Direct Medium-Voltage-to-800 VDC Conversion for AI Data Centers

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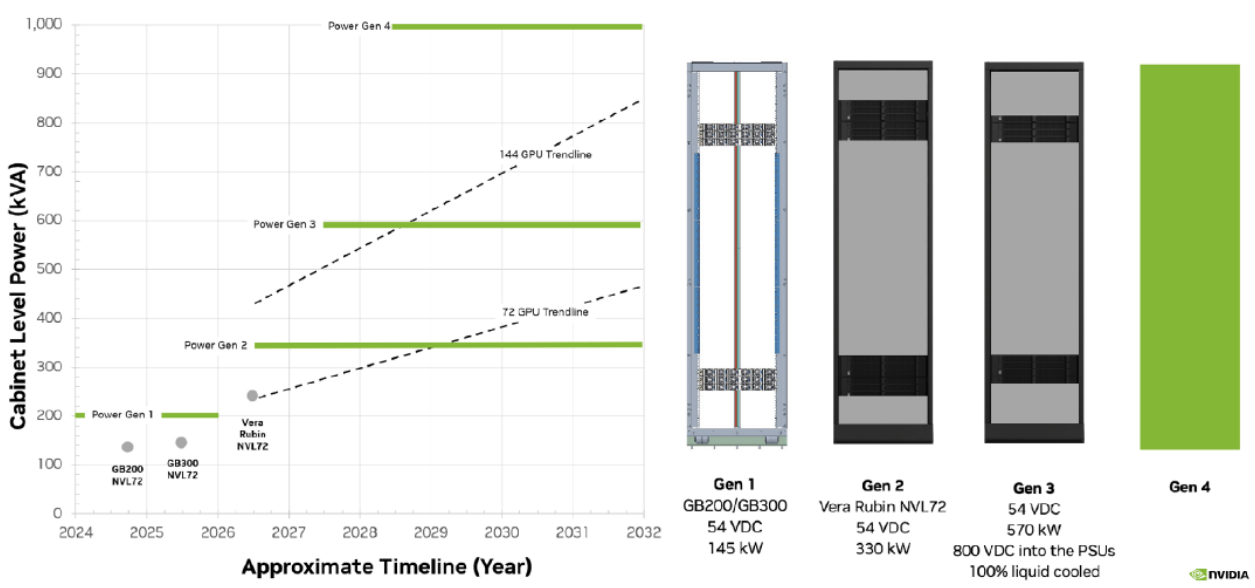




AI Rack Power Is Outgrowing Low-Voltage AC Distribution

Rack power is approaching 1 MW, driving higher current and copper use in LVAC distribution.

