Designing and Future-Proofing Energy Systems

CENGRN-1000

Designing and Future-Proofing Energy Systems

From the Data Center to the Campus

CENGRN-1000

Denise Lee
VP Engineering Sustainability Office & Engineering Alliances

Energy Consumption Continues to Climb

Impact of AI in the Data Center

Challenges

- Performance Demands
- Power Constraints
- Cooling Dilemma
- Space Efficiency
- Network Implications
- Investment

Data Center Construction

46% Growth '22-'23

3,077.8 megawatts under construction in N. America in 2023

CBRE

Data Center Spending

$75B

AI to drive data center spending by 2028

Cushman & Wakefield

Liquid Cooling Growing

27.6% CAGR

Worldwide market growth from 2024 to 2032

Markets and Markets

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Impact of Modernizing Buildings

Challenges

Power Constraints

Space Optimization

Network Implications

Government Regulations

Health & Safety

Investment

Regulatory Pressure

75%

Buildings built prior to 2000 have poor energy efficiency

EU Buildings Directive

CO_2 Building Emission

30%

Operations of buildings account for global emissions

IEA

Skilled Labor Shortage

New Jobs Annually

80,000

By 2031 demand for skilled electricians will not be met

eeNews

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Bringing Energy into Focus

Energy Networking and Liquid Cooling Solutions

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Advancing Sustainability with Energy Management

Visibility to power telemetry and consistent greenhouse gas (GHG) metrics across global on-premises, cloud, and edge environments

Control use of analytics and insights to drive policy and control

Automate workflows with AI based recommendations and virtual assistant to achieve sustainability goals

ENERGY METRICS	Energy Consumption	GHG Emissions	Carbon Intensity	Energy Mix	Energy Cost

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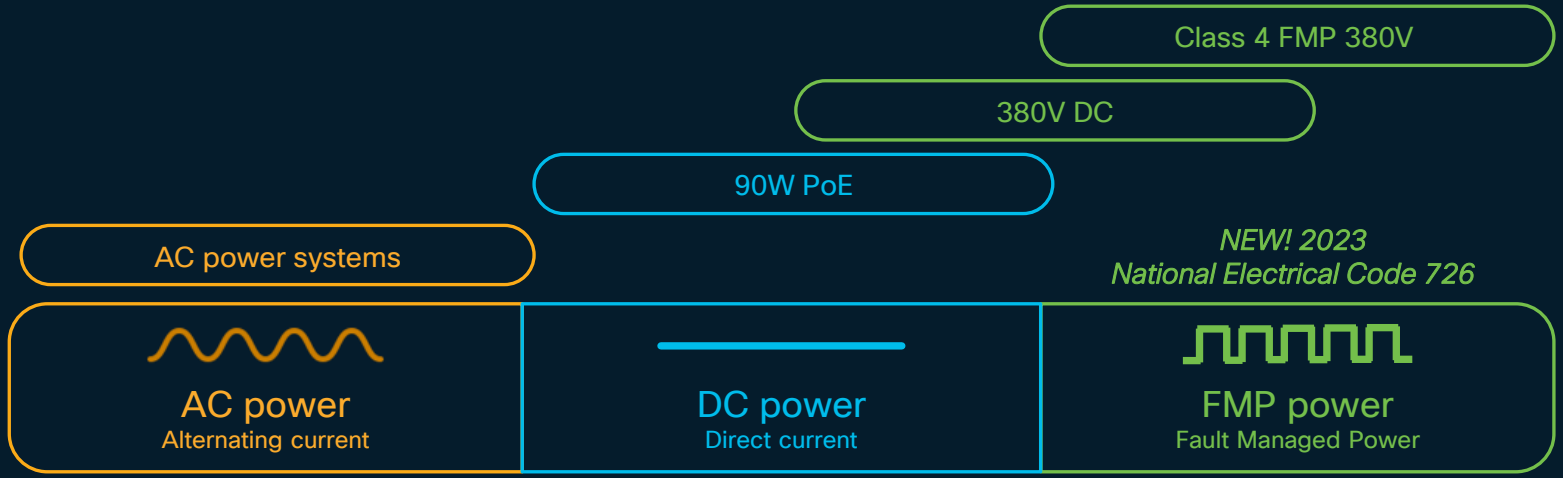
Evolution of Powering the Network

Enhance reliability and support of safe and secure power and data



FMP White Paper

Creating energy networks that connect and distribute energy more simply, safely, securely and sustainably

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Art of the Possible with FMP

