Scott Tinker (00:00):

Next on Energy Switch, we'll look at another critical topic, how to make energy more sustainable.

Sean O'Donnell (00:06):

There's two billion people today, and four billion people by 2040 that need additional... It's not an energy transition for them. It's an energy addition for them.

Bridget Scanlon (00:17):

It's very important, understanding the context and where we've come from, how systems have evolved. And my feeling is, we have lots of solutions.

Scott Tinker (00:25):

Coming up on Energy Switch, how can we make energy more sustainable?

Speaker (00:31):

Funding for Energy Switch was provided in part by Microsoft and by the University of Texas at Austin.

Scott Tinker (00:42):

I'm Scott Tinker, and I'm an energy scientist. I work in the field, lead research, speak around the world, write articles, and make films about energy. This show brings together leading experts on vital topics in energy and climate. They may have different perspectives, but my goal is to learn and illuminate and bring diverging views together towards solutions. Welcome to the Energy Switch.

Scott Tinker (01:12):

Energy is required to sustain modern economies, but we need to make energy more sustainable to reduce its environmental impact. That means reducing CO2 emissions, but also methane release, managing water impacts, and considering land use issues. These things cost money, so we'll need price signals to drive the market and incentives to motivate investment. My expert guests are, Dr. Bridget Scanlon is a hydrogeologist, a senior research scientist at the Bureau of Economic Geology at the University of Texas at Austin, leading the Sustainable Water Resources Program. Sean O'Donnell oversees quantum energy partners, energy transition, and decarbonization investments, and formerly, was president and CFO of Quantum Utility Generation.

Scott Tinker (02:01):

On this episode of Energy Switch, how can we make energy more sustainable? Let's talk about CO2, small topic in the world today. How do we lower the emissions of CO2?

Bridget Scanlon (02:15):

We have been doing it in the US for the past couple of decades. When we had shifts from coal to natural gas, we reduced CO2 emissions, and so we've seen the benefits of that. And I guess, we will be continuing in that track in the future with the coal plants closing down and being replaced by natural gas or other energy sources, so I think that will play an important role.

Scott Tinker (02:40):

Yeah, that's an early win kind of thing. Can that happen around the world? Can you replace coal with gas?

Sean O'Donnell (02:46):

Theoretically, yes, but you have a problem of priorities. There's different priorities within the US. Regionally, we've got different priorities, gas versus coal, so we haven't sorted it out ourselves yet, so how far into the future before you've got a global set of standards as to what that priority is? We don't think it will, but from a timing perspective, we know what we can do at home today, right, and lead the way, right? Going back to your question, is it about carbon? And I would go one step further. I'd say, it's really, GHGs. Let's talk about CO2 equivalents because-

Scott Tinker (03:22):

Greenhouse gases?

Sean O'Donnell (03:24):

Carbon somewhat unfairly focuses on power in people's minds, but we both know it's much more than that, right? It's carbon, it's power, it's industry, it's transport.

Scott Tinker (03:34):

It's ag.

Sean O'Donnell (03:36):

20% is ag, right? And 70% of that is farming, so we should talk about, it's really GHGs, not the fuel. Fuel creates a competition, right, depending on, are you oil and gas, are you renewable? That creates more sound. That creates more noise than signal. The standard signal that the market and the participants need is around GHG or CO2, right? That will decide, in time, through a marketplace, what fuels should or should not gain market share. So we tend to be fuel agnostic and starting to look at carbon as either a cost or a revenue line item that treats different fuels differently.

Bridget Scanlon (04:22):

I think if people are concerned about carbon or greenhouse gases, that they should be more open, I think, to nuclear.

Scott Tinker (04:28):

Zero emissions, pretty dense form of energy.

Bridget Scanlon (04:31):

Right, right, base power, which could really help to replace some of the large power plants and stuff.

Scott Tinker (04:40):

And it's amazing, the passion around nuclear. It's all over the board, right? It truly is. And you mentioned replacing coal with gas as another... Both of those technologies exist today. Are there options for big levers, for CO2 or greenhouse gas emissions reductions?

Sean O'Donnell (04:56):

The levers that we have today, particularly around CO2, it's natural gas, it's carbon capture. These are technologies on the shelf today. It will provide for growth of base load, sustainable, responsibly-sourced gas that is fully or 95% carbon capture. So we can begin to bend the arc on our CO2 growth every year. It can only happen with carbon cap, post-combustion carbon capture here in the next couple of years.

