Leah Stokes (00:02):

In the fall of 2021, a coal plant just north of the Crow Reservation near Hardin, Montana, started burning coal. This was strange because, just a few years before, the plant was as good as dead, until suddenly it came back to life.

Anne Hedges (00:17):

We were watching the plant slowly die. It just wasn't operating very much. They were looking desperately for any buyers and the state to bail them out. Nobody was willing to do so. So we thought the plant was really going to go away very soon. And then crypto happened. And with the introduction of the use of crypto at the plant, its operations have been nearly full bore over the course of the last year. It's just shocking to see so much climate pollution going into the air suddenly, from a plant that was about to go by the wayside.

Leah Stokes (00:59):

That's Anne Hedges, the Director of Policy and Legislative Affairs at Montana Environmental Information Center, or MEIC. After working to shut down this plant for more than 15 years, she found herself losing ground.

Anne Hedges (01:13):

It felt like one day we woke up and started noticing that the plant was operating an awful lot. And somebody said, "Have you seen Marathon Digital Holdings' website?" And so we looked, and that's when we found out what had happened, and that it had been made available to this crypto operator who was purchasing what are known as miners in huge quantities. It's dramatic. By the numbers, if you look in 2020, the plant operated for 48 days. If you look in 2021, the plant operated for 323 days. That's a giant increase. So, I went out there last fall just to have a look. And what you see out there is the coal plant operating, lots of steam and pollution coming out of the stack, but in the back end, you see this really big building. That didn't used to be there. That's where they're putting the miners, and that's where they're operating this crypto operation.

Leah Stokes (02:19):

What Anne soon realized is that this isn't just happening in Hardin. It's not just happening in Montana. It's happening all across the United States. Cryptocurrency is giving a lifeline to dirty fossil fuel operations from coast to coast.

(02:37):

This is A Matter of Degrees, stories for the climate curious. I'm Dr. Leah Stokes.

Katharine Wilkinson (02:42):

And I'm Dr. Katharine Wilkinson.

(02:49):

I think I can speak for many of our listeners when I say that the complexities of cryptocurrency are just a smidge outside my field of expertise.

Leah Stokes (02:58):

Totally. Cryptocurrency is confusing, and it's pretty new. Bitcoin, which was the first cryptocurrency, was developed in 2009. And then the second most popular coin, Ethereum, it only launched in 2015. So this is new, and there's a lot most people don't really understand about cryptocurrency.

Katharine Wilkinson (03:18):

You're telling me we're dealing with a 13 year-old here. This is tween age, these cryptos.

Leah Stokes (03:26):

Yes.

Katharine Wilkinson (03:27):

So I have very many questions, including, how did we get here, to this moment where a crypto mining corporation can just buy out a dying coal plant in Montana and jolt it back to life?

Leah Stokes (03:39):

Well, that's the exact same question I was asking myself. And to go about answering it, I called up someone named Alex de Vries. He's an economist and one of the foremost experts on crypto's impact on the climate. Alex created this thing called the Bitcoin Energy Consumption Index, which provides an estimate of Bitcoin's energy consumption. But the interesting thing is that, seven years ago, he knew almost nothing about this topic, until he stumbled across an article in 2015.

Alex de Vries (04:09):

The thing is, at some point, I just read an article myself in 2015, that the amount of energy being consumed on average per Bitcoin transaction was as much as a U.S. household consumes over a period of one and a half days. And when I read that, I was like, that sounds like a lot for something as simple as me sending you money. That shouldn't be the case. And then I started looking into that, because I was like, is this possible? Is this accurate? And when I started looking into it, I couldn't find any information. So it just struck me as something that already sounded gigantic at the time, at least to me. Also made it seem like, if this system is going to get any level of mainstream adoption, then that number is going to blow up really fast. But it wasn't something that anyone was paying attention to. So given that combination, I just decided to do something with that myself, and start providing people with this information. I was writing about blockchain and cryptocurrencies for some time longer than that, mainly some fraud analysis, so completely different from the energy topic.

Leah Stokes (05:24):

So basically you, in your spare time, became obsessed with the energy impact of cryptocurrency and trying to estimate that, and you just built a whole website around it.

Alex de Vries (05:36):

Yeah. You can say it's a bit of a hobby that just got way out of hand, because now I'm dealing with three jobs. So that went a bit beyond what I expected.

Katharine Wilkinson (05:51):

Okay. I love this story. You've got one person who sees a crazy fact about the climate impact of an industry, and gets so obsessed that he devotes his entire career to understanding it. This is my kind of tale, Leah Stokes.

Leah Stokes (06:07):

I know. It's an amazing story. And it just shows you the kinds of impact that anybody can make if they just get obsessive.

