



## LEADING BY EXAMPLE 2.0: HOW INFORMATION AND COMMUNICATION TECHNOLOGIES HELP ACHIEVE FEDERAL SUSTAINABILITY GOALS



by

Stephen Seidel  
Jason Ye  
*Center for Climate and Energy Solutions*

June 2013





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Roughly half of the Obama administration's goals of reducing federal agencies' direct and indirect greenhouse gas emissions by 24 percent by 2020 (from 2008 baseline levels) could be achieved through widespread adoption of ICT across the government.

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By any measure, the federal government has an enormous impact on the economy and the environment. Federal agencies:

- Own or operate 660,000 vehicles;
- Own or manage approximately 400,000 buildings; and
- Employ 1.8 million workers.

The federal government also paid over \$26 billion in fuel and electricity bills in 2011.<sup>1</sup> In 2011, its direct and indirect greenhouse emissions were responsible for 1.8 percent of the nation's total.<sup>2</sup>

As the nation's largest landlord, employer, fleet operator, and purchaser of goods and services, the federal government has the opportunity, if not the responsibility, to lead by example in moving our country in a more economically efficient and environmentally sustainable direction. Faced with tightening budgets, agencies are looking for new ways to reduce costs and increase productivity, while at the same time meeting a growing list of congressional and executive mandates to consume less energy and reduce greenhouse gas emissions.

The expanded use of "intelligent efficiency"—the application of information and communication technologies (ICT) to reduce energy consumption<sup>3</sup>—has become an important means of enabling agencies

to become more sustainable while enhancing productivity. Innovative technological developments have created new energy-saving opportunities in the areas of smarter buildings, electricity, transportation and travel substitution. In addition, mobility and collaboration tools offer many opportunities to transform the federal workplace while cutting energy consumption.

This report highlights the initial progress in adopting ICT across the federal government as agencies seek new ways of meeting their sustainability challenges. It draws from our 2012 report, "Leading by Example: Using Information and Communications Technology to Achieve Federal Sustainability Goals," which highlights eight case studies detailing examples of agencies employing ICT solutions.<sup>4</sup>

Recent studies have suggested that use of ICT applications has the potential to reduce our nation's total energy use by 12–22 percent by 2020.<sup>5</sup> This report estimates that roughly half of the Obama administration's goals of reducing federal agencies' direct and indirect greenhouse gas emissions by 24 percent by 2020 (from 2008 baseline levels) could be achieved through widespread adoption of ICT across the government. This would result in savings of over \$5 billion in energy costs through 2020.<sup>6</sup>



## FEDERAL SUSTAINABILITY MANDATES AND SCORECARD

In October 2009, President Obama set the federal government on a path to enhanced sustainability. Executive Order 13514, *Federal Leadership in Environmental, Energy and Economic Performance*, requires agencies to meet a quantified set of goals related to increases in energy and water efficiency, cuts in petroleum consumption, reductions in greenhouse gas emissions, and increased use of renewables.

Executive Order 13514 requires agencies to issue an annual Strategic Sustainability Performance Plan and to monitor its implementation. The executive order also calls on the Office of Management and Budget (OMB) to issue annual scorecards for each agency grading its performance toward meeting these goals.<sup>7</sup>

The executive order consolidates a number of existing and new mandates. By setting out numerical targets for a number of specific

sustainability objectives, it requires agencies to achieve the following:

- 2% reduction per year in agency consumption of petroleum products through 2020 based on a 2005 baseline;
- 26% reduction in potable water consumption by 2020; and
- 50% recycling and waste diversion by 2015.

In addition, agencies are required to take actions to ensure that 95 percent of all applicable agency contracts meet sustainability requirements. And, all federal buildings entering the planning process by 2020 must be designed to achieve zero-net-energy by 2030.

The executive order also lays out a timetable for establishing specified targets for agencies for their direct and indirect emissions of greenhouse gases.

“As the largest consumer of energy in the U.S. economy, the federal government can and should lead by example when it comes to creating innovative ways to reduce greenhouse gas emissions, increase energy efficiency, conserve water, reduce waste, and use environmentally responsible products and technologies.”

—President Obama in announcing Executive Order 13514.<sup>8</sup>



U.S. DEPARTMENT OF ENERGY



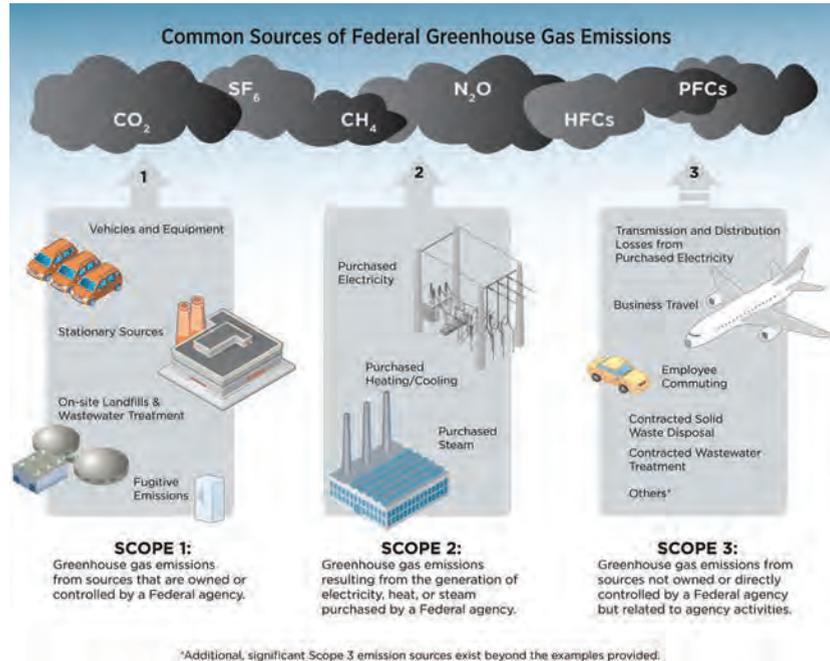
# REDUCTIONS IN GREENHOUSE GAS EMISSIONS

Following up on the requirement in Executive Order 13514, in January 2010 President Obama announced that the federal government would reduce its “scope 1 and 2” greenhouse gas emissions (these are emissions directly controlled by the government or associated with its electricity, steam or heat purchases) by 28 percent by 2020 from a 2008 baseline (see **Figure 1**).<sup>9</sup> In July 2010, the Administration added that the federal government would reduce its “scope 3” greenhouse gas emissions (those related to employee commuting, business travel, and transmission and distribution losses from electricity purchases) by 13 percent by 2020.<sup>10</sup> The federal government estimates that achieving these goals will reduce its cumulative greenhouse gas emissions by 101 million metric tons of carbon dioxide equivalent and save up to \$11 billion dollars in energy costs through 2020.<sup>11</sup>

## BREAKOUT OF FEDERAL GREENHOUSE GAS EMISSIONS

Federal greenhouse gas targets apply only to “covered” emissions, exempting those agency emissions related to national security. In practice, this results in exempting mostly fuel used by the Department of Defense in overseas operations. In 2011, federal agencies emitted almost 65 million metric tons of carbon dioxide equivalent of covered emissions. Of this total, 47 million metric tons were defined as scope

**FIGURE 1: Common Sources of Federal Greenhouse Gas Emissions**



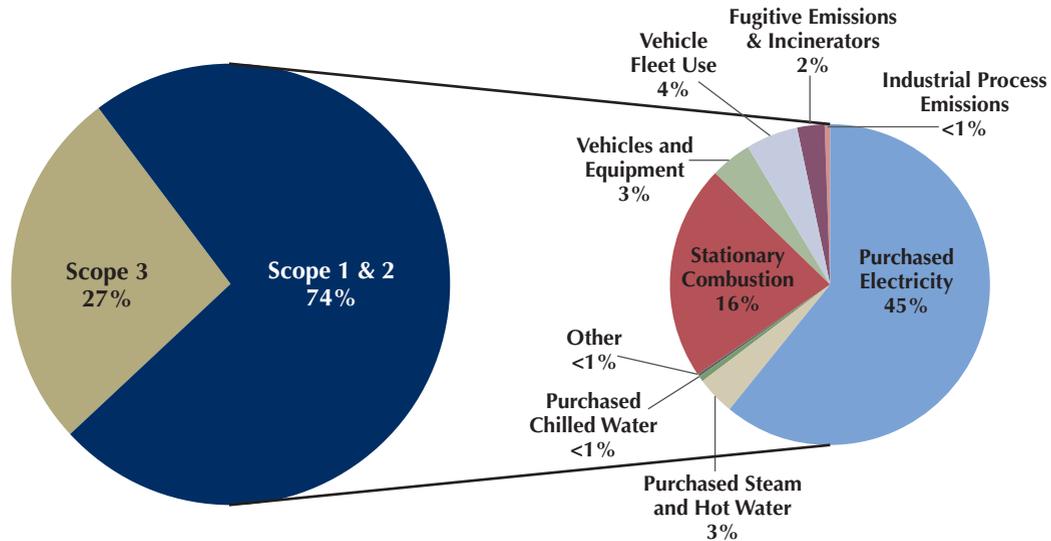
Source: Council on Environmental Quality, *Federal Greenhouse Gas Accounting and Reporting Guidance* (Washington, DC: Council on Environmental Quality, 2012).

1 and 2 emissions (see **Figure 2**). The largest percentage of these emissions was from purchased electricity (29 million metric tons) and stationary combustion (10 million metric tons).

The remainder of these emissions, almost 17.4 million metric tons, was defined as scope 3 emissions. The breakout of emissions by agency shows that the Department of Defense was by far the largest source of direct emissions and indirect emissions (see **Figure 3**). Other agencies

with significant emissions include the U.S. Postal Service, the Department of Energy and the Department of Veterans Affairs. The General Services Administration is a small direct contributor, but has enormous influence across the government through its role in managing buildings, fleets and procurements.

