SECRETARY OF ENERGY ADVISORY BOARD

MEMORANDUM FOR: Secretary Ernest J. Moniz

FROM: John Deutch
Chair, Secretary of Energy Advisory Board

DATE: November 1, 2016

SUBJECT: Transmittal of SEAB Task Force Report on Federal Energy Management

SEAB approved the report of the Task Force on Federal Energy Management at its public meeting of September 22, 2016.

SEAB's Federal Energy Management Task Force has produced one of the most interesting and thorough Task Force reports of the last eight years. The report analyzes ten important federal energy management challenges and identifies opportunities to improve performance. The Task Force raised many critical issues:

- Reliance on executive branch-wide numeric targets with inadequate consideration of the cost of compliance in different agencies;
- Wide-scale absence of meters to guide investments in federal energy efficiency, including energy savings performance contracts, and to confirm the value of these investments ex post;
- Reluctance in some federal energy programs to adopt Randomized Control Trials and other advanced Evaluation, Measurement, and Verification (EM&V) techniques to validate programs intended to reduce energy use;
- The constraint that budget scorekeeping rules place on realizing least-life-cycle-cost contracts for federal buildings, facilities, and vehicles;
- Multiple and often conflicting objectives for federal energy management (e.g. least-cost energy services, carbon reductions, energy security, and the demonstration and validation of pre-commercial energy technologies and energy management practices to the private sector).

SEAB believes these and other issues indicate confusion of purpose and lack of focus on cost efficiency in some federal energy management programs. The Task Force makes many constructive recommendations to address the issues it identifies. SEAB believes further work is justified on federal energy management programs to (1) ensure clarity and prioritization among the goals, and (2) establish metrics to judge program progress in improving cost-effective federal energy management.

U.S. Department of Energy

Secretary of Energy Advisory Board Report of the Task Force on Federal Energy Management

September 22, 2016

Table of Contents

Acronyms iii

Executive Summary 6

Acknowledgments 6

Structure of the Report 7

Ten Major Opportunities for Improved Federal Energy Management 8

Introduction: The Federal Energy Landscape 12

Progress to Date 15

Executive Order 13693 18

Facility Investment 21

SECTION 1: Federal Energy Goals 23

RECOMMENDATION: Assess Federal energy goals: are they a useful tool for Federal energy management? 23

1.1 Background 23

1.2 Discussion 24

1.3 Recommendations 26

SECTION 2: Evaluation, Measurement, and Verification 28

RECOMMENDATION: Improve Federal energy efficiency projects through advances in evaluation, measurement, and verification and randomized controlled trials. 28

2.1 Background 28

2.2 Discussion 30

2.3 Recommendations 34

SECTION 3: Energy Savings Performance Contracts 38

RECOMMENDATION: Improve and expand the use of energy savings performance contracts (ESPCs). 38

3.1 Background 38

3.2 Discussion 39

3.3 Recommendations 44

SECTION 4: The Federal Real Estate Footprint 48

RECOMMENDATION: To reduce the Federal carbon footprint, reduce the Federal real estate footprint 48

4.1 Background 48

4.2 Discussion 49

4.3 Recommendations 54

SECTION 5: Federal Renewable Energy Procurement 56

RECOMMENDATION: Improve Federal procurement of renewable energy. 56
5.1 Background 56
5.2 Discussion 57
5.3 Recommendations 65
SECTION 6: The Federal Power Marketing Administrations 68
RECOMMENDATION: Increase the role of the Federal Power Marketing Administrations in renewable energy deployment and transmission development. 68
6.1 Background 68
6.2 Discussion 70
6.3 Recommendations 71
SECTION 7: Renewable Energy Development on Federal Lands 76
RECOMMENDATION: Address regulatory and program barriers to expanding renewable energy development on Federal lands. 76
7.1 Background 76
7.2 Discussion 76
7.3 Recommendations 79
SECTION 8: Alternative Fuel Vehicles 81
RECOMMENDATION: Improve Federal deployment of alternative fuel vehicles. 81
8.1 Background 81
8.2 Discussion 82
8.3 Recommendations 86
SECTION 9: Federal Technology Test Beds 95
RECOMMENDATION: Expand the role of military bases and Federal buildings as technology test beds 95
9.1 Background 95
9.2 Discussion 96
9.3 Recommendations 103
SECTION 10: Federal Energy Management Program 106
RECOMMENDATION: Strengthen FEMP's budget, standing, and relationships 106
10.1 Background 106
10.2 Discussion 109
10.3 Recommendations 117
Endnotes 119

Acronyms

AFV	Alternative fuel vehicle
AWC	Areawide contracting
BLM	Bureau of Land Management
BPA	Bonneville Power Administration
BRAC	Base Realignment and Closure
BTU	British thermal unit
CBO	Congressional Budget Office
CEQ	Council on Environmental Quality
CO_2e	Carbon dioxide equivalent
CSO	Chief Sustainability Officer
DAS	Deputy Assistant Secretary
Dem-val	Demonstration and validation
DFARS	Defense Federal Acquisition Regulation Supplement
DLA	Defense Logistics Agency
DOD	Department of Defense
DOE	Department of Energy
DOI	Department of the Interior
E.O.	Executive Order
ECM	Energy conservation measure
EERE	Office of Energy Efficiency and Renewable Energy
eGRID	Emissions & Generation Resource Integrated Database
EIM	Energy Imbalance Market
EISA	Energy Independence and Security Act
EM&V	Evaluation, measurement, and verification
EPA	Environmental Protection Agency
EPAct	Energy Policy Act
ESCO	Energy service company
ESPC	Energy savings performance contract

ESPC-ESA	Energy Savings Performance Contract Energy Services Agreement
ESTCP	Environmental Security Technology Certification Program
EUL	Enhanced Use Lease
EV	Electric vehicle
FAR	Federal Acquisition Regulation
FCSO	Federal Chief Sustainability Officer
FEEF	Federal Energy Efficiency Fund
FEMP	Federal Energy Management Program
FERC	Federal Energy Regulatory Commission
FWS	Fish and Wildlife Service
FY	Fiscal year
GAO	Government Accountability Office
GHG	Greenhouse gas
GSA	General Services Administration
GW	Gigawatt
HTUF	High-Efficiency Truck Users Forum
HVAC	Heating, ventilation, and air conditioning
IRS	Internal Revenue Service
kBTU	Thousand British thermal units
MW	Megawatt
NASA	National Aeronautics and Space Administration
NDER	National Deep Energy Retrofit
NECPA	National Energy Conservation Policy Act
NEPA	National Environmental Policy Act
NGDVs	Next-Generation Delivery Vehicles
NREL	National Renewable Energy Laboratory
O&M	Operations and maintenance
OMB	Office of Management and Budget
OSD	Office of the Secretary of Defense
PEV	Plug-in electric vehicle

PHEV	Plug-in hybrid electric vehicle
PMA	Power Marketing Administration
PPA	Power purchase agreement
RCTs	Randomized control trials
REC	Renewable energy credit
ROWs	Right-of-ways
RPS	Renewable Portfolio Standard
RTO	Regional Transmission Organization
SCC	Social Cost of Carbon
SEAB	Secretary of Energy Advisory Board
SEPA	Southeastern Power Administration
sf	Square feet
SPP	Southwest Power Pool
SWPA	Southwestern Power Administration
TEP	Tucson Electric Power
UESC	Utility energy service contract
USPS	U.S. Postal Service
UTC	United Technologies Corporation
V2G	Vehicle-to-Grid
WAPA	Western Area Power Administration

Executive Summary

In March 2015, Secretary of Energy Ernest Moniz appointed the Secretary of Energy Advisory Board (SEAB) Task Force on Federal Energy Management to review the Federal Government's energy use and management. The impetus for the Task Force was President Obama's 2015 issuance of Executive Order (E.O.) 13693, "Planning for Federal Sustainability in the Next Decade." This Executive order sets new and more stringent goals for Federal agencies in a range of areas, including building energy efficiency, greenhouse gas emissions, use of renewable energy, water efficiency, motor vehicle efficiency, and energy performance contracting.[1]

The individuals appointed to the Task Force include several SEAB members, as well as experts from the private sector, universities, and nonprofit organizations—many of whom have experience working in the Federal Government. The Task Force members are as follows:

- Dan Reicher, Co-Chair, Stanford University (SEAB member)
- Ellen Tauscher, Co-Chair, Baker Donelson (SEAB member)
- John Deutch, (Ex Officio), Massachusetts Institute of Technology (SEAB Chair)
- Frances Beinecke, Natural Resources Defense Council
- Rafael L. Bras, Georgia Institute of Technology (SEAB member)
- James L. Connaughton, Nautilus Data Technologies
- Jeffrey Eckel, Hannon Armstrong
- Michael Greenstone, University of Chicago (SEAB member)
- David Krieger, Warburg Pincus
- Ronald Litzinger, Edison Energy
- Arun Majumdar, Stanford University (SEAB member)
- Michelle Moore, Groundswell
- Dorothy Robyn, Boston University Institute for Sustainable Energy
- Phil Sharp, Resources for the Future

Acknowledgments

The Task Force wants to thank several individuals who contributed substantially to this report: Timothy Unruh, Program Director, and Hayes Jones, Operations Supervisor of the Department of Energy's (DOE's) Federal Energy Management Program (FEMP); Corey Williams-Allen, Principal Deputy Director, DOE Secretarial Boards and Councils (now with DOE Advanced Research Projects Agency-Energy); and Stanford Law School students Greer Mackebee (now with Orrick, Herrington, and Sutcliffe) and Alison Gocke.

