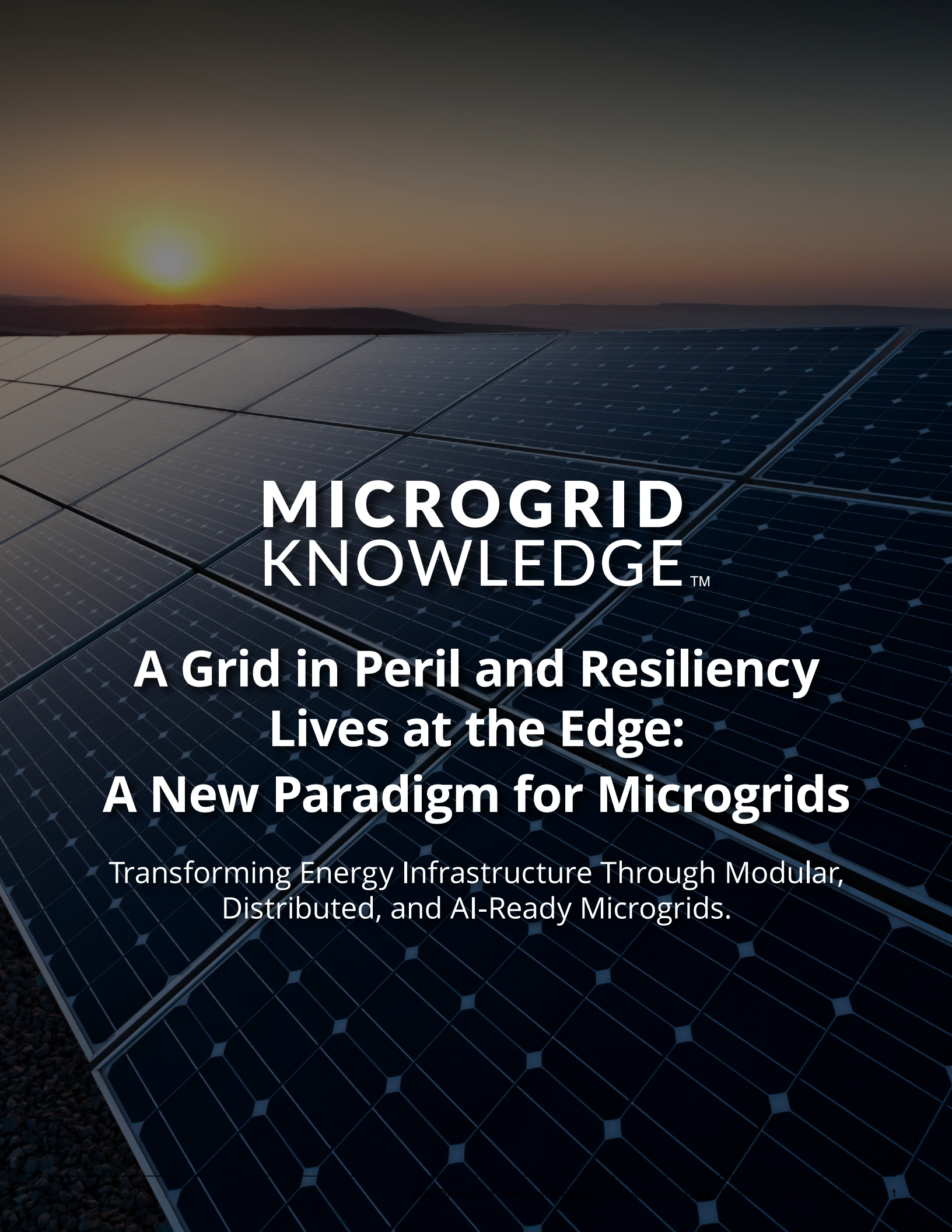

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A Grid in Peril and Resiliency Lives at the Edge: A New Paradigm for Microgrids

Transforming Energy Infrastructure Through Modular, Distributed, and AI-Ready Microgrids.

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GETTING CLOSER TO THE EDGE: HOW MODULAR AND DISTRIBUTED GENERATION CAN TRANSFORM POWER INFRASTRUCTURE

Insights from Rehlko CEO Brian Melka looking at C&I power demand trends within and without AI and data centers.

BY ROD WALTON, MICROGRID KNOWLEDGE MANAGING EDITOR

Want energy resiliency? Get closer.

That's the tune that more commercial and industrial customers are telling not only the power utilities which traditionally met those prime power demands, but also the refrain also hums in the ears of distributed energy and microgrid developers and generation partners alike.

Co-location and on-site power? C'mon now, get closer.

"What is happening in real time right now is that the utility grid model hasn't changed in 135 years, and the reality is that model is no longer going to work," Brian Melka, president and CEO of industrial and home generator provider Rehlko, formerly Kohler Energy, told Microgrid Knowledge in an exclusive interview.

