If Pete ruled the world, what investments would we be making? And then how do you convince people to make them?

This is A New Angle. And I'm your host, Justin Angle. This show is supported by First Security Bank, Blackfoot Communications, and the University of Montana College of Business.

Hey, folks, welcome back to another edition of our incentives and instincts series. I'm joined again today by Bryce Ward. Bryce, how are you doing today?

I'm good. I listened to your new venture fireline. And I want to make sure all of our listeners go and listen to it. It's very well done. So congratulations.
Oh, thanks. Appreciate that. It’s been a really fun project. And speaking of fun, the sun is shining, it’s starting to feel a little bit like spring. So it’s easy to forget that a couple short weeks ago, much of the country was in a deep freeze. And Texas in particular, was in crisis as winter storm had rocked its power grid, leaving residents freezing without power. And lots of us wondering how in a country like ours, could infrastructure fail so spectacularly? Is Texas unique? Could something like this happen in Montana? What’s the state of affairs with our energy grid? So again, to think about this stuff, Bryce and I phoned a friend, Peter Larsen is a staff scientist and deputy leader in the electricity markets and policy department at the Lawrence Berkeley National Laboratory. Peter conducts research and analysis on the economics of electricity, reliability, and resilience. He’s also an expert on the risk to infrastructure from extreme events. He holds a PhD in management, science and engineering from Stanford, master’s degrees from Stanford and Cornell. And he studied economics as an undergraduate right here at the University of Montana. Pete, thanks for joining us today.

Hey, thanks for having me. Great to be here.

So I guess what, you know, as a starting place, like when we see something like what happened in Texas, you know, hear all about how their grid is, is isolated from the rest of the country. But like is what happened in Texas surprising is that is that a surprising event from your vantage point?

In some ways it is. But in other ways it isn’t. And I’ll explain that. It’s surprising to me, because a lot of our work at Lawrence Berkeley National Laboratory looks at reliability and resilience to the power system. And typically, it’s something like 95% of power outages occur at the distribution level, these are the power lines, like you might see in your neighborhood. And in Texas, it was surprising because the power outage is actually caused way upstream from natural gas suppliers. And then both thermal and renewable resources that were were offline due to the due to the weather events. So that’s surprising to me. It’s not surprising that it happened because we know that they’re under investments being made. Well, there are investments that aren’t being made in trying to make the systems more resilient to these these, these widespread long duration
interruptions. And so there’s some surprising elements and some unsurprising elements with what happened in Texas.

**Justin Angle 03:34**
So can we generalize that statement about, you know, underinvestment or lack of investment in infrastructure to the rest of the country, like what’s the state of affairs at a national level, and then maybe bring the lens to Montana, in particular, how are things looking in Montana.

**Pete Larsen 03:50**
So starting off at the national level, utilities have a really good, and, you know, a long standing understanding of how to make the power system as reliable as possible. There’s no such thing as having a perfectly reliable system because that system would cost ungodly amounts of money. And so utilities make investments all the time. They go in front of regulators and seek cost recovery and investments to deal with reliability issues. And we think of these as like blue sky reliable, yeah, there’s a storm, how fast can you get the system back? Where it becomes a challenge is when you try to address the issues that come with, with big natural disasters, like hurricanes, and wildfires. And those types of investments, we can we call those investments in resilience, and those tend to be much more costly, no undergrounding big sections of the power system, moving substations from you know, flooding and inundation. These are big ticket costs, and so utilities have a hard time justifying those investments in front of regulators. That’s what’s going on nationally, in Montana, Montana has had, you know, the great fortune of, frankly, having a pretty reliable power system and relatively inexpensive electricity rates. But we’re, you know, I did a little bit of research before this call. And, you know, there are some, some changes in in reliability across Montana. And so that suggests that potential additional investments need to be made to ensure that the system is reliable and resilient. But also starting to understand what happens if you don’t make those investments. And so that’s kind of the state of play in Montana at a very high level.