The Task Force also thanks the following individuals who testified at Task Force meetings, helping to shape both the scope and substance of this report:

- Miranda Ballentine – Assistant Secretary for Installations, Environment, and Energy, Air Force

- Kate Brandt – Federal Chief Sustainability Officer, White House Council on Environmental Quality
- Joseph Bryan – Deputy Assistant Secretary for Energy, Navy
- Kevin Carroll – Energy Branch Chief, Office of Management and Budget
- John Conger – Acting Assistant Secretary for Energy, Installations and Environment, Department of Defense
- Mark Ewing, Director, Energy Division, General Services Administration
- Katherine Hammack – Assistant Secretary for Installations, Energy and Environment, Army
- Kathleen Hogan – Deputy Assistant Secretary for Energy Efficiency, Department of Energy
- Rich Glick – Director of Government Affairs, Iberdrola
- Kevin Kampschroer, Senior Sustainability Officer and Director, Federal High Performance Green Buildings Office, General Services Administration
- Frank Kendall – Under Secretary for Acquisition, Technology and Logistics, Department of Defense
- Richard Kidd IV – Deputy Assistant Secretary for Energy and Sustainability, Army
- David Klaus – Deputy Under Secretary for Management and Performance, Department of Energy
- Jeff Marootian – Assistant Secretary for Administration, Department of Transportation
- Jeff Marqusee – Chief Scientist, Noblis
- Bill Miller – Program Manager, Lawrence Berkeley National Laboratory
- Karen Palmer – Research Director, Resources for the Future
- Kris Sarri – Principal Deputy Assistant Secretary for Policy, Management, and Budget, Department of the Interior
- Al Stayman – Senate Energy and Natural Resources Committee
- James Sullivan – Director, Office of Asset Enterprise Management, Department of Veterans Affairs
- Tim Unruh – Director, Federal Energy Management Program, Department of Energy
- Dan Utech – Deputy Assistant for Energy and Climate Change, White House
- Keith Washington – Deputy Assistant Secretary for Administration, Department of Transportation
- Stu Webster – Director of Permitting and Environmental Affairs, Iberdrola
- Ali Zaidi – Associate Director for Natural Resources, Energy and Science, Office of Management and Budget

Structure of the Report

This report begins with a description of the Federal energy landscape, including E.O. 13693. The body of the report consists of 10 discrete analyses, each devoted to an important opportunity for

improving Federal energy management. Federal energy management is a rich and varied topic, and our approach is designed to provide the current and next administrations, Congress, and the public with a detailed review of a set of high-priority opportunities and concrete actions, as briefly outlined below.

Ten Major Opportunities for Improved Federal Energy Management

Section 1. Federal Energy Goals

- Section 1 examines Federal energy goals—multiple, numeric targets that apply uniformly to each executive branch agency. These goals have long histories and offer significant advantages for managing how agencies obtain and use energy. However, in some cases, they may not be the most cost-effective way to achieve desired energy- or carbon-reduction targets. Incentives and other "market" mechanisms, such as allowing agencies to trade reduction opportunities, may accelerate innovation to achieve increasingly aggressive targets at lower costs. This section looks at the strengths and weaknesses of Federal energy goals as a tool for Federal energy management. The Task Force has not achieved full consensus on the value of detailed numeric goals applied uniformly to each Federal agency; however, it supports maintaining this overall approach because of its simplicity, transparency, and results to date. At the same time, the Task Force recommends that the next administration consider different cost-effective ways to achieve and sustain further progress in government-wide Federal energy management performance.

Section 2. Evaluation, Measurement and Verification of Energy Efficiency

- Section 2 looks at how Federal agencies evaluate, measure, and verify investments in facility-based energy conservation measures (ECMs), which account for roughly $1 billion a year in appropriated funds and third-party-funded investments. Federal agencies have been slow to install building-level meters, and the lack of meter data limits agencies' ability both to select the right investment opportunities and to conduct rigorous ex post evaluation of the impact of individual ECMs. The Task Force calls for widespread deployment of building-level meters and a pilot deployment of advanced energy analytics systems, which incorporate sensors to provide more granular data. The Task Force also recommends the use of more rigorous ex post evaluation of ECMs, including pilot tests of randomized controlled trials or quasi-experimental techniques to determine the rate of return on these investments. Where these techniques cannot be used, traditional evaluation, measurement, and verification approaches should be rigorously applied, per guidance issued by DOE in 2015.

Section 3. Energy Savings Performance Contracts

- Section 3 examines Federal use of energy savings performance contracts (ESPCs)—arrangements under which a third party invests in an ECM and is repaid over time from a

portion of the resulting energy savings. ESPCs have become a major tool for Federal agencies, with Federal ESPCs in recent years ranging from $500 million to $750 million a year. They are an important alternative to the use of appropriated funds and enjoy strong bipartisan support. The Task Force recommends that the White House and DOE resolve several outstanding debates concerning ESPC scope and implementation, quickly adopt new dollar-denominated goals for 2016–2018, and improve systems to track progress through the contracting life cycle.

Section 4. The Federal Real Estate Footprint

- Section 4 makes a simple but novel argument: to reduce its carbon footprint, the Federal Government should reduce its real estate footprint. The report quantifies the impact on energy consumption and carbon emissions from a modest decrease in the Federal facility footprint—a reduction that Federal agencies themselves favor. It also suggests some ways to tackle the impediments to this consolidation, including a "space-saving performance contract" analogous to an ESPC.

Section 5. Federal Renewable Energy Procurement

- Section 5 looks at impediments to the use of third-party mechanisms to finance Federal procurement of renewable energy systems, an important goal under E.O. 13693. The key mechanism is a power purchase agreement (PPA), which allows a developer to develop and finance a system in exchange for the customer's long-term commitment to buy the power at an established price. Despite the benefits of PPAs and PPA-like mechanisms, agencies face major impediments to their use, including statutory limitations and the complexity of the Federal procurement process. The report looks in detail at the use of PPAs by the Department of Defense (DOD), with its aggressive plan to deploy three gigawatts of renewable energy, and it examines two alternative approaches that DOD has embraced because of their comparative ease and expedience. The report also looks at recent innovative efforts by the General Services Administration (GSA) to work within the statutory limits on the terms of civilian agency PPAs, and it discusses a mechanism backed by DOE's Western Area Power Administration. The report makes a set of recommendations aimed at removing impediments to the use of PPAs and at expanding the use of PPA alternatives.

Section 6. Federal Power Marketing Administrations

- Section 6 looks at the Federal Power Marketing Administrations (PMAs)—the Bonneville Power Administration, Western Area Power Administration, Southwestern Power Administration, and Southeastern Power Administration—which are an arm of DOE that markets and delivers electricity generated at Federal hydropower facilities primarily to "preference customers," i.e., municipally owned electric utilities and rural electric cooperatives. The report analyzes how PMAs could use their thousands of miles of electricity transmission networks, as well as their significant financing and eminent

domain authority, to improve renewable energy deployment and transmission development, while being mindful of the PMAs' core obligations to their preference customers and following principles whereby beneficiaries pay the costs of improvements.

Section 7. Renewable Energy Development on Federal Lands

- Section 7 considers renewable energy development on Federal lands where efforts to take advantage of the vast opportunities for deployment of wind and solar energy face major barriers, including a cumbersome permitting process and concerns about wildlife impacts, limiting the deployment of wind and solar energy. The report makes a set of recommendations about how to reduce uncertainty and delay surrounding the assessment of potential wildlife impacts, formulate a new and improved permitting approach for future energy development on Federal lands, and increase research on technology that can improve species conservation.

Section 8. Alternative Fuel Vehicles

- Section 8 looks at how to increase the deployment of alternative fuel vehicles (AFVs)—e.g., biofuel, plug-in electric, natural gas, and hydrogen—in the Federal fleet, the largest in the country. Two problems loom large in meeting statutory and executive branch obligations. First, while about 75 percent of Federal vehicle acquisitions are AFVs, actual alternative fuel *use* in Federal fleets was less than 5 percent of total fleet fuel consumption in 2014. Second, Federal purchase of plug-ins has been limited because of their higher initial purchase price. The report stresses that the government should focus on the full life-cycle costs of a vehicle—purchase, maintenance, and operation—as opposed to just the initial cost. The government should also identify key locations where there are high concentrations of E-85[a]-capable Federal vehicles and work to increase this fueling infrastructure and other options to advance Federal AFV deployment.

Section 9. Federal Energy Technology Test Beds

- Section 9 looks at the critical role that military bases and Federal buildings play in the energy technology innovation process. The lack of data on the real-world performance and cost of new energy technologies for the built environment is a major impediment to their commercialization and adoption. In 2009–2010, DOD and GSA, out of a similar calculation of self-interest, created programs that use their facilities as test beds to demonstrate and validate (dem-val) new technologies that can significantly improve Federal energy performance. With 150 formal demonstrations completed or underway, the two programs are filling an important gap in the innovation process and showing exciting results. However, the programs are oversubscribed, and their budgets are declining. The report urges DOE to help support such dem-val activities across the

[a] E85, also known as "flex fuel," describes high-level ethanol-gasoline blends containing 51 percent to 83 percent ethanol, http://www.afdc.energy.gov/fuels/ethanol_e85.html.

government by partnering with agencies like DOD and GSA that are large customers for building energy technology. Among other benefits, this will introduce much-needed "demand-pull" into DOE's energy research and development process, which has long been criticized for being overly driven by "technology-push."

Section 10. DOE's Federal Energy Management Program

- Section 10 focuses on DOE's FEMP, an office under the Department's Assistant Secretary for Energy Efficiency and Renewable Energy that provides Federal agencies with the information, tools, and assistance they need to meet and track their energy-related requirements and goals, as established by Congress and the President. This section looks at two key challenges FEMP faces: (1) a limited budget and (2) organizational issues, including FEMP's position within DOE, its relationships administration-wide, and its role nationally. The Task Force recommends an increased FEMP budget and actions to resolve key issues that impede the Office's progress.

Introduction: The Federal Energy Landscape

The Federal Government is the single-largest energy consumer in the Nation, owning more than a quarter of all U.S. land, 400,000 non-tactical vehicles, 350,000 buildings, and tens of thousands of miles of transmission lines. At 0.94 quadrillion site-delivered British thermal units (BTU) in 2014, the Federal Government accounts for 1.6 percent of the Nation's total energy use.[2] Sixty-one percent of the government's energy consumption is used to power vehicles and equipment (e.g., aircraft, ships, and trucks), with jet fuel alone, amounting to 44 percent of total Federal energy use.[3, b] The bulk of the remaining energy is used in Federal buildings (Figure 1).

