



DATA CENTER ON DEMAND COOLING



Make Cooling a Strategic Asset for Data Centers

 **Grid-Smart™**

Cooling for Data Centers

Grid-Smart™ for Data Centers is Earth Core Energy Services' intelligent Energy Management System (EMS) that enables data centers and commercial facilities to:

- ✓ Implement On-Demand Cooling (ODC)
- ✓ Modernize Cooling with High-Efficiency RTUs
- ✓ Provide Layered Redundancy
- ✓ Improve equipment reliability and uptime
- ✓ Reduce operating costs → Increased profits
- ✓ Increased server density → Increased Revenue

Grid-Smart™ for Data Centers

Cooling a Strategic Asset — Not Just an Expense

Data centers operate under three uncompromising requirements:

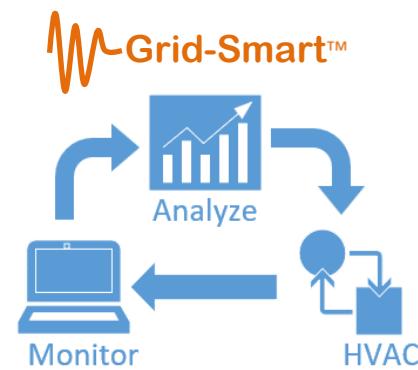
- Reliability — protect up time → preserve revenue
- Capacity — Increase rack density → increase revenue
- Efficiency — Reduce operating costs → increase profit

Earth Core's **GRID-SMART™** for Data Centers is designed to address these critical parameters. It transforms traditional cooling into an optimized, resilient, efficient, revenue-enhancing system, designed specifically for data environments.

What We Do and Why It Matters

Most data centers still rely on traditional (CRAC/CRAH)¹ split systems, placing compressors indoors, consuming server-space area, limiting economizer capability, and constraining redundancy. Earth Core's **GRID-SMART™** system corrects these problems by combining:

- *On-Demand Cooling (ODC)* — precision cooling only where needed
- *Data-Center-Grade RTUs* — compressors outdoors, expanded free cooling, and flexible redundancy
- *Advanced Air-to-Air Economizing* — more hours of no-compressor cooling, and an additional layer of redundancy
- *Improved Redundancy & Reliability* — safer uptime envelope
- *Increased Revenue Capacity* — from recovered floor space and reduced maintenance
- *LED + Intelligent Networked Lighting Controls (NLC)* — reduce heat load and electrical demand



Results typically *achieved*:

- Reduction in cooling energy ≈ 20–35%
- Increased revenue ≈ \$40,000 (per 10-Ton cooling) from recouped server space
- Increased economizer hours → lower compressor run time → reduced maintenance
- More stable thermal load and fewer power spikes → improved reliability
- Integrated Redundancy → improved up-time

¹ CRAC = Computer Room Air Conditioner, CRAH = Computer Room Air Handler

On-Demand Cooling (ODC) — Cooling Only What Needs Cooling

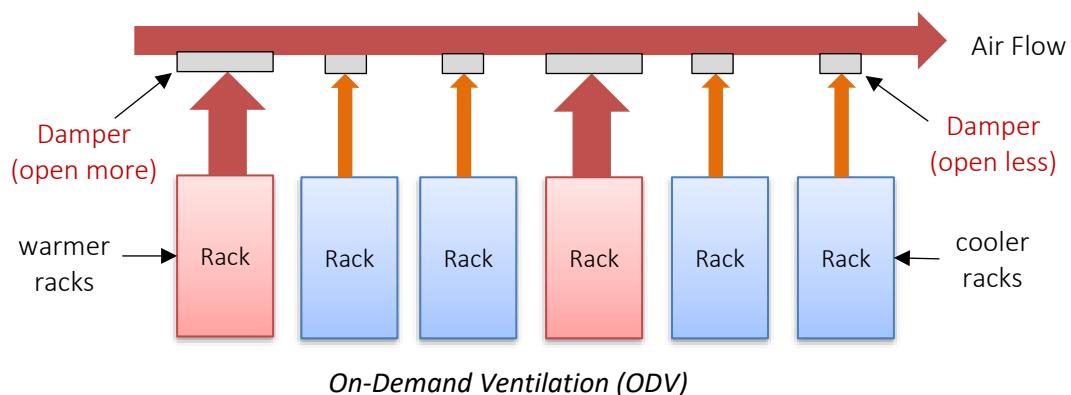
What Our system implements *On-Demand Cooling (ODC)* that continuously measures temperature above each bank

of servers and automatically adjusts the return-air dampers to match actual heat output. Racks running hotter receive increased heat extraction, while cooler racks receive less. This targeted approach removes heat precisely where it's generated—eliminating hot spots, stabilizing rack inlet temperatures, improving server MTBF, and reducing the energy wasted by traditional one-speed cooling systems.

