



Intelligent power for AI

IQ SST: Distributed, solid-state transformers for AI data centers

Safe harbor

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AI data centers create a new power problem

Three constraints emerging at the same time: capacity, dynamic response, and efficiency

Capacity gap

Demand is growing faster than active AI-dedicated capacity and available power infrastructure.

Dynamic loads

AI training loads can swing from idle to full power several times per second, stressing the grid.

Efficiency losses

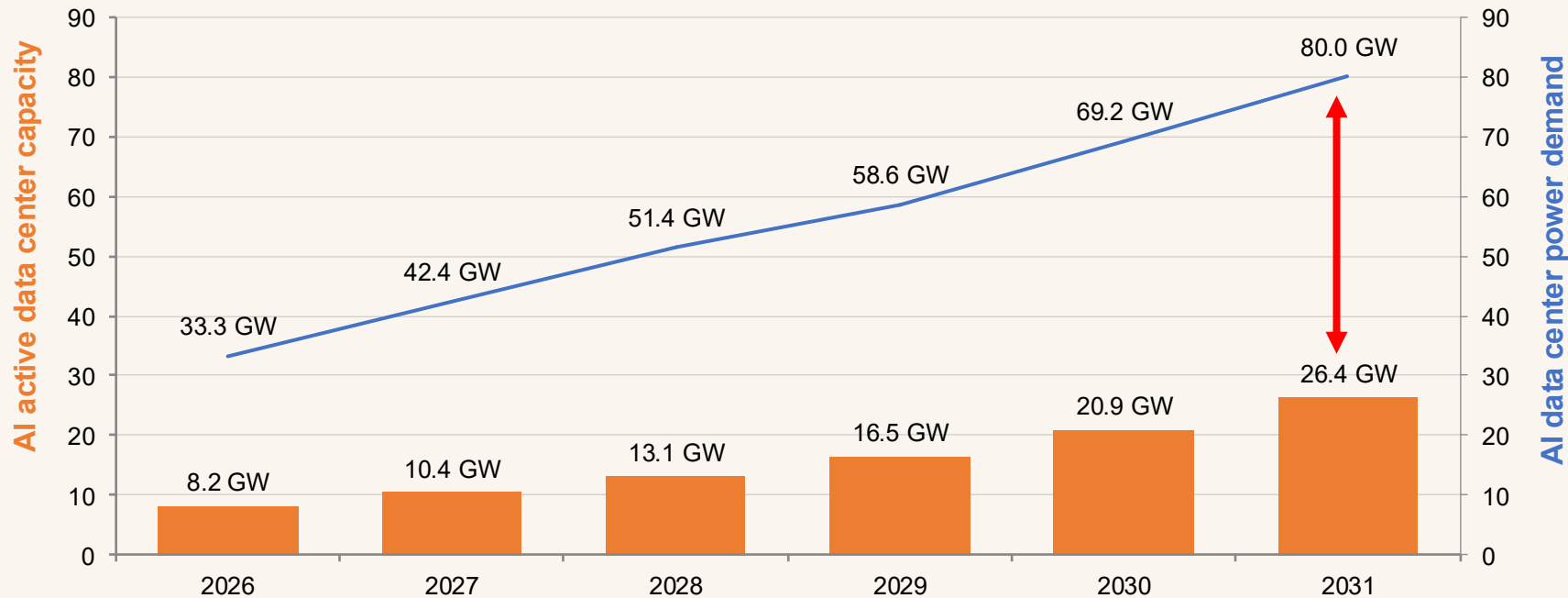
Legacy architectures rely on too many conversion stages between the grid and compute racks.



AI demand is outpacing power infrastructure

U.S. data center power demand could reach ~80 GW by 2031, far ahead of expected AI-dedicated active capacity — and today's power architecture cannot deliver it efficiently.