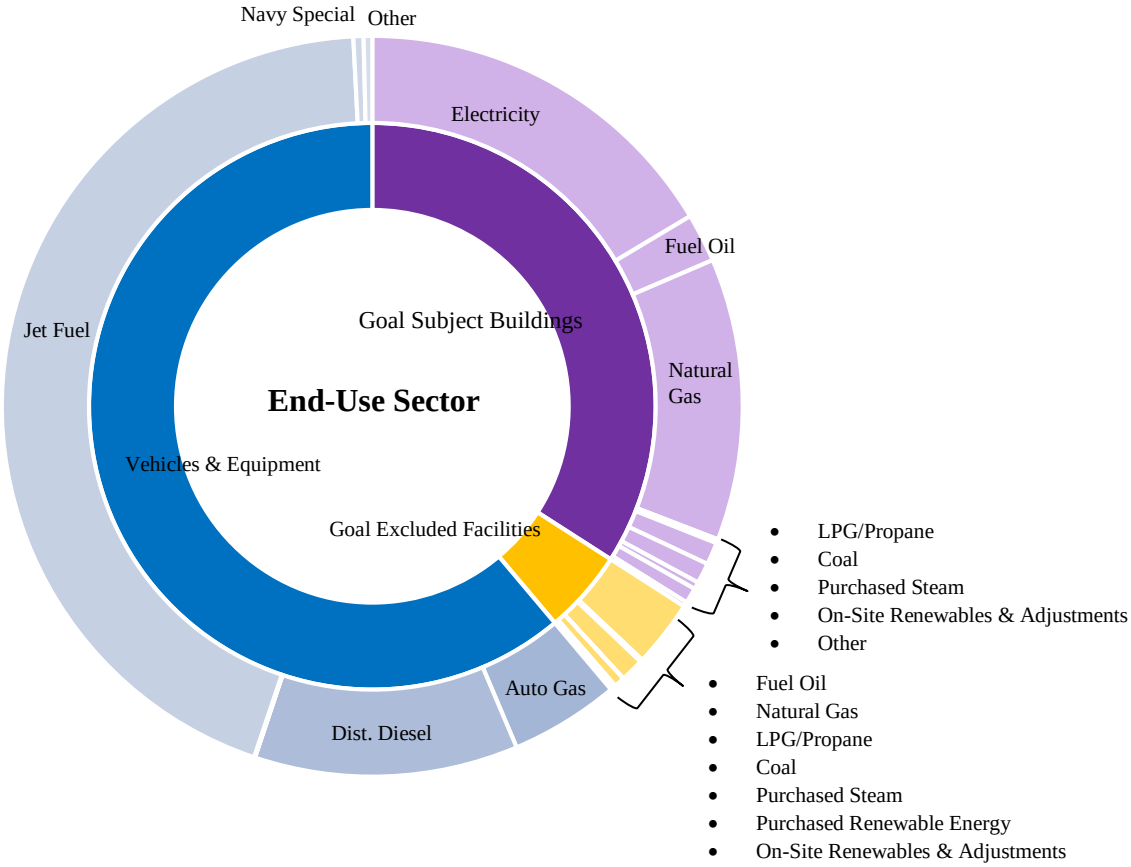

Figure 1. Federal energy usage by end-use sector and fuel type (total 0.94 quadrillion BTU)[4]
Acronyms: Dist-Diesel – distillate diesel; LPG – liquefied petroleum gas.

[b] Because the Department of Defense's (DOD's) jet fuel consumption is excluded from most legislation and Executive orders regulating energy usage, it is not addressed in this report.

The Department of Defense (DOD) represents the majority of Federal facility energy use (excluding vehicle usage), followed by the Department of Veterans Affairs, the Department of Energy (DOE), the U.S. Postal Service (USPS), and the General Services Administration (GSA) (Figure 2).

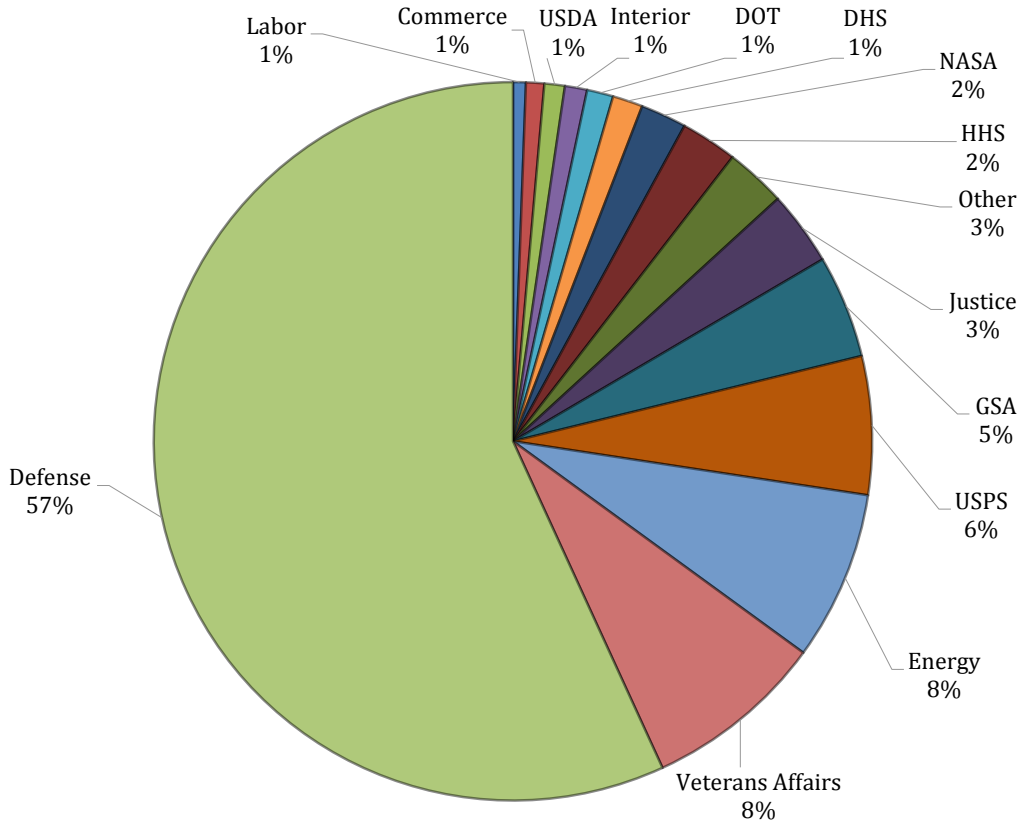

Figure 2. Federal facility energy use by agency, 2014[5]

Acronyms: USDA – U.S. Department of Agriculture; DOT – Department of Transportation; DHS – Department of Homeland Security; NASA – National Aeronautics and Space Association; HHS – Department of Health and Human Services; USPS – U.S. Postal Service.

All of this energy consumption carries significant costs—both in terms of expense (Figure 3) and environmental impact, including greenhouse gas (GHG) emissions (Figure 4). The Federal Government spent $21.3 billion on energy in 2015 alone. By comparison, the United States as a whole spent approximately $1.1 trillion for energy across the residential, commercial, industrial, and transportation sectors in 2014 (the most recent data available).[6, 7] The Federal Government also produced 82 million metric tons of Scope 1 and Scope 2 GHGs[c] in 2014[8]—approximately 1.2 percent of total U.S. GHG emissions.[9, d] Reducing Federal energy use across the board, and

[c] Scope 1 emissions are direct GHG emissions from sources that are owned or controlled by the Federal agency. Scope 2 emissions are indirect GHG emissions resulting from the generation of electricity, heat, or steam purchased by a Federal agency. See the GHG Protocol website: http://www.ghgprotocol.org/calculation-tools/faq.

[d] The total U.S. number is based on 2014 emissions, the most recent available.

transitioning away from fossil fuel–heavy energy sources, would allow the government to reduce its expenditures and its environmental footprint.

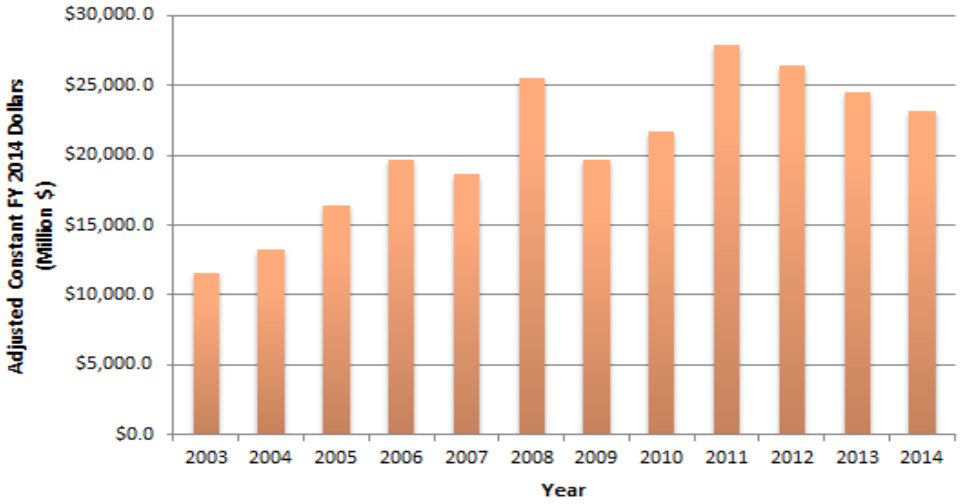

Figure 3. Total Federal Government annual energy costs, 2003–2014[10]