Katharine Wilkinson (06:17):

Yeah, just let the obsession snare you. Go wild. Okay. So it's pretty clear that cryptocurrency basically munches on energy all day long, just consumes massive amounts of it. So why is that?

Leah Stokes (06:30):

Well, we need to start with some cryptocurrency basics.

Katharine Wilkinson (06:34):

Okay. I like it.

Leah Stokes (06:35):

So basically, cryptocurrency is a form of money that's entirely digital. It's also unregulated and decentralized, which means unlike the dollar or the euro, there isn't a federal bank of Bitcoin.

Katharine Wilkinson (06:48):

Okay. So there's no centralized authority that is overseeing cryptocurrency.

Leah Stokes (06:54):

Exactly. And the other key part about cryptocurrency is that it's secured with cryptography. So you know how a $100 bill has all these little fibers in it that make it really hard to counterfeit?

Katharine Wilkinson (07:05):

Yep.

Leah Stokes (07:06):

You just can't photocopy it and make a bunch of other $100 bills because it wouldn't have those fibers.

Katharine Wilkinson (07:12):

Yeah, sadly. I feel like we all learned that lesson at some point in elementary school, much to our dismay

Leah Stokes (07:27):

Yeah, like when we were trying to make fake little milk carton tokens or something like that. Exactly. And they were like, "No, it's got to be the right color. You can't just be getting free milk cartons." Well, cryptography is kind of the digital version of that. It's authentication that prevents other people from creating counterfeit transactions. Cryptography proves that your digital coins and transactions are valid, which is important because, remember, this currency is not backed by a bank or regulated by a government.

Katharine Wilkinson (07:47):

Cryptography. That's the same word that we use to describe the whole code cracking, cipher creating, spycraft situation back in World War II, right?

Leah Stokes (07:56):

Yeah, same concept. You're encoding this in a code, basically, all this information, and we're just adapting it to a digital currency.

(08:05):

So the other big thing we need to understand is this word called blockchain.

Katharine Wilkinson (08:10):

Yes. This one seems like it's being thrown around all the time. Let's have a definition.

Leah Stokes (08:15):

So a blockchain is basically a list of transactions made with cryptocurrency. Leah sent Katharine two Bitcoin. Katharine sent Bob one Bitcoin. I'm making you very rich in this story, and you're not giving me money back. It's rude.

Katharine Wilkinson (08:28):

I'm not very generous to Bob, am I?

Leah Stokes (08:30):

No, I know. You're hoarding that Bitcoin. But anyway, these lists of transactions, they're grouped into chunks of data, and each chunk of data that includes all this information about who's sending this money, that's called a block.

Katharine Wilkinson (08:44):

Aha. And the blocks then form a chain?

Leah Stokes (08:47):

Yes. So each block can only store so much data, just like a box. You can only put so much information into a box if you had it all on paper. It's the same kind of idea. And so once that list is full of all the transactions it can hold, that block is locked, and then the next wave of transaction is stored in a new block.

Katharine Wilkinson (09:07):

Okay. So I am definitely not a computer whiz, but I am imagining that to hold all of that data in those locked boxes forever requires a bunch of machines whirring, and that takes energy.

Leah Stokes (09:22):

It does. Storing all that data takes significant energy, but there's an even bigger part of the energy consumption of cryptocurrency, and that's the creation of each block. That's where a lot of energy is wasted.

Katharine Wilkinson (09:36):

Okay. So I'm translating this to, you've got the energy that it takes to make a car, and then the energy that it takes to keep that car running over its lifetime.

Leah Stokes (09:45):

Exactly. And when we're creating these blocks, that is where a lot of energy is used. The Bitcoin system was actually designed by this anonymous creator who goes by the name Satoshi Nakamoto. And what he did was he created a massive competitive number guessing game, and it needs a lot of energy to work.

Alex de Vries (10:09):

They're just literally trying out numbers, more or less, like, is it one, is it two, is it three? Except they're doing this 200 quintillion times a second, every second of the day, nonstop. And only the first machine that gets it correct is allowed to create the next block for the blockchain, and then get a reward. And in the Bitcoin network, you have millions of devices all around the world that are together generating over 200 quintillion guesses every second of the day, nonstop, in this block creation process. And that's where the energy consumption resides

because in order to make and produce all those computations, you just need a whole lot of energy.

Leah Stokes (10:54):

Wow. So there's this little beast in the energy system.

Alex de Vries (10:59):

Yeah. That's it. We just created the world's most energy intensive random number generator. These mines might be consuming as much as all data centers in the world combined – 1% of total global electricity consumption.

