

OPTIMIZING DATA CENTER PERFORMANCE

How AUROS INSIGHTS™ BRIDGES BUILDING SCIENCE AND DATA SCIENCE FOR MAXIMUM ROI

The data center industry stands at a critical juncture. While data centers currently consume just 2% of global electricity, they're projected to account for approximately 10% of electricity demand growth between 2024 and 2030. For data center owners, contractors, and engineers, this growth presents both unprecedented opportunities and significant challenges that demand sophisticated solutions combining building science with data science.

The Efficiency and Resilience Imperative

According to Rocky Mountain Institute's recent analysis titled [Fast, Flexible Solutions for Data Centers](#), the path forward for data centers requires solutions that:

- Enhance flexibility of when and where energy is used, also known as time-of-use.
- Deliver energy supply that is fast, modular, reliable, and cost-effective.
- Right-size infrastructure to confirmed loads rather than speculative demand.
- Reduce energy consumption through advanced efficiency measures.

The stakes couldn't be higher. Utilities historically over-forecast demand by more than 17% over 10-year periods, leading to billions in stranded utility generation assets that ratepayers ultimately fund. For data center operators, this translates to higher energy costs and reduced competitiveness in an increasingly demanding market.

The Critical Role of Time-of-Use Analysis

The key to unlocking both efficiency and resilience lies in sophisticated time-of-use analysis that can balance energy supply and demand at an hourly level. This granular approach enables:

Cost Optimization Through Grid Intelligence

Time-of-use analysis enables data centers to:

1. Avoid peak demand charges that can significantly impact operational costs.
2. Simulate the value and benefits of energy storage.
3. Shift delay-tolerant workloads to periods of low-cost, abundant renewable energy.
4. Participate in demand response programs for additional revenue streams.

Demand Response Enablement

RMI's research shows that if new data centers achieve just 0.5% annual load curtailment, merely a handful of hours per year, it could make nearly 100 GW of new load available without expanding generation capacity. This represents roughly 1,000 hyperscale data centers worth of capacity.

Operational Carbon Optimization

Real-time, automated, hourly carbon emissions accounting reveals the true environmental impact of operations, enabling data centers to:

1. Minimize carbon footprint during peak grid stress periods.
2. Optimize renewable energy utilization when abundant.
3. Reduce exposure to carbon pricing and regulatory risks.

Physics-based Modeling: The Foundation for Data Center Excellence

While time-of-use analysis provides the operational intelligence for grid optimization, whole building, physics-based modeling and simulation serves as the critical foundation that makes this intelligence actionable and reliable. For data center operators managing mission-critical infrastructure, integrating simulation metrics delivers high-fidelity predictions of a building's performance potential. That, in turn, dramatically increases investor confidence in the delivery of real results.

In an industry where milliseconds matter and uptime is paramount, physics-based modeling delivers competitive advantages not matched by traditional approaches.

- Faster Time to Market – reduce design iterations and commissioning time through virtual testing and optimization.
- Operational Excellence – achieve industry-leading Power Use Effectiveness (PUE) and reliability through precision engineering.
- Scalability Confidence – replicate successful designs with confidence knowing the underlying physics are validated.

AUROS Insights: The Solution that Delivers

The AUROS Insights™ product represents the first data layer developmental toolkit that comprehensively addresses these challenges by integrating building science with data science. Here's how AUROS Insights capabilities directly address data center efficiency and resilience needs:

Real-Time, Time-Series Operational Intelligence

The platform's ability to operationalize hourly-calibrated, building energy models (software agnostic) provides unprecedented operational insight:

1. Continuous Calibration: Calibration of physics-based models ensures models reflect actual performance.
2. Predictive Analytics: Compare hourly predicted versus actual performance to identify optimization opportunities.
3. System Integration: Aggregate time-series data from disparate Operational Technology sources.

Advanced Commissioning and Fault Detection Analytics

Long-term building resilience becomes actionable through:

1. Monitoring-Based Commissioning: Continuous optimization of system performance with context from simulation, in lieu of history and comparable data.
2. Interrogation-Based Commissioning: Deep-dive virtual analysis of system inefficiencies before investments are made.
3. Fault Detection & Diagnostics: Proactive identification and resolution of performance issues against intended outcomes.

Real-time Automated Carbon Accounting with Hourly Precision

The platform's automated carbon accounting using EIA Balancing Authority and EPA eGRID regional emissions rates provides:

1. Granular Visibility: Automated Site EUI, Source EUI, Total Costs, GHG Emissions, and Water UI metrics.
2. Compliance Automation: Automated Sustainability Program, Building Performance Standards Reporting, and Carbon Market Connectors.
3. Decision Support: Hourly carbon accounting enables optimal time-of-use for energy-intensive operations.

Comprehensive Efficiency Decarbonization Planning

The platform's Energy Efficiency and Decarbonization Plan tool works for new, existing, and portfolios of buildings, which is critical for data center operators managing multiple facilities. This capability enables:

1. Strategic Portfolio Optimization: Prioritize investments based on Return on Investments goals.
2. Scenario Planning: Model efficiency and decarbonization scenarios using proven building science with statistically precise, calibrated building energy models.
3. Future-Proofing: Reveal potential future fines through integrated Building Performance Standards (BPS) libraries.

Conclusion: The Path Forward

As RMI notes, with the right tools, investors in data centers can be "enthusiastic partners" in building a cleaner, more affordable electricity system. The AUROS Insights platform provides the sophisticated analytics foundation necessary to realize this potential.

For data center owners, contractors, and engineers focused on maximizing return on invested capital, the platform offers an unprecedented combination of:

- Reduced Costs: More granular understanding of energy production, use and storage time-of-use impacts.
- Operational Excellence through continuous optimization.
- Financial Performance through demand response and reduced energy consumption.
- Risk Management through predictive analytics and compliance and reporting automation.
- Strategic Positioning in a data-intensive economy.

The question isn't whether data centers will need sophisticated building science and data science integration, it's whether operators will choose platforms that deliver measurable ROI while positioning them for long-term success in an increasingly complex energy landscape.

The AUROS Insights solutions represents the convergence of building science and data science that data center operators need to thrive in the next decade of unprecedented growth and opportunity. Beth.eckenrode@aurosgroup.com.