Touch-Safe DC Power up to 450VDC

Enhanced Fault Detection and Isolation

Improved Energy Efficiency and Reduced Losses

Optimized Energy Storage Integration Preventing Overload

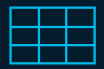
Optimized Energy Flow and Load Balancing

High-Voltage DC and Low-Voltage Power Distribution

Minimized Downtime and Maintenance Costs

Microgrid Support and Distributed Energy Systems

Increased Network Resilience and Reliability



Compliance with Smart Grid and IoT Technologies

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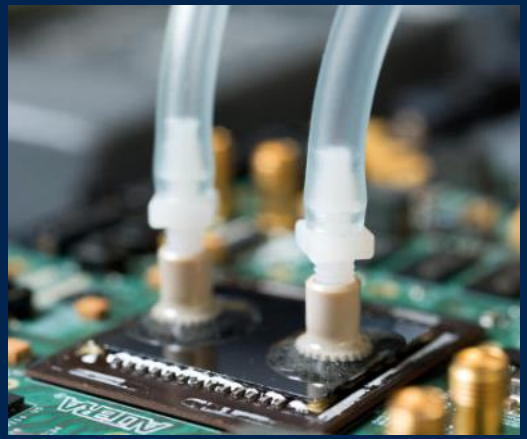
Solutions for Liquid Cooling in the Data Center

Integrated, Multi-Vendor Deployment

Rear-Door Heat Exchange
20-40 kW per rack



Direct to Chip
150 kW per rack

Immersion
250 kW per rack

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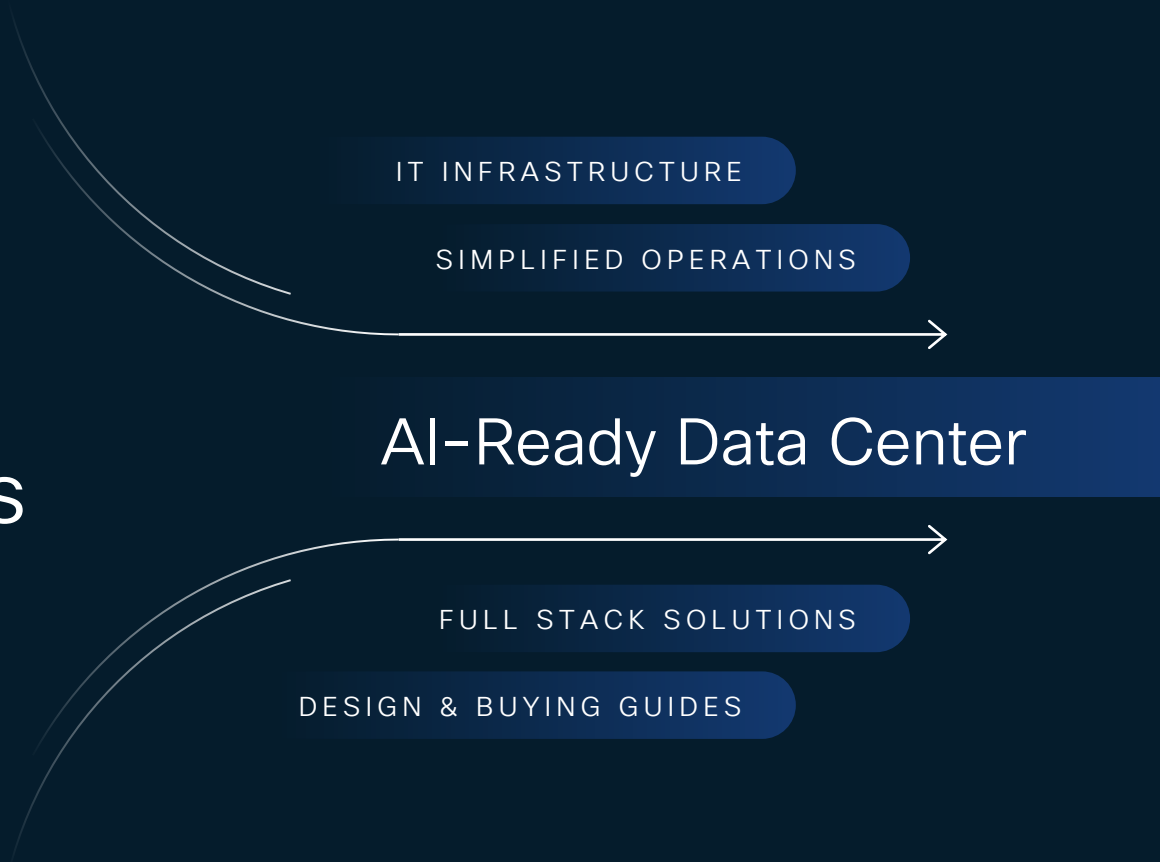
Helping You
Future Proof Your Investments



