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DATA CENTERS

Flexible Data Center Power

How we can help the grid

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As data center power demand continues to grow, driven by demand for cloud and AI services, grid operators in major data hubs are struggling to forecast and meet electricity needs.

This short Iron Mountain Data Centers (IMDC) insight paper looks at why, how and where engaging proactively and flexibly with grid operators can benefit the data center industry, support grids, and benefit all customers.

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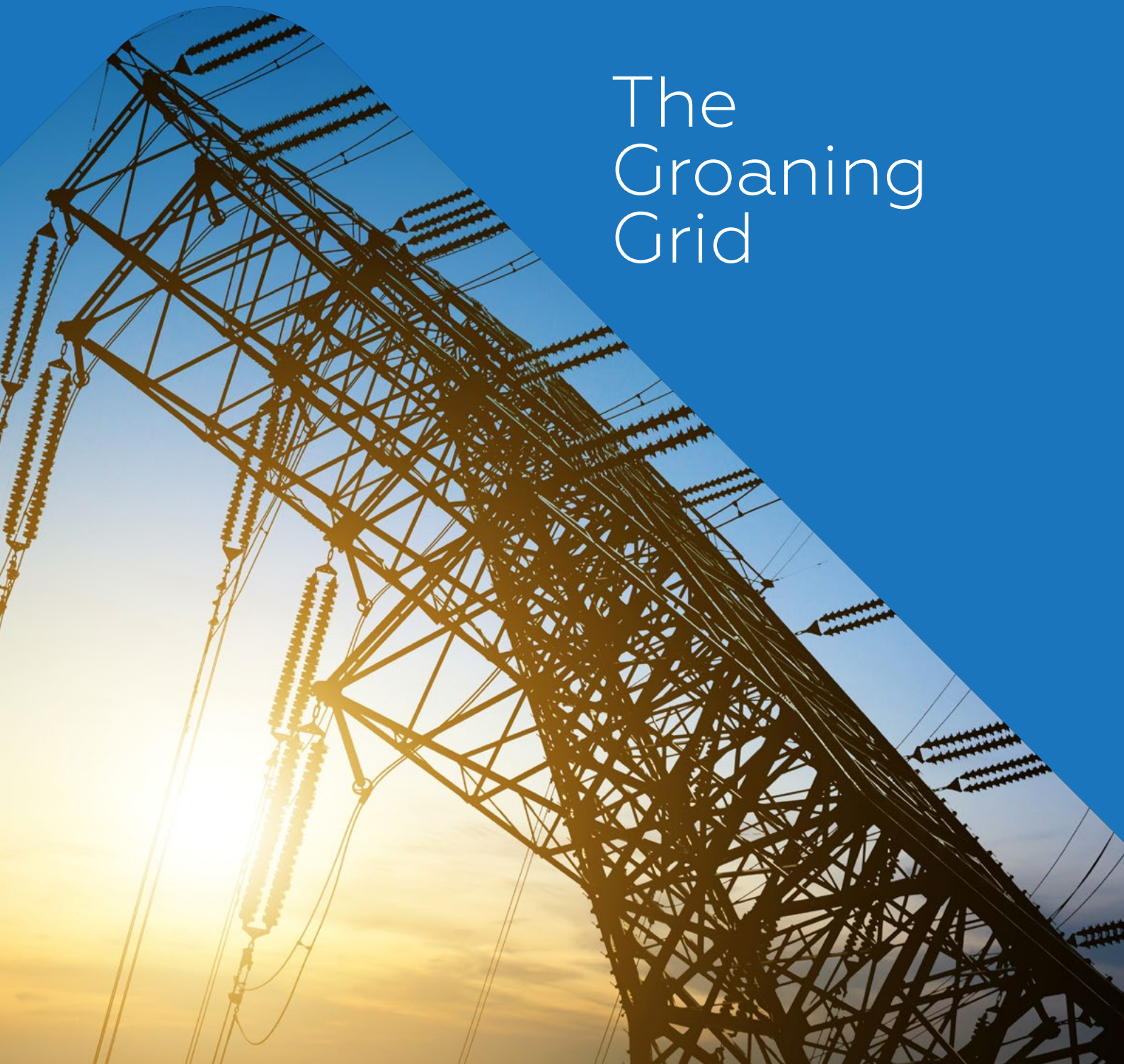
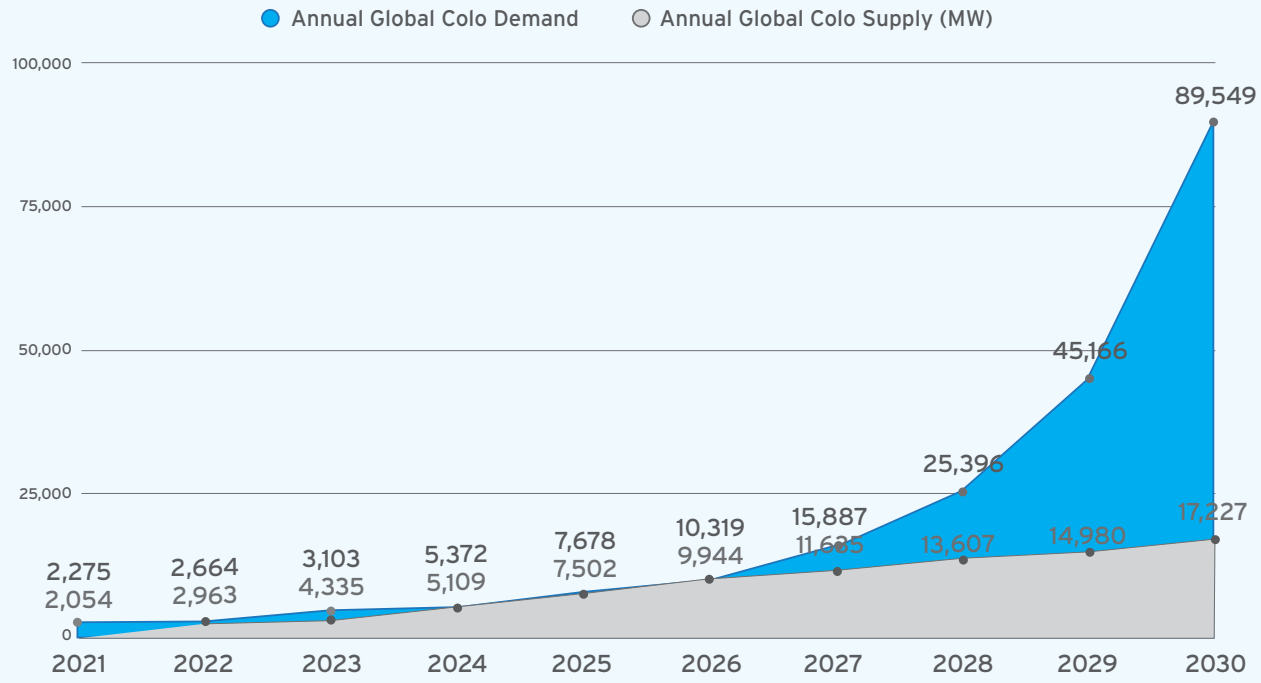