**Bryce Ward 05:48**
So yeah, Peter’s correct that this is the basic challenge that we face, whenever we’re dealing with something that’s an extreme event, that’s really bad when it happens. It’s like, oh, man, how does something like Texas happen? Is that yeah, it’s really costly to do all the work that you need to do to make sure that you avoid that. Because while we understand that these types of risks exist, and I think in the Texas case, I think the I was that, you know, wasn’t actually that low of a probability risk. But some of the other risks
that we face that are the big extreme events that we really do want electricity to operate during, you know, they’re, they’re more low probability events. And, you know, as humans, we’re bad, right? There’s a small group of humans that are, you know, the preppers that are very, like risk averse and aware of these risks and want to do everything that you can to avoid them. But for the most part, then there’s another group people that are just kind of risk averse, and maybe don’t know there’s the risk exists. And then there’s lots of other people who are kind of like, add, it’s not gonna happen, I don’t need to worry about it. And a lot of times, they turn out to be right. So before I moved to Montana, I was on this thing called the Oregon Seismic Safety Policy Advisory Commission. And while I was on the commission, we wrote the thing called the Oregon Resilience Plan, which is basically like, you know, yesterday, when we recorded this anyway, was the 10 year anniversary of the Tohoku earthquake and tsunami. And you know, our job in Oregon was basically to convince Oregonians that that exact event is going to happen in Oregon, at some point, we just don’t know when. And unlike Japan, where they know that that kind of event is likely and that prepared for it. Oregon, at least at the time, 10 years ago, was very unprepared for it. And that’s basically the same kind of issue that we face, kind of across our infrastructure is because I know these low probability events are out there. But there’s kind of this while is it worth it to invest and, and try and make it so that, you know, when the event happens, you know, we’re prepared. And so kind of getting that cost benefit analysis, right is really hard. Pete, correct me if I’m wrong. That’s kind of what your job is, is trying to help us do a better job of doing that cost benefit analysis?

Pete Larsen 08:12
That’s exactly right. And a lot of the earlier part of my career, you know, I focused on costs of infrastructure. let us study on, you know, the costs of climate change on Alaska’s infrastructure. That was one of my really early, big pieces on this subject. But lately, all my work in this power system resilience, economic space, is really trying to get at quantifying the benefits of making investments. And it turns out that relative to everything else, as main costs are easy. The benefits of making an investment are much more challenging to understand until that’s a lot of our work is trying to put an economic impact on past and future power outages. And then if you make the investment showing that that’s an avoided economic impact or a benefit, that’s where a lot of my work is these days on the benefit side of the equation.

Bryce Ward 09:11
So how large are the benefits?
Pete Larsen 09:14
Well, depends. Some of the benefits can be insanely large, billions and billions of dollars. If you were able to avoid let's say that Texas and so go through a little thought exercise if Texas had fully winterized their power system to be able to withstand cold temperatures, meaning spending investments in making investments in natural gas suppliers and distribution, winterizing the thermal power plants, the natural gas facilities, so their mouths didn't freeze up, dealing with some of the renewable issues and there were some but those were overhyped, and in some corners of the media, you make those investments that's expensive. But if you avoid a power outage that impacts 5 million people for a week. You know, you're talking 10s of billions of dollars. And, you know, we develop tools. We have sort of tools in our toolkit to try to get at some of those benefits. What's fun about talking about this is this is the frontier, at least in energy economics, is how do you estimate the economic impact of power outages, and there are also other benefits that economists sometimes put values on, like avoiding lost life, you know, the value of avoiding pollution. And so there are all these other benefits swirling around out there. But we're really zeroed in on the economics of what happens when the when the lights go out.

Bryce Ward 10:39
So how many events like Texas Do you guys even have to study? It was so it's kind of I think it was so shocking to most of us, because the notion that like a large state could be without power during the cold part of the year for a prolonged period was it was kind of unimaginable, I guess.

Pete Larsen 10:58
Well, yeah, it's funny, you mentioned I don't wanna go off on a little side. tangent here. I one thing I've been reflecting on since, you know, a couple weeks ago, when this happened in Texas was, it was right at the same time, that, you know, we sent a spacecraft 100 million miles, you know, to Mars, we dropped the rover and watching that video was just, you know, mind bending, dropped the rover, literally on a dime. And at the same time, you have one of the most prosperous states in the country in arguably the most prosperous country in the world, to 5 million people without power, boiling drinking water. That to me was when I reflect that was the most stunning irony of the timing of what happened in Texas.