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Drivers for Change
AI-Ready Data Center

1

Largest Data Center Expense: Electricity

46% of total spending for enterprise data centers, 60% for SP data centers

Source: [IDC]

2

AI Driving Rack Power Capacities up to 100kW

To offset the emergence of large language model and generative AI applications

Source: [Del Oro]

3

Energy Management Drives Operational Efficiency

Predicting energy demand and adjusting resources reduces downtime to optimize efficiency

Source: [Data Center Dynamics]

Cisco’s Routed Optical Networking

Resilient AI Infrastructure for Optimized Fabrics and Trusted Transport

Cisco’s Routed Optical Networking (RON) Architecture lowers internet costs by reducing equipment and energy consumption

Simplify the Network

By merging routing and optical layers onto a single network with end-to-end automation through Cisco 8000 routers and Silicon One

RON is Cost Reducing

Due to a reduction in energy consumption, cooling, and space requirements

Routed Optical Networking	Impact	
Increased optics speed and a reduced footprint	5x Energy reduction	70% Space reduction
Chip performance 12-18 month innovation cycles	2x Power reduction	3% Space reduction
Evolution of cloud enhanced applications	2x Memory reduction	2X Boot time reduction
Built-in layered end-to-end automation	70% Less time to operate	46% Transport savings
Service Optimized Power	57% Opex savings	35% Capex savings

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Energy Networking Before and After

AI-Ready Data Center Systems

BEFORE

- 10% or more in power factor (PF) loss
- 20-40% in AC/DC conversion losses
- 10-20% in transformer & phase balance loss
- 20%+ loss in idle load and power supply units
- 15% loss due to in-chassis fans
- 40-60% energy consumption in cooling

40%* **energy conversion loss**
resulting in power inefficiencies throughout transmission

AFTER

- Reduced transmission losses
- Real-time fault management
- Selective fault isolation in the network
- Dynamic load management
- Automated energy redistribution
- Low-voltage safe and efficient DC distribution
- Optimized for high-voltage DC (HVDC) long-distance power transmission

50%* **energy savings gained**
operationally more efficient using liquid cooling and FMP

**Illustrative example: Findings performed in lab environment*

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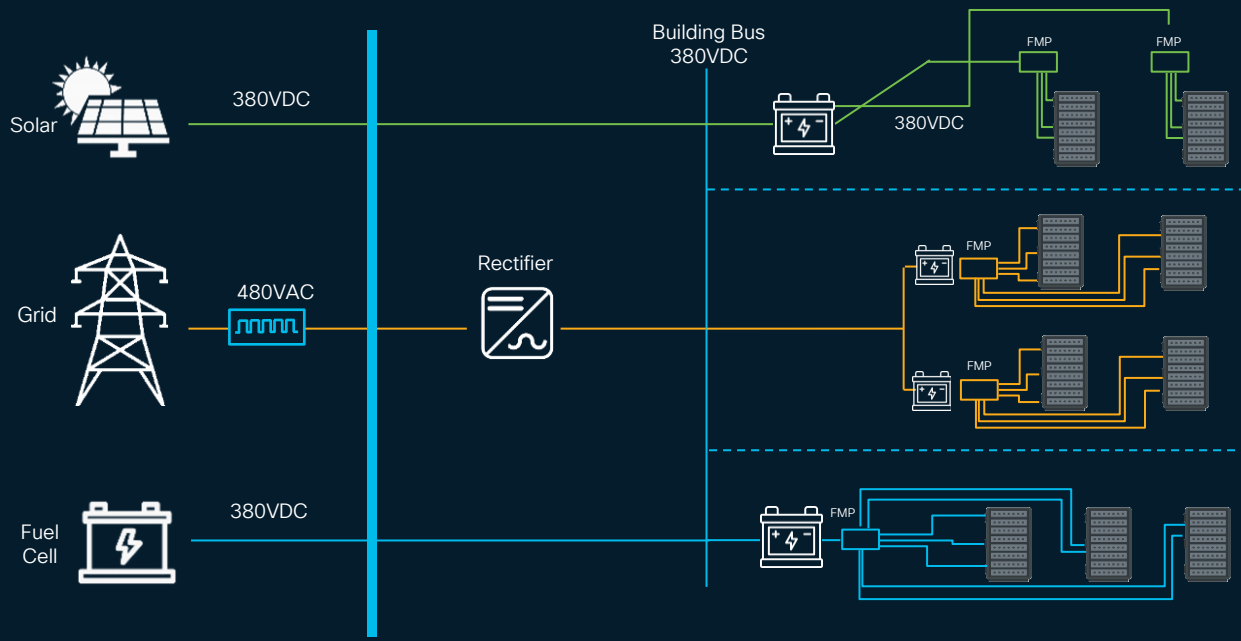
FMP Enabled Data Center