AI Rack Power Evolution

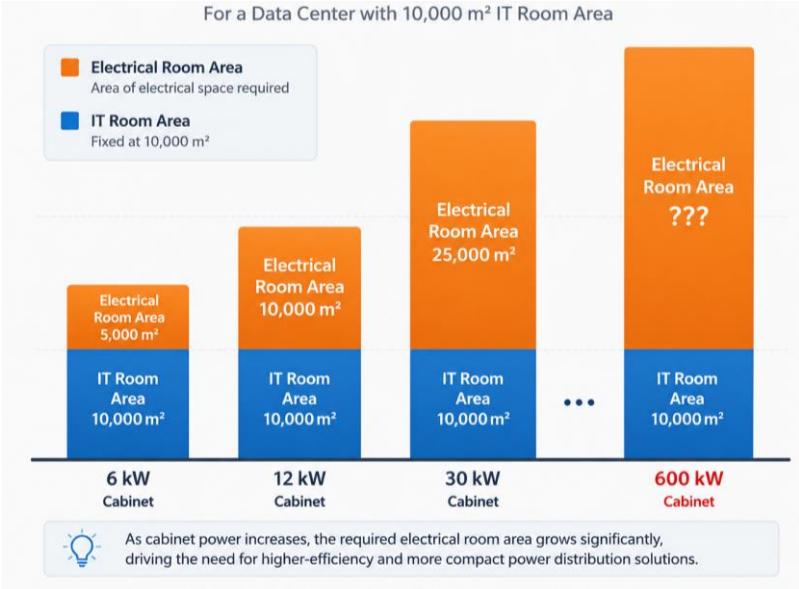


AC Distribution Limitations

- Higher Current
- Larger Footprint
- Limited Scalability

Source: NVIDIA, 800 VDC Architecture: Industry Alignment & Execution

Electrical Room Footprint



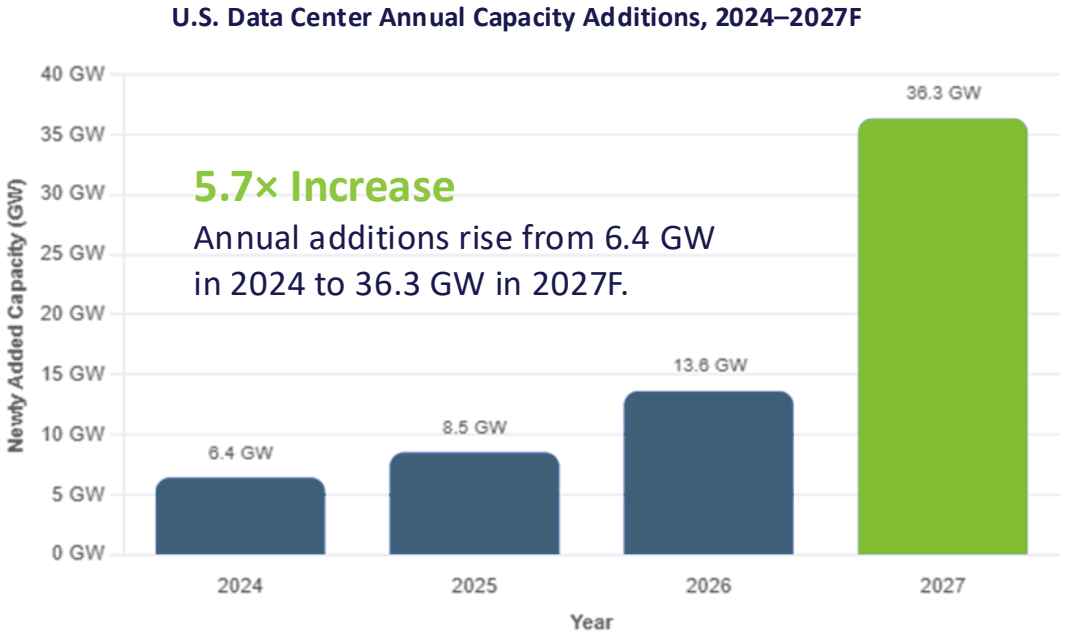
Source: ODCC, Guosen Securities Research Institute

Megawatt-scale AI racks require much higher power density across the power distribution system.

Power Infrastructure Is Not Scaling at the Pace of AI Compute

Grid deployment and transformer supply are becoming critical schedule constraints.

Accelerating Capacity Additions



Source: Goldman Sachs Research

Constrained Transformer Manufacturing



- Engineer-to-order production
- High copper and steel content
- Limited factory throughput

128 weeks

Reported U.S. power-transformer lead time

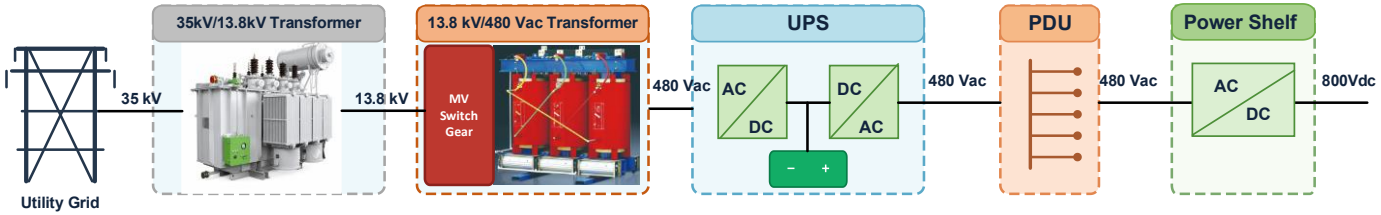
Sources: MBT/ Vietnam Transformer, image; Industrialsage, power-transformer lead-time report