Katharine Wilkinson (11:14):

Almost 1% of total global electricity usage is going to guessing numbers. This is mind boggling. I mean, just think about the more than half a billion people who have zero access to electricity, and here we are just wasting vast amounts of it. This is maddening, Leah.

Leah Stokes (11:34):

It's infuriating. And it's also having a massive impact when it comes to carbon pollution.

Alex de Vries (11:42):

Last year we estimated that the total footprint of the Bitcoin network was over 60 million metric tons of carbon dioxide per year. And the really mind blowing thing is that the total amount of carbon that we are saving globally by deploying electric vehicles, so compared to having a fleet that's running on internal combustion engines, is around 50 million metric tons of carbon dioxide. So the carbon emissions from the Bitcoin mining network are more than completely negating our net savings from electric vehicles globally.

Katharine Wilkinson (12:22):

This fact is astounding and so depressing.

Leah Stokes (12:26):

And remember, Katharine, that's just for Bitcoin. It may be the biggest of the cryptocurrencies, but there are thousands of other currencies out there.

Katharine Wilkinson (12:35):

Wow. I feel a bit like a deflated balloon hearing all of this.

Leah Stokes (12:39):

And what's even more disturbing is that the creator of this whole thing, that anonymous guy, Satoshi Nakamoto, he knew what he was doing.

Katharine Wilkinson (12:47):

Of course he did. They always do.

Leah Stokes (12:50):

Yeah. He knew what the energy and climate impact would be, but he did it anyway.

Alex de Vries (12:56):

We don't know this from Satoshi Nakamoto himself, but then again, there was this famous cryptographer named Hal Finney, who fortunately passed away, but he was probably one of the first users of the Bitcoin network. And just two weeks after it launched, he tweeted that he was already thinking about what would happen in terms of carbon emissions if this type of system was adopted at a grand scale. So I think that the realization that they made something that could potentially be very harmful environmentally was already there at the very beginning.

Leah Stokes (13:40):

It's kind of like Frankenstein, that story. They created a monster. And they knew what they were doing.

Katharine Wilkinson (13:50):

Cryptocurrency clearly wastes a lot of energy, and a lot of that energy is dirty energy. But why is this happening in the United States?

Leah Stokes (13:58):

Well, that's a great question, and to understand that we need to go back to Anne Hedges, who we heard at the top of the show. Anne has been working for three decades to make progress on environmental issues, and for a time, change was happening. Montana seemed to be moving in the right direction on coal. But when China outlawed cryptocurrency mining in early 2021, things changed.

Anne Hedges (14:20):

There's a lot of reasons that China has outlawed this type of operation, and that's one of the reasons we've seen such a big influx in the United States, because these guys can't operate in China anymore. So they had to find another area that had cheap electricity and was willing to accommodate their needs. It's discouraging. It is incredibly discouraging to be somebody working in the climate space, trying to move particularly our state level operations off of fossil fuels. There is plenty of work to be done in stopping expansions of coal mines and coal plants. But to see the crypto operations coming in to revitalize coal plants, it's a gut punch. It really is.

(15:07):

A lot of countries have said no. But the United States, it feels like the Wild West, which is a terrible term to use, because the Wild West was never wild. There were Native American populations here first. And I feel that's kind of what these guys are. These guys are the people coming in and saying, "There's nobody here. Let's just take all their climate goals and throw them out the window and make a whole lot of money." And the rest of us are screwed.

Katharine Wilkinson (15:34):

Wow. So China just says, no way. This isn't happening within our national borders. So now you've got all these folks coming to the U.S.

Leah Stokes (15:43):

Yeah. And crypto mines started setting up shop at coal plants like the one in Montana. When Anne started looking into the details of the Hardin plant buyout, she couldn't believe the impacts on pollution.

Anne Hedges (15:55):

What's really concerning is the increase in things like air pollution. So you have, for nitrogen oxide emissions, you saw an increase in that period of time of 842%. For sulfur dioxide, you saw an increase in emissions of 508% over the course of the year. For carbon dioxide, you saw an increase of emissions 850%. So this plant went from barely operating to putting an awful lot of really harmful pollutants into our air, pollutants that are hard for people who have any kind of respiratory distress or cardiovascular problems. We are a state that is really dry. We are a state that is in the midst of a really big drought, just like a huge part of the western United States. And you put more carbon dioxide and methane into the air, and you're going to see increases in temperatures and increased drought and increased wildfires. And we've seen all of that in recent years. We simply don't need and can't afford to have anything make this climate crisis worse.

Leah Stokes (17:06):

And it's not just the coal plant. Anne is also seeing gas operations in Montana turn towards crypto.

