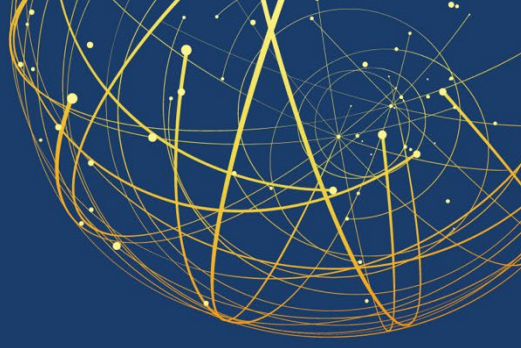

AI INFRASTRUCTURE AT SCALE: FINANCING THE POWER-CONSTRAINED GRID

Brian Sullivan 00:10

I got to get into the Waldorf, so thanks for showing up. We got a great panel here. I appreciate everybody being here. I don't know if you guys heard, Ted Turner passed away this morning, and I only mention that because this is my 25th Milken Conference, and I started when I was nine years old. And Ted Turner was my first big interview here at the conference, and I was scared sh**less. And he sat there, and one minute before the show began, he started to get up, and I started sweating blood. And I said, “Mr. Turner, what are you doing? We're live in 30 seconds.” And he said, “I got a plane to catch.” And I said, “Mr. Turner, it's your plane.” He said, “That's a good point.” And he sat down and did the interview. So, there's my Milken story, and we've got a great panel on “AI Infrastructure at Scale: Financing the Power-constrained Grid.” To my direct left, Doug Kimmelman, executive chair and founder of Energy Capital Partners. We've got Karl Kuchel. He's the head of infrastructure at Macquarie Asset Management. Lucy Heintz, managing director at General Atlantic/Actis, came all the way from somewhere outside of Newcastle, England. I didn't even know there was an outside of Newcastle. They used to call that Scotland, but welcome. Rajit Nanda is the CEO of Datavolt. Rajit, where do you come from? Where are you—

Rajit Nanda 01:25

—I come from the great kingdom of Saudi Arabia, Riyadh.

Brian Sullivan 01:31

Is that a direct? Did you make it Saudia, like a direct to LA?

Rajit Nanda 01:34

Well, through London, but yes.

Brian Sullivan 01:35

You don't have to answer that question. Michael Zelkowitz, he is managing partner and global head of capabilities at Oliver Wyman. The term AI is something that, Doug, as you know, I am contractually obligated to mention 47 times a day on my show on CNBC. That's only somewhat of a joke. Where's the money going to come from?

Douglas Kimmelman 02:00

Well, the good news is we have the best balance sheets in the world who want to get this done, spending what, maybe $700 billion a year now, the Amazons, the Metas, the Googles. So, this is a unique thing in the world of we need all this electricity, that we have large balance sheets that are willing to backstop all that we're doing. And because of this huge demand for electricity, here we're in LA, Southern California Edison, deregulated power. They've sold off their power plants 30 years ago. They have to buy power on behalf of their customers. They're nervous that they're going to get crowded out, so they're signing contracts. And if you're a company like a Walmart, a low operating margin business, you're worried you're going to get crowded out, so you're going to sign contracts. So never before have we seen this opportunity to term out your sales of power and therefore finance it on the backs of some of the best balance—

Brian Sullivan 02:53

—What do you mean term it out?

Douglas Kimmelman 02:58

So when I own a power plant, merchant is a risky thing where I'm selling my power on a spot basis because I don't know where power prices are going to go from one hour to the next, let alone 10 years from now. So, if I can sell under a long-term contract my power output to a big balance sheet who is standing behind that obligation, I can lock in a fixed rate of return, lock in my cash flows over the long term—and that will attract so much more capital to get this built out because we have those term contracts.

Brian Sullivan 03:23

Yeah, Lucy, we talk about we're hitting a trillion-dollar number on CapEx. We're not there yet, but at current rates, we're going to be there pretty quickly. Are all these projects going to happen? Is the capital going to be there to be available to build out these AI dreams?

Lucy Heintz 03:39

So, AI is very much—and this kind of AI dream is very much a US story. The rest of the world, those term contracts are there, financed for just building the backbone of the economy in terms of meeting countries' electricity demand that is industrializing, electrifying, enterprise migration to the cloud. AI in growth markets outside the US is only 5 percent of electricity demand. So, it's a totally different economic equation. But those term contracts—which actually are in some ways more available in growth markets than they are in the US, this is a much more recent thing now that there's a shortage of power absolutely everywhere—are what unlocks that financing.

Brian Sullivan 04:18

Well, I would add that, fair point, Lucy, but coming back to you a little bit, obviously in the UK and parts of Europe, energy is hard to come by and it's expensive. It's a different world than we have. We have a lot more production capability here in the United States for many different reasons. How about this? Does the UK, will Europe, will it have AI dreams? Because if we run the show, the United States, we're going to own the world even more than we do now.

Lucy Heintz 04:45

So it depends where you're getting your electricity from. In terms of is electricity expensive? It's probably going up more in the US. You'll come from West Virginia. That price has gone up, what, 17 percent you were saying? The cost of wind and solar combined with batteries somewhere like India right now is five cents. We asked the question on yesterday's panel in terms of how much is nuclear fusion going to cost. That's 25 to 40. Think about that delta and think about therefore what that cost will mobilize in terms of the technologies that will come most quickly.