The Groaning Grid: Demand & Risk

Global demand for data center capacity is projected to outstrip supply by 2027-2030, reaching nearly 90 GW by 2030. The key factor limiting the ability of the data center industry to meet this demand is power availability.

Is AI going to break the Grid?

Demand projected to outstrip supply from 2027-2030



Today, data centers account for 2–4% of world power usage, with the IEA forecasting that consumption will more than double by 2030. However, in many densely developed hubs the figures are far higher. A study by Lawrence Berkeley National Laboratory stated that in 2023 America's data centres used 176 terawatt-hours (TWh) of electricity, a figure forecast to increase to up to 580 TWh by 2028 – 12% of America's total energy consumption.

This global phenomenon is taking place while the world's power infrastructure is in transition. The sharp rise in power demand for AI infrastructure is taking place in parallel with the broader shift from fossil fuels to low-carbon electrification. These two trends are putting immense pressure on the transmission capacity of electricity grids, many of which were built decades ago.

Mature data hubs like Northern Virginia, Dublin, London, Singapore, Frankfurt, Amsterdam, Silicon Valley, and Phoenix are facing multi-year delays for new grid capacity, forcing developers to rethink everything from site selection to energy strategy and procurement.

The grid perspective

Power grid operators and data center operators have very different approaches.

- The two sectors operate according to different timeframes. Data centers can be built in 18 months to 2 years, while national and regional grids require many years of planning, permitting, and construction to scale.
- Load serving utilities are typically regulated by local utility commissions which adds a layer of control and approval over investments, unlike data centers that can act more nimbly when deploying capital. It is challenging for utility regulation to balance rapid changes in demand while maintaining commitments to deliver reliable and affordable power to all ratepayers. Overbuilding based on optimistic forecasts risks leaving utilities with underutilized assets whose costs flow through to ratepayers. On the other hand, underbuilding, or insufficient investment in infrastructure upgrades, risks shortages, congestion, reduced AI/cloud capability, and reliability challenges.

Partnering to mitigate risk

Predicting data center demand is challenging for grids. Due to the scale of demand for data center capacity, grid operators receive hundreds of power requests, many of which are duplicated elsewhere. The result is so-called "phantom data centers."

These speculative requests can drive up prices. A common stipulation now from grid operators in the Northeastern U.S. is to insist on "take or pay" contracts, where utilities require substantial financial commitments in advance. This can drive up costs, and tie up large amounts of capital and credit for extended periods of time, reducing investment in certain markets and stranding capital.

Speculative power connection requests submitted simultaneously to multiple grids are creating huge numbers of "phantom data centers" which make it very hard to predict future demand accurately.

Assessing the risk

Solutions are emerging for this issue. Clear fact-based communication is essential, with partnerships emerging between power sector stakeholders, offtake (data center) operators, grid/utility operators, government and regulators. Accurate forecasting of future grid loads is critical to this effort, otherwise pricing can get out of control. Clarity, accurate planning and the avoidance of duplicated risk make for fairer contracts - for example, the Data Center Coalition, together with E3 has made a very positive contribution to a new standardized approach.

The partnership principle

This is a first step to solving problems in collaboration with grid operators. It also establishes an important principle. Data center operators need to recognise that, unlike other more passive customers, they are in a position to help; in other words they need to be partners, not customers.

And, in addition to sharing the risk of investment in new transmission capacity, there is much more that data centers can do.

