33:26](#) Yeah. You know of them. Yeah. So basically they kind of do what, what, what you, what you were talking about in the sense that they connect to the smart thermostat in your, in your home through an app and they can optimize the grid until you look the energy's cheaper now. Draw your energy now from from renewables basically, and they'll optimize your bill that way. It'll save you money and also push you to use more renewables, if I understood correctly.

Joshua: [33:53](#) Yeah. So yeah, so there's a, you know, there's two sides of the supply and demand equation there. Right. And so you know, demand response or shifting demand, making demand more responsive to supply. Is you know, something that. Be very powerful in terms of you know, keeping the grid stable, keeping the lights on and you know, allowing more no renewables to be. On the system. Now there's you know, there's a limited amount of that. Cause a lot of times a lot of times that's either, you know thermal processes like, you know, heating and cooling. Or another big one that's coming out is ed charging. And maybe potentially at some point, you know, pushing power back to the grid is vehicle to grid technologies. And so if you can, you know, use that demand to help, you know, mitigate issues with supply. And you can control both sides of the equation to some degree. Yeah. You can, you can get, you know, a lot more. Renewables on the system. And you know, and also keep the lights on.

Dragos: [35:10](#) Cool. Thanks for explaining that. It makes much more sense now. So I want to ask this question, which is kind of the last one that I usually ask. And it gets a lot of people either either they say it's a trick question or they say they can't really answer it. But ask it this way and your way because it's, it's interesting to see everyone's worldview. So basically if you were to take the, the following sectors politics and policy and everything that results from that society. So, you know, activism, civil disobedience, all this awareness that we've seen recently about climate change businesses. So both businesses that consume energy, but also the ones that created. And then finally, scientific research innovation. So think about advancements in nuclear technology making batteries cheaper and so on. If you were to rank them one through four, depending on their importance or if you want to comment on their interconnectivity, what would you say?

Joshua: [36:12](#) Mmm. Yeah. So I, so my view on things is like, we are going to do best in terms of fighting climate change, if we can make clean energy cheap. And so the things that we can do that that make clean energy cheap are going to be Mmm. The fastest drivers towards it's cleaning up our, our energy system. And so, Mmm. I know a little bit biased cause I am, I'm a scientist and researcher and so I [inaudible] Mmm. I'm a big fan of, of research and innovation, although we have all the technologies today that we need, Mmm. In order to do this. And so I guess if I were having to lump these two these together, I would go, Mmm. I kind of lump business and then also policy together because I think those two things together can make clean energy cheap. Mmm. And if they can work together, make clean energy cheap, then we'd go a long way in our in our in our, in our in our, in our requests. And then I guess I would put a R and D scientific research and innovation. Cause I think we're always going to, Mmm, you know,

Joshua: [37:30](#) We, we can get 80 with today's technology, we can get 80% there, no problems. The last 20% is a lot harder. And so we still need that, that scientists that research and development is not to say that activism and civil disobedience, all of these things are not important. It's just, it's hard to make people change their lifestyles. I think it really, really is. When it comes down to it, I think people you know, there's bill, there are billions of people in this world who wants to have mobility. They want to have light, they want to have you know, the ability to travel. They want to do all of these things. And I, I'm just, I mean I just, there's something I, there's an, I have a knee jerk reaction against, against telling them that they can't do that. Because I have, we have the, you know, the West has. And so I want to somehow give them the ability to have that lifestyle but have it such that it doesn't impact society. I hope we can do that. Mmm. I really, really do. So I guess, yeah, business and policy. Oh, scientific, R and D and then society B, the order, although that doesn't make the last one any less important.

Dragos: [38:44](#) Yeah. And I know exactly what you mean because I agree with you that individuals can't be hold, can be held accountable for their actions and their consumption because they've been used to all these things and obviously there's a lot of dissolve benefits to us being able to travel wherever you want, whenever we want to and having these lifestyles. And obviously you cannot prevent people that are in the developing world from benefiting from the same things. So I agree with you on that. Where I think society's really important is you can see this shift mostly is coming from this, this does this change that has happened in 2019 and all these activists that are, you know, people, Mark, I saw someone recently, I can't remember his name from the U S just told Gretta Timberg to, to go back in school and study economics to which she replied, okay, but this graph still shows us, shows us that there's no way we can stay on 1.5 degrees Celsius. So I don't need an economics degree to tell me that. So I think that activism has been really important to kind of steer the conversation and that that conversation goes and influences politics or hopefully it does because in the U S it hasn't, hasn't really that much anymore. At least at the, at the national level.

Joshua: [40:01](#) Yeah, no, that's a, that's a, that's a good point. I mean, I because I mean a lot of times like, you know, the business, the decisions that businesses make are, you know, are driven by what their consumers want. And so like and we see that in the energy sector too. Mmm. I hope we see that more in the electric vehicle sector coming up. Americans just want to drive SUV. That's all we want to do. Someone just make an SUV, an electric SUV, that's someone that we want to drive and we probably will

Dragos: [40:32](#) Is the model or the model? It's not good enough. I love the driving model.