Scenario 1: Top-of-Rack FMP & Centralized BESS

- 380VDC FMP Power Shelf
- Point-to-Point distribution in rack
- Centralized BESS / backup battery

Scenario 2: Distributed Row-level FMP & BESS

- Co-located 380VDC FMP power-rack mid-row and distributed BESS/ backup battery
- FMP distribution within row

Scenario 3: Centralized FMP and BESS

- 380VDC to Centralized FMP & BESS electrical room
- P2P distribution entire floor
- Small Scale deployments

FMP: Fault Managed Power and
BESS: Battery Energy Storage System

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Transition for Scaling Data Center Cooling

The journey starts where you are

CURRENT

Air Cooling

Existing IT Workloads

Limited to lower density racks

Cannot account for spot problems

8-16 kW / rack

Rear Door Heat Exchanger

Near-term Evolve

Locationally deployed

Liquid CDU to solve hot spot problems

Building solution for DtC

20-40 kW / rack

TRANSITION

Direct-to-Chip (DtC)

Initial High Density

Higher rack density solutions

Scales from Liquid/Liquid CDU

150 kW / rack

TRANSFORMATIVE

Single-Phase Immersion

3 Year High Density Highest rack density solutions

250 kW / rack

Single-Phase Immersion + DtC

3 Year Single-phase immersion with DtC for extreme thermal density loads

350+ kW / rack

Liquid cooling technologies are highly compatible, and deployment is situational

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An ecosystem built to deliver more sustainable outcomes in the data center

Liquid Cooling Solutions	DeepCoolAI, VERTIV., GRC Green Revolution Cooling The Immersion Cooling Authority, Asperitas Immersed Computing
Infrastructure Modernization	HITACHI, NetApp, NUTANIX, PURESTORAGE, cisco Cisco Data Center Networking
Application Modernization	Epic, Microsoft SQL Server, SAP, ORACLE, vmware, NUTANIX
Security, Cyber-Resiliency	COHESITY, cisco SECURE, NetApp, NUTANIX
Hybrid Cloud, Hybrid Work	COHESITY, citrix, servicenow, RED HAT OPENSHIFT, vmware, NUTANIX
Artificial Intelligence	NVIDIA, PURESTORAGE, NetApp, intel, AMD, NUTANIX

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SoFi Stadium
HOLLY
WOOD
PARK

Helping You
Future Proof Your Investments

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Drivers for Change

Future-Proof Workplaces

1

Low Voltage and DC Deployments

Highlights PoE as a central strategy for commercial real estate executives

Source: [Deloitte]

2

Commercial Real Estate Loans: $4.7 Trillion

CRE loans (USA) in 2024 up for refinancing in a high interest rate environment

Source: [Markets Insider]

3

Smart buildings worldwide projected to climb

From 45 million in 2024 to 115 million in 2026 as demand grows for energy-efficient buildings

Source: [Smart Energy]

Integrated Solutions and Experiences

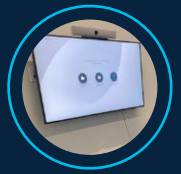
Meraki Cameras
Floor occupancy & tripwire (macro floor plate loading)

Cisco Wi-Fi AP
People count, people's physical location to track their journey through the office

Air Quality
Meraki and 3rd party sensors for CO2, temperature, humidity, TVOC & PM2.5

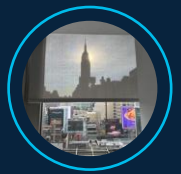
Occupancy
3rd party sensors for people count

BMS Systems
Existing building owner systems for HVAC, fire, access control, and more

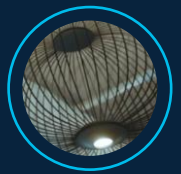


Cisco Room devices
People count, Ambient Noise

Cisco Navigator
Temperature, Humidity & TVOC



Shading
Shading sensors for Lux level to help maximize daylight and manage visual comfort & heat load



Lighting
Low voltage lighting powered by PoE can be both more efficient and can easily be powered via solar.