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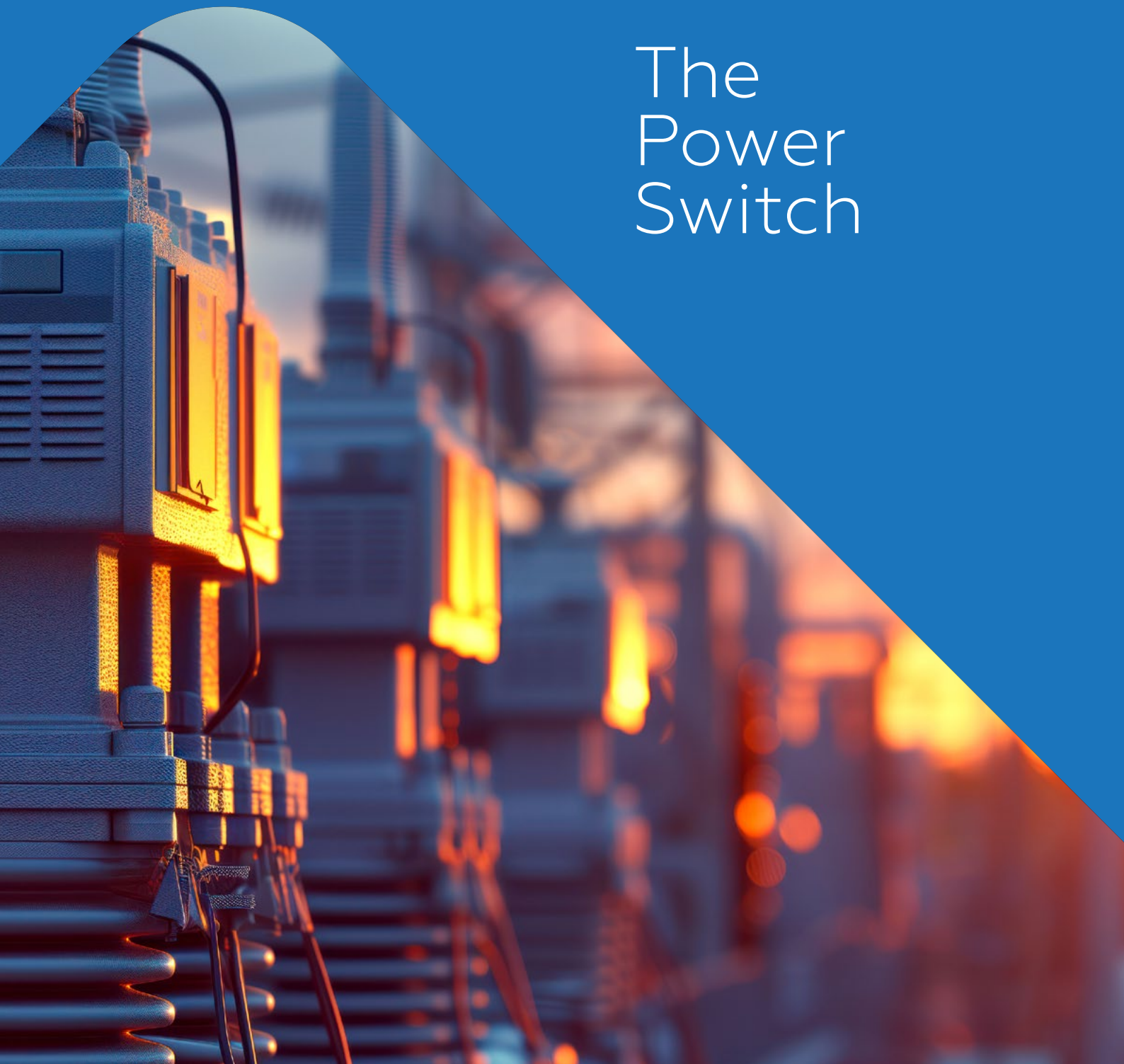
The Power Switch



The Power Switch: From Buyer to Backer

Data center operators are already moving "behind the meter" (BtM). They have three key options which can be deployed separately or in combination: generating their own power via a microgrid, decreasing workloads during peak grid usage, or deploying and sharing flexible, dispatchable power.

How can the data center industry support the Grid?

1. Do-it-yourself power

A recent survey by Bloom Energy highlighted a sudden rise in the American data center industry´s approach to self-generated power using microgrids that take the strain off grids. The survey found that, faced with lengthening interconnection queues for grid connections, data center decision makers expect that by 2030, 38% of facilities will have at least some onsite power generation, and 27% of facilities will be 100% independently powered. This contrasts with last year's survey, which showed 13% partially self-powered and 1% fully self-powered by 2030.

The range of self-generation options is growing. Nuclear power (e.g. Small Modular Reactors) is an increasingly popular option for large loads, but permitting, testing and commissioning the plants will take several years. Renewable investment is becoming even more aggressive and direct, with hydropower, solar and wind investments such as Google´s $3 billion investment in hydropower in Pennsylvania, and recent purchase of Intersect Power. Onsite natural gas generation is on the rise in markets where permitting and gas pipelines allow, despite the fact that it is costly and carbon-intensive.

Where interconnection queues are very long, full Behind the Meter (BtM) builds can be completed before a grid connection becomes available, with timeframes as short as 18 months for solar and storage or natural gas. In addition to faster access to power, BtM solutions also bring greater certainty to power planning.

2. Varying the load

Data centers can also support grids by ramping workloads up and down to stabilise the broader grid load. This is not something that colocation operators with multiple customers can do, but it is already being implemented by operators with more uniform loads like the Nvidia Omniverse DSK Blueprint.

