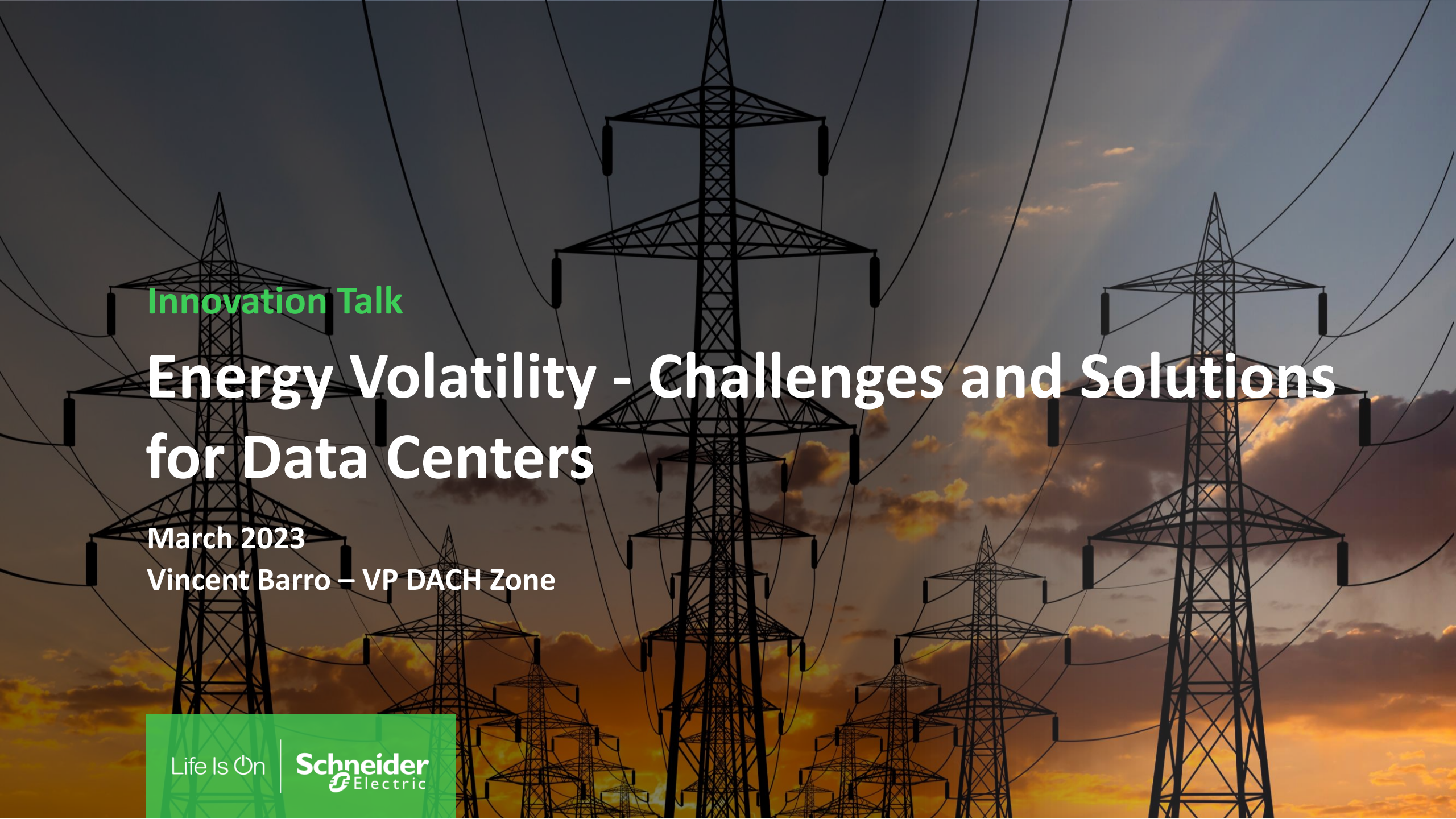

Innovation Talk

Energy Volatility - Challenges and Solutions for Data Centers

March 2023

Vincent Barro – VP DACH Zone

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Growing volatility in the energy system

- **At Schneider, our purpose is to empower all to make the most out of our energy and resources, bridging progress and sustainability for all.**
- We recognize the immense challenge presented by increased energy market and system volatility.
- Today's agenda focuses on:
  - Challenges: 3 areas of impact from volatility
  - Solutions: short-, mid- and long-term, addressing each of these 3 challenges

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Defining the challenge

Volatility in the energy system is a growing threat to data center operations, and is constraining profitability, uptime, and the placement of new facilities.