Energy Metering
Customer owned circuit or submetering systems.

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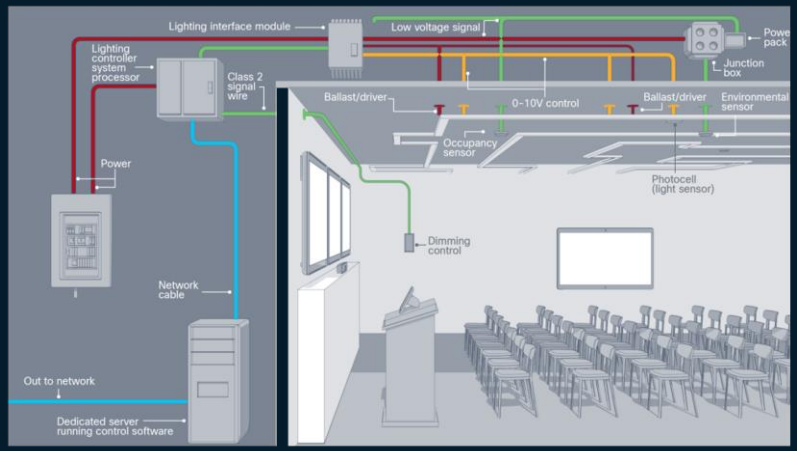
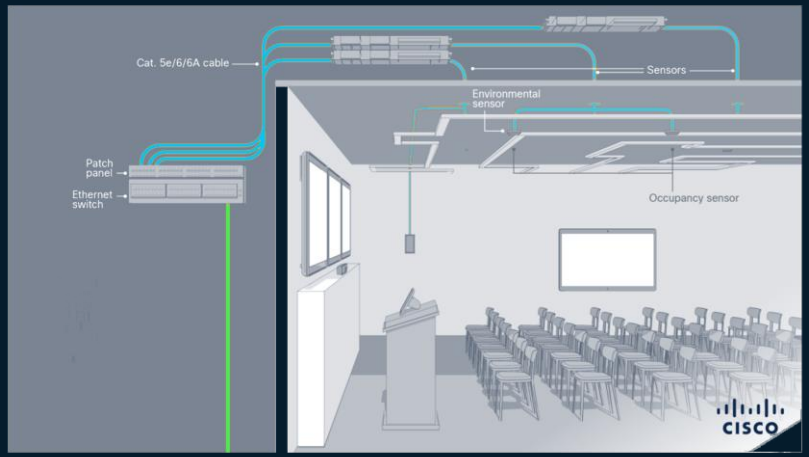
Energy Networking Before and After