Demand management is a tried and tested way to support the grid, having been used by other industries such as steel production, where furnaces adjust production schedules to avoid peak usage times. This not only supports grid reliability, it optimizes the grid's capacity which contributes to lowering costs for all ratepayers.

Load variation can free up "stranded capacity", which is available or contracted power that cannot be effectively utilized due to various constraints. As a recent Duke University Report pointed out, if new data centers could commit to a curtailment of just 0.5% of load, this could free up 100 GW of stranded capacity on the grid.

3. Shifting the load

Just like the grid, data centers have stranded capacity too; capacity standing by to serve critical IT demand that varies and is not continuously 'always on'. Adding energy storage at the data center, in the form of grid-sized batteries, enables the data center to reduce its load on the grid when necessary, then increase its load later to recharge when capacity on the grid allows. This does not have to be a huge amount of power over a long period of time in order to make significant contributions to grid optimization; it may only require a few hours across the year.

While a low carbon solution like battery-stored power is preferable, there is also a substantial amount of capacity in the form of diesel or Hydrotreated Vegetable Oil (HVO) backup power. For many reasons, including air quality, noise limitations, and limited fuel availability, these data center assets should not be called on for regular optimizing of the grid. However, when grid need is extreme, these generators can enable the data center to shift load off the grid to avoid blackouts or catastrophic grid failures.

> "Data center partnerships may well be the key to achieving our own objectives; cleaner, more resilient, more cost-effective power for the people."
>
> Brian Levite, Long Island Power Authority
> on DataCenter Dynamics Navigating the Energy Crunch Broadcast

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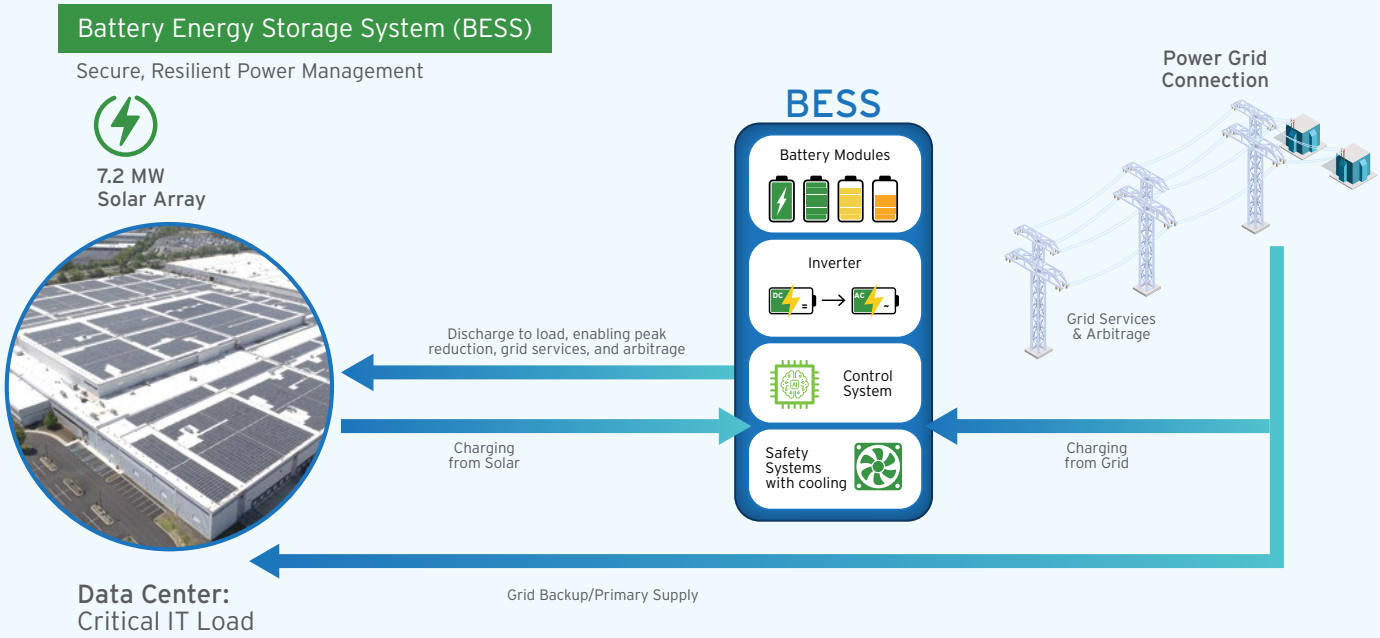
Battery Backup