"Whether it's aging infrastructure, considering that 60% to 70% of that infrastructure needs to be replaced, and demand is changing," Melka added. "What's driving this is for energy production, consumption and management much closer to where the demand is."

THE CENTER IS CRUMBLING BUT THE EDGE IS HOLDING

That driving force is the commercial and industrial customer, whether its data centers, industrial computing and manufacturing facilities or even residential consumers seeking more control over their own power resiliency. Data shows that long-distance transmission infrastructure is in desperate need of upgrade, and a build-out at the edge of the grid could help avoid inefficient costs accruing down the road.

Wisconsin-based Rehlko is an old hand at distributed generation, despite the new name. The larger Kohler Industries spun off and rebranded its generator business last year so the parent company could focus on its core home product lines.

Rehlko CEO Brian Melka

The Kohler brand of generators and home power solutions is more than a century old, and why not change the name because the game is evolving into something brand new and a nod to the past at the same time. Centralized utility generation is still a marvel but honestly it was built and has remained a 20th-century tool for 20th-century problems.

Nearly everything must change at the edge and nearer the meter. Backup power can evolve into prime power, the grid interconnection can evolve into off-grid and distributed, decentralized energy choices could become more of the norm than the exception.

"Power plants hundreds of miles away—we don't believe that is the future," Rehlko's Melka said. "Right now, speed-to-power is a No. 1 issue in a lot of industries, especially data centers. Speed-to-power is a problem, a real challenge."

IT'S HARDLY JUST AI AND EVS

Data centers currently consume close to 5% of national utility-scale electricity generation. If nothing changes—meaning that utilities and developers don't match up by building more power capacity of diverse resources such as natural gas, nuclear and renewables—that average will be closer to 25%.

Some call this scaremongering and hype; some call this bubble building by investors. A rising tide of consensus, however, calls it an immediate and inevitable challenge that will only get worse if not faced and solved sooner than later.

"If you take nothing else away, take this: This world and this country will get more electrified," Aamir Paul, president of North America operations for global energy management giant Schneider Electric, said during his company's Innovation Summit in Las Vegas last month.

"In 2025 industrial electricity demand surges 15%," Paul pointed out. "The U.S. must absorb 1,000 terawatt hours of added demand in the next 10 years."

If the nation cannot do that, it must ready itself for widespread energy unaffordability, load shedding and failure to keep up with technology supremacy on the world stage. Once again, previous long-term load projections predicted flat load growth, so these futurists can be wrong.

But what if they are not? Energy leaders must get closer to the problem and figure it out. We may not know who's right for 10 years.

Rehlko-Kohler has worked with Schneider Electric and many other partners on distributed energy solutions, so together they have reached an agreement on what might be coming.

Even if a portion of AI projects are purely hyped, it's just a part of all the other rising demand scenarios.

"Power is going up 1% annually for the average home," Rehlko CEO Melka pointed out. "That doesn't sound like a lot until 10 to 15 years go by. And we haven't even hit that yet.

"AI is still a small percentage of overall power," he added. "There is the underlying demand coming

from cloud-based computing, other factors in the commercial and industrial space, and you still see double-digit increases annually even before you add in AI."

OPPORTUNITY KNOCKS FOR MODULARITY AND STANDARDIZATION

Rehlko and its financial backers are investing in the idea that the rising demand scenario is ever closer. The company has acquired United Kingdom back-up power firm The Wilmott Group and is collaborating with Toyota Motor North America to develop a hydrogen-power fuel cell system for a hospital in Washington state.

Image credit Rehlko

Getting closer also means getting smaller or at least building out energy capacity in layers of modularity. Standardization, modularity and co-location are key goals in the energy transition.

"We're driving modularity," Melka said. "A 1-GW data center doesn't fire up as 1 GW—it fires up as 50 MW, then another 50 MW."

This means more power in a smaller footprint, a shift that is happening with Rehlko, Cummins Inc. and other gen-set producers such as Innio.

"Essentially I want Lego blocks," Rehlko's CEO added. "How do I build modular units as we scale power on the campus over time?"

Every step gets the industry closer to an answer.

GENERATE OR PERISH: PREPARING FOR THE DISRUPTIVE POWER HUNGER OF ARTIFICIAL INTELLIGENCE

IDSO partnerships are revolutionizing the dental industry, offering dentists a unique opportunity to build generational wealth while retaining control of their practices. Discover how these alliances can unlock equity gains and transform dental practice growth