Factors affecting volatility:

- Climate change
- Geopolitics
- Grid constraints

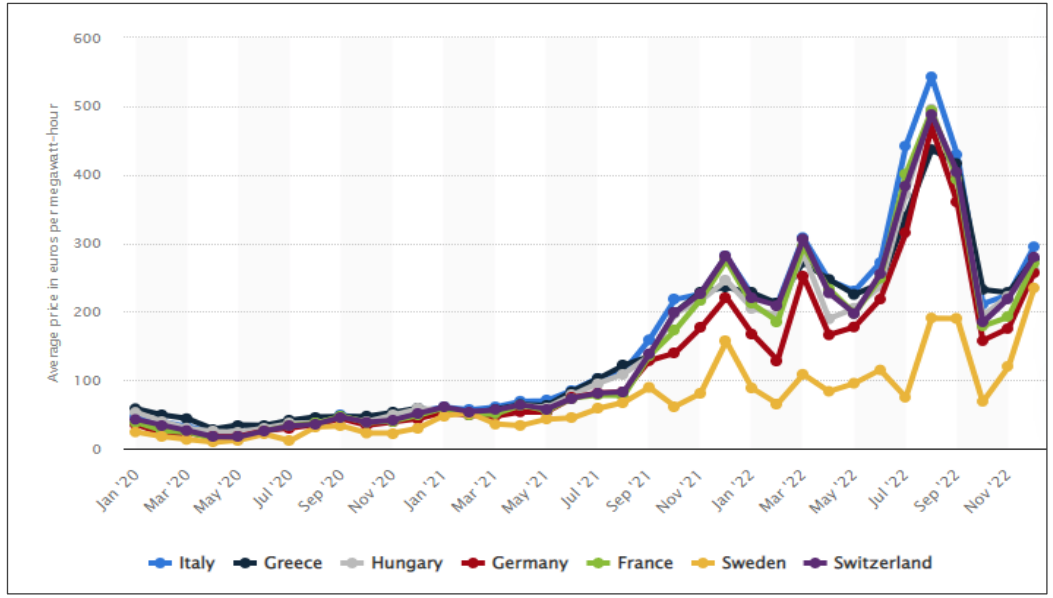
Three main areas of impact:

- Cost Volatility
- Supply Constraint
- More frequent and severe outages

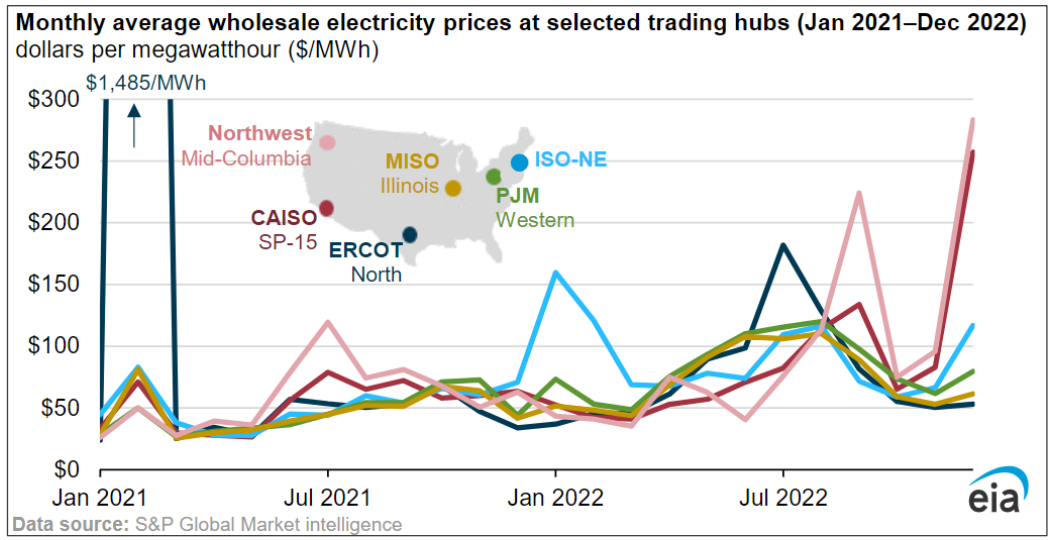
Challenges

Energy Cost Volatility

Climate change, geopolitics, and supply chain stress have combined to create record levels of volatility in energy prices in 2022, and 2023 offers continued risk.



Avg monthly electricity wholesale prices in EU, 2022



"Average wholesale electricity prices at major trading hubs in the United States rose throughout much of 2022 and were volatile as a result of extreme weather events. " - EIA