Brian Sullivan 05:16

Yeah, it's a fair point, and you got that question in on me. I didn't know it was you in the audience hitting me with a question. I love it. Rajit, obviously Saudi Arabia, there's some stuff going on in the Middle East right now. Oil price is down a little bit. Things are evolving quickly. Where does the Middle East stand right now with regard to, well, you have very low power costs. You've got a lot of sun, a lot of solar, a lot of fossil. Things are in flux right now. Have any of your big plans changed?

Rajit Nanda 05:39

Thank you, and I think it's a great time to segue into what Lucy just mentioned. I think first and foremost, it's important to understand that the Middle East in general, Saudi in particular, is very well positioned to capture this whole AI surge by virtue of where it stands on its feet as far as energy is concerned. Lowest cost, reliable, and green. That's like icing on the cake on top of everything else. Lucy, I heard you mention about five cents, in terms of integrating round the power. In Saudi, we can do that behind the meter at

about three to three and a half cents. And what that means is when you look at the whole position of the country in terms of connectivity, Saudi—people don't realize—in the last nine years built 17 sub-sea landing stations. Which is going up to 24 in the next one and a half years.

Brian Sullivan 06:57

What does that do for you? What do you get with those?

Rajit Nanda 06:59

What the whole point that I'm trying to make here is that it's not about captive consumption. It is about being a center of gravity to basically deliver compute power to half the world, which is Europe, which is to Africa, one and a half billion people in Africa, about 450 million people in Europe, and 2 billion people in South Asia. All of this within 30 to 40 milliseconds of latency. And the country remains very well positioned as we, in terms of the AI cycle, move from training to basically other AI workloads. It is able to service all of this population.

Brian Sullivan 07:47

Karl, does it matter where it happens, where we build this stuff out with the global interconnectivity?

Karl Kuchel 07:47

Oh, absolutely. I think national sovereignty and data sovereignty as part of that is one of the top issues for many around the world. All developed countries, it's one of the top two or three issues that they're thinking about. So, I would pick up on that issue of data sovereignty and then match it with latency, because I think what you're talking about is building a latency stack. Which is what all the big off-takers are doing here in the US as well, right? That you've got a really concentrated buyer group. They are taking a national approach and sometimes a global approach to where they're going to have their capacity so that they can serve their customers. But I think just like we've dealt with supply chain coming out of COVID, where it was just all about economics, I think you've got this overlay now of data sovereignty that is impacting where you need your power generation and also where you need your compute power.

Brian Sullivan 08:45

You say data sovereignty; it sounds like countries might want to control some of that data.

Karl Kuchel 08:50

What a novel thought, Brian. [Laughter]

Brian Sullivan 08:52

It's amazing, isn't it? You've heard of China.

Karl Kuchel 08:55

I have, I have. But I think more broadly, and maybe Doug was going to go here—but there seems to be an equivalence in the discussion about power generation and AI—as if all the electricity demand growth is just linked to AI, and without this concept of AI, there wouldn't be growth. Actually, the electricity demand growth is much more broad-based here in the US. And so, this is a thematic that we would be dealing with regardless of AI. It's a bit like on the compute power side. We already had this huge movement to the cloud that was driving load, that was compounding in the mid-teens, and AI just increased the size of the wave. So, I think that a lot of the discussion talks about compartmentalizing AI as a separate item. It's just the next iteration of a requirement for high—

Brian Sullivan 09:47

—Yeah, but I think, Michael, we're talking about it, correct me if I'm wrong, because there's already a push/pull in the media, right? Some senators have come out and said, “No data centers. You're going to steal electricity from people, or you're going to double their costs,” which is weird. Loudoun County, Virginia, capital data centers, actually electricity rates have come down. Property taxes have come down because the big hyperscalers are paying into the grid. I don't know if that'll be the case everywhere. Michael, what do you think? Maybe you will. Who wins? Is there a fight over power between people and AI?

Michael Zelkowitz 10:18

I would not see it as a fight, but I would say maybe I'll take a little bit of a different view to what Lucy said. Look, if you look at it, we have now figured out how to manufacture intelligence, right? And the ingredients for that is electricity and chips, and you manufacture intelligence at a marginal cost. And so, you have to think about upstream—what that drives. And if you look at the earnings call last year for all the hyperscalers, right? A lot of the demand is now actually coming from inference, not from training. So, what I take from it, people are now using it, right? And I think we think about the three revolutions that we've gone through is, first it was chatbot, then you get to smart intelligent models, and now you have agents that are generating their own demand. So, I think all of that translates to exponential increase in demand, and you can see that we are trying to catch up with it. So, I think we are early in this, and I think we'll continue. Now obviously that has implication for the electricity and all of that. Turns out capital is easier to find than infrastructure.

Douglas Kimmelman 11:15

Well, let's talk about cost, because we heard three cents, we heard five cents, we heard 45 cents. Here in California, highest electricity prices in the world, retail rate maybe 55 cents. That's competition with

Germany, by the way, neck and neck. So, I think we got to unpack. There is an unfortunate narrative, politicians picking up on it. It's AI's fault. The whole reason electricity prices—

Brian Sullivan 11:40

Well, you need to have an antagonist, a villain, and there you go. Darth Vader, it's very easy to point the finger. Right?