Bryce Ward 11:53
Well, here, let me just add to that, we're also simultaneously ramping up the the distribution of a vaccine that we developed in a year to an entirely novel disease. Like it's
Yeah. Now, they're all these ironies. And it's, it was obviously a big tragedy. For the people that went through that in Texas. You'd ask the question a bit ago about how many? How many examples Do we have to study a big power outages? By the way, this wasn't the biggest power outage in history, but it was certainly very big. And we we just published a study, I guess, about, literally the, during the middle of the power outage in Texas, we published a pair of studies, right at the same time, talking about the economics of big, wide widespread power outages. And one of those studies was a case study analysis of six different locations across the country that have faced natural disasters. And what happened with the power outage and how utilities started to assess that damage. And so we do have some historic precedent to study past power outages. But we don't have enough. And we don't have enough of insights from how customers behaved before, during and after the outage to really calibrate what we call regional economic models to study the full economic impact of those types of outages.

So it might be useful at this point P to talk a little bit about what a public utility is, I mean, as you're sort of laying this out there your work and kind of forecasting the benefits or the avoided costs of a catastrophic failure or natural disaster. I mean, human beings are not so good at sort of just cognitively grasping those probabilities and making sound decisions based on them. You know, if you were to put it to voters, right, after a natural disaster, you probably get a lot of support for investments. Few months later, they forget about it. And they're not going to want to pay for what feels like a low probability event. Is that where a public utility fits in it can kind of bridge this public private. If we let only market forces dictate investments, you're not going to have facilities and a lot of place like how does how does that come into play?

Yeah, so maybe I'll start by just describing us at a very high level the difference between a public and a private utility? Yeah. So private utilities, we typically, at least in my own work would refer to them as IOUs or investor owned utilities. And Northwestern is an example. Northwestern provides the most most of power for Montana, but not all. They typically report to shareholders. And many parts of the country they have regulated electricity rates where they have to go in front of regulators and justify their costs and then the regulator gives them a greater return on their investment. It's a, usually a fixed percentage
above their costs.

Justin Angle  15:03
And that's kind of in exchange for their monopoly power in a region. Is that kind of the trade off there?

Pete Larsen  15:09
That's right.

Justin Angle  15:10
Okay.

Pete Larsen  15:12
So that's a private utility. And there's, you know, a lot of variety and how different, you know, regulatory agencies deal with their utilities and the rates of return that they allow the utility to earn. In a public utility, there are a couple of different kinds, there are cooperatives, Coop, that's, you know, basically a group of citizens to collectively own utility. There are municipally run utilities, these are, you know, local or city government, that may run a utility. And then there are the federal power programs, this is sometimes referred to as power marketing administration. This is a Department of Energy control entity that basically deliver power to, in most cases, the Muni and the Coop, local utilities and the big power administrations are, you know, primarily hydroelectric resources across the west and the central part of the country, and they sell power at a pretty reasonable rate to the communities and the Coops and the Coops deliver that power to their customers. So that's the sort of general gist of public power versus private utilities. We haven't studied a lot on the topic of whether public versus privately run utilities have better reliability, we do have an ongoing partnership with the American Public Power Association, to look at reliability and the benefits of making investments in reliability. But we have never really studied, you know, to publicly run utilities performed better. One thing I can say about public utilities and private utilities is, it's not clear to me whether a public utility would be able to get or have access to the capital needed to make some of these bigger investments to avoid the big natural disaster type interruptions.

Bryce Ward  17:28
How big are those investments?
Pete Larsen 17:31
While these investments, you know, if you're talking about moving a substation, because of flooding, you know, a big big substation, these are 50 million, you know, 50 million plus type endeavors and taking down the old one and moving it to the higher ground and then reconnecting all the you know, the transformers and, and all the different components. That's a heavy undertaking for a little, you know, potentially a small, relatively small municipally run or a coop.