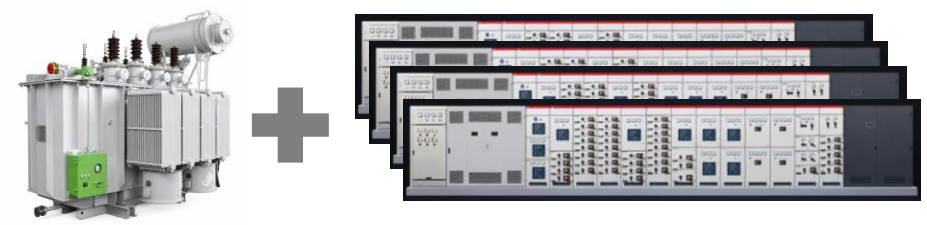
AI scaling now depends on how quickly power capacity can be manufactured and deployed.

Solid State Transformer Simplifies AI Data Center Power Infrastructure

Replacing multiple conversion stages with one integrated medium-voltage platform

Conventional 35 kV / 10 MW Architecture





35/13.8 kV XFMR, 1 × 10 MW

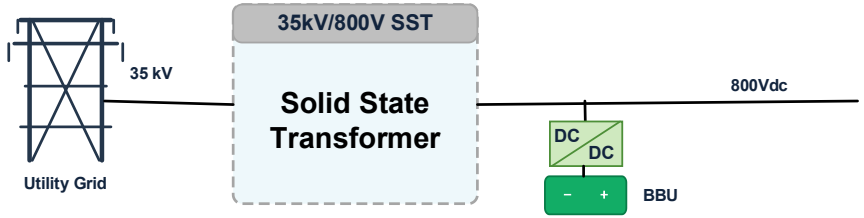
13.8 kV/480 V XFMR+ MSB+ UPS + RPP+ AC/DC PSU, 4 × 2.5MW