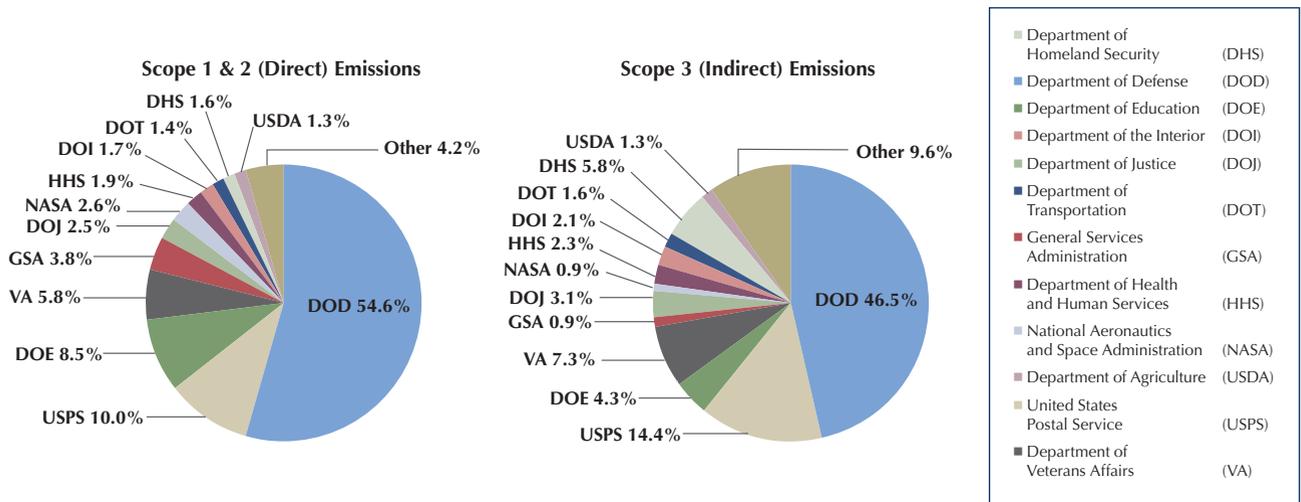
**FIGURE 2: FY2011 Covered Federal Government Greenhouse Gas Emissions by Scope and Category**



Scope 1 and 2 emissions (those directly controlled or associated with operations) make up three-quarters of federal greenhouse gas emissions. Of these, almost half are from purchased electricity.

Source: C2ES analysis of federal agencies' Strategic Sustainability Performance Plans for 2012. Scope 1 and 2 emissions from Chris Tremper, "Facility Energy Management: Linchpin for Federal Sustainability" (presentation, GreenGov Symposium, Washington, DC, September 25, 2012).

**FIGURE 3: 2011 Covered Federal Government Greenhouse Gas Emissions by Agency**



The breakout of emissions show that five agencies (DoD, USPS, DOE, VA, and GSA) make up nearly 83 percent of direct emissions, and nearly 74 percent of indirect emissions.

Source: C2ES analysis of federal agencies' Strategic Sustainability Performance Plans for 2012.



## PROGRESS TOWARD FEDERAL TARGETS

The federal government's goal is to reduce covered greenhouse gas emissions by 28 percent in 2020 for scope 1 and 2 sources and by 13 percent for scope 3 sources. The Council on Environmental Quality (CEQ) has estimated that this would achieve a cumulative reduction of 101 million metric tons of carbon dioxide equivalent over this period. Given the distribution among these sources of greenhouse gas emissions, the overall target in 2020 would be a 24-percent reduction in emissions from 2008 baseline levels.

In May 2013 the Agencies' Scorecards on Sustainability and Energy were released reflecting activities through 2012 (see **Figure 4**).<sup>12</sup> The grades earned by agencies reflect their continued progress in meeting

the goals specified in Executive Order 13514 and other mandates. All but four agencies are on target to meet the 28 percent reduction in direct greenhouse gas emissions, while for their indirect emissions, all but three are similarly on track to meet the 13 percent reduction goal by 2020.

Agencies are also generally making solid progress toward the energy intensity goal of reductions of 30 percent by 2030 from a 2003 baseline. Seventeen agencies are on target toward this goal, while 7 are falling short.

The one goal that is proving most problematic for agencies involves implementing the Guiding Principles for Federal Leadership in High

Performance and Sustainable Buildings for 15 percent of new, existing and leased buildings by 2015.<sup>13</sup>

Of the 25 agencies that have released scorecards, 15 agencies are falling short of this goal with 13 of these earning the lowest grade. Only five agencies are on track to meet this requirement.

The General Services Administration and the Environmental Protection Agency were the only two agencies who are on track (scored green) to meet the goals in every category. In addition, the Social Security Administration and the Department of Housing and Urban Development are on track to meet all applicable goals.



**FIGURE 4: 2012 Federal Agency OMB Sustainability and Energy Scorecard**

	SCOPE 1 & 2 GHG EMISSION REDUCTION TARGET	SCOPE 3 GHG EMISSION REDUCTION TARGET	REDUCTION IN ENERGY INTENSITY	USE OF RENEWABLE ENERGY	REDUCTION IN POTABLE WATER INTENSITY	REDUCTION IN FLEET PETROLEUM USE	GREEN BUILDINGS
Department of Agriculture	▲	●	●	●	●	■	●
Department of the Interior	●	●	●	●	●	●	■
Department of Commerce	▲	▲	●	■	●	●	■
Department of Justice	●	●	●	■	■	●	■
Department of Defense	●	●	■	▲	●	●	■
Department of Labor	●	●	●	●	■	●	■
Department of Homeland Security	●	●	▲	●	●	■	■
National Aeronautics and Space Administration	●	●	●	●	●	●	▲
Department of Education	■	●	N/A	N/A	N/A	■	N/A
National Archives and Records Administration	●	●	●	●	●	■	■
Department of Energy	●	●	●	●	●	■	■
Office of Personnel Management	●	●	■	●	■	■	N/A
Environmental Protection Agency	●	●	●	●	●	●	●
Smithsonian Institution	●	●	■	●	●	●	■
General Services Administration	●	●	●	●	●	●	●
Social Security Administration	●	●	●	●	●	●	N/A
Department of Health and Human Services	●	●	●	●	■	●	■
Department of State	●	●	■	●	●	▲	●
Department of Housing and Urban Development	●	●	●	●	●	●	N/A
Department of Transportation	●	●	●	●	■	●	■
Department of the Treasury	●	●	■	●	▲	●	▲
U.S. Army Corps of Engineers	▲	●	■	●	●	■	■
Tennessee Valley Authority	●	■	●	●	●	■	■
Department of Veterans Affairs	▲	■	●	●	●	■	●
United States Postal Service	●	●	●	N/A	●	■	N/A

Green ● indicates an agency is on track to meet a goal, yellow ▲ indicates an agency is off track in meeting a goal, and red ■ indicates an agency is substantially off track in meeting a goal.

Source: C2ES compilation of federal agencies' OMB Sustainability and Energy Scorecard for 2012.



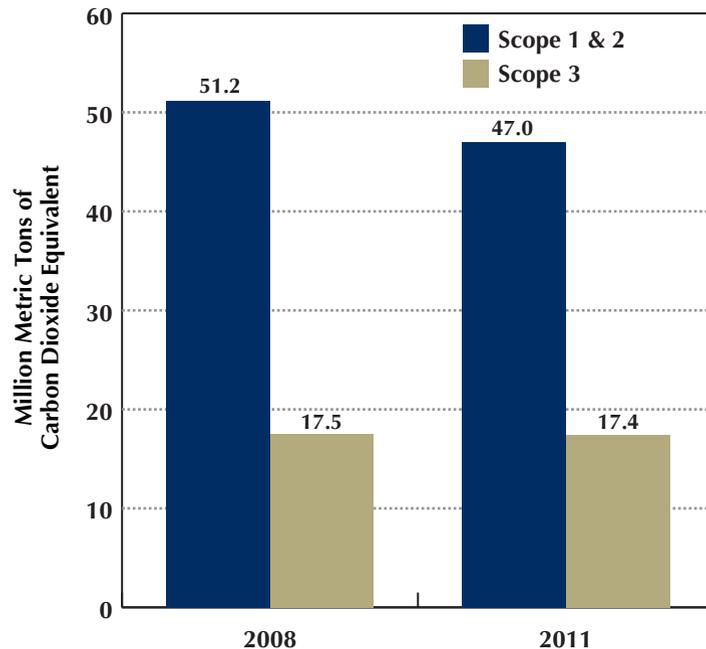
For the period 2008 through 2011, the federal government has been able to reduce total covered greenhouse emissions by almost 7 percent, primarily through energy efficiency and purchases of renewable energy (see **Figure 5**). ICT solutions have just begun to play a role in achieving these reductions as agencies take the following steps:

- Expanding their use of telework, teleconferencing and e-training;
- Installing more energy meters, building sensors and energy management systems; and
- Consolidating data centers and shifting information technology systems to the cloud.

ICT applications offer substantial additional opportunities for the federal government to reduce costs, meet its sustainability goals and operate more efficiently. The “Smart 2020” report produced by the Global e-Sustainability Initiative (GeSI) found that ICT has the potential to reduce total U.S. greenhouse gas emissions by 13–22 percent in 2020.<sup>14</sup> The report estimates potential reductions from ICT use in the following areas:

- Smart grid—integrating renewables into the grid; real-time pricing; and reductions in transmission and distribution losses.
- Smart buildings—advanced-design building to enhance energy efficiency; sensors and building energy management systems.

