Supplemental Project Notice

HYPERSCALE DATA CENTER GRID INTEGRATION



PROJECT HIGHLIGHTS

- Increase visibility of developments in the data center industry
- Examine grid connection requirements for data centers emerging flexibility of data center load
- Insights into evolving load modeling developments and guidance on parameter setting for dynamic and steady state modelling
- Insights into load forecasting for short term operational considerations
- Insights into load forecasting developments for resource adequacy considerations

Background, Objectives, and New Learnings

The continued growth in electricity demand from data centers has strong significance for local power systems and bulk electric system operations. Data center development has been rapid and is accelerating in several locations with large interconnection queues where rapid network investment and build out may be required to provide necessary network capacity. With the projected growth in use of artificial intelligence, the continued digitalization of multiple service sectors, and the rise of cryptocurrency, it is envisaged that data centers will be a large growth sector for some time.

Increasingly, concerns related to network congestion, resource adequacy, and the overall impact of large, sudden increases in energy demand on consumer outcomes are leading to isolated regional moratoria on new data center connections. Discerning where dispatch flexibility may exist and how it can be incentivized could help mitigate some of the impacts data center load growth can have on local power systems. Emerging developments in the cryptocurrency data center market to provide demand response and early developments from the hyperscale data center sector in terms of spatial and temporal load management to minimize carbon emissions in line with local and regional (balancing region) zero carbon energy output may change the operational profiles of some sites. Understanding the environmental related operational strategies (e.g., heat/drought related) data center operators may utilize to manage operations and protect critical data center infrastructure will also be important considerations to capture for power system modelling and operations.

This project proposes to investigate key aspects of data center design and operational characteristics to provide greater insights and optimal solutions to achieve efficient grid integration and improved load modelling, load forecasting and system operation processes relevant for data center load. This will include:

- Identifying sector developments, growth predictions, and sector type evolution
- Providing visibility on grid connection requirements
- Documenting evolving flexibility characteristics and capability of data center operations to shift demand

- Documenting existing and evolving expertise in load modelling and dynamic/steady state stability assessments
- Examining load forecasting of data center load in multiple time horizons

Benefits

Project participants will gain a deeper understanding of key technical issues related to data center demand. It seeks to provide an understanding of differential attributes between data center types.

Project Approach and Summary

EPRI will work with project participants to deep dive into several topics related to data centers.

Topic 1: Data center segments and development trends

- Assess data center segments and development trends, issues leading to delays, and solutions currently in development or operation. In addition, issues emerging from environmental or climate (e.g. heat or drought) related operational constraints due to data centers will be highlighted.

Topic 2: Load forecasting

- Assess evolving approaches to short, mid-long term load forecasting of data centers for scheduling applications and resource adequacy analysis will be carried out.

Topic 3: Dynamic and steady state assessment recommendations

- Detailed dynamic and steady state stability modelling recommendations pertinent to data center operations will be provided. Guidance on sensitivity studies that may be required to assist in dealing with parameters of the dynamic model that may not be determined with a high level of accuracy will be provided.

Milestone meetings are expected to take place during the project to update project members on progress, review deliverable drafts, and final results.

Deliverables

Each utility participating in this project will receive the following deliverables:

- Report - Data center technology, performance summary and data sheet
- Report - Load forecasting and resource adequacy assessment strategy
- Report - Recommendations on data center power system model integration
- Workshop to disseminate final project results

The non-proprietary results of this work will be incorporated into EPRI's Transmission and Distribution Operations and Planning R&D programs and made available to the public for purchase or otherwise.

Price of Project

The price of the project is $40K per funder. A minimum of four participants is needed to begin the project. The project qualifies for Self-Directed or Tailored Collaboration funds.

Project Status and Schedule

The project is expected to kick off in Q1 2024, pending signing up the minimum number of participants, with an estimated project duration of seven months between kickoff and completion.

Who Should Join

Utilities currently dealing with existing large volumes of hyperscale data center operations, and utilities anticipating data center growth.

Contact Information

For more information, contact the EPRI Customer Assistance Center at 800.313.3774 (askepri@epri.com).

Technical Contacts

Mo Cloonan at 650.955.2128 (mcloonan@epri.com)
Eamonn Lannoye at 704.595.2794 (elannoye@epri.com)
Parag Mitra at 865.218.5907 (pmitra@epri.com)

Additional Contacts

Brian Long at 704.408.8139 (blong@epri.com)
Dan Tavani at 704.773.2025 (dtavani@epri.com)
David Welch at 702.208.8276 (dwelch@epri.com)
Jeff Hlavac at 402.314.1049 (jhlavac@epri.com)
Tony Beddard at 44.745.063.6550 (tbeddard@epri.com)

Project ID: 3002028627 **Product ID: 1-118878** **December 2023**

EPRI
3420 Hillview Avenue, Palo Alto, California 94304-1338 USA • 800.313.3774 • 650.855.2121 • askepri@epri.com • www.epri.com
© 2023 Electric Power Research Institute (EPRI), Inc. All rights reserved. Electric Power Research Institute, EPRI, and TOGETHER...SHAPING THE FUTURE OF ENERGY are registered marks of the Electric Power Research Institute, Inc. in the U.S. and worldwide.