93.3%
System Efficiency

188 m²
Equipment Footprint

24-30 Months
Typical Delivery Lead Time

Nova Link™ 35 kV / 10 MW SST



Mult. Conversion Stages → One Integrated Platform



35 kV | 10 MW Solid State Transformer

98.7%
System Efficiency

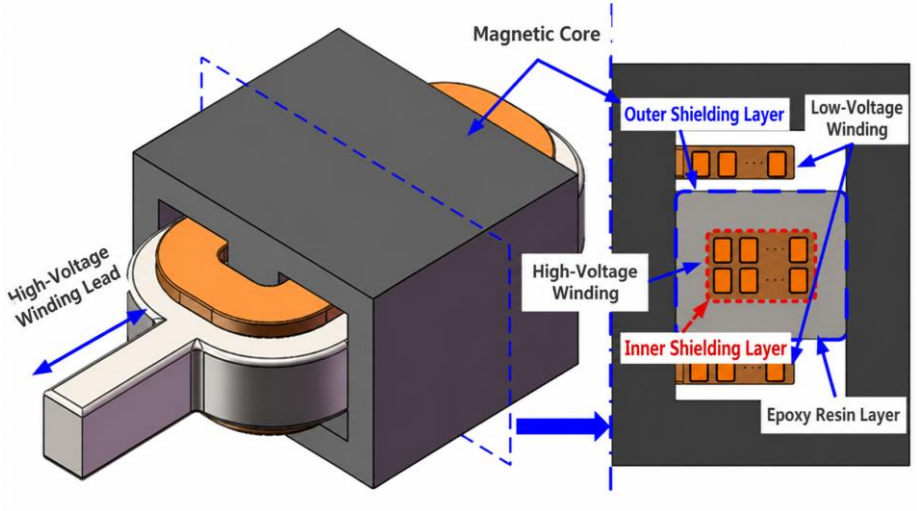
9.6 m²
Equipment Footprint

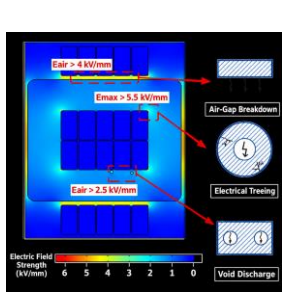
4 Months
Delivery Lead Time

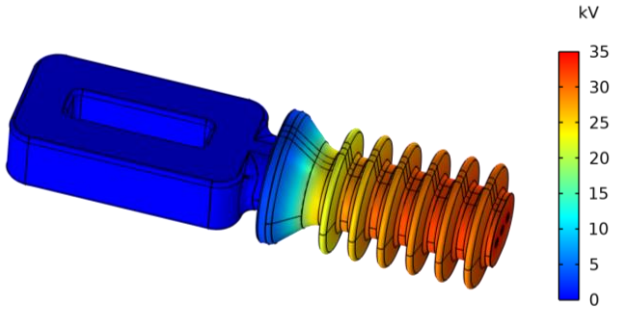
Direct conversion reduces losses and footprint, but concentrates key challenges in the SST.

Challenge 1: Insulation and Thermal Co-design

Typical MV Transformer Insulation Architecture







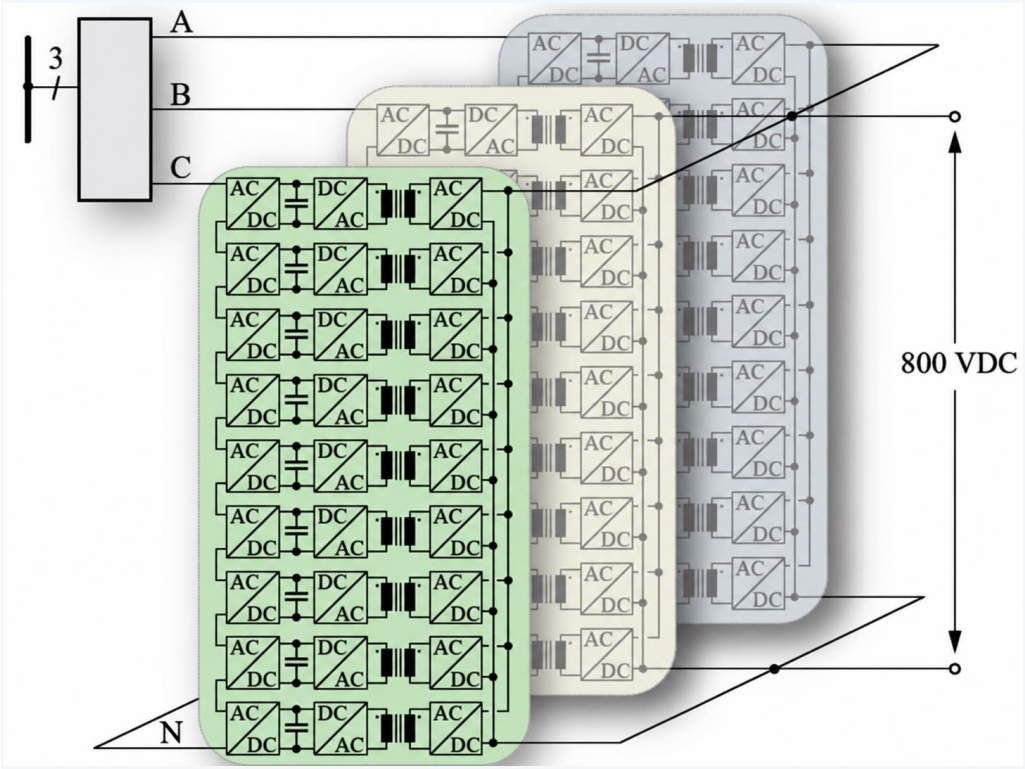
Source: Prof. Chushan Li, Zhejiang University

	DESIGN CONSTRAINT	NOVA LINK™ RESPONSE
1	**Frequency Scaling** Magnetics shrink. Insulation does not.	**Fully Solid-Insulated Power Cell** MV and LV circuits, including the transformer, share a coordinated solid-insulation system
2	**Electro-Thermal Conflict** Thicker insulation increases thermal resistance.	**Dedicated Cooling Path** A dedicated thermal path cools the windings and magnetic core.
3	**Insulation Aging** CTE mismatch drives interface stress and delamination.	**Compliant Mechanical Decoupling** Decouple the winding from rigid insulation.

Insulation architecture sets power density and service life.