**FIGURE 5: Covered Federal Greenhouse Gas Reductions, 2008–2011**

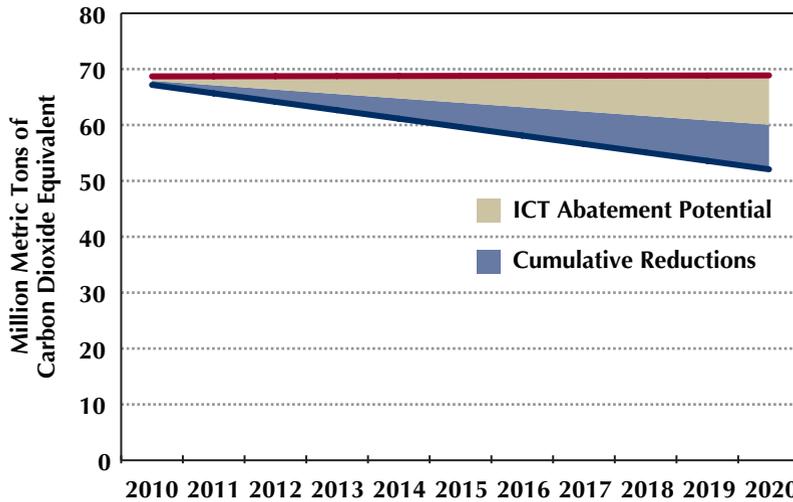


Source: C2ES analysis of federal agencies’ Strategic Sustainability Performance Plans for 2012.



*Smart meters allow for greater energy efficiency.*

**FIGURE 6: Potential ICT Reductions in 2020**



ICT solutions could reduce federal agencies greenhouse gas emissions by roughly half the goal established by the Administration.

Source: C2ES analysis of federal agencies’ Strategic Sustainability Performance Plans for 2012.

We estimate that expanded use of ICT solutions by federal agencies could reduce their greenhouse gas emissions by approximately 12.8 percent of covered federal emissions by 2020—roughly half the goal established by the Administration.

- Travel substitution—expanded telework and teleconferencing.
- Road transportation—enhanced logistics for more efficient utilization of commercial and personal vehicles.

Based on the assumption that many (though not all) of the federal government’s sources of emissions are similar to those elsewhere in the economy, we estimate that expanded use of ICT solutions by federal agencies could reduce their greenhouse gas emissions by approximately 12.8 percent of covered

federal emissions by 2020—roughly half the goal established by the Administration (see **Figure 6**).<sup>15</sup>

The following sections look in more detail at the specific ways ICT can be used across the federal government to reduce energy use and greenhouse gas emissions while enhancing agency productivity. Each section highlights one or more of the case studies included in our report, “Leading by Example: Using Information and Communications Technology to Achieve Federal Sustainability Goals.”



## ENHANCING ENERGY EFFICIENCY IN FEDERAL BUILDINGS

Federal buildings are responsible for over 87 percent of federal agencies' covered scope 1 and 2 greenhouse gas emissions and about \$7.2 billion in annual energy costs. This has made them an important longstanding target of congressional and executive efforts to enhance energy efficiency (see **Box 1**).<sup>16</sup>

### PROGRESS TO DATE

Led by the Federal Energy Management Program,<sup>17</sup> the General Services Administration and the Department of Defense, the federal government has initiated a wide range of activities to enhance the energy efficiency of its buildings, including:

- Evaluating facilities to identify potential efficiency measures;
- Using energy-saving performance contracts to finance energy projects;
- Benchmarking building energy performance;
- Installing meters and building energy management systems;
- Increasing purchases of renewable energy;
- Expanding the government's efforts towards high performance and sustainable buildings; and
- Facilitating the development of innovative new energy-saving technologies.

### BOX 1: Examples of key mandates aimed at reducing energy use in federal buildings

- Increase renewable electric energy use to 7.5 percent by 2013 (Energy Policy Act of 2005).
- Require electricity metering of energy use (Energy Policy Act of 2005).
- Reduce energy intensity by 30 percent by 2015 compared to 2003 baseline (Energy Independence and Security Act of 2007).
- Reduce fossil fuel energy consumption by 100 percent for new federal buildings and major renovations by 2030 (Energy Independence and Security Act of 2007).
- Reduce scope 1 and 2 greenhouse gas emissions across the federal government by 2020 (Executive Order 13514, *Federal Leadership in Environmental, Energy and Economic Performance*, 2009).
- Beginning in 2020, ensure that all new federal buildings entering the planning stages be designed to achieve zero net energy in 2030 (Executive Order 13514, 2009).

Through these efforts, federal agencies have made substantial progress toward the goal of achieving a 30-percent improvement in energy intensity of federal buildings by 2015 from a 2003 baseline (see **Figure 7**).

From advanced energy systems modeling in designing or renovating a building to integrated automated controls for lighting and cooling, ICT solutions are playing an increasingly important role in helping federal agencies meet their ambitious efficiency goals. Two of our case studies focused on the role of these technologies in achieving federal sustainability goals in buildings (see **Box 2** and **Box 3**).



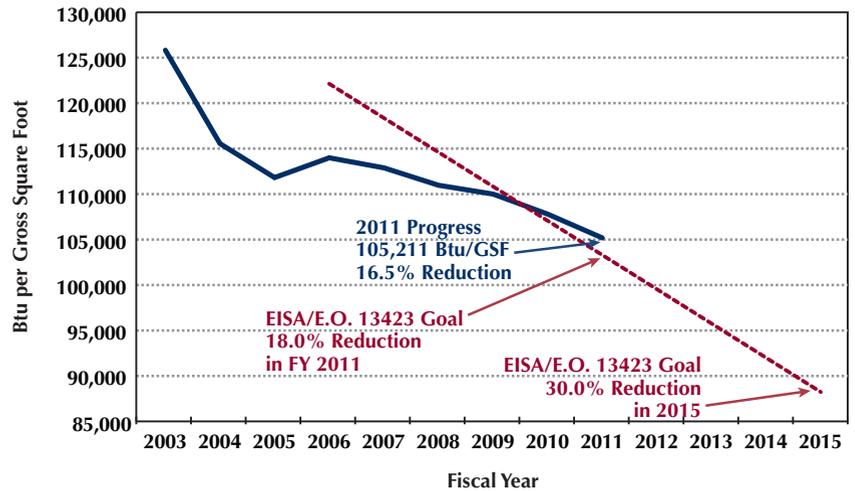
U.S. GENERAL SERVICES ADMINISTRATION

EPA is one of two agencies on track to meet their sustainability goals.

## NEW TOOLS FOR SAVING ENERGY

New technologies are currently being tested that provide managers of existing federal buildings with the information they need to substantially reduce energy consumption. In one trial, GSA is using 50 of its most energy-intensive buildings to test an expanded network of sensors monitored through a cloud-based centralized system that can identify anomalies and allow building managers to quickly take energy-saving corrective actions.<sup>18</sup> In contrast to this innovative application of “big data,” another project is aimed at developing and testing a low-cost, high-tech model that could be used to rapidly assess energy

**FIGURE 7: Federal Facility Energy Intensity, 2003–2015**



Federal agencies are currently on track to reduce their energy intensity by 30 percent by 2015 from a 2003 baseline as required by the Energy Independence and Security Act of 2007.

*Chris Tremper, “Facility Energy Management: Linchpin for Federal Sustainability” (presentation, GreenGov Symposium, Washington, DC, September 25, 2012).*

## BOX 2: Sustainability Base: NASA’s Use of Space-Age Technologies at Ames Research Center



NASA’s Sustainability Base is a new office building located at its Ames Research Center. As one of the federal government’s greenest buildings, Sustainability Base makes use of several ICT solutions:

- Advanced building design modeling systems to maximize energy-saving benefits from “native-to-place” design;
- Production of electricity through use of solar cells and advanced fuel cells;

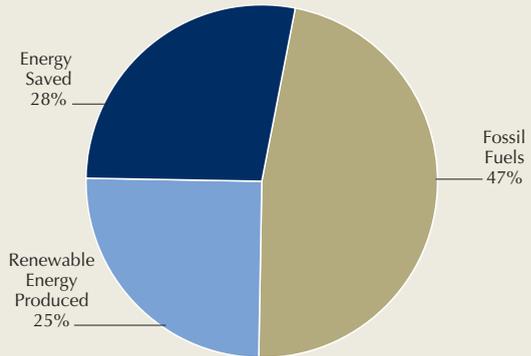
- Use of geothermal cooling and heating system, plug load management systems, and LED lights to reduce energy consumption;
- Use of advanced monitoring and adaptive operational systems to maintain reduced energy consumption over time; and
- Use of gray-water recycling system, low-flow fixtures and drought-resistant landscaping to reduce water consumption.

With reduced demand for artificial light and the application of high-efficiency radiant heating/cooling systems, the building site produces more electricity than it uses. Sustainability Base also is on its way to reducing potable water consumption by up to 90 percent compared to a traditional building.

### BOX 3: Coast Guard Facilities in Puerto Rico: Using an Energy-Savings Performance Contract to Cut Energy Use

At its facilities across Puerto Rico, the U.S. Coast Guard used an energy-savings performance contract (ESPC) to finance energy efficiency improvements under a program where a contractor provides financing for the project and is reimbursed from the resulting energy savings. The Coast Guard's use of an ESPC in this project paid for a wide range of energy-saving measures including building energy controls, more efficient HVAC systems, cool roofs, and renewable energy. These measures substantially upgraded 360 buildings located at three different facilities, reduced a 10-year deferred maintenance backlog, enhanced energy security for one of the facilities at a remote location, and substantially cut energy requirements. With 75 percent of the project funding from private-sector sources, this initiative resulted in reducing fossil-fuel based energy consumption at these facilities by 53 percent.

FIGURE 8: The Coast Guard's Projected Post-Project Energy Use in Puerto Rico



The energy efficiency (28 percent) and renewable energy (25 percent) savings reduced energy consumption by 53 percent, equating to roughly \$2.2 million in annual savings from reduced energy expenditures.

Source: Kevin Vaughn, *United States Coast Guard Embarks on Milestone Energy Savings Project with Schneider Electric* (Austin, TX: Schneider Electric, 2011).



