USING FEDERAL ENERGY
MANDATES TO BOOST
FACILITY PERFORMANCE

A Survey and Report       October 2014

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Commercial Buildings Group
RAISING THE BAR FOR ENERGY EFFICIENCY IN FEDERAL FACILITIES

To power its immense building portfolio, the federal government spends $7 billion annually on energy. That expense alone might draw scrutiny in a time of hotly debated federal budget deficits. Additional complications include the connection between energy usage and greenhouse gas emissions from fossil fuels. Another is national energy independence in the face of upheaval in the Middle East.

Over the last decade, the federal government has issued a number of increasingly stringent targets for its buildings and launched initiatives to reduce energy. This report addresses the mandates and how federal agencies are responding to them.

The background research for this report had two components. The first consisted of a phone survey of facility managers working in the federal government. The facility managers were drawn from the BUILDINGS Media subscriber file. Thirty interviews were completed in July and August 2014. The questions focused on how the managers are responding to energy efficiency targets in their facilities.

For a top-level view of the government’s initiatives, the second component involved interviews with executive federal officials and federal policy experts. The names, titles, and organizations of these individuals appear at the end of the report.

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The federal government manages some 429,000 buildings totaling 3.34 billion square feet. It owns approximately 80% of that space and leases 20%.

A portfolio of that mammoth size clearly has an impact on the buildings industry. Just the 20% of the federal portfolio that is leased – some 670 million square feet – is far larger than the 420 million square feet of office space in New York City, the nation’s largest building market.1 The federal government’s facility policies and practices influence industry regulations, new technology, suppliers, and energy management practices.

And influence is an explicit objective of the federal government. “The U.S. government must lead by example. Experience shows that reductions in GHG emissions and increased consumption of renewable energy are both possible while continuing to deliver the mission and may increase mission readiness,” wrote Michael Boots, Acting Chair of the Council on Environmental Quality, and GSA Administrator Dan Tangherlini in a FY 2014 quarterly update on the government’s progress.

For its leased space in commercial buildings, the government has put teeth into its energy objectives. “After the Energy and Security Act and the Energy Policy Act, we rewrote a lot of our lease clauses,” says Kevin Kampschroer, Director of GSA’s Office of Federal High-Performance Green Buildings. For larger leases, the facilities must be ENERGY STAR certified. But the bar is higher than that. “We have a clause that any energy conservation measure that is cost-effective over a lease’s term must be done by the landlord,” adds Kampschroer. As a result, both federal-owned and federal-leased buildings are driven to increase energy efficiency.

A case in point is the FBI Chicago Field Office, an 800,000-square-foot, three-building complex that includes a 10-story office building, two separate guard shacks, a two-level structured parking deck, and two levels of below-grade parking. The FBI is the only tenant in the build-to-suit project, which pursued LEED certification after occupancy. It was awarded the world’s first LEED Platinum certification for Existing Buildings: Operations & Maintenance.

During the Bush and Obama administrations, a range of regulations, executive orders, and presidential memoranda established energy requirements for federal facilities (see timeline on following page). Deadlines for some major goals occur in 2015, including a 30% reduction in energy consumption based on 2003 levels.


**FEDERAL FACILITIES BY USE (SQUARE FEET IN MILLIONS)**

<table>
<thead>
<tr>
<th>Category</th>
<th>Percentage</th>
<th>Square Feet</th>
</tr>
</thead>
<tbody>
<tr>
<td>Office</td>
<td>22%</td>
<td>740.8</td>
</tr>
<tr>
<td>Warehouses</td>
<td>14%</td>
<td>460.4</td>
</tr>
<tr>
<td>Service</td>
<td>12%</td>
<td>416.2</td>
</tr>
<tr>
<td>Family Housing</td>
<td>11%</td>
<td>364.9</td>
</tr>
<tr>
<td>Barracks/Dormitories</td>
<td>8%</td>
<td>271.2</td>
</tr>
<tr>
<td>Schools</td>
<td>8%</td>
<td>251.7</td>
</tr>
<tr>
<td>All Remaining Uses*</td>
<td>18%</td>
<td>612.8</td>
</tr>
<tr>
<td>Other Institutional Areas</td>
<td>7%</td>
<td>221.4</td>
</tr>
</tbody>
</table>

*Includes prisons and detentions centers, hospitals, labs, industrial, communications systems, museums and post offices

SOURCE: GSA, 2010
The list below summarizes significant energy initiatives in various executive orders, memoranda, and policy acts. Many of these mandates include other sustainability elements, such as targets for water, greenhouse gases, and vehicle fleets.