BY ROD WALTON, MICROGRID KNOWLEDGE MANAGING EDITOR

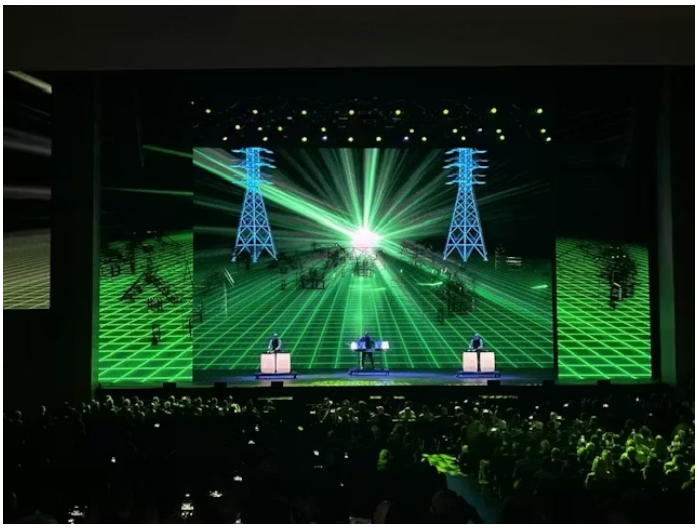
If you're a dinosaur, you might want to skip this story. If you're a dinosaur that wants to survive, read on.

We only mean the prehistoric reptile in a metaphorical sense, of course, as it pertains to the commercial, industrial, energy and readership sectors. The meteorite has already arrived so let's dive in.

The projectile forcing a choice between economic, political and fiscal survival or extinction is called artificial intelligence. We can discuss whether part of this AI mania is hype later, but even if projections of future demand are only partially correct, the fireball from space is supercomputing capacity that forces competition between nations and companies, with those skeptics buried in the dust of economic and technological irrelevance.

"If you don't like change, you're going to hate extinction," said Raj Subramaniam, himself only the second CEO in the history of logistics giant FedEx and a keynote speaker at the Schneider Electric Innovation Summit North America earlier this week at the Fountainebleau Resort in Las Vegas.

READY OR NOT, THE AI REVOLUTION IS HERE



SE Innovation Summit photo credit Rod Walton

Subramaniam knows a thing or two about supply chains and keeping pace with change. FedEx is only 50-something years old, but it has grown from an American startup competitor to the U.S. Postal Service into a global giant with hundreds of airplanes and thousands of cargo vehicles that move millions of packages every day.

And even he was caught off-guard by the rise of AI, the phenomenon which one of superchip maker NVIDIA's top creative leaders will explain later.

For Subramanium, FedEx and any number of companies hoping to stay alive over the next few decades, AI is a reality that grows more real and demanding every day.

"I didn't know the AI revolution was coming, but it did come," the FedEx CEO admitted.

Hype? Tell that to the meteorite of technological evolution coming to sweep away the old and reward the adaptable. Schneider Electric CEO Olivier Blum and James Lee, partner at private equity giant Blackrock Global Infrastructure Partners (GIP) both pointed out during the Innovation Summit that a majority of major commercial and industrial companies are utilizing generative AI in their operations. A report this year by the St. Louis Federal Reserve echoes the consensus that corporate and personal use of AI agents is already skyrocketing beyond even adoption of the personal computer decades ago.

HYPERSCALE ACTIVITY IS PROOF POSITIVE THAT GENERATION IS GOLDEN

And this AI adoption increases the pressure on the energy grid to a point where the old utility model, already under the stress of aging equipment without transformational upgrade, cannot keep up with the possibly hundreds of GWs in new capacity which will be needed in the next decade.

"We firmly believe it is not a bubble," said BlackRock GIP's Lee. "There are strong fundamentals, first in the rapid acceleration of adoption. . . That adoption is driving real revenue."

SE Innovation Summit photo credit Rod Walton

And it is driving hyperscalers such as Microsoft, Google, Amazon, Meta and Oracle to get off the energy sidelines and invest big in support for next-generation capacity both on the grid and possibly off-grid. These new power plants could be microgrids or co-located power plants, which the data industry sometimes calls energy parks, powered by natural gas and next-gen nuclear resources.

ON-SITE POWER BY ANY OTHER NAME IS STILL AS RELEVANT

None of these small modular reactor projects have happened yet, but they are moving closer to reality with the momentum of a well-positioned asteroid of change called AI. The old utility model is not going to work in this new world, and survival of the fittest means flexibility and forward investment by digital infrastructure entities.

"They are not calling them microgrids but calling them energy parks," noted Jana Gerber, North American Microgrid sector president for Schneider Electric, in an exclusive interview with ***Microgrid Knowledge*** at the Innovation Summit North America.

"The concept is very adaptable (microgrids providing prime and backup power for data centers and AI factories)," Gerber said. "We must shift the concept of DERs (distributed energy resources) so it's not going to be just solar. . . We're working on early stages of what projects are going to look like and what is the DER mix that will be required."

For the future hyperexpansion of AI and cloud-based facilities in this Industrial Compute Age, that mix could be gas generators, with renewables and battery storage and eventually maybe even SMR nuclear. Everything is on the table.

To lay out the options, it might help take a step back and understand what AI is and how it is radically different in terms of data center computing. Who better to do that than Rev Lebaredian, vice president of Omniverse and Simulation Technology for leading processing unit maker NVIDIA.