SCHNEIDER ELECTRIC

Several of the 360 upgraded Coast Guard buildings located across Puerto Rico.





*One of GSA's 22 sustainably designed buildings.*

consumption in smaller, older buildings where little information on energy use is readily available.<sup>19</sup> The Rapid Energy Modeling system will use aerial or satellite imagery to help the Department of Defense identify those facilities most in need of energy-saving modifications.

### THE ROAD AHEAD

Given the amount of energy they consume, federal buildings will remain a major target for additional energy-saving actions. Improved tools for designing and renovating buildings so they use as little

energy as possible will likely play a larger role in the government's sustainability efforts over time. In addition, better integration of metering and data from sensors with building energy management systems offers substantial opportunities for improved maintenance and performance of buildings. Finally, the government also is exploring opportunities to provide real-time information about energy consumption as a means of encouraging employee behavior aimed at cutting energy use.

## Do Federal Green Buildings Deliver?

A recent analysis comparing the post-occupancy performance of 22 of GSA's representative newly designed or renovated green buildings to national benchmarks for comparable facilities found that on average these sustainably designed buildings reduced energy costs by 28 percent, and overall operations and maintenance costs by 19 percent.<sup>20</sup>

—U.S. General Services Administration, Green Building Performance, 2011



## ENHANCED EMPLOYEE MOBILITY AND COLLABORATION

The Internet and the rise of other new technologies have fundamentally reshaped how people communicate. Advances in information and communication technologies have created new opportunities for federal workers to work from almost anywhere. These technologies also allow for enhanced collaboration among workers in ways that can increase productivity, reduce travel costs, and cut energy consumption. For example:

- Cloud computing allows workers to more readily access their emails and files from any location;
- Smart phones and cell phones are widely available, and phone calls can be automatically routed seamlessly to multiple devices regardless of location;
- Multimedia teleconferencing and video conferencing allow direct, face-to-face interaction without the time and money spent on travelling to a common location;
- Document-sharing software allows select groups to work simultaneously or through a shared arrangement on the same document; and
- E-training has increasingly shifted employee learning online at far lower costs and with reduced travel time.

These tools have also proven to be a powerful and versatile means for meeting a growing list of congressional and executive requirements (see **Box 4**).

ICT applications offer new opportunities for agencies to reduce their energy and environmental impacts, meet congressional mandates to increase telework, and create work environments that facilitate collaboration and enhance productivity. Two of our case studies looked at innovative ways federal agencies are using ICT to advance mobility and collaboration. GSA has redesigned

office space in renovating its headquarters to encourage increased collaboration and enhanced mobility while saving energy and reducing space requirements (see **Box 5**).

With the availability of more powerful and user-friendly information technology applications, a variety of federal agencies—including the Department of Defense—are now



U.S. DEPARTMENT OF DEFENSE

### **BOX 4: Examples of key mandates aimed at reducing costs and greenhouse gas emissions in employee travel**

- All federal workers were recently deemed eligible to telework unless their agencies affirmatively designate them ineligible (Telework Enhancement Act of 2010).
- Agencies are required to cut expenses by 20 percent across five areas including official travel (Executive Order 13589, Promoting Efficient Spending, 2011).
- Agencies were recently required to reduce by travel expenses by 30-percent compared to the previous fiscal year (OMB Memorandum, 2011).



*GSA's Prototype Alternative Workspace at its headquarters building.*

moving towards use of enhanced communication and collaboration tools (see **Box 6**). These tools are especially important as agencies look to reduce travel and training costs while encouraging increased collaboration among employees.

### EXPANDED USE OF TELEWORK

The increased availability of powerful, lower-cost technology has removed some of the critical obstacles that limited the use of telework across the federal government for the past decade. In recognition of the opportunities that telework presents, Congress passed the Telework Enhancement Act of 2010, which makes all federal workers eligible to telework unless their agencies affirmatively deem them ineligible. In addition, the law requires all agencies to set telework goals and to monitor and report on progress toward meeting their goals.

A 2012 survey by the U.S. Office of Personnel Management found that an estimated 141,000 federal workers were teleworking at least one day a week, with substantial numbers doing it two or three days or more. (See **Figure 10**.) Overall, about a quarter of federal employees were teleworking in September 2011.<sup>21</sup>

### BOX 5: GSA's Prototype Alternative Workspace: Redesigning the Federal Workplace for the 21st Century

“Work is what you do, not where you do it.” President Obama used these words to describe the need for flexible workplaces across the federal government. Fully embracing the latest mobility and collaboration tools, the General Services Administration (GSA) has redesigned part of its headquarters offices as a pilot project. Through the use of a “hoteling” system that allows employees to reserve space from among a range of different office configurations on an as-needed basis, GSA has been able to substantially improve the efficiency of its office space, encourage greater collaboration among its staff, and facilitate increased telework. The prototype space is estimated to cut energy use by 45 percent, with a corresponding reduction in carbon dioxide emissions. The project also reduced annual rental costs by \$632,000.

**TABLE 1: The Impact of the GSA's Prototype Alternative Workspace**

COMBINED RELOCATED OFFICES	BEFORE REDESIGN	AFTER REDESIGN	% REDUCTION
Usable square feet	29,120	14,065	52%
Full time employees (FTE)	170	170	0%
Work stations	170	103	39%
Usable s.f. per FTE	171	83	52%
Rent per square foot			\$42
Reduction in square feet			15,055
Implied annual rent savings			\$632,310
Approx. project cost			Less than \$1M
Payback			Less than 2 Years

*Source: Gavin Bloch, “GSA Headquarters 7th Floor Workplace Prototype” (Presentation, March 13, 2012).*

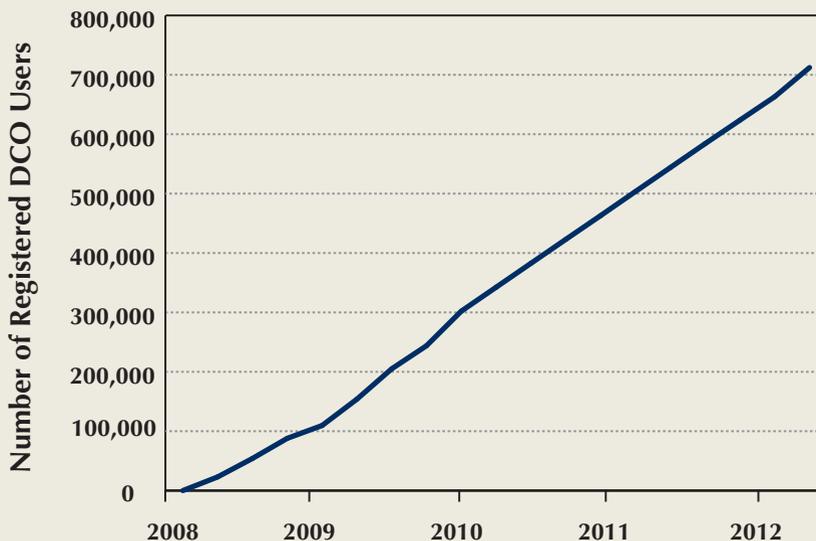
## BOX 6: Defense Connect Online: Advancing Sustainability through Enhanced Collaboration and Communication Tools

For the U.S. Department of Defense, Defense Connect Online (DCO) provides a suite of web-based tools that allow users to collaborate virtually anytime from anywhere. DCO has evolved from a planning and collaboration tool into a mission-critical function connecting the department's global operations. Its use has grown dramatically since it was initially implemented in 2008. DCO is being used in the following ways:

- To allow users in multiple locations to collaborate and interact virtually;
- To strengthen operational effectiveness by improving collaboration;
- To enable dispersed groups of users to participate in organization-wide meetings;
- To provide content-rich meetings that allow for real-time collaboration; and
- To support continual training through online courses and e-learning.



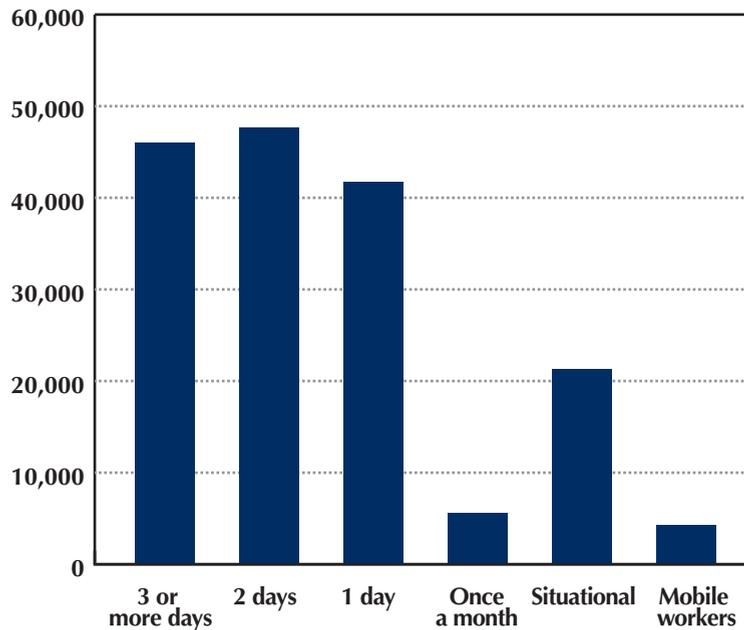
FIGURE 9: Growth in Defense Connect Online Usage



DCO has rapidly become a popular tool with more than 700,000 registered users.

Source: Mike Murtha, "Connect and the U.S. DoD: Defense Connect Online" (Presentation, Washington, DC, June 21, 2012).

**FIGURE 10: Telework Participation Numbers, Federal Employees**



Source: U.S. Office of Personnel Management, *Status of Telework in the Federal Government* (Washington, DC: U.S. Office of Personnel Management, 2012).

The U.S. Patent and Trademark Office is one of the leading federal agencies in embracing telework (see **Box 7**).