Battery Backup: Flexibility in Action

A Battery Energy Storage System (BESS) is one of the most practical BtM solutions, and is currently being pioneered by a few operators. Data center load flexibility using a BESS can unlock gigawatts of stranded capacity by reducing load on the grid during peak demand.

What is the most practical and sustainable form of flexible power?

Data Center BESS: Energy Flow & Component Overview



IMDC & BESS

IMDC is developing large-scale load flexibility via BESS at a number of sites, but the project nearest to completion is at the NJE-1 data center in Edison, New Jersey, where a new 12 MW/23 MWh BESS has received utility and township approvals and is under construction in partnership with Calibrant Energy.

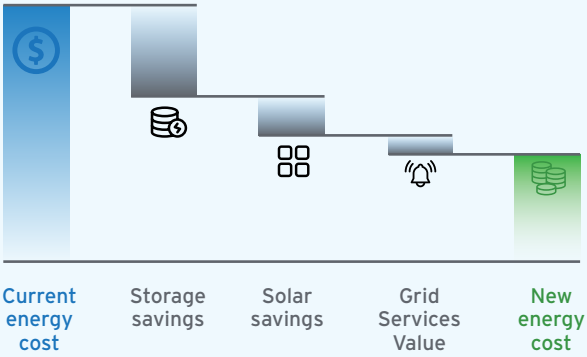
This new BESS is both behind the meter and in front of the data center, so that it can be dispatched as needed without any impact to the critical power systems that supply the facility. It will be capable of supporting the entire IT load for hours if needed, reducing load on the grid.

The NJE-1 data center includes power generated by the rooftop solar array which, with over 18,000 panelsand a capacity of 7.2 MW, is the largest rooftop solar installation of any North American data center.

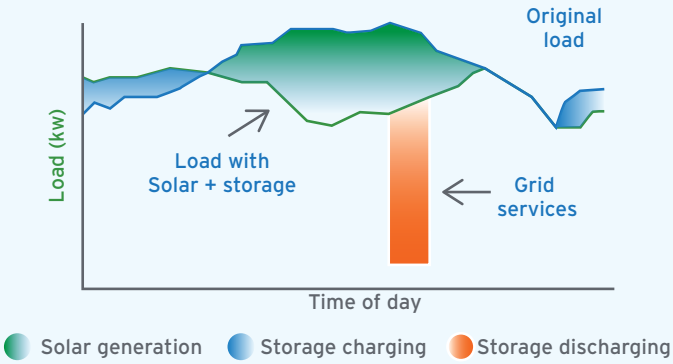
Through an advanced control system the BESS will both respond to real-time grid conditions and reduce consumption during peak periods. The battery system exceeds international safety standards by incorporating multiple layers of protection, including safer battery chemistry, built-in fire mitigation measures, advanced thermal imaging with real-time alarm, automatic shutdown, and remote 24/7 monitoring – for reliable and safe operations.

Completion is currently scheduled for the end of 2026, with grid support starting as soon as the BESS is ready for service.

Impact of On-site Solar + Storage



When batteries are integrated into data centers, they allow the grid's fixed costs to be shared across a larger base of delivered energy, putting downward pressure on electricity rates and positioning data centers as part of the solution rather than a driver of higher costs.



Combining on-site solar with storage amplifies the benefits of each. In the summer peak grid demand may occur as solar power subsides in the evening. Energy storage can ease this daily transition period, effectively prolonging the positive impact of solar. Savings are at their greatest when storage and solar reduce facility demand when the grid is experiencing peak usage.

