Cross-sector partnerships for energy efficient data centers

COASTAL
CONSERVATION
LEAGUE

July 2025

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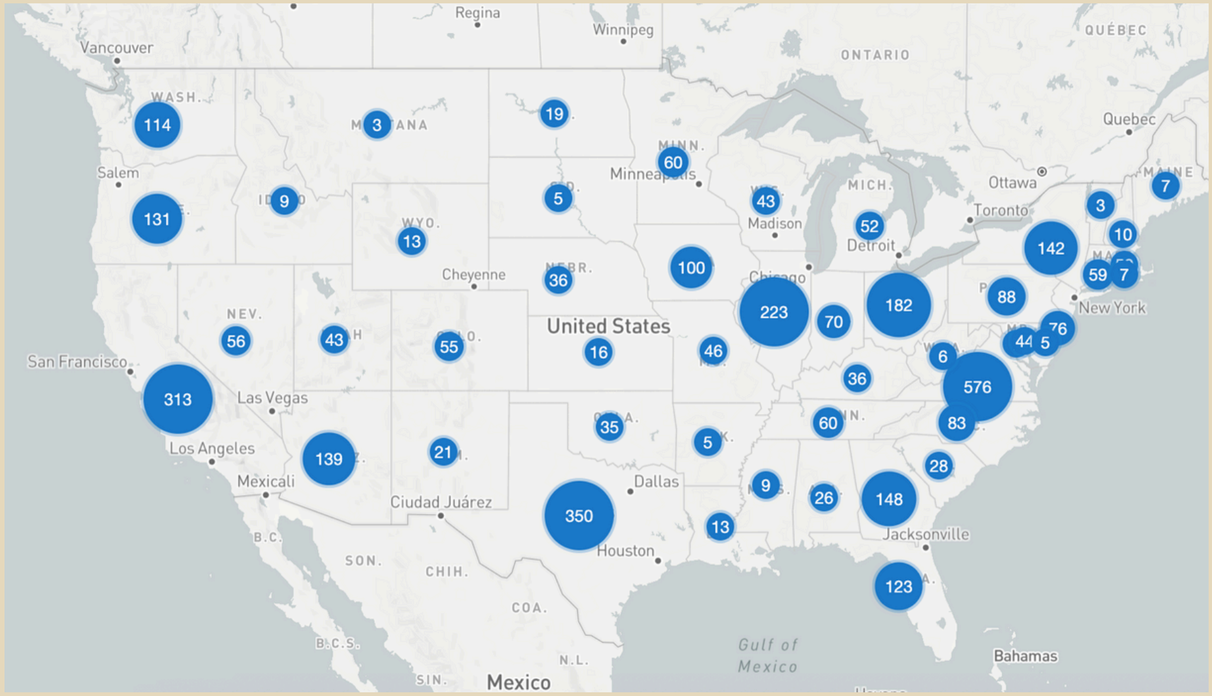
Energy use reached 176 TWh in 2023, which was 4.4% of total U.S. electricity consumption.

Data center energy use will range between 325 and 580 TWh by 2028 (6.7% to 12% of total forecasted U.S. electricity consumption)



Map of data centers in the United States

Sources: Lawrence Berkeley National Laboratory, “2024 United States Data Center Energy Usage Report”; DataCenterMap.com

IT equipment is the largest contributor (45%) to data center energy consumption, followed by cooling systems (38%)

Servers store and process vast amounts of data, which generates significant heat…

- Each server has several hardware components that contribute to its energy use, of which **processors (32%) are the most energy intensive**
  - Followed by PCI slots (20%) and conduction loss (15%)
- **AI workloads** (e.g., model training, ML) are demanding and **need specialized processors**
  - Central Processing Unit (CPU) does general computing tasks, one after another (i.e. sequential processing)
  - AI accelerators (or AI chips) process multiple tasks simultaneously (i.e. parallel processing)