### THE ROAD AHEAD

If widely adopted, enhanced mobility and collaboration tools can transform

the federal workplace. To the extent that agencies update their technology infrastructure and embrace new opportunities for telework, they can increase worker productivity, reduce costs and improve employee satisfaction, all while advancing government-wide sustainability goals.

### BOX 7: U.S. Patent and Trademark Office (USPTO)

The U.S. Patent and Trademark Office (USPTO) was the first federal agency to establish a telework program. Launched in 1997, USPTO's program has grown to nearly 5,700 participants and has one of the highest telework participation rates in the federal government (80 percent of eligible employees). USPTO's success can be traced to a number of practices, such as: incorporating good performance management practices; emphasizing strong communication with teleworkers; ensuring clear and concise documentation of telework agreements and guides; and providing office equipment and hoteling space for teleworkers. Danette Campbell, senior advisor for telework at USPTO, believes telework offers numerous benefits, such as:

- Increasing employee satisfaction and retention by providing flexibility in when and how employees work;
- Attracting high-quality candidates for jobs;
- Reducing operational energy costs; and
- Reducing employee commute costs and associated greenhouse gas emissions.<sup>22</sup>



## TRANSPORTATION AND FLEET MANAGEMENT

The federal government owned or leased 660,000 vehicles in 2011, making it the nation's largest fleet operator. In all, federal agencies spent \$4.4 billion to maintain and operate the U.S. government fleet; fuel costs alone amounted to \$1.4 billion of this total.<sup>23</sup>

Federal fleets are subject to several legislative and executive mandates to minimize their energy use and environmental impact (see **Box 8**). Agencies can meet these federal goals and mandates through the application of the three broad approaches shown in **Figure 11**.

While alternative fuel vehicles have become the primary driver in reducing petroleum consumption across federal agencies, the availability of new ICT applications and management systems also can play a significant role. For example:

- Federal agencies are now required by GSA to have a fleet management information system (FMIS) in place to collect and aggregate vehicle-related data from multiple sources into one central place. An FMIS will help agencies right-size their fleets, simplify compliance with reporting requirements, and enhance operations and maintenance activities.
- Vehicle telematics are now available through GSA for use by federal agencies. These systems allow for real-time monitoring to optimize fleet utilization and reduce miles traveled, increase fuel



### **BOX 8: Examples of key mandates aimed at reducing costs and energy use in transportation**

- Federal agencies are required to reduce annual petroleum consumption by 20 percent by 2015 from a 2005 baseline (Energy Independence and Security Act of 2007).
- Under Executive Order 13514 in 2009, the Obama administration extended these petroleum reduction requirements to 2020, with an additional 2 percent per year in mandated reductions.
- Agencies are required to utilize a newly developed vehicle allocation methodology that helps them evaluate the optimal size and configuration of their agency fleets (Presidential Memorandum on Federal Fleet Performance, 2011).
- All new light-duty vehicles added to the federal fleet must be alternative-fueled vehicles by 2016 (Presidential Memorandum on Federal Fleet Performance, 2011).

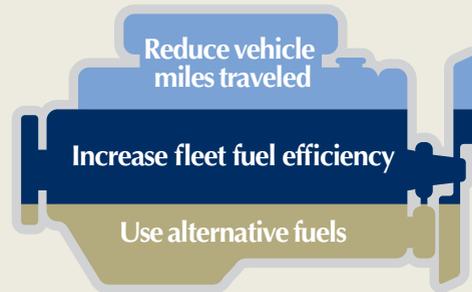
efficiency, enhance driver safety, and facilitate maintenance from automated engine diagnostics.

One of our case studies examined how the Smithsonian Institution implemented both a fleet management information system and vehicle telematics as part of a broad effort to improve its fleet operations. These measures, along with other actions such as a shift to alternative-fueled vehicles and biofuels, have reduced petroleum consumption by the Smithsonian fleet by 44 percent since 2005 (see **Box 9**).<sup>24</sup>

### THE ROAD AHEAD

To ensure federal agencies have a range of tools at their disposal, GSA now offers its client agencies an assortment of vehicle telematics management and tracking solutions. In an additional step to make better use of vehicles and lower costs, GSA also has tested an 80-vehicle shared motor pool system in Washington, D.C., that is similar to commercial car-sharing services. Last but not least, GSA's Federal Fleet Management System (FedFMS) provides a standard and reliable government-wide management system for both GSA-leased vehicles and agency-owned vehicles. All of these activities, combined with agency-level innovations, are likely to go a long way to helping the federal government achieve its goals for reducing petroleum consumption and greenhouse gas emissions associated with operating the largest fleet of vehicles in the world.

**FIGURE 11: Driving Principles for Reducing the Government's Energy Use and Greenhouse Gases**



#### Reduce VMT

- Consolidate trips
- Use web and video conferencing
- Use mass transit and shuttles
- Improve trip routing

#### Increase Fleet Fuel Efficiency

- Replace existing vehicles with higher fuel economy vehicles (e.g., right-sizing)
- Institute operational changes (e.g., improve maintenance, drive more efficiency, avoid idling)

#### Use Alternative Fuels

- Shift to E85, CNG, biodiesel blends and other alternative fuel vehicles
- Deploy electric vehicles

*Source: Federal Energy Management Program, Guidance for Federal Agencies on E.O. 13514 Section 12; Federal Fleet Management (Washington, DC: U.S. Department of Energy, 2010). See also: Mark Reichhardt, "Achieving Your Petroleum Reduction Requirements" (presentation, FedFleet 2012 and More, Louisville, KY, June 26, 2012).*



The federal government owned or leased 660,000 vehicles in 2011, making it the nation's largest fleet operator.

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#### **BOX 9: Fleet Management at the Smithsonian Institution**

The Smithsonian Institution operates a widely diverse fleet of 1,500 vehicles to support its operations in more than 80 countries around the world. Through its fleet management information system and telematics, the Smithsonian has realized a number of important benefits, including:

- Reducing the Smithsonian's light-duty vehicle fleet from 600 to 490 vehicles (an 18-percent reduction);
- Optimizing routing and deliveries to achieve a reduction of 12 full-size vehicles;
- Ensuring vehicles are used in a safe manner and for authorized work purposes only;
- Reducing vehicle idle time by 40 percent through vehicle telematics;
- Reducing fleet petroleum consumption by 44 percent between 2005 and 2011;
- Reducing unscheduled maintenance by 15 percent through preventive maintenance; and
- Reducing the number of full-time staff needed to manually collect and enter fleet information from three employees to one.



## DATA CENTER CONSOLIDATION AND CLOUD COMPUTING

The federal government is the nation's largest consumer of information technology (IT), spending more than \$80 billion annually on more than 10,000 systems.<sup>25</sup>

Faced with a number of recent mandates, the federal government is on track to substantially upgrade its IT infrastructure while cost-effectively advancing its sustainability goals (see **Box 10**).

These policies have the potential to produce substantial savings for federal agencies. One study estimated a shift to cloud computing by itself could reduce data center infrastructure expenditures by 30 percent.<sup>26</sup>

The federal government is on track to shut down at least 1,200 of 3,133 identified data centers by the end of 2015.<sup>27</sup> Data center and server consolidation has the potential to save the government between \$150 to \$200 billion over the next decade.<sup>28</sup>

In many respects, the challenges of consolidating data centers and migrating to cloud computing solutions are inherently linked. Cloud computing can accelerate data center consolidation efforts by reducing the number of applications hosted within government-owned data centers.<sup>29</sup>

Cloud computing is a paradigm-shifting model for making computing resources (e.g., networks, servers, storage, applications and services) more readily available over the Internet as a service. One main



INTEL CORPORATION

### **BOX 10: Key federal mandates aimed at reducing costs and energy consumed by data centers**

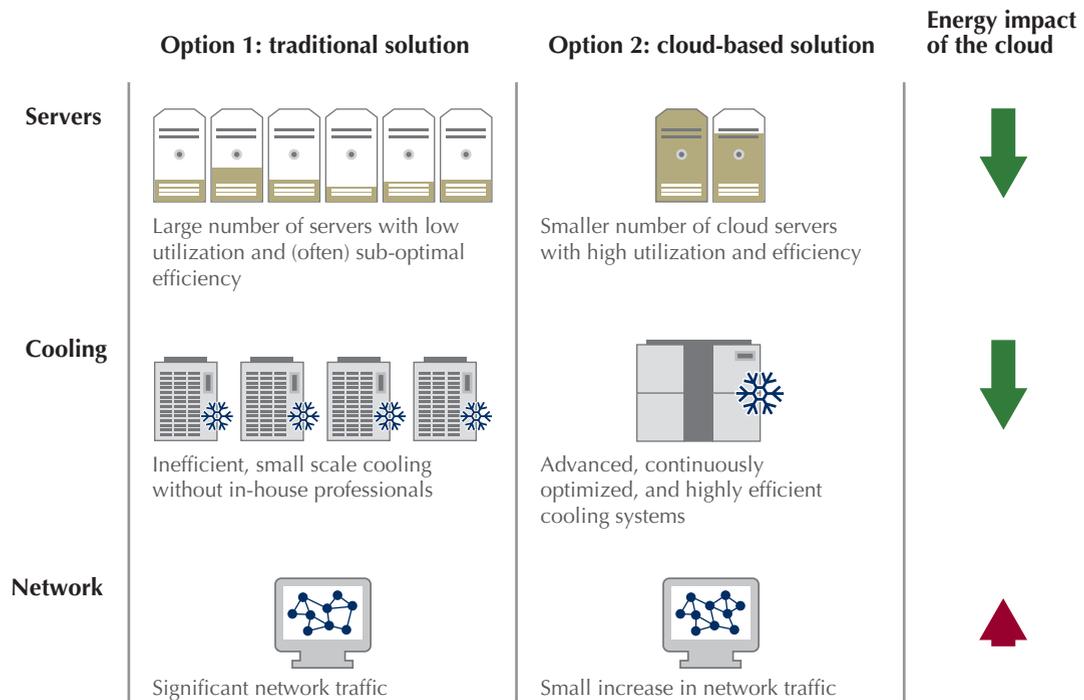
- Agencies must implement best practices for energy-efficient management of servers and federal data centers (Executive Order 13514, 2009).
- The federal government will reduce the number of government data centers and the real estate and energy they consume, increase IT security, and improve IT service delivery (Federal Data Center Consolidation Initiative, 2011).
- The government will reduce the number of government data centers by 40 percent by 2015 and adopt a “cloud first” policy (25-Point Implementation Plan to Reform Federal Information Technology Management, 2010).

