June 6, 2025

Matthew Homsher, Esq.
Secretary Pennsylvania Public Utility Commission
Commonwealth Keystone Building
400 North Street, 2nd Floor
Harrisburg, PA 17120

RE: **Comments of Emerald AI in response to** *March 27, 2025 En Banc Hearing on Interconnection and Tariffs for Large Load Customers* **-- Docket No. M-2025-3054271**

Dear Secretary Homsher,

Please find attached a copy of the post-hearing Comments of Emerald AI in the matter of the En Banc Hearing Concerning Interconnection and Tariffs for Large Load Customers.

Very truly yours,

Frank Lacey
President
frank@eacpower.com
610-793-2809

Comments of Emerald AI

Chairman DeFrank and Commissioners Barrow, Zerfuss, Coleman and Yanora:

I am writing to respectfully submit comments of Emerald AI in response to Chairman DeFrank's March 27, 2025 motion for the Pennsylvania Public Utility Commission ("Commission") to convene an *en banc* hearing and to receive post-hearing comments Concerning Interconnection and Tariffs for Large Load Customers.[1] Thank you for the opportunity to contribute to this important discussion.

These comments introduce an emerging technology platform, **Emerald AI**, that transforms data centers into flexible power consumers capable of delivering grid services and responding reliably to reduce system-coincident peak demand. By considering such innovative solutions, the Commission can meet the dual goals of seizing a tremendous economic opportunity by swiftly interconnecting new or upsized data centers, while rationalizing the need for massive infrastructure upgrade requirements, limiting rate increases, and bolstering grid reliability and resilience by incentivizing flexible grid-friendly AI data centers. We encourage the Commission to consider advanced technologies such as those offered by Emerald AI as it welcomes data centers and other large loads to the Commonwealth. The Emerald AI technology can speed the interconnection of data centers and can minimize the physical network infrastructure needs of a data center. Collectively, these improvements aid in economic development by encouraging AI investment and innovation in the State of Pennsylvania, and they also mitigate rate increases for customers while bolstering grid reliability.

Introduction to Emerald AI

Emerald AI is a technology company whose software platform enables flexible load management for data centers. The company provides an AI-powered software engine that orchestrates cloud computing and AI workloads to dynamically adjust power demand. In practice, Emerald AI can control **computational power usage** across data centers running cloud and AI applications, ensuring continuous, acceptable service quality for computing customers while reliably meeting power grid requirements for curtailment and emergency response. In other words, Emerald AI provides a demand response service specifically tailored to data centers which allows data centers to reduce power demand by managing the data compute work by either relocating the compute or managing the speed of the compute. By making data center power demand more flexible and responsive, this technology can complement utility infrastructure improvements. Emerald AI's platform exemplifies how emerging technologies

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[1] Motion of Chairman Stephen M. DeFrank, En Banc Hearing Concerning Interconnection and Tariffs for Large Load Customers, Docket No. M-2025-305427, March 27, 2025.

could expedite interconnections by allowing large loads to flexibly align with grid capacity, thus reducing the need for immediate capital-intensive grid upgrades.

Emerald AI has already performed a technology demonstration of orchestrating a substantial AI cluster in a commercial, production-grade data center in Arizona to meet utility demand response objectives. In addition, Emerald AI recently presented to the Electric Reliability Council of Texas ("ERCOT") Large Flexible Load Task Force. The ERCOT presentation is attached as Appendix 1 to these comments. The Commission should consider and enable these types of solutions as part of a holistic strategy to accommodate large new loads efficiently in Pennsylvania.

Overview of Emerald AI's Technology Platform

Emerald AI is a unified software platform that enables large-scale data centers to operate as flexible, grid-responsive load resources. The system integrates with real-time telemetry from computing infrastructure and grid conditions to determine when and how to adjust power consumption, based on both operational constraints and utility dispatch signals. It interprets demand response events, curtailment instructions, and other triggers from utilities and system operators, and converts them into executable workload management actions in an automated fashion without manual intervention.

The platform orchestrates computing tasks within one data center or across a network of connected data centers to ensure the data center's electrical demand aligns with grid requirements. These actions are implemented through integrations with existing cloud and data center management systems, allowing for precise and automated load modulation while maintaining core performance commitments to computing customers. The Emerald AI system combines a simulation engine that maintains a digital twin of a data center's power use as well as an automated execution engine that orchestrates workloads to reliably meet power grid targets. In doing so, Emerald AI transforms traditionally static computing loads into dynamic, dispatchable assets that support grid reliability and resource adequacy objectives.