Scott Tinker (05:27):

Yep. Midterm and long term-

Sean O'Donnell (05:30):

Then the next set, that's more of R and D dollars, and this gets into, other than power, what are the other segments of the economy that need... I go to ag and I go to buildings. And this is really material science, right, concrete, 8% of global CO2, not because of process, just because of curing, right?

Scott Tinker (05:51):

Yeah. And we use a hell of a lot of concrete in the world.

Sean O'Donnell (05:54):

It's ubiquitous. We're sitting on it, we drove on it. It's everywhere. We don't even think about it. And that's 8% of your personal carbon footprint, is the concrete that you and I used today. Ag buildings, 40% of global emissions are buildings. And cities are growing, going forward, so you have 70% of global emissions from cities, which are 3% of the total land mass. The opportunity in the low-hanging fruit in buildings and cities, but it's not talked about. The power sector gets talked about, electrification gets talked about, but buildings, ag, and just the how we do things every day, there's no price signals for that.

Sean O'Donnell (06:32):

What is that carbon credit to incentivize a skyscraper in New York or Hong Kong or New Delhi to triple paint its glasses or to change out heat pumps? Where is that price signal that motivates that player that has 40% of the global CO2 portfolio? Doesn't have a price signal. So it's priorities, it's the material science that can work its way into that sector, I think is that next couple of years. It's much easier to go attack a power plant than it is eight skyscrapers, right? It-

Scott Tinker (07:00):

And not cheap, either. The price signal may not be low. It could be reasonably costly, and you got to think about how that cost translates through the economy and who it impacts and how you balance all those things. Methane, of course. What do you see on the methane front?

Bridget Scanlon (07:19):

Well, some of our colleagues have looked at methane issues in terms of flaring and leaks. And I think there's a lot of progress being made, but I mean, maybe we need to regulate it. Unless we can pipe the gas away, maybe we shouldn't be producing it, because we're losing a lot of energy and then impacting the greenhouse gases.

Scott Tinker (07:47):

Yeah. And that low price gas, which it's been for a little while, not much incentive for industry to capture those leaks. Prices going up, they might see some incentive, but you're talking about gathering lines and not flaring and being-

Bridget Scanlon (08:03):

And co-producing gas and the main emphasis being oil, because it's a much higher price commodity, so then, less emphasis on the gas side of things and... But approaches to using that on site, if possible, for different things, powering things and beneficial uses, instead of flaring it.

Scott Tinker (08:25):

You either put the methane up or you put the CO2 up after you burn it, so how can we use it, right, without doing that?

Bridget Scanlon (08:33):

Well, people talk about using the energy to treat the produced water, which is high salinity. And if they want to have beneficial use of that produced water, then use the energy to treat that water and to use it for different purposes. And there's a consortium being developed in Texas right now to evaluate those options, and also, in New Mexico, because many of these oil and gas players are in semi-arid regions, and water scarcity is an issue.

Bridget Scanlon (09:00):

But I mean, the first thing to do with that produced water is to just use it for hydraulic fracturing so that hydraulic fracturing is not reducing groundwater resources in those places. So that's the cheapest and the easiest and they can use it with very little treatment, so you're not drilling wells into the aquifers to supply water for fracking. But a lot of work has to be done to evaluate the reliability of that treatment before we do too much with it because of potential unintended consequences.

Scott Tinker (09:29):

Right. When you take the salts and things out of it, you got to do something with the salts that come out of the water.

Bridget Scanlon (09:35):

So sea water is about 35,000 total dissolved solids, and some of this water was around that level, but most of it could be up to 100 or 150. But actually, the treatment companies were more interested in the higher TDS water because then, they could do other things with the solids that would come out.

Scott Tinker (09:52):

Oh, interesting. We use water in power generation quite a bit for cooling, and we use it in fracking. You've mentioned some of that. I mean, where do we use water for energy production and how can we get better at it? How can we make it more sustainable?

Bridget Scanlon (10:05):

Well, I mean, if water is a real issue for thermoelectric power plants, you can do dry cooling. And I think most of the power plants in Australia are dry cooled.

Scott Tinker (10:15):

Interesting, so with air?

Bridget Scanlon (10:18):

But there's a trade-off there in more carbon and less efficiency, so there's trade-offs in everything. Most power generation is with thermoelectric power plants, and so water is a big part of that. And then you add carbon capture and storage to those power plants, you increase the water use.