Justin Angle 18:01
And so how are we thinking about these sorts? How are you thinking about these sorts of, you know, investments and the need for them? And I'm sure there's like basic modeling of how, you know, the investments amortize over time, but, but in terms of resilience, and the risks posed to these, to this infrastructure through you more extreme and more frequently, extreme weather events, how does how's your group kind of conceptualizing those risks? And how are they changing?

Pete Larsen 18:31
So we, I kind of think of us as a bit downstream. We certainly cite research and review research that talks about how extreme weather is increasing in the frequency and intensity, we then make assumptions about how much reliability may get worse, or resiliency may be worse if those trends continue. And then our neck of the woods is all around. Okay, so if we can show that reliability is getting worse over time due to extreme weather or natural hazards, then what would be the economic impact of that? And so we do develop models, and I've developed models for my dissertation looking at reliability trends over time. But it's very difficult to tease out what portion of those trends are due to extreme weather versus lack of spending by the utilities versus the share of line miles that are underground. And that's just primarily due to the fact that the data that we get from utilities on reliability performance over time, it's very, it's got what we call a coarse, spatial and temporal scale and I did real wonky on it.

Bryce Ward 20:00
It just means that we get annual reliability data. And it's usually for the whole service territory, not for a neighborhood. And when you have that, when you have that kind of data, it's very difficult to detect signals that are driving reliability.
That makes sense. Yeah. So, you know, you talked about that the course data, and it makes me sort of think of supply and demand dynamics. I mean, one of the stories was all over the newspapers after the Texas debacle was these people, you know, they endured boiling water in their homes, to heat them and their families and so forth. And then they’re hit with a $17,000 electric bill, it makes sense that there’d be you know, surge pricing, if you will, I mean, we’re trying to provide incentives to limit people’s consumption of scarce resources. But at some point, something like $17,000 is ridiculous, right? So like, how does, how does how do those things operate in energy markets, both in terms of you know, you can understand consumer demand, but supply issues, interesting terms of, you know, the different sources of energy, fossil fuels, renewables, hydro, hydro, whatever, like they have different dynamics in terms of when they can supply energy and in different forms, right.

That’s right. And you know, that 17,000, I thought some of those articles in there, yeah, I can only imagine getting a bill like that in the mail. I, what I do know is that in Texas, I say this summer is only a quarter of the residents were on that variable pricing scheme base, basically, meaning that the majority of Texas residents are on a fixed price of electricity rate structure. But there still were a quarter of the residents that were basically broadside to what happened in Texas in terms of electricity prices.

And that was that an opt in thing that people opt in thinking they could game the system for a lower rate, and then they just got pinched, or how did that work?

I don’t know whether it was opt in or opt out. What I do know is that, you know, Texas has historically had fairly low electricity rates. And, you know, people looked at what their fixed rate would be and what the historical average electricity rate was and said, I’m gonna roll the dice. Maybe they didn’t think about it like that, but the dice you know, landed in a very unfavorable way for those customers. Thinking in Texas and I’m I wouldn’t call myself an expert in market design of Texas and Texas is unique. It’s in some ways kind of an island.

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unknown 23:06
Raging wildfires has scorched a record number of acres and killed at least 31 people.

unknown 23:10
It leads us to climb from those devastating wildfires.

Justin Angle 23:12
And last year, wildfires scorched a landmass nearly five times the size of Yellowstone National Park. It was the largest area burned since reliable records began.

Justin Angle 23:24
Fires are getting bigger and hotter, and more devastating than ever before. What all that fire means? And what to do about it depends on who you ask.

Lily Clark 23:34
Experience of a forest taking fire is really something.

unknown 23:38
Not only a gift to us, but it's more more of a gift to the land.

unknown 23:43
There will always be fear of fire. I know that and I don't pretend there won't be but in certain situations, there shouldn't be.

Justin Angle 23:49
I'm Justin Angle. And for the last couple years, I've been talking to scientists, historians, and firefighters themselves to hear their stories.
unknown 23:59
You owe it to the guys that died.

Justin Angle 24:02
I wanted to figure out how did we get here?

unknown 24:05
We’re going to knock fire out at the landscape.