Benefits of Emerald AI's Technology for Pennsylvania

The Emerald AI approach offers several **key benefits that align with the Commission's goals** of expediting interconnections for large loads while safeguarding utilities and ratepayers:

1. ### Improved Utilization of Existing Infrastructure - Enhancing Affordability:
   Emerald AI's innovative technology enables more effective use of existing grid infrastructure by orchestrating computational workloads in data centers to dynamically manage power consumption. By gracefully shifting or temporarily reducing computing tasks during periods of peak demand or grid stress, the platform optimizes the utilization of current transmission and distribution assets. This optimization results in greater

throughput without significant new infrastructure investment, lowering overall electricity cost/kWh, enhancing affordability for ratepayers across Pennsylvania. Nationwide, Duke University estimates that "76 GW of new load—equivalent to 10% of the nation's current aggregate peak demand— could be integrated with an average annual load curtailment rate of 0.25% (i.e., if new loads can be curtailed for 0.25% of their maximum uptime)" and "126 GW at a rate of 1.0%" This Duke study shows that PJM is the balancing authority with the greatest amount of room for growth.[2]

2. Avoiding Costly and Risky Infrastructure Investments

Traditionally, interconnecting large new loads requires substantial infrastructure investments, including new transmission lines, substations, or additional generation capacity. Such investments are expensive, require extensive planning and construction timelines, and carry significant risk of becoming stranded assets if anticipated load growth does not fully materialize. Emerald AI's flexible load orchestration offers an alternative by substantially reducing or eliminating the immediate need for extensive grid infrastructure upgrades. This flexibility allows utilities to mitigate financial and operational risks associated with traditional infrastructure expansions, significantly protecting both utilities and ratepayers from unnecessary expenditures and stranded asset costs.

3. Accelerating Economic Growth through Faster Interconnection

Emerald AI's approach accelerates the interconnection process by eliminating or minimizing the dependency on new infrastructure builds. Faster interconnections mean data centers can come online more quickly, translating to accelerated job creation, increased local investments, and broader regional economic benefits. By facilitating quicker, lower-risk integration of flexible large loads, Pennsylvania can enhance its competitiveness and attractiveness to future data center developments. Rapid deployment of these economic opportunities ensures timely realization of the significant economic benefits associated with large-scale data center growth.

Emerald AI's technology provides a tremendous market option that marries the interests of new large loads and the existing grid. It enables faster, more certain interconnections for developers, and it shields utilities and ratepayers from undue risk by using innovation to manage demand

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[2] Norris, T. H., T. Profeta, D. Patino-Echeverri, and A. Cowie-Haskell. 2025. *Rethinking Load Growth: Assessing the Potential for Integration of Large Flexible Loads in US Power Systems.* NI R 25-01. Durham, NC: Nicholas Institute for Energy, Environment & Sustainability, Duke University.
https://nicholasinstitute.duke.edu/publications/rethinking-load-growth

within present grid limits. It allows both a new data center and the host utility to deploy capital as needed and not ahead of projected, but uncertain load additions.

Active Demonstrations of the Technology

To move from theory to practice, Emerald AI is actively demonstrating its platform's capabilities in real-world settings. These pilots have proven that flexible, AI-driven load control works at scale and meets stringent reliability criteria:

1. ### Phoenix, Arizona Demonstration

   Emerald AI's first commercial demonstration took place in May 2025 at a production-grade, commercial data center in Phoenix. This involved a fully operational cloud data center – not a lab environment – where Emerald AI's system modulated AI workloads in coordination with the local utility and partners. The goal was to showcase how real-time workload orchestration can yield on-demand load reductions without harming the data center's services. Early objectives included matching the utility's demand response targets precisely and providing detailed telemetry to verify performance.

   The demonstration, as exhibited in Appendix 2 to these Comments, proved Emerald AI is able to reduce data center IT load by up to 40% during peak-load events and even react dynamically during a simulation of a historical CAISO critical grid event. This on-the-ground evidence is key to demonstrating the concept's viability to regulators and industry stakeholders.

