

Susan Oxley 00:01

Welcome to Project Zion Podcast. I'm your host Susan Oxley from Seattle, Washington, USA. This is the series climate brewing, where we interview scientists and presenters who given presentations as part of the Community of Christ, North American Climate Justice Zoom series, which we're calling "All of Creation - From Crises to Transformation". It's my joy today to be interviewing my good friend Randy Litzenberger, who and he's the co-chairman of the Seattle 34th District Environmental Energy and Land Use Caucus, along with another friend of ours, Annie Phillips.

Randy's a high school teacher. He specializes in social and policy issues, and is teaching those topics all kinds of ages, because he's often a guest. And this January, he shared with us in one of our webinars, a summary of the outcome of COP26, the climate summit meeting that met in November - about two months ago - in Glasgow. And although the news from that summit and what he shared was not necessarily encouraging, Randy also brought us some very interesting information about some trends that are surprisingly hopeful. So let me introduce Randy. Randy, thank you for being here. And first of all, how's your family Mari and the two kids Spencer and Theo. How are they doing?

Randy Litzenberger 01:38

Well, thank you, Susan, for the chance to come back and join here. The family is doing well. We just had the opportunity actually today to get out and enjoy some of that nature that you and I hold in such high regard. We went for a six mile hike up by Mount Si near Issaquah, Washington. A little drive, but we had a chance to meet up with some of my students who are in a "Wolverines Who Hike" club. The Wolverine is the high school mascot where I teach and so had a chance to join them in the great outdoors and savor a little bit of nature on this chilly but clear January day.

Susan Oxley 02:11

Wow, that's wonderful. Six miles. Yeah, not bad. Well, for Theo, he's what? Seven? No.

Randy Litzenberger 02:21

Theo's eight. And he made it, he made it a about five miles, which was pretty darn good. So there was a decent bit of uphill there. So yeah, he can be a trooper when he wants to.

Susan Oxley 02:34

Oh, I'm impressed. Okay, Randy, let's start off our conversation about climate. I just wanted you to share with us a brief summary of what COP26 is, and its significance. And what you think about the results of that meeting?

Randy Litzenberger 02:54

Yeah, happy to. So the Conference of the Partners [sic] 26, which was originally scheduled for fall 2020, delayed, like everything else in the world by COVID, took place in Glasgow, Scotland, here back in November. It was several days long. And I think that, you know, there's the conference in terms of the dignitaries and delegates from countries across the globe, which amounted to something better

than 30,000 people. So this was probably the biggest conference ever, in terms of the Conference of the Partners [sic].

And it was also attended by a number of protesters as well, in the several 1000s, and in some cases, in terms of the joint efforts that took place. One of the big marches that took place in the middle of it was estimated at north of 100,000 participants that were there temporarily for the day, partner protests, yeah, with partner protests across Europe and the like, making a big statement. In a lot of ways the success or failure of a Conference of the Partners[sic] includes what happens in those several days of the event.

It also includes what happens leading up to it, and then ultimately, what happens after it. And so just to kind of consider those before we talk about some of the results. The challenge is: can you get countries to raise their ambition coming into the conference in the several months in advance of it, which was limited in terms of what happened, but there was certainly a lot of talk on both sides of the Atlantic anyway about prospects and promises. And then the events there as far as breakthroughs and details and language, there was discussion of reaching a reduction in methane by the year 2030. A 30% reduction was much purported. There were also points of frustration in terms of coal where the language that should have been “phase out” was changed to “phase down” in terms of global coal use at the insistence of two big coal users in China and India. So there's definitely room to grow there.

And then ultimately, the promises in terms of Nationally Determined Contributions, the NDC's, which usually get a lot of the headlines. The ambitions that are there talk about ultimately, most of the countries in the world that came in with Nationally Determined Contributions that were aiming for Net Zero economies by the middle of the 21st century, by 2050. China and India are still holding fast at 2060 for China, and 2070 for India respectively. And so those are ambitions that simply aren't good enough for us to get to the magic numbers that we're looking for. The magic numbers, of course, are two degrees at the worst, but preferably keeping 1.5 degrees Celsius, increase in global temperatures since 1750s, post-industrial increase has been the goal all along. And ultimately, we are not there yet.

What I think it's important to note is the progression over time, because just as recently as six years ago, we were facing, before the Paris conference in 2015, we were facing a scenario that talks about 4.6 degrees Celsius increase by 2100, with the way that things were progressing based on the numbers we had at the time. But the Paris conference increases in areas that I'll share in a moment with some of the other questions in the private sector, sub national governments, as well as some national governments, we've really moved the needle on that. We've gone from 4.6, and a very likely scenario, all the way down to probably 2.7 now by 2100, with a very slim and outside chance based on the current numbers of getting down to 1.8, or 1.9.

But that seems a little optimistic. That's if all the pledges, all the targets by 2050, are met perfectly by all the countries. So more realistically, I think instead of 4.6 degrees Celsius, where we were six years ago, now we are on path right now to about 2.7 degrees Celsius with where things currently stand.

Susan Oxley 06:47

Okay, and what would 4.7 mean for the world?

Randy Litzenberger 06:52

Well, anything above two degrees Celsius, to be honest, is an increasing chance of runaway scenarios. So if you're at two degrees, once you break that threshold, you're talking about one chance in three, a 33% chance that the Earth's tipping points will have been reached or exceeded and you enter runaway disaster climate scenarios; methane forcing in the Arctic, for example; rapid ice sheet loss problems; increasing problems in terms of drought, wildfires, well beyond anything that we have seen yet; where we can no longer control those systems, we cannot stop them, they run off on their own.

And you get into some pretty dire scenarios for humanity, and really, most of the species on the planet. 4.6 degrees would be the worst catastrophe you can imagine for planet Earth, short of being hit by a massive comet. It would take decades to play out. But certainly by 2100, you'd be looking at massive depopulation of the world in terms of most species; you'd be the sixth extinction event, the sixth mass extinction event and, and geologic history would be all but assured and would be well underway by 2100.

Humanity could not survive in those circumstances, you would have billions of people that simply couldn't cool themselves, even at night, for most of the year. I mean, it's pretty catastrophic: rising sea levels that would displace most of humanity since most of the human population lives at or near sea level. 4.6 degrees is pretty awful.