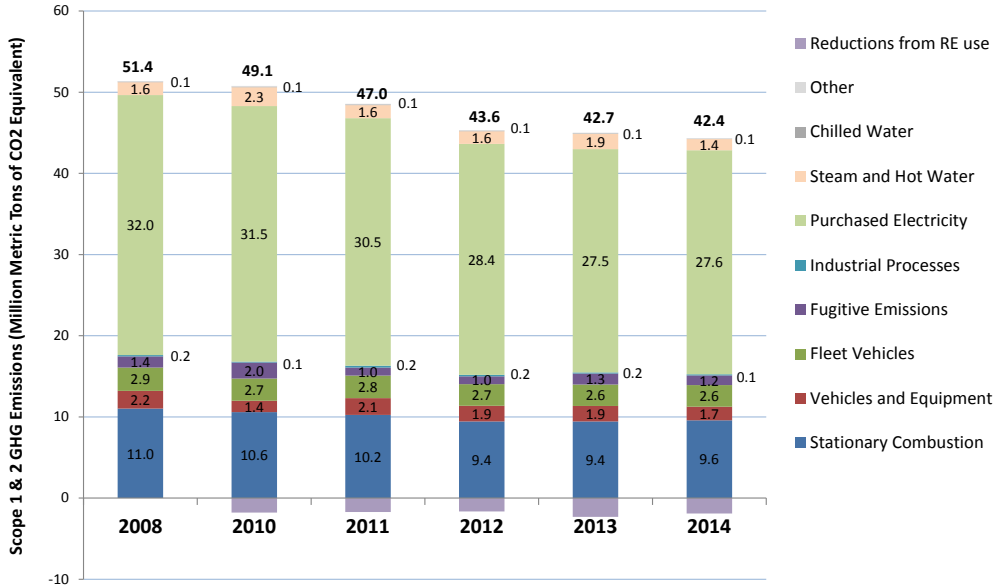

Figure 4. Federal Government–targeted GHG emissions, 2008–2014[11]

Substantial opportunities exist within the Federal Government to increase energy efficiency and clean energy deployment, as well as cut energy expenditures and GHG emissions. Many of these efforts do not require new legislation, as Federal agencies currently have significant authority, sizable energy budgets, and broad expertise. Furthermore, as the Federal Government improves its own energy management, it can share best practices, innovation, and expertise with the private sector, states, and localities.

How Many Federal Buildings Are There?

The number of Federal buildings ranges broadly in various reports. The Federal Real Property Profile (FRPP) states that in 2015, there were 273,125 Federal buildings. This does not include USPS buildings or DOD buildings overseas. The Federal Real Property Profile FRPP also indicates that there are 496,022 "structures,"[e] such as airstrips, parking facilities, utility systems, and ports and harbors. Some of these structures do not use energy, but others, like the Federal Aviation Administration's unoccupied navigation installations, are powered. Estimating for USPS buildings, DOD buildings overseas, and unoccupied structures that use energy, the Federal Energy Management Program (FEMP) estimates that there are approximately 350,000 Federal buildings. This is the figure used in this report.

Progress to Date

The Federal Government has been working for several decades to improve its energy use. Much of this has been spurred by executive and legislative action, including the following:

- The National Energy Conservation Policy Act (NECPA) of 1977[12] (covering Federal agency energy reporting and auditing, energy efficiency, and energy savings performance contracts [ESPCs])
- The Energy Policy Acts (EPActs) of 1992[13] and 2005[14] (covering renewable energy, energy efficiency, energy procurement, building metering, and alternative vehicle acquisition)
- The Energy Independence and Security Act (EISA) of 2007[15] (covering energy efficiency and fossil fuel reduction)
- Executive Order (E.O.) 13693, replacing E.O. 13423[16] and E.O. 13514[17] (setting standards for renewable energy usage, water consumption, energy efficiency, and GHG emissions).

These laws and Executive orders have achieved significant success. Federal building energy intensity has decreased by more than 45 percent since 1975, and more than 35 percent since 1985 (Figure 5).[18] Of that facility energy use, an increasing proportion has come from renewable energy sources (8.8 percent reported toward the renewable energy goal in fiscal year [FY] 2014, up from 3.4 percent in 2008) (Figure 6).[19, 20, 21] At the same time, the Federal Government reduced its Scope 1 and 2 GHG emissions by 17.4 percent in FY 2014 (as compared to a FY 2008 baseline).[22]

[e] These data were extracted from the Real Property Profile Tool found at http://www.gsa.gov/portal/content/102880.

Nonetheless, progress in other areas has been weaker; the government as a whole has fallen short of its goals in promoting Federal building sustainability, cutting petroleum use in the Federal fleet, and transitioning to the use of alternative fuels, such as biofuels, electricity, natural gas, and hydrogen, in Federal vehicles.[23] Furthermore, while government-wide successes are admirable, they can mask significant variation within, and among, agencies.[f] In order to ensure compliance with E.O. 13693, each individual agency (in coordination with FEMP) must take full responsibility for achieving its own goals in accordance with a Strategic Sustainability Performance Plan.

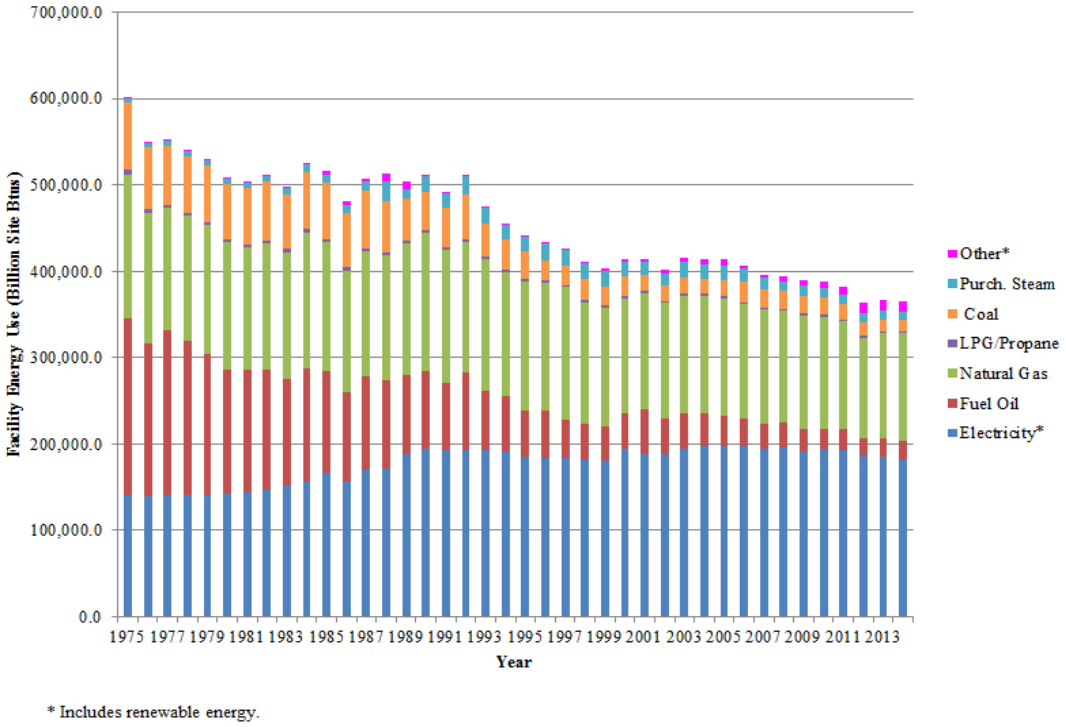

Figure 5. Federal total facility energy use by energy type, 1975–2014[24]
Acronym: LPG – liquefied petroleum gas.

[f] For instance, while the Department of Justice decreased its facility energy intensity by 43 percent over the 2003–2014 period, DOD saw a reduction of only 18 percent over the same period, and the Department of State registered an 11 percent reduction. C. Tremper, "Federal Progress Toward Energy/Sustainability Goals," Department of Energy, Office of Energy Efficiency and Renewable Energy, June 10, 2014, http://energy.gov/sites/prod/files/2015/06/f22/facility_sustainability_goals.pdf.

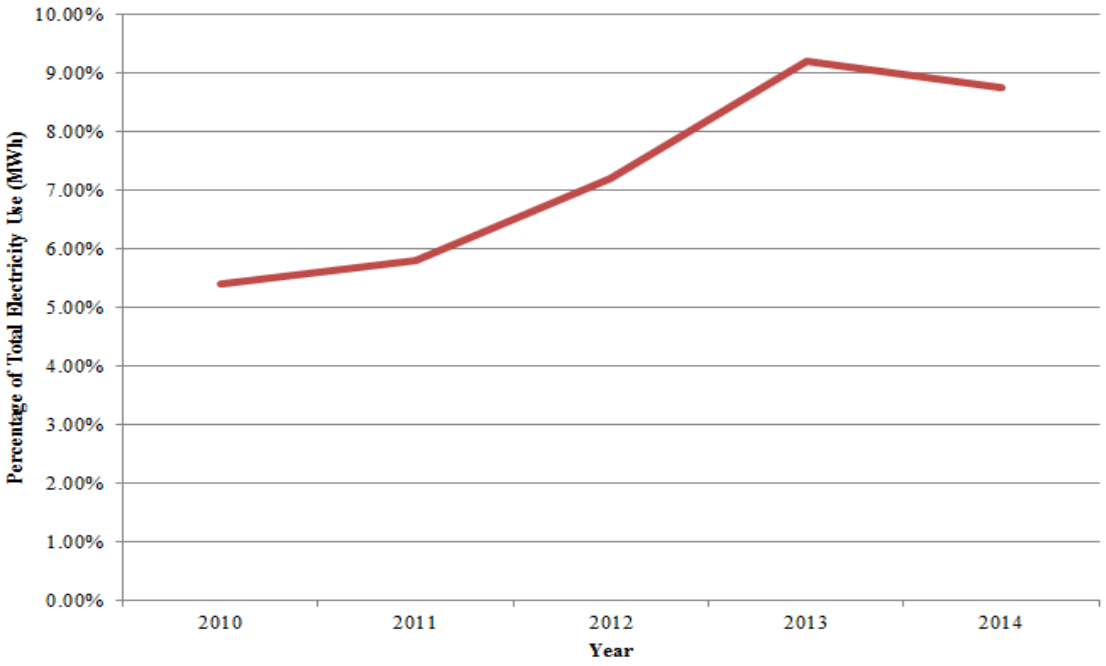

Figure 6. Facility renewable electric energy (percentage of total electricity use), 2010–2014[25]

Acronym: MWh – megawatts per hour.