Douglas Kimmelman 11:43

And who's fueled that are utilities behind the scene—fueling that. So let me unpack that and explain that for a second. Power generation rates in the United States have actually gone down. What hasn't gone down is dramatic spending on transmission and distribution. Why does California have the highest electricity prices in the world? Massive amount of transmission and distribution. It's windy and sunny in the desert and the mountains. The people live on the coast. That goes into your bill. And there's a lot of other things that go into your bill, taxes and the like. Superstorm Sandy, where we live in New Jersey, public service electric and gas, tens of billions of dollars of spending convincing regulators that there's going to be a hurricane every Thursday, and they put that into rates, and that caused things to go up. The biggest factor in the price of electricity is natural gas. That's the fuel on the margin. Natural gas prices down dramatically. Even since the Iranian conflict started, they're down 10 percent. The low part of your bill is power generation. So, here's an idea to maybe get the villain off of the back of the Microsofts and the Metas of the world. Electricity, as you know, is a commodity that really can't be stored. Just a little bit with batteries. The peak part of the year, we have 10 to 50 hours when we have an extreme weather event, but we build hundreds of billions of dollars of infrastructure just for those 10, 20 hours a year, and that goes into your bill and drives up rates. How about hyperscalers, instead of wanting five nines reliability 99.999 percent of the time, could we settle for one nine and four eights, 98.888? Allow us to interrupt the power that we're building behind the meter on your site and use that power to help us out in those tough periods. I think that would be a good kind of balancing act.

Brian Sullivan 13:31

Lucy?

Lucy Heintz 13:31

But there are some hard constraints, right, in terms of data sovereignty trade-offs, and there's an urgency here in terms of coming back to your point in terms of what Saudi Arabia has to offer, in terms of there's a race. There is an urgency in terms of when you're going to get the power. And so, there are some hard constraints. You're absolutely right in terms of the cost of the grid, and it's a grid that has to be very all-purpose for every eventuality. But the cost of a gas turbine, which is the choice that this country is making in terms of how to then meet that increased electricity demand, has gone up three times. And you're not going to get one for five years. Whereas coming from China, where the supply chain for wind, solar, and storage is extremely elastic, you're going to get power in Saudi Arabia in a much shorter timeframe, and

that time matters in this urgency point of trading off hard constraints, data sovereignty, what you're going to deliver to who by when.

Brian Sullivan 14:21

Karl?

Karl Kuchel 14:22

Yeah, I think it's an important point, the speed at which power is required. Because if you think of the demand side, power in five years doesn't help a certain LLM win the race, so to speak, against somebody else. So as an infrastructure investor, the thematics are as strong as we've ever seen. I think the risk is assuming that this environment lasts for a really long time. And so, you see a lot of capital investing in this sector, and the question is not so much identifying these thematics. I think we're broadly agreeing on the fact huge capital needs to go into power, huge capital needs to go into data centers. It's the question of, well, are you investing on the basis of supply-demand imbalance for an extended period of time? And so, the takeaway I would make here is, we see the constraints today and this imbalance. You've got to assume that the demand side of this equation adjusts, i.e., hyperscalers may not need five nines. But also, on the supply side for AI, chips are going to get a lot more efficient cooling solutions. All of this sort of response is going to counteract the structurally short market we are in in the US at the moment.

Rajit Nanda 15:37

Look, I think the important point to realize today is the whole AI race has pivoted to speed to power. Okay? It's no more speed to market; it's speed to power.

Brian Sullivan 15:53

What's the difference?

Rajit Nanda 15:55

Well, the difference is that for the last 15 years, power was following the DC industry. Today, the DC industry is following power. DC industry is getting relocated to places that can deliver at scale, reliable power, that's what it means. And from that perspective, we cannot just constrain ourselves to the country. We have to look at the whole world as one place, and that means we need to talk about democratizing this whole inference race. I think the training race has its own sensitivities, and it's probably way down the line. It's almost, I would say, now starting to fall off the cliff rather than going uphill the cliff. So, the next phase is all about inferencing, and the next phase is all about speed to power.

Michael Zelkowitz 16:53

I think it's right. I think part of the issue that you have is it's growing exponentially. So 10x, if you look at the big hyperscalers and the [inaudible], they're growing 10x a year. Infrastructure can't keep up with that. So, if you think about data utilization, data center utilization, that's probably going to peak next year. So, there's still a long way to go—it's all supply constraint—but I do think the other effect we'll see as the models get better, as the agents get better, the intelligence get cheaper. Any time you make something cheaper, demand goes up.

Brian Sullivan 17:25

Yeah.

Michael Zelkowitz 17:27

So there will continue to be more demand for it. We're just discovering the use cases for this, and it's kind of happening is 88 percent of companies say they have AI as a priority, but only about less than 10 percent of them say that it's fully in production and all that. So that's all going to ramp up.

Brian Sullivan 17:40

Is the market pricing and risk appropriately right now?

Karl Kuchel 17:44

Probably not yet. We're kind of investing ahead of demand, right? Ahead of fully understanding the economics of this. I mean, ultimately, I think on the infrastructure side, really what you're taking a view on is aggregate demand. There's going to be winners and losers in the race to deliver AI. But what you're really underwriting is that as supply gets better, as there are winners and losers, will there be the need for the aggregate amount of data center capacity or whatever that we're building? It feels like we're still very early in the build-out of data center capacity. But certainly, we will, as we get further into that build, be conscious of the fact that as efficiency gains come through, what will be the nature of the compute that's required?

Brian Sullivan 18:25

But are people, Doug—or anybody jump in on this—are people appropriately pricing in the losers? Because we have the World Cup of soccer coming here to the United States, Mexico, and Canada. Let's say I bet on every team to win, right? Only one team's going to win, but everybody's betting on every team and then see what happens. That's a losing bet because I'm going to spend more on the bet than whatever. Unless Cape Verde Islands somehow wins and I win 100,000 times my money. Whatever. Right now, it feels like

that, that everybody's betting on everything—and if Karl's right and there are losers, a lot of capital's going to go down the toilet.