Anne Hedges (17:13):

We also have about a dozen flared gas wells where crypto operations have set up, and we only know about it because they had to go get air permits from the state, and we were able to access those air permits. They're using flared gas to run miners to generate cryptocurrency. And maybe your gut will say, isn't that good? We're using that flared gas for something. But we have been arguing for the last decade that those companies should be capturing that flared gas, and they should be using it for our needs, for the needs of the communities in the state and the area, for heating homes. That is a useful product that they're flaring. And these crypto miners now are creating an incentive to flare methane gas.

So do we really as a society need to create an incentive for increased flaring, when we know that we have to leave an enormous amount, 60% of oil and methane gas underground, if we want to reach our Paris goals? We're not going to get there with this kind of thinking and with this kind of behavior.

Katharine Wilkinson (18:28):

Leah, the thing that I want to say is something that we are not allowed to say on this podcast, because it's a clean podcast, but this is really effed.

Leah Stokes (18:35):

It's unbelievable. And we know Bitcoin has an impact on the environment, because when crypto experienced a major crash in the spring of 2022, Bitcoin's value dropped by like 70%. And guess what happened, Katharine?

Katharine Wilkinson (18:50):

I don't know, Leah. Did its environmental impact also plummet?

Leah Stokes (18:54):

Yes, Katharine. That's correct. Bitcoin's energy usage dropped by 70 terawatt hours a year. What on earth does that mean? Well, that's equivalent to the energy usage of the entire country of Austria.

Katharine Wilkinson (19:09):

That's not just a lot of energy. That is a lot of energy wasted on something that we don't need.

Leah Stokes (19:17):

You're right, it is such a waste. And Montana is not the only place that's dealing with this epidemic of zombie coal plants. Kentucky has been giving tax breaks to lure crypto miners in, to revive obsolete fossil fuel power plants, just for mining. Anne is seeing this everywhere.

Anne Hedges (19:37):

New York, Nebraska, North Dakota – they're all seeing the same thing. Everybody is looking at these zombie coal plants and wells, oil and gas wells, and seeing these crypto operations pop up. But it's very difficult to track them. Unless they're a publicly traded company, unless they have to get something like an air permit, you don't know. So we know that there's far more occurring out there than those that we've already identified. They are looking for coal plants in the United States, and anyone who thinks that this crypto stuff is a fun game needs to take a hard look at its impacts. We are not going to meet our Paris goals. We are not going to limit carbon dioxide emissions. We are not going to be able to mitigate drought and flood and fire if we can't get a handle on our energy system. And cryptocurrency is taking us in exactly the wrong direction at exactly the wrong time. We don't have time for this.

Katharine Wilkinson (20:40):

We have so many legitimately hard problems to address. Why? Why are we adding another one to the list?

Leah Stokes (20:48):

And the most insidious thing about crypto is they actually claim they're an energy solution.

Katharine Wilkinson (20:53):

Wait, what?

Leah Stokes (20:54):

Yeah. The industry spreads misinformation claiming that they're actually going to help with this whole climate and energy problem.

Anne Hedges (21:01):

I think there's a real lack of information, but I also think there's a lot of misinformation. So I listen to the crypto industry argue in favor of it being the solution to our energy crisis, the solution to advancing the grid. But when you throw out ideas like that, which sound great, you've got to back them up with something. It can't just be, cryptocurrency can help balance the grid. Cryptocurrency can really help solve our energy problems. That's really disingenuous. It's misleading, it's wrong, and it's something that people probably want to believe. But my main concern has to do with energy. We simply cannot continue down this path and think that we're going to solve a climate crisis if we allow cryptocurrency to run rampant.

Leah Stokes (21:55):

This reminds me of the fossil gas industry. They tend to promote themselves as the cleaner solution, the bridge fuel. The crypto industry is doing a similar thing. They're just making stuff up.

Katharine Wilkinson (22:06):

While the greenwashing party is a very popular party to go to, and frankly even if these guys are running on renewable energy and the best, most 21st century grids, they're wasting all of that infrastructure and all of that clean energy that we should be using for things that we actually need.

Leah Stokes (22:24):

Right. The cloud isn't some ethereal nebulous thing floating around. It needs energy, it creates pollution. And in the case of something like Bitcoin, it uses a lot of energy. So this company that set up shop in Montana, it's actually announced that it's moving its operations to a wind farm in Texas, so that they can be carbon neutral by 2023.

Katharine Wilkinson (22:50):

Carbon neutral shmarbon neutral, Leah. I cannot think of a worse thing to do to the already burdened Texas energy system than adding crypto mining to the mix. We know that it is already facing really big challenges just to keep lights on and air conditioning and heating running in peak months of the year.