The following are areas where the government has met or exceeded its goals:

- *Renewable electric energy*—EPAct 2005 and E.O. 13423 required the Federal Government to achieve renewable electric energy usage equivalent to at least 7.5 percent of its total electricity use by 2013. At least half of that energy had to come from sources developed after January 1, 1999. In 2014, Federal renewable electric energy usage reached 8.8 percent.[26] Of that energy, 94.9 percent came from sources developed after January 1, 1999.
- *Water consumption intensity*—E.O. 13423 and E.O. 13514 required the Federal Government to reduce water consumption intensity (gallons per gross square foot) by 14 percent relative to a 2007 baseline. In 2014, water consumption intensity decreased by 20.8 percent.[27]
- *GHG emissions*—E.O. 13514 required the Federal Government to reduce Scope 1 and Scope 2 GHG emissions from targeted sources by 28 percent by 2020 (relative to a 2008 baseline). As noted above, the government achieved a 17.4 percent reduction in GHG emissions in 2014.[28]

Despite these successes, the government is still falling behind in its energy management goals in several sectors, including the following:

- *Federal building efficiency*—E.O. 13423 and NECPA required the Federal Government to reduce its building energy intensity by 27 percent compared to a 2003 baseline. In

2014, energy intensity had decreased by 21 percent.[29] EPAct 2005 and EISA 2007 also both set standards for Federal agency building efficiency. In March 2016, 13 of 27 Federal agencies were at least 90 percent compliant with the EISA requirement to evaluate covered facilities every 4 years (at a facility level),[30] and 4 agencies failed to meet their EPAct efficiency standards for new construction.[31] Only 3.7 percent of eligible Federal buildings met the Guiding Principles for Federal Leadership in High Performance and Sustainable Buildings set by E.O. 13423 (below the 13 percent interim target for 2014).[32, 33]

- *Alternative fuel vehicle (AFV) efficiency*—Although AFV acquisition rates have met EPAct 1992 requirements every year since 2003, actual alternative fuel use in Federal fleets is only 4.7 percent of total fleet fuel consumption.[34] As a result, petroleum use in the Federal fleet dropped just 3.3 percent in 2014 relative to 2005, well under the 18 percent reduction goal established by EISA in 2007.[35]

Executive Order 13693

President Obama issued E.O. 13693 in March 2015. This Executive order builds upon previous Federal energy management goals established in E.O. 13514 and 13423. Many of the goals set out by E.O. 13693 are more stringent than their predecessors, and some (relating to data center energy efficiency and renewable energy usage in Federal buildings) are new. While the Federal Government has made strides in improving its overall efficiency and reducing its environmental impact, more will need to be done to satisfy E.O. 13693. In particular, agencies will need to take significant steps to reduce their GHG emissions; increase their building energy efficiency and renewable energy deployment; and adopt more alternative fuel and/or fuel-efficient vehicles. In addition, because much of the low-hanging fruit in energy savings and diversification has already been harvested, E.O. 13693 will require more aggressive efforts on the part of Federal agencies to manage their energy budgets.

Table 1 outlines the goals set by E.O. 13693. The table also notes the Federal Government's current performance with regard to each goal.

Table 1. E.O. 13693 Goals as Compared to Current Performance[36, 37, 38]

Target Sector	E.O. 13693 Goals	Current Federal Energy Government Performance
GHG Emissions	• 41.6 percent reduction in Scope 1 & 2 GHG emissions by the Federal Government by end of 2025 (relative to 2008 baseline)	• Government reduced Scope 1 & 2 GHG emissions by 17.4 percent in FY 2014 relative to FY 2008 • 20 of 25 scorecard agencies are on track to meet their individual targets

Target Sector	E.O. 13693 Goals	Current Federal Energy Government Performance
Building Energy Efficiency	• 2.5 percent annual reduction in building energy intensity through 2025 (25 percent reduction in BTU/square feet [sf] relative to 2015 baseline)* • 2015 reduction goal is 30 percent relative to 2003 baseline • All new buildings designed to be 30 percent more efficient than relevant codes, where life cycle is cost-effective • Energy net-zero for all newly constructed Federal buildings greater than 5,000 gross sf by 2020	• Government decreased energy intensity by 21.0 percent in FY 2014 relative to FY 2003 • 12 of 24 scorecard agencies achieved goals • Little change in building energy intensity from FY 2012 to FY 2014 (however, national heating degree-days during the period increased by 25.5 percent)
Data Center Energy Efficiency	• Installation of advanced energy meters in all data centers by 2018 • Adoption of power usage effectiveness target of 1.2–1.4 for new data centers; <1.5 for existing data centers	• Not applicable; new goal
Clean Energy (Renewable /Alternative) Usage in Federal Buildings	• ≥10 percent of total building electric and thermal energy shall be renewable** or alternative energy*** in 2016 and 2017 • ≥13 percent in 2018 and 2019 • ≥16 percent in 2020 and 2021 • ≥20 percent in 2022 and 2023 • ≥25 percent in 2025 and each year thereafter	• Not applicable; new goal
Renewable Electric Energy Consumed by Federal Agencies	• ≥10 percent of total building electric energy is renewable energy in 2016 and 2017 • ≥15 percent in 2018 and 2019 • ≥20 percent in 2020 and 2021 • ≥25 percent in 2022 and 2023 • ≥30 percent in 2025 and each year thereafter	• Government purchased or produced renewable energy in FY 2014 equivalent to 8.8 percent of total electricity use • 20 of 24 scorecard agencies achieved the goal of 7.5 percent in FY 2014

Target Sector	E.O. 13693 Goals	Current Federal Energy Government Performance
Water Efficiency	• 36 percent reduction in agency potable water-consumption intensity by 2025 (through 2 percent annual reduction relative to 2007 baseline) • Installation of water meters on Federal facilities • 2 percent annual reduction in agency industrial, landscaping, and agricultural water consumption through 2025 (relative to 2010) • Installation of green infrastructure features to manage stormwater and wastewater	• Government reduced potable water consumption intensity by 20.7 percent in FY 2014 relative to FY 2007 • 22 of 24 scorecard agencies achieved the goal • 23.3 percent reduction in industrial, landscaping, and agricultural water consumption in FY 2014 relative to FY 2010 (5.8 percent average annual reduction)
Motor Vehicle Efficiency	• Elimination of unnecessary or nonessential vehicles from agency's fleet inventory • ≥4 percent reduction in fleet-wide per-mile GHG emissions from agency vehicles by 2017 • ≥15 percent reduction by 2021 • ≥30 percent reduction by 2025 • Deployment of vehicle telematics for all new passenger and light-duty vehicle acquisitions within 2 years • 20 percent zero-emission or plug-in hybrid vehicles for all new agency passenger vehicle acquisitions by 2020 • 50 percent zero-emission or plug-in hybrid vehicles for all new agency passenger vehicles by 2025	• Not applicable; new goal • Petroleum use in Federal fleet decreased 3.3 percent in FY 2014 relative to FY 2005 (falling short of 18 percent reduction goal) • Alternative fuel use in FY 2014 increased 199 percent from FY 2005 (surpassing FY 2014 goal of 136 percent, but this constitutes only 4.7 percent of total fleet fuel consumption)
Sustainable Acquisition & Procurement	• Compliance with existing statutory mandates regarding recycled content products, FEMP-designated products, and BioPreferred and biobased products • Compliance with Environmental Protection Agency (EPA) programs (e.g., ENERGY STAR) • Annual agency targets established for purchase of BioPreferred and biobased products	• Not applicable
Waste & Pollution Prevention	• ≥50 percent of non-hazardous solid waste diverted annually	• Not applicable

Target Sector	E.O. 13693 Goals	Current Federal Energy Government Performance
Guiding Principles for Federal Leadership in High-Performance and Sustainable Buildings	• At least 15 percent of new, existing, and leased buildings >5,000 square feet meeting the Guiding Principles by 2015	• FY 2014: 3.7 percent of eligible Government buildings meet Guiding Principles, 8.3 percent in terms of the buildings' square footage • 3 of 20 scorecard agencies met the interim target of 13 percent
Performance Contracts for Federal Buildings	• Fulfillment of existing goal of $4 billion in Federal performance-based contracts by 2016 • Implementation of annual agency performance contracting targets for 2017 and each year thereafter	• $3.97 billion committed in ESPCs ($3.09 billion awarded as of May 15, 2016, with an additional $3.3 billion in the pipeline)

*Suggested achievement through adoption of remote building energy performance assessment auditing technology; demand management programs; monthly input of performance data into EPA's ENERGY STAR Portfolio Manager for covered buildings; incorporation of Green Button energy measurement system; optimization of space usage; and transition of test-bed technologies to deployment stage.

**Renewable electric energy includes installing agency-funded renewable energy on site, contracting for the purchase of renewable energy from an off-site Federal facility, or achieving similar values through the purchase of Renewable Energy Certificates.

***Alternative energy includes installing thermal renewable energy; installing combined heat and power processes; installing fuel cell energy systems; using energy from new small modular reactor technologies; and using carbon capture and storage technologies.

Facility Investment

In order to meet these goals, agencies invest in their facilities using direct appropriations and two types of performance contracts—ESPCs and utility energy service contracts (UESCs). In FY 2014, Federal agencies invested $1.7 billion in energy efficiency and renewable energy projects from these sources (Figure 7).[39] Investment through appropriations was substantially higher in 2009–2012 due to funding from the American Recovery and Reinvestment Act. Historically, appropriations and performance contracts have each accounted for approximately 50 percent of annual investments.