Douglas Kimmelman 18:56

Yeah. Well, I'd say a couple of things. We've been talking about where should this happen in the world and relative advantages. And I got to come back to the United States. We have something that, maybe Saudi Arabia has some of this, but we've got the most abundant natural gas resources in the world, and it's cheap and it's available today. That is an enormous advantage of building this out on scale. And Europe obviously is going to have to think long and hard because they don't have the energy and how are they going to keep up? The other aspect of this—and I think you touched upon it is—is there the potential, you talk about losers, of obsolescence of these data centers? It doesn't seem rational that we're building data centers that are so energy intensive and so water intensive. You can't tell me in 10 years from now that there's going to not be a better mousetrap. So, you better be careful when we talk about behind the meter and putting that power plant not connected to the grid. The last thing you want is a stranded power plant alongside a stranded data center. I think you obviously need to have some grid interconnection, and thank God as you said, there's other sources of demand.

Brian Sullivan 20:03

Well, I would, as the king of merchant power as you are, Doug, I would say that if I had a stranded power plant right now, I would have a solid gold helicopter on top of the Waldorf. Because—

Douglas Kimmelman 20:15

—If you had a transmission line to move that power.

Brian Sullivan 20:16

Fair enough. But look at Hut 8 today. It's a stock today, I don't know if you saw, it's up like 35 percent because they did a $9.8 billion deal because they had excess power, because all the people that went into Bitcoin mining suddenly were like, "Oh, wait a minute, AI? What's Bitcoin?" Boom. And then you transfer over here.

Douglas Kimmelman 20:31

Exactly.

Brian Sullivan 20:31

It worked out pretty well. It is interesting. I was going to pivot to that. Anybody want to jump in on this idea that are we wasting maybe our time and money here when there's going to be data centers in space or maybe data centers underwater in, and I'm not kidding, in a submarine. It's naturally cooled. You run the power lines up. The submarine doesn't go. It's like a static submarine. You're nodding your head, Lucy. What are we not thinking about here?

Lucy Heintz 20:56

I think you are thinking about the right thing, which is it's not just a supply side game—which is where I'm going to bet on every technology—is coming from. The point that Doug made, and you as well, was that there is going to be a merit order of how you meet that demand, but it's a demand side piece as well, and it's important not to get overexcited about supply without thinking about how that demand might shift.

Brian Sullivan 21:15

Do they match up right now, Lucy?

Lucy Heintz 21:17

No, they don't, but—

Brian Sullivan 21:18
—So where's the imbalance?

Lucy Heintz 21:19

The imbalance is right now in the US looking for supply. But it's not the case everywhere.

Brian Sullivan 21:27

Well, you invest all around the world in emerging markets.

Lucy Heintz 21:29

We do. We do. So, there is—

Brian Sullivan 21:30

—All around the world—

Lucy Heintz 21:31

—The AI piece is what's driving the demand, the additional incremental excitement about demand in the US. As I said, it's 5 percent of electricity demand growth outside the US, and there the drivers of demand, as I said, are fundamental. It's around the Indian population becoming wealthier and buying more appliances and putting their enterprises onto the cloud. And so that creates a much more fundamentals driven opportunity where you can see the way that demand is going because it's not got these big tipping points in terms of are data centers going to space or are they going to go underwater? And that creates not only a genuine diversification opportunity, but a much more stable picture that you can invest against.

Brian Sullivan 22:10

Well, you referenced India, and I'm not picking on India, but they have well-known power production problems. So, it's somewhat unstable in certain parts of the country. Are they talking about AI? Is capital going to places like that? Or are they just worried about being able to turn the lights on and the heat on when they need to?

Lucy Heintz 22:25

So it's a really interesting point you make because actually India has one of the best programs for renewable energy, which is the cheapest form of energy to bring onto the grid in India, probably in the world. They've built—

Brian Sullivan 22:37
—It's micro grids mostly, right?

Lucy Heintz 22:38

No, no, no. This is 120 gigawatts of wind, solar, and storage that has been added to the Indian grid in the last 15 years. Now India's only a 400 gigawatt overall system, so they've added another 25 percent plus to the size of their grid. Not many other people have done that. So, there's definitely some templates in there in terms of—

Brian Sullivan 22:55
—But I would imagine they're not worried about data centers as much. They're worried about, to your point—

Lucy Heintz 22:58

Everybody wants data centers, but they don't necessarily want them for AI or only for AI at this point in time.

Karl Kuchel 23:03

The point I'd pick up on there is there is this narrative that AI is like this whole other different thing. From a compute perspective, we are just moving to more compute intensive applications, and even AI is a spectrum. The whole world is going to need more electricity. So, I'd look at the US market as a leader—this scarcity of supply is going to become more pervasive. AI is just making it more acute at the moment. But we use AI as this sort of narrative that it entered the general consciousness a couple of years ago, and before that there wasn't. But actually, there was already huge growth in demand for compute just via the movement to the cloud before that. AI, I think you can just probably describe it as in five years' time, I don't think any of us know the applications we're going to be using the most, but I would absolutely bet that they're much more data intensive than the ones we're using today. So that's the direction of travel.

Douglas Kimmelman 23:54

Yeah. I think just as this risk mitigant that you talked about, I hate to keep coming back to the United States, but the sources of demand are so diversified.

Brian Sullivan 24:04

Yeah.