- Eliminates hot spots and thermal risk concentrations
- Delivers highly stable rack inlet temperatures
- Matches cooling delivery to real-time server load conditions
- Improves efficiency by cooling only what needs cooling
- Mitigates temperature spikes

How it Works

- Sensors read temperature at the top of each server bank.
- Each rack's temperature is compared to the room's average temperature profile.
- Dampers open wider above hot racks to pull out more heat.
- Dampers reduce airflow above cool racks to avoid overcooling.
- Cooling dynamically redistributes based on real server demand.



Modernizing Cooling with High-Efficiency RTUs

Our solution modernizes rooftop units with advanced controls, variable capacity, intelligent ventilation, and real-time monitoring to deliver stable supply temperatures, uniform airflow distribution, and dramatic reductions in compressor usage and energy waste. The result is better performance, lower risk, and measurable financial benefit.

The Problem

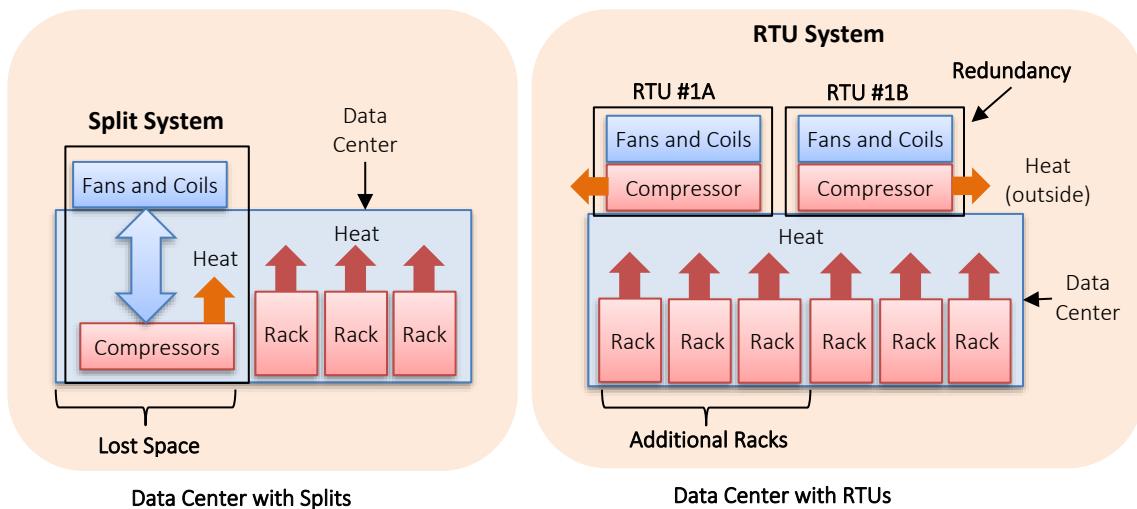
Most existing data centers rely on split systems (CRAC/CRAH) units located inside the data hall.

- Compressors are inside the building, adding heat into the environment
- Occupy valuable server floor space that could otherwise hold revenue-producing racks
- Depend primarily on refrigerant-based economizers, limiting true free-cooling hours
- Restrict redundancy options because space is physically constrained
- Require maintenance inside the server space, increasing operational disruption and risk

Our Solution

Upgrading to Data-Center-Grade RTUs (e.g., AAON) solves this by relocating units outdoors

- Eliminates internal compressor heat from the data floor
- Free up physical floor space for additional racks and growth
- Enable simpler and more practical redundancy strategies
- Expand true air-to-air economizer operation instead of relying on refrigerant economizing
- Easier maintenance without entering or disrupting critical server areas