AI-dedicated active capacity versus power demand for U.S. data centers



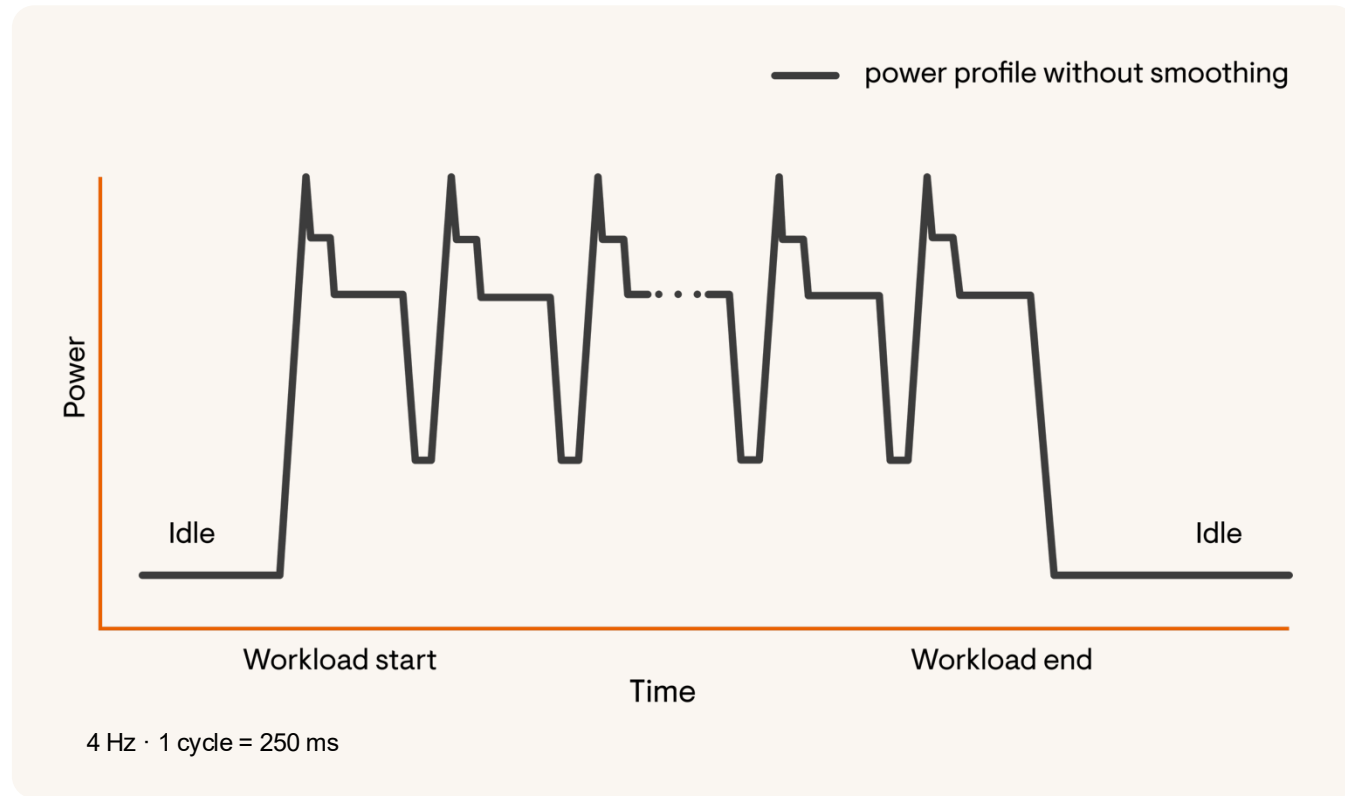
Source: ABI Research for AI-dedicated active capacity; McKinsey for U.S. data center power demand through 2030; 2031 extrapolated from prior-year trend.