Smoky the Bear 24:07
Remember, only you can prevent forest fires.

unknown 24:10
It was a crazy ambition.

Justin Angle 24:12
And where do we go? It just knowledge is freakin power.

unknown 24:17
I’ll talk about it in a calm way. But this is me hitting the panic button.

unknown 24:21
Am I making any difference here with the science? That’s what I wonder sometimes.

Justin Angle 24:27
This is fireline a six part podcast series from Montana Public Radio and the University of
Montana College of Business about what wildfire means for the West, our planet and our
way of life.

Mark Moss 24:54
Hey, this is Mark Moss from Tell Us Something and you’re listening to A New Angle.

Pete Larsen 25:01
You allow you have these high prices. And if the high prices show up that you’re incentivizing producers to show up and deliver power. And by having, you know, price signals that are, you know, when you have $9,000 a megawatt hour for an amount of time, the thinking is that every independent power producer is going to rush and get try to get their power to the places in Texas that were showing some of those prices. The problem was that those power producers weren’t out there, because their capacity was down due to the cold weather. And then furthermore, places bordering Texas, were also having their own challenges with our getting power produced and delivered in Texas as a, you know, as a state electricity system. You know, it’s they’ve always counted on Texas power plants, delivering power to Texans. And in this situation, they really needed places from outside to get power to Texans. And so there were some some problems with the import of electricity, in addition to that these other places having their own challenges with the weather.

Justin Angle 26:16
Yeah, that movement of like, like storing and movement of electricity, those are two difficult, well, somewhat difficult things to do, depending on the type of energy right and how you’re connected to a grid.

Pete Larsen 26:27
That’s exactly right. And this is one of the things that is sometimes difficult to explain to people, because everybody, I think most people think renewable energy is pretty cool. And for a lot of different reasons, self sufficiency, self reliance, the obviously the environmental stuff, but you got to get that power from from somewhere to somewhere else. And it turns out that if you’re talking about utility scale renewables, you know, siting and building transmission lines is not an easy undertaking, and especially if across the state, you know, state lines.

Justin Angle 27:10
Like what’s the role of like high capacity batteries, and you hear you hear Elon Musk, and others like speculating in those areas about the importance of being able to build storage capacity, what role, how does storage work in energy markets? And how do you build infrastructure there?
Pete Larsen 27:26
So I have to tell you, I think one of the coolest things that’s coming down the pike is these big storage technologies. I’m not an expert in, you know, lithium ion batteries and some of the amazing work that people are doing. But that for your listeners is something to keep a close eye on both as you know, someone that might be interested in just clean energy and reliable energy. But also if you’re an investor, I’d be looking very closely at what’s happening in the storage space, maybe connecting it back to Montana. Whenever we talk about storage, it’s important to mention that there’s other types of storage besides batteries. And I recently became aware of this project outside Martin’s Dale called the Gordon Butte pumped storage facility. Have either of you heard about this project?

Justin Angle 28:21
A little bit.

Bryce Ward 28:23
Yeah.

Pete Larsen 28:24
As far as I can tell, it’s an independent power producer. There’s a there’s a bunch of wind turbines up outside Martin’s Dale. And they’re basically building two reservoirs, one that’s low, and then one that’s higher up higher elevation. And they’re installing, essentially a pump storage facility that will it’s a big battery, in a way it’s pumping water in the lower reservoir up to the upper reservoir. And then whenever the system needs to be balanced, because renewables are intermittent, and they have, you know, some challenges hooking into the grid, they can release the water, basically like a hydro unit. And they can provide power, both capacity, but also what we call, you know, voltage support. And so it’s a 400 megawatt project. So it’s a big, big project. That’s an example of a battery, but on a grand scale. And that project, which is under development. I mean, that’s the kind of stuff that’s happening in Montana that I love. I mean, I love seeing stuff like that.

Justin Angle 29:35
So yeah, as you describe that, that seems like an awesome idea. At the same time, that also sounds like the sort of idea that’s like a punch line in a presidential debate. Like how does how does an I that’s a bold idea how to infrastructure projects at that level kind of come to pass because we’re talking billions and billions and billions of dollars, who’s going
to make that investment? How are they going to kind of pay for it over time. How they kind of come off the ground?

