

The U.S. Department of Energy (DOE) is working with public and private building owners to address the increasing amount of energy consumed by our nation's data centers. Through the Better Buildings Initiative owners of data centers can partner with DOE and commit to making their existing infrastructure that houses network and other data processing equipment more efficient.

An organization can partner with DOE to improve data center energy efficiency in one of two ways. Through the Better Buildings Challenge, an organization joins a nation-wide and multi-sectorial partnership program and commits its entire portfolio of data centers to 20% energy savings in ten years. As a partner in the Better Buildings Data Center Efficiency Accelerator, an organization commits to reducing the energy intensity of one or more of their data centers by 25 percent within five years. Partners will work together and with DOE to highlight and exchange, innovative and replicable solutions that will help to accelerate wide-spread adoption of and investment in energy efficiency practices and technologies.

For more information on joining, please visit the Better Buildings Challenge [website](#) or the Better Buildings Data Center Efficiency Accelerator [website](#).

What is the savings opportunity for the nation?

Data center energy use has grown rapidly in recent years and is expected to continue to grow. In 2013, U.S. data centers consumed about 100 billion kilowatt-hours of electricity, representing more than 2% of all U.S. electricity use¹.

If all U.S. data centers were 20% more efficient, we could save more than 20 billion kWh by 2020 as a nation. That translates to roughly \$2 billion in cost savings².

Is 20% energy savings possible for a data center? Is it cost effective?

Data center energy consumption can be reduced 20%-40% by applying best management energy efficiency measures and strategies typically used with very attractive returns on investment and short payback periods.

DOE is focused on improving efficiency of infrastructure (cooling, power supply losses) rather than installation of emerging IT systems or technologies. The opportunity for infrastructure savings is nearly 50% of the overall data center use. Said another way, for most data centers, the amount of energy used in the data processing, networking and storage equipment is as much as the energy to run the facility.

Typical upgrades include aligning the servers into hot and cold aisles, managing cool air flow to the servers, supplying air to the servers within the ASHRAE recommended temperature range and optimizing cooling systems and controls. These upgrades reduce capital and operating expenses, and can pay back their investment cost within five years.

Why now?

Data center electricity use continues to grow rapidly while overall U.S. electricity use has remained stable over the last few years. The opportunity to make energy efficiency improvements is large because the majority of owners and operator have focused on the availability and reliability of the data centers. Owners of the largest data centers providing cloud services practice energy management, but the vast majority of owners do not. Sharing and implementing existing best practices can reduce costs while increasing reliability. Typical investments in infrastructure improvements have payback periods of less than five years.

What kind of organizations can join?

Any organization with a portfolio of data centers or a single data center of at least 100 kW of IT load can join the Better Buildings Initiative as either a Better Buildings Challenge partner or a Data Center Efficiency Accelerator partner. Both public sector and private organizations are encouraged to participate in either program.

What does DOE offer Better Buildings Challenge and Data Center Efficiency Accelerator Partners?

DOE will offer technical assistance and best practice implementation models to partners to encourage investment in energy efficiency. In addition, DOE will connect partners with financial, technology, and service allies that can provide best practice services for deep energy savings and guarantee transparency in results.

What type of data centers do partners represent?

Data center partners are leaders in their industry. These partners include national laboratories, federal agencies such as EPA, DOD, SSA, and companies including CoreSite Realty Corporation, eBay, and Digital Realty Trust.

For a complete list of these partners, [click here](#).

Will data center partners be installing new networks or systems to drive efficiencies beyond the building?

Data centers typically have IT refresh rates between three to five years. New IT equipment is generally more efficient than the older equipment that it replaces. DOE expects that the partners will be refreshing their IT equipment as they make improvements to the infrastructure.

Under the Better Buildings Initiative, DOE will work with data center owners on improving efficiency of infrastructure to complement the work they are doing on the installation of emerging IT systems or technologies. Half of the energy supplied to a typical data center is used in the cooling and power infrastructure.

When will we see results?

Within the first year of joining, all partners will share their energy performance data, and develop an energy metering plan. Better Building Challenge partners will also develop a showcase project and implementation model. All of these solutions will be made available on the Better Buildings Challenge website.

How are federal agencies stepping up to improve their data centers?