2. ### Planned ERCOT Demonstration (Texas)

   Building on Phoenix, the next major demonstration is planned in the ERCOT grid region on the MW scale. The demonstration will use a large, commercial AI workload to mirror the stresses of a true data center, and it will provide ERCOT and other observers with auditable results (e.g., telemetry traceable to grid control centers, logs of automatic control actions). Appendix 1 to these comments provides a more detailed concept note for the ERCOT demonstration, including how it will address specific criteria of upcoming legislation in Texas and integrate with utility/TSP (Transmission Service Provider) operations, as presented to the Large Flexible Load Task Force in ERCOT. The Texas experience is particularly relevant because it deals directly with regulatory evolution for large load interconnections. Success there would signal that technologies like Emerald AI can satisfy even strict mandates and potentially serve as a template for Pennsylvania and other states.

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3. Recommendation for a Pennsylvania Pilot

Encouraged by interest from multiple stakeholders, **Emerald AI is willing and eager to pilot this technology in Pennsylvania** as well. The Commonwealth's mix of robust data center growth and focus on reliability makes it an ideal testing ground. A possible Pennsylvania pilot could involve partnering with one of the state's electric utilities and a data center developer to integrate Emerald AI's platform before the data center comes online. This would allow the parties and the Commission to empirically test how much local grid stress can be alleviated via flexible computing load control. Such a pilot could be done on a limited scale initially (for example, a portion of a data hall's load under Emerald's control) and then scaled up. The insights would inform the Commission's policy-making by providing Pennsylvania-specific data on how new large loads might deliver flexibility, what communication and verification systems are needed, and how much infrastructure investment could be saved or deferred in an interconnection case using flexibility. Emerald AI stands ready to discuss and facilitate a demonstration project or other collaborative proof-of-concept in the Commonwealth at the Commission's direction.

Conclusion – A Call to Embrace Evolving Technologies

Emerald AI urges the Commission to consider that rapidly evolving technologies like Emerald AI's software platform can complement traditional utility infrastructure solutions for large load interconnections. By acknowledging and exploring these tools, the Commission can craft policies that leverage innovation to contain costs and risks. Over-reliance on only conventional utility infrastructure expansions could inadvertently raise costs or delay beneficial projects, especially if flexible alternatives exist. Similarly, ignoring the potential of technologies to manage demand could leave cost-effective opportunities untapped, ultimately making electricity service more expensive for both data centers and the wider customer base. Emerald AI's capabilities are one example of a new resource at our disposal – a resource that turns intelligent computing into a grid asset. Pennsylvania can benefit from welcoming such solutions into the regulatory dialogue.

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Thank you for your consideration of these comments. Our goal is to introduce a perspective on how innovative demand flexibility technologies might assist the Commission in meeting its dual mandate: facilitating economic development (through faster, more certain interconnections for new large loads) and protecting ratepayers (through reliability enhancements, risk mitigation and cost control). Should the Commission have questions or wish to discuss pilot opportunities, the Emerald AI team is readily available to provide additional information or arrange discussions with technical experts.

Respectfully Submitted,
Frank Lacey
President, Electric Advisors Consulting
frank@eacpower.com
(610) 793-2809

Appendix 1

ERCOT Presentation

Data centers and AI *can* be flexible power consumers

Around the country, utilities and grid operators are seeking flexibility from data centers—and many tech companies would accept limited flexibility and curtailment to achieve faster interconnection