~ 80 GW

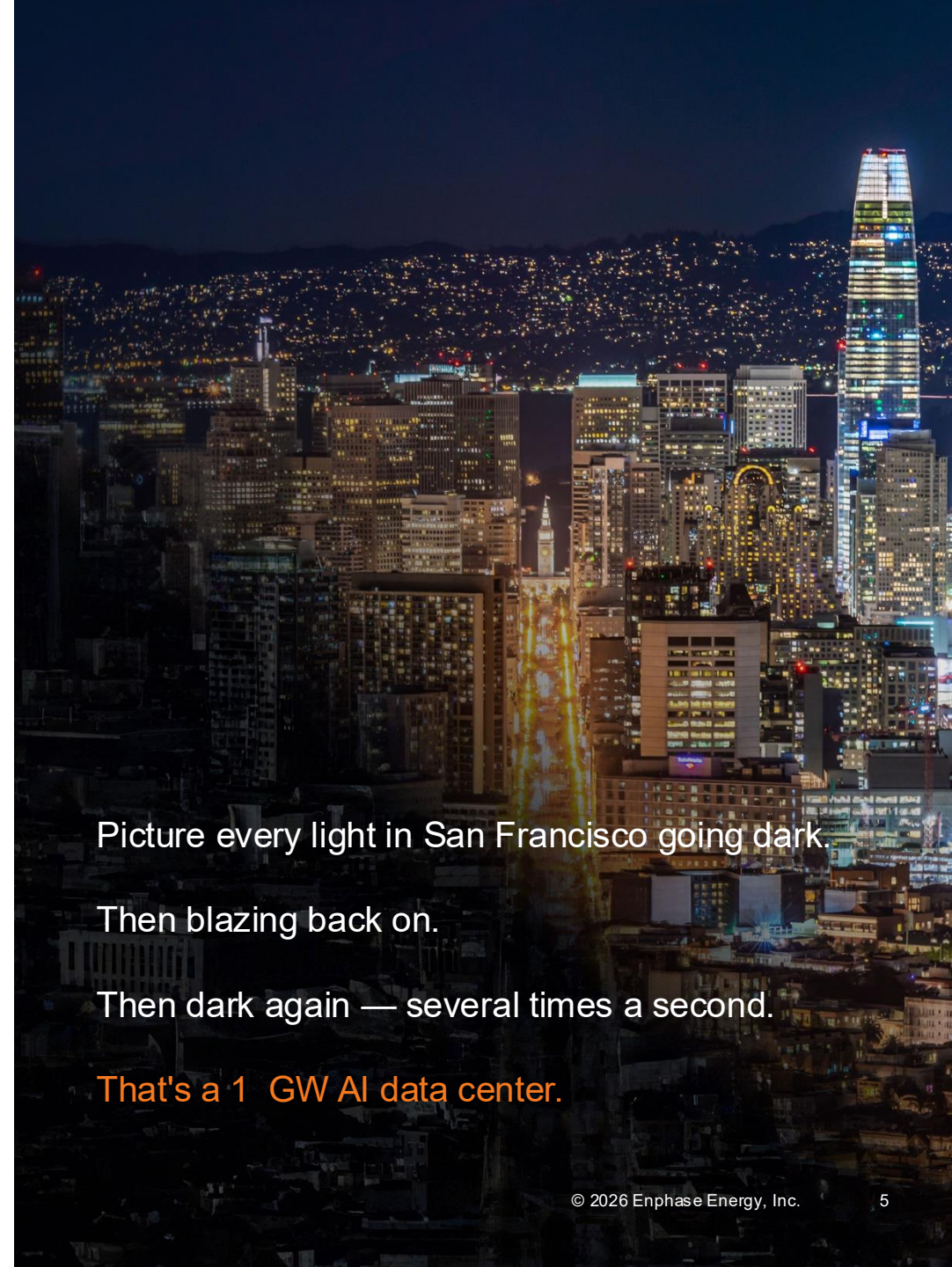
U.S. data center power demand by 2031 versus ~26 GW AI-dedicated active capacity

AI also has a dynamic load problem

AI training loads can swing from idle to full power several times a second. Power infrastructure must respond in milliseconds, not seconds.



Graph source: NVIDIA Technical Blog, "How New GB300 NVL72 Features Provide Steady Power for AI," Figure 1 (AI training workload power profile), July 28, 2025.



Picture every light in San Francisco going dark.

Then blazing back on.

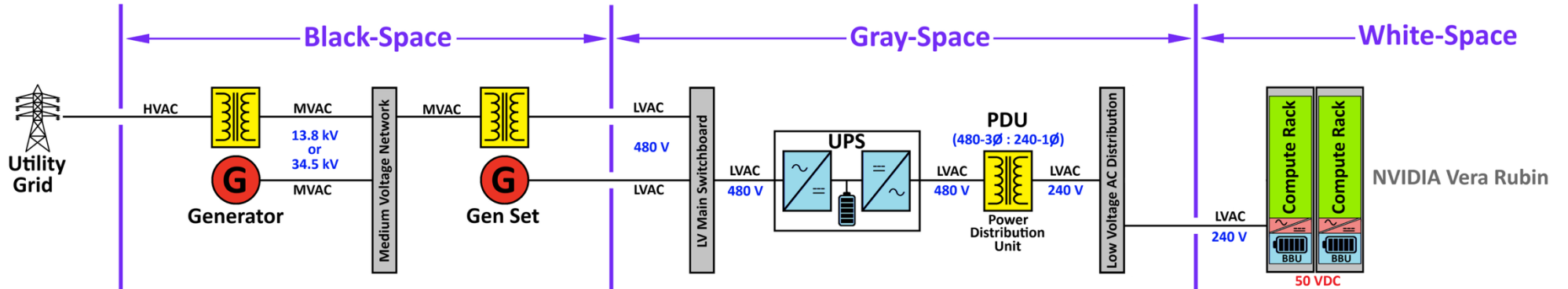
Then dark again — several times a second.

