# The Active BBU

## Dynamic Power Orchestration for Stable and Efficient ORv3 AI Racks

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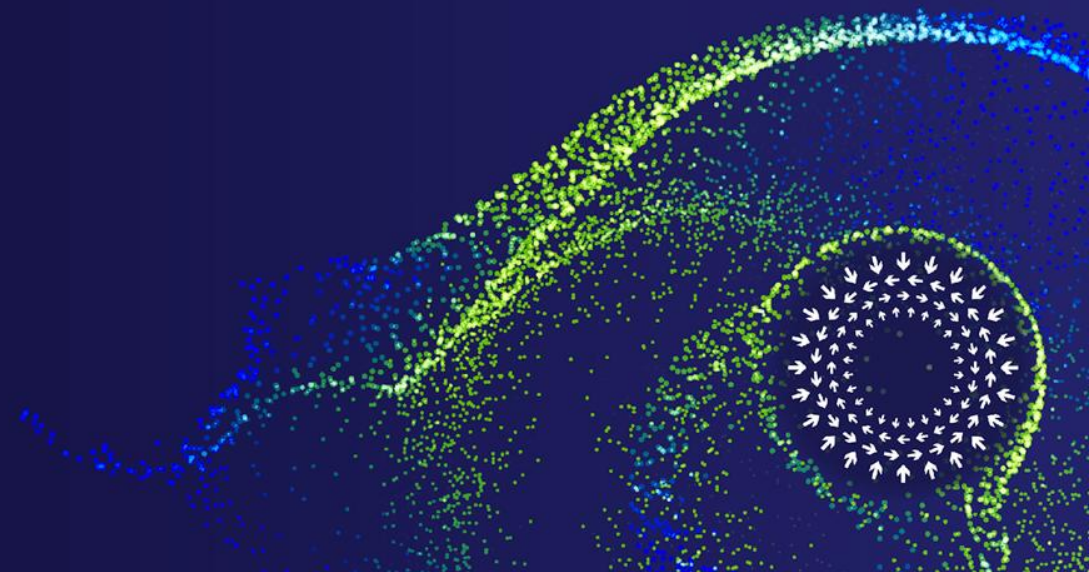


# Problems: Stranded Compute Capacity & Grid Risk

## Problem 1:
## Stranded Compute Capacity

Racks operate at 60 – 70 %, leaving **~30 %** of AI compute capacity idle

Source

P. Patel et al., "POLCA: Power Oversubscription in LLM Cloud Providers," in Proc. ACM International Conference on Architectural Support for Programming Languages and Operating Systems (ASPLOS), 2024

## Problem 2:
## Grid Risk -
## PFAPR Non-Compliance

ORV3 **> 9 s** to recover, while Grid requires **PFAPR < 1 s**.

Source

E. Meier, "Design Implications of Power Grid Voltage Ride-Through Requirements for Data Centers," presented at the OCP Rack & Power Project Telco, ERCOT, Sep. 10, 2025.

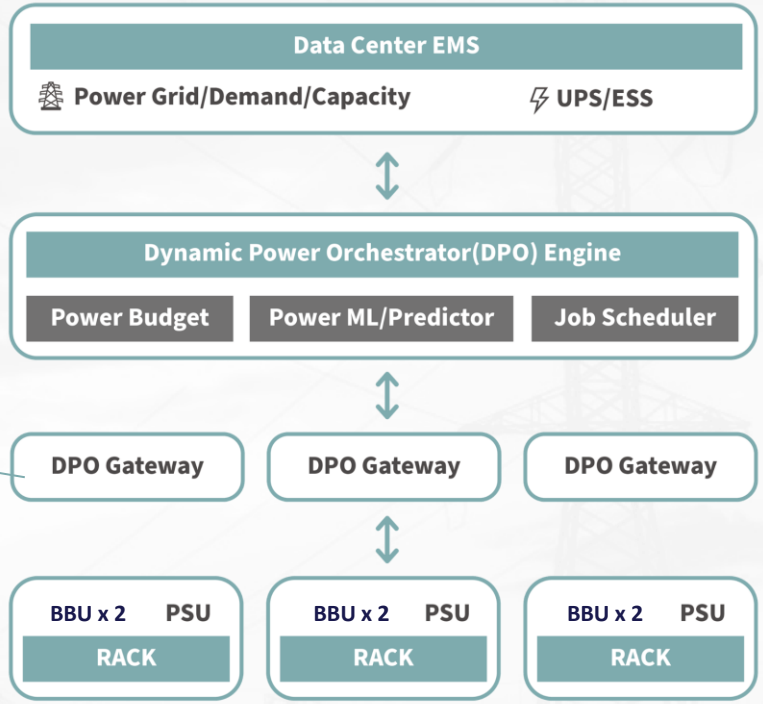
# Real-world power transients on a GPU motherboard