Emerald AI has developed technology to control the computational power demand from data centers running cloud and AI workloads, **delivering acceptable compute service quality while reliably meeting power grid curtailment, emergency response, and demand response needs.**
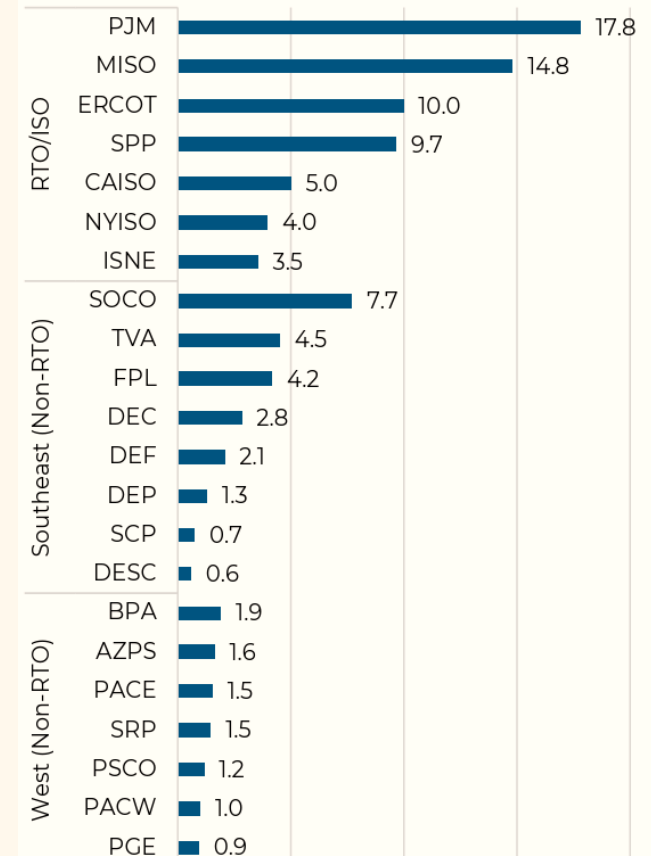
Power utilities see clear value of flexibility—with the right assurances
- If data centers can *reliably, enforceably, and verifiably* reduce load during system peak events, there is 100GW of interconnection headroom across US (Fig. 1)
- Utilities across North Carolina, Arizona, California, Oregon and elsewhere aim to either offer priority interconnection for flexibility or plan to require flexibility by mandate.
- **Emerald AI will execute a demo at a commercial, production-grade data center in Phoenix** with local utilities, tech companies, and EPRI's DCFlex to prove AI flexibility (see Appendix for details on demo design)

Data centers can solve these problems, despite historic resistance
- Major hyperscalers are amenable to curtailing up to 25% for up to 200 hours in return for priority interconnection of 1GW
- Data centers are actually the most controllable large loads in history. Emerald AI's technology provides responsive demand from seconds to hours.

Fig. 1: Capacity headroom with 0.5% Load Flexibility (GW)

RTO/ISO
	GW
PJM	17.8
MISO	14.8
ERCOT	10.0
SPP	9.7
CAISO	5.0
NYISO	4.0
ISNE	3.5

Southeast (Non-RTO)
	GW
SOCO	7.7
TVA	4.5
FPL	4.2
DEC	2.8
DEF	2.1
DEP	1.3
SCP	0.7
DESC	0.6

West (Non-RTO)
	GW
BPA	1.9
AZPS	1.6
PACE	1.5
SRP	1.5
PSCO	1.2
PACW	1.0
PGE	0.9

Source: Norris et al., 2025, "Assessing the Potential for Large Flexible Loads in U.S. Power Systems," Duke University.

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New solutions needed for new ERCOT regulations

As Texas Senate Bill 6 and ERCOT policy advance, new technologies can enable enforceable curtailment of large loads while supporting Texas economic growth and electric system reliability

Emerald recognizes that large load flexibility has had mixed historical record. Price-responsive loads can fail to respond when the system needs capacity during emergencies. ERCOT system planners rightfully need to count on firmly available resources to meet grid operational needs and protect reliability.

Senate Bill 6 and large load policy formulation and rulemakings present a critical window of opportunity. As ERCOT develops rules for large load interconnection and performance, AI data centers must prove more than theoretical or price-following capabilities—they must be reliable resources.

Emerald AI seeks to build on its Phoenix demonstration: its next demo will focus on ERCOT enforceable curtailment. To reduce reliance on expensive capital equipment like new backup power infra or risking grid access shut-off, AI data centers must demonstrate that they can comply with SB 6, including:

- **Emergency Curtailment Capability Aligned with SB 6 §39.170:** Show deterministic response to ERCOT-issued curtailment signal and sustain over a defined period.

- **Contract-Enforceable Load Reduction:** Test automated execution in response to grid emergency event to prove to ERCOT a binding mechanism.

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For Discussion: Emerald AI seeks guidance on ERCOT needs

After the Phoenix demonstration, Emerald AI will further scale up and bring partners to an ERCOT facility. What functionality would be most useful to demonstrate for the LFLTF?

