OAK RIDGE National Laboratory

Modeling Energy Growth Associated with Data Center (MEGA-DC)

Giri Iyer, Sr Program Manager, PI- MEGA-DC
Supriya Chinthavali, Group leader, Critical Infrastructure Resilience, co-PI

V6.1 5.16.2025

CUI//SP-CEII/SP-PROPIN/SP-PRVCY//NOFORN

U.S. DEPARTMENT OF ENERGY

ORNL IS MANAGED BY UT-BATTELLE LLC
FOR THE US DEPARTMENT OF ENERGY

Controlled by: ORNL, Critical Infrastructure Resilience Group, Geospatial Science & Human Security Division,
Hillary K. Fishler, fishlerhk@ornl.gov, 865-341-3192

What is the MEGA-DC project all about?

Modeling the **E**nergy **G**rowth **A**ssociated with **D**ata **C**enters and its associated impact on infrastructure and energy affordability

We are doing research/analytics to serve states, its utilities and the data center builders/customers;

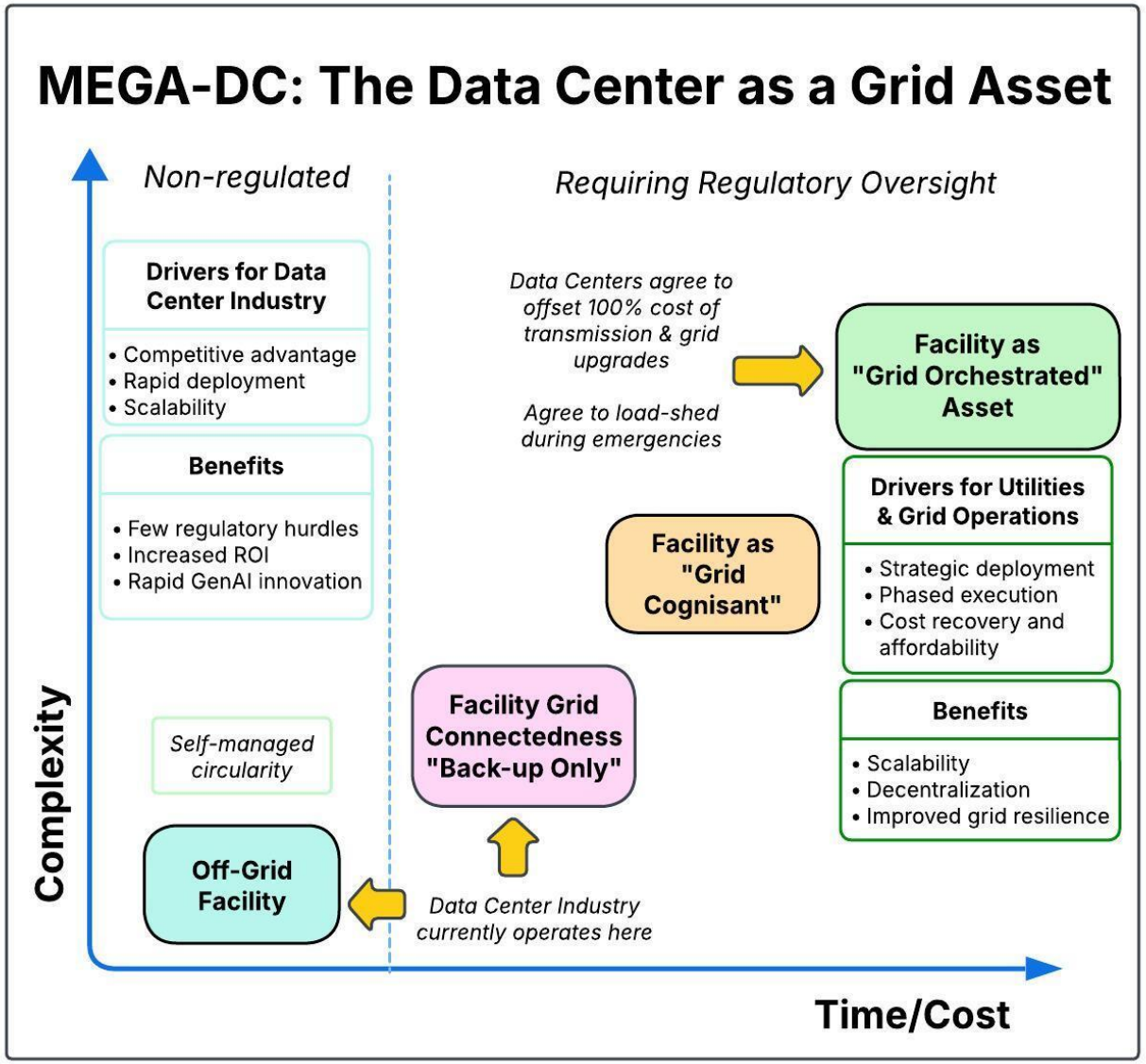
- How to converge three different sets of drivers and motivations
- Understand regulatory/infrastructure constraints and state incentives
- Grid reliability and resiliency impacts of data centers
- Data center as not just as black box load, but a grid orchestrated critical infrastructure asset
- Design long term sustainable winning strategies for states and data center companies

MEGA-DC tasks include collecting data needed for analysis from states/utilities and data center companies and helping provide actionable insights including T&D infrastructure/water/gas/noise/affordability impacts

Our vision for Data Centers as a Grid Asset

Most data centers today operate as passive grid loads: MEGA-DC models the shift toward coordinated, grid-supportive infrastructure.

- **Backup-only and off-grid models** limit transparency and shift upgrade costs to ratepayers.
- **Grid-cognizant sites** coordinate with utilities but lack full flexibility or cost-sharing.
- **Grid-orchestrated data centers** support demand response, offset grid upgrade costs, and improve system resilience.
- **MEGA-DC helps states identify and prioritize sites** that move toward this high-value integration.



MEGA-DC builds on ORNL track-record in Data Center innovation and more…

No	ORNL Core R&D	Link	Highlights
1	ORNL Frontier	https://www.olcf.ornl.gov/frontier/	1. Industry leading PUE of 1.03 demonstrated 2. AI task disaggregation algorithms
2	GRID-C for microgrid innovation	https://www.ornl.gov/gridc	Leading next generation microgrid innovations critical for grid-connected generation that enables data centers to behave like a microgrid asset
3	ExaSGD for large scale load simulation	https://www.ornl.gov/research-highlight/exasgd-using-high-performance-computing-operate-decarbonized-resilient-grid	Transformational grid modeling and simulation software and the first in the industry to demonstrate Exascale level simulations leveraging ORNL HPC capabilities
4	OR-SAGE	https://www.ornl.gov/news/or-sage-framework-siting-supercritical-co2-reactors	Industry leading siting tool already being used for data center physical siting by customers
5	TASTI-GRID	https://www.ornl.gov/group/critical-infrastructure-resilience	1. Leveraging 10+ years of EAGLE-I outage data 2. Grid resiliency models for all 50 states and 3100+ counties including system resilience curves and cost of resiliency improvements by county for the USA 3. Supporting 20+ with grid resiliency and grid hardening strategies for formula grants and other efforts