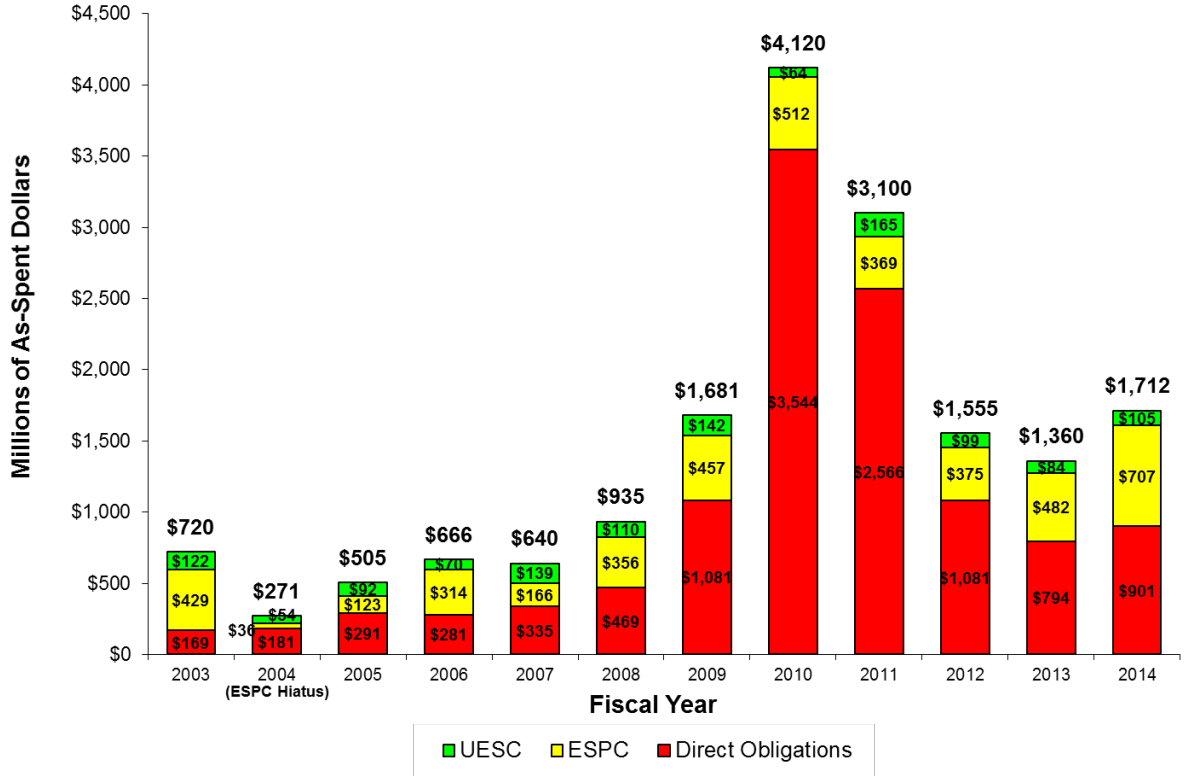

Figure 7. Federal facility energy efficiency and renewable energy investment, 2003–2014[40]

SECTION 1: Federal Energy Goals

RECOMMENDATION: Assess Federal energy goals: are they a useful tool for Federal energy management?

1.1 Background

Federal energy goals—multiple, numeric targets that apply uniformly to each executive branch agency—have a long history and offer significant advantages for managing how agencies obtain and use energy. However, in some cases, they may not be the most cost-effective method for achieving desired energy- or carbon-reduction targets. Incentives and other "market" mechanisms, such as allowing agencies to trade reduction opportunities, may accelerate the innovation that is needed to achieve increasingly aggressive targets at lower costs. This section looks at the strengths and weaknesses of Federal energy goals in advancing Federal energy management. The Task Force has not achieved full consensus on the value of applying detailed, numeric goals to each Federal agency, but the Task Force supports maintaining this overall approach because of its simplicity, transparency, and results to date. At the same time, the Task Force recommends that the next administration consider alternative cost-effective ways to achieve and sustain further progress in government-wide Federal energy management performance.

Executive Order (E.O.) 13693 is the latest in a series of policy directives dating back to the 1970s by which the White House and Congress have imposed energy and sustainability goals on the Federal Government. The goals are largely numeric, and they apply uniformly to every agency. For example, the Energy Independence and Security Act of 2007 (EISA) required each agency to reduce its energy intensity (British thermal units [BTU] consumed per square foot of eligible building space) by 3 percent a year, or 30 percent by 2015, relative to a 2003 baseline.[41] E.O. 13693 extends the energy-intensity reduction goal but at a slightly less aggressive level (2.5 percent a year, or 25 percent by 2025).

Federal energy goals cover a broad array of activities. The most visible goals are the ones that address building energy intensity and use of renewable energy, which, in turn, most directly affect Federal agency greenhouse gas (GHG)-emissions reductions. Other goals address motor vehicle efficiency, energy reporting and auditing, metering, and energy performance contracting. E.O. 13693 has added several "net-zero" goals.[g] For example, beginning in 2020, all new Federal buildings must be designed to reach net-zero status by 2030. Importantly, Federal GHG emissions-reduction goals are agency-specific and tied directly to each agency's operational footprint and mission.

[g] A net-zero energy building is a building with zero net energy consumption, meaning the total amount of energy used by the building on an annual basis is roughly equal to the amount of renewable energy created on the site or, in other definitions, by renewable energy sources elsewhere. https://en.wikipedia.org/wiki/Zero-energy_building.

This broad array of numeric goals is a key tool for Federal energy management. The Office of Management and Budget tracks each agency's performance on a "stoplight" (red-yellow-green) scorecard that is issued semiannually. The Department of Energy, the General Services Administration, and the White House Council on Environmental Quality also play critical roles in helping agencies meet the goals.

1.2 Discussion

Federal energy goals are a response to the admonition that "if you can't measure it, you can't manage it." Although energy goals and scorecards have become a fact of life for Federal agencies—and have driven significant success—there has been little analysis of their strengths and drawbacks as a tool for Federal energy management.

1.2.1 Drawbacks to Federal Energy Goals

While the purpose of Federal energy management is to reduce Federal energy use and carbon emissions, applying uniform energy goals across all agencies may not be the most efficient way to achieve such reductions. Arguably, the most efficient approach may be (1) to set an overall target for energy or carbon reduction based on a rigorous analysis, and (2) to let agencies themselves identify the best ways to meet the target. Current Federal energy goals deviate from that approach in three ways.

First, Federal energy goals are set for specific types of activities rather than being defined at the aggregate level. For example, there are defined goals for reducing building energy intensity, using renewable energy to operate buildings, and purchasing alternative fuel vehicles as discrete activities. The more prescriptive the target, the less flexibility agencies have to achieve a given reduction target, which may lead to inefficiencies in attaining those goals.

The most prescriptive goals address the specifics of how (and how often) agencies should identify or pay for energy-reducing investment opportunities. For example, EISA requires Federal buildings to be audited every 4 years. Federal energy managers, who interpreted the goal as requiring actual on-site audits, complained that it was inconsistent with commercial practice and that the expense left fewer financial resources to make actual building improvements. (To its credit, E.O. 13693 explicitly states that the goal can be met in other ways, including remote audits.)

Second, the quantitative targets specified in the goals are based on potential or projected cost-effective improvements in performance rather than actual data. Lacking the data and analytical tools to set agency-specific targets, the Federal Government prescribes uniform energy goals across all agencies. This approach, however, may drive some agencies to over-invest in the targeted area of energy-performance improvement to the detriment of other operational priorities. Conversely, uniform energy goals may understate the potential for cost-effective investments in energy efficiency for other agencies.

Existing goals that embody the concept of "net-zero" are a particularly controversial example. Supporters of net-zero goals (including members of the Task Force) argue that they are a powerful imperative and that the Federal Government, leading by example, can inspire behavioral change by achieving such goals. However, critics (also represented on the Task Force) see net zero as a goal that lacks an analytic basis, and they point out that the incremental actions needed to achieve full compliance—the "last mile" of reductions or savings—often impose costs well in excess of benefits.

A third way that Federal energy goals may not achieve optimal efficiency is their *uniform application*. The requirement for agency-by-agency compliance cuts against government-wide approaches to energy reduction and mechanisms to allow agencies to trade reduction opportunities. For example, to achieve the E.O. 13693's aggressive renewable energy goals, it might cost less to deploy a few mega-projects rather than the multiple small projects that agency-by-agency compliance will produce. Alternatively, this might involve incentivizing the Department of Defense to deploy renewable energy more widely than civilian agencies because it furthers a mission interest, such as energy security and resilience on military bases.

The measures embodied in current Federal energy goals lead to other challenges, including accurate measurement. For example, energy intensity (BTU consumed per square foot) is a valid way to track improvements in energy efficiency insofar as the number of building occupants stays the same. However, changes in occupancy introduces an exogenous factor. The Army, in particular, believes that its failure to meet its energy intensity goals is partly due to the increase in population on certain military bases that are home to U.S. troops returning from the Middle East. This speaks to the need for better-designed metrics, with appropriate flexibility.

1.2.2 Advantages of Federal Energy Goals

There are several advantages of agency-specific numeric goals, perhaps chief among them are simplicity and ease of implementation. The ability to measure progress against concrete targets is not an insignificant challenge in a Federal energy system made up of hundreds of thousands of buildings and vehicles operated by scores of diverse organizations. Simple numeric goals focused on individual agencies can motivate program managers and the officials who oversee them more than approaches that might, in theory, be more efficiently designed but also more complicated and less feasible to implement.

A related advantage of numeric energy goals is their visibility and transparency. Energy management is an area in which the government seeks to set a positive example through its own actions. For example, in his 2009 "Sustainability Executive Order"—E.O. 13514—President Obama stressed that "the Federal Government must lead by example." The use of transparent goals serves that policy objective.

Moreover, leading by example means more than just achieving an aggregate target for energy or carbon reduction. Historically, the Federal Government has played an important role as an early adopter of new technology, helping to kick-start commercial markets that would otherwise be

slow to develop. Some Federal energy goals, such as the ones related to renewable energy or sustainable procurement, contribute to this important function. In this context, sometimes "leading by example" means taking steps that may not be initially cost-effective when viewed through a purely economic lens. Nevertheless, it could send a signal about the broader societal value of an action and help launch a deployment process that can take a technology down an important cost curve.

Another advantage of numeric goals is that they help compensate for the ways in which government operates differently from industry. To illustrate, consider investments in the energy efficiency of Federal buildings. First, unlike a private firm, a Federal entity may lack the *incentive* to undertake efficient investments—investments for which the benefits outweigh the costs—because it will not see the savings. For example, if the commander of an Air Force base invests in building improvements that will lower the base's utility bill, the Air Force budget office may simply give the commander less money for utilities (and no more money for other expenses) in the next year's budget. Additionally, budget constraints and restrictions on borrowing mean that an agency often lacks a private firm's *ability* to undertake smart investments. By putting pressure on budget officers and other key decision makers, numeric energy goals lead agencies to undertake some of the smart investments that they would otherwise forego.