Context and Objectives

Emerald AI will collaborate with its major strategic partners to execute demo that is useful to ERCOT's needs:

- Simulate ERCOT-curtailed load response
- Prove reliability with auditable results
- Show full telemetry path & duration compliance

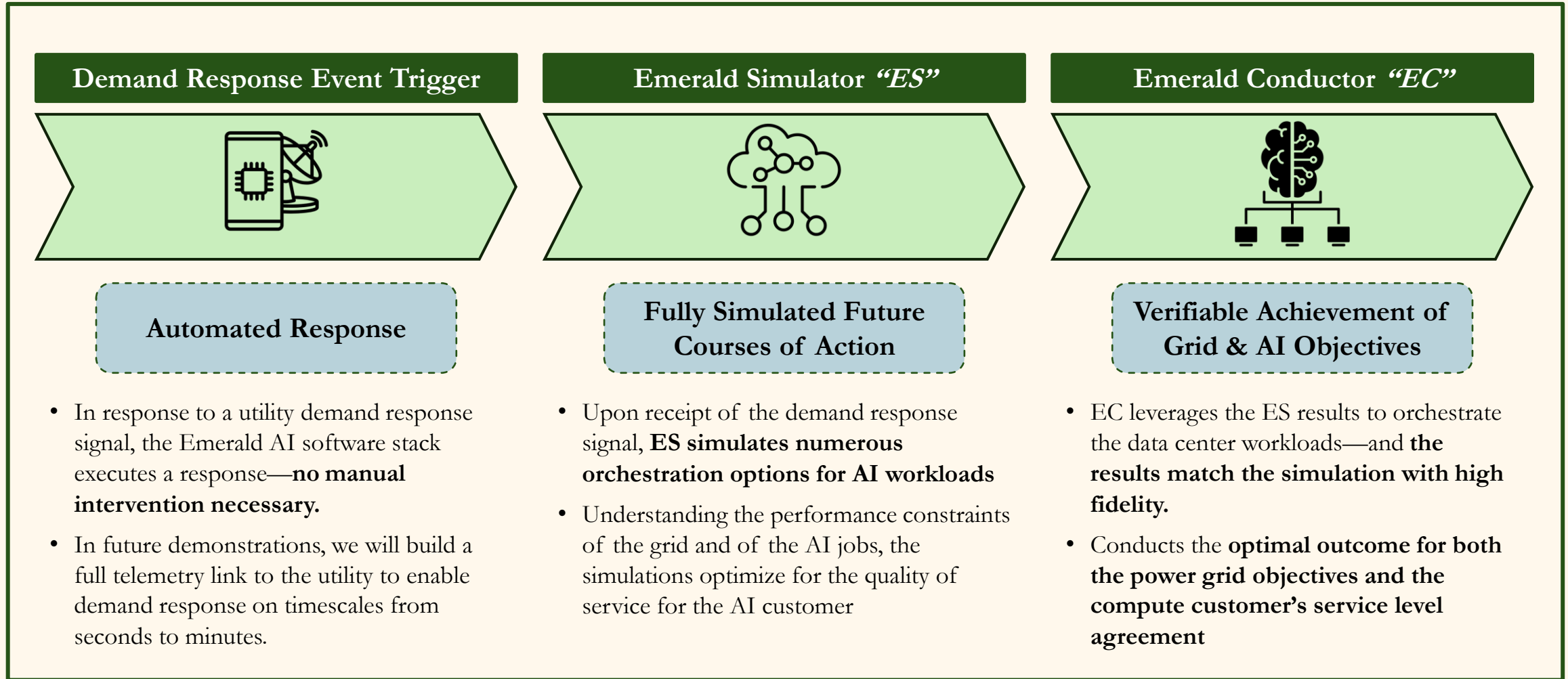## Emerald AI Partnerships: Energy and Tech

Key Questions to ERCOT about Emerald AI Demo Design

1. **What data and telemetry will enable the most compelling demo?**
   For example, Emerald AI might:
   - Use real, historical EEA events as synthetic signals to test load curtailment performance
   - Demonstrate telemetry traceable to ERCOT or utility control centers, in direct alignment with the upcoming mandatory load-shed coordination requirements.

2. **Which energy-sector entities are ideal partners?**
   - For this demo, Emerald AI will bring data center, cloud, and AI partners.
   - Are there utility and TSP partners that have expressed interest in innovative demonstrations to ERCOT?