Future-Proofed Workspaces

BEFORE



AFTER



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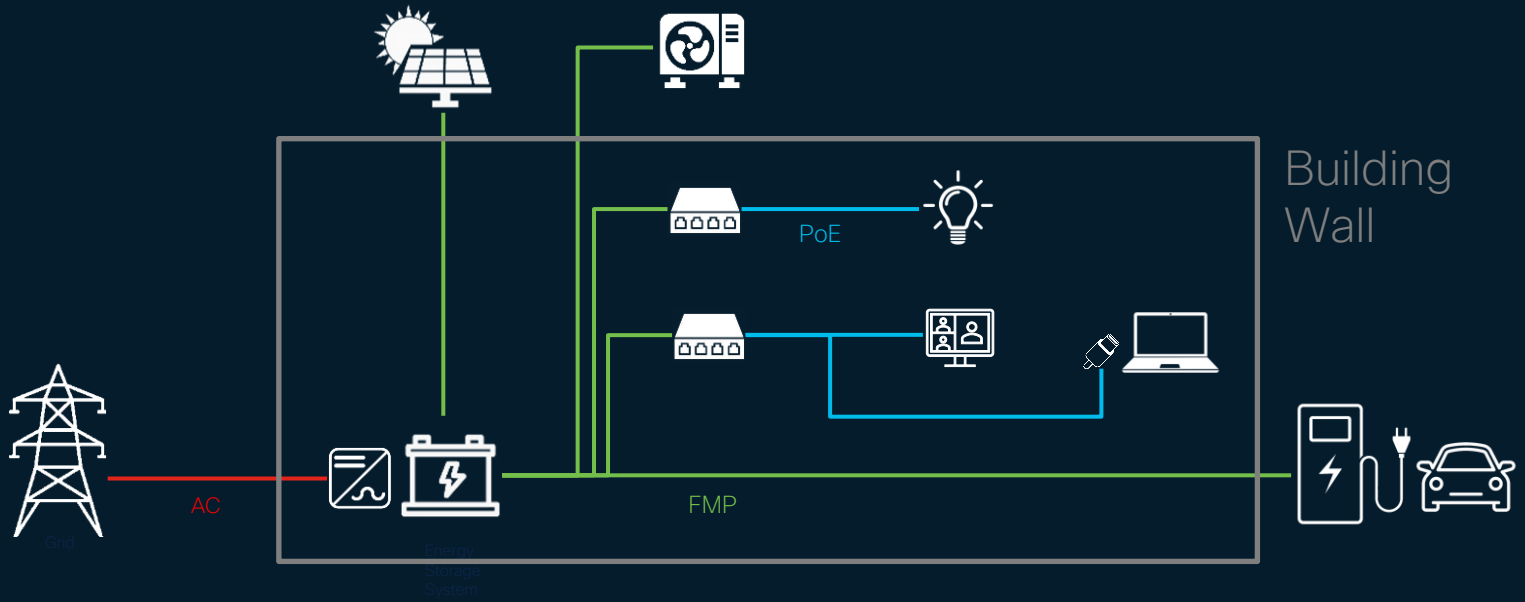
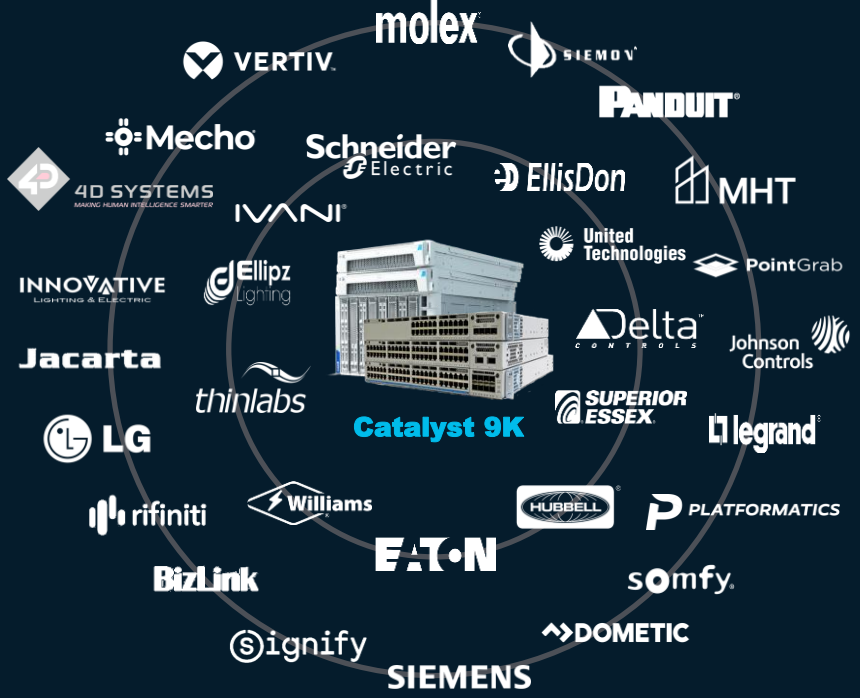
FMP + PoE
Completes an End-to-End Safe DC Microgrid



An ecosystem built to deliver more sustainable outcomes in Smart Buildings



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Engineering Alliances

Accelerating Technology Innovation Ecosystems

Get More Information Here

Technical Validation for Solutions | Standardization & Scale | Integrates SolutionsPlus

Retrofit for Air-Cooled Data Centers

Options for liquid cooling solutions without data center layout changes

Immersion Cooling for Data Centers

Options to solve data center hot spots or enable new high-efficiency facilities

Touch Safe High-Voltage Power Backhaul

Options to reduce cost (energy, labor, material) while increasing safety in smart buildings

Low-Voltage Last Mile Power Distribution

Using PoE for lighting, signage, and office equipment through last-mile infrastructure

DeepCoolAI VERTIV. GRC Asperitas PANDUIT thinlabs MHT

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Industry Relationships Driving Progress

SSI Alliance

IETF

OPEN Compute Project®

ITU

Merge® ALLIANCE

NEMA National Electrical Manufacturers Association

the green grid® get connected to efficient IT

FMP Alliance

PoE Consortium™

Ultra Ethernet Consortium

ETSI

Infrastructure Masons

Project 150 Consortium

Consortium of Industry Leading Specialists Delivering
Intelligent Ready Buildings (IRB)