Maybe you've heard of it? N-V-I-D-I-A. First company to reach a $5 trillion market valuation, the current and dominant chip and graphic processing unit (GPU) player in the era of AI, and an overnight success story that took 30 years to develop.

Lebaredian was a visual effects maestro previously working in Hollywood before he joined NVIDIA and its founder, Jensen Huang, to create the same level of graphically fantastical worlds for gaming chips. That seemed good enough for a time, but Lebaredian, Huang and his leadership team wanted to take the highest performing computing a quantum step up to solve major challenges in the physical world.

"Our goal was to build special computers to solve problems that were nearly impossible," he recalled.

GAME CHANGER IN DEEP LEARNING AND AI SUPERCOMPUTING

And eventually they produced the most powerful chips possible, including at least one so powerful there was no computing capacity to handle it. So they waited, and waited, about seven years until research at the University of Toronto achieved real breakthroughs in the potential of supercomputer-level deep learning, neural networks and natural language processing. It certainly didn't start with ChatGPT.

"Finally someone figured out what to do with all that computing power," Lebaredian recalled. "This is going to change everything."

To empower that change the technology requires AI factories, which are not really the same thing as data centers. In Lebaredian's illustration, a data center is essentially a warehouse or storehouse which can be accessed with relatively minor computing power.

An AI factory is just what its name implies—the power-hungry manufacturing and refining center where all of that data is intensively distilled into something useful on a massive scale, such as gaining incredible insights into healthcare or industrial processing or facility operations and maintenance, so far beyond writing an easier school report that it becomes quaint to think of AI that way.

"You put into a factory all the raw materials and energy, and all the raw materials are reconfigured into it and out comes a refined production that is better than all of its parts," he said. "With the factory you want to maximize the density as much as possible."

SITTING ON A VOLCANO AT THE FAULT LINE OF ENERGY SUPPLY AND DEMAND

And that's where a large part of the next revolution in energy will need to be deployed. Currently, data computing racks consume energy capacity at about 140 kW per rack, but that is likely going to 1 MW per rack by 2027 and producing the possibility of 1-GW AI-enabled data computing centers by the end of decade. One gigawatt is equal to the average nuclear reactor unit.

The realization, shared not only by companies but also by the Trump Administration, political rivals and leaders throughout the world, is that you cannot lose the AI race. Winning that race, or keeping pace, will demand energy production at a growth rate the grid has not handled since its early days.

Mark Christie, former chairman of the U.S. Federal Energy Regulatory Administration said that electricity load has been lately growing five to six times faster than the commissioning of new generation capacity. This warp speed of demand over supply could produce a real human crisis in coming years, from energy unaffordability to access to reliable energy for the individual.

"We are sitting on a volcano," Christie said during the second day Innovation Summit keynote at the Fountainebleau, quoting an old line by French writer Alexis de Tocqueville about his country on the brink of a revolution. He worries that the same thing could happen if America doesn't get a handle on how to adequately power energy-hungry AI and a growing population.

"The political volcano could be from energy prices, and we've got to address that," Christie added. "We cannot forget that what retail customers are paying is going to be a huge part of it. If we don't, the volcano could blow up and it could be bad."

Enter microgrids and energy parks, or whatever the data industry decides to call them, to the rescue. Building out capacity at the edge of the grid or even off-grid could circumnavigate interconnection and regulatory delays, but even so the impetus is on the business, political and technological contributors to collaborate and figure out how to balance supply and demand so it doesn't come down on us like space rock.

Utilities are certainly not ignorant of this, and they are growing capital expenditures by 60% or more in recent years.

"That investment is happening but that investment by itself is not enough," BlackRock GIF's Lee pointed out. "We need an all-of-the-above solution on baseload . . . Gas plants with carbon capture, next-gen geothermal and all forms of nuclear. We'll need all of these to be able to meet the task at hand."

The world as we know it may depend on it, and that is clearly not artificial hype.

THE MACRO GRID DILEMMA: EXTREME WEATHER MAKING UTILITY T&D CHALLENGES EVEN WORSE

Warnings from JD Power, the American Society of Civil Engineers and the federal EIA are purely statistical but paint a vivid picture of the grid's inadequacies for meeting future challenges.

BY ROD WALTON, MICROGRID KNOWLEDGE MANAGING EDITOR

Still think the utility grid might be able to handle what's coming both in rising energy demand by digital infrastructure and increasingly devastating weather impacts?

New reports coming from several fronts indicate that the utility grid cannot overcome what it's dealing with now, much less meet the intense challenges of the near future. These kinds of worsening statistics might make the value argument for more distributed energy, on-site power and microgrid deployments at the commercial, industrial and residential customer levels.

In fact, microgrids have stepped up and proved their worth in the wake of major storms in the U.S. and Jamaica.