…and requires cooling controls for optimal temperature and humidity conditions

- **Industry shift toward liquid cooling** as a more energy-efficient alternative to air cooling
- In liquid cooling systems, a **coolant flows to the servers and transfers heat** through a heat exchanger
  - Direct to chip: "Cold plates" attached to hottest components within a server, and coolant flows through tiny channels in the plate to draw heat away
  - Immersion cooling: Servers submerged in dielectric coolant. Either single phase (coolant remains a liquid) or two phase (coolant becomes gas)

Sources: Lawrence Berkeley National Laboratory, "2024 United States Data Center Energy Usage Report"; IEEE, "A Review of Data Centers Energy Consumption and Reliability Modeling"; Pambudi et. al, "The immersion cooling technology: Current and future development in energy saving"

South Carolina conservationists are concerned that the influx of data centers will strain natural resources at a cost to all

Google's energy-hungry SC data center sparks a rate dispute

BY JOHN MCDERMOTT JMCDERMOTT@POSTANDCOURIER.COM
JUL 6, 2025

Santee Cooper argued in part that Google's electricity load is too large and "unusual" to move to the lower pricing tier. It estimated that the **internet giant's Moncks Corner data center**, which is served by a member of Central Electric, consumes more power than all other industrial businesses on its system combined, at more than 380 megawatts.

Google announces $3.3B investment in SC data centers, 200 new jobs

The tech giant broke ground on 2 new centers as legislators debate their massive energy needs

BY: **JESSICA HOLDMAN** - SEPTEMBER 26, 2024 7:43 PM

"Even though they're paying a rate 60% below, they're consuming so much power that they're paying a substantial amount of money to the utility," state Commerce Secretary Harry Lightsey said during a special committee hearing at the Statehouse last week in response to concerns raised by Sen. Chip Campsen, R-Isle of Palms.

"Having that money available, instead of just having to get that money from residential customers, is a significant benefit," Lightsey said.

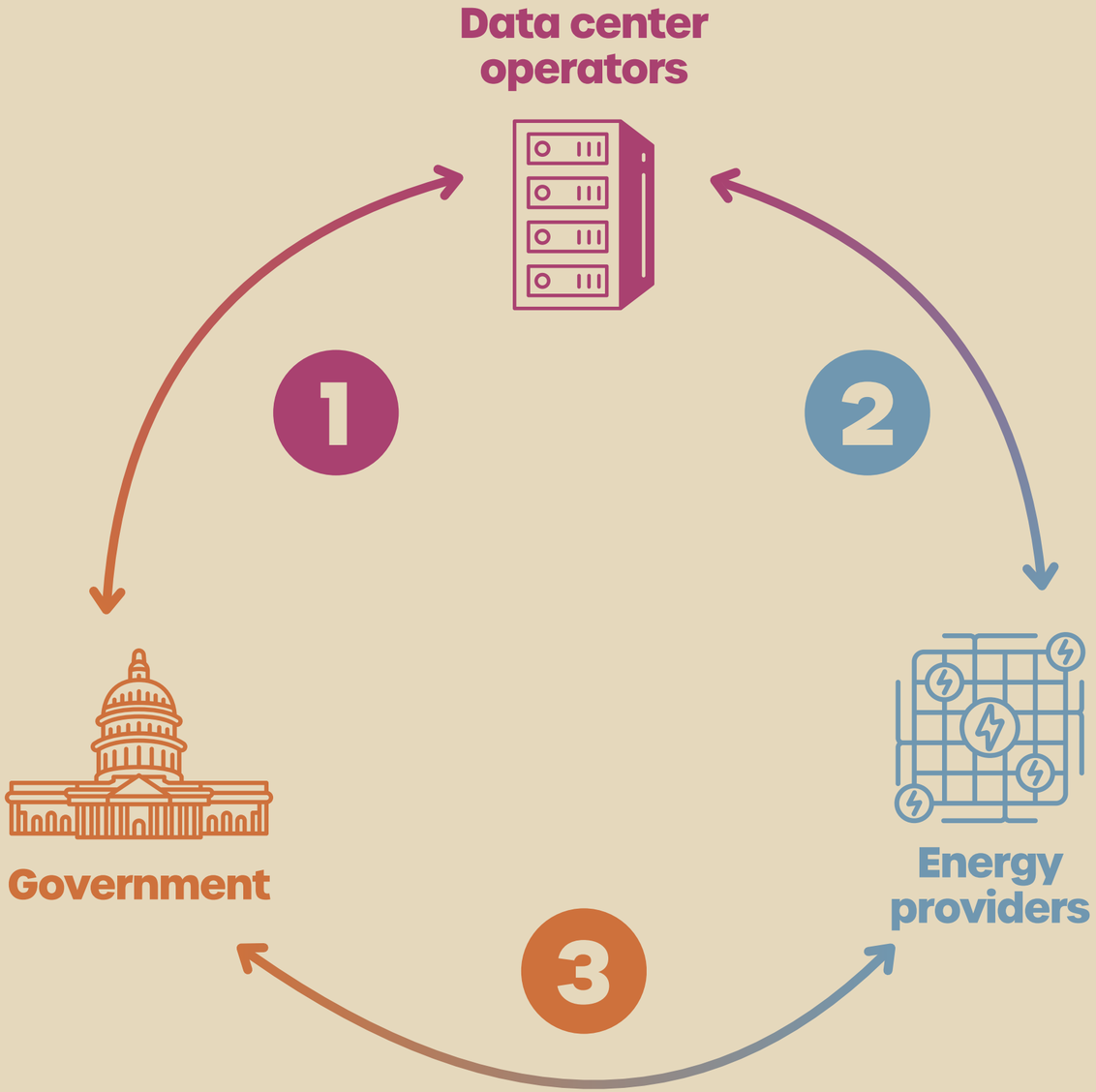
Meta plans $800m data center campus in Aiken County, South Carolina