Joshua: [40:40](#) Mmm. Right. Alas know. Mmm. Yeah. No, it is awesome. It's a sweet car. But yeah, no, I hear ya. I hear you. It's tough. But these directors

Dragos: [40:56](#) And, and, and, and one of the thing that I wanted to add is that a company that you might enjoy looking at, I'm probably gonna speak to them soon. They're called ignite solar and they just established a record for providing cheap electricity in Africa. So they have, I think about, I think they can light up something like basing light basic lighting. I mean, I, I couldn't believe, first of all that so many households in Africa just rely on, on, on kibosh combustible substances to even cook their food. But they basically provide basic electricity in houses for like 60 cents a month or something like that. I might get the numbers wrong, but it's something ridiculously cheap. And they do that by giving them like a basic solar panel and a battery pack and like three led lights and they're just crushing it. They have like a million customers, I think in Rhonda and a few other countries. So it's kind of, it's kind of the dilemma that I had. You don't want to tell people in developing countries that they can't have the same standard of life that we have, but what if they can actually take advantage of the natural resources and just go straight in with renewables as opposed to taking the long way that we took with with fossil fuels.

Joshua: [42:12](#) Yeah, no, no, for sure. And like, you know, and that's, you know, and that's where it starts, you know, that, I mean, that's where we started. You know, we were using fossil fuels for like lights and things like that and, you know, lights, you know, let us study, let us get smarter, let's go to school, let us, Mmm. You know did go on to develop the other, the other technologies you know, that works on that scale to really grow economies. You typically need more energy dense stuff, you know, for the manufacturing sector and all of these other, you know, kinds of like, they, they need that dense energy as well. And we need, we need to figure out like, you know, how the it provide that we're, yeah. It's great that millions of kids are going to be able to study and they're going to be able to, you know, go to school and learn [inaudible], you know, if they don't have those industries, those jobs, those, Mmm. You know, those, those opportunities when they, you'll get done there. I think it'll it wouldn't have been a wasted process, but it, like, it couldn't know. It'll be you know, I, I don't think it will, it will be as good as it could.

Dragos: [43:25](#) And just briefly, like how, when you say energy dense, so is that the, the baseload power type sources? So fossil fuels possibly. So,

Joshua: [43:34](#) Yeah. So you know, companies typically, you know, Mmm. You know, I've done some work in in, you know, Nigeria and, you know, one of the things that is the biggest, you know, pain point is just that the grid just goes down for multiple hours at a time. Right. And so like, I'm a company, Mmm. Can't rely on the electricity grid. If they're, you know, if they're, if they have to, Mmm. You know, if going, you know, if the electricity grid goes down and they have to start all over in whatever they're building or whatever they're developing or making, Mmm. You know, that, you know, it's just, it's just hard. It's just hard to, you know, for that to make economic sense. And so a lot of them, you know, bring in diesel generators and all these dirty know types of fuels and you know, to give themselves Mmm.

Joshua: [44:26](#) You know, consistent energy in order to, you know, develop the things that they, that they want. And so if we can, Mmm. You know, if we can get that energy to them cheaper and cleaner it'll be, it'd be better for, you know, their societies there. You know, there Mmm. You know, getting there, getting their people out of poverty et cetera. You know, they, they want the resources we have. And I'm like, you know, we shouldn't deny them those at all.

It's just how do we get them to them, you know, cleaner than, you know, the path we did, like you said.

Dragos: [45:00](#) Yeah. That makes all sense. All right. Thanks a lot for your time. It's been like super fascinating conversation. I'll link up to your Twitter profile where people can check you out and also you, you guess, write in, in publications such as Forbes, I think it was.

Joshua: [45:17](#) Yeah. Forbes and Axios also. Right. For those too.

Dragos: [45:20](#) Awesome. Solving all the profiles in the show notes and definitely encourage people to follow you on Twitter and join the conversation.

Joshua: [45:28](#) No, I appreciate it. It's been a pleasure.

Dragos: [45:30](#) Yeah, same here. Take care. Can I go share again, thank you so much for listening to this. You've been wormed episode. I really hope you enjoyed it as much as I did. Now you can find all the episodes on our website and it's www dot you've been warmed.com both in audio and written form so you can find the transcriptions on there. I'd love for you to reach out to me on Twitter and tell me what your favorite episode has been thus far, or if you have any feedback on the episode they just listened to. My Twitter handle is at DRG Stephanie's school, so DRG coming from draggish, my first name, and then Stephanie school, which is my last name. And finally, if you want to get notified when new episodes are out, subscribe to this podcast and consider dropping a review for us if you enjoy the content that's all for now. See you soon.