That's a 1 GW AI data center.

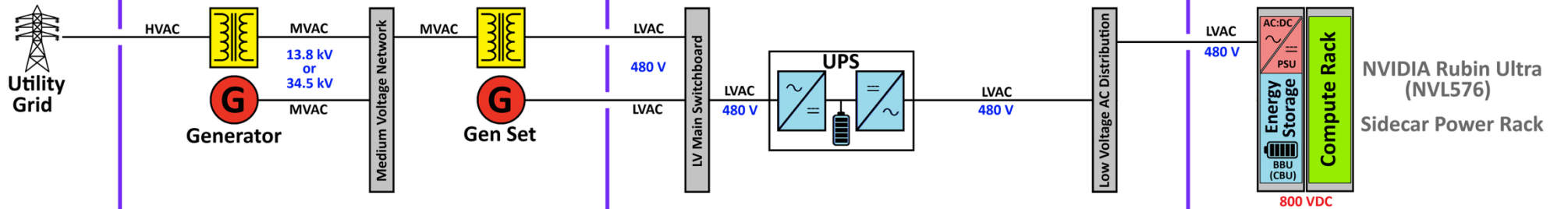
AI has an efficiency problem

Today's architecture has too many conversion stages. IQ SST will convert medium-voltage AC directly to 800 VDC, reducing sidecar infrastructure and power losses.

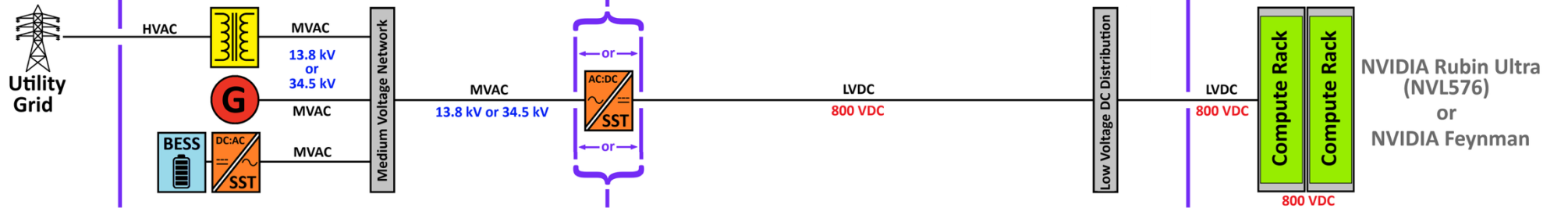
2026
50 VDC Power Shelf



2027
800 VDC Sidecar



2028+
SST Architecture



Source: Based on NVIDIA, "800 VDC Architecture for AI Data Centers"; NVIDIA Developer Blog, "NVIDIA 800 V HVDC Architecture Will Power the Next Generation of AI Factories," May 2025; Open Compute Project, "Power Architecture Evolution in Data Centers," Sept. 2025.

AI needs a new power architecture – IQ SST

IQ SST will be a distributed solid-state transformer that converts medium-voltage AC directly to 800 VDC for next-generation AI racks.

	Today	Tomorrow
Architecture	UPS, PDU + sidecar (PSU, BBU, CBU)	Reduced sidecar and backup infrastructure. More space for compute
Voltage	48 VDC power delivery	800 VDC (± 400 VDC) power delivery to align with NVIDIA/OCP architecture
Reliability	Important	Distributed redundancy; five-nines availability
Supply chain	Offshore, custom builds	Supplied from U.S. manufacturing facilities
O&M	Specialized field service team	Modular hot-swap; no specialists

Why Enphase, and why now?

AI is setting a new standard for power delivery. Enphase is ready.

A 20-year head start

The core technology is what we've been shipping for two decades.

~87.8 million microinverters in the field. Nine microinverter generations. Five ASIC generations. Established and scalable manufacturing.

Distributed by design

No single point of failure. 99.999% availability.

342 power modules per unit with 10% built-in redundancy.

Performance

Single-stage power conversion with sub-millisecond response time.

Fewer failure points. Higher efficiency. Simpler manufacturing. Lower service cost. Built on platforms we already ship at scale.

We changed solar. Now we're bringing distributed power to AI.

