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ESG Now Podcast

“Powering AI: The Nuclear Option”

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Bentley Kaplan:

Hello and welcome to the weekly edition of ESG Now, the show that explores how the environment, our society and corporate governance affects and are affected by our economy. I'm Bentley Kaplan, your host for this episode. On today's show, we are going to get into the lofty plans of big tech companies that are driving the AI revolution. Because while these companies are laying out plans to build more energy-intensive data centers, they're also hoping to meet pretty ambitious net-zero targets. But getting more of the right type of energy that is both low on emissions and high on consistency is proving to be a little tricky. And in that trickiness, some are seeing a tempting foothold for a new type of nuclear reactor. So, thanks for sticking around. Let's do this.

In the middle of the Susquehanna River, just downstream from Harrisburg, the state capital of Pennsylvania, there's an island. Despite what you might think, it's not actually three miles long, even though it's called Three Mile Island. That's a story for another day. Three Mile Island rose to infamy in 1979 after the partial meltdown of a nuclear reactor that released radioactive gases and iodine. It resulted in a local evacuation, but no immediate deaths or injuries. The incident sparked multiple investigations and a presidential commission. The meltdown effectively triggered a shift in sentiment around nuclear power, and 1979 became a watershed year in US energy. No new nuclear facilities were built for decades. But the story of Three Mile Island may be getting a new chapter courtesy of Microsoft and Constellation Energy, because the tech company has signed a 20-year deal starting from 2028, effectively Constellation Energy's largest power purchase agreement or PPA.

This would happen only after improvements to the facility and is still subject to regulatory approval. And one of the main reasons for dusting off the nuclear station is to meet rapidly rising energy requirements from Microsoft's AI operations. You see, for all the flash and panache of AI, it doesn't actually run on just dreams and lines of code. It's very much tethered to data centers, massive warehouses of networked computer servers and related hardware. And these servers are storing, processing and distributing huge amounts of data, and they're doing it constantly, 24/7. And it's not just the servers themselves that are drawing power, but necessary air conditioning and cooling systems, as well as uninterrupted power supplies, UPSs and backup generators to ensure that power is delivered constantly. To give you an idea, data centers used between 10 and 100 times more energy per square meter or square foot if you prefer, than a typical office building.

And if we're looking at energy consumption by unit area or energy density, data centers can outstrip even things like heavy industrial manufacturing because of how tightly packed their servers are. So tech companies are needing to find new sources of energy and in a hurry if they want to capitalize on the rising demand for AI. But not only are these companies needing to find more energy, but they're

also trying to find low-carbon energy because the key players in this market like Alphabet, Meta, and Amazon, have also set net-zero emissions targets. Talk about threading a needle or more specifically, let's get my colleague Yoon Young Chung out of our Boston office to talk about threading a needle. Yoon Young covers the software and services industry and has been closely following the rise of AI and what it means for the energy requirements and climate ambitions of big tech firms.

Yoon Young Chung

These tech companies' cloud consumption has already been driving exponential data center growth with AI acting as a growth multiplier. Meanwhile, these tech companies remain committed to achieving their net zero plans. Microsoft, Alphabet and Meta aim to reach net zero emissions by 2030 while Amazon is targeting 2040. So, if you look at their net zero plans, their primary strategy for reducing scope 2 emission involves purchasing carbon-free energy like renewables. These companies have signed clean energy power purchase agreement or PPAs to power many of their assets including data centers. However, AI requires computing power from thousands of servers housed in data centers, which need massive amounts of energy,

Bentley Kaplan

Right. So these tech giants were already starting to ramp up energy demand for cloud computing, but AI has taken things to another level. And that's made it difficult for tech companies to one, source new energy and two, for this new energy to be low on emissions. Yoon Young mentions PPAs, basically where companies will buy future energy output from a utility. Much like Microsoft is planning to do with Constellation energy on Three Mile Island. And setting up PPAs from renewable sources – even those connected to different grids – means that tech companies can effectively feed their energy-hungry AI expansions while still meeting net-zero goals. But as Yoon Young told me, it looks like renewable PPAs are getting scarce. Alphabet, Meta and Amazon have all reported recent increases in their carbon emission intensities. To meet their rising energy needs, tech companies can of course fall back on a more traditional power mix, which could include both coal and natural gas depending on where they're located. That would definitely dent their net-zero plans.

They could also more proactively support the build-out of more wind and solar facilities. Or what seems like something out of left field, they could make like Microsoft and bring some retro-nuclear energy back into the game. And weighing up nuclear with its emotive history against wind and solar, the two fastest growing renewable sources, you might think that the choice is obvious. But as my colleague Mathew Lee out of our New York office told me, wind and solar as options to power data centers specifically, would not be without notable drawbacks.

Mathew Lee

This presents two complications. The first is the intermittency issue of renewables even with storage options today. But secondly is the delays with trying to interconnect a project. There's a very long queue right now, even if you have all the agreements and licenses in place to even interconnect to the broader grid. And so as this gets to a more five-year type of a wait, then the viability perhaps of some of these other options like nuclear that are not going to happen in the next two to three years either factor into the calculations of these tech companies. So the best option typically with conventional larger nuclear facilities is to try to extend their useful life right now. At the end of the day though, there's only so many former nuclear plant sites, so that really limits where you can be building or rather sourcing your power from these locations. And so that's where small modular reactors, SMRs enter the picture.