Key benefits for stakeholders

BESS deployments benefit the different stakeholders in a variety of ways:

- For **communities**, a data center with on-site energy storage can actively help optimize the use of existing grid infrastructure. It can help compensate for the peak loads that we all contribute to as individuals using the power grid, such as running our air conditioning at the hottest hours or collectively cooking dinner at 6pm.
- For **data center operators**, energy storage can enhance the power quality on the grid helping to mitigate the risk of needing to switch over to backup generators due to voltage fluctuations.
- For **utilities**, a BESS is a flexible and distributed tool that can be counted on to perform when needed most. It can enable more load to be interconnected to the existing grid, which allows the grid's fixed costs to be shared across a larger base of delivered energy and putting downward pressure on electricity rates.

A Template for the Industry

By offering targeted and timely capacity reduction on the local grid, projects like this enable large power users like data centers to provide an important solution to grid congestion – which helps electric utilities maintain grid reliability.

It serves as a real-world template of how data centers can operate as dynamic grid partners, and an example of how the data center industry can bring grid solutions, not just challenges.

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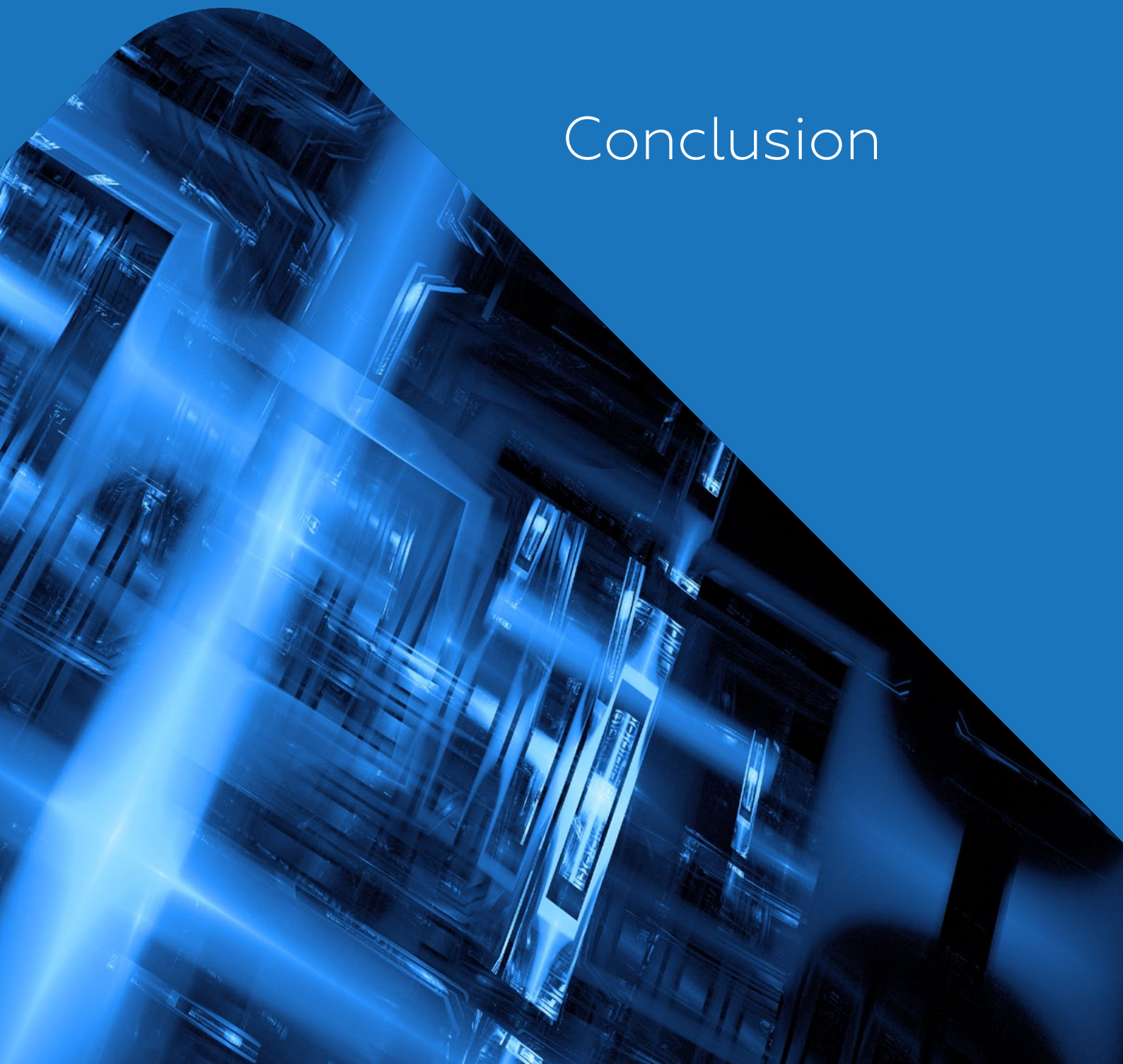