715,000 sq ft campus coming to Graniteville

August 30, 2024 By: Dan Swinhoe Have your say

Once operational, the Aiken Data Center will be optimized for AI workloads. Meta previously paused its data center build-out amid a change in facility design to better cater for AI workloads.

The Coastal Conservation League engages with stakeholders and advocates for measures that reduce energy consumption



- 1a **Data center:** Provides capital investment and job creation.
- 1b **Government:** Offers sales tax exemptions on equipment and electricity and property tax agreements (FILOTs).
- 1c **CCL:** Promotes (or opposes) legislation by testifying during public hearings and lobbying to legislators.
- 2a **Energy providers:** Supplies power. Expands or upgrades power plants and infrastructure to meet increased demand.
- 2b **Data center:** Purchases power.
- 2c **CCL:** Participates in IRP stakeholder processes.
- 3a **Government:** Authorizes construction of major power generation infrastructure.
- 3b **Energy providers:** Proposes rate adjustments to cover construction and operation costs of new infrastructure.
- 3c **Government:** Reviews proposed adjustments to electric rates.
- 3d **CCL:** Intervenes in rate case proceedings.

Legislative advocacy

- In May 2025, the state legislature passed the omnibus energy bill H3309, now known as the SC Energy Security Act
- The Senate approved, but the House ultimately removed, key provisions advocated by CCL:
  - Data centers cover the full costs of their electric service
  - Required reporting on water usage

IRP stakeholder process

- CCL comments on resource modelling, cost assumptions, resource portfolios, etc. for our major electric utilities

Utility rate cases

- In September 2024, the SC Public Service Commission approved our settlement in Dominion SC's rate case, which secured:
  - $3 million in shareholder funding to expand their existing Neighborhood Energy Efficiency Program
  - A new low-income energy efficiency pilot program
  - A lower rate increase

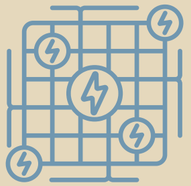
There is opportunity for stakeholders to adopt best practices that will lead to more energy efficient data centers