Douglas Kimmelman 24:05

We're in the business of electrons. I don't care if it's AI, I don't care if it's enormous LNG regas facilities that take a ton of electricity. I don't care if it's electric vehicles. I don't care if it's a governor of New York making a silly mandate that any new home can't have gas, or building can't have gas, it has to have electricity. What did you and I talk about? Do you want to make your omelet on an electric stove? Not really. But electrons—

Brian Sullivan 24:30

—Taxi engines. I'll just do it on a taxi engine. It's great.

Douglas Kimmelman 24:32

There you go. And cryptocurrency mining. So, you really want to find a place that your electron has a home if this AI doesn't work out, if economic growth doesn't work out. And that's really, I think, the business you want to be in. A lot of people are saying, "I want to be in the picks and shovels. I don't want to bet on the technology." But there's so many services around this.

Michael Zelkowitz 24:51

No, I think that's right. Let me just build on that. I think by our projections, about 30 percent of the data center demand in five years will be AI-driven. So, it's not going to be all. There's a lot of other things. All I would say, as I said, as it gets cheaper, you'll have a lot more demanding things. So, I think physical AI is coming down the pipe, right? So, when you think about robots, and again, I don't mean just humanoid robots, but think about any physical application, monitoring, maintenance, a lot of these things are coming. Now they use images a lot more, right? So, all of a sudden, a huge amount of data will need to be processed. And it turns out that two years ago, we thought it's going to be all edge computing. It turns out it's too intense for that, so it's actually going to be centralized in some data center. So again, I think about it simply as we are building new sort of workers. The workers live in data centers. If you take some of the Apollo numbers, let's say maybe to get a return on investment here, by 2030, you will need about one and a half trillion of AI-related revenues to pay for this. So that's about—

Brian Sullivan 25:49

You think we're going to get there? Because that's the big question. I mean, is the revenue going to match up to the investment? At some point, people pull back because they realize 20 bucks a month on Gemini or Claude or whatever it is not going to ever get to $1.3 trillion.

Michael Zelkowitz 26:02

Well, but I don't know but represents about 10 percent of the aggregate wage bill of the economy. So, if you say the companies have to say, in addition to having physical labor cost, I need to have a compute AI budget. And if you say it's going to be about 10 percent in aggregate, you could see it. If you look at some of the tech companies, they spend a lot more on compute than they spend on people already. Now, not everybody will be that way, but—

Brian Sullivan 26:26

But I guess not to belabor the point, Rajit, but non-hyperscaler off-take risk, right? I'm not worried about the Googles, the Metas of the world. They're going to be just fine. Right? I'm worried about Bill spending all this money and then having it—what's the risk for the non-hyperscaler? Because, again, people need power. If they don't have power, they tend to get angry. When they get angry, bad things happen. Doesn't matter what country you're in.

Rajit Nanda 26:59

Yeah, we have another Arab Spring, right? Who knows? No, but look, the market indeed is segmented between the big techs, the hyperscalers, and of course we have the neo clouds who cater for mostly the developers and the apps and everything else. And fundamentally, in terms of the losers and winners, we had that chat a few minutes back. I think the big techs will probably find their way out there, because they have multiple sources of revenue out there, which is going to help them pull through or kind of demonstrate to the investment market that there is still hope. But for the smaller ones out there, there is going to be a bit of consolidation that will come through in a few years.

Brian Sullivan 27:52

In what? Who's buying what?

Rajit Nanda 27:56

I think there will be consolidation horizontally and vertically. What that means is we'll see the bottom three layers of the AI stack being consolidated, energy, DC, and compute, all of them being consolidated together. And we'll also see it horizontally between the players.

Karl Kuchel 28:15

But going to your point, Brian, I think what we're getting to is that the revenue model that is required to support all of the CapEx investment that is going in is not yet clear. And I think a lot of the capital that's going in, rightly so, is to quote unquote, "Win the race," and then monetize it.

Brian Sullivan 28:35

It's an amazing point, Karl. I think you're right onto something because my little brain, I don't do this for a living, but I pretend I do on television, which is amazing. It's like I feel like we're building just a ton of airplanes, but we have no airports, or vice versa. Right? Will the revenue match up to the investment? Or are we just lighting hundreds of billions of dollars on fire?

Karl Kuchel 29:03

Well, certainly the best balance sheets in the world are using their operating cash flow.

Brian Sullivan 00:29:08

They're using those balance sheets.

Karl Kuchel 29:08

They are using those balance sheets. And I think as an infrastructure investor, you take comfort in that. But you've got to then look, well, what sits behind them, right? And these are large language models and a number of other parties for which their profitability is emerging, but nowhere near the scale that it needs to be. But certainly, that partnership and the infrastructure is very much, or the dollars are being invested in the infrastructure with the comfort of those balance sheets. But all balance sheets eventually reach a limit. And we've seen some of that even amongst some of the biggest players in the space where you have seen widening at times or concern about the amount of capital that's going into some areas to support AI without that clarity on revenue. So, I think it's something really to watch. But I go back to that point of, if you're not in this race, automatically you're on the sidelines.

Brian Sullivan 30:04

Yeah, going back to your point about how there's storms and the utilities, they spend all this money to protect us from like 1 percent of their time or less than 1 percent we hope, right?

Douglas Kimmelman 30:15

Less than 1 percent.

Brian Sullivan 30:15

With extreme weather storms, they get all the attention because you get power knocked out, but they're so rare, right? Whether or not they're increasing here or there, they're still, thank God, pretty rare events. But I would push back a bit with my airline analogy. My flight back to Newark, they don't use the tires much. We use them to take off, and we use them to land, but I like that they're there.

