**Panel 12b: Data Centers: Load Growth and Solutions**

This panel will explore the challenges and solutions —current and prospective—for using energy efficiency, load flexibility and energy generation technologies to meet data center power requirements. Data centers are the fastest-growing end-use in the U.S. economy. Between 2014 and 2024, annual energy use by large data centers in the U.S. increased from 10 TWh to 140 TWh—roughly 4% of total U.S. electricity consumption. Forecasts from credible sources predict a wide range of potential annual growth rates: 16% to 25% or higher over the next five years, driven by uncertainty over key drivers in technology and market development. All stakeholders in the ecosystem—data center developers and operators, utilities and grid operators, regulators, equipment and service providers, and government agencies—are working to identify and implement strategies to power data centers while mitigating risks of increased electricity rates, degradation of local water and land resources, and grid instability associated with rapid growth.

Energy efficiency, load management and targeted use of generation play key roles in meeting these challenges by helping to slow the pace of demand growth and extend the capacity of existing grid resources to meet demand. Topics to be explored include, but are not limited to:

- AI Load Management – Balancing Flexibility with Affordability
- Load Forecasting & Grid-Aware Operations
- Smarter Workload Placement – Using Time-of-Use Algorithms
- Server Performance vs. Infrastructure Cost – Rethinking Redundancy and SLAs
- Scaling Liquid Cooling Efficiently – Cost Models and Retrofit Strategies
- High-Density Cooling Innovations for Affordable Scale and Market Adoption
- Heat Recovery & Energy Reuse – When Waste Heat Becomes a Revenue Stream
- Low-Cost Materials for Construction – Beyond PUE
- AI/ML for Energy Optimization – Real-Time Control and Automation for Reliability
- Battery and generation technologies for load flexibility
- Beyond PUE – Affordable Performance Through Better Metrics (e.g., TREE, REF, TUE)
- Data Dashboards – Turning Real-Time Facility Data into Actions
- Policy, Incentives, and Market Transformation for improvement and load management
- Life Cycle Analysis – Informing Cost-Effective Design Decisions
- Intermittent Power Integration – Maximizing Grid Independence and Cost Stability
- Sequestration Opportunities in Data Centers: Potential and Applications
- Regional data center load forecasts
- Accounting for load flexibility in grid connection processes
- Analysis of grid connection request realization and ramp rates
- Stakeholder collaborations to advance technology and business model innovation