Scott Tinker (10:37):

Every time you bolt something onto a power plant, it's an energy penalty. Whether it's stripping out sulfur or nitrogen or mercury or particulates or CO2, you're using more of the resource to cool it because you have to have more energy. Or there's some kinds of things destructive to water and some not. I mean, you end up with water you can't use for anything else as opposed to-

Bridget Scanlon (10:59):

Well-

Scott Tinker (11:00):

... usable water. What are the right terms for that-

Bridget Scanlon (11:01):

Well, I mean, for thermo-electric power plants, you withdraw a lot of water, but you return 98% of it. And so, if it's a surface water salt, which it usually is, then it's at a hotter temperature, and so you can affect ecosystems and stuff because of the temperature issues. And then-

Scott Tinker (11:19):

When you say return it to-

Bridget Scanlon (11:21):

To the river or to the reservoir or whatever, so it's just, most of the water that you withdraw, it goes back, and the consumptive use that goes to evaporation is a very small percentage.

Scott Tinker (11:34):

Gotcha, yeah. Let's get to land. Solar and wind are great for some things, emissions-wise, but not so much for the land side. How do we lower the impact of energy on land? Thoughts on that?

Sean O'Donnell (11:45):

You have a challenge onshore that people don't want to see it. You can make it bigger, but people don't want to see it, so you have this priority. Well, what do you want? Do you want carbon-free energy or do you want visuals? So you have land constraints. That is one of the biggest challenges of terrestrial, renewable development.

Scott Tinker (12:04):

Sure, and understandably, in some ways.

Sean O'Donnell (12:08):

It's back to your priorities, right? I think everybody should build a wind project in somebody else's backyard. And-

Bridget Scanlon (12:15):

But maybe-

Scott Tinker (12:15):

That's true for all energy.

Sean O'Donnell (12:16):

That is true for all energy. But you can move offshore. You're just moving the problem, so the bubble moves onto the carpet. Okay, I can't build on land. Okay, let me go build in the... Well, the ocean presents its own challenges, right? Now-

Bridget Scanlon (12:28):

And fisheries in other groups are-

Sean O'Donnell (12:31):

Fisheries and military don't want to have you there, but that's only two stakeholder groups as opposed to on land. You've got more that's surrounding you, but it is a big challenge. But to be fair, the definition of energy density is changing, because as we looked in the last 50 years, right, coal, nuclear gas, the energy density, when you just think about it from a surface perspective, is 20 to 500 times more than wind or solar. I think what we're all beginning to now conceptualize is, that didn't price carbon. When you just look at a two-dimensional, what is the surface impact, that's power density. Power density is actually, or could be, a three-dimensional concept. What is the impact to the atmosphere, to the surface, and the subsurface?

Sean O'Donnell (13:22):

Power density is hard enough to calculate, right, when you're talking about a two dimensional. But now you get into the, what is power density of wind and solar? And it's a little understood, but the carbon footprint of a solar project is not zero. The carbon footprint of a wind project is not zero. What winds up happening is, people don't see over the horizon to understand that entire value chain. Where did that solar project come from? Where did the polysilicone in Asia come from? What were the mines and the labor that went into that? How much concrete, how much steel? When it shows up on your electricity bill as I've got 2000 watts of solar, you feel really good about that, but it is not exactly zero carbon.

Bridget Scanlon (14:05):

I think, Sean, I mean, we need a portfolio, we need all of the optionality for resilience, and what people want to zone in on, one thing or another thing or whatever. I mean, they just don't get it. And many people don't consider the trade-offs. Everything is a trade-off and they just don't think about those. And maybe they don't know, maybe it's the education, that they don't know the life cycle aspects of different types of things.

Sean O'Donnell (14:39):

Yeah, yeah. When you go back to 2020 or 2021, your energy outlook was really your politics, right? It was not a science based. It was not an academic based. It was not, hey, let me compare the numbers, which is really the right way to start with everything. Let me look at the numbers, [inaudible 00:14:58]-

Scott Tinker (14:57):

Yeah, the data.

Sean O'Donnell (14:59):

Data, right, as opposed to rhetoric.

Scott Tinker (15:02):

Well, let's look at another kind of sustainability. We've talked about the environment, we've talked about the social-political. Which energies are the most financially solvent, if you will, or the most sustainable as we start looking across the energy spectrum?

Sean O'Donnell (15:16):

Instead of solvent, I think about it in terms of economic viability. What technologies can attract capital to get built? And that's a relative answer, but there are established technologies, natural gas, solar, wind, battery storage, increasingly. They're all viable. If I asked you for a hundred dollars because we're going to go build a solar project together, or I asked you for a hundred dollars because we were going to go do small modular nuclear, which would you rather give me a hundred dollars for? Nine people out of 10 would put that hundred dollars in solar project. That's economically viable. And hydrogen's probably the better example of all of them. There's really not a debate as to the efficacy of the hydrogen molecule. It's just, what's the right technology? What are the right widgets to access hydrogen? And there's a spot for government subsidies there because it is not economically viable, strictly speaking-

Scott Tinker (16:12):

Back to those partnerships again.