**2005 ENERGY POLICY ACT OF 2005 (EPACT)**
- New federal facilities must be 30% more efficient than the ASHRAE 90.1 energy standard
- All federal facilities to be metered
- 7.5% of electricity consumed by federal facilities must come from renewable sources

**2007 ENERGY INDEPENDENCE AND SECURITY ACT (EISA)**
- Facility energy consumption to be reduced by 30% (compared to 2003 levels) by 2015
- New facilities and major renovations to be free of all fossil-fuel energy by 2030
- Green building rating systems should be used to confirm progress toward goals

**2007 EXECUTIVE ORDER 13423: STRENGTHENING FEDERAL ENVIRONMENTAL, ENERGY AND TRANSPORTATION MANAGEMENT**
- All new construction and major renovation must comply with the Guiding Principles for Federal Leadership in High Performance and Sustainable Buildings
- 15% of existing space must comply with the Guiding Principles by 2015
- By end of fiscal year 2015, energy consumption in federal facilities to decrease by 3% annually or by a total of 30%

**2009 EXECUTIVE ORDER 13514: FEDERAL LEADERSHIP IN ENVIRONMENTAL, ENERGY AND ECONOMIC PERFORMANCE**
- Requires each federal agency to develop a Strategic Sustainability Performance Plan and update it annually
- Establishes percentage reduction targets for greenhouse gases by 2020
- Requires new federal facilities to achieve zero-net energy by 2030

**2011 IMPLEMENTATION OF ENERGY SAVINGS PROJECTS AND PERFORMANCE-BASED CONTRACTING FOR ENERGY SAVINGS**
- This presidential memorandum challenged federal buildings to enter into $2 billion in performance-based contracts within two years. The goal was exceeded with some $2.65 billion in projects

**2013 PRESIDENTIAL MEMORANDUM ON FEDERAL LEADERSHIP ON ENERGY MANAGEMENT**
- 20% of energy consumed in federal facilities to come from renewable sources by 2020
- Federal agencies to implement any energy conservation measures that have a payback of less than 10 years

**2014 PERFORMANCE-BASED CONTRACTING FOR ENERGY CHALLENGE INCREASED**
- In May, President Obama challenged federal agencies to enter into an additional $2 billion in performance contracts for building energy efficiency for a total commitment of $4 billion by the end of 2016
To increase energy efficiency, federal facilities face many of the same challenges and opportunities as commercial facilities in the private sector. However, the federal portfolio has some distinctive conditions due to its size and the combination of owner-occupied and leased buildings.

The costs to operate, maintain, and repair a building over its lifetime are greater than the initial cost of design and construction. According to one estimate, the average operational costs over a 30-year period are 6 to 8 times larger than the cost of design and construction.\(^1\) The average age of U.S. commercial buildings is 50 years, according to a 2011 study. Federal facilities are the oldest of all public buildings at 55 years.\(^2\)

Due to their long service life, federal buildings present a considerable opportunity to benefit from energy efficiency. Federal mandates for efficient buildings take the long view – they focus on lifecycle performance. However, the federal government’s budget process does no better job of accounting for lifecycle costs than the commercial sector. Federal budgets focus only on first costs for new construction and major retrofits. Funds for operation and maintenance of existing buildings appear on a different budget line item. This disconnect means that lifecycle costs are not easily apparent to executive decision makers.\(^3\)

Another factor for federal facilities is the time required to receive funding. Once a budget request is submitted for new construction or a major retrofit, it may take as long as five to seven years. As a consequence, preliminary designs dated years earlier may not benefit from the most recent technology.

A thicket of energy mandates also complicates matters due to a confounding variety of reporting methods and baselines. In addition, an accumulation of policies and regulations compromises measures of energy efficiency. For example, federal agencies are required to reduce both their energy intensity (as measured by square-foot consumption) and the square feet that they occupy (the so-called “freeze the footprint” policy). Consequently, the same number of employees occupying less space can result in an increase in square-foot energy consumption despite a decrease in overall consumption.\(^4\)

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\(^2\) Commercial Building Inventory (CBI), a sampling in 2011 of 4,42 million buildings based on local tax assessor records. www.COMMBuildings.com


\(^4\) Ibid.
Standards for Success — *Red Standard, Yellow Standard, Green Standard*

### Scope 1 & 2 GHG Emission Reduction Target

**GREEN:** Achieved its 2013 Sustainability Plan proposed reduction for GHG Scopes 1 & 2 and is on track to achieve its 2020 target.