Challenge 2: Availability and Serviceability

Cascaded ISOP Architecture



10 cells per phase | 30 cells per system | Common 800 VDC output

Source: Adapted from J. W. Kolar, ETH Zurich

	DESIGN CONSTRAINT	NOVA LINK™ RESPONSE
1	**High Component Count** More devices create more failure points.	**Multi-Level Reliability Design** System availability targets guide module- and device-level design.
2	**Fault localization** Cascaded cells complicate fault detection.	**Cell-Level Fault Isolation** Local protection isolates and bypasses faults.
3	**Repair time** Diagnosis and replacement extend downtime.	**Rapid Cell Replacement** Standard cells and quick-connect interfaces reduce MTTR.

High availability requires fault-tolerant operation and short MTTR.

Challenge 3: Coordinating Grid, Load and Cell Dynamics

Hierarchical SST Control Across Multiple Time Scales



	DESIGN CONSTRAINT	NOVA LINK™ RESPONSE
1	**Grid-Side Disturbances** Grid faults and voltage disturbances require fast, compliant response.	**Grid-Responsive Control** Current regulation and fault ride-through (FRT) meet grid requirements.
2	**Fast AI Load Transients** Rapid load steps disturb the 800 VDC bus.	**Software-Defined Load Response** Bus control and power slew rate match rack and BBU requirements.
3	**Cell Coordination and Faults** Cell faults disrupt voltage sharing and modulation margin.	**Fault-Tolerant Reconfiguration** Automatic bypass restores voltage sharing and continued operation.

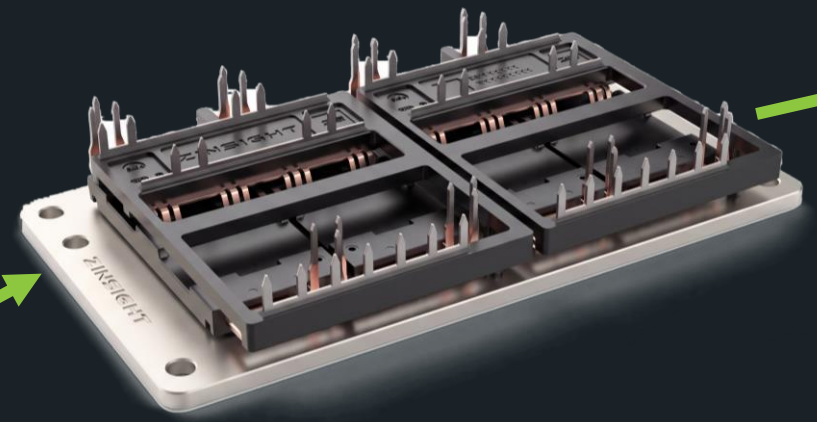
Grid, load and cell dynamics require coordinated control.