Government

No mandatory energy efficiency requirements or greenhouse gas emission targets for data centers

Data center operators

Voluntary environmental reporting

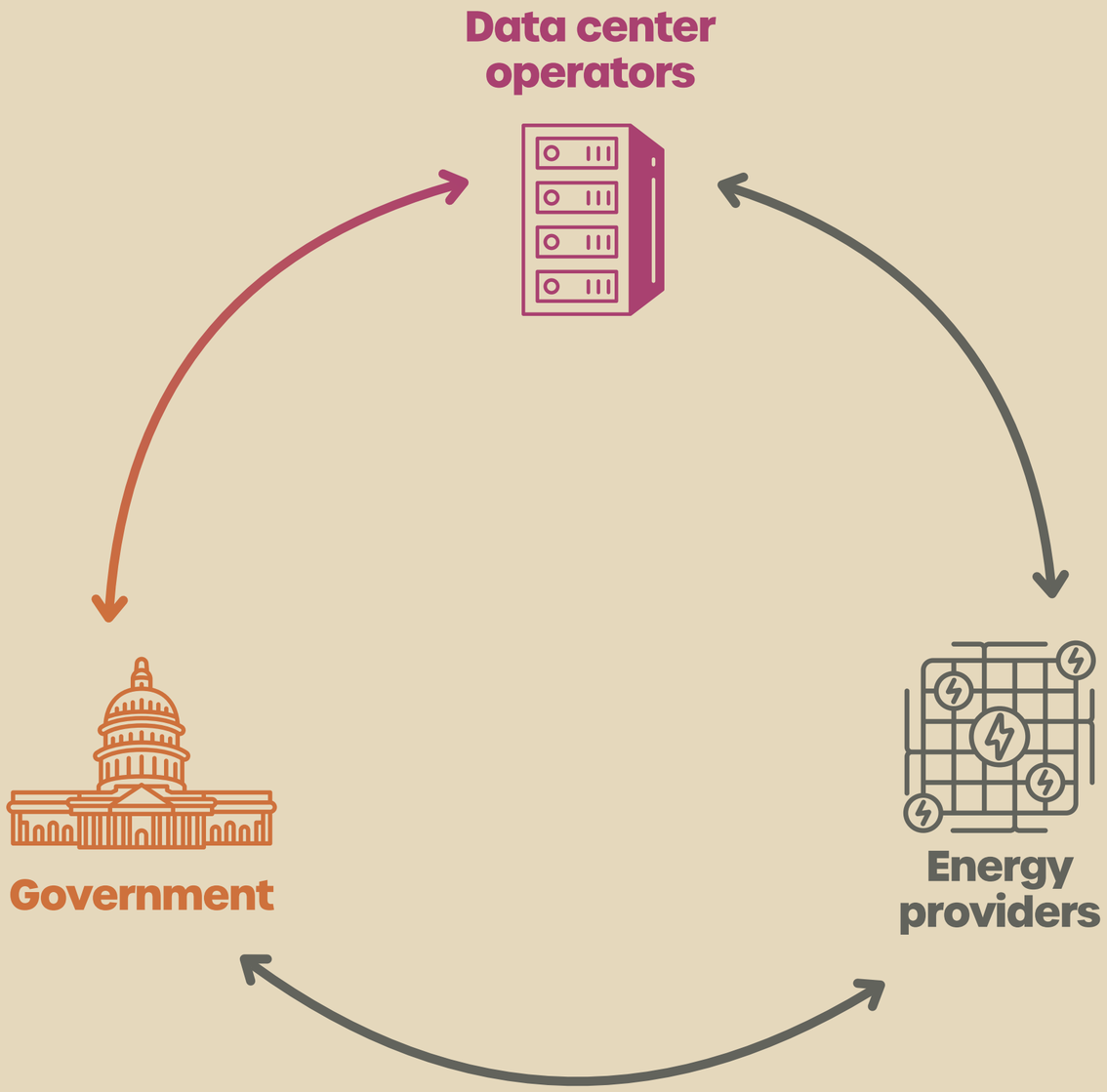


Energy providers

Industrial customers can opt out of DSM and EE rates by notifying the utility in writing of their intent to implement their own DSM and EE initiatives

What are best practices from successful public-private and private-private partnerships that conservationists could advocate for stakeholders to adopt?