Leah Stokes (23:12):

And we focused a lot on the waste and the energy and the pollution side of things, but crypto has also had big negative impacts when it comes to people's financial stability.

Katharine Wilkinson (23:23):

Right. This isn't just a planet problem, it's very much a people problem. There's a predatory aspect to this whole industry.

Leah Stokes (23:31):

And when I happened to talk to Anne earlier this year, it was during a week when the whole crypto market crashed, and she started to talk about how protecting everyday Americans was yet another reason we need to regulate cryptocurrency.

Anne Hedges (23:45):

So we need the federal government to come in and put some sideboards on this. A lot of other countries have already done that. There's environmental reasons to do it. There are reasons to do it as far as national security. There's reasons to do it as far as just making sure that people aren't getting ripped off, that people aren't losing their shirts and not having any recourse. What we've been seeing in the crypto sector this last week, where they've lost hundreds of millions of dollars worth of value in one week, there are people who... I listened this morning to this one crypto podcast, and they were talking about people committing suicide.

(24:23):

We need regulation on a sector that has so much attention, so many people invested, and a lot of these people are people who don't have a lot of resources to begin with. They're doing this because they see a get rich quick scheme. And I understand that. We all want to get rich quick, that'd be really lovely. But we've got to temper that enthusiasm. We have to make sure it's done in a way that you're protecting people, you're protecting their pensions, you're protecting our financial sector, which is tied to the crypto sector. We need to make sure that we're not giving away the store before it's too late.

Leah Stokes (25:02):

Crypto markets are extremely volatile. Even before the giant crash of 2022, the value of Bitcoin dropped 30%, from around $42,000 per coin to $30,000 per coin, in the span of a single day

back in 2021. In this summer so-called crypto winter, Bitcoin fell $900 billion below its all-time high.

Katharine Wilkinson (25:26):

Imagine waking up one day and finding a third of your bank account gone. Vanished. So, regulation clearly wouldn't just benefit the climate. It would benefit everyone that is currently invested in crypto, and maybe even protect them from losing their shirts.

Leah Stokes (25:43):

Yeah. And this is a justice issue as well, because cryptocurrency has been marketed to Black Americans. So when the crash happened, it hit their savings much worse than white Americans. So when it comes to justice and equity and dealing with income inequality, cryptocurrency has a bad track record.

Katharine Wilkinson (26:08):

So cryptocurrency is bad in a lot of dimensions. What are the solutions? What can we do about it?

Leah Stokes (26:15):

So for that, I called up Dr. Anna Kelles. She's a New York State Assembly member representing upstate New York, including Ithaca, home to Cornell University. In her district, there was this coal plant in Dresden, New York. It had been operating since 1937 for almost three quarters of a century, until it closed in 2011.

Anna Kelles (26:35):

So, the Greenidge Power Plant, this is a power plant that is decades old. It was a coal-fired fossil fuel-based power plant. The older power plants had a harder time keeping up and being able to be competitive on the open market selling power to the grid. And so what we saw as we pushed with regulations and incentives, over the last couple decades, we've seen power plants shutting down because they simply couldn't keep up. Now, these are the oldest, most inefficient power plants in the state. It went bankrupt, it could not compete, and it closed down completely. Therefore zero greenhouse gas emissions, and zero impact on water quality.

Katharine Wilkinson (27:20):

A decade ago, the Greenidge coal plant in Dresden was dead and gone. Somehow, I don't imagine that's the end of this story.

Leah Stokes (27:28):

Sadly, it's not. That's when Dr. Kelles first heard that a company wanted to redevelop the plant and convert it to gas. They said that they wanted to make a data center, maybe sell some of

the energy to the grid, but Dr. Kelles wanted to make sure that this power plant wouldn't be used for cryptocurrency, because she was concerned about how much pollution that would create.

Anna Kelles (27:53):

When I was a county legislator, I was the chair of the Housing and Economic Development Committee. And the power plant on Cayuga Lake had been decommissioned, and there was a company that was interested in building a data center on the property. And it was at that point where a bunch of environmentalists brought their concerns to me about cryptocurrency mining. They said it is just fundamentally different than other technologies in data centers. So when I spoke to the owners at the time, I said, "I think this is a great alternative for this facility, rather than a coal-fired power plant, but I want to get some reassurances that you're not interested in cryptocurrency mining," because of just the sheer magnitude of energy consumption compared to other forms of technologies that are typically in data centers, like cloud storage. So, people don't really understand, if you take all the global energy consumed by Facebook, Amazon, and Google combined globally, it collectively uses less energy than Bitcoin mining.