Finally, while the nature of some energy goals may lead to over-investment in targeted areas, given the amount of low-hanging fruit on the Federal Government's energy "tree," this probably has not been a major problem to date.

1.3 Recommendations

As noted above, the Task Force has not reached full consensus on the value of detailed numeric goals, but it believes that we are better off maintaining this overall approach because of its simplicity, transparency, and results to date. At the same time, the Task Force recommends that the next administration consider alternative cost-effective means for achieving and sustaining government-wide Federal energy management performance. Consequently, the Task Force suggests the following:

1. The next administration, in the development and issuance of any Federal energy-related orders, directives, or guidance, should consider the pros and cons of numeric energy goals and potential alternative approaches to achieving desired environmental, economic, and security objectives.
2. The next administration should consider pilot efforts to increase flexibility of compliance with Federal energy goals and related cost savings. This might allow, for example, smaller agencies to pool their resources in the joint development of a single larger renewable energy project that would count toward compliance with the relevant Executive order.

3. The next administration should also consider potentially recommending changes to underlying legislative requirements to provide greater flexibility in meeting congressional Federal energy management mandates.

SECTION 2: Evaluation, Measurement, and Verification

RECOMMENDATION: Improve Federal energy efficiency projects through advances in evaluation, measurement, and verification and randomized controlled trials.

2.1 Background

Energy efficiency investments are often viewed as the most cost-effective means for reducing pollution and energy production costs.[42, 43, 44] For that reason, the Federal Government has repeatedly pushed for increasing the energy efficiency of its own facilities.[h] To improve the performance of energy efficiency projects in Federal Government buildings, it is critical to accurately measure and evaluate the true returns on energy efficiency investments so that scarce Federal funds can be provided to projects with the highest yields. Such evaluations require detailed energy consumption data and rigorous ex post verification. It is only by knowing how a building and its occupants actually respond to energy efficiency investments that we can learn how to improve our approach. Two challenges currently impede efforts to evaluate the performance of energy efficiency projects in Federal Government buildings and to identify the highest payoff of energy efficiency investments.

2.1.1 Challenge #1: Metering

A major barrier to evaluating the efficacy of energy efficiency projects in the Federal Government is the absence of granular data about building profiles, energy usage, and energy spending over time. The Federal Government owns and leases approximately 350,000 buildings, spanning approximately 3 billion square feet of floor space. These include offices, laboratories, dormitories and barracks, data centers, schools, hospitals, prisons and detention centers, and housing facilities.[45] The Energy Policy Act (EPAct) of 2005 states that by 2012, "all Federal buildings shall, for the purposes of efficient use of energy and reduction in the cost of electricity used in such buildings, be metered." EPAct 2005 goes on to direct that, to the maximum extent practicable, advanced meters or metering devices should be deployed. Despite this clear direction from Congress, as of the end of fiscal year (FY) 2014, only about 109,000, or roughly one third of Federal buildings, had been separately metered, and of these, only about 42,000 had advanced meters.[46, 47] Without the ability to precisely measure building energy performance, the Federal Government cannot adequately assess the energy savings that efficiency upgrades are supposed to produce.

Meters can be challenging to install at many Federal locations because of the difficulties that energy managers in certain agencies have in demonstrating the meters' life-cycle cost-

[h] The National Energy Conservation Policy Act of 1978, the Energy Policy Act of 1992 (EPAct 1992), the Energy Policy Act of 2005 (EPAct 2005), the Energy Independence and Security Act of 2007 (EISA), and Executive Orders (E.O.) 13423, 13514, and 13693 have all put in place requirements for Federal building energy efficiency.

effectiveness. Adding to this dilemma, the meters that have been installed often are different from each other and do not have consistent functions. There is also concern that smart meters, sensors, and related analytical and management systems installed in Federal buildings (and potentially grid-connected vehicle fleets) could increase the vulnerability of government agencies to cyber attacks. On the other hand, there is a view that these systems can provide both cybersecurity detection and protection capability.

A related challenge involves Federal Government reporting mechanisms that rely on planning, tracking, and reporting methods that are largely manual and use very basic software tools (e.g., spreadsheets). Such processes are expensive, often unreliable, and lead to substantial delays in reporting and decision making. These outdated data-collection systems are still used by both the higher-level energy management operations overseen by the Office of Management and Budget (OMB) and the White House Council on Environmental Quality (CEQ), governed by Executive Order (E.O.) 13693 and various statutes, and the Federal Energy Management Program (FEMP), in its monitoring requirements for performance-based contracts.[i]

2.1.2 Challenge #2: Reliable Ex Post Verification

Two primary funding mechanisms exist for Federal agencies to improve the energy efficiency of their facilities: (1) appropriated funding, in which taxpayer dollars are used to implement energy conservation measures (ECMs); and (2) energy savings performance contracts (ESPCs), in which a third party provides the funding to implement ECMs and is repaid from a portion of the energy savings accrued over time. In FY 2014, agencies accomplished roughly half of their energy efficiency projects with appropriated funding and half with ESPCs (plus a related mechanism called a utility energy service contract).[48] Both funding mechanisms, however, suffer from a lack of rigorous and efficient accountability methods. While significant money has been spent on ECMs over the last several decades and substantial progress has generally been made,[j] questions remain about ECMs' cost-effectiveness and whether they have fully yielded their promised energy savings (see Section 3).[k]

In simple terms, effective energy evaluation, measurement, and verification (EM&V) involves (1) an ex ante evaluation of the energy-saving potential of the ECM; (2) measurement via metering—at a granular level—of these savings once the ECM is installed; and (3) ex post

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[j] For instance, Federal facility site-delivered energy use per gross square foot has decreased 21 percent since 2003. See Table A-3, "Site-Delivered Energy Use, Costs, and Gross Square Footage of Federal Facilities by Agency," *Comprehensive Annual Energy Data and Sustainability Performance*, Department of Energy, Federal Energy Management Program, June 1, 2016, http://ctsedwweb.ee.doe.gov/Annual/Report/SiteDeliveredEnergyUseCostsAndGrossSquareFootageByAgency.aspx.

[k] Most of this uncertainty reflects a longstanding debate over how energy savings are best measured. See: Michael Greenstone, "Is There an Energy Efficiency Gap?" *Journal of Economic Perspectives* 26, no. 1 (2012): 3–28, https://www.aeaweb.org/articles?id=10.1257/jep.26.1.3; and Meredith Fowlie, Michael Greenstone, and Catherine Wolfram, "Do Energy Efficiency Investments Deliver? Evidence from the Weatherization Assistance Program," working paper, University of California, Berkeley, 2015, https://nature.berkeley.edu/~fowlie/WAP.pdf.

verification that the projected savings have been realized as a result of the ECM. Thus, Section 432 of the Energy Independence and Security Act (EISA) of 2007 directs the Federal Government to measure and verify the "persistence of savings for implemented measures."[1]

Despite this statutory direction and broader agreement about the importance of EM&V, it is often missing in the implementation of Federal ECMs. While ex ante examinations generally are undertaken to determine the potential efficacy of an ECM, too often ex post evaluations do not occur. This is especially true for projects financed with appropriated funds, as opposed to ESPCs where ex post EM&V is required. That is, projections are made about expected savings but are often not scrutinized after the project has been implemented to determine the extent to which those savings materialized. Or, if an evaluation is done, it is often an observational study that only looks at the simple before-and-after consumption data. This approach runs the risk of confounding the effects of the energy efficiency investments with other factors, such as changes in temperature, type of usage, or building occupancy.

2.2 Discussion

2.2.1 Data Collection and Advanced Energy Analytics

An important first step in developing a rich body of ex post evaluations is collecting precise and accurate building energy usage data. The efficacy of an efficiency project cannot be assessed—either ex ante or ex post—without knowing how existing buildings have consumed energy in the past and continue to consume energy in real time once an ECM has been installed. Technological advances that combine new and existing metering and monitoring capabilities with machine learning, cloud computing, and other information and communication technologies are making it easier and less costly to automatically monitor and collect building energy performance data. These data improve energy savings assessments and helps verify the results of actions based on those assessments.

Two recent reports on how to improve energy efficiency planning and measurements have pointed to the importance of using advanced energy analytics systems to gather building data, prioritize energy efficiency projects, and track the efficacy of such projects over time.[49, 50] According to the American Council for an Energy-Efficient Economy, advanced energy analytics systems "can cost-effectively identify opportunities for commercial-sector energy efficiency projects and then determine the resulting savings. Automated commercial programs can be scaled more easily than existing labor-intensive approaches."[51] Northeast Energy Efficiency Partnerships came to a similar conclusion in its 2015 review of key trends in future energy measurement and verification practices.[52]

[1] See, 42 U.S.C. 8253 (f)(5): "Follow-up on implemented measures For each measure implemented under paragraph (4), each energy manager shall ensure that—(A) equipment, including building and equipment controls, is fully commissioned at acceptance to be operating at design specifications; (B) a plan for appropriate operations, maintenance, and repair of the equipment is in place at acceptance and is followed; (C) equipment and system performance is measured during its entire life to ensure proper operations, maintenance, and repair; and (D) energy and water savings are measured and verified."

Advanced energy analytics systems have proven capable of providing real-time monitoring of building energy performance in large commercial and residential building portfolios.[m] These systems acquire, aggregate, normalize, and process the available building profile and usage data gathered from conventional meters, smart meters, smart thermostats, sensors and other monitoring devices, and alternate data sources such as weather or real estate records. The technology then visualizes the data and provides analytic results in real and near-real time, taking advantage of new computer science techniques, including elastic cloud computing, machine learning, and social human-computer interaction models.

Cisco, for example, currently uses such a system, covering more than 500 of the company's facilities globally. Such systems are also currently deployed to handle thousands of commercial facilities and millions of residences by San Diego Gas & Electric and Pacific Gas & Electric in California, by Eversource across six of their distribution utilities in New England, and by Efficiency Nova Scotia, among others.[53, 54] These systems enable users to extract significantly more economic value from prior investments in information technology infrastructure. They also justify the business case for such investments and significantly amplify the savings from investments in new, more advanced hardware technology, such as smart meters.