CISCO	Sidara	Schneider Electric	ideal	PARA
Secure, Converged Connectivity Platform	Client, Architect, Consultant, Occupier	MEP Engineering OT & BMS Partner	Secure CNS Systems Integrator	Data Visualization & Digital Consulting

End-to-End Sustainability

Leverage Cisco's product life cycle management programs

- Cisco Refresh program 24 years strong
- Product takeback with 99.9% reused or sent to recycle
- Green Pay flexible IT payment solution
- Partner environmental sustainability specialization
- Global public funding for sustainability initiatives
- CX Sustainability Services

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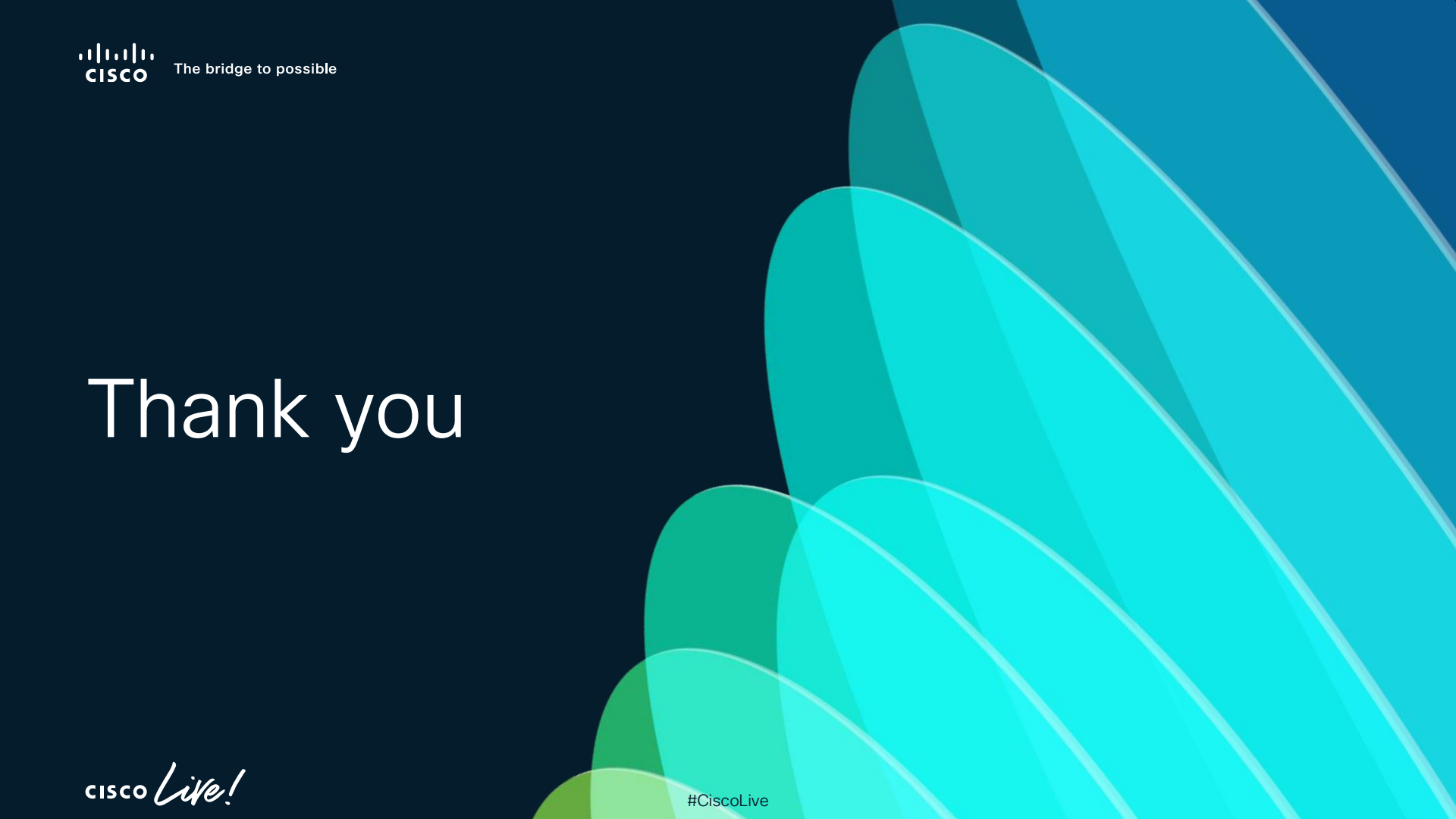
Continue Your Education