20

years of distributed
power electronics

9

Microinverter
generations

~87.8M

Microinverters
shipped

~5.2M

Systems
worldwide

~31.5 GW

of managed
solar systems

~2.5 GWh

of deployed
energy storage

165

Countries
served

~550

patents and pending
applications

IQ Solid-State Transformer (IQ SST)

- Power: 1.25 MW, ambient-air cooled
- Architecture: supercluster of 342 power modules (Δ configuration)
- Will support 35 kV and 15 kV utility interconnection classes
- Designed for five-nines availability
- 10-year limited warranty
- Modular hot-swap design — service without shutdown
- No internal batteries required
- U.S.-based manufacturing and supply chain
- Dimensions: 1.8 m \times 1.5 m \times 2.3 m
- Scales up to 5 MW per skid



Product under development. Specifications and performance subject to change.



The building block: Enphase power module

- Designed on nine generations of microinverter technology
- 4 kVA continuous peak power
- Single-stage power conversion
- Custom Kestrel ASIC and bi-directional GaN switching
- Over 98.5% peak efficiency expected
- High-frequency transformer (>250 kHz average)
- Soft-switching design for low EMI
- Potted, all-plastic enclosure
- Targeting microinverter-class reliability
- Dimensions: 600 mm × 200 mm × 40 mm

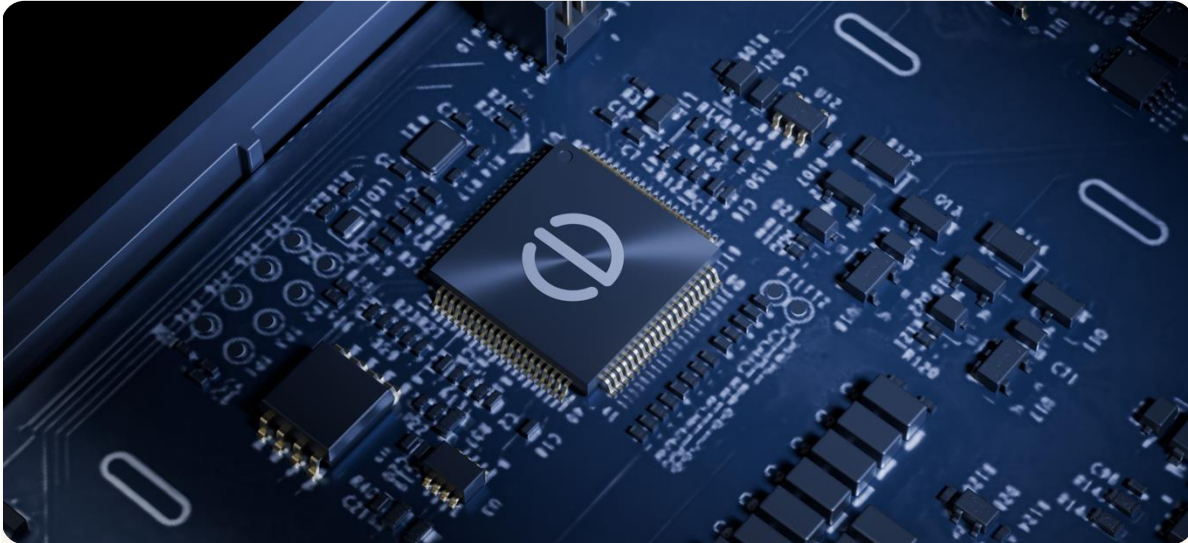


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Heart of the Enphase power module

Two breakthroughs, one single-stage converter.



Kestrel ASIC

- 5th-gen custom 22 nm control ASIC powering the single-stage converter
- Multi-core software with built-in communications, security, and safety
- Proprietary tandem function supports fiber-optic interface for SST application



GaN bi-directional switch

- Bi-directional GaN switching technology proven in IQ9 Microinverters
- Enables compact, high-efficiency power conversion
- Supports low EMI and fast switching in single-stage design

IQ SST Roadmap

From functioning power modules to volume shipments

9+

months of active development

80+

Engineers dedicated to IQ SST

20+

Prospective customers & partner engagements

PRODUCT ROADMAP

TODAY · Q2 2026

2026

2027

2028

Functioning power modules

Engineering samples in-house and producing power. Core conversion architecture validated.

Full system demonstration

Complete 1.25 MW rack demonstration. 34.5 kV AC → 800 V DC at full power.

Customer pilots

Pilot deployments with select data center partners. Real-world validation at customer sites.