But when we even when we get down to two degrees, Vanessa Nakate, the famous Nigerian activist spoke eloquently about this during the Conference of the Parties in Glasgow, and she talked about two degrees is a death sentence for a billion people. Because they face what's known as wet bulb temperatures of 35 degrees Celsius for long stretches of the year, that's a temperature where the human body cannot cool itself, even when it's sweating, because the air temperature exceeds the temperature the human body consistently, even at night.

So these are truly nightmare scenarios that start at two degrees Celsius. And ultimately, that's why 1.5 degrees is seen as not an easy reality, but the easiest that's possible, and one that keeps a variety of countries - the Marshall Islands, and low lying nations - keeps them from being inundated by rising sea levels, if we can manage not to break that 1.5 degrees Celsius barrier. It keeps them alive, it keeps them viable, and it's one that we desperately need to aim for.

Susan Oxley 09:31

Right, Randy, I just feel horrified by the scenario you shared, and I can feel my heart beating faster and my stress level rising. So the urgency of making changes is very clear. So there's a quote that I just heard this last weekend that says we're not approaching a cliff, we've already jumped off of it and most people don't recognize it yet. Do you think that there's any way of getting back to the cliff? Or are we? Are we past the point where we can do anything?

Randy Litzenberger 10:14

I think we're very much short of the cliff. The trend is clear, we're driving towards the cliff, if you want to continue the metaphor, at an increasing rate of speed. The question now is, can we hit the brakes hard enough to prevent going over. Because once you get to the cliff event, as I would consider the metaphor, you're entering those runaway scenarios where the planet simply cannot be stopped in terms of what it's doing. It enters positive feedback loops, where more Arctic melting releases more methane from permafrost thawing, which increases methane in the atmosphere, added to the greenhouse gas emissions from CO2. And it just reinforces itself dramatically beyond what we have the technology to stop.

So I would disagree that we have jumped off the cliff here at this time, but we can see it. It's not 30 years out, it's probably eight or nine years out, if we don't reach 50% global reduction in greenhouse gas emissions by 2030 - then that's the moment where I feel like we were heading over the cliff.

So maybe that's a little more optimistic than what some may say. But, you know, I think we have to follow the science. Michael Mann - one of the best climatologists that we have - he, along with others back in the 1980s and 90s, were the eminent scientists in this and they've continued to talk about the fact that there's some alarmist scenarios that we get from some features that they're talking about, you know, we're doomed now. I don't think that's accurate. It certainly isn't inspirational.

Susan Oxley 11:50

Right. So,

Randy Litzenberger 11:53

We're in a position now where we have the ability to control it. Yeah.

Susan Oxley 11:57

Right. Oh, no, I didn't mean to interrupt. So what, what do you think COP accomplished in that meeting and summit of the international leaders? They understand this? Do they realize the urgency? What do you think?

Randy Litzenberger 12:12

Yeah, I think it's a great question to kind of juxtapose that with, because I do think the Conference of the Partners[sic] accomplished the continued progress we need to have in terms of the aspirational pieces. Did it accomplish everything we needed to guarantee we're going to be at 1.5 degrees Celsius? No, that's also not true. But it did put us in a position where 1.5 is still viable and possible for us that that would be the highest we would go by 2100? Yes, but the path is getting narrow, and it is a winding one for us to accomplish that.

And I think as far as - it's a metaphor, I'll refer to later on - but as far as the role that national governments play (and to some degree, the international community is a collection of that), ultimately, as I'll share here, in a moment, when we talk a little bit more about markets (and to some degree, the private sector and civic organizations and sub national governments), that national governments definitely play a role. But they're less and less in the driver's seats, more and more, they're the ones

that could hit the brakes - as a metaphorical Caboose, I suppose - to the train in terms of what we're doing right now.

But I do think that the Conference of the Partners [sic] was dramatically important. It speaks to our hopes and aspirations. They set the ambitions, they set the targets.

But what gets us to those targets is to some degree in national action, it's always nice to have that. But there are other elements here that are pushing us forward towards those targets, beyond what national governments themselves do. That certainly the fastest route to be able to get to where we need to go would have national governments setting targets, pushing forward their budgets, acting to cut off fossil fuel projects. We're only seeing that in a limited way right now.

And ultimately, the leadership by national governments has been selective. Some countries like Germany, some countries like Denmark, have really paved the way forward for renewable energy in the last really 20 plus years, let alone the last five or six, and they're starting to reap the benefits of that. But we need more work. We simply need more aspiration on the parts of national governments to really get us to 2030 where we need to go. But I think still, the conference did open the door for that.

One of the best things that we can consider from the conference - because there's so much we can talk about financial governments - but is the role of the protesters themselves, which I was really flattered to be partnered with Michael and Andrew, I believe, in terms of their work in the presentation that we had in the Q&A just this last weekend. To see them and to understand the commitment that's there by people on the ground to go and to be the visible public push for those countries to be more aspirational, for them to go harder with it. It matters.

It really does matter that you had 100,000 people marching through Glasgow during the course of that Conference of Partners[sic]. That's part of the process. Without it we know that we'll never come anywhere near what national governments seem to do. With it there's a chance, though it's an outside one, of those governments will continue to push, continue to have better targets, continue to push us more towards 1.5 degrees as opposed to not.

Susan Oxley 15:15

Right, let's pursue that topic of protests for just a moment. I know that Michael and Andrew, who attended as protesters, peaceful protesters, and said that, you know, it went very smoothly, very peacefully. But they met some of the delegates from some developing nations, who basically said to them, we don't have a voice here. We're delegates, but we're not being given a chance to speak. And I found that very sad to hear that. And so did Andrew and Michael, and made a point of telling us that. Why is it that some of the delegates don't have the right to speak?