Challenges

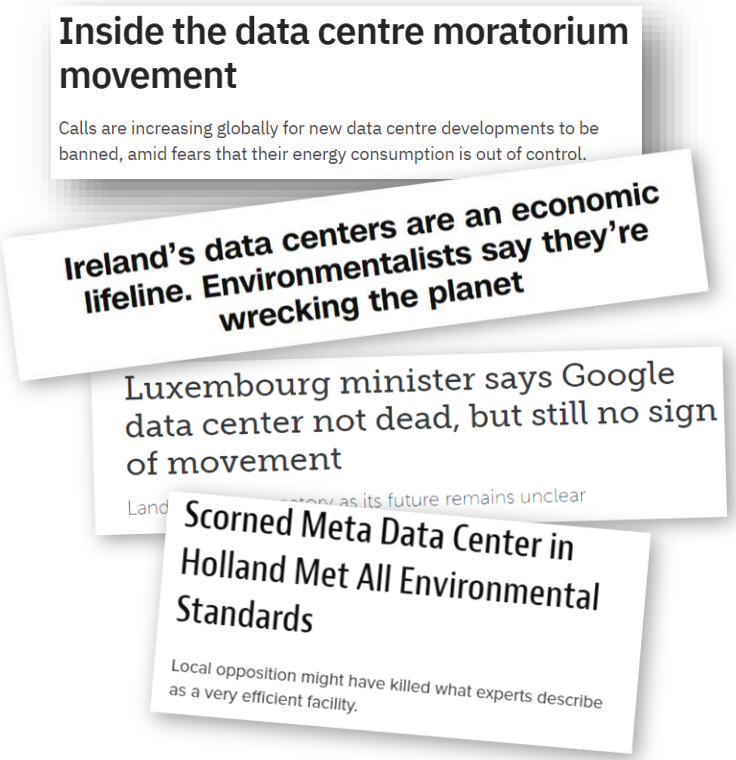
Grid Constraints

- Availability of grid power and transmission capacity is a growing constraint on data center placement.
- This further contributes to energy price uncertainty for data center operators.

Competition for resources is feeding public opposition to data center development

In the US:

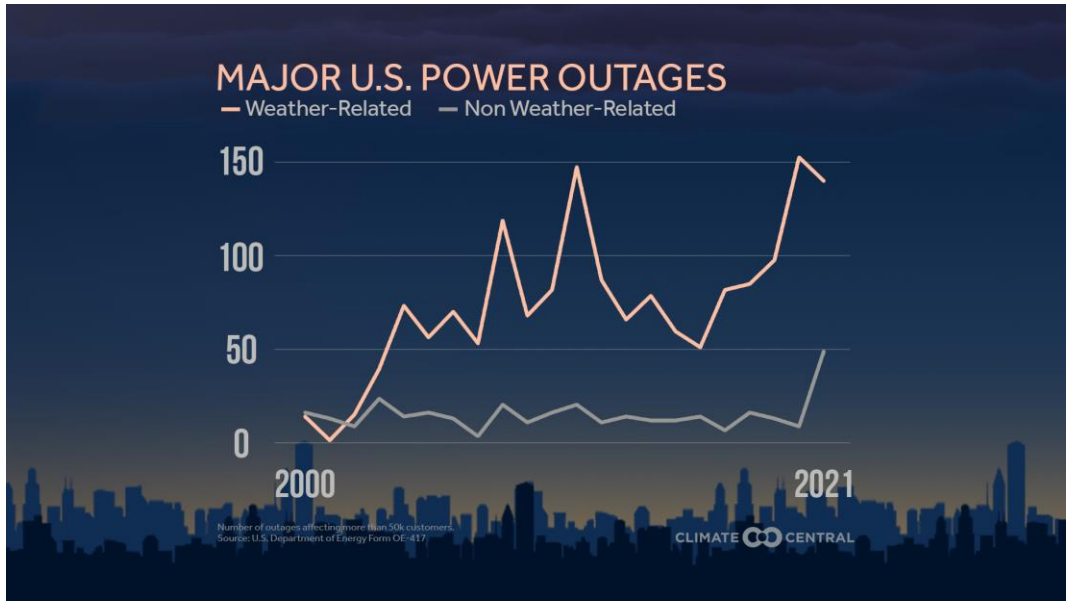
In Europe and Asia:

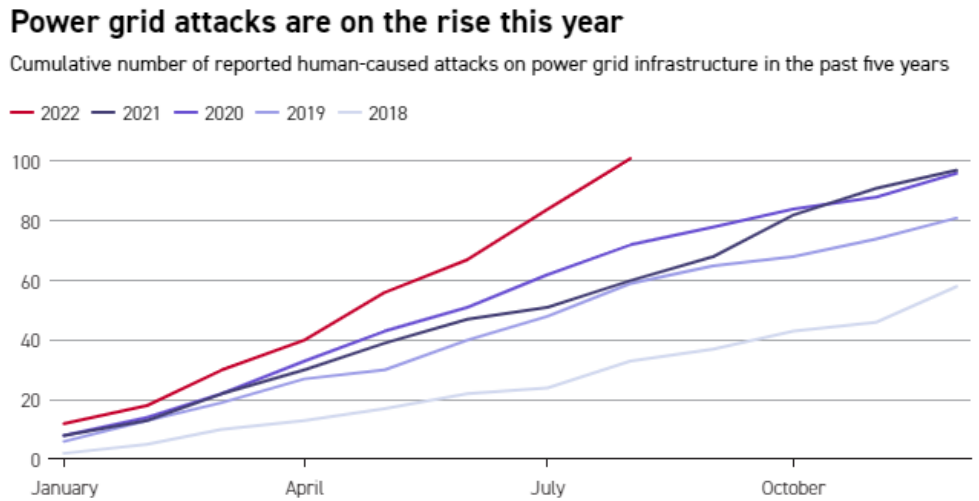


Challenges

Increasingly Frequent and Severe Outages

Climate change is challenging grid reliability in multiple ways simultaneously, including drought, wildfires, and severe storms. Incidents of sabotage are also on the rise.