Brian Sullivan 30:43

And I want them there when we go to land at Newark.

Douglas Kimmelman 30:47

Yeah. Well, we are a society, in the developed world, exceedingly spoiled if the power goes out for 10 second. In India and places like that, that's a pretty good day if it's only out for an hour. They're more accustomed to it. And I think what consumers have to realize is what is the cost of doing this. We all hope and pray that battery technologies make a leap forward and if it were me, in 100 years from now, we ought to be all nuclear, solar, and batteries.

Brian Sullivan 31:16

I thought you hated nuclear.

Douglas Kimmelman 31:18

From an investment perspective and a time perspective, what do the hyperscalers want? They want large—

Brian Sullivan 31:24
—They want it now.

Douglas Kimmelman 31:24

They want large scale power, they want it now, and they want it at a reasonable cost. SMRs fail on all three of those. I hope it's green, it's base load, it's reliable. I hope we get there, but we can't just snap our fingers and go down the cost curve. And we're not there yet. And so, it really is all above on the fuel side, and as I said, I think the hyperscalers need to contribute to this peak period and contribute a part of that cost because they need to get the consumers behind them. Right now, they're starting a battle, and a battle that they could lose if there is an outrage against the hyperscalers.

Brian Sullivan 32:02

So Lucy, if somebody in this room wanted to stroke a $200 million check to somebody to invest in something, what questions should they be asking?

Lucy Heintz 32:10

I want to come back to Doug's point, if I may. When you talk about a future grid that is nuclear, renewables, and batteries, how does the nuclear operate? Because it's pretty much of a base load concept, but if we do all these other things right and we get the grid to work better for us so that the cost of having your tires gets cheaper, but they're still there when anyone needs them, we won't necessarily need base load as a solution. It'll be very useful, but we'll want actually much more intermittent. We need power for when the sun's not shining and the wind's not blowing. How do you see that working?

Douglas Kimmelman 32:44

Well, we need a technological breakthrough. We're not there today, right? All of this data center build-out can't be supported by intermittent renewables. We said five nines, they're not going to be happy with five twos, and so the battery technology has got a long way to go. 50 years we've been working on battery technology.

Brian Sullivan 33:05

So then let me come back, Lucy, to the question, because I'm going to say something that a lot of people in this room might disagree with or dislike, but I think it's true, and if I'm wrong, I want somebody to jump in. We have not had that big breakthrough necessarily. I'm going to tell you something—in 1993, I wrote a fiction novel about cold fusion, the idea of creating power out of nothing, and then its infinite generation is basically free—it was a murder mystery. It was a piece of crap. It never went anywhere. But I wrote it on a typewriter.

Douglas Kimmelman 33:29

Is it still on Amazon? Or, oh.

Brian Sullivan 33:30

No, I never published it. It was a piece of dog dung, but whatever. It kept me busy, and I was thinking about this in '93, and I only bring it up because you look at like we're all flying wherever we're going, right? They had the Concorde. Anybody remember the Concorde? Supersonic jet. Concorde went out of service about 15 years ago because one of them unfortunately blew up. It was loud. It was very fuel inefficient. The first 747 took flight in 1969. 1969. The 747 is now out of service. A380 is going out. We haven't had a big breakthrough. Battery technology is effectively, Michael, the same as it was 70 years ago. The first cars in 1899 were electric, and the batteries that they used, while slightly different, weren't that much less efficient than the ones today. Is anything I said wrong?

Michael Zelkowitz 34:18

You can look at it that way. There's a lot of things where you could say fundamentally on some of the solutions—

Brian Sullivan 34:22

Thanks for coming to my TED Talk, everybody. [Laughter]

Michael Zelkowitz 34:24

I will tell you that, again, going back to what Rajit is doing, the data center thing is new. That's technology we talked about today I think is fundamentally new. We didn't have it. The ability to manufacture intelligence, new, right? So again, we are going to use it more, and I think a lot of tension. So, if you use it, for example, for medical imaging, for diagnosis, we will want it to be reliable.

Brian Sullivan 34:46

Yeah, but that's the software side, right? The data centers themselves are just a bunch of computers in a room with 1,000 air conditioners.

Michael Zelkowitz 34:52

Well, but you still need to power it. And I think now I look at it more, this is how we innovate. So, when you have these big investment booms, and this is one of them, we had something internet, we had it with utilities before. This is how we invest in infrastructure, right? We go through these cycles. So, this is the moment during which we're going to innovate. Yes, you're right. Some of that stuff, it's good for the economy. That's how the economy innovates. Not every investment will work out. To your point, as you said, if you put your bets everywhere, not all of them will work out. So that's the challenge for investors. So, I agree with that, but I do think this is how we're going to push this forward. The amount of investment we are doing, that creates the innovation.

Karl Kuchel 35:27

The scale of the challenge that we have at the moment is such that, take your point about the innovation curve, and this is coming from an infrastructure investment perspective, you can't invest with a long-term outlook assuming problems don't get solved or that innovation doesn't happen. So, I see a lot of capital going in on the basis of the supply-demand imbalance at the moment and going, "This is a great time to be investing in data centers and power generation." We absolutely agree with that. The question is: Should you assume that that's the case for the next 30 years? And if you look at some of the challenges that we're talking about, I'm not sure any of us would necessarily be able to put our finger on, "This is what's going to happen. This is going to be the innovation." But you've got to assume that some innovation—

Brian Sullivan 36:14

Okay. Go to the cost curve. So, and again, last night I had dinner with a guy who invented the broadband modem. Right? The one we all now have at home. You have your Comcast or whatever, whether it's Starlink, whatever it might be, and the ability to, let's say you have a $300 modem you go to Best Buy and it powers the Wi-Fi in your home. He invented that with his team, and the first one that he invented, he said, would've cost $99,700. Like if you're going to buy it at home, it was $100,000. Now they're $300. Lucy, are we close to that kind of—is there any kind of cost—is the cost curve, maybe not to that extent, doing that?