Randy Litzenberger 16:00

Yeah. Or if they do have the right to speak, they're not being allowed to speak in the main circles to the main players. I think either of those scenarios is possible. And so, yeah, and it's a question of, I mean, you certainly have delegates from a variety of the developing countries, particularly, I mentioned, the Marshall Islands, that's famous from a couple of COPs ago. And even here, when we're hearing those,

those voices from countries that are not facing problems a decade or two decades from now, they are right now being devastated by rising sea level, even if it isn't inundating islands of the Pacific or elsewhere, they're facing saltwater penetration in terms of their limited freshwater supplies now, those things are happening presently. And so it's very difficult to see how the next 10 years for them is anything short of catastrophic.

So why are their voices not being heard? I think probably the short answer is that if their voices were being heard, we'd see the developing world take the actions to be able to address not only the problems in terms of greenhouse gas emissions, but also you'd see that they would be receiving damages from the developing world.

And this is a topic that came up, which is, I think, a little source of hope for us here, that the topic of damages, meaning that money would come as punishment – penalty - for the developing world to... - I'm sorry - from the developed world to the developing world, that would amount to basically some kind of reparation, and we pay for that.

That has never been on the table of the Conference of the Partners[sic], that has never been taken seriously up until this year. And what was promised was that would open talks for what will happen in 2023, here – sorry - fall 2022, in terms of discussions. We'll have another conference in department as this coming fall. And that's going to be one that I think we'll see some possibilities opening the door to damages.

So in a limited way, that is some recognition of the voices and the challenges they're facing, less so for a mitigation, more so for adaptation, in terms of where those funds could go. I think also that the challenge for those voices from protesters and from countries that are facing the very front lines of this, is simply that they get ignored by the media, they get ignored by other countries, because ultimately, it's a question of power. How influential are you? Do you have the ability to force the rest of the world to see what's happening here? Do you have the ability to grab their collective attention, and it stinks, for so many reasons that our world works that way. But we very much are in these high stakes international conferences, still built around the understanding that if you don't have power, if you don't have a multi-trillion dollar economy, if you don't have political leadership that is connected to a military that can get your attention, and an economy that requires respect in terms of a global trading partner, then you do often get ignored.

That's the harsh, ugly truth of the world that we live in. But it shouldn't surprise us too much. We've lived in that kind of world for a long time. In the era of colonization 50 and 100 years ago, those areas didn't get listened to at all by the mainstream powers and the like. And now we're just barely starting to see any kind of recognition. So it's up to us to continue to keep the pressure on and to join our fellow activists as much as we can in many different ways. To respect those questions.

Environmental Justice here is very much a part of the equation, not just in the United States, in terms of frontline communities, or in our respective countries with our populations that have borne the brunt of most of this, but also for communities and countries around the world, in Sub Saharan Africa, in low

lying islands in South Asia and Southeast Asia. These are the areas that have traditionally been ignored and now that the ignorance of their circumstances is leading to a desperate plight.

Susan Oxley 19:54

I understand that the UN has set up a Green Fund that is designed for wealthier nations, like the USA, to contribute millions of dollars to that Green Fund in order to help developing nations make the transition from fossil fuels to green fuels. How is that going? Has the United States given anything to that is, are those funds being used? What's happening?

Randy Litzenberger 20:21

Yeah, you're talking about the Green Climate Fund, which several years ago was conceived back in 2010, actually, as this the main avenue for the developed world to provide funds for the developing world, knowing that ultimately, the aspirations for better standard of living for developing nations and the like was going to be carbon based. If you want to have power in your home, for most of the last 100 plus years, it was going to be generated by some kind of fossil fuel or a plant or whatnot elsewhere.

So the goal was to provide funds in a voluntary capacity starting in 2010, 2011, and to aspirationally hit \$100 billion a year in funding by 2020. That was the goal. We did not reach that goal, we did not reach that goal by November of 2021, either. But you have seen numbers that are starting to pick up or looking at 10s of billions of dollars that the global community has placed into the Green Climate Fund, over time - it's nowhere near \$100 billion a year yet - but you're starting to see some promise.

The United States specifically was one of the earlier and larger contributors to that. Under the Obama administration, they committed \$4 billion to it. Ultimately, only about \$2 billion of that was delivered to the Green Climate Fund, because, well, the remaining \$2 billion got held up by the Trump administration. And now just in the last year, we're starting to see more commitments coming from it.

So I think in terms of the international community, there's much more that needs to be done. And it needs to be, there's much debate about the Green Climate Fund: well, what are the strings attached to these funds? Are these loans? Or are they grants? Or do they have some other capacity to them. And if you look at the Green Climate Fund, in terms of some of the breakdown - I'm happy to share one of the resources I have for your listeners, maybe we can do that separately here, that allows you to see some of the graphic breakdowns or the like for it - you're looking at a relatively modest percent that comes in grants, historically.

A lot of it is tied up in loans. It may well be low interest, but the reality is you're telling the developing world, "Here come these funds, here come 10s of billions of dollars, but you need to pay this back with some interest". But that's just not a realistic scenario for success. We need to have that be in grants, we need to have that be contribution because ultimately, they're facing the choice.

India right now, for example, has enough coal reserves inside their borders, to more than allow for their citizenry - 1.4 billion people - to have a world class standard of living in terms of electrification. But we know if they burn that coal, that's game over for the planet. We're in runaway scenarios, certainly before the middle of the century.

So we need to incentivize those communities that are looking at coal, that are looking at fossil fuels saying, “Well, we have access to this, but we don't have the ability quite yet to be able to choose the green option, because of the green premium that exists.” Bill Gates' book, *How to Avoid a Climate Catastrophe*, he talks a lot about the green premium that has existed for certainly the last 20 years.

I think we're getting close to that opportunity where it's not only a better choice ethically - obviously it is - but in terms of the straight, hard knuckles finance, that the green options about solar, the green options about wind, and other possibilities are becoming quite competitive with fossil fuels, even the cheap ones like coal, and what's become relatively cheap in terms of natural gas.

Susan Oxley 23:56 [23:31]

So you mentioned Bill Gates, and I've heard you say before that you were not very enthusiastic or encouraged about help from the private sector. But in recent times, you've changed your mind. So what changed your mind is, does Bill Gates have anything to do with that?