Leah Stokes (28:59):

But it turned out that they were interested in cryptocurrency, and they actually used public money to convert this old coal plant to a gas plant and start up crypto mining. Now, this plant is as polluting as it's ever been.

Anna Kelles (29:14):

They made a deal with the previous administration, Governor Cuomo, to get an Empire State Economic Development grant to extend a natural gas pipeline to the facility and convert the facility to natural gas. And the intention, of course, at the time was to sell energy to the grid. But when it opened in 2019, it was already using some of the energy that they produced in-house for their own private gain for cryptocurrency mining profits. But where in 2012, even when it was in operation, it was only in operation a couple weeks at the most per year, now it's in operation 24/7, 365 days out of the year. It has a permit to pull in up to 130 million gallons of water a day, at about 40 to 60 degrees temperature, dumping it back into a class C trout stream at up to 108 degrees temperature in the summer. Trout show signs of stress and start to die out at about 70 degrees. So at 108 degrees, they're cooking. They're dying off.

Katharine Wilkinson (30:26):

So, what are New Yorkers like Assemblymember Kelles doing to address this?

Leah Stokes (30:31):

Well, once Dr. Kelles learned about the effect of cryptocurrency and understood what impact it was having in her community, she didn't sit around. She used her political position to take action.

Anna Kelles (30:44):

Here's this industry that has the potential to have tremendous negative impacts on our environment and our ability to reach our climate goals, and it's a new technology that people don't understand, that could move in really quickly, very quietly, and then it's done. That was the inspiration for the bill that I wrote, which creates a two year moratorium on the use of power plants, specifically fossil fuel-based power plants, for the use of cryptocurrency mining. And then during those two years we would require our Department of Environmental Conservation to do a full generic environmental impact statement, a GEIS. It's an official process, to evaluate the impact of the industry on our ability to reach our climate goals. It is not a finance bill, it's not a regulatory bill. It is only focused on the environmental impact. And therefore, that's why it focuses only on cryptocurrency mining, and it focuses explicitly on mining in power plants.

(31:45):

We have in New York State about 30 retired power plants that are all the oldest and the most inefficient power plants in the state. And the reason they're retired is because they couldn't compete on the market any more, because they're so inefficient, which means that they're the greatest greenhouse gas polluters. We don't want them turned back on. That will literally send us in the wrong direction as a state and as a planet.

Leah Stokes (32:08):

Her moratorium bill, which was first introduced in May 2021, passed the Assembly and the Senate in 2022.

Katharine Wilkinson (32:16):

Well, that seems like great news. Is it going to become law?

Leah Stokes (32:19):

Well, there's been no movement since. Folks are waiting for it to be sent to the Democratic governor, Kathy Hochul, and she's facing a lot of pressure on both sides, whether she will sign it or veto it, we don't know yet. Even if her bill does become law, Dr. Kelles has many other concerns about crypto.

Anna Kelles (32:37):

It is absolutely true that access to the dollar and access to traditional wealth in the United States has not been equitable. That there is systemic racism in access to wealth: 100% true. Using that truism and then building on it and saying that this is therefore a solution, that's where I find it to be very manipulative. Because in truth, Bitcoin is one of the most

consolidated currencies in the world. About 0.01% of all wallets own about 27% of the entire currency.

(33:14):

It is true that anyone can access cryptocurrencies without having a bank account. Again, a truism. To say that that then translates to equity in access to wealth of cryptocurrencies is manipulative, because on the ground, in reality, that is not turning out to be the case. And a perfect example of that is a recent study that just came out that showed, in this major crash of cryptocurrencies, the wealthy people who owned the major share of cryptocurrencies – because of how they work and how they're balanced and how they're protected – have come out relatively unscathed. And all the people who had all the day jobs, in the companies and the corporations, they've all lost their jobs. The people who are investing but were everyday people, they lost their shirts. Huge negative impacts.

Katharine Wilkinson (34:11):

So just like we were talking about earlier, Leah, this is not just a planet problem, it's also a people problem. It sounds like Dr. Kelles has her eye on this many layered issue.

Leah Stokes (34:22):

Her eyes are wide open. She's asking her state to take a deep breath and investigate this industry before we just allow it to take root.

Katharine Wilkinson (34:30):

This sounds like a really wise approach to me.

Leah Stokes (34:33):

Dr. Kelles's bill is quite balanced in its approach, and she's worried about the kinds of cryptocurrency that have the biggest environmental impact, the ones that use what's called proof-of-work.