First up, the federal Energy Information Administration recently reported that U.S. electric power interruptions extended to the longest number of hours per customer in the past 10 years. The electric service interruptions caused by weather events and other outages in 2025 averaged about 11 hours per every customer, according to the EIA.

These outage durations were the most hours of interruption of any year in the last 10, and more than 50% higher than 2023, the EIA report says. Hurricanes Beryl, Helene and Milton account for 80% of the hours without electricity last year.

And yet the EIA chart shows that while 2024 was a benchmark year in the worst possible way, it hardly qualified as an outlier. Hours of electric power interruption have been rising steadily since 2014, according to the federal statistics.

Eastern seaboard states such as Florida, South Carolina and North Carolina experienced the highest level of electric power interruptions due to major storms. Microgrids were put into work in the Carolinas and Florida to alleviate some of the power interruptions at the edge of the grid.

Statistics from consumer surveyor JD Power show that the struggle is going more extreme every year. In JD Power's latest Utilities Intelligence Report, nearly half of utility customer respondents say they experienced a power outage in the first half of 2025.

Forty-eight percent of those outages were caused by major weather such as hurricanes, flash flooding, ice storms, fire or other weather. Some of these extreme weather events were so intense by nearly one-fifth of customers say they had to evacuate their homes, according to JD Power.

Overall, property damage from extreme weather caused at least $131 billion in losses globally for the first half of 2025, according to German-based insurer Munich RE.

"Disasters like the one (wildfires) in Los Angeles have become more likely due to global warming and they teach us a very important lesson: people, authorities and companies must all adapt to new circumstances," Thomas Blunck, member of the Board of Management at Munich RE, said in a statement. "The best way to avoid losses is to implement effective preventive measures, such as more robust construction for buildings and infrastructure to better withstand natural disasters. Such precautions can help to maintain reasonable insurance premiums, even in high-risk areas."

Earlier this year, the American Society of Civil Engineers released its quadrennial Infastructure Report Card, downgrading the U.S. energy sector to a grade of D+. Upgrading a 20th century power grid to 21st century needs and standards could require close to $1.9 trillion in near-term capital investment, according to the ASCE report card.

One big problem is that utility and energy infrastructure investment, while growing in recent years, is still lagging by some $580 billion in needed upgrades, the ASCE said in the March release.

"An increase in electric vehicles and a rise in data centers will demand 35 GW of electricity by 2030 alone, up from 17 GW in 2022," reads the energy snapshot of the ASCE Infrastructure Report Card. "This rapid acceleration, compounded by federal and state net zero greenhouse gas emission goals, means utilities will need to double existing transmission capacity to connect new renewable generation sources."

And those recommendations don't even take the extreme weather impacts into account.

HOW MICROGRIDS CO-LOCATED WITH DATA CENTERS AND IN PHASES CAN MEET ENERGY DEMAND

Data centers and utilities can meet rising energy demand by building facilities near energy sources such as microgrids. It's also more cost-effective to deploy microgrids using a multi-year approach that helps transition data centers to using developing resources such as small modular reactors, industry members say.

BY LISA COHN

For A.J. Javan, founder and CEO at Qoob, building smaller data centers powered by local energy–including microgrids– is an important strategy for meeting the anticipated high energy demand from data centers and Artificial Intelligence (AI).

Worldwide, data center electricity demand is expected to double by 2030 to approximately 945 TWh, with AI accounting for much of the increase, according to the International Energy Agency.

"If you can develop a power plant and data center at the same location, you don't have to spend on the delivery of power far away where the data center is located," he said. His company

develops smaller-sized data centers powered by "dynamic" microgrids, said Javan.

Under Qoob's approach, grid-connected microgrids, consisting primarily of renewable resources and storage, can island many times a day to avoid high grid prices, thereby lowering data center energy costs.

AVOIDING EXPENSIVE UTILITY POWER WITH BATTERIES

"You are behind the grid connecting to batteries instead of having to buy expensive power. This is reliable and reduces stress on the grid," Javan said. The company stores grid power in a battery system, then releases it to data centers when grid power is expensive.

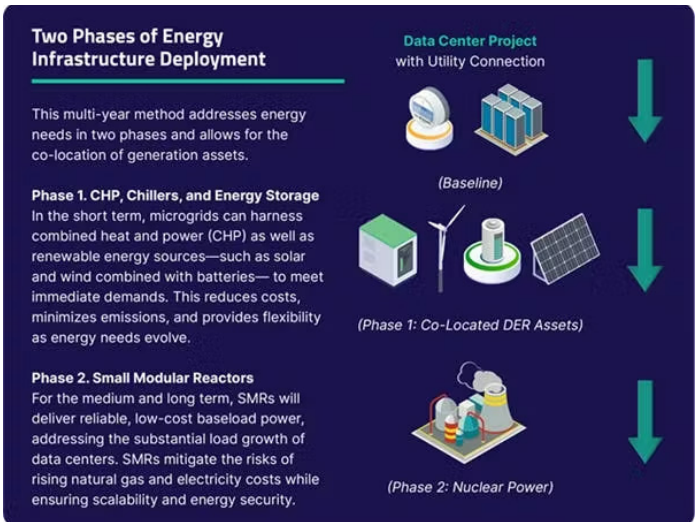
Qoob is now building a data center, co-located with a solar microgrid, in The Dalles, Oregon, close to an existing Google data center.