Challenges

Solutions

Efficiency First

Challenges	Solutions
Energy Cost Volatility	PUE has driven much progress, but does not account for efficiency of cooling systems or IT utilization. Continuing to drive efficiency decreases energy bills and exposure to cost fluctuations.
Grid Constraints	The better the efficiency of the entire data center (including whitespace), the lower the overall load on the utility grid.
Increasingly Frequent and Severe Outages	Many solutions that improve efficiency, such as advanced energy monitoring and controls, can also support resilience solutions like microgrids.

Challenges

Energy Cost Volatility

Grid Constraints

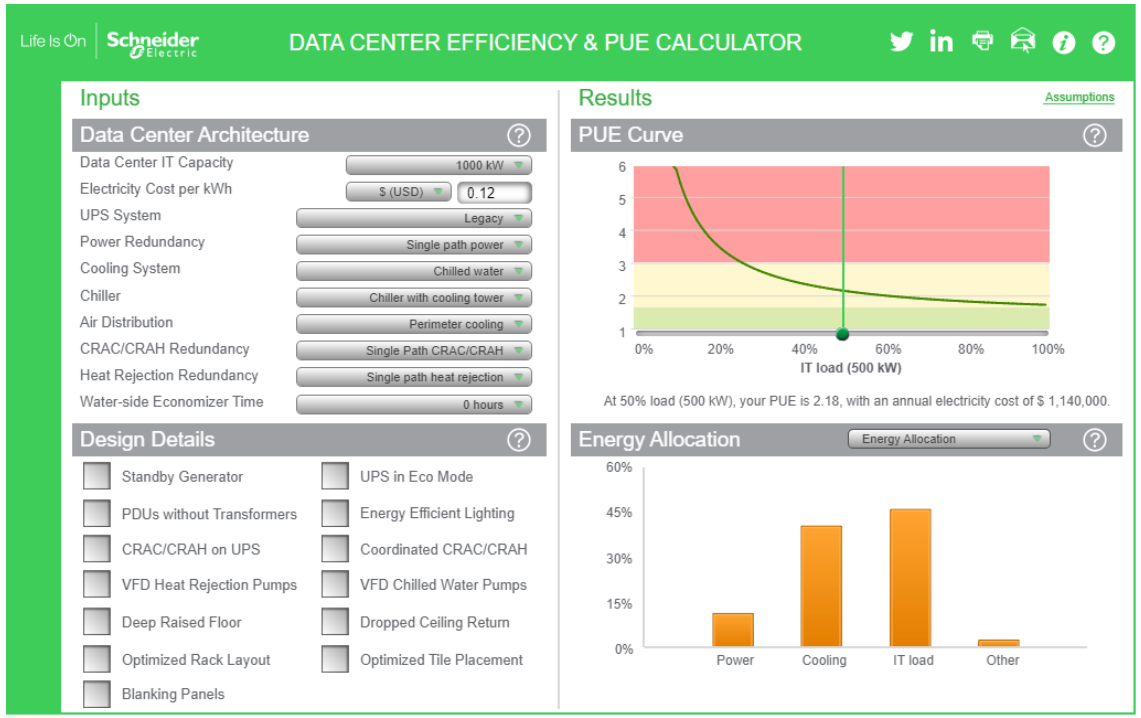
Increasingly Frequent and Severe Outages

Solutions

Efficiency First

Key Resource:

Tool: Data Center Efficiency and PUE Calculator



Challenges

Energy Cost Volatility

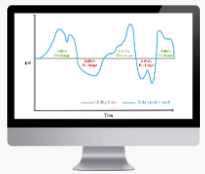
Grid Constraints

Increasingly Frequent and Severe Outages

Solutions

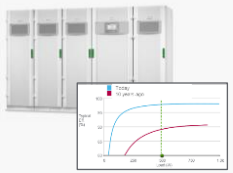
Efficiency First

Examples:



Advanced Monitoring Controls (Power, Building, IT)

High temperature chilled water solutions



UPS Designed for Sustainability

Liquid cooling

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Challenges

Energy Cost Volatility

Grid Constraints

Increasingly Frequent and Severe Outages

Solutions

Efficiency First

Examples:

3-phase UPS, Galaxy VL

Galaxy VL

RoHS, REACH, Battery compliant

52t CO_2 emissions savings *

99% (up to) Energy efficiency

Battery and Unit Takeback and Recycling

Green Premium™

PEP ecoPASSPORT®

Eco designed

Modularity
Increasing lifespan & reparability, allowing right sizing

Adaptability
Ready to use the latest and most efficient battery technology

High-density
Manufactured with less material resulting in smaller and lighter footprint

* for the following use case Hypothesis: 200 KW load/ 50% of time ECOnversion

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Challenges

Energy Cost Volatility

Grid Constraints

Increasingly Frequent and Severe Outages

Solutions

Efficiency First

Examples:

Air-cooled free-cooling oil free chiller

BCEC/F

LCA / Environmental Product Declaration ready. BREEAM eligible

16.000t CO_2e emissions savings **

1.034 pPUE*

Low GWP, less than 7

Green Premium™

PEP ecopassport®

Eco designed

Efficiency
Free-cooling extension drives down annual pPUE. Low pick pPUE in summer mode

Low GWP refrigerant optimized
Designed to maximize efficiency with low GPW refrigerants. No capacity losses despite low refrigerant density.