Sean O'Donnell (16:14):

... today. Right.

Scott Tinker (16:15):

Yeah, yeah. Gotcha. Bridget, you've been to universities and worked with government funding, state and federal and other kinds of things. What are the roles of incentives and subsidies and investment from different entities in addressing some sustainability things?

Bridget Scanlon (16:32):

Well, I mean, I think it's very important to have the research to support and to provide information and data to investors and policy makers and decision makers, and so research plays a very critical role in universities. And the more universities can work with industry and government and you have all three working together, I think then, you may have more communication, and even internationally. At the University of Texas, our carbon group work a lot with people in other countries, in China and Japan and other places, so helping them to move towards more sustainable development.

Bridget Scanlon (17:15):

My own research area is in water resources, and I think energy plays a key role in sustainable water resources because the more we can reuse the waste water... And people in the past, they've always been going after new sources of water, but if we can reuse the water in dense urban areas and treat it, we have the energy to treat it, then that will make considering it as one water, one resource. I think it would be much more sustainable.

Scott Tinker (17:48):

Right, right. We academics, we publish our research in peer review literature. Does that do it? Are people reading?

Sean O'Donnell (18:00):

I read your stuff, Scott, yeah.

Bridget Scanlon (18:05):

Research is very important in looking at data and providing context. Sustainability, are we talking about in a yearly timeframe or are we talking about a decade? Are we talking about a century? So it's very important, long-term... understanding the context and where we've come from, how systems have evolved, get beyond that and how are we going to solve these problems? And my feeling is, we have lots of solutions and we need to emphasize that rather than talking about all the negatives.

Scott Tinker (18:37):

Yeah. What do you think on these things, Sean, especially on the subsidy side and the role of finance? How does that work?

Sean O'Donnell (18:46):

Yeah. Government's job is to not let me pick a winner with a subsidy here or a subsidy there. It is a necessary evil to get some industries off the ground to generate some momentum, but in time, much as it has for wind and solar now, it will roll off because these are competitive, viable sub-sectors in power generation.

Scott Tinker (19:07):

Government hasn't done a great job of picking winners in energy, I mean, but when they set frameworks like you're describing... So it's emissions, here are some incentives. Can you compete? Lower your emissions. Is that what you're describing?

Sean O'Donnell (19:19):

It's all about competitive. The government should not be investing. Government is not an investor, right? Government needs to set a playing field, send signals, let the market go to work. The research has to continue, but there are things we can be doing today that markets can do today. Research is helping provide a little bit of clarity on, what's the aperture on what could come next? So there's a little bit of advanced planning so markets can see a little bit further, beyond what's available in the market today.

Bridget Scanlon (19:45):

But I think educating the public is extremely important too, in stakeholders, because we want their voice.

Scott Tinker (19:52):

They vote.

Sean O'Donnell (19:52):

I'm glad you went there, yeah.

Bridget Scanlon (19:53):

Yes, yeah. And helping them understand the nuances and not the black and white binary kind of things that we've-

Sean O'Donnell (20:02):

And when they do, they not only vote, their wallet will matter. So we're playing the policy game now to set... There are subsidies to create a framework around CO2, but when we get beyond that, then there is enough competition and enough verticals across the entire emissions envelope, power, ag, buildings. When we've really made it is when it becomes a consumer choice.

Bridget Scanlon (20:29):

But I-

Sean O'Donnell (20:30):

Electric vehicles are there soon, but there's other elements of the entire marketplace that are not yet a consumer choice, which is where the government and the subsidies have to step in until those choices become readily apparent, for the market to make up its mind.

Bridget Scanlon (20:47):

But when I was in Brazil and we were working on biofuels and people, when they were buying their gas, whether they would buy it for biofuel-based or regular gas, they would have their calculator and they would figure out which was cheaper. But you say people vote with their wallet. I mean, but people want cheap.

Sean O'Donnell (21:07):

I think that will change. Younger people are growing up with a different worldview and what feels right for them. Now, when they're on their own and paying all their own bills, that may change, but they talk differently. With three girls, I have the conversation at the dinner table about, "How many oil wells versus how many windmills this month, Dad?" And I'm like, "I wouldn't have thought to ask my dad that 30 years ago." It's an interesting level of awareness.