Randy Litzenberger 24:19

Bill Gates – I'll give him a little bit of credit, I mean, reading his book also is always an eye opener. He's been in the news for other reasons as well. I'm not a fan of billionaires by any stretch. But ultimately, we're facing something that I think should be a wake-up call for everyone, right now, which in terms of the magnitude of the possible disaster here, the rather dire scenarios we get to if we don't proceed aggressively in this decade, globally, then there's no reason why we should be saying, “Okay, well, we're going to solve this but we don't want to pay attention to markets; we don't want to pay attention to those who can move funds around and help with this”, because it's really an all hands on deck situation. Very much so.

We don't have the luxury of saying, “Well, you're not pure enough in terms of our perspective, for climate and for social justice; your hands are filthy with money.” And they very much are for a lot of these folks we're talking about. We need everything. We need to throw everything we have at it. So what's shaped my opinion, I think recently, has: (1) been that understanding about the desperation of the circumstances, and, (2) honestly a greater appreciation for, for the leverage that you can get from markets that we can't, at least so far, cannot get from national governments.

I mean, I would love it, Susan, if we could just say, all right, Federal Reserve, and most of the central banks in the world, print money! Solve it now that way, because currency isn't based on gold or silver, it's based on confidence. And if we simply buy our way to a climate solution, that could be pretty efficient in a lot of scenarios, although we're seeing some realities now for inflation, that may sap up whatever political will is there to do that. The reality though, is we don't necessarily need to do that. There are other ways available that allow us to harness something that by itself is, you know, a pretty phenomenal invention if it's regulated and controlled.

Capitalism has this habit of making phenomenal, phenomenal amounts of wealth and resources. The problem is left to its own devices - which it certainly was in the 19th century at its inception, and in the last 40 years, for decades, deregulation has largely been - it tends to flow one direction, it tends to flow

up. And you get people starved for resources at the bottom, you get corruption in terms of political systems that perpetuate such inequalities. It tends to be a disaster if you don't regulate it carefully.

When you do regulate it, when you do provide structure to markets and I completely disagree with those on the right, who would say that "markets are crystalline, perfect entities. Don't touch them, let them operate for themselves because they're perfection in nature." Nonsense, hogwash! Nothing can be further from the truth. Markets are created by people.

Yeah.

As Robert Reich, one of my favorite economist says, we have the ability to structure markets so they can do more or less anything we want. And so why can't we create market structures that incentivize renewable energy, and remove incentives for fossil fuels? We absolutely can do that. And the proof is what I learned in terms of my preparations for this most recent presentation with your group, that when you talk about the rate of change that can come from markets on a whole host of things - I shared examples about, you know, the automobile in 1900 versus 1913, just in New York City. How you couldn't find more than one automobile on Fifth Avenue on Easter Sunday in 1900 - that graphic that I showed from Tony Seba - and then 13 years later, the horses were all gone, the only thing left were automobiles and they were everywhere.

The reality is that markets and the private sector – Yes - can produce rapid accelerating change that can be profound in terms of making new technologies readily available to so many people. And they can also have their downside. They can also do that in such a manner that you displace traditional institutions, that you displace workers and old institutions that suddenly have no work anymore. They have to retrain, they have to move on, on their own unless they get a lot of help.

So, can we create markets that have the ability to go past the political logjam, to get past the influence of fossil fuel money in our political systems, which is everywhere now? And the answer is yes. And we're seeing it happen before our very eyes. In my first presentation, I shared the fact that we have, through Project SunShot from the federal government, but also from a lot of a lot of solar panels being built in China in the last 10 years, we've dropped the price of photovoltaic solar power installed dramatically using the levelized cost of electricity. We've dropped it better than 90% in some cases. That's the result of markets doing what they do. They introduce new technologies. And once they get past this gestation stage, they get on these nonlinear S-shaped growth curves. And once they're there, they tend to stay on there.

Randy Litzenberger 29:14

Part of the heart of my presentation, I think, that that may be really enthusiastic about sharing these pieces about markets, is that we're looking at, for our purposes, four game changing technology set in the last 10 years have gotten on those S shaped growth curves. They are in varying places on it, depending on which we're talking about.

The most aggressive and promising are wind and solar. We're looking at costs that we have reached now in terms of down below \$100 per kilowatt hour installed, or I'm sorry, per megawatt hour installed,

that we weren't supposed to get to until 2050. We're 20 and 30 years ahead, ultimately, of where we thought we would be as recent as five or six years ago. The projections from the International Energy Agency said that okay, yeah, you'll get below \$100 per megawatt hour install for solar, but that's going to be 2050. Nonsense. We got there by 2020. We've done it.

{Okay}. When we look at the fact that solar and wind are on these nonlinear growth curves, which we have clear evidence that that's been the case here. We've reduced their cost dramatically over the last 10 years through a mix of incentives, through the market in terms of what has been doing in terms of efficiencies. We're looking at this reality, they're going to outcompete fossil fuels, in some cases are doing it right now in different parts of the world. But by the time we get to the middle of this decade, by 2025, we're going to be looking at this as a widespread source of energy and the preferred one in terms of electricity generation. The question now is not, "Will we continue to move forward in a way that really sees dramatic acceleration of this?" The question is, rather, "Can we through policy - which is one of the central tenants I think I brought up from both presentations - can we through good policy, at a variety of levels, accelerate the growth on that, so that we can get to 2030 and have 50% reduction in terms of our greenhouse gas emissions, much of which comes from the energy sector?"

And I think ultimately, we should think about the metaphor that I used a little bit in the second presentation about pushing this great weight up the hill, a giant rock, if you will. The last 20 years, we have been lifting that through helps of policy and those things up to the top of a mountain. And the reality is, it's arrived now. All of that inertia that will create an avalanche of renewable energy penetrating deep into global markets is there, it's poised, it's ready to go.

What we have to do now is clear the obstacles. And those include things like fossil fuel subsidies, for example, globally, we need to remove those, we need to redirect those. And we're starting to see that happen in a limited sense. For example, one of the promises that came out of the Conference of the Partners[sic] looping back to that for a quick second was that we would have a reduction in national government support for fossil fuel projects overseas outside of their own country. And it's limited right now.