3. **How can this demo best demonstrate SB 6 compliance?** In addition to its core technology of controlling AI workloads and power demand, Emerald AI seeks to partner to demonstrate compliance tooling, such as:
   - Interconnection milestone management.
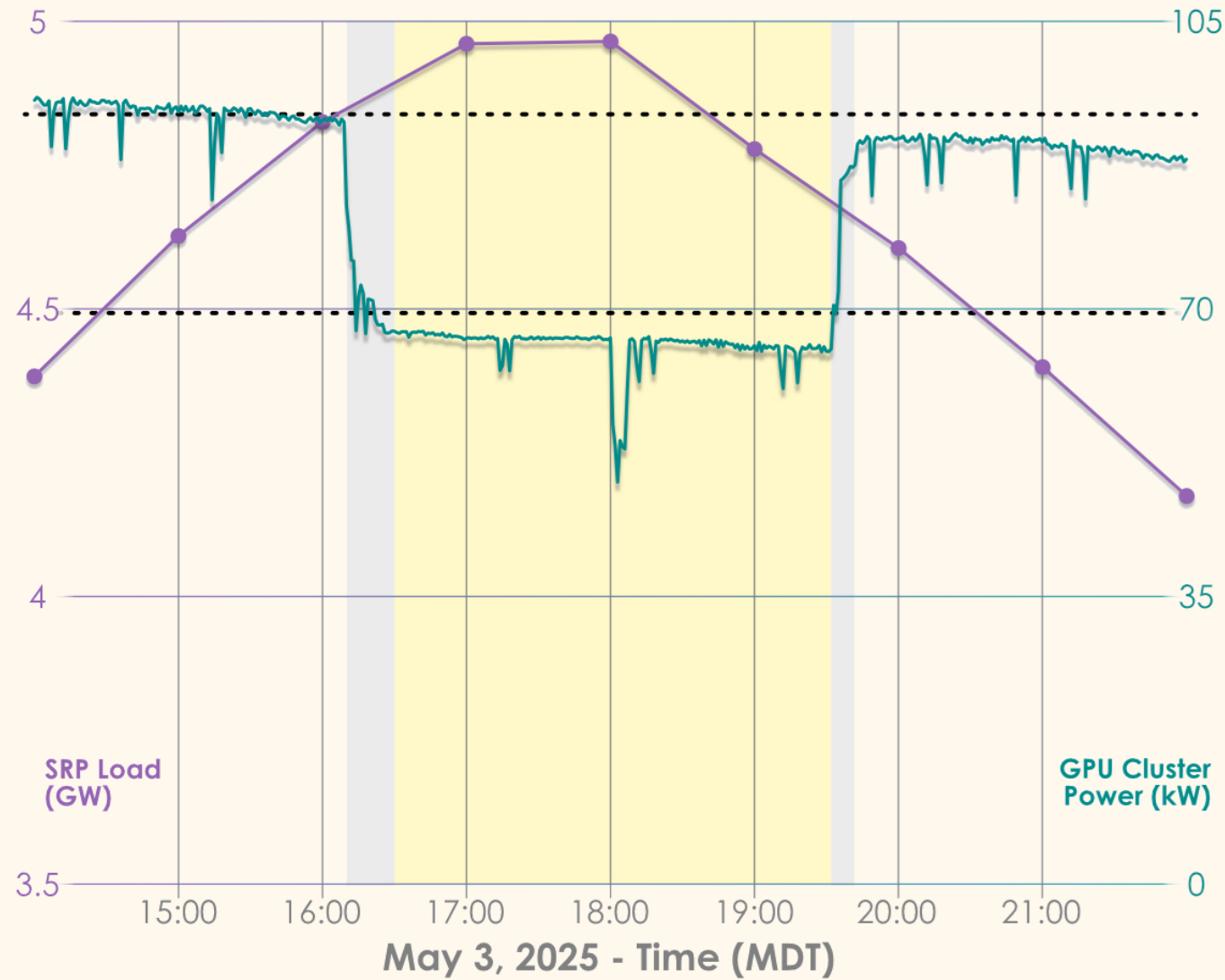   - Readiness dashboard usable by TSPs.
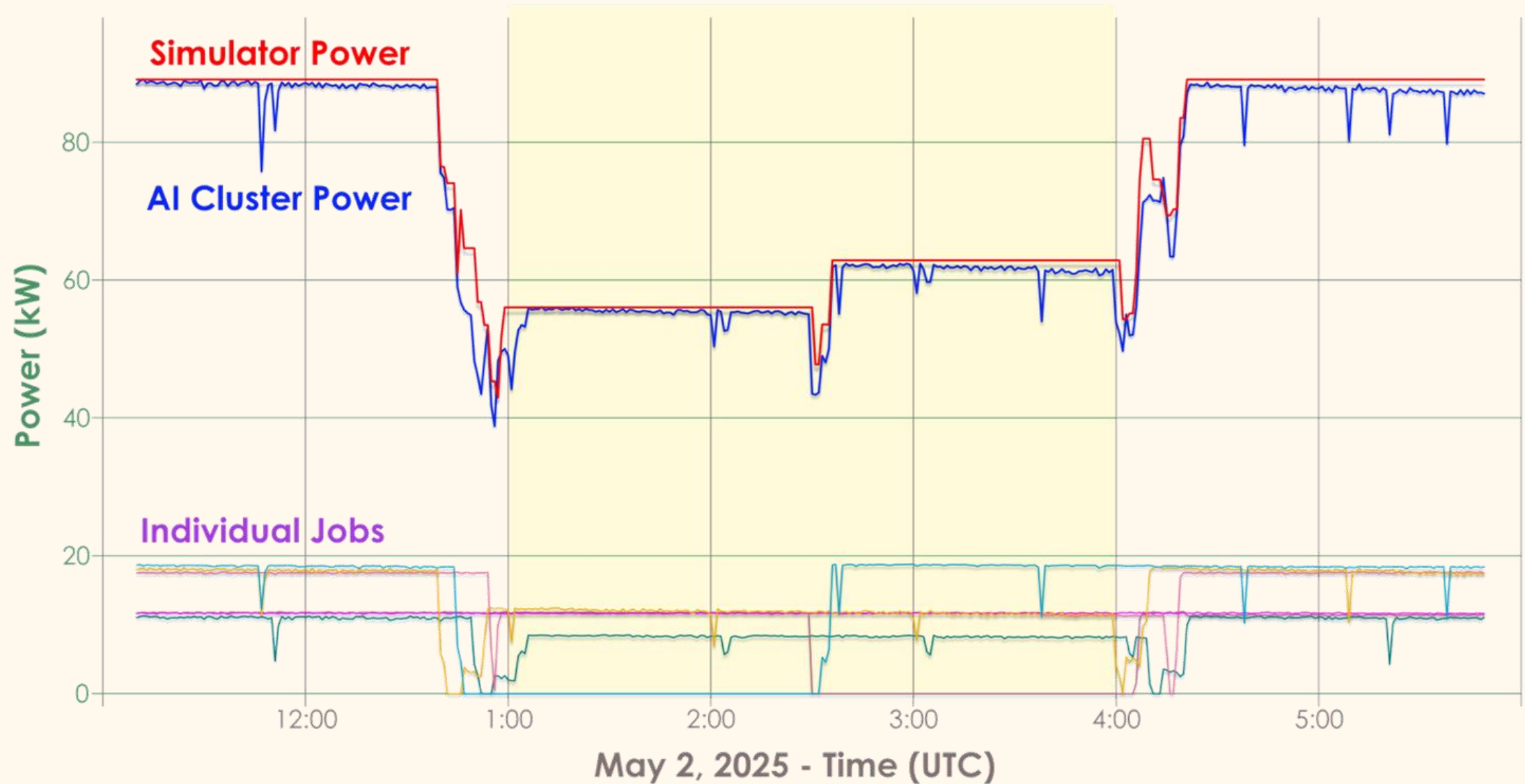
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Appendix 2