Scott Tinker (21:36):

Wrapping it up here, what are some investment-worthy, if you will, energies to help improve sustainability broadly? And climate being certainly the most important global conversation today, but

other things as well, what are some things that you're seeing that are investment worthy today and help to move this ball?

Sean O'Donnell (21:59):

Carbon capture and storage today, readily available, understood, adaptable, and-

Scott Tinker (22:06):

Scalable.

Sean O'Donnell (22:07):

... scalable. And again, the energy transition, there's two billion people today and four billion people by 2040 that need additional... It's not an energy transition for them. It's an energy addition for them, right? There are eight billion people now, only six billion energy consumers. So there's two billion people without power, and the global population is going to grow by another two.

Scott Tinker (22:30):

And even of those six, Sean, there's about half of those don't have the kind of energy we have, nothing close, right?

Sean O'Donnell (22:36):

And either are technologies. But when solar-

Scott Tinker (22:38):

So CCUS does this and helps with that because-

Sean O'Donnell (22:41):

Absolutely. Look, you're taking advantage of tried and true infrastructure, tried and true processes, Fortune 500 companies that have done this for 50 years. All of that available IQ and capacity and value chain, how do we just ignore all that and say, "No, let's wait another decade for hydrogen"? How can you afford to wait when there's four billion people you know, right now, that can use any and all of [inaudible 00:23:07] that?

Scott Tinker (23:07):

So [inaudible 00:23:07]. I like this. Your urgency, it's climate, but it's more poverty.

Sean O'Donnell (23:12):

It's people. You can imagine, if you liberate the productivity of two to three or four billion people, the feedback loop that could then do.

Bridget Scanlon (23:21):

And how they could help themselves, not this launching in and trying to give them things. Capacity building would really help.

Scott Tinker (23:30):

So important, Bridget. I mean, because otherwise, culturally, if you're not building that capacity yourself, it doesn't even fit your culture. What else? CCUS? Any other big levers we can throw now that are investment worthy for this challenge?

Sean O'Donnell (23:47):

I think part of the fallacy of what the next 30 to 40 to 50 years is going to be, that it can be all renewable. The larger systems, the urban loads, there will need to be a material element of-

Bridget Scanlon (24:01):

High density.

Sean O'Donnell (24:02):

High density, whether that be hydro or natural gas, right. It will be here for some time. Let's not ignore that fact. Let's stop debating that and embrace what we have, that we know works, with improvements like carbon capture, and continue to deploy it.

Bridget Scanlon (24:18):

But also, I think research things, because right now, we may not know too much about hydrogen, but we should be doing the research to... so we have the data.

Scott Tinker (24:30):

Like we did for CCUS.

Bridget Scanlon (24:31):

Right, and the pilot studies and the demos and-

Sean O'Donnell (24:34):

Right, it will work, and it's a 10 to 30-year process because [inaudible 00:24:37], we have an entire-

Bridget Scanlon (24:39):

And the nuclear, and the nuclear.

Sean O'Donnell (24:40):

But nuclear doesn't have to reinvent its whole distribution system.

Bridget Scanlon (24:43):

But the small modular reactor system.

Sean O'Donnell (24:45):

But it has that too, right? Now you're just on a low voltage, right? This thing is almost distributed at 300 megawatts. But the hydrogen economy, it will happen.

Bridget Scanlon (24:57):

But you could phase it in with using methane rather than water or whatever, and so-

Scott Tinker (25:05):
As [inaudible 00:25:06]-

Bridget Scanlon (25:05):
Yes, right, right, and the pipelines, and added to the natural gas, and then, gradually-

Sean O'Donnell (25:11):
There's a limit to it, but yes, you can blend, up to a limit.

Scott Tinker (25:13):
Get started. Optionality.

Scott Tinker (25:17):
All energies have environmental impacts and all involve trade-offs. Coal, oil, and gas still provide over 80% of global energy. To reduce their CO2 emissions, we'll have to capture and store their carbon. There's also reducing methane releases from natural gas flaring and leaks, reducing water use in the oil and gas industry and at water-cooled power plants, considering the land use, mining impacts, and disposal of wind and solar, increasing efficiency and energy, but also in buildings and cities. All these things cost money, so we'll need price signals and incentives to motivate energy producers, investors, and consumers to make environmental sustainability economically viable.

Speaker 4 (26:36):
Funding for Energy Switch was provided in part by Microsoft and by the University of Texas at Austin.