Conclusion

Conclusion: A Powerful New Partnership

Because of the exceptional pressure on grid capacity from data centers and other sectors, we need to find new technologies and new ways of working together. Flexible data center loads, where data centers become grid supporting resources rather than one-way energy buyers, will become an important part of future solutions.

What is the future of flexible data center power?

There are many examples of progress made towards delivering the grid of the future, including recent developments in Virtual Power Plants (VPP) and 'patio solar' systems that enable residential customers to meet some of their power needs with at-home generation in a cost-effective way. Still there is much more that we can do.

New solutions, new roles

Now is the time for data center innovation, and the industry is well positioned to take on big challenges. For years data center operators led the way on accelerating clean energy procurement, for example. Today the largest corporate clean energy buyers are data center operators, regularly executing utility-scale agreements. And while the pursuit of clean energy needs to continue, an even greater challenge is emerging in the form of energy affordability and reliability.

Flexibility is one of the keys to addressing this new challenge, and we're at an exciting point in time where solutions are emerging that have the potential to scale. In addition to battery energy storage, potential solutions include Virtual Power Plants and innovative capacity contracts that pay for residential energy upgrades to make room for new loads to be added. There are a few key ingredients that create the market conditions needed for these innovations:

- Financial risk should be rationally estimated and not exaggerated. Most of us do this in our daily lives by choosing insurance to cover only what is most likely to happen and setting appropriate limits to the coverage. The same mentality needs to prevail when considering investments into shared infrastructure and recognizing the likely increase in electricity demand. Excessive collateral requirements for new large loads may limit capital that can be deployed supporting innovative solutions.
- Utility programs should enable investment into new solutions, like battery storage, instead of blocking capital dollars from coming to the market. Today we see new utility tariffs emerging that remove opportunities for storage to create value, by implementing minimum take-or-pay fees that erode the economic business case that storage relies on.
- We need to get new businesses and facilities connected to the grid more quickly. While transmission upgrades may continue to take years to develop and execute, connecting new generation and loads to local grids can enable us to grow and solve problems simultaneously. We have better data and tools today than ever before, many of them enhanced through the use of AI, and we can clearly identify solutions faster than we can implement them.

Flexible power partnerships require negotiation, long-term commitment, and trust. This means stepping outside traditional roles and investing time in understanding and proposing solutions to the challenges faced by specific utility providers. Some data center operators and utilities are already working together, and the results are encouraging. This needs to become the new standard.

Iron Mountain Data Centers

Protect, **connect** and **activate** your data

Your data is your advantage. Yet too often it remains untapped: disconnected from systems, underutilized, untrained, and exposed to risk. At Iron Mountain, we help the world´s most complex organizations unlock what´s possible with data centers that protect, connect, and activate your data like never before.

How? By combining our legacy of trusted security with advanced, cloud-agnostic data centers powered by 100% clean energy - delivering scalable, compliant, sustainable and future-ready solutions. Our global 1.3 GW portfolio empowers customers including leading cloud and AI providers to scale their data footprint, enhance security and unlock greater value.

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What can we unlock together?

www.ironmountain.com/data-centers

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