Lucy Heintz 36:46

Yes, it is, and that's the thing that's different about batteries since whenever the date was that you mentioned.

Brian Sullivan 36:51

Long time ago.

Lucy Heintz 36:52

A long time ago.

Brian Sullivan 36:53

Even before I was born.

Lucy Heintz 36:54

So batteries have got a load cheaper, and that was 27 percent cheaper just last year alone, and they're forecast to get another 34 percent cheaper. And that's just the ones we see today—and yet battery technology is changing—you are seeing solid state batteries, you're seeing sodium batteries because we needed to find a way not to use so much lithium, and now you're seeing iron oxidization, which is not a technology I fully understand, but it is around rusting and then un-rusting again. But that's going to give you 100 hours of storage, and once you can load those up beside each other, you start to have solutions that are really impactful.

Brian Sullivan 37:30

Can I answer your other question on what the thing that's most important?

Lucy Heintz 37:32

I don't even remember what I asked. Go ahead. So, the thing that's most important, and I think I must be quite a boring infrastructure investor because I don't like betting on innovation. I like betting on long-term longevity of a power project. The revenue piece is the most important piece in terms of the contracts that we're signing and what the balance sheet is on the other side of that and what might happen to it. Because it might feel super comfortable today, but if everything goes pop because there's just too much power and the data centers need less, that balance sheet's going to feel a lot less comfortable. So, what the other side is of that contract and all those contracts that we get excited about, Doug, is super important.

Brian Sullivan 38:03

Well, Doug, that was kind of my point in a roundabout way, which was if you're investing big time and your investors say, "I want to see this projection, this revenue projection," whatever, and all of a sudden in three years everything changes.

Douglas Kimmelman 38:18

Well, and I said contracts, but probably 10 years, that's it. And you know—

Brian Sullivan 38:22

—But 10 years even seems like a long time to lock into something.

Douglas Kimmelman 38:25

Well, not when you're building a 40-year asset.

Brian Sullivan 38:28

Yeah.

Douglas Kimmelman 38:28

And so that's why I think you got to think around the corner that perhaps there's going to be innovation. Perhaps there could be obsolescence of this. Perhaps Elon and Larry Page do shoot their data centers into outer space with solar panels where you don't need any batteries up there. Maybe your water thing—I'll read into that. So in the power side of the equation, as I said, I want to own a commodity that has another use, which is why we have to forecast that in 10 years my customer is gone, and I have to be in a location with transmission access that I can move that power from. Maybe I'm going to be supplying a Walmart, maybe I'm going to be supplying Southern California Edison, because the world is not just about data centers, because we know how technologies changes so quickly. So, I think that obsolescence risk is real, and one has to, as an infrastructure investor, we're supposed to be the lower risk guys. We got to find ways to structure around that.

Brian Sullivan 39:19

Well, Rajit, if somebody says, "I need 200 million bucks," but this thing that you're going to pay me for may be obsolete in five years, I'm not the smartest guy in the world. I'm not sure that's the road I'm going to go down. Is obsolescence a real risk?

Rajit Nanda 39:34

Yes and no, because if you look at the whole AI stack, it's segregated. There is a part of it which is a four, five-year cycle, and then there is a part of it, a significant part of it also, which is a 40-year, 30-year period. So, you need to address it in a different manner. You need to address with different pockets of capital, the

shorter duration one, and you need to address it with a different pocket of capital for the one which is the longer one.

Karl Kuchel 40:06

But this is the tension we're seeing here in the US in places where something like a regulated utility could build a new natural gas power plant with a 40-year outlook. But if that's on the basis of demand from data center offtake, that might be seven-year contracts, might be 10, might be 15. They're looking at that capital investment and saying, "If that customer isn't there for the full 40 years, the cost of that plant goes back onto the retail or the other customers." And so, you've got this duration mismatch in part of—

Brian Sullivan 40:37

We've had that, like if you think of aluminum plants, that they build a big power plant out in Montana for an aluminum smelter. Prices go down, boom. Can almost bankrupt you too.

Douglas Kimmelman 40:45

Well, it sounds like a good problem, negative power prices. In Germany actually lately, they've had a lot of days because they have so much solar and wind where they've had prices have gone negative.

Brian Sullivan 40:57

True. Which sounds amazing. Oh, basically free electricity. But Michael, is it a good thing because if prices are fluctuating that much, that's got to impact the investing market.

Michael Zelkowitz 41:02

But I think to me that comes back to the battery thing. So, we say again, it is fundamentally changing. If you have some ways of storing it, and increasingly you see, again, things move from experimental stage to things that are now larger scale, and I think hopefully you'll see the more industrial country scale, then that should help. In the short term, it creates problems, and I think it is a problem in some situations. But I do think if you take a bet on some of the battery type situation, which again, I think some of the infrastructure we talk about here is pretty compatible with batteries, unlike other usage, right? So, I think then I would be more bullish on it.