High-capacity
Full range up to 2MW to reduce number of units. Package unit to simplify transportation and installation

* for the following condition: 1 MW, London based
** for key colo 2021 portfolio from Schneider Electric

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Challenges

Energy Cost Volatility

Grid Constraints

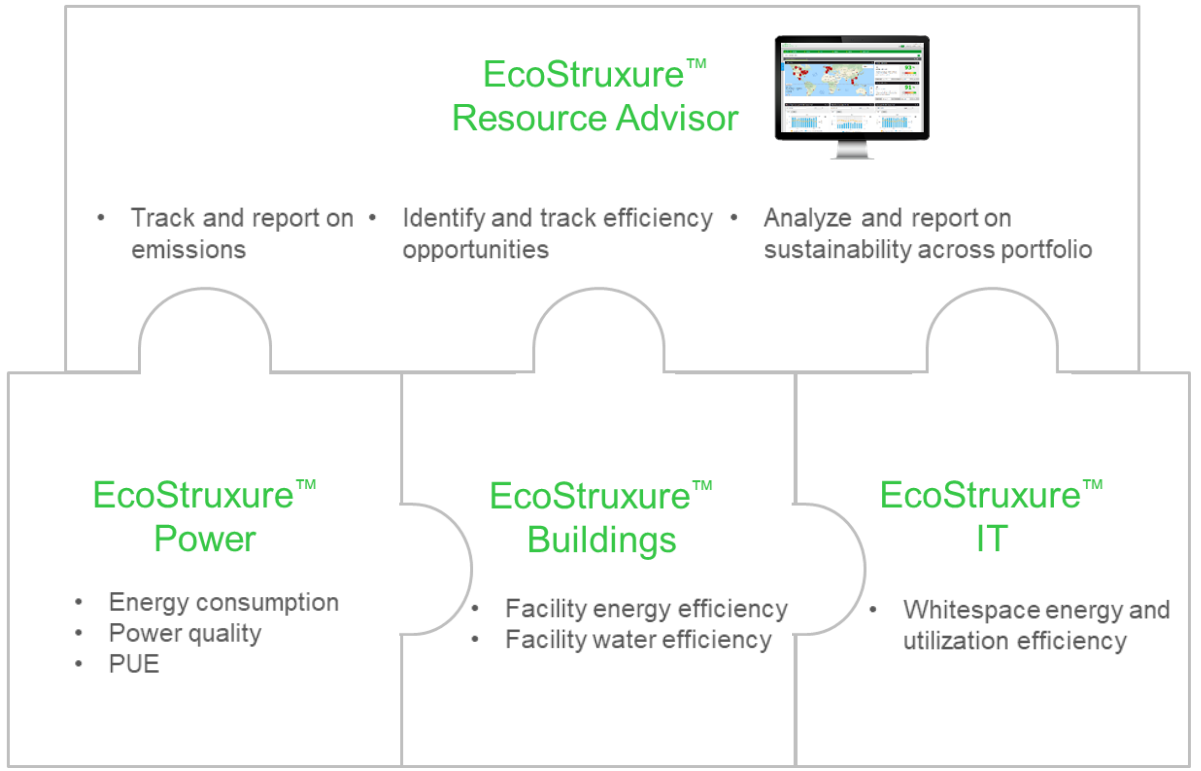
Increasingly Frequent and Severe Outages

Solutions

Efficiency First

Examples:

EcoStruxure™ - Digitization for Sustainable Performance



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Challenges

Solutions

Energy Procurement Diversification

Challenges	Solutions
Energy Cost Volatility	Diversification of energy portfolio can help hedge against cost volatility, especially with a focus on renewables that are shielded from fuel cost fluctuations. Expert guidance can optimize financial performance of energy portfolio.
Grid Constraints	Investing in offsite renewables can add capacity to the grid and ensure the public that the data center is contributing value to the community.
Increasingly Frequent and Severe Outages	In the medium term, investment in renewables is critical to mitigating the severity of climate change impacts (storms, drought, extreme temperatures). A diverse generation mix can make the utility grid more resilient.