Anna Kelles (34:45):

The thing that is important that people understand is, one, it's not retroactive. Two, it does not impact any cryptocurrency mining operation that is based off of renewable energy, and it does not impact any cryptocurrency mining operation that's plugged directly into the grid. The other thing that it's really important that people understand is that this only relates to cryptocurrency mining. And cryptocurrency mining is synonymous with proof-of-work validation. So there are about 16 different methods that have been designed, engineered, to validate transactions in the sphere of cryptocurrencies, these digital currencies. Only one of them uses a tremendous amount of energy.

Katharine Wilkinson (35:29):

Okay, I just want to make sure I'm getting all of this, Leah. What does proof-of-work actually mean?

Leah Stokes (35:35):
Well, remember when we talked about that giant number guessing game that uses all that energy to guess massive numbers, all the time, 24/7? That's proof-of-work. That's proving that you're using all the energy and you're doing the work to guess the number.

Katharine Wilkinson (35:52):
So if proof-of-work is the problem, what would we do instead? Is there an alternative way to do crypto?

Leah Stokes (35:59):
Essentially what people are proposing is moving to another system that uses way less energy. It's called proof-of-stake. I talked to Alex, the expert on cryptocurrency, and I asked him to break this down for us.

(36:13):
So let's talk about proof-of-work and proof-of-stake. Can you explain these two concepts simply?

Alex de Vries (36:22):
Simply? It's never really simple, but the thing is that in these systems, you need a way to select a certain random participant that gets to create the next block for the blockchain. And in Bitcoin's proof-of-work based system, that participant is selected by a competition, wherein everyone tries to guess a certain winning number. And then the winner, the first one that guesses the number, is the randomly selected participant that makes the next block for the blockchain, and then the cycle repeats.

(36:58):
In proof-of-stake, they take out the computationally intensive part of the process. They do leave it as a lottery, but in order to participate in the lottery, you don't need very powerful computer equipment. In fact, the only thing you need is to acquire some coins of the respective system. And then you put those coins, what they call at stake, you lock those coins up as collateral in the staking process, and then the algorithm will just randomly select one of the participants who is participating in the staking process, to make the next block for the blockchain. So it's still a lottery, but the whole way it's designed is completely different. And that difference leads to a massive difference in the power requirement for this type of system, because something that is built on the proof-of-work will take up to 10,000 times more energy to run than something that is built on proof-of-stake.

Katharine Wilkinson (38:09):

Okay. So the way I'm going to simplify this for my brain is, proof-of-work is reams and reams of pages of long division, and proof-of-stake is more like a single roll of the dice. How's that for a metaphor, Leah?

Leah Stokes (38:23):

I think that's a really intuitive way to get it. The second biggest cryptocurrency, Ethereum, recently made the switch to proof-of-stake in September of this year, and now it's going to use like 99% less energy than it was using before.

Katharine Wilkinson (38:37):

Wow. That seems amazing, actually.

Leah Stokes (38:40):

It's a lot better. But, as Alex pointed out, we shouldn't just compare the energy usage to something like Bitcoin, which is still using proof-of-work, because that gobbles up an insane amount of energy. What we should probably be doing is comparing proof-of-stake, this new crypto method, to traditional financial systems. How much energy are they using per transaction?

Alex de Vries (39:07):

If Bitcoin were to switch to proof-of-stake, it could save a factor 10,000 on its energy requirement. So instead of 2,200 kilowatt hours per transaction, you would be talking about 0.22 kilowatt hours, which is, by the way, still a lot. We're talking then about still a sizable difference compared to a payment provider like Visa. And maybe I can best illustrate that with the help of the carbon footprint. The carbon footprint of a Bitcoin transaction, that's more carbon dioxide than the per passenger footprint of a flight from London to New York and back. But a Visa transaction has a carbon footprint of just 0.4 grams. So we're talking a factor 3 million difference between the carbon footprint of a Visa transaction compared to a Bitcoin transaction.

Leah Stokes (40:10):

So the Visa transaction is like the carbon footprint of taking one step onto a flight, or something like that.

Alex de Vries (40:17):

I wouldn't even know how to express it, but it's very low compared to a Bitcoin transaction. Like I said, there's a factor 3 million difference. And then you realize that a factor 10,000 isn't enough to make up for this difference. It would make the system perform a whole lot better, but the obvious problem is, it's still going to be relatively inefficient to having a payment provider like Visa process your transaction. And that's because of something that a lot of people don't talk about in this context. When we talk about the energy consumption of Bitcoin,

we're always talking about the mining and the energy that's being consumed for that, but a lot of people forget that blockchain technology by design is also about replicating data and processes over many different nodes in a network, and the more the better. And because of that, these systems, even when you take out the proof-of-work and you replace it with something like proof-of-stake, they continue to be relatively inefficient. But in any case, it would matter a lot if we could at least get them to move to proof-of-stake to begin with.