- Visit the Sustainability zone for related demos
- Book your one-on-one Meet the Engineer meeting
- Attend the interactive education with DevNet, Capture the Flag, and Walk-in Labs
- Visit the On-Demand Library for more sessions at ciscolive.com/on-demand. Sessions from this event will be available from March 3


The bridge to possible
Thank you
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(from 11:30 on Thursday, while supplies last)

All surveys can be taken in the Cisco Events mobile app or by logging in to the Session Catalog and clicking the ‘Participant Dashboard’

Content Catalog

Continue your education

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DRAFT only

Center Stage Abstract | Denise Lee / Session catalog

Designing and Future-Proofing Energy Systems – from the Data Center to the Campus

Rehearsal: Sunday Feb 9 / 15:00 (3:00pm)
Session: Tuesday Feb 11 / 13:45 Be at theater at 1:30 (1:45-2:15)

Abstract: Cisco is at the forefront of shaping the future of energy, playing a critical role in innovating and transforming the energy landscape. We believe we must sustainably design and future-proof energy grids, buildings, networks, data centers and technology for whatever energy requirements are around the corner - whether that's AI or whatever comes next. Cisco understands the urgency of designing and future-proofing energy systems. As technology evolves, so too must our energy infrastructure, so that we can meet emerging demands efficiently and sustainably.

Cisco believes that achieving energy sustainability requires a holistic approach, with four key focus areas:

1. **Re-designing data centers for AI:** Optimizing data centers with AI to increase energy efficiency and reduce carbon footprint.
2. **Transitioning to Smart Grids:** Enhancing the efficiency of electricity transmission and distribution through smart grid technology to reduce losses and incorporate renewable sources effectively.
3. **Upgrading and digitalizing industries, buildings, and cities:** Implementing intelligent systems to reduce energy consumption in buildings and urban areas.
4. **Protecting what we connect:** Strengthening grid security to safeguard against cyber threats and ensure a resilient energy infrastructure

By focusing on these key areas, Cisco aims to drive a sustainable energy transition, integrating cutting-edge technology to prepare for the next wave of energy requirements. Through strategic partnerships, alliances and innovative solutions, we're leading the way in sustainable energy practices, ensuring that technological advancements contribute positively to our environmental goals.

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Center Stage Storyboard | Denise Lee REVISED

Designing and Future-Proofing Energy Systems – from the Data Center to the Campus

Topic	Time	Description
Current Landscape	2 min	Challenges & Opportunities Energy (and costs) consumption is growing - Buildings and data centers are huge consumers and contributors of GHG emissions Change is happening to sort of mirror the title which is from the campus to the data center and all the building that is happening and just show that the interaction moments that we see, like we're driving on the on the freeway or driving in our neighborhoods, you see these huge cell towers. You see these data centers being built. You see, you know, huge landscapes and campuses being built.
Stats / opportunity		Stats of the the underlying connection across all of that. Is energy and power. Cisco is the network backbone, and we are a networking company and we are very excited to continue the evolution of this conversation with you because we see this huge opportunity. Trillio
Focus Area Overview	6 min	Before & After Scenarios / schematics 1. Upgrading and digitalizing our industries, buildings, and cities 2. Modernizing data centers 3. Transitioning to Smart Grids
Energy Networking/FMP	10 min	Introduction to How FMP and liquid cooling can be utilized in energy networking to optimize operations: Campus & DC Logos with all data center and one logo of all campus. Let's bring them together in one slide and show from the data center to the campus, look at all of these partners that we can work with, and that's where the engineering alliances piece comes in.
Customer Examples		We are bringing all these partners in at speed and scale. This is how we're doing it. We are going to deliver these use cases to you. And this is where I want to take those use cases and highlight a couple of them and and it would be great to highlight with real examples, customer examples things that are already done, things that are underway, things that have just sold that showcase some of these use cases and and what the decision-making criteria or matrix looks like. And I think if we can do that.
Video	3 min	Sofi / HP video
Eng Alliances		We can get very excited about fault managed power, very excited about liquid cooling, point them to the demos and the booths, and then sort of Gartner that excitement around engineering alliances is that opportunity for us to get it done.
Cisco's Solution	10 min	1. Future-Proofed Workplaces - Making Buildings Smarter and More Sustainable 2. AI-Ready DC - Re-designing data centers for AI / Liquid cooling strategies
CTA	2	Resources to get more information