Qoob boasts it can provide predominantly green power at costs between 30% to 35% lower than grid power, he claimed.

Qoob is not the only industry player touting the advantages of deploying microgrids to solve data center energy demand challenges.

A MULTI-YEAR APPROACH TO MEETING DATA CENTER ENERGY NEEDS

A report from microgrid modeling technology firm Xendee, "A Guide to Meeting Energy Demand for Data Centers with Distributed Energy and Future Small Modular Reactors, " found that deploying microgrids–including combined heat and power (CHP) and distributed energy resources (DER)–for data centers using a multi-year approach would reduce reliance on utility electricity and lower costs.



A single-step approach that involves utilities upgrading their distribution systems and power plants to meet increasing loads fails to account for sustained demand growth or developing energy technologies such as small modular reactors (SMR), said Michael Stadler, chief technology officer at Xendee, which provides microgrid modeling software.

In addition, increasing power demand requires expensive upgrades to utility cables and transformers, and this can't be done quickly, he said. New transmission projects take about seven to 10 years to develop, approve and construct.

COULD EXPENSIVE UTILITY GRID INVESTMENTS BECOME STRANDED?

Because of these delays, costly grid expansions could become stranded investments for utilities.

While SMRs won't be available for five to 10 years, a multi-year approach could provide a pathway to deploying them when they are available, Stadler said.

Under this approach, current energy needs would be met through existing DERs—such as renewable generation, battery systems and CHP. Second, as SMRs become viable, they can be integrated to provide scalable, low-carbon baseload power. "This approach addresses immediate challenges while future-proofing data centers for sustained growth," he said.

The DERS provide predictable operating costs, offer immediate economic benefits and serve as a hedge against price volatility.

The study found that relying on utility power would be the most expensive choice. In one scenario, using utility power yielded a levelized cost of energy (LCOE) of

$0.4704/kWh, compared to a multi-year scenario that phased in resources. That option produced an LCOE of $0.0383/kWh.

THE VALUE OF MICROGRID FLEXIBILITY

Brian Nelson, US Renewables Segment Manager at ABB, a technology company focused on automation and electrification, agreed that microgrid flexibility is an important characteristic that can meet increasing power demands.

"Loads change, electricity rates change, the grid changes and technology never stands still. Microgrids enable flexibility to ensure the needs of customers can be met in perpetuity," he said. Microgrids can also help reduce power bills by avoiding demand charges, maximizing renewable energy utilization and providing grid services, he said.

John Glassmire, vice president for digital enablement and transformation in North America at Hitachi Energy, said data centers should take a multi-pronged approach to meeting rising energy demand, and that microgrids are an important part of that strategy.

THE ADVANTAGES OF PROVIDING UTILITY GRID SERVICES

Also key to meeting growing energy demands are transactive solutions that can provide grid services, especially in areas where the grid is congested. Glassmire pointed to regulatory advances such as FERC 2222 that allow DERS to offer utility grid services, including load flexibility, battery storage and distributed generation.

Focusing on both sides of the meter is also important, Glassmire said.

"As AI and advanced analytics continue to accelerate into planning and operations, modern evolutions of microgrids - such as energy hubs that provide value on both sides of the meter - can play a role in future-proof, comprehensive investments at overall lower cost," Glassmire said.

Not only do microgrids, deployed over a number of years, reduce costs. They help data centers meet decarbonization goals and boost the efficiency of investments, said Stadler.

"This approach represents a paradigm shift in microgrid planning, offering a flexible, scalable blueprint for sustainable and resilient energy infrastructure tailored to both high-cost and low-cost regions," he said.

WHY RESILIENCY REIGNS AND OFFERS STRONGEST MICROGRID VALUE PROPOSITION

Leaders from Xendee, Eaton and ChargePoint detail how collaboration at the edge is revolutionizing electrical infrastructure and distribution.

BY ROD WALTON, MICROGRID KNOWLEDGE HEAD OF CONTENT

What's the biggest and most vital "R" in electricity service and delivery?

Rates? Certainly, that's a big one, as utility customers struggle with costs associated with an increasingly beleaguered transmission grid system. Price signals matter but they fluctuate.

Renewables? Of course, wind and solar are a growing and essential part of the evolving generation mix. But decarbonization cannot rely on renewables alone. Natural gas, nuclear, and battery storage provide lower-emission alternatives to the historically coal-dominated utility resource portfolio of the past. Multiple pathways exist to help us move closer to net zero for the future.