**YELLOW:** Achieved at least half of its 2013 Sustainability Plan proposed target for GHG Scopes 1 & 2.

**RED:** Did not achieve at least half of its 2013 Sustainability Plan proposed target for GHG Scopes 1 & 2 or did not provide trajectory for 2020.

### Scope 3 GHG Emission Reduction Target

**GREEN:** Achieved its 2013 Sustainability Plan proposed reduction for GHG Scope 3 and is on track to achieve its 2020 target.

**YELLOW:** Achieved at least half of its 2013 Sustainability Plan proposed target for GHG Scope 3.

**RED:** Did not achieve at least half of its 2013 Sustainability Plan proposed target for GHG Scope 3 or did not provide trajectory for FY 2020.

### Reduction in Energy Intensity

**GREEN:** Reduced energy intensity (Btu/GSF *) in EISA goal-subject facilities by at least 24 percent compared with 2003 and is on track for 30 percent reduction by 2015.

**YELLOW:** Reduced energy intensity (Btu/GSF) in EISA goal-subject facilities by at least 21 percent compared with 2003.

**RED:** Did not reduce energy intensity (Btu/GSF) in EISA goal-subject facilities by at least 21 percent compared with 2003.

### Use of Renewable Energy

**GREEN:** Uses at least 7.5 percent electricity from renewable sources as a percentage of facility electricity use & at least 3.75 percent of facility electricity use comes from new sources (post-1999). (Thermal and mechanical renewable energy can be included in the 3.75 percent new requirement, but not the 7.5 percent goal; i.e., an agency meets all new sources requirement with thermal and mechanical energy (3.75 percent) but would still need an additional 7.5 percent from renewable electricity sources.)

**YELLOW:** Uses at least 7.5 percent renewable energy from electric, thermal or mechanical sources to power facilities and equipment; but less than half was obtained from new sources (post-1999) or part of the requirement was met with thermal and mechanical renewable energy.

**RED:** Did not use at least 7.5 percent renewable energy from electric, thermal or mechanical sources to power facilities and equipment.
Performance contracting offers not only little or no initial cost to a cash-strapped federal government but also a broad and deep approach to upgrades of existing buildings. It is a pivotal part of the federal government’s plan to achieve energy-efficient facilities. The government is working the strategy from several angles.

Energy savings performance contracts – or ESPCs, as they are known in the federal code – refer to contracts awarded to energy service company (ESCOs). After completion of an investment-grade energy audit, an ESCO provides a turnkey solution for a retrofit that is guaranteed to provide a given decrease in energy consumption. The stream of future energy savings pays the ESCO for the project, resulting in little or no upfront costs for the government. The terms of such contracts can be as long as 25 years. ESPCs are also available to federal agencies through a utility energy service contract (UESC) with a facility’s energy supplier.

In 2011 President Obama challenged the federal government to enter into $2 billion in performance contracts within two years. That goal was exceeded with some $2.65 billion in projects. The president added $2 billion to the challenge in 2014, making the total goal $4 billion by the end of 2016.

ACCELERATORS FOR PERFORMANCE CONTRACTS

The president’s performance contracting challenge comes with its own implementation challenges. Projects with large scopes and long-term commitments to an ESCO provoke caution. Facility managers may not be familiar with the energy management technologies or comfortable with an ESCO’s control of some building operations.

Another factor is the nature of the performance contract itself. “The contracting process is unfamiliar to them because it’s a negotiated process based on best value, not a low bid. That’s a whole different ball game,” says Donald Gilligan, president of the National Association of Energy Service Companies.

The Department of Energy’s Federal Energy Management Program (DOE FEMP) is tasked with helping agencies undertake ESPCs. FEMP’s efforts to accelerate the process include the development of indefinite-delivery, indefinite-quantity contracts (ID IQ) for use by contracting officers. According to Timothy Unruh, FEMP Program Director, these umbrella contracts expedite the ESPC process with a pre-approved list of ESCOs who have demonstrated their ability to perform ESPCs.

FEMP has also introduced a web-based project entry and tracking system, eProject Builder, that standardizes performance data for ESPCs across all government agencies. The system compiles data from previous ESPCs, enabling ESCOs to compare historical data to estimated savings for proposed retrofits.

For smaller federal facilities under 200,000 square feet, FEMP and GSA have developed a new funding approach. The ENABLE program is designed to speed the award and construction process to 6 months or less. Pre-qualified vendors and pre-negotiated pricing expedite a contracting process that offers the same benefits as conventional ESPCs.