Currently, the major I think top five countries that include the United States, have basically put in something like \$63 billion in support from national governments for fossil fuel projects over the last several years overseas outside of their own borders. Well, this isn't a complete shift of that. But if the pledge that is held up that came from the Conference of the Partners[sic], this time in Glasgow, is held up, we're looking at a \$15 billion reduction in that in terms of the projects that are kind of in the pipeline that have yet to go forward with it. That's not nothing, but you're starting to starve the beast so to speak, you're starting to remove those obstacles so that that avalanche of renewables is going to come crashing down the hill. In a lot of ways it already is, but will accelerate through this decade. It will make it so that it has fewer obstacles on the way.

So that transition--the renewable energy, the clean energy transition that is coming--is happening right now. Honestly, we can only push it faster if we have good policy. And that policy will bring incentives to markets, it will clear away hurdles to allow for the creation of more wind farms: offshore wind farms in the United States and Europe. That will allow for access for the cables and the transmission lines that

we need to be able to make that link in the grid, to green the grid, and ultimately, to help us electrify everything, because we'll have the power for it. There was one study I saw just in the last week that talked about ultimately, if we electrify everything globally, we will only use about 40% as much power as what we currently use because of the efficiencies of electricity over natural gas and fossil fuels. (That's impressive.)

Yeah, we're talking about not only an ethical solution in terms of this horrible morass of climate change that we're finding ourselves in, but one that is simply more efficient. We're playing to physics as opposed to against it. And that brings the opportunity for, I think, dramatic change, and that's renewables that are pushing this forward in that regard.

Susan Oxley 34:04

Great. So that's both electricity and wind power. What are the other two? Yeah, remind me of the other two that you talked about? At the webinar.

Randy Litzenberger 34:14

Absolutely. The other two in the webinar that we talked about included batteries, and then electrolyzers. Think Green hydrogen, not blue hydrogen, because then we're just using fossil fuel inputs to make hydrogen, but green hydrogen where it's generated from renewables. First, for batteries: with batteries, it's a similar story to solar and to wind, although it's a little earlier in the growth curve for it. When it comes to batteries, we have made phenomenal jumps ahead in terms of lithium battery packs in terms of their cost. And their storage has dropped in terms of cost of storing a kilowatt of electricity. I mean, 10 years ago, we were talking about something that would be well over \$1,000 per kilowatt hour of storage.

If you think of the first Teslas, right? The Model S. I mean, you're trying to get a car that will get you 200 plus miles range, but it will cost you \$75-\$80,000. That was the state of the art in terms of that. But (I don't want to [give] Musk too much credit, because he's anti-union, and I'm very pro Union) but when we talk about different innovators and markets--and honestly, [that's] both the United States and China in terms of the money they've put into batteries and lithium ion. What we've done is we've made lithium ion batteries more efficient. And we have made them cheaper in the past decade, decade and a half. And the reality of that is it now we're looking at costs that are not quite at \$100 per kilowatt hour of storage, but are very close to that.

And again, it's well ahead of schedule. The International Energy Agency said we wouldn't get to that cost (really \$100 per kilowatt hour) until the middle of the century--until 2050. And now we're there! Or we're right on the cusp of it anyway. So with batteries, we're looking at phenomenal opportunities. And you know, there's discussion I always hear from folks about, "well, isn't lithium bad for the environment? aren't we using things like cobalt and other rare earths to make them?" And the answer is "yes, on both counts, they absolutely can be." But we have to consider ultimately how we're going to improve our ability to harvest those. Mining lithium from traditional mining methods--dig a big hole in the ground, dig it out--there's Thacker Pass in Nevada, there's a site for lithium now that could have a massive amount of our lithium supply going forward, but it would be absolutely destructive in terms of tearing up the Earth.

Randy Litzenberger 36:30

When you think about the open water spaces, and the like, for dissolving lithium--basically using the power of the sun in Chile, where it's most famous for that--you're talking about a slower process that still has a lot of environmental problems in terms of using water in deserts for something like refined lithium. So neither of those--one is certainly better than the other-- but neither of those needs to be our solution long term. They currently are (they're where the state of the art is), but we're starting to see prospects in terms of lithium and harvesting that.

The Salton Sea, for example, in Southern California. There are prospects there that talk about closed loop systems that don't use groundwater from the surrounding area--that don't dig big pit mines, that are non-invasive and allow us to cycle basically lithium out of the brine that is naturally occurring there. That could be a phenomenal load in terms of the lithium we need to continue to transition for the clean energy economy. So we shouldn't think of lithium as "there's only one way to do it, or two ways to do it right now."

And we don't think of it in terms of "hey, the only internal combustion engine we have right now is the Model T, or the carbureted engine." Those are dinosaur technologies. We advanced the technology through innovation, through market incentives, through better structured markets and policy. And those are policies that brought us cleaner air, more efficient automobiles, and they'll do the same thing in terms of batteries. They'll bring us cleaner processes as long as we hold them to count. And ultimately, as long as we continue with this clean energy transition.

Just a quick word on electrolyzers with green hydrogen, because it's the one that is very much in the gestation stage. Right now, it is the one of the four technologies that I mentioned (with solar PV, and then wind and batteries), green electrolyzers/green hydrogen has the furthest to go. It's very much at the front end of things. It's not even really \$1,000 per kilowatt hour in terms of storage. But the promise of this is immense, because you're never going to be able to stuff enough batteries into an airplane to make it fly, other than a little gimmicky thing that can only carry a few 100 pounds of cargo or a couple of passengers.

Ultimately, we need something to convert the hardest decarbonize sectors in terms of aviation, for sure. But also things like steel refining and the like that are really carbon intensive industries. And we're going to have to depend on something like hydrogen to come along for that. If we end up doing blue hydrogen--if we just use natural gas inputs for it--that's a tragedy. And we're going to go nowhere in terms of reducing our emissions.

But we're hearing about promising things in Australia, for example, which has tremendous resources in terms of solar and wind. Andrew Forrest, his Fortescue Metals Group, which is one of the largest metal refineries and iron ore harvesters on the planet. They have dedicated themselves in the last couple of years to do something pretty radical, which is this: They're not only going to decarbonize--they're very hard to decarbonize systems in terms of creating metals for the planet, and steel ore, or iron-oriented steel--but they're going to make themselves a green energy company by putting a lot of solar and a lot

of wind out there in those areas. And they're going to start making green hydrogen. And they're going to export that.