Resiliency? Ding-ding-ding: There it is, the thing that matters most. Customers don't like higher rates and may not care about diverse

fuel mixes, but nothing riles them up like grid outages or load shedding.

Resiliency, that's the trillion-dollar word in the energy transition. You can clean it up and mix it up, but don't mess it up.

Utilities do an incredible job to bring electricity on a massive scale, but only a few years ago they were predicting flat load growth and now we see the data centers, industrial electrification and the race for artificial intelligence leadership pressuring the 20th century system more than ever.

COLLABORATION IS KEY TO MAKE THE GRID EDGE STRENGTHEN THE WHOLE

Photo of the Eaton booth at RE+. Image credit Rod Walton

Enter the microgrid and distributed energy resource (DER) solution.

"Microgrids and on-site power relieves a lot of businesses of having to have their business strategies and execution tied to how well the utility is going to treat them," Adib Naslé, CEO of microgrid design and analytics modeling firm Xendee, said during an interview with Microgrid Knowledge at last week's RE+ conference in Las Vegas.

"It's one of those situations where there are a lot of wins in it for a lot of people," Naslé noted about the prospect of on-site power directly supplying energy for business operations, whether its electric vehicle charging, manufacturing or AI computing. "The ship has sailed on distributed energy for electrification of industry or transportation.The business case is just too compelling, and the resiliency needs are inherent."

Xendee recently announced its microgrid collaboration with energy management technology firm Eaton Corp. as RE+ was getting underway at the Venetian Resort and Caesar's Forum. The partnership with Eaton will further empower Xendee in offering a full-suite solution for microgrids utilizing the company's predictive control software and DER modeling, coupled with Eaton's own control hardware and expertise.

The campaign to meet the so-called Industrial Compute Age is clearly centered around teamwork making the dream work. Eaton also recently announced a digitalization collaboration with Autodesk.

Eaton was also there at its RE+ booth last week joined by leadership both from Xendee and EV infrastructure partner Chargepoint.

"To really scale electrification, you need collaboration across industries," Paul Ryan, vice president and general manager of energy transition at Eaton, told Microgrid Knowledge. "I don't believe any company can do this on its own."

Microgrid developers are recognizing that. Schneider Electric has created its EcoStruxure Microgrid Flex program to standardize and streamline project development, bringing in partners such as Sprocket Power, Pisgah Energy and Azzo.

TAKING THE DIRECT CURRENT ROUTE TO DISTRIBUTED ENERGY RESILIENCY

Data centers certainly are the game changer on a macro level, with some 100 or more GWs of additional capacity expected to come online in the U.S. alone by the early 2030s. But industrial and transportation electrification connected to co-located or on-site power is another spoke in the wheel to create greater resiliency durability at the edge of the grid, if not completely disconnected from the main grid.

Earlier this year, Eaton and EV charging solutions provider ChargePoint detailed the beginnings of their collaboration to unite both on-site power for charging infrastructure as well as intelligent, AI-ready power management.

Chargepoint has worked itself into position as an "end-to-end enabler" of the complete EV charging ecosystem. This will include direct-current (DC) charging and vehicle-to-everything (V2X) capabilities.

It makes sense on multiple levels, experts say. The points of distributed generation, such as solar and battery storage, are DC, while the points of use are also DC.

ChargePoint CEO Rick Wilmer said the discussions with Eaton on a better and more energy-efficient path forward to DC and V2X go back years and now aim forward by decades.

"We're integrating charging in a more technologically advanced way with the grid and with vehicles, and by doing so we can unlock all kinds of value," Wilmer said at RE+.

By shifting the charging dynamic from AC to DC and filling it with DC-DC, the power of a charging cabinet can be expanded beyond 1 MW.

"The amount of cars you can charge, in a limited footprint, goes way, way up," Wilmer added. "You can save 30% on capital expenditures, reduce operational expenditures 30%. . . And in 30% less physical footprint."

Once more fully realized on the ground, this could elevate the value argument for electrification with heavy-duty vehicle fleets as well as more long-distance drivers.

"That is what we believe is the game changer: Reducing operating costs and making it easier to install," Eaton's Ryan said.

"The customer should have a choice," he added. "You can integrate the technology seamlessly in the home, vehicle and grid."

All of this sounds great physically, but it doesn't work without precise control aspects from the ones, zeros and AI. Digital tools will balance and direct the bi-directional flow, while microgrids can take the pressure off the utility substation down the road from the future EV charging park.

And that's where AI collaborations between Eaton and partners such as Xendee and Autodesk connect present-day ideals with future project success. Next-gen communication is key to making it work in the brains of the controller system, telling the customer-facing muscles such as meters and charging modules exactly what to do and by precisely by how much.

SUSTAINABLE INNOVATION TO OVERCOME POLITICAL CHAOS

Predictive technology and predictable outcomes are what excite both investors and consumers.