### **BOX 11: Energy Impacts of Expanding the Role of ICT Applications**

A recent analysis shows that U.S. ICT-related emissions from end-user devices, data centers, and networks accounts for 3 percent of total U.S. greenhouse gas emissions; these emissions are projected to grow by 0.4 percent by 2020.<sup>30</sup> The potential reductions in energy consumption from increased use of ICT applications have been estimated to be seven times greater than the energy directly consumed by those applications.<sup>31</sup> Moreover, as the case study presented in this section demonstrates, energy reductions on the order of 85 percent are achievable by shifting from inefficient local servers and data centers to cloud-based services.



**FIGURE 12: Why is Cloud Computing More Efficient?**



A shift from traditional servers to a cloud-based solution will substantially reduce energy consumption from the servers themselves and cooling required for their operations with a small increase in energy consumption due to increased network traffic.

Source: *Google Apps: Energy Efficiency in the Cloud* (Menlo Park: CA: Google Inc., 2012).

## BOX 12: GSA: Leading the Way in Federal Cloud Computing

In June 2011, the GSA became the first federal agency to migrate its 17,000 email users from a locally hosted email system to a cloud-based email and collaboration service. Before the shift, GSA hosted a traditional email system made up of 324 servers in 14 data centers the agency operated across the United States. GSA's email service was considered outdated; it didn't include features such as integrated messaging and collaboration tools and was not fully compatible with GSA's telework efforts. By migrating to the cloud, GSA expects to reduce the operating costs of its email system by more than 50 percent over the next five years, saving \$15.2 million annually.<sup>32</sup> The new system should reduce email service energy use by more than 85 percent, with almost as large a reduction in carbon dioxide emissions.



Energy reductions on the order of 85 percent are achievable by shifting from inefficient local servers and data centers to cloud-based services.

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advantage of cloud computing is that it enables IT services to be better utilized, achieving greater economies of scale in both computer hardware utilization and efficiency of cooling systems, while achieving significant reductions in energy consumption (see **Figure 12**).

Email is one of the first systems that the federal government has focused on migrating to cloud computing services. It is estimated that cloud-based email could save the federal government \$1 million annually per 7,500 users.<sup>33</sup> One of our case studies focused on the experiences of the General Services Administration

(GSA), the first federal agency to shift to a cloud-based email and collaboration service (see **Box 12**).

### THE ROAD AHEAD

In March 2013, OMB announced plans to consolidate the Federal Data Center Consolidation Initiative into the PortfolioStat program, which more comprehensively audits an agency's IT portfolio to eliminate waste and inefficiencies.<sup>34</sup> PortfolioStat has identified \$2.5 billion in potential agency savings covering fiscal year 2013–2015 through the consolidation and elimination of low-value IT investments.<sup>35</sup>

GSA has been taking additional steps to facilitate the transition to cloud computing solutions by other federal agencies. For example, the agency is developing standardized procurements for cloud services that would be available for use by all agencies. In August 2012, GSA awarded “email-as-a-service” blanket purchase agreements to 17 vendors that will be offering five different cloud-based email solutions to federal agencies, creating an easier option for agencies to migrate hundreds of thousands of email accounts to the cloud.<sup>36</sup>



# ADVANCING INNOVATIVE ENERGY-SAVING TECHNOLOGIES AT GSA AND DOD

Energy used in buildings accounts for over 80 percent of the federal government’s covered scope 1 and 2 emissions. As two of the largest property owners and managers in the United States, the General Services Administration (GSA) and the Department of Defense (DoD) have a critical need to drive down those costs. But new energy-saving technologies often face a critical hurdle on the road to commercialization; too many promising technologies are unable to bridge the “technology valley of death” and never make it beyond a promising concept or prototype. DoD and GSA have each recently launched programs that use their buildings to provide real-world tests to validate the costs and energy-saving performance of emerging new technologies.

The programs initiated by the two agencies are:

- **DoD’s Installation Energy Test Bed Initiative:** Started in 2009 (as part of its Environmental Security Technology Certification Program

Program) with a focus on using DoD facilities as test beds for evaluating energy-saving technologies that are at the pre-commercial stage of development, this program has selected and supported 70 projects through 2012.

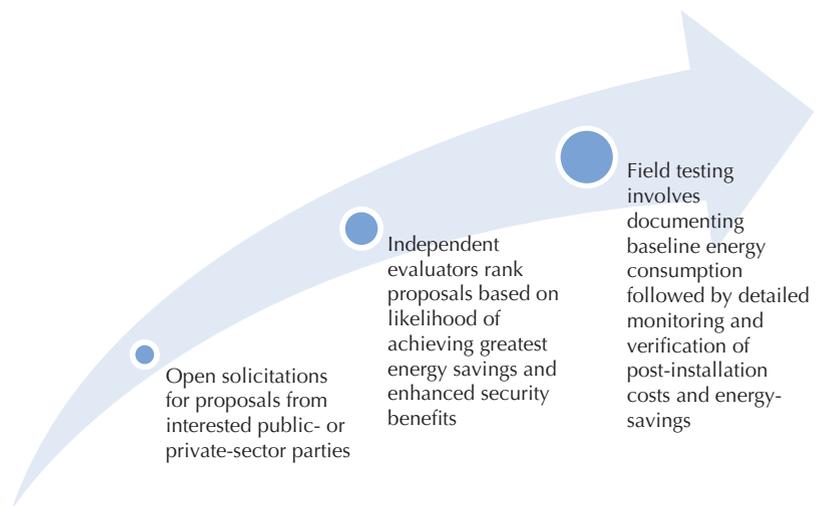
- **GSA’s Green Proving Ground (GPG):** Launched in 2010, this program tends to focus on more innovative or underutilized products that are just reaching commercialization. It has

targeted more than 20 energy-saving technologies for testing since its inception.

**Figure 13** shows the similar process used by each of these programs for identifying and evaluating innovative new technologies.

Each of the agencies has identified priority areas for their technology-testing initiatives. DoD has focused its efforts on: smart micro-grids; energy storage; advanced

**FIGURE 13: Energy-Saving Test Bed Program Design**



Source: Steve Seidel, and Jason Ye, *Leading by Example: Using Information and Communication Technologies to Achieve Federal Sustainability Goals*, (Arlington, VA: Center for Climate and Energy Solutions, 2012).

**TABLE 2: Examples of Energy-Saving Technologies Tested**

DOD'S ENERGY TEST BED PROGRAM	GSA'S GREEN PROVING GROUND
Integrating battery energy storage and microgrid control systems	Wireless mesh sensor network
Real-time itemized electricity consumption intelligence for DoD bases	Integrated daylighting systems
Secure Network of Assured Power Enclaves (SNAPE) project to demonstrate a full-scale microgrid system	Smart windows
Collaborative building energy management and control for occupant engagement	Variable refrigerant flow
Demonstrating enhanced demand response program participation	Plug load reduction

*We are working to be a leader and an innovator in environmental stewardship, energy efficiency, and energy security.*

—U.S. Secretary of Defense  
Leon Panetta, Speech,  
Washington D.C., 2012

energy management and control systems; advanced building components; tools for energy design and assessments; and renewable energy. GSA, for its part, has focused on: building-envelope solutions; heating, venting and air conditioning; lighting; on-site power generation; and water use.

**PROGRAM EXAMPLES**

The Green Proving Ground’s first completed project in March 2012 focused on reducing energy consumption at a data center operated by the U.S. Department of Agriculture.<sup>37</sup> Through the use of a wireless sensor system to monitor temperature and airflow, facility managers were able to adjust the use of existing air conditioning equipment to

achieve more optimal airflow and cooling. During the period of evaluation, the data center cut its cooling load by 48 percent and its total energy consumption by 17 percent with an estimated payback of 3.4 years.

DoD’s Installation Energy Test Bed program completed a project in October 2012 involving the deployment and testing of an advanced energy management and control system in a medium-sized office building at an Army installation.<sup>38</sup> The HVAC system and controls of the building were retrofitted with a system aimed at saving energy by taking advantage of building utilization and weather patterns, as well as utility rate structures. The system achieved a 45–50 percent reduction

in HVAC system energy use while improving occupant comfort. In addition, the use of a robust wireless sensor network versus a fully wired network reduced installation costs by 10–15 percent.

**THE ROAD AHEAD**

Despite being in their early years of implementation, both the GSA and DoD technology-testing programs show the potential to play an important role in validating the performance of innovative new technologies. As large purchasers, these agencies can also help create a market for the most promising of these technologies, providing direct benefits to the federal government and broader energy and cost savings for the economy as a whole.



## ADVANCING SUSTAINABILITY EFFORTS

In the years ahead, the challenge of meeting the federal government's sustainability goals will likely become more difficult due to tightening federal budgets. While the case studies described in this report highlight real economic and energy-savings benefits from the use of ICT applications, their wider deployment remains uncertain. The agencies in our case studies had to overcome a range of difficult barriers as they set out to implement their energy-saving and emission-reducing initiatives. These barriers included:

- Upfront capital may not be available to agencies even for investments that have short paybacks;
- Operational areas (e.g., travel, printing, building and fleet management) that are not core to an agency's mission may not receive the requisite management attention despite the potential for energy-saving opportunities;
- Agencies often face split incentives that can imperil these activities—for example, where an agency does not directly pay the energy bills for a space occupied by its employees, a situation that reduces incentives to conserve energy;
- Adoption of new technologies and workplace practices may require organizational and cultural changes requiring adjustments in the traditional ways managers and employees interact with each other; and

- Agency procurement and practices sometimes create additional barriers to adopting new technologies.