Case study: Data center-government partnership



ARPA-E increases U.S. energy independence and reliability while cutting emissions and inefficiencies

$4.07 billion in funding

Funds early-stage technologies to find new ways of generating, storing, and using energy.

Has supported 1,500+ projects since the agency's founding in 2009.

1,225 patents

Serves as a launchpad to research and develop technologies that are too early for private sector investment.

258 projects have gone on to receive $14.6 billion in private equity fundraising.

1,225 ideas received patents from the U.S. Patent & Trademark Office.

The agency funds innovations across 6 research areas, 52 active programs, and 1500+ projects







Research areas	Agriculture & bioenergy	Buildings	Grid	Industrial efficiency	Power generation	Resources	Transportation
	Produce biofuels and bioproducts from biomass and waste resources	Improve energy efficiency through heating and cooling systems, lighting, and materials	Develop electricity storage, transmission, and distribution technologies	Reduce energy consumption across industrial processes	Advance technologies for renewable, nuclear, and other generation soruces	Extract conventional and nonconventional fuel resources; develop new materials (e.g., semiconductors)	Improve batteries, engines, and motors for EVs; create alternative fuels to gasoline
Active programs	9 Ex: *HAEJO to cultivate seaweed for biomass production*	5 *Ex: COOLERCHIPS to develop efficient cooling systems for data centers*	10 *Ex: DC-GRIDS to expand grid capacity*	20 *Ex: ROSIE to increase domestic iron and steel production*	18 *Ex: GREENWELLS to develop chemical reactors for storage of intermittent renewable energy*	7 *Ex: ULTRAFAST to develop semiconductors for grid reliability*	13 *Ex: PROPEL-1K to develop energy storage for fleet electrification*
Active projects	30	20	69	161	122	64	94

Notes: As of May 2025; Programs may cross multiple research areas
Sources: arpa-e.energy.gov/research/our-research-areas; arpa-e.energy.gov/programs-and-initiatives/view-all-programs; arpa-e.energy.gov/programs-and-initiatives/search-all-projects

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Intel and Purdue received $1.7 million from the COOLERCHIPS program to work on an immersion cooling project

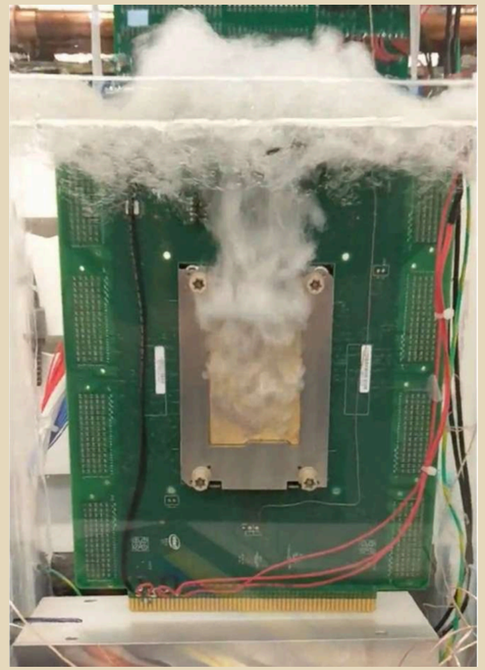
With program funding, Intel and Purdue are designing cooling technology capable of supporting at least eight processors, each consuming up to 2 kW

The $40 million COOLERCHIPS program has the goal of limiting total cooling energy consumption to under 5% of a data center's IT load. Intel and Purdue are contributing to this objective through the following design elements:

1. ## Topologically-optimized heat sink
Through computer simulations, Purdue and Intel tested thousands of designs and coral-shaped prototypes had the best results. This **3D, coral heat sink maximizes surface area for heat transfer**, and they can be clustered like a “coral reef” for greater efficiency.