Now it is far-fetched, but you should read about Andrew Forrest and Fortescue and his story. He's a guy who came in with minimal resources and set up ultimately this company with a few lucky investors 15-20 years ago and they have kind of taken the world by storm in a lot of ways. So I wouldn't bet against somebody who has ambition and resources, that has an established company right now. Because they can see what the future is. The future is not these energy- and carbon-intensive, hogging industries staying as they are. The future is in transitioning and whoever does it first has a dramatic edge in terms of the future. And they have this opportunity to help rewrite the rulebook on their terms, as opposed to being forced into a green energy future when they wait and get behind the curve.

So there's tremendous cost savings, there's tremendous market share available for folks that are looking towards that. And it's a moment to be bold, because that's what we're going to see, along with good policy from national governments that will support those private sector pieces. We have to have those good pieces of policy to make it possible for them as they take big risks. Otherwise, it simply won't happen. You'll have a few outliers, and maybe they'll get the breakthroughs we need. But we need this as a broad base spectrum. Because as I said earlier, this is an all-hands-on-deck moment. We don't have the luxury of what my political predilections are, which is very suspicious of billionaires, and ultimately private companies and their motives. We need to force them to work for us. And the clean energy transition is perhaps the biggest opportunity to do that right now.

Susan Oxley 41:13

So you are reiterating what you said in the webinar, and that is the marketplace is actually driving the change faster than the politics--or I should say the politicians.

Randy Litzenberger 41:28

I would say the national governments because politicians come with all sorts of lenses.

Susan Oxley 41:32

Okay. So if the marketplace is striving to change faster, what does that mean? Can you talk about that in relationship to some of the other solutions that have been proposed: like reforesting everything--planting enough trees to, you know, pick up the carbon dioxide in the air; about animal agriculture and moving to a plant-based diet, which is also proposed as a primary solution? Where do all these different solutions fit together?

Randy Litzenberger 42:16

Yeah, I think they fit together importantly, in some of the areas that also can be challenging to decarbonize. I mean, one of the areas when it comes to greenhouse gases, CO2 tends to get all the attention because it's 98 or 99% of the greenhouse gas emissions that we have, as far as the tonnage, right? --the Giga tonnage. But the reality is, we know that carbon dioxide as far as a molecule [goes] is not equal to a molecule of methane. Methane is 27 – 90+ times as damaging a greenhouse gas, just because it retains heat so much more effectively than carbon dioxide does in terms of its impact is a greenhouse gas. But we also know that it's more temporary.

So how that fits in with agriculture, let me speak to this personally. Then I'll bring in a couple of things that are promising with it. There's a good TED talk I listened to just this weekend that spoke to this. The big opportunity right now--the easiest low-hanging fruit for reducing greenhouse gases--is in methane. We have the technology. And honestly, we have the political will coming out of Glasgow, to cut our methane emissions in half by 2030. And how we do that includes agriculture in terms of changing where those pieces are.

And it also includes things like the current fossil fuel economy, where it's kind of a plumbing problem. That might be one of the easiest, cheapest things to solve, because... I mean, I'm no fan of natural gas companies. But one thing we can all agree on is that if they have leaky pipes, and if they have prospects in terms of transporting methane from where it's produced to market or natural gas in the market, that [the leaking] doesn't do anybody any good. They lose their commodity, just out to the open atmosphere.

And ultimately, we're taking massive step backwards in terms of our prospects of reaching 1.5 degrees. So the first solution in terms of when it comes to dealing with methane and reducing it by 50% by 2030, you have to replumb the system to make sure it doesn't leak. And to give incentives through market structure to businesses to say, "well, we don't want to be sloppy with this. We want to make sure that we're getting every last drop, ultimately to market."

And then in terms of agriculture, I mean, it's multifaceted. But with agriculture, right now we have, oh, boy, more than a billion cows on planet earth. And the reality is that they exist. They get good prices in terms of their meat. They're very popular in it [the market], and it's a protein that is preferred, even though it's not a very efficient one. But to deal with those, you can either start to phase out the use of them--that is, as one of the members of one of the political parties in DC say about the Green New Deal, that "they're going to ban our hamburgers." Well, we could try to do that. But that's probably going to be politically problematic.

Or you can simply make that beef less methane intense. And the way you do that--one of the simplest ways--is changing feedstocks. Which means there are ways to modify the diet of the bovine species by providing things that would naturally reduce the methane in their burps. I mean, a lot of the argument is that the methane comes out the other end, but mostly it's from their mouth. Their multiple-stomach-system is burping that out of the mouth. So if you reduce some of the prospects of that, just from additions to their feedstocks--I've heard of mint as one of the interesting ones--then it makes sense. It's an antacid, right? That's something that can have some prospects to reduce methane by at least somewhat in terms of feedstocks. So there's some prospects there.

I think we'd all be way better off if we ate a lot less meat. And if we pushed ourselves in a direction where we don't need a billion cows, to be the feedstock for the planet. So I do think a plant-based diet for now is very promising. It has its own problems right now, in terms of commercial agriculture, because you're talking about fossil fuel feedstocks that come from fertilizers that not only are greenhouse gas intensive--I mean, nitrogen fertilizers and the like have their own greenhouse gas

problem in the making of them--but they also run off into our waterways and do great damage, in that sense too.

Think about the dead zone at the mouth of the Mississippi River or the Gulf of Mexico. That's because you're draining how many 1000 tons of fertilizer every single day down the Mississippi from all the farm fields in Iowa, in the Midwest and the like. So that's problematic.

One of the interesting things is kind of a fifth technology, (if I can cheat a little bit and add that on), which is very early in its prospects. But it's going to (I think) see a lot of dynamic growth in the next 10 years. [That] is lab meat, where you're talking about meat proteins that are meat that are grown in labs, and not out in pastures. And that prospect--as the costs on that continue to come down and it's as nutritious and as attractive as meat...

Randy Litzenberger 47:04

Because I mean, let's be honest, Susan. I'll be honest, I'll speak only for myself. I can't speak for you in that. But I have never gone and, you know, owned a cow, killed a cow, had it slaughtered and then had the meat brought to my table, I have never done the complete cycle on that.