Brian Sullivan 41:36

Is that the easiest place to get money right now if I wanted to build a big battery storage facility? What would be the easiest places to allocate capital right now? Anybody?

Douglas Kimmelman 41:45

Well, I think it may be the hardest one to finance because we don't have a 10-year operating history of batteries of are they going to be able to hold that charge? For us, to put billions of dollars of work in a large bet, we've built the largest one, I believe it's the largest one in the world, it's here in California, four hours is all we can get. And to be able to finance that, we've got to buy a proven technology where there's an operating history behind it. There are so many different technologies. I've worked with the Stanford Battery Research team. They've had seven sure things in the last 10 years, and none of them have panned out, and no one will finance—

Brian Sullivan 42:22

—That's a sure thing—

Douglas Kimmelman 42:23

—Any of these new bets. It's a sure thing—

Brian Sullivan 42:24

—0 percent success rate.

Douglas Kimmelman 42:25

Yeah, exactly right. So, I'm hopeful on this, but you go to a bank, you go to a lender, they're not going to lend you a dollar against a new technology with no history.

Lucy Heintz 42:35

So it's not just about batteries, it's about solutions. In the Philippines, we're building, maybe it's bigger than yours, a three and a half gigawatt solar project with four and a half gigawatt hours of batteries. That's a solution that is going to deliver firm power 12 hours a day, same as a gas plant. But it costs more to import the gas now into the Philippines because you've got to buy the turbines as well, and that's delivering that power at a cost-competitive rate. So those solutions are eminently financeable and super attractive because they're really doing something rather than just adding a technology or a thing to a grid and—

Brian Sullivan 43:05

—But they're also advantaged by the fact that they have a lot of sun all the time.

Lucy Heintz 43:09

Absolutely. That's fantastic.

Brian Sullivan 43:11

That helps.

Lucy Heintz 43:11

That's how Rajit is getting three-and-a-half cents. He's got a pretty low cost of capital in that.

Brian Sullivan 43:14

Yeah.

Lucy Heintz 43:15

Because in Abu Dhabi, the project is six cents, I think. But that's the point, is that those are compelling because you have got that solar and wind—

Brian Sullivan 43:23

—And who's the off-taker? Is it the government on that? Or just—

Lucy Heintz 43:25

—Yeah.

Brian Sullivan 43:26
So that's the—

Lucy Heintz 43:27
—20 year PPA, so—

Brian Sullivan 43:29

—So what is the role of governments then here and globally in financing these projects? It's got to be massive.

Lucy Heintz 43:35

So I think it's all about creating that regulatory framework so that you do get that route to market. You do potentially mitigate that risk of obsolescence if you want the power now. You create the ability to sell to other customers so that you have that optionality, as Doug was talking about.

Douglas Kimmelman 43:49

But that's a government subsidy when the contract's with the government, and right now in the current administration, those subsidies here in the United States are being pulled back. So, it's got to be more of a market-based solution, and it's kind of hard to get a market-based solution when you're competing with natural gas at $2.75.

Brian Sullivan 44:05

But we're talking about different places, so it's—

Douglas Kimmelman 44:07

—Very different—

Lucy Heintz 44:08

—Capital requirements are going to be very different.

Douglas Kimmelman 44:09

Very different.

Karl Kuchel 44:10

But here we're already talking about the operating model. I think government has a massive role to play in regulation and permitting to actually enable the delivery of power generation on a more accelerated basis than what we do today. So that's the starting point that the government can definitely be heavily involved in around the world, but certainly here in the US as well.

Brian Sullivan 44:31

Yeah. Well, listen, I'm going to wrap it up. It's an incredibly exciting time. I think we can all—we can fight over the money, and we can talk about this and what's the technology going to be, but can we all just agree, Doug, this is an exciting—I know everything's exciting. I'm sure our grandparents or great-grandparents, depending on how old you were, were pretty cool when they saw the first planes. To me, that is insane, right? Like, a car. The first guy that got run over by a car and killed actually was in 1899 on Central Park West and 73rd Street. The car was going two miles an hour, and I have a lot of questions about how that guy got hit. Literally, it was two miles. I'm not joking. There's a plaque on this place; the first man was killed by a car. I think it's outside the, near the Dakota building. If you're in New York City, check it out. But, it's an exciting time, right? This is exciting. We're going to figure it out. We're going to finance it.

Douglas Kimmelman 45:22

Well, two years—five years ago, coming to this conference, I didn't hear the word electricity once. And AI, probably more than once a year.

Brian Sullivan 45:30

I know. Good for me. I love it. My 25th. Back when I started, the ticket prices were, like, six bucks.

[Laughter]

Douglas Kimmelman 45:38

Now you're having to sleep on a—

Brian Sullivan 45:40
—Now I'm in the Waldorf. I know they're going to kick me out right after this.

Douglas Kimmelman 45:42

No, you're in a van in El Segundo. I know where you are.

Brian Sullivan 45:44

El Segundo would be up because that's next to the airport, so I'm close. But I was actually born right here where you're building. By the way, I just want to give Doug a quick shout-out. Doug is, in honoring his late wife, is building an amazing $170 million tennis center for underprivileged kids, academic tennis center, in

Compton, California. Place of my birth. And doing great work. So, I want to thank all of our panelists, guys. It was fantastic. Really learned a lot. And Michael, Rajit, Lucy, Karl, Doug, I'm Brian, I'm going to go do a TV show at 11 o'clock Pacific. I hope I make it. I'll see everybody. Have a great rest of your day. Take care.