From ZPAK™ SiC Module to 35 kV/420 kW Liquid-Cooled Power Cell

2.3 kV SiC MOSFET



ZPAK™ Power Module



35 kV Liquid-Cooled Power Cell



5 x 6 mm die size

4.6 mΩ·cm² specific on-resistance

Optimized for high-frequency switching

<5nH commutation inductance

0.2 mΩ package resistance

225°C junction-temperature capability

Automotive-grade package

420 kW In 216 L

1.94 kW/L

Including 35kV insulation

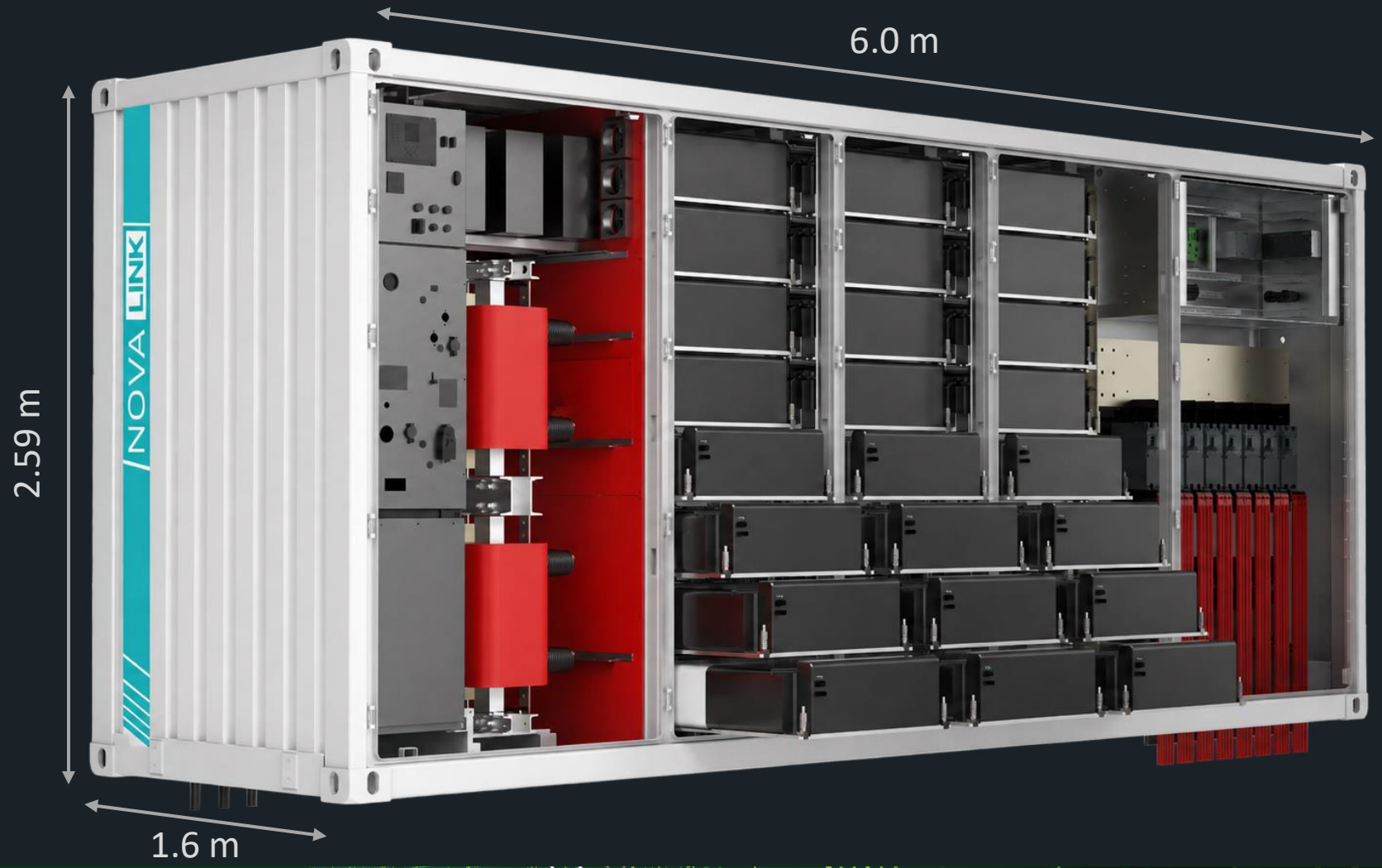
99.0% Peak Cell Efficiency

Integrated Redundancy

Aux. power, communication and control

Nova Link™ 35 kV/10 MW Liquid-Cooled SST

Direct 35 kV-to-800/1500 VDC Conversion



Product Specifications :