Susan 47:17

No, I haven't either.

Randy Litzenberger 47:19

And I think that's probably true for 90 plus percent of Americans. So let's be clear: we don't care--beyond the point where we can pick it up in the supermarket in its little cellophane wrapper (which is its own conversation)--we don't care how it gets to that point. What we care about is that it tastes like it and it meets our needs in that course. And lab meat is going to do that. And ultimately, you're going to see something that, over the next 10 to 15 years, is going to be appearing. And ultimately it's going to be cheaper. And it's going to out-compete the current very inefficient model of getting meat from the pasture to our tables. And its carbon footprint will be negligible. Really it'll just be transporting it from point A to point B, from lab to market and the like. And once that's electrified, it will effectively have zero carbon footprint compared to where we are right now.

The last one that you brought up was reforestation. And I think that there's a lot of promise here. But it also kind of depends on how you're doing it and where. I mean, right now think about the Forest Service presently in the United States, for them to have national forests that are served by, let's say Weyerhaeuser, which is a big timber company. Currently, their model is in Washington state where I live that you plant a forest, after you've harvested the last one that stood there. You plant that forest, usually it's very mono crops. So it's all Douglas fir for example. We need to do better than that. But after 35 or so years, it's ready to be harvested. The trees are mature, the size of the trunks fit the mills perfectly. So they come back and they cut it all down and away you go.

Well, the problem is: the first 20 years of basically a forest growth is generally ... it's a source. It's a net emitter of carbon dioxide based on the science that we're seeing now. If you go take a look at a replanted forest--with all those little shrubby-kind-of-Christmas-tree kind of things--for the first 10 years

to 15 years around here (maybe as long as 20 in other parts of country), they just don't hold that much carbon. They are emitting carbon dioxide, they are not storing it. They're not sequestering it. Once they get to certainly 20 years old in Western Washington--Eastern Washington, for example, drier climate got to be a little bit more than that 20-25 years--once you get to that mark, then it's a net sequester of carbon. It's actually storing that away as opposed to just continually remitting it.

So we need to understand that with forestry practices, if you're going to say, "well, after 25 or 30 years, we're going to chop them down," then we're never getting those forests to reach their potential as carbon storage.

Now, when was the last time you went for a walk in the National Park?

Susan Oxley 50:00

Oh, just a few months ago,

Randy Litzenberger 50:03

And you saw it: the gigantic trees, all of the moss and the like, hanging off from them here in Western Washington, and you can see the carbon everywhere. That's what you're looking at. You're looking at carbon. And these massive 500-, 600-, 700-year-old trees, they are carbon storage powerhouses. Whereas if we're counting on Christmas tree farms and the like to do this for us, they don't. They do the opposite. So we need to push the model in terms of the Forest Service. That's one of the pieces where policy would matter here in terms of markets and the timber market. We need to get it so that we are harvesting trees not every 25 to 35 years, but probably 50 to 75 years at best and preferably up to 100 years.

Does that slow things down? Does that limit the supply of wood? Yeah, it does. But honestly, we're going to have to create some kind of incentive structure to make it so that older trees are better. And that ultimately, we're going to use them for what they need to do, which is storage of carbon. So I think that's something that needs to happen in terms of reforestation.

Susan Oxley 51:04

Okay, well, Randy, before we close--and I know I kept you going for quite a while here--but before we close, I would like to just ask you a couple of quick questions. You started by talking about tipping points, and runaway tipping points. What can we do to assist most in addressing those? What should we watch for about those tipping points as they approach? Maybe, what are the three, you know, worst ones? And what can we do? What can we do?

Randy Litzenberger 51:50

Sure. Well, I think one that we talked about just a moment ago was methane. Because it's "firstest with mostest," right? It is the one that we're emitting a lot of right now that's harder to detect. It has massively more impacts. Even though it's only one to 2% of greenhouse gases that we're emitting, when it's 27 to 90 times more powerful than CO₂, it gets to the atmosphere faster, and it tends to have a shorter life cycle. But it's one that if we removed that then we can slow down the rate of warming very quickly. So in terms of tipping points, what we can do in terms of just a straight up piece--in terms of

atmospheric change in what's happening--we need to reduce our methane impact. I think that's the first thing we can do. It needs to be concurrent with everything else, but it's been under emphasized, right?

And I think the other tipping points we want to consider: you get into questions about the polar regions right now, and specifically about ice sheets in Antarctica. Certainly you've reached in past tipping points when things like the--I believe it's pronounced Thwaites Glacier, what some scientists refer to as the Doomsday Glacier. There's an ice shelf right now that is breaking up considerably faster than we would like and it's somewhat retaining the glacier itself. And its grounding points are starting to effectively erode as it holds on to land, there at that grounding point. [There's} water underneath it, the temperature is above freezing, which certainly melts the underside of that glacier. So we get into tipping points there that are problematic.

We need right now to know more, because reaching places like the Thwaites Glacier and Antarctica is enormously difficult. It's about as remote as you can get on planet Earth. We've only had a couple of groups of scientists that have been able to go down there and study it. So we need to know more. And I think honestly, study and the like is going to be a big piece to help us figure that out. And more funding for the National Science Foundation in those areas are going to be the experts looking at this in the field, because we can't address what we don't know. And there's a great deal yet that we don't understand in terms of glaciology, [and] in terms of ocean marine science and the like.

We know that coral reefs across the planet are bleaching at an increasing rate because the oceans have saved us from runaway atmospheric climate change. They're our massive intake for carbon. So the acidification of the oceans there is basically because we've dumped a bunch of carbon into them that has been soaked in instead of going straight in the atmosphere. But we're reaching saturation points in areas we need to study that more.

Randy Litzenberger 54:25

And I think too that, when we consider things like forest fires, when we talk about drought in those areas, and we consider what may be going on with the jet stream that we don't understand yet, we ultimately need to have clear study and more research into that. To make sure that what we're starting to hear about--and one of the theories that's out there--is that the heat dome that hit us in the Pacific Northwest last summer was because the jet stream effectively kinked. It swung well north and sucked a lot of dry air up from the southwest United States. And heat effectively got stuck there for a long period of time.