### OVERCOMING BARRIERS

None of these barriers is insurmountable. The case studies we examined identified a number of concrete steps agencies have taken to advance their sustainability efforts. While no one solution fits all situations, the following tools stood out in our research as showing great promise for supporting wider-scale energy savings and emissions reductions:

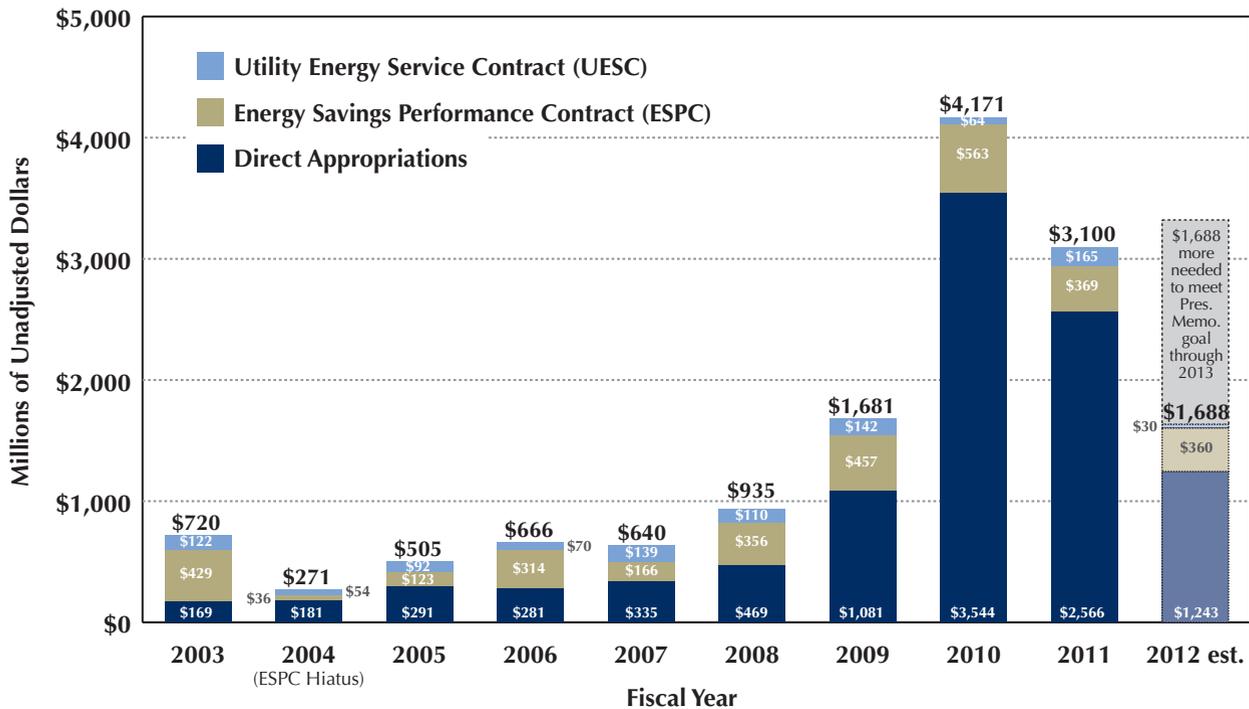
- **Energy Saving Performance Contracts (ESPCs):** Tighter federal budgets will require that agencies increasingly look to the private sector for ways to finance energy-saving investments. The use of ESPCs spiked recently in response to a presidential memorandum setting a goal of \$2 billion in new ESPCs over a 2-year period (see **Figure 14**).<sup>39</sup>
- **GSA's Procurement Programs:** Through programs like its Federal Strategic Sourcing Initiative, which leverages the federal government's purchasing power, GSA has identified and now makes available to agencies a range of technologies that can deliver substantial cost and energy savings. By putting these products on federal purchasing schedules, GSA has essentially preapproved certain products, delivering them at competitive cost, while also making them more easily procured by agencies.

None of these barriers is insurmountable. The case studies we examined identified a number of concrete steps agencies have taken to advance their sustainability efforts.

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- **Communities of Practice:** Learning from the experiences of federal colleagues is an effective method for advancing sustainability goals. Through interagency workgroups, federal program managers (e.g., building, fleet and print managers) can benefit from the experiences and perspectives of others, learn best practices, and participate in problem-solving activities.
- **OMB Scorecards:** The use of quantified sustainability goals, along with annual monitoring of progress, is crucial in focusing attention and resources on agency actions to become more sustainable. OMB's agency-specific scorecards provide senior federal officials with a clear indication of where their sustainability plans are paying off and where additional actions are required.

**FIGURE 14: Investment in Federal Facility Resource Efficiency Projects, 2003–2012**



Investment in federal energy efficiency projects increased dramatically from 2010 to 2011 due to the American Recovery and Reinvestment Act of 2009. In 2012, the use of energy savings performance contracts (ESPCs) increased in response to the presidential memorandum setting a goal of \$2 billion for new ESPCs over a 2-year period.

Source: Chris Tremper, “Facility Energy Management: Linchpin for Federal Sustainability.”

### BUILDING ON PROGRESS TO DATE

As noted above, expanding the use of a wide range of ICT applications offers the potential to achieve roughly half of the greenhouse gas emissions reductions required to meet federal agencies’ 2020 targets. Moreover, as suggested by the case studies referenced in this report, these sustainability gains can be accompanied by a range of other benefits, including costs savings, increased productivity and collaboration, and enhanced energy security.

In order to more fully realize these benefits, the federal government should take additional actions to advance its sustainability goals. These actions include:

- Expanding the use of ESPCs:** Energy saving performance contracts traditionally have focused on a defined set of energy conservation measures, including more efficient lighting, windows, and HVAC equipment. Working with its ESPC partners, the federal government could expand the

scope of what measures can be included under ESPCs to include ICT solutions. For example, DOE has been exploring the use of this mechanism to support data center consolidation and IT equipment upgrades. ESPCs might also be used to enable investments in a range of energy-saving ICT applications, including advanced sensors and building energy management systems.

- Scoring progress on ICT:** The OMB sustainability and energy

The federal government has made significant strides in its efforts to become a more efficient, productive and sustainable force in our economy.

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scorecards now include goals for a wide range of energy metrics. These could be expanded to include a new goal that provides a benchmark against which each agency's progress in using ICT applications to achieve energy savings can be evaluated.

- **Building new communities of practice:** The federal government could build on existing federal working groups or create new groups that bring together federal agency program managers in specific areas (managers of buildings, fleets, data centers, etc.). These working groups could be expanded to include private-sector leaders in each of these areas with the goal of creating public-private sector

partnerships to explore best practices and identify and address critical future needs.

- **Improving accounting practices:** The federal government could explore changes in existing budgeting procedures that limit investments in energy-saving opportunities because the costs of such investments are counted in a single year while the cost savings (energy reductions) accrue over multiple years.

The federal government has made significant strides in its efforts to become a more efficient, productive and sustainable force in our economy. By building upon these efforts it will be better positioned to meet the new realities of the 21st century.

### BOX 13: President Obama's Climate Action Plan

On June 25, 2013, President Obama announced a new set of actions aimed at helping the United States achieve its goal of reducing greenhouse gas emissions in the range of 17 percent below 2005 levels by 2020. The three-part plan calls for EPA to begin regulating carbon dioxide emissions from new and existing power plants, prepare the United States for the effects of climate change, and help lead international climate efforts. The plan also outlines a number of additional steps for federal agencies to reduce their own greenhouse gas emissions, including:

- Increases the goal for agencies to use electricity from renewable sources from 7.5 percent by 2013 to 20 percent by 2020.

- Builds on the existing mandate calling for federal agencies to employ \$2 billion in energy saving performance contracts within 2 years by streamlining contracting procedures and synchronizing federal building requirements.
- Leverages the "Green Button" standard, which facilitates public access to energy use data from federal buildings, to drive improvements in managing energy consumption and reducing greenhouse gas emissions.
- Extends the Better Buildings Challenge, a Department of Energy program aimed at achieving a 20 percent increase in energy efficiency at commercial and industrial buildings, to include public and private multifamily housing.<sup>40</sup>



## ENDNOTES

<sup>1</sup> Chris Tremper, Program Analyst, Department of Energy, Federal Energy Management Program, email message to author, January 7, 2013.

<sup>2</sup> Total federal emissions were estimated to be 117.8 million metric tons carbon dioxide equivalent in 2011. Of these, 64.5 million metric tons were covered by emission reduction targets established by the agencies. The emissions not covered were those mostly associated with national security operations (e.g., non-highway fuel use by the Department of Defense).

<sup>3</sup> Neal Elliot, Maggie Molina, and Dan Trombley, *A Defining Framework for Intelligent Efficiency*, Research Report (Washington, DC: American Council for an Energy-Efficient Economy, 2012), <http://aceee.org/research-report/e125report/e125>.

<sup>4</sup> Steve Seidel, and Jason Ye, *Leading by Example: Using Information and Communication Technologies to Achieve Federal Sustainability Goals* (Arlington, VA: Center for Climate and Energy Solutions, 2012), <http://www.c2es.org/publications/leading-by-example-federal-sustainability-and-ict>.

<sup>5</sup> Elliot, Molina, and Trombley, *A Defining Framework for Intelligent Efficiency*.

