Industrial Technologies Program

Saving Energy at Data Centers

Taming an Intense and Growing Appetite for Electricity

Data centers provide mission-critical computing functions essential to the daily operation of top U.S. economic, scientific, and technological organizations. These data centers consume large amounts of energy to run and maintain their computer systems, servers, and associated high-performance components. To protect these systems and their vital functions, however, data centers also employ energy-intensive HVAC systems, fire suppression systems, redundant/backup power supplies, redundant internet connections, and high-security systems. In 2006, U.S. data centers used approximately 61 billion kWh (about 209 trillion Btu in end use), accounting for about 1.5% of all U.S. electricity consumption.[1]

To support growing demand for processing power throughout the economy, individual data centers are increasingly using more compact and energy intensive servers even as the total number and size of data centers continues to increase. This growth in electricity demand by individual data centers and the rapidly increasing number of data centers nationwide represent an alarming increase in electricity demand. Rising electricity demands pose a serious threat to the already strained U.S. electric grid and to data center reliability. According to a recent survey, data centers average at least one serious outage per year.

The Opportunity

A coordinated program of focused R&D and operating practice improvements in the data centers could produce large energy savings, reduce the load on the electric grid, and help protect the nation by increasing the reliability of critical computer operations.

Challenges

- Data center owners necessarily focus on maintaining daily operations and managing rapid growth in the number and capacity of centers.

- Energy-saving techniques must be updated continuously because computer technology evolves rapidly; new server product requirements change faster than manufacturing processes.

- Tools for modeling energy management and heat transfer in data centers are limited by complexity, technical constraints, and cost.

Benefits

- Constrain increased electricity demand and associated carbon emissions

- Protect data and computing functions vital to our economy

- Reduce risk of power outages and increase regional electricity reliability

- Postpone need to build new electricity generation capacity

- Support replication of energy-efficient practices across the sector

[1] U.S. EPA, Report to Congress on Server and Data Center Energy Efficiency, Public Law 109-431, August 2007

DOE Resources Can Cut Electricity Demand of Data Centers

DOE can play a key role in moderating data center energy demand by working with the centers to deploy energy management best practices and conduct supporting targeted research and development. The DOE strategy will focus on building upon the success of Save Energy Now. DOE's highly successful Save Energy Now program and associated Energy Savings Assessment process provide a useful framework for working with data center owners and operators to benchmark energy use and identify opportunities for reducing energy demand by 25% or more through the adoption of energy-efficient practices. Activities and resources include:

• Development of a suite of Data Center Energy Profiler (DC Pro) tools to identify and evaluate energy efficiency opportunities in data centers. The DC Pro Profiling Tool assists data center owners in quickly diagnosing how energy is being used by their data centers and how they might save energy and money. Other tools available to conduct a more accurate assessment of energy efficiency opportunities are the Air Management Tool and the Electrical Systems Assessment Tool.

• Issuing a cost-shared solicitation for R&D projects that increase the energy efficiency of server-based information and communication technology (ICT) systems found in the nation's data centers and in telecommunications central offices. The "Information and Communication Facility Energy Efficiency" funding opportunity seeks proposals that increase the efficiency of IT equipment and software, power systems, and cooling systems. The solicitation will fund the demonstration and field test of pre-commercial technologies in these areas as well as in distributed generation or alternative power technologies used to power ICT systems.

• Training data center experts in the latest energy management best practices and tools. DOE is partnering with industry to develop a Data Center Certified Energy Practitioner (DC-CEP) Program to accelerate energy savings in the dynamic and energy-intensive marketplace of data centers. DOE is also working with ASHRAE and The Green Grid on data center awareness trainings and training materials.

A Strong Energy Portfolio for a Strong America

Energy efficiency and clean, renewable energy will mean a stronger economy, a cleaner environment, and greater energy independence for America. Working with a wide array of state, community, industry, and university partners, the U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy invests in a diverse portfolio of energy technologies.

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