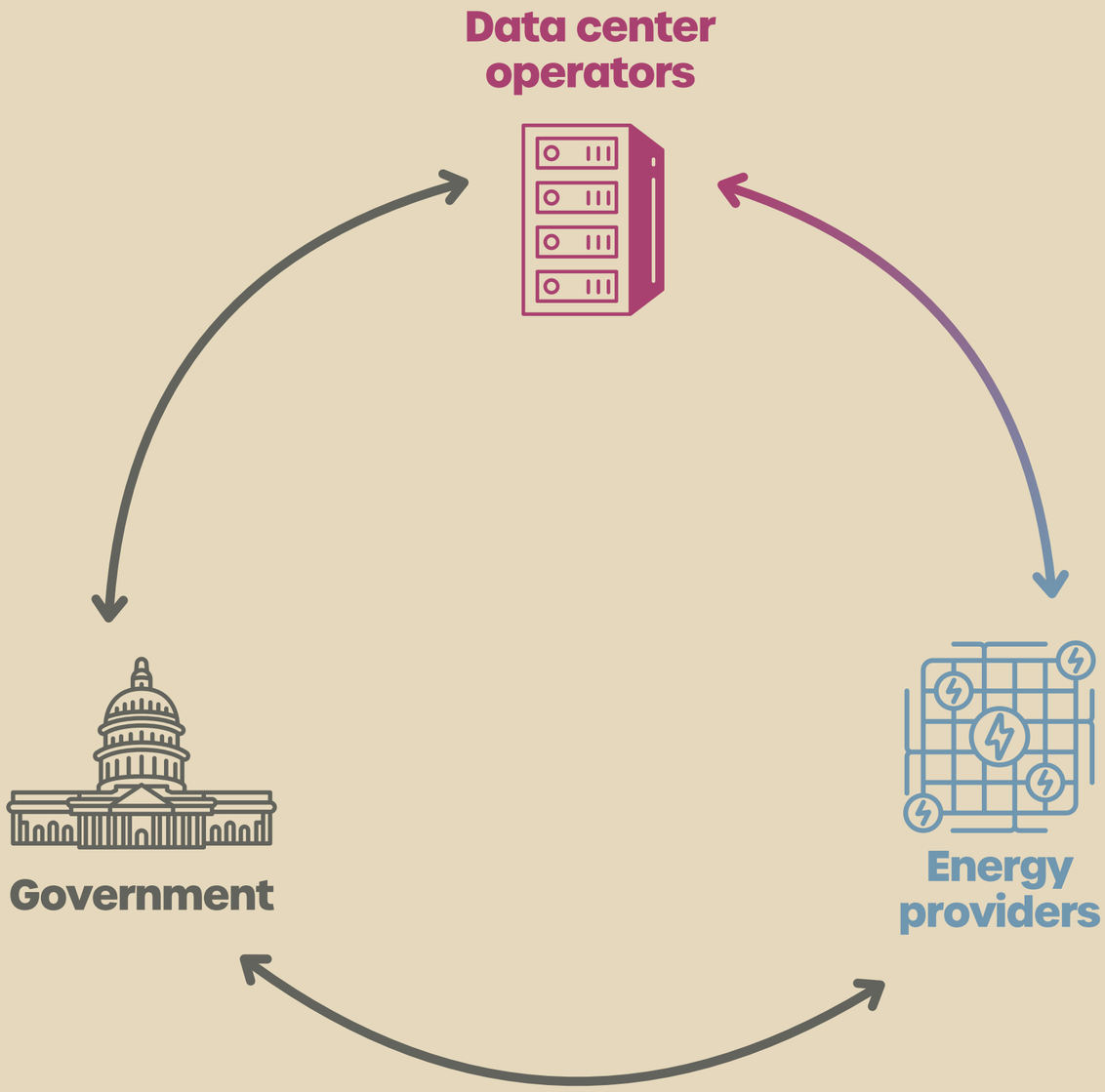
2. ## 3D vapor chambers
Sealed environments containing dielectric fluid. They reduce spreading resistance, ensuring **heat is efficiently dissipated across the heat sink** and preventing hotspots.