Source

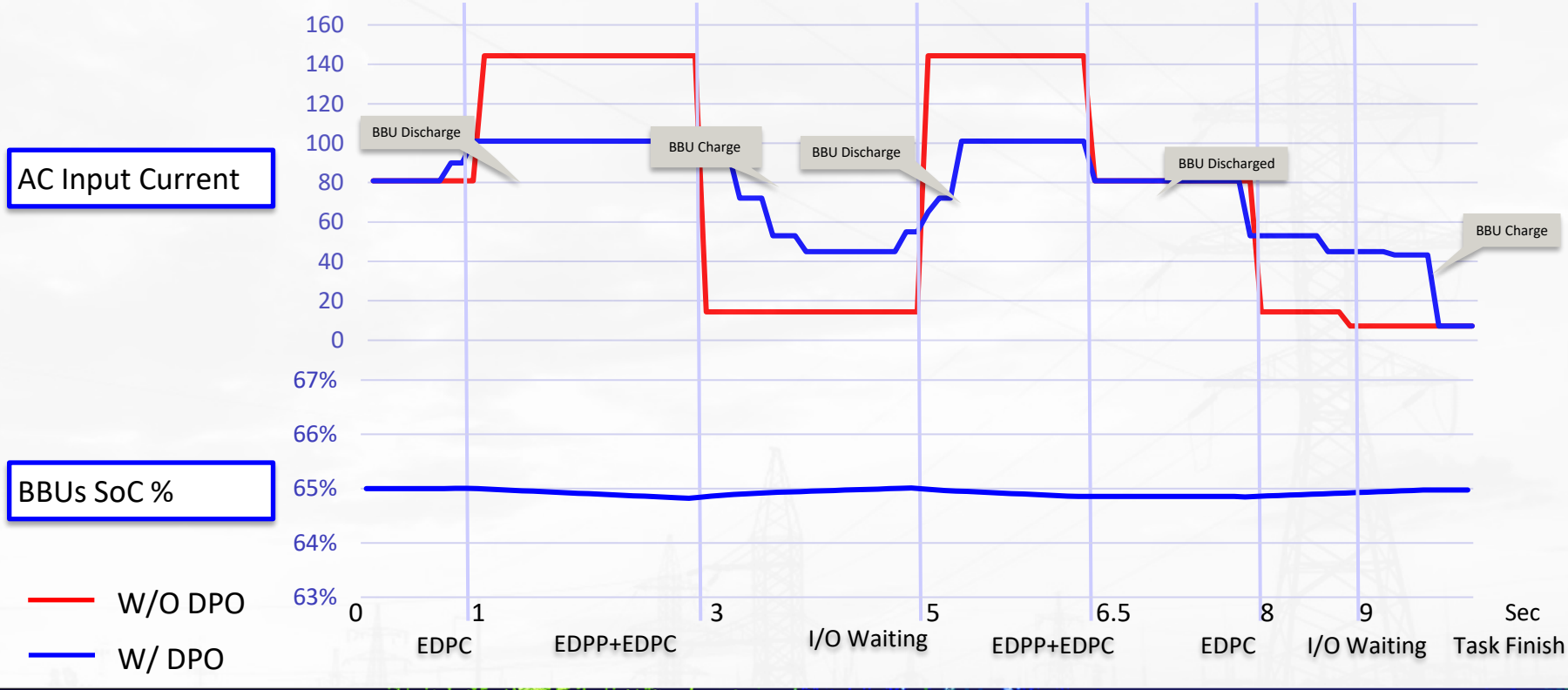
Y. Li and Y. Li, "AI Load Dynamics-A Power Electronics Perspective," arXiv:2502.01647, 2025.

# Solution: DPO - Dynamic Power Orchestrator

Replacing the standard PMI
(Power Monitor Interface)



# How Smart PSU + BBU Smooths AI Server Peaks



# DPO PERFORMANCE VS. BASELINE (PROJECTED)

| Metric | Baseline - ORv3 | With DPO | Improvement |
|---|---|---|---|
| **Peak-to-Average Ratio (PAR) for AC Input Current** | ~2.5 | ~1.75 | 25-35% Reduction |
| **Compute Power Utilization** | 60-70% | 85-100% | Unlocks ~25-30% Capacity |
| **Post-Fault Active Power Recovery (PFAPR)** | > 9 seconds | < 0.5 seconds | Meets Grid Requrements (PSU standby) |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