Demonstration Results

How it works: Flow from Event Trigger to Software Execution

Demand Response Event Trigger	Emerald Simulator *"ES"*	Emerald Conductor *"EC"*

Automated Response

Fully Simulated Future Courses of Action

Verifiable Achievement of Grid & AI Objectives

- In response to a utility demand response signal, the Emerald AI software stack executes a response—**no manual intervention necessary.**
- In future demonstrations, we will build a full telemetry link to the utility to enable demand response on timescales from seconds to minutes.

- Upon receipt of the demand response signal, **ES simulates numerous orchestration options for AI workloads**
- Understanding the performance constraints of the grid and of the AI jobs, the simulations optimize for the quality of service for the AI customer

- EC leverages the ES results to orchestrate the data center workloads—and **the results match the simulation with high fidelity.**
- Conducts the **optimal outcome for both the power grid objectives and the compute customer's service level agreement**

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Emerald Simulator Accurately Predicts Real-World Power Consumption

Emerald AI Responds to Real-World CAISO Reliability Event Through Dynamic Control of AI Compute Load

3 P.M.
A 500MW power plant trips offline
CAISO draws heavily on reserves and requests modest load reductions (15%)

6 P.M.
Rolling outages occur after net demand peaks, with insufficient reserve capacity
CAISO requires deeper load reductions (25%)

Demand

Net Demand

August 14, 2020 - Time (PDT)

Demand (GW) · GPU Cluster Power (kW)
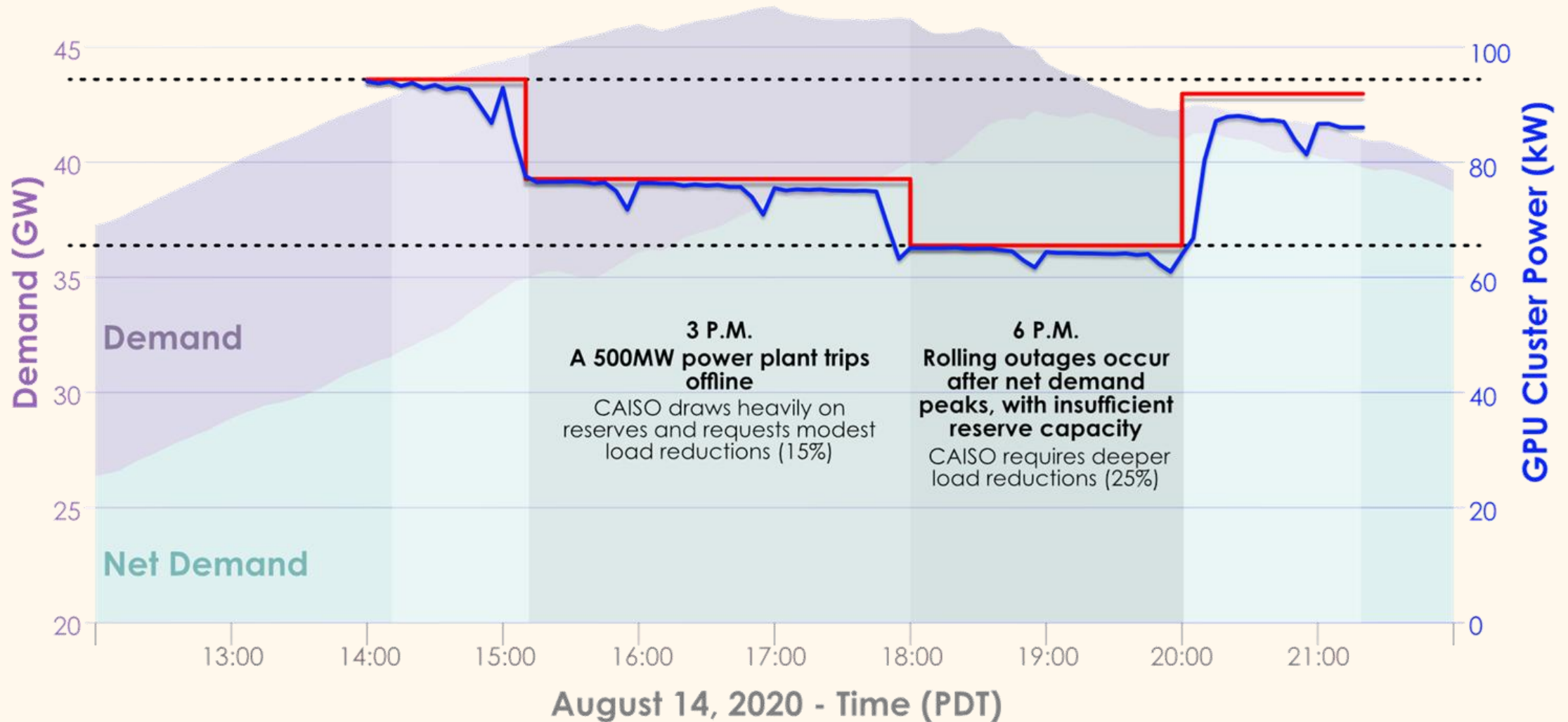
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Contact Us:

Varun Sivaram, *Founder & CEO:* varun@emeraldai.co

Ayse Coskun, *Chief Scientist:* ayse.coskun@emeraldai.co

Aroon Vijaykar, *SVP Strategy & Commercial:* aroon.vijaykar@emeraldai.co

Jack Megrue, *Business Operations Associate:* jack.megrue@emeraldai.co