Leah Stokes (41:31):

So, the first step is moving to proof-of-stake, but even that is not really enough to really reduce the environmental footprint of cryptocurrency.

Katharine Wilkinson (41:40):

So, I think by brief love affair with proof-of-stake is over. It is not such a silver bullet after all.

Leah Stokes (41:48):

No. That's why we actually need a lot more regulation, including from the federal government.

Katharine Wilkinson (41:54):

We return to one of our favorite themes. So are we talking all new law here, Leah? Or are there already policies in place that could help regulate this newfangled industry?

Leah Stokes (42:05):

Well, it's a combination. The Environmental Protection Agency can use some bedrock laws, things like the Noise Control Act of 1972 and the Quiet Communities Act of 1978. And they can also check that proof-of-work plants, these crypto plants, are in compliance with the Clean Water Act and the Clean Air Act. But we also need Congress to step up and start regulating the crypto industry. We need reform legislation that keeps climate front of mind when we're talking about cryptocurrencies.

Katharine Wilkinson (42:38):

And what about the White House? Is the Biden administration getting engaged in any of this?

Leah Stokes (42:43):

There's one hopeful sign. The Biden administration recently put out a report from the White House Office of Science and Technology Policy, what folks in the know called OSTP. And they said that crypto miners should, and I quote, "reduce greenhouse gas emissions, avoid operations that will increase the cost of electricity to consumers, avoid operations that reduce the reliability of electric grids, and avoid negative impacts to equity communities and the local environment." I mean, it sounds to me like crypto needs to stop doing a lot of bad stuff.

Katharine Wilkinson (43:17):

And it sounds like they're going to need some help. The White House, the EPA, the Department of Energy, sounds like we're going to need all of it working on this.

Leah Stokes (43:25):

And in the meantime, as we wait and put pressure on the government to step up and regulate cryptocurrency, we also need everyday people to stop feeding this Frankenstein monster. And they can do that by divesting from cryptocurrencies. Here's what Alex said.

Alex de Vries (43:41):

If you're an investor, don't invest your money into these energy intensive crypto assets. If money stops coming in, the price will go down, and the miners will not be able to pay for the electricity bills. Really simply said, if the Bitcoin price is zero, then whatever they're going to be mining is going to be worth zero.

Katharine Wilkinson (44:01):

There's always something that we can do, and I think friends don't let friends invest in crypto is a pretty good mantra to take away from this episode.

Leah Stokes (44:09):

I couldn't agree more. And it's particularly important that people divest from dirty currencies like Bitcoin, that are still using energy intensive and polluting proof-of-work. The planet will thank you, and frankly, so will your finances.

(44:28):

A Matter of Degrees is co-hosted by me, Dr. Leah Stokes.

Katharine Wilkinson (44:31):

And me, Dr. Katharine Wilkinson.

Leah Stokes (44:34):

We are a production made in partnership with FRQNCY Media, the 2035 Initiative at UC Santa Barbara, and the All We Can Save Project.

Katharine Wilkinson (44:42):

Thanks to our funders and supporters who make the show possible. Energy Foundation, NorthLight Foundation, McKnight Foundation, Bloomberg Philanthropies, and the 11th Hour Project.

Leah Stokes (44:52):

If you're digging the show, please hop on Apple Podcasts or Spotify and give us a five star rating, or leave us a review.

Katharine Wilkinson (45:00):

Jordan Rizzieri is our producer. Catherine Devine and Emily Krumberger are our associate producers. Enna Garkusha is our supervising producer, and Michelle Khouri is our executive producer.

Leah Stokes (45:12):

William Cagle and Ellie Katz wrote the script, and Isabel Moncloa Daly and Becca Godwin were script editors. Matthew Ernest Filler is our lead audio engineer, mixer, and sound designer, with dialogue editing and additional mixing by Claire Bidigare-Curtis.

Katharine Wilkinson (45:28):

Rose Wong designed our new show art, and Sean Marquand composed our theme song. Additional music came from Blue Dot Sessions.

Leah Stokes (45:36):

Research, fact checking, communication and production support by Daniela Schulman, Amarachi Metu and Madeleine Jubilee Saito.

Katharine Wilkinson (45:44):

Come back soon as we tell more stories for the climate curious.

Leah Stokes (45:51):

Great. Well, I know you probably have to go. Any final thoughts that we didn't cover?

Anna Kelles (45:56):

No, we can always do this again. I know, I'm a teacher, I don't do sound bites very well. My deepest apologies.

Leah Stokes (46:03):

Girl, don't worry. We're going to chop you up. It's going to be perfect. In a good way, not in a murder-y kind of way.