"A small facility is not generally a good candidate for an extensive retrofit," says Kevin Kampschroer, Director of GSA’s Office of Federal High-Performance Green Buildings. “But sometimes if you go in and tune up the controls, do a little HVAC work, and change the lighting, you get 50% of the savings from 5% of the labor.” ENABLE contracts are prepackaged to expedite their use by facility managers.

The ENABLE program, which is designed for facilities under 200,000 square feet, was used to undertake an energy savings performance contract (ESPC) at the Lassen Volcanic Visitors Center in Mineral, CA.
The National Deep Energy Retrofit (NDER) project, a pilot launched by GSA in 2012, is designed to push the savings from performance contracting well beyond that of typical ESPC projects. The ultimate goal: Discover innovations that will allow existing buildings to achieve net-zero energy consumption.

The NDER currently encompasses 32 facilities totaling more than 20 million square feet. As with other ESPCs, NDER projects must self-finance in 25 years or less. The program emphasizes renewable energy and other innovations. Identified improvements must be linked to the expected useful life of the equipment and the facility.

Based on results in FEMP's database, the average energy savings for ESPC projects across all federal agencies is 18%. However, the average anticipated savings for the first 10 projects in the NDER pipeline is 38%, according to 360° Degree Perspective on Federal Deep Energy Retrofits, a 2014 report by GSA and the Rocky Mountain Institute.

A key component of the NDER program is maximizing a retrofit's impact by bundling all improvements into one deep package.

“You can combine the quick payback items with the long payback items and get an average that does much better than if you looked at them individually. That is a big lesson learned,” says Kevin Kampschroer, Director of GSA’s Office of Federal High-Performance Green Buildings. “Every time we touch a building, we’re looking to do as much improvement as we can.”

To ensure maximum savings from deep retrofits, GSA is currently looking at ways to include operations and maintenance (O&M) measures within ESPCs. GSA buildings typically contract for O&M services on a per-system basis. However, both GSA and ESCOs see value in integrating O&M into whole-building ESPCs.

GSA’s Deep Retrofits in Cleveland

The ESPC in Cleveland encompasses energy conservation measures at three facilities: the Howard M. Metzenbaum U.S. Courthouse, the Carl B. Stokes U.S. Courthouse, and the Anthony J. Celebrezze Federal Building.

Among the improvements are design and installation of four central heating and cooling plants in the Metzenbaum and Celebrezze buildings. The plants will have modular magnetic-bearing centrifugal chillers and high-efficiency hot water boilers.

- Square footage: 2,544,356
- Annual energy cost reduction: $2,427,748 (Year 1)
- Energy reduction percentage: 29%
- Payback period: 20 years + 1 year construction
- ESCO: Siemens Government Services

The Howard M. Metzenbaum U.S. Courthouse in Cleveland
Energy conservation measures for federal ESPCs (top) generally have a different profile of investment than those in the NDER program (bottom). At a three-fold increase, investments in boiler plants and envelope modifications grew most among the NDER projects. Investments in chiller plant improvements more than doubled.

Source: 360° Degree Perspective on Federal Deep Energy Retrofits
In the deployment of new technology, a hurdle often higher than the discovery itself is its transformation into a viable commercial product. And the buildings industry is not known for a great willingness to employ new and unproven products.

GSA’s Green Proving Ground (GPG) program is designed to clear this hurdle and help federal agencies meet Executive Order 13514. The program leverages GSA’s building portfolio as a real-world place to evaluate new technology.

“The program addresses the risk of high first cost and possible underperformance that might otherwise stymie adoption,” says Kevin Powell, director of GPG. Because GSA owns and leases over 354 million square feet in 9,600 buildings in more than 2,200 communities, new technologies can be tested in sufficient numbers and locations to predict their potential.

Building systems rather than tenant fit-out systems are the target. “We’re focused on the building systems that GSA, as a landlord and building owner, can control,” says Powell. Most evaluations take place in spaces that GSA leases to other agencies.

To select technology for evaluation, GPG looks for both innovation and deployment potential for its portfolio. Technology that would likely reach the market anyway is passed over. GPG also seeks a balance of risks, pursuing some high-risk, high-payoff products as well as more certain opportunities. GPG works with the National Renewable Energy Lab on screening and rating technologies for possible assessment.

When evaluating a product technology, GPG categorizes each in one of three phases:

- **Translation** – a product with very limited or no commercial installations
- **Adoption** – a product with an emerging market but a limited installation base and little objective information available about its performance
- **Diffusion** – a product with some market penetration, possibly even with multiple suppliers, but little available information about performance and best practices

GPG product evaluations specify whether a technology is suitable to replace equipment at end of life, to retrofit for immediate benefits, or to use in new construction. Assessments have included products for energy management, envelope, lighting, HVAC, and onsite generation (see below).