**Pete Larsen  30:03**
That's a great question. I believe that that specific project out that Martin's Dale is being funded by by private private equity or private investment firms. There's a an investment fund based in Denmark, that's, you know, contributing to development that but yeah, these are, these are large scale projects. But if we envision a world where we have more and more renewables coming online, you need, you need power plants, like that one, to keep the system stable, the power system stable. And, you know, that's why you see, whenever you see a lot of, you know, renewables coming online, you'll often see natural gas, typically peaking. Now, natural gas units, or combustion turbines are basically jet engines on the ground. You see those show up not far from renewables, and they have sort of coexistence together in many cases. So that's why the Gordon Butte Project is really interesting, because it's essentially a renewable resource that supporting other renewable resources.

**Justin Angle  31:17**
Sure, so okay, so like, draw that out a little bit with those, you know, natural gas turbine. So, you know, the thing with renewables is that, you know, that, like, the wind turbines only turn when the winds blowing, and solar panels only generate electricity when the sun is shining. So, you know, there's gaps in supply, so you gotta either store it, or you got to figure out a more steady supply. So those gas turbines natural gas turbines kind of fill the gaps. Is that is that kind of what's happening?

**Pete Larsen  31:48**
Yep, that's exactly right. They're often a lot of times they're called combined cycle combustion turbines. But often you hear they're called simple cycle combustion turbines. And these are fast start units. They can, I mean, it's like driving up, you know, Ferrari, they can kick these things on instantly. So if there's an imbalance in the frequency or the voltage on the system, because renewables are over generating or under generating, because maybe the wind is blowing too much or not enough, then the natural gas fired power plants kick on instantaneously in the system.

**Justin Angle  32:24**
Yeah, like the gas powered motor in a Prius, it sounds like, in some ways.
Pete Larsen  32:29
Very, very similar concept.

Justin Angle  32:30
So how does it work kind of at the, you know, at the consumer level, you know, demand for electricity fluctuate through some natural cycles. But we also, you know, I guess there's a societal interest, at least through conservationists, to get people to use less electricity to be more thoughtful about least the use of fossil fuels, how is kind of energy conservation, you think about how policy in that space can come to pass given this complex structure of how energy is generated and stored and delivered?

Pete Larsen  33:09
Yeah, and I, my, I got my start at Berkeley Lab, conducting research into the US energy efficiency issues. Berkeley Lab has a long history of studying, you know, energy conservation issues. They call him the godfather of energy efficiency was a was a very famous scientist named Mark Rosenfeld. And he was a student, I can't remember if it was Fermi or who but somebody at the University of Chicago, very famous physicist. Rosenfeld was the one who's coined the term megawatt, meaning a negative megawatt. And I happen to believe very strongly that energy efficiency and demand response, they're not sexy. They're, you know, from a from a policy perspective, they always kind of get short, shortchanged, but we have shown at Berkeley Lab, and other places that conserving you know, megawatt hour of electricity is cheaper than producing an additional megawatt hour of electricity. And so, you know, energy efficiency and demand response need to be at the table and all these discussions and frankly, you know, when you talk about power, system reliability and resilience, if there had been more energy efficiency in places like Texas and potentially the the ability to respond to demand in real time, power outages may not have been as pronounced as they, they were.

Bryce Ward  34:47
So what's the low hanging fruit in terms of energy efficiency?

Pete Larsen  34:52
We kind of think about things in terms of households and businesses. The low hanging fruit that has been picked quite a bit is lighting, having LED lights, low, low energy use lighting, those things. I typically focus on the building side or I focus on that sector and my energy
efficiency work, you know, escos, these energy services companies, they come in and retrofit old buildings, the first thing they go after is lighting. And then it gets more complicated after that.

Bryce Ward  35:26
Kind of going back to the economic benefits of resilience. Can you make it a little bit more concrete or descriptive to the listeners in terms of what are we talking about? When we say that there are billions of dollars of benefits to avoiding something like the Texas disaster? What, where are those benefits coming from? And how do we know that they’re real?