Volume shipments

Full commercial production ramp. Supplied from U.S. manufacturing facilities.



Designed for AI. Built to scale in the USA

IQ SST is designed around Enphase's high-volume manufacturing playbook: automated production and standard high-volume components.

- Automated manufacturing designed for repeatability and scale
- Existing Enphase processes adapted for SST power modules
- Standard high-volume components to improve supply availability
- Potted, all-plastic enclosure built for reliability and manufacturability
- Supplied from U.S. manufacturing facilities

Rearchitecting AI power — the Enphase advantage



Reduce or eliminate sidecar infrastructure

Less power infrastructure. More space for GPUs. More tokens. More revenue.



Sub-millisecond response

Single-stage power conversion.
>250 kHz average switching frequency



Five-nines availability

Distributed architecture with 342 power modules. No single point of failure



Lower field service cost

Hot-swap without shutdown — no specialized technicians required



U.S. supply chain

Supplied from U.S. manufacturing facilities; standard high-volume components



Semiconductor-based, software-defined

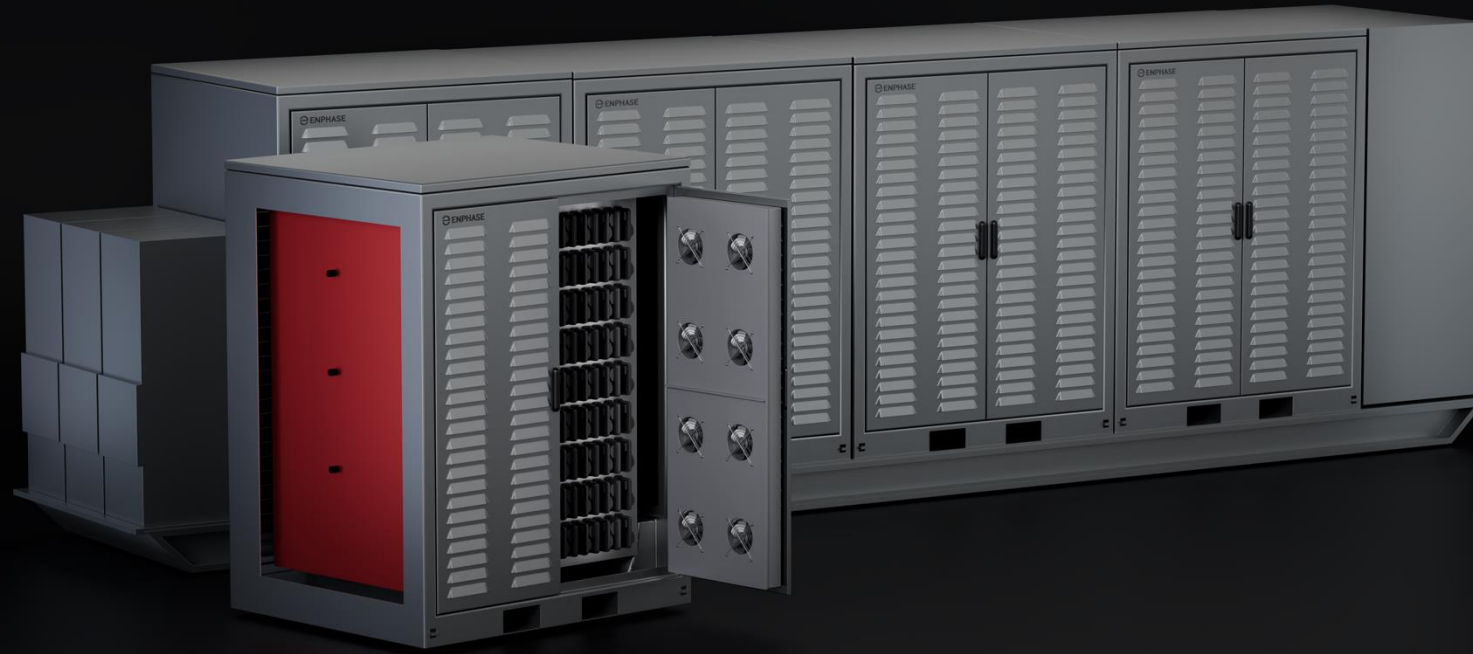
Custom Kestrel ASIC and bi-directional GaN. 98.5% efficiency



Enphase IQ SST

Intelligent power for AI

Distributed by design. Backed by 20 years of Enphase.



Learn more at enphase.com/iq-sst