The federal government is leading by example. Today, seven federal agencies are committing fourteen data centers and eight of the data centers are located within DOE's national laboratories.

Current estimates are that 10 percent³ of the federal government's electricity use goes to data centers. Federal data center partners will pilot new solutions and focus on how to reduce energy used by these data centers.

What is the role of Green Grid in the Better Buildings Initiative?

DOE currently has a Memorandum of Understanding with Green Grid. Green Grid is a non-profit, open industry consortium of end users, policy makers, technology providers, facility architects, and utility companies that works to improve the resource efficiency of information technology and data centers throughout the world. DOE has worked with Green Grid and other stakeholders to include data centers in the Better Buildings Initiative. DOE looks forward to working with Green Grid and other organizations interested in promoting and driving increased data center efficiency.

Is DOE regulating data center energy use?

No, the Better Buildings Challenge and Data Center Efficiency Accelerator are voluntary partnership programs. Data center owners and operators that commit are doing so because it is something they want to do.

Data Center Background

What is a data center?

A data center is a repository (closet, room, floor or building) for the storage, management, and dissemination of data and information. Data centers house computer systems and associated components, such as telecommunications and storage systems.

Data centers can be small, medium, and large and set up in closets or take up an entire floor of building space. Large data centers are typically stand-alone buildings.

Who owns U.S. data centers?

The vast majority of data centers are small server rooms and closets found in a variety of buildings owned by small and medium businesses and organizations, or are located in multi-tenant data centers. Multi-tenant data centers have expanded rapidly over the last few years. The larger data centers owned by the major cloud providers and national super computer centers comprise about 8% of the server market. Some of the players in the multi-tenant data center market include household names such as Dell, HP, and IBM. Federal agencies also own data centers. These data centers represent 5 to 10%⁴ of all data centers in the U.S.

How many data centers are there in the U.S.?

There are about 3 million data centers - that's 1 data center for every 100 people – located all across the country and each requires a lot of energy⁵.

What are the highest priority improvements a data center owner can make?

Improving the utilization of servers, consolidating data center operations to take advantage of the efficiencies of scale, adopting integrated organizational models to increase accountability, deploying data center infrastructure management strategies to enable greater reporting and efficiency, and adopting best practices for cooling and powering data centers can all lead to significant savings.

In a typical data center, every kW saved with IT equipment can potentially result in nearly 2 kW saved in the infrastructure. Additional savings can be obtained by applying best practices such as hot and cold aisle isolation, managing airflow, and raising the temperature within the ASHRAE recommended range.

How is the efficiency of a data center measured?

The industry standard metric for data center efficiency is the Power Usage Effectiveness or PUE™. Most simply, PUE™ equals the total energy consumption of the data center divided by the energy consumption of the IT equipment.

What is PUE?

PUE™ is a measure of the effectiveness of the infrastructure, including cooling and power systems, serving the IT systems. Data centers with smaller PUEs are considered more efficient because they need less cooling.

End Notes

- ¹ This figure is a DOE estimate based on the 2000-2010 historical compound annual growth rate of 10.5% from the 2007 EPA report to Congress and the 2011 Koomey Report. The projection starts from the midpoint of the 2010 range of data center electricity use provided by the 2011 Koomey report. Jonathan Koomey. 2011. Growth in Data center electricity use 2005 to 2010. Oakland, CA: Analytics Press. August Report to Congress on Server and Data Center Energy Efficiency, Public Law 109-431, August 2, 2007.
- ² These figures are DOE estimates based on the 2000-2010 historical compound annual growth rate of 10.5% from the 2007 EPA Report to Congress and the 2011 Koomey Report, as well as an LBNL survey of data centers that found that on average as much electricity was used for the cooling and power as was used for the IT equipment in a data center. The 20 billion KWh represents savings in the cooling and power infrastructure due to energy efficiency improvements. The \$2 billion is a conservative approximation based upon a constant cost of 10 cents per kilowatt-hour.
- ³ This figure is a DOE estimate based upon an approximation contained in the 2007 EPA Report to Congress, and actual electricity data in FY 13 from the Federal agencies.
- ⁴ 2007 EPA Report to Congress
- ⁵ 2014 NRDC Issue Paper