"There is a science-based and reliable way to deliver on those benefits and to improve customer adoption and, at the same time, bring in bankability and finance-ability behind the projects," Xendee CEO Naslé said. "Our focus is to go to market with power controller and intelligence layers."

All of this comes during a time referred to at RE+ as "peak chaos." Tariffs come in and out, up and down, while the One Big Beautiful Bill Act sunsets production and investment tax credits for many renewable energy projects of the future.

And yet optimism reigns and the sun shines like the big ball of nuclear fusion that it is.

Solar, for instance, is cheaper and quicker to build, while the nationally interconnected grid is amazing for what it does, but not nimble enough to do what it doesn't: bringing specific power on-site for specific purposes such as high-level data computing, electrification and, bringing it all back home, resilience for any and all mission-critical needs.

Microgrids, DC and otherwise, can do that. The proof is at the edge.

"The distributed energy system inherently has resiliency," Naslé said. "Just as computing went from the mainframes to distributed and personal computers and now, we have the internet.

"The same path will move forward with the electrical system," he added. "The central system will always be there. Distributed energy is an architecture that includes scalability and resiliency."

GOING GRID-INDEPENDENT TO SATISFY AI POWER AND COOLING: CAPSTONE SIGNS MICROGRID MOU

Capstone Green Energy and Microgrids 4 AI are collaborating to develop off-grid microgrids with advanced liquid cooling for AI data centers, addressing growing energy demands and scalability challenges.

BY ROD WALTON, MICROGRID KNOWLEDGE MANAGING EDITOR

On-site power manufacturer and supplier Capstone Green Energy is taking its first steps to team up with an artificial intelligence data center developer to provide grid-independent microgrids for AI-enabled, liquid-cooled computing facilities.

Capstone's memorandum of understanding, signed with developer Microgrids 4 AI, Inc., is focused on the off-grid possibilities of microgrids for a new generation of energy intensive data centers. Microgrids 4 AI has been focused on edge data centers under 20 MW in capacity.

The work between Capstone Green Energy and the developer, when realized, will integrate localized,

off-grid microgrids with advanced liquid cooling technology. Microgrids 4 AI was formed with leadership from veterans of digital infrastructure companies such as Dell, HPE, Intel, Micron, Equinix, Digital Realty Trust and Supermicro.

FROM KW TO MW TO GW: DATA RACK FUTURE

The focus of Microgrids 4 AI's development is meeting the power needs of next-generation graphic processing units (GPUs). Many AI data center developers are concerned that utility-scale grid capacity may not keep up, considering that GPU racks are almost certainly more than doubling to densities of 1 MW per rack over the coming years.

"The future of AI will not be built on yesterday's data centers. It demands innovative new infrastructure – where power, liquid cooling and compute converge as one, a complete kit," said Ken Kajikawa, CEO of MG4AI, in a statement. "Together with Capstone, MG4AI is creating a new blueprint for AI: sovereign, sustainable and infinitely scalable (140kW today and scaling to 600kW per rack). We're not just keeping pace with the AI revolution; we're building the new foundation that makes next-generation AI infrastructure possible."

Kajikawa has spent more than four decades working in the data center industry, including stints at Dell, HP, Digital Realty and Micron. His work earned a patent on Universal Serial Bus technology.

The predictions vary, but forecasters from Goldman Sachs to Deloitte and Wood Mackenzie all agree that data center and AI energy demand will grow more than 100 GW over the coming decade. The tech industry's concerns over power resource adequacy is fueling movements to line up on-site prime power and strategically located interconnections.

PLOTTING ALL-OF-THE-ABOVE POWER RESOURCES BEYOND UTILITY-SCALE

Some project developers are pursuing off-grid options to avoid long interconnection delays. Capstone will bring its own power and cooling package to the collaboration with Microgrids 4 AI.

"Artificial intelligence is one of the most energy-intensive applications and disruptive workloads of our time," Vince Canino, president and CEO of Capstone Green Energy, said. "By aligning Capstone's technology with MG4AI's modular compute architecture, we are setting a new standard for speed, efficiency and sustainability in AI infrastructure deployments."

Capstone provides gas-fired microturbines for commercial and industrial customers. In the plan for meeting energy needs of AI-enabled computing, the Capstone microturbines will integrate with advanced cooling technologies vital to data center operations, including chillers, dry coolers and pumping packages.

The microgrid combinations could include battery energy storage systems when needed, according to Capstone Green Energy.

The expected expansion of both AI data center growth and industrial electrification is pushing accelerated project development around numerous fuel resources. Some tech giants are shoring up long-term renewable power purchase agreements, while also working with energy firms on future natural gas-fired and even small, advanced nuclear reactors.

"The way to dominate the AI race (for the U.S.) is to build as much as you can of all types of generation," Ryan Plaff, executive vice president at EDF Renewables North American, said during a key session at the RE+ conference in Las Vegas.

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