Advanced analytics systems work by developing building performance models based on historical data; providing customized recommendations for ECMs based on that building model; calculating the cost and expected payback of each measure at each building; and confirming ECM performance by constantly tracking changes in building performance after ECM implementation. Machine learning allows real- and near-real-time building performance to be fed back into the analytic program and refine the predictions and recommendations. The resulting analyses reflect the real-world conditions specific to each individual building, portfolios of buildings, geographic regions, and weather. These algorithms can be customized for a wide range of buildings and can be built to include existing data sets, like those captured in ENERGY STAR® or the Department of Energy's (DOE's) Standard Energy Efficiency Data Platform, an open-source energy measurement software platform.[55]

Using this technology, along with simple survey-based instruments, managers and analysts are able to understand and manage their "whole-building" energy performance, evaluate available submeter data (e.g., heating, ventilation, and air conditioning operational data) across uses and

[m] Private-sector entities providing the hardware and software components of advanced energy analytics systems to building owners include electricity and gas distribution utilities, meter and sensor manufacturers, thermostat manufacturers, platform-as-a-service and software-as-a-service software technology companies, and competitive energy services companies. See: Heather Clancy, "10 Companies to Watch in Energy Analytics," *Forbes*, December 31, 2014, http://www.forbes.com/sites/heatherclancy/2014/12/31/10-companies-to-watch-in-energy-analytics/#2715e4857a0b26206fc121c7; "Navigant Research Leaderboard Report: Building Energy Management Systems," Navigant Research, 2016, https://www.navigantresearch.com/research/navigant-research-leaderboard-report-building-energy-management-systems; "Navigant Research Leaderboard Report: Home Energy Management," Navigant Research, 2016, https://www.navigantresearch.com/research/navigant-research-leaderboard-report-home-energy-management; "Gartner Identifies Top 10 Technology Trends for the Energy and Utilities Sector in 2013," Gartner, April 15, 2013, http://www.gartner.com/newsroom/id/2426515.

fuel types, and disaggregate usage into its components. Analysts can then identify inefficiencies in building equipment, evaluate relevant energy-conservation measures, isolate facilities with outlier energy use, optimize and plan demand side management projects, track and measure energy savings results over time, and automatically report on actions taken and their impacts. All of this enables automatic benchmarking of facilities—a priority in E.O. 13693—in real time and over time, across a wide range of key performance indicators.

2.2.2 Application of Advanced Energy Analytics to Federal Facilities

By harnessing the building energy information provided by advanced energy analytics systems, the Federal Government can better evaluate energy conservation measures, track energy savings, and calculate the cost-effectiveness of specific measures. Advanced energy analytics systems are potentially scalable to thousands of facilities managed by the Federal Government. However, as noted above, smart meters are currently deployed at only about 14 percent[56] of the roughly 350,000 Federal buildings, and separate metering of any sort is available in only roughly one third of Federal buildings. The lack of smart meters, sensors, and other devices deployed in Federal buildings will substantially limit the use of advanced energy analytics. At the same time, the use of advanced analytics technology at Federal facilities that have already made the investment in smart meters and submetering should help justify acceleration of the deployment of smart meters at other Federal facilities.

The power, accuracy, and cost savings from advanced analytics technology will increase with increased deployment of smart meters, submeters, and other sensors and monitoring devices in Federal buildings. Nevertheless, increased smart meter deployment will require recognition by Federal managers of the value of the information collected versus the cost of installation. Federal officials must also address the cyber-security-related benefits and drawbacks of advanced analytics (see Section 10). Taking into account growing awareness and interest in this transformative technology, pending Federal energy legislation includes a Public Utility Regulatory Policy Act provision requiring state public utility commissions to consider clarification or modification of their regulations to encourage and enable deployment of advanced energy-analytics technology nationally.[57]

2.2.3 ECM Data Evaluation

The development of rigorous evaluation protocols for ECMs at Federal facilities provides another method for improving energy management at these facilities. DOE defined the process for reviewing ECMs at Federal facilities in guidance published in late 2015.[58] These "M&V Guidelines" direct how to quantify the savings that result from ECMs installed under performance-based contracts—but the guidance indicates that it is adaptable to measures installed in other projects, regardless of funding source. The guidelines define M&V (measurement and verification) as "the process of quantifying the energy and cost savings resulting from improvements in energy-consuming systems."[59] Under DOE's approach "[e]nergy and cost reductions are compared to a historical baseline, which may be adjusted to reflect changing operating conditions or utility rates." Originally, this was accomplished by simple

comparison of baseline and post-installation utility bills, but this led to difficulties in buildings and multi-building facilities with varying patterns of energy use, especially over longer periods of time. The recent DOE guidance specifies several different approaches for calculating baseline measurements depending on a facility's available data. Thus, there are options for a comparison of baseline and post-installation component or system energy use, regression analysis of baseline and post-installation billing and heating-degree data, and computer simulation where no meter existed in the baseline situation.[60]

A number of observers have raised questions about the reliability of this traditional approach to evaluating energy efficiency investments. There are a multitude of explanations, but they include: selection of an appropriate baseline; assumptions about consumer electricity use; incomplete, missing, or delayed data collection; and complex modeling insufficiently calibrated to individual energy efficiency projects. These problems are often referred to as "selection bias." Recent research that compares the estimated returns to energy efficiency investments from traditional M&V studies with estimates from randomized control trials (RCTs) confirms these concerns in the context of low-income residential energy efficiency investments.[61]

The optimum response to these concerns is to adopt a system of ex post evaluations that rely on RCTs. RCTs have long been the "gold standard" used to determine the efficacy of new pharmaceutical drugs because they identify the causal effect of the drug, avoiding the confounding that plagues alternative techniques. Also, they are increasingly used in economics, sociology, criminology, and other fields. A number of Federal agencies are increasingly relying on RCTs, including the Department of Education's What Works Clearinghouse.

RCTs would be effective in the Federal energy context where metering data is available and a population of similar buildings is involved. A shift to RCT evaluations of Federal energy efficiency investments would allow agencies to know both whether their monies were well spent and how to assess the relative costs and benefits of energy efficiency projects in the future. More broadly, a body of evaluations on what does and does not work in energy efficiency projects for Federal Government buildings could increase the rate of return on energy efficiency investments and provide substantial environmental benefits.

The RCT research design involves randomly assigning potential efficiency projects into either a "treatment group" that receives the benefits of the investment or a control group that does not receive any upgrades (at least for now). Randomization helps ensure that the groups are identical, except for the implementation of the energy efficiency measure. This is desirable because it helps ensure that the observed differences in energy consumption are caused by the energy efficiency project being assessed, not by other factors. Put another way, random assignment means that it is possible to answer the question, "What would have happened in the absence of the project?" Experimentally assigned treatment and control groups enable an investigator to pinpoint the impact of a program and eliminate other influences.

If it is not feasible to incorporate an RCT, quasi-experimental design evaluations can provide a high degree of reliability in some settings. Quasi-experimental studies assign subjects to

treatment and control groups by a method other than random assignment. Despite the non-random assignment of treatment status, it may still be possible to draw valid inferences from the differences in outcomes between the treatment and control groups. The validity of the inference rests on the assumption that assignment to the treatment and control groups is not related to the determinants of the outcomes. There are several quasi-experimental approaches.[62, 63] While helpful in some cases, quasi-experimental design evaluations are more likely to suffer from selection bias than full-fledged RCTs.[64]

The robust building energy performance data provided by an advanced energy analytics system, as discussed above, can aid and strengthen ECM data evaluation. While RCTs can be conducted with existing billing data from meters, advanced analytics can provide greater visibility, allowing for detection of smaller effects and quicker conduct of analysis. These advanced analytic systems can also be combined with traditional EM&V techniques to identify candidate energy efficiency measures to be undertaken and evaluate their performance.

2.3 Recommendations

1. *Accelerate installation of individual building meters, smart meters, submeters, and sensors.*

    a. As discussed above, only a small fraction of Federal facilities and buildings are metered, either with traditional or advanced meters. In order to be able to effectively deploy advanced energy analytic systems and improve evaluations of the efficacy of ECMs, Federal agencies should aggressively increase the installation of individual building meters (with an emphasis on smart meters) plus submeters, and sensors. Metering is required by EPAct 2005, EISA 2007, and E.O. 13514 "to the maximum extent practicable."[65]

    b. FEMP can take two steps to address the existing lack of meters in Federal facilities, as discussed in Section 10: first, develop standard meter specifications for use across the Federal Government; and second, establish a fixed operations and maintenance savings amount resulting from metering that can be used in metering purchase decisions (so-called "deemed" savings). Based on these steps, FEMP could establish a government-wide meter-buying program using the deemed savings and standard meter specifications.

    c. FEMP should also amend its measurement and verification guidance[66] for ESPCs to require all third parties engaging in long-term contracts for ECMs to install smart meters and sensors at the subject building and to deploy advanced energy analytics software. This requirement would include some of the costs of meter and software installation in the terms of the contract; provide continuous (as opposed to annual) monitoring of ECM performance; and automatically feed real-time energy usage data and analytics insights into the FEMP database.

d. Federal agencies should fill in data gaps caused by a lack of meters. Building-level energy usage can be estimated by combining data from a facility-wide or campus-level meter with online surveying of building profile metrics (e.g., primary use information, number of occupants, total square footage, etc.). Until all Federal facilities are metered, submetered, and sensored, this technique should be used to create better models of building energy usage. Agencies can also request and automate the receipt of utility data for Federal buildings. Additionally, some Federal buildings may already have real-time energy use data through the utilities that supply them energy. For instance, utility participants in the Green Button program[67] or the OpenEEmeter[68] would already have granular use data. Where this is available, FEMP should request that the data be recorded in its database.

2. *Conduct an advanced energy analytics system pilot implementation study run by FEMP, in coordination with OMB and CEQ.* As the paucity of meters and sensors at Federal facilities is addressed, the Task Force believes a promising method for improving energy efficiency and performance measurement is to move toward real-time, data-driven assessment