Pete Larsen  35:54
Okay. So we start by calling the benefits of voided costs. So these are costs that would not have occurred had you made an investment in our system reliability, or resilience. And so some of those avoided costs for a household could be not having your pipes freeze, damaging, you know, all the ceilings and walls in your house. That’s a huge cost.

Bryce Ward  36:20
Yeah, there’s pictures of like the fans with that had like, you know, the water is pouring off, it’s frozen inside your house. But those were very, you know, terrifying.

Pete Larsen  36:29
Yeah, that’s a very iconic photo, that ceiling has that ceiling fan shot. So that’s a, you know, damage to your home, because the power outage occurred. There’s also food spoilage/inconvenience costs, you’re having to drive across town to go get food with your neighbor, whatever. That’s on the household side, on the business side is too complicated. So the way I explain it, to more general audiences is as follows. Let’s say that there’s an automobile manufacturer in Texas. And they’re without power, and they’re without power for a week. They have lost revenue, because they’re not able to produce automobiles, that would be considered a direct cost. They also have potentially some damage, just like the household had, you know, that they’re their plant, whether it’s freezing pipes or machinery that needed power, and now is, you know, overheated or something’s happened. They have direct costs. And there are ways to measure that. We refer to this other category of impacts, and we call these indirect impacts. And so let’s say that this, this automobile manufacturer has no power. Upstream, its supplier, maybe it Michelin tires, they had power. But Michelin can’t ship the tires, to the automobile manufacturer, because they’re
without power. I mean, that Michelin upstream phases and economic impact. Same on the same side, downstream customers of the automobile manufacturer, can also be impacted, whether they have power or not, they're not able to get that pickup truck they needed for their business when they needed it. And so if you can make an investment in power, system reliability, or resilience and avoid some of those impacts, it doesn't take a huge mental leap to realize those numbers get big real quick.

Bryce Ward 38:32
Is it nonlinear? Like, you know, is it like we can do without power for a day or two? And then, is there an inflection point at which it kind of just explodes? Or is it kind of relatively linear?

Pete Larsen 38:44
Good. Alright, now we’re getting into my turn. I love wonky questions. So the, the way I think about it, if I was to, like describe the shape of the impacts, I think they’re like an S, or an S shape. And with on that, for you math nerds out there, and I know you’re out there on the x axis is duration of the power outage. And on the y axis is dollars damage or dollar impacts. It’s more of an S shape that goes up real quick. And then it starts to level off and potentially come down as businesses just relocate away permanently. Yeah. So I believe the impacts we believe the impacts have more of an S shape than a pure exponential shape.

Bryce Ward 39:33
Back to my earthquake experience, right. The you know, the the terrifying scenario in the Cascadia Subduction Zone earthquake is you could be without power for months. And yeah, the terrifying scenario as well, at what point do businesses just say, Well, this is not a place I want to be anymore. And they just there are people and they just leave. It'll be interesting to see what the long term effects of the Texas event. I’m very curious to see, you know, is there migration? Is there? Is this something that people are going to be forgotten about in a month? Or is this actually changing investment and location decisions for at least some time horizon?

Justin Angle 40:16
You know, and it hit at a time when Texas was getting a ton of in migration, you know, notably from California and other folks trying to, for whatever reason, avoid taxes or get more favorable regulatory environments or whatever. So yeah, there’s something like this
just draw salience to, you know, avoiding some of those taxes and dealing with lower levels of regulation. And this might be a lazy argument, but it might come with the cost of some of these infrastructure failures coming to bear.

Pete Larsen  40:48
That’s right. And how much is someone willing? Like, if you’re a small business, how much are you willing to take? Before you’d really think seriously about, you know, making your business energy efficient, putting on some solar and potentially putting in a backup generator? That’s, those are decisions and that are being discussed? Not just Texas. But I mean, California is another one, right? The wildfire situation in California, is ongoing and catastrophic. There’s no, you know, there, we haven’t heard any stories, that this situation will be public safety, power shut offs, are going to stop anytime soon. They’re gonna keep doing this until we get to a point where they, you know, make some major translate, you know, transformational changes in their, in their systems, their

Justin Angle  41:41
Pete with your work, like, you know, how do you make the case to policymakers? Or do you make the case to policymakers, I mean, politicians, and people make policy gotta gotta decide if these investment happened, ultimately, taxpayers and voters, I suppose have some input as well, but like, you know, the, this isn’t like a, it’s like buying insurance right now. He wants to buy insurance. No politician, although maybe now like, we’re in a, we’re in a climate where investing in infrastructure is maybe thought to be a little bit more favorable? Like, how does that interface work with making this case for these benefits that are actually avoided cost? How do you convince people?