10 MW

In 9.6m²

1.04 MW/m²

Complete-system footprint density

98.7% System Efficiency

800/1500 VDC Output Options

NEMA 3R Outdoor enclosure

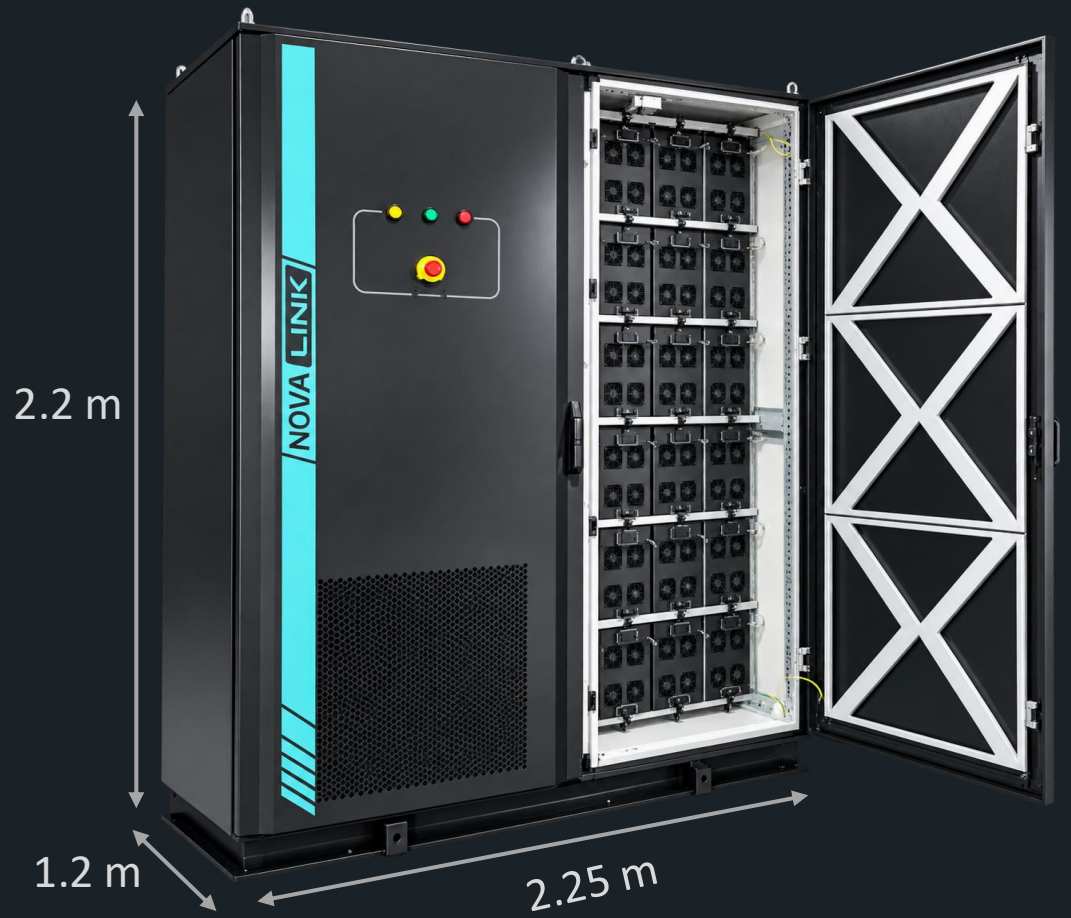
Grid-forming Capability

Integrated SSCB Protection

OCP SST Spec. V0.3 Compliant

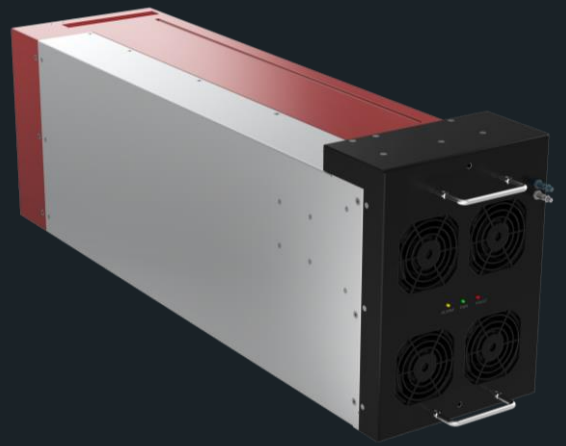
Nova Link™ 13.8 kV/3 MW Air-Cooled SST

13.8 kV/3 MW Air-Cooled SST



13.8 kV/ 100 kW Power Cell

10 power cells per phase



Product Specifications :