<sup>6</sup> The Administration estimated cumulative energy savings of up to \$11 billion through 2020 for meeting these targets. Nancy Sutley, “Knowing Where We Stand to Save Money, Improve Efficiency, Reduce Pollution, and Eliminate Waste,” The White House, last modified April 28, 2011, <http://www.whitehouse.gov/blog/2011/04/28/knowing-where-we-stand-save-money-improve-efficiency-reduce-pollution-and-eliminate->.

<sup>7</sup> Since 2006, OMB has used scorecards to evaluate federal agencies’ progress

in achieving energy, transportation, and environmental goals. Following Executive Order 13514, OMB combined past scorecard metrics into a single Sustainability/Energy Scorecard. “Sustainability,” Performance.gov, last accessed May 28, 2013, <http://sustainability.performance.gov>.

<sup>8</sup> “President Obama signs an Executive Order Focused on Federal Leadership in Environmental, Energy, and Economic Performance,” The White House, last modified October 5, 2009, [http://www.whitehouse.gov/the\\_press\\_office/President-Obama-signs-an-Executive-Order-Focused-on-Federal-Leadership-in-Environmental-Energy-and-Economic-Performance](http://www.whitehouse.gov/the_press_office/President-Obama-signs-an-Executive-Order-Focused-on-Federal-Leadership-in-Environmental-Energy-and-Economic-Performance).

<sup>9</sup> “President Obama Sets Greenhouse Gas Emissions Reduction Target for Federal Operations,” The White House, last modified January 29, 2010, <http://www.whitehouse.gov/the-press-office/president-obama-sets-greenhouse-gas-emissions-reduction-target-federal-operations>.

<sup>10</sup> “President Obama Expands Greenhouse Gas Reduction Target for Federal Operations,” The White House, last modified July 20, 2010, <http://www.whitehouse.gov/the-press-office/president-obama-expands-greenhouse-gas-reduction-target-federal-operations>.

<sup>11</sup> “Knowing Where We Stand to Save Money, Improve Efficiency, Reduce Pollution, and Eliminate Waste,” The White House Blog, last modified April 28, 2011, <http://www.whitehouse.gov/blog/2011/04/28/knowing-where-we-stand-save-money-improve-efficiency-reduce-pollution-and-eliminate->. See also “Guidance for Federal Greenhouse Gas Accounting and Inventories,” The White House, last accessed April 23, 2013, <http://www.whitehouse.gov/administration/eop/ceq/sustainability/fed-ghg>.

<sup>12</sup> “Leading by Example in Environmental, Energy, and Economic Performance,” Performance.gov, last accessed April 23, 2013, [http://www.whitehouse.gov/the\\_press\\_office/President-Obama-signs-an-Executive-Order-Focused-on-Federal-Leadership-in-Environmental-Energy-and-Economic-Performance](http://www.whitehouse.gov/the_press_office/President-Obama-signs-an-Executive-Order-Focused-on-Federal-Leadership-in-Environmental-Energy-and-Economic-Performance).

<sup>13</sup> U.S. General Services Administration, “High Performance Buildings,” September 27, 2012. <http://www.gsa.gov/portal/content/105331>.

<sup>14</sup> The Boston Consulting Group on behalf of the Global e-Sustainability Initiative, *Smart 2020* (Brussels, Belgium: 2008), <http://www.smart2020.org/publications>.

<sup>15</sup> The analysis assumed that federal ICT-enabled reductions would be similar to those estimated for the U.S. economy as a whole. However, reductions from optimization of commercial vehicles and reduced losses from electricity transmission and distribution were excluded because federal agencies have less direct control over these reductions.

<sup>16</sup> Chris Tremper, May 10, 2013.

<sup>17</sup> The U.S. Department of Energy’s Federal Energy Management Program (FEMP) works to meet energy related goals and to provide energy leadership to the country. For more information on FEMP, see Federal Energy Management Program webpage, U.S. Department of Energy Federal Energy Management Program, <http://www1.eere.energy.gov/femp/index.html>.

<sup>18</sup> U.S. General Services Administration, “New Smart Building Technology to Increase Federal Buildings Energy Efficiency,” May 14, 2012, <http://www.gsa.gov/portal/content/135115>.

<sup>19</sup> “Rapid Energy Modeling Workflow Demonstration EW-201259 Fact Sheet,” Strategic Environmental Research

and Development Program (SERDP)/ Environmental Security Technology Certification Program (ESTCP), last accessed April 23, 2013, <http://www.serdp.org/Program-Areas/Energy-and-Water/Energy/Conservation-and-Efficiency/EW-201259>.

<sup>20</sup> U.S. General Services Administration Public Building Service, “Green Building Performance” August 2011. [http://www.gsa.gov/graphics/pbs/Green\\_Building\\_Performance.pdf](http://www.gsa.gov/graphics/pbs/Green_Building_Performance.pdf).

<sup>21</sup> U.S. Office of Personnel Management, *Status of Telework in the Federal Government* (Washington, DC: U.S. Office of Personnel Management, 2012), [http://www.telework.gov/Reports\\_and\\_Studies/Annual\\_Reports/2012teleworkreport.pdf](http://www.telework.gov/Reports_and_Studies/Annual_Reports/2012teleworkreport.pdf).

<sup>22</sup> Scott P. Overmyer, *Implementing Telework: Lessons Learned from Four Federal Agencies* (Washington, DC: IBM Center for the Business of Government, 2011), <http://www.businessofgovernment.org/report/implementing-telework-lessons-learned-four-federal-agencies>.

<sup>23</sup> U.S. General Services Administration, 2011 Federal Fleet Report (Washington, DC: U.S. General Services Administration, 2012), [http://www.gsa.gov/graphics/ogp/2011FFR\\_Tables\\_FINAL.xlsx](http://www.gsa.gov/graphics/ogp/2011FFR_Tables_FINAL.xlsx).

<sup>24</sup> Federal Energy Management Program, “Petroleum Consumption by Agency” (Washington, DC: U.S. Department of Energy, 2012), [http://federalfleets.energy.gov/sites/default/files/static\\_page\\_docs/ff10\\_covered\\_petro\\_consumption\\_agency\\_FY11.xls](http://federalfleets.energy.gov/sites/default/files/static_page_docs/ff10_covered_petro_consumption_agency_FY11.xls).

<sup>25</sup> Steven VanRoekel, “Federal Information Technology FY 2014 Budget Priorities,” Chief Information Officers Council, last modified April 10, 2013, [http://www.whitehouse.gov/sites/default/files/omb/assets/egov\\_docs/2014\\_budget\\_priorities\\_20130410.pdf](http://www.whitehouse.gov/sites/default/files/omb/assets/egov_docs/2014_budget_priorities_20130410.pdf).

<sup>26</sup> Vivek Kundra, *Federal Cloud Computing Strategy* (Washington, DC: U.S. Office of Management and Budget, 2011), <https://cio.gov/wp-content/uploads/downloads/2012/09/Federal-Cloud-Computing-Strategy.pdf>.

<sup>27</sup> “Technology | Achieving Operational Efficiency,” Performance.gov, last accessed April 23, 2013, <http://technology.performance.gov/initiative/achieving-operational-efficiency/home>.

<sup>28</sup> Patricia Dalton, *Opportunities to Reduce Potential Duplication in Government Programs, Save Tax Dollars, and Enhance Revenue* (Washington, DC: U.S. Government Accountability Office, 2011), Publication No. GAO-11-318SP, <http://www.gao.gov/products/GAO-11-318SP>.

<sup>29</sup> Vivek Kundra, Federal Cloud Computing Strategy.

<sup>30</sup> Global e-Sustainability Initiative, *SMARTer2020: The Role of ICT in Driving a Sustainable Future* (Brussels, Belgium: 2012), <http://gesi.org/SMARTer2020>.

<sup>31</sup> Ibid.

<sup>32</sup> Martha Johnson, “GSA is in the Cloud,” U.S. General Services Administration, last modified July 26, 2011, <http://gsablogs.gsa.gov/gsablog/2011/07/26/gsa-is-in-the-cloud>.

<sup>33</sup> *The Next IT Revolution? Cloud Computing Opportunities and Challenges*. 112th Congress. 2011. (Statement of David McClure, Associate Administrator of Office of Citizen Services and Innovative Technologies at the General Services Administration). Statement available at: <http://www.gsa.gov/portal/content/120147>.

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<sup>35</sup> Steven VanRoekel, “Federal Information Technology FY 2014 Budget Priorities.”

<sup>36</sup> “Email as a Service (Eaas),” U.S. General Services Administration, last modified April 5, 2013, <http://www.gsa.gov/portal/content/112223>.

<sup>37</sup> Rob Mahdavi, and William Tschudi, *Wireless Sensor Network for Improving the Energy Efficiency of Data Centers* (Berkeley, CA: Lawrence Berkeley National Laboratory, 2012), <http://www.gsa.gov/graphics/pbs/wireless-sensor-network-final-full-report.pdf>.

<sup>38</sup> Satish Narayanan et al., *Wireless Platform for Energy-Efficient Building Control Retrofits* (East Hartford, CT: United Technologies Research Center, 2012), <http://www.serdp.org/Program-Areas/Energy-and-Water/Energy/Conservation-and-Efficiency/EW-200938>.

<sup>39</sup> “Presidential Memorandum—Implementation of Energy Savings Projects and Performance-Based Contracting for energy savings,” Office of Management and Budget, last modified December 2, 2011, <http://www.whitehouse.gov/the-press-office/2011/12/02/presidential-memorandum-implementation-energy-savings-projects-and-perfo>.

<sup>40</sup> “President’s Climate Action Plan,” The White House, last accessed June 25, 2013, <http://www.whitehouse.gov/sites/default/files/image/president27s-climateactionplan.pdf>.



This report highlights the federal government's use of ICT solutions to achieve cut costs, improve efficiency, and advance sustainability goals.

The Center for Climate and Energy Solutions (C2ES) is an independent non-profit, non-partisan organization promoting strong policy and action to address the twin challenges of energy and climate change. Launched in 2011, C2ES is the successor to the Pew Center on Global Climate Change.



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