3. ## Boiling coating
Heat from the chip boils the liquid. A boiling enhancement coating covers the heat sink, resulting in more **bubbling to carry away heat**.



Sources: Sebastian Moss, “Why Intel is developing data center cooling tech”; Purdue, “Creating a 'coral reef' of heat sinks to cool high-powered Intel chips”; Intel, “US Energy Department Selects Intel to Develop Innovative Data Center Cooling Tech”

Case study: Energy provider-data center partnership



PowerSecure, a microgrid provider, has partnered with data center developer Edged to build sustainable facilities

September 2024

Their collaboration initiated with a 169 MW data center campus in Atlanta

- Engineered for reduced energy consumption while supporting high-density AI workloads
  - Edged's portfolio PUE is 1.15, a 74% reduction from the energy average of 1.58
  - Air cooling for up to 70 kW / rack and liquid cooling for up to 200 kW / rack

June 2025

Expanded partnership to several U.S. markets

- To date, PowerSecure has provided 152 MW of load capacity to Chicago, Columbus, Dallas, and other sites

Atlanta data center

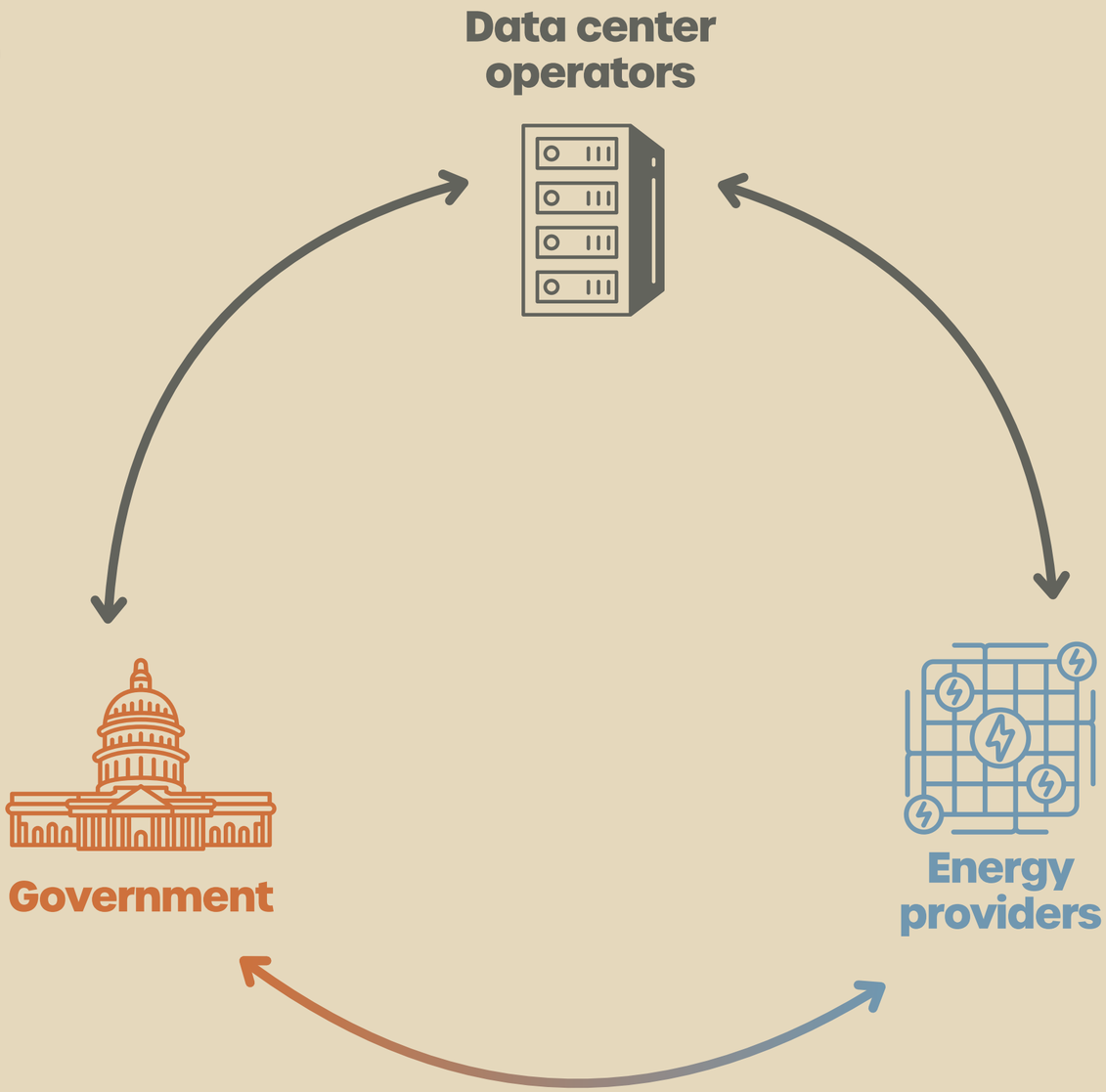
January 2025

Announced 6 year partnership for PowerSecure to supply its microgrid system to Edged

- PowerBlock microgrid has up to 625 kW in capacity
  - Can run on both diesel and renewable fuels
- Rated Tier 4 Final under EPA guidelines

Sources: Edged website; PowerSecure website; Zachary Skidmore, "Edged expands partnership with PowerSecure"

Case study: Government-energy provider partnership



Dominion Energy Innovation Center launched the nation's first accelerator program for data center energy solutions

This accelerator, DEIC Hyperscaled, received $150,000 in government funding

- Energy Program for Innovative Clusters (EPIC) funds incubator and accelerator programs that **support regional startups and entrepreneurs** with developing innovative energy ideas