Financial Advantage— Turning Cooling Back Into Capacity

Data center real estate is extremely valuable, averaging roughly \$200 per square foot. Traditional split-system cooling frequently occupies ≈ 200 sq. ft. of premium floor space per 10-ton cooling unit. By shifting cooling to upgraded RTUs, facilities can reclaim that floor space. The result:

- More deployable data capacity
- More revenue-producing rack area
- More efficient facility design

That reclaimed footprint can represent \$40,000 or additional revenue more per 10-ton cooling — meaning

- Outdated split systems may be quietly costing operators substantial annual revenue

Advanced Air-to-Air Economizing

Increased Reliability

Because server rack discharge air commonly exceeds 100°F, RTUs can take advantage of outdoor air much more often than comfort systems. When outdoor air is roughly 80°F or below, and its enthalpy (total heat content) is lower than rack air, RTUs can cool using outside air instead of compressors. This dramatically:

- Increases economizer hours
- Reduces compressor runtime
- Lowers electrical demand
- Decreases mechanical wear
- Improves reliability while cutting cost

Built-In Redundancy — Protection When It Matters Most

Economizing is not just an efficiency benefit — it is a *reliability advantage*. If a refrigerant failure or mechanical issue occurs, the RTU can continue operating in full economizer mode, removing rack heat, and maintaining safe supply air conditions. This capability:

- Adds a critical layer of built-in redundancy
- Extends the time window before thermal risk becomes catastrophic
- Buys valuable reaction time for service restoration
- Reduces the probability of rack shutdowns or equipment loss

Integrated Lighting Improvements for Data Environments

Cooling efficiency is only part of the solution. Lighting contributes both electrical load and heat gain. Grid-Smart™ integrates advanced Networked Lighting Controls (NLC):

- High-efficiency LED lighting upgrades
- Smart lighting controls and zoning

Benefits include:

- Reduced heat load — lowering cooling demand
- Lower electrical consumption and operating cost
- Extended fixture life and reduced maintenance
- Alignment with ESG (Environmental, Social, and Governance) and sustainability objectives
- Enhance the comfort and productivity of building occupants.

Why GRID-SMART™ for Data Centers

Integrated Control

Grid-Smart™ provides a means to monitor, analyze and proactively initiate:

- Automated real-time On-Demand Cooling (ODC)
- RTU and Economizer Redundancy Control
- Network Lighting Controls (NLC), minimizing energy usage (kWh) and demand (kW).
- Measure, report, control, and optimize your energy use in a single building or across multiple facilities.
- Generate energy savings automatically year after year.

Energy Efficiency Gains

- Reduction in cooling energy \approx 20–35%
- Increased revenue \approx \$40,000 per 10-Ton cooling (split system)
- Increased air-side economizer hours through RTU design
- Lower compressor run hours and improved lifespan
- Reduced overcooling through On-Demand Cooling (ODC)

Reliability Improvements

Peak temperatures and rapid temperature excursions (thermal spikes) are among the leading drivers of electronic component failure in servers¹. According to the *Arrhenius equation*, a common rule of thumb is that component failure rates double for roughly every 10°C (18°F) rise in temperature.²

- Reduces hot spot severity and mitigates peak temperature spikes
- Increases MTBF by mitigating peak temperatures
- Maintains more stable rack inlet temperatures
- Reduced thermal cycling stress on equipment such as compressors

Operational Advantages

- Fully scalable cooling architecture
- Increased usable floor space for revenue-generating server racks
- Better support for high-density GPU and AI clusters
- Easier equipment replacement without disrupting data hall operations
- Support for future expansion without mechanical room congestion

Make Cooling a Strategic Asset

Grid-Smart™ employs *On-Demand Ventilation* (ODV) and *RTU upgrades* to transform cooling from a fixed overhead into a strategic asset—cutting energy costs, reducing thermal failures, and enabling higher-density server deployments.

About Us

Earth Core Energy Services (ECES) is a utility-certified Energy Services Company (ESCO) specializing in data-center cooling, efficiency, and mission-critical reliability engineering. We deliver end-to-end solutions that reduce operating costs, extend equipment life, and support sustainable, high-density data-center growth.

Please visit us online for pricing and support at
www.ecesddc.com



¹ ASHRAE Technical Committee 9.9. Thermal Guidelines for Data Processing Environments. 5th ed., ASHRAE, 2021

² K. Gray, "Field failures and Traditional Reliability Engineering," Accendo Reliability, 2024.