Challenges

Energy Cost Volatility

Grid Constraints

Increasingly Frequent and Severe Outages

Solutions

Energy Procurement Diversification

Three ways to procure renewable energy

ENERGY ATTRIBUTE CERTIFICATES

- The way clean energy use is tracked and traded
- EACs: RECs, GOs, I-RECs, LGCs, TIGRs, etc.
- Needed to make environmental claims
- Short-term Green Tariffs & Retail Options

ONSITE/DISTRIBUTED GENERATION

- Ownership, lease, or PPA
- Direct reduction of energy at a facility
- High visual appeal
- Scalability challenges
- Fixed to real estate portfolio
- Virtual Net Metering possible in certain markets

OFFSITE GENERATION

- Typically large-scale purchases of utility-scale projects
- Power Purchase Agreements (Virtual, Direct, Retail)
- Can create additionality and scale
- Usually includes EACs
- Long-term Green Tariffs & Retail Options
- Tax Equity Investments

Challenges

Energy Cost Volatility

Grid Constraints

Increasingly Frequent and Severe Outages

Solutions

Energy Procurement Diversification

Key Resource: *The Definitive Guide to Renewable Electricity Options*

Evaluates considerations and advantages for numerous renewable energy options:

- Owned onsite
- Onsite & offsite PPAs
- Collaborative renewable PPAs
- Green Tariffs
- Energy Attribute Certificates

"Schneider Electric is the **#1 Provider of PPA Marketplace Solutions**."

- Guidehouse, 2022

Challenges

Solutions

Onsite Energy Resources / Microgrids

Challenges	Solutions
Energy Cost Volatility	Onsite energy resources managed as a microgrid can be controlled to optimize cost performance, choosing the least expensive source at any given time, and facilitating participation in demand response programs.
Grid Constraints	Onsite generation and storage can decrease load on grid, and limit public opposition. Microgrid controls can facilitate grid services such as demand response and frequency response.
Increasingly Frequent and Severe Outages	Microgrids, built around onsite energy resources such as natural gas gens, fuel cells, or renewables, can allow the data center to island during outages and continue to operate for longer durations than possible with diesel generators.

Challenges

Energy Cost Volatility

Grid Constraints

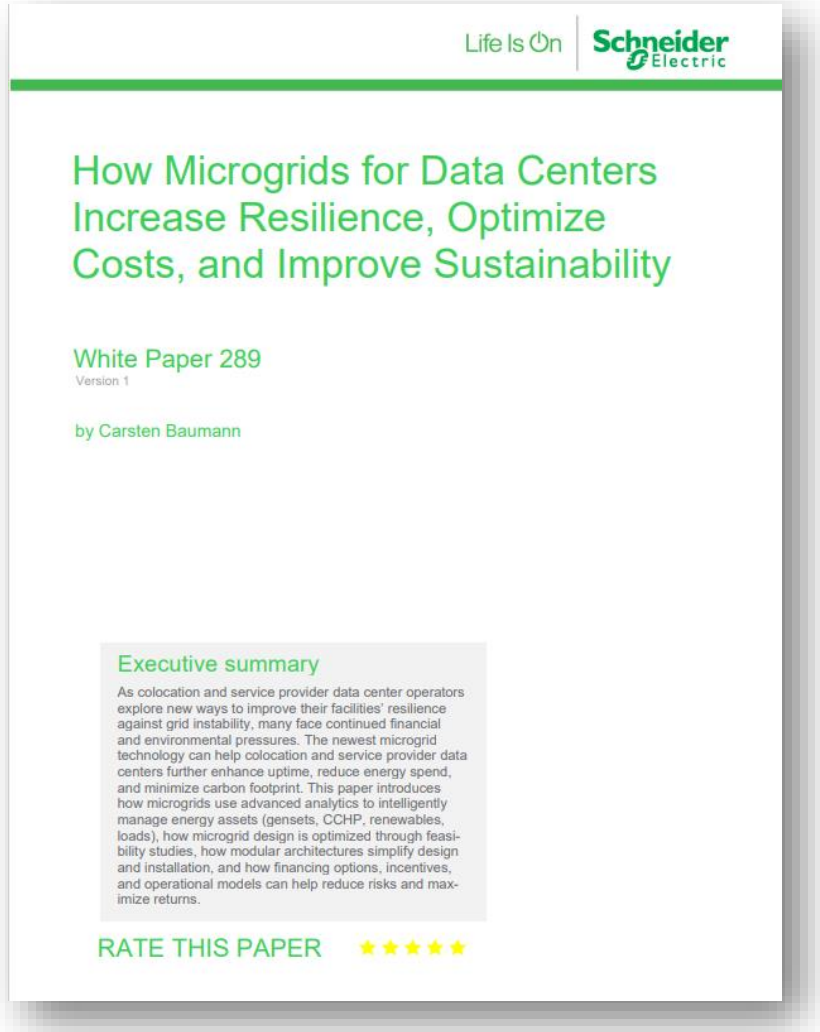
Increasingly Frequent and Severe Outages

Solutions

Onsite Energy Resources / Microgrids

Key Resource:

White Paper: *How Microgrids for Data Centers Increase Resilience, Optimize Costs, and Improve Sustainability*