  - Housed within Department of Energy's (DOE) Office of Technology Commercialization
- There is a **regional need for energy solutions**:
  - Northern Virginia has more than **35% (~150) of the world's hyperscale data centers**
  - Data centers account for **21% of Dominion Energy's power sales**

It connects energy and sustainability startups with potential customers and investors

5-6 companies with products or services ready to pilot

Solutions for energy efficiency, design, grid infrastructure, etc.

11 weeks

Paired with mentor

Virtual workshops and events

DEIC has no equity or IP

Sources: DEIC website; Virginia Economic Development Partnerships, "Data Centers"; Virginia Business, "On Cloud Nine"

What best practices could other governments, data center operators, and energy providers adopt?

- Collaboration crosses **the entire innovation lifecycle**, from initial testing of new designs to full commercialization.
- **Sustained government funding is essential** to minimize risk of project failure and help develop innovative products and services in early stages.
  - Government support enables the exploration of energy-efficient technologies that, despite offering transformative potential for the industry, may face **long payback periods or high initial investment.**
- Electric utilities have less direct involvement; instead, **providers of distributed energy resources** (e.g., microgrids) suitable for colocation **play a larger role.**
  - A **holistic view** of data center sustainability extends beyond energy efficiency to include **water usage, carbon emissions, and grid resilience.**
- Policy could **establish clear energy efficiency standards** for data centers, such as a minimum Power Usage Effectiveness (PUE).
  - By implementing innovative rate designs, legislatures can **shield customers from rate increases** driven by new power generation infrastructure for data centers.