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**GPG PRODUCT ASSESSMENTS**

To date, the GPG program has published findings from 15 completed assessments. Nine assessments are underway for which results will be published in 2016. For more information on each assessment, visit [www.gsa.gov](http://www.gsa.gov).

**COMPLETED ASSESSMENTS:**
- Integrated Daylighting Systems
- Wood-Pellet-Fired Biomass Boiler
- Multistaged Indirect Evaporative Cooler
- Synchronous and Cogged Fan Belts
- Vacuum Insulated Panels
- Electrochromic and Thermochromic Windows
- Variable Speed Mag-Lev Chiller
- PV Guidance
- High R Value Windows
- Variable Refrigerant Flow
- Photovoltaics
- Condensing Boilers
- Plug Load Control
- Occupant Responsive Lighting
- Wireless Sensor Networks

**ASSESSMENTS UNDERWAY:**
- Electrochromic Windows with Dynamic Controls
- Low-Emissivity Window Film
- Passive Thermal Storage Platform Predictive HVAC
- Predictive HVAC Optimization
- Virtual Energy Audit
- Variable Speed Screw Chiller
- LED Replacement Lamp for CFLs
- LED Retrofit for Fluorescent Luminaires
- Networked Lighting
The Green Proving Ground evaluates new products that have little installed base as well as more mature products with some market penetration.

Products are categorized in one of three phases: translation (limited or no installations), adoption (emerging market but little objective information about installations), and diffusion (market penetration but little objective information on performance and best practices).
rapid detection and response to building faults are key to operating at peak efficiency. To continuously monitor its buildings, GSA is developing the GSALink platform.

GSA awarded a contract to IBM to develop the software. The program’s architecture pulls data from individual buildings, stores it in a national database, runs it through a fault detection diagnostics engine, and presents the data back to building operators so they can react to any problems.

GSALink has been deployed in 81 GSA buildings. The agency plans to roll out the program to its 200 most energy-intensive buildings, which collectively represent 75% of GSA’s facility energy consumption.

The software’s search for faults includes malfunctioning equipment, inconsistent application of processes and policies (e.g., weekend shutdowns), and equipment working at cross purposes (e.g., simultaneous heating and cooling). With continuous monitoring, operators can be alerted to problems promptly rather than waiting until the next cycle of preventive maintenance. For example, the system was able to detect a fault due to a bird stuck in a damper, a situation that not only was wasting energy but risking frozen equipment due to winter temperatures.

GSALink currently has about 40 rules that are applied to the building data, according to Frank Santella, acting assistant commissioner, Facilities Management & Services Programs, GSA Public Buildings Service. For example, 7 data points are used to detect simultaneous heating and cooling. “I think as people get a better understanding of the tool, they will request rules for their specific building,” Santella says. GSA will make the platform available to other agencies.

GSALink identifies a sensor failure that is causing equipment to run 100% 24/7. Without continuous monitoring for faults, such problems might not be uncovered until the next maintenance cycle.
Through the current and previous presidential administrations – one Republican and one Democratic – energy efficiency policy for federal facilities has regularly expanded. Moreover, the expansion has occurred in spite of the lack of a comprehensive plan or national energy policy from the Congress. While it is impossible to predict how future administrations may influence the trend, energy mandates have steadily taken root in federal facilities, making efficiency business as usual.

Efficiency policy has also taken a consistently long and large view of facilities. An emphasis on lifecycle performance and assessment has been a part of many initiatives and programs. The whole-building approach encourages facility managers to consider bundling several energy conservation measures into a package whenever a single building system needs replacement. Development of computer-based modeling and monitoring tools also takes a whole-building and whole-portfolio approach. The ultimate goal of net-zero energy – for both existing federal facilities and new construction – underlies many daily federal efforts. For the foreseeable future, the federal government will view energy efficiency in its facilities as a long-term rather than a short-term commitment.

THE OUTLOOK FOR FEDERAL EFFICIENCY POLICY

The Porter Neuroscience Research Center on the campus of the National Institutes of Health in Bethesda, MD, has a long list of energy-efficient features. It includes solar panels, geothermal heating and cooling with ground source heat pumps, addressable lighting controls, and a chilled beam system that reduces air changes per hour. Perkins+Will is the architect.
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360° Degree Perspective on Federal Deep Energy Retrofits. A report issued by the General Services Administration and the Rocky Mountain Institute, August 2014.


“GSA Net Zero Renovation Challenge Charrette.” A workshop report issued by the Rocky Mountain Institute and the General Services Administration, December 2011.

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