So compared to the conventional boiling water reactor we're used to which is about one gigawatt plus size of capacity, SMRs are usually between 10 megawatts to 300 megawatts. And due to some engineering innovation, they're actually easier to build potentially just right in a factory all with the same specification, hence the modular moniker in the name.

Bentley Kaplan

Right. So wind and solar aren't always on, and having a big enough battery storage system to compensate for night, cloudy or windless conditions isn't always going to be feasible or cost-effective. And building out new solar or wind farms takes time. AI might be fast and fancy, but permitting requirements are not. And it's these sorts of drawbacks in conventional renewable energy that is making nuclear energy for all of its own caveats more appealing. And we've spoken about nuclear energy and its caveats on the show before. Most recently in June this year when Mike sat down with our colleague Elchin Mammadov. In true Mike-style, the episode is called “How I Learned to Stop Worrying about Nuclear Energy.” Check it out after this to hear more. The key points that stuck with me from that discussion are that nuclear energy is viewed quite differently in different markets. And that some of the main barriers to its growth are the sizeable upfront capital needed for large-scale, boiling water reactors and the relatively untested capability of smaller modular reactors.

But as more mainstream renewable capacity is getting a little more scarce, the balance of interest in nuclear may be tipping, at least in some places. As Mathew mentioned, extending the life of existing large-scale reactors or dusting off inactive ones like on Three Mile Island where Microsoft is working with Constellation Energy, might be the quickest and cheapest way to get this done. But small modular reactors or SMRs are another option. They're scalable, more flexible, and much smaller than traditional reactors. The advocates also point to more inbuilt or passive safety measures to prevent, among other things, overheating, which is critical to reducing the risks of a meltdown which is something you really do want to avoid. Some SMR designs also allow for the reactors to be stored underground, which may lessen the impact of a radiation leak in the event of something like an earthquake.

And as Mathew would tell me, all of this makes SMRs a niche, but appealing option for several applications. But the key consideration is whether you're planning to deploy SMRs to meet energy requirements or to get net-zero timelines back on track because for Mathew critically, these are not the same thing.

Mathew Lee

To me this is definitely low carbon, but perhaps not net-zero aligned. I think again, in theory the use case of an SMR can be for industrial use and outside of the industrial use case, co-op utilities, more rural areas, anything with a decentralized power grid. This seems like a good concept. I think there's a couple of considerations for investors as well as potential adopters alike. One is if you're in it for emissions reductions, you need to think about the time when this will come online. We know that every emission reduction available today is a lot more valuable. And if you're only doing your emissions reductions starting from 10 years from now onwards, it's a much steeper curve you would have to bend versus more meeting a future power need.

I think that's a very big trade-off in terms of developments, large utilities, putting this in their resources plans now. Seeing that pop up definitely puts it on a pathway towards being operational. Duke Energy, for example, in their most recent resource plan has 600 megawatts actually of advanced nuclear, but coming online 2034 and 2035. So still a decade away for some of the large US utilities involved in this.

Bentley Kaplan

Right. So the time needed to get SMRs up and running means they're not the perfect candidates to spearhead net-zero strategies on tight timelines. But they might be able to help. And as we reckon with rising emissions, not only in data centers but a whole chunk of other activities, climate-focused investors may be looking at any help that's on offer. Because if we zoom out a little, the challenge of an economy-wide energy transition isn't confined to securing low-carbon energy for new use cases like data centers. Some might well argue that a far more pressing challenge is replacing emissions-intensive energy sources that are currently being used in hard-to-abate sectors. And there are aspects of nuclear power that could support some of these more substantial challenges. So successful pilots of SMRs for data centers might help to build a broader use case or to support more innovation that yields improved SMRs. So to close out this episode, I asked Mathew how investors may want to think about risks and opportunities, the players operating in the market. And whether this growing interest may have implications for the broader nuclear value chain.

Mathew Lee

There are still a lot of regulatory as well as investment complications that need to be navigated. It's very expensive. This is so early, still not commercial yet. There's no agreed upon design that's the most competitive. And so there's going to be some winners and losers likely in terms of which design ends up being commercially viable. The waste issue is not going to be as big of a footprint as conventional nuclear would require. But nevertheless, there still will be waste produced, and we don't really have today a good solution yet for storing nuclear waste in general. So I think there's a lot of regulatory uncertainty too just because this is a new type of projects that's being proposed. The risk I think is still quite formidable, and perhaps that's why we see the different arrangements in terms of who's funding the leading companies in this space.

Some private startups, but you also have some of the conventional industrial players like GE, Hitachi, even Rolls-Royce. But you also have the startups, Oklo, TerraPower, NuScale, X-energy, Kairos. Some of them are publicly traded, others are smaller private companies. And then more broadly, there's of course a whole value chain that stands to benefit if this takes off. So uranium mining, refining, enrichment. We know that there's also an energy security element here in terms of the US interest in developing that industry out. So of course, the more use cases of it through SMRs would help develop this industry. So if you're a company like General Matter, Centrus Energy that works more in uranium or Westinghouse with nuclear equipment, I'm sure they're watching these project developments very closely.

Bentley Kaplan

And that is it for the week. A massive thanks to Yoon Young and Mathew for their take on the news with the sustainability twist. And I also want to say thank you very much for tuning in. If you like what we're doing, then let us know. Drop us a review, rate the show on your platform of choice and tell a friend or colleague about this episode. Thanks again, and until next time, take care of yourself and those around you.

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