3 MW

In 2.7 m^2

1.11 MW/m^2

Complete-system footprint density

99% Power Cell Efficiency

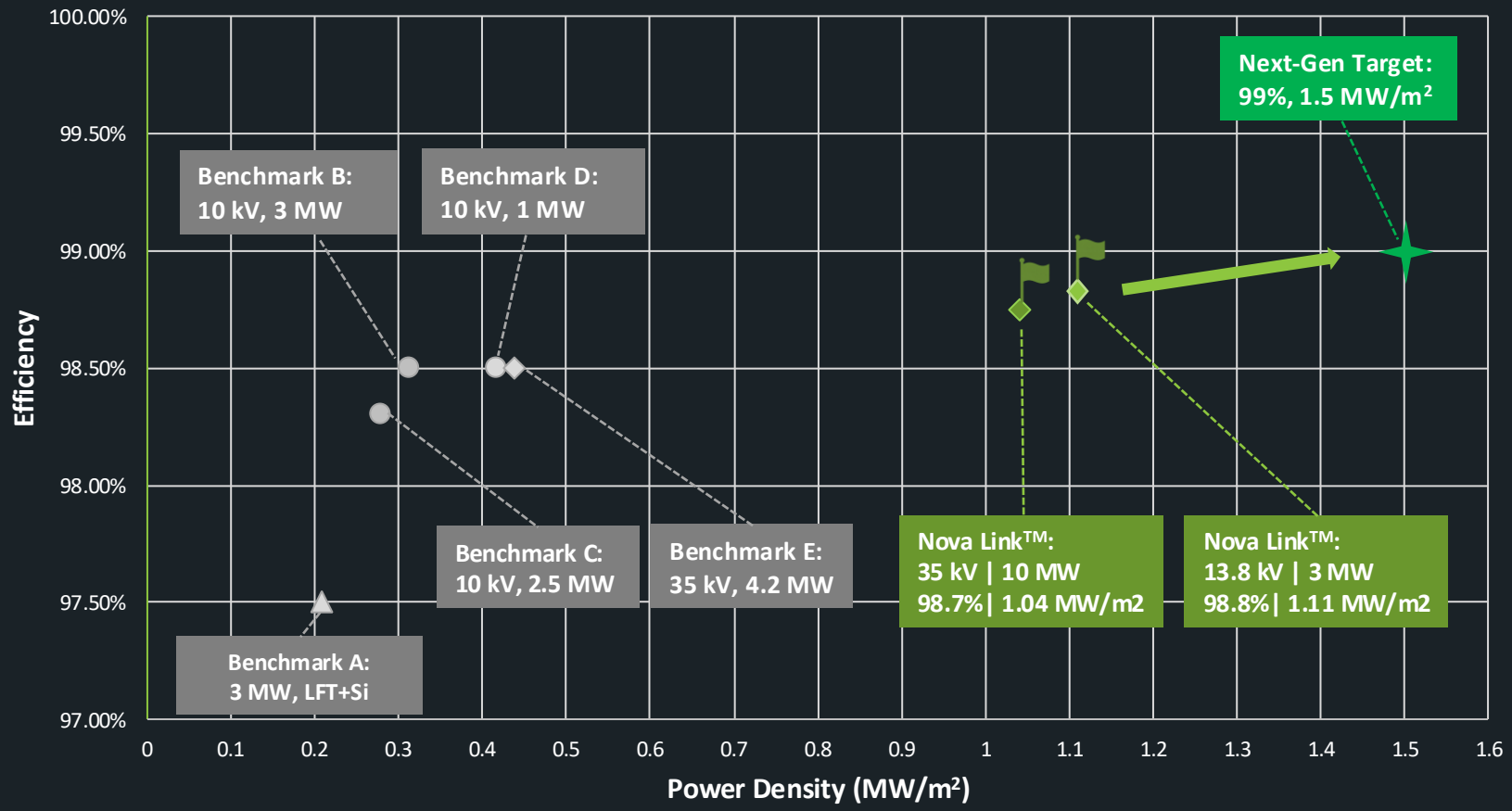
98.8% System Efficiency

800/1500 VDC Output Options

IP 21 Indoor Enclosure

SST Performance Benchmark and Nova Link™ Roadmap

SST Performance Benchmark and Next-Generation Targets



NEXT GENERATION TARGETS

99% System Efficiency

1.5 MW/m² System Power Density

KEY TECHNOLOGY LEVERS

- Lower-Loss Converter Topology
- High-Performance Insulation
- High-Performance Magnets
- Next-Gen SiC MOSFETs

Note: Benchmark data are based on publicly reported values. Efficiency and power-density boundaries may vary by supplier.

Thank You! Questions?

Visit Luxshare-Tech Booth A31