The opposite happened with the Texas ice storm of just under a year ago now, where Dallas and Fort Worth are. And so we need to ultimately continue our study, we need to make sure that we're doing not just the research and development for renewable energy and clean energy transitions and the like. But we also have to continue study in the scientific community with better funding from national governments and institutions to help us see the best way forward. It may well be--if you read the Kim Stanley Robinson's book, *The Ministry for the Future*, which has been popular in circles recently--it may well be that we need to incentivize fossil fuel companies to instead of drill for oil, that they need to go to the glacial ice sheets and drill holes in them to reduce or to remove meltwater from underneath them.

So those glaciers will basically sit down on the ground instead of being lubricated by melt water underneath and move faster towards the ocean.

If we're going to prevent tipping points, like runaway climate change and rising sea levels, glaciers from Greenland, Antarctica and so many in between will play a massive role in that. And we may end up in some desperate scenarios to try to reduce their impact on sea level rise. And you know, sea level rise is probably the slowest moving actor, it's the one that we have the longest lead time to. But it's also so, so massive in terms of its scope, that everything you can do now to prevent that is so worth it down the road.

Think about what that does to you. (And I know we're short for time, so I'll be brief.) But nobody wants a scenario where a billion human beings have their homes flooded, and ultimately, they're migrating. Because we know with mass migration comes political chaos. We saw that out of Syria and the Middle East ten years ago in terms of the Syrian Civil War--which climate change was an accelerant for that. Farmers facing drought went to cities; radicalization in terms of some groups that were there led to civil war [and] overthrow the regime; and suddenly that country's dissolving. And where did they go? They had to find safety. And ultimately, that tipped Europe's politics in a way that was pushing it to the right. Viktor Orban probably isn't in power in Hungary, with his right wing government, without that mass exodus of human beings.

And we need to consider what's happening here in the Western Hemisphere with that, too. We need to make sure that ultimately we prevent mass migration, mass catastrophe, mass tragedy for people as they're forced to leave their homes as they're inundated by sea level rise, or desertification and the like, or wildfires. And we need to provide them the best chance to have to stay and thrive where they are. I wish the world worked differently. I wish when we had refugee chaos, and people welcomed them with open arms by the millions; but in a very ugly way, we don't live in that kind of society. It's reprehensible, honestly, but that's the sad truth of it.

Susan Oxley 57:53

Well, thank you, Randy, I know that you have shared with us the hope that you have, in terms of the way things can change with the markets, the way national governments have the potential to remove the barriers, the impediments to that marketplace change, and the way in which the common person can be an advocate for those national government changes. So in spite of some of the difficulties that we face, you continue to be a voice of hope.

One of the other quotes I heard this week was hope is believing in spite of the evidence, and then watching the evidence change. So I would like to give you a chance to simply make a closing statement in whatever way you wish, to address your continued voice of hope.

Randy Litzenberger 59:05

I'd love to and I appreciate the opportunity to do so because certainly much of what we've shared here is a mix of hope and despair, right?--in terms of what could happen if we aren't vigilant. And I think that hope is the best tool that we have. Because as I said in my first presentation in the group that, you

know, is it climate hope or climate Doom? And I think hope is something that's a much more motivational piece for individuals to take action, which is what we need.

We need people by the hundreds of thousands to engage in the political system. Not disengaged because they find it disgusting, but engage because we absolutely must do so. We have to do that now. We have to engage with our local levels of government, we have to engage with our state levels of government or provincial levels in Canada and elsewhere, and with our national governments and we have to persist in doing that.

My own favorite hope quote is by Senator Cory Booker, and he said this one several times, but it's [this]: "Hope is the active conviction that despair will not have the last word."

One of the scientists that I shared a little bit in this last presentation with your group was Katie Hayho. She talked about the reality: that we "shouldn't think of hope as this bright light that shines on us every single day. Hope is that little pinprick of light that you see through a lot of darkness." That's proof that you just need to keep pushing through hard times, because there's something good at the other end of that tunnel.

We're facing hard times right now. And there will be moments in the next 10 to 15 years where it gets bleaker not better, no matter what we do. But we have to persist, we have to continue to hope that through our actions, we can do better. And I think that those actions are what give me the greatest hope. When I see my son Spencer speak to the Seattle school board, and last summer to talk about electrification of school buildings to replace fossil fuel heating systems that are there, and instead to move to efficient heat pump systems.

[For Spencer] to get that opportunity to have him make the mark on my ballot just this past week, because he worked towards that. And he's the one that gets to vote on that part of the levy, ultimately, with his hand on my ballot. That's not fraud, sorry. But it's ultimately one that shows an act of hope and to show the next generation that they too can make a difference. This is their opportunity.

And I think too when I see my students take that opportunity to be able to engage the system. When they make calls or contacts to their state legislatures right now in Washington state, when we're facing a whole range of beautiful pieces of legislation that can do tremendous change in some of the hardest decarbonize sectors. When I hear them engaging that system, that gives me great hope.

When I see my son Theo, who's eight years old, join me for canvassing my neighborhood for candidates that will fight in the right direction on this, putting out the flyers and leaflets for people, talking to people at their doors. That's a cause for hope. And that's ultimately what we need to grasp onto right now. There's plenty of doom and disaster and the like. We can talk about that all day and make ourselves very heart sick about it. But the part that we need to keep coming back to--acknowledging the challenge that exists--is that pinprick of light at the end of the tunnel. To show everyone that we can ultimately [win]. They need to join us in pushing for that too, through the darkness and towards that light that's ahead. Because that is our best hope to bring the change that we need.

Susan Oxley 1:02:22

Thank you, and the more people who can grab that vision and add their feet, their hands, their voice, to advocating with their legislators--and advocating with calls and emails and voting pamphlets--the more people who are doing that, the greater the hope grows. (Absolutely.) Thank you, Randy. Wow, you've just done a super job for us today. Thank you so much. I will sign off, let you go. If you have any other last words, please feel free.

Randy Litzenberger 1:03:06

I think we're good. I've said my bit. And I want to thank you again, Susan, for this opportunity to share with your fantastic community. These are a bunch of doers, definitely. And to be part of this these last several months has been a pleasure.