Challenges

Energy Cost Volatility

Grid Constraints

Increasingly Frequent and Severe Outages

Solutions

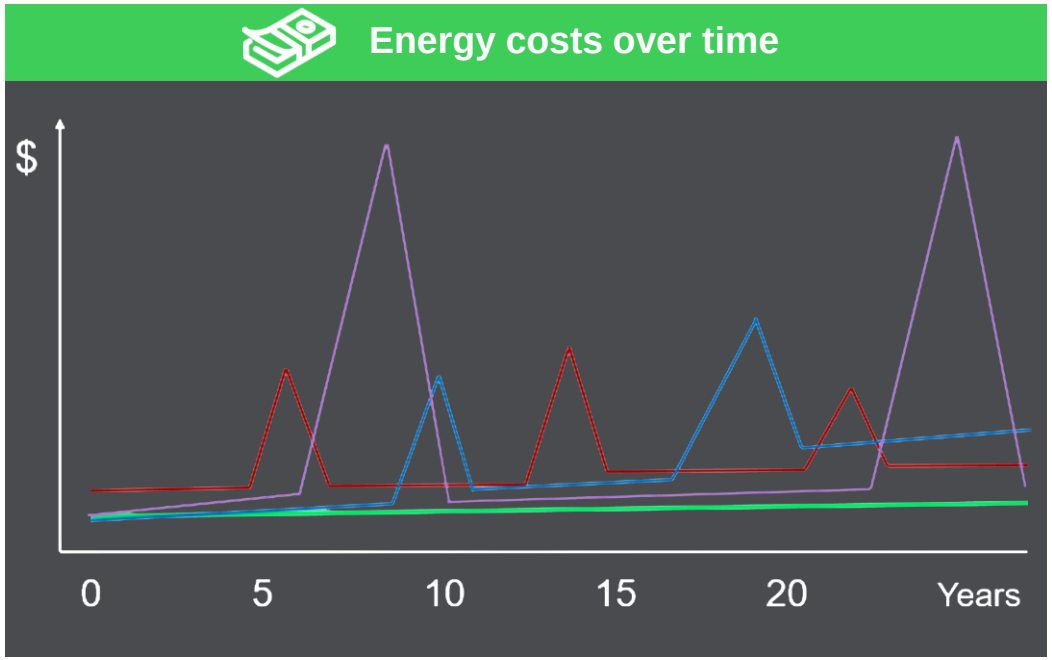
Onsite Energy Resources / Microgrids

Examples:

Energy-as-a-Service (EaaS)

Energy as a Service arrangements for distributed energy resources (DERs) or microgrids have the same cost control benefits as an offsite PPA.

EaaS avoids upfront capital expenditures, with reduced performance risk.



- Business as usual outage costs
- Business as usual O&M costs
- Business as usual regulatory compliance cost
- **EaaS cost**

Challenges

Energy Cost Volatility

Grid Constraints

Increasingly Frequent and Severe Outages

Solutions

Onsite Energy Resources / Microgrids

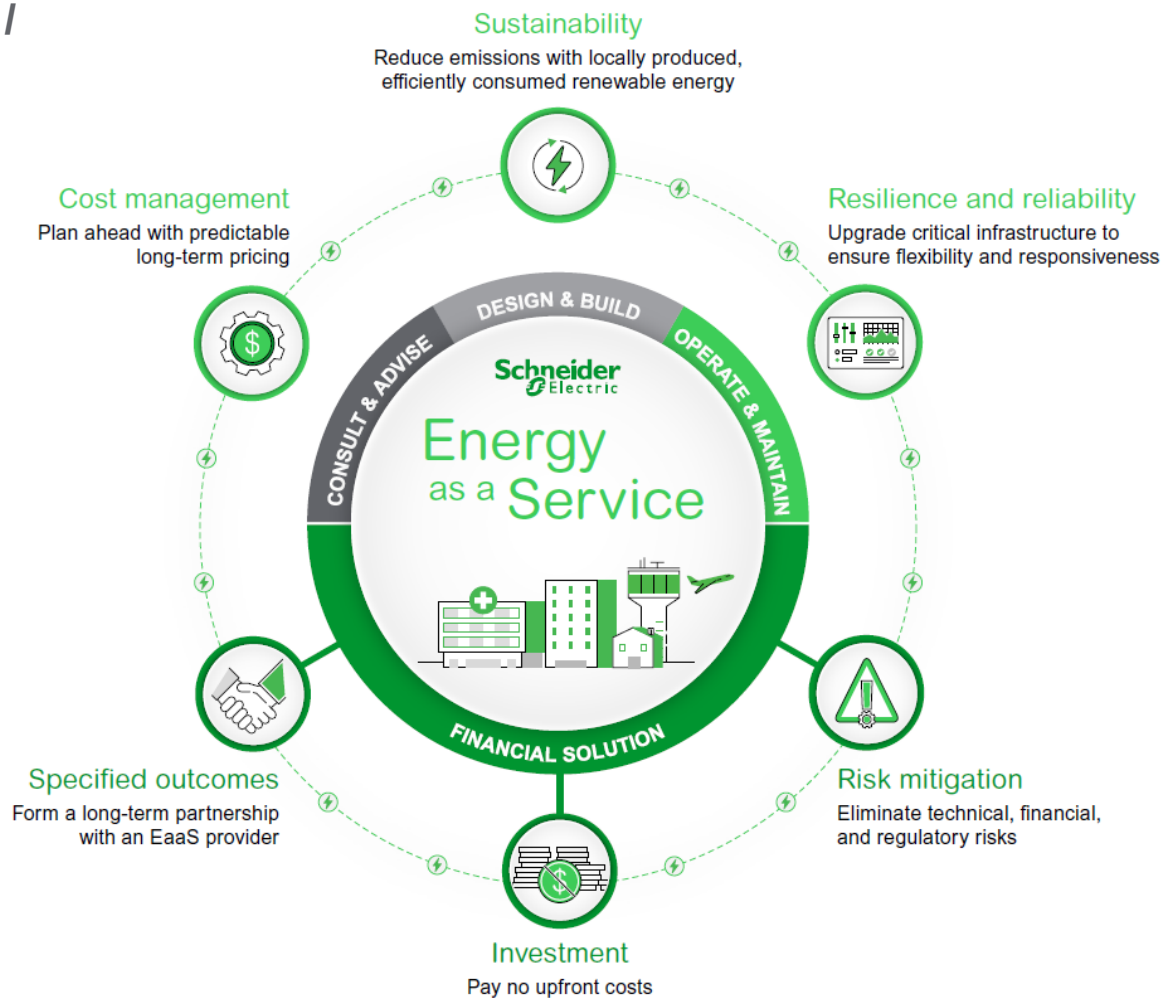
Examples:

Energy-as-a-Service (EaaS)

Customer partners with a solutions provider that oversees energy portfolio

Subscriptions, leases, PPAs, and energy savings performance contracts are all options.

Result: adoption of flexible DERs and lower capital cost



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Challenges

Solutions

Challenges	Efficiency First	Energy Procurement Diversification	Onsite Energy Resources / Microgrids
Energy Cost Volatility	Continuing to drive efficiency decreases energy bills and exposure to cost fluctuations.	Diversification of energy portfolio can help hedge against cost volatility. Expert guidance can improve performance of portfolio.	Microgrids can be controlled to optimize cost performance, and facilitate grid interaction (demand response, TOU rates, etc).
Grid Constraints	The better the efficiency of the entire data center the lower the overall load on the utility grid.	Investing in offsite renewables can add capacity to the grid.	Onsite DERs decrease load on grid, and mitigates public opposition.
Increasingly Frequent and Severe Outages	Many solutions that improve efficiency can also support resilience solutions like microgrids.	Investment in renewables will help limit the severity of climate change impacts.	Microgrids can allow the data center to continue to operate for longer durations than possible with diesel generators.

Conclusion

New Opportunities

As threats to our energy system seem to grow and multiply, so do the opportunities to address them.

- US government tax breaks on energy solutions
- EU shifting to build a more sustainable energy system less reliant on Russia

Shared Vision

The data center industry has a shared vision of sustainable growth that meets society's needs for digital services in an environmentally sustainable manner.

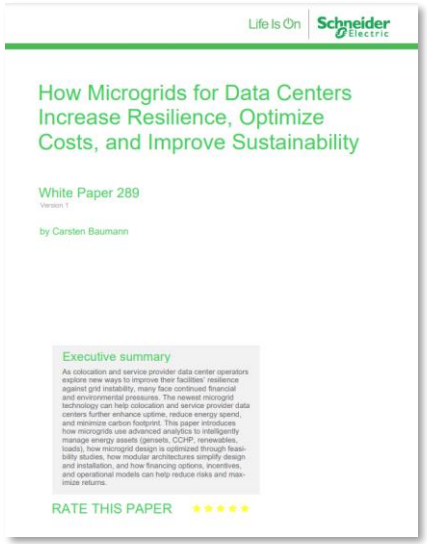
Collaborative Growth

Working together, we can prove that the data center industry can grow in a manner that is:

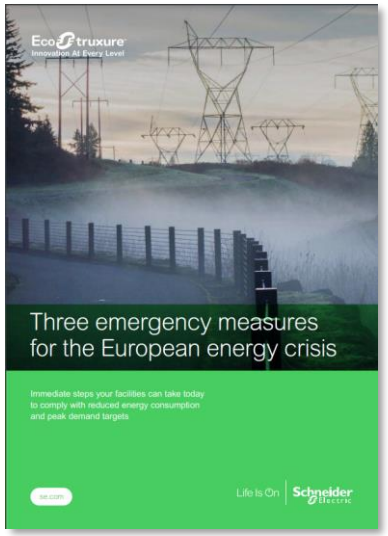
- Resilient to fluctuations in energy costs
- Hardened against grid outages
- Sustainable for power grids and local communities.

Additional resources

Schneider Electric Sustainability Consulting



White Paper 289 Microgrids for Data Centers



European energy crisis e-brochure

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Thank you

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