2011. The best practice scenario shows that electricity use in servers and data centers can be reduced below its 2006 level during the next five years rather than almost doubling, which would be the result if current efficiency trends continue.

Based on the assumption that the federal sector accounts for about 10 percent of electricity use and electricity costs attributable to servers and data centers, the annual savings in electricity costs in 2011 to the federal government range from $160 million (for the improved operation scenario) to $510 million (for the state-of-the-art scenario).

Table ES-2. Annual Savings in 2011 by Scenario (Compared to Current Efficiency Trends)

Scenario	Electricity consumption savings (billion kWh)	Electricity cost savings ($billion 2005)	Carbon dioxide emissions avoided ($MMTCO_2$)
Improved operation	23	1.6	15
Best practice	60	4.1	38
State-of-the-art	74	5.1	47

These efficiency gains appear to be achievable without compromising product or data center performance. Because energy efficiency is a secondary attribute of the equipment used in data centers, changes that would compromise performance will generally not be implemented. In other words, data center designers and managers will first ensure that primary needs – performance and availability – are satisfied and will only then differentiate among products and practices based on energy efficiency. In some situations, improved energy efficiency increases performance and availability. For instance, better cooling distribution in data centers can eliminate hotspots and thereby prevent equipment faults. Finally, it is important to note that the energy-efficiency improvements addressed in this report reduce the costs of excess energy use and excessive power and cooling infrastructure.

The analysis in this report includes consideration of use of fuel cells and other distributed generation (DG) technologies in data centers. DG resources can reduce data center energy costs, particularly when used in combined heat and power (CHP) systems, which use waste heat to provide cooling. CHP systems can produce attractive paybacks and are well suited to the steady power and cooling loads of data centers. Clean DG also has the environmental benefits of reduced criteria pollutants and greenhouse gas emissions. Fuel cell DG systems offer many attractive qualities, such as DC power output, for use in data centers. But fuel cells, as a new-market entrant, have a premium price over more traditional DG systems. So while DG systems based on traditional gas turbine or engine technologies can be considered cost effective without incentives, fuel cells, in many cases, will need financial incentives to be cost effective. Finally, DG systems, particularly fuel cells, do not have a long track record in high power quality, high availability applications such as data centers Given the high cost of outages for these types of facilities, more demonstration and conclusive information about system availability are needed before most facility designers and operators would likely be willing to adopt DG and CHP technologies.