Bryce Ward  42:26
Well, let me piggyback on that. What are you? What, what’s your dream scenario? Like, what if Pete ruled the world? What investments? What investments would we be making? And then how do you convince people to make them?

Pete Larsen  42:42
Well, if Pete ruled the world, I’d be fishing and hunting and playing golf.

Bryce Ward  42:50
Well, that’s why you came back to Montana of course.
But I’m playing full time full time. No, I, I like to think about it. And I think, you know, obviously, both of you have a lot of history, conducting research in business and economics. And I always think about it like having resilient power is a public good. And what I mean by that for the non economics folks out there is that there are bystanders, they get benefits from these investments. They’re, you know, the direct people involved in the decision or the utility and its customer. But then you have a power system that can withstand anything, you’ve got national security benefits, you got all these, you know, all these big things that are brought, I would consider more public good type quality. And what we know from economics is that with public goods, you got to incentivize them. And so the way I’ve been thinking about is, if you’re going to make some huge investment in your power system, that at face value, all the ratepayers are gonna, you know, riot over because the cost of electricity quadruple, or whatever it is, you know, maybe you break up and you have state, local and federal government contribute to the cost of any repairs contributing to the cost. And so if there is some major investment that needs to be made, that it’s a mix of public and private funding, and how you allocate how you come up with that, let’s share who pays for what, in an open the open and interesting research question, but if I ruled the world, and I hope I never have to do that. I would develop a business model that ratepayers and private sector folks cover a portion of the costs, and then state, local and federal government contribute the remainder and then you’ll get these investments made that wouldn’t have been made otherwise by the utility or the ratepayers by themselves.

Are there any good models for that? Is that happening anywhere or any states or municipalities or organizations doing that well?

I don’t know the answer to that question. I’m certain there are plenty of examples of it, whether they’re doing it well or not. I’m not exactly sure. Well, yeah.

And you don’t know if you’ve done it well, for 50 years.
Right. Right. Right.

Pete Larsen  45:32
Yeah. And then how do you measure something that never happened? Because you made an investment. It’s that back that insurance point you made a second ago.

Justin Angle  45:38
Indeed. Well, Pete, I gotta say, when you take over ruling the world, I hope you invite me and Bryce to your tee time. Yeah, this has been fantastic. learned a ton. As we close, how can people learn about you and your research and your work online?

Pete Larsen  45:59
Yeah, thanks. Well, first off, thanks so much for having me. It’s, it’s real honor to be part of the podcast. And then it’s also an honor to be able to be on here as University of Montana alumni. So that’s a that’s a really big deal to me. My time in Missoula was some of the best times of my life. So I’m really happy to be part of this. You can find out more about me by just going to Google and type in Peter Larsen, Berkeley Lab. And it’ll direct to the research I do at Berkeley Lab. And you’ll see probably a lot of other research done by my colleagues who, frankly know a lot more about some of these topics than I do.

Justin Angle  46:43
Well, thanks for sharing your wisdom with us. And, gosh, I hope these sorts of events never happen here. But I hope people are listening and can make decisions about it will be more thoughtful about the risks of these sorts of things and the investments we all might consider to to avoid them. Pete, thanks for joining us today.

Pete Larsen  47:00
Thank you.

Justin Angle  47:03
Thanks for listening to A New Angle. We really appreciate it. We’re coming to you from Studio 49 the generous gift of you UM alums Michelle and Lauren Hanson. A New Angle is presented by First Security Bank, Blackfoot Communications and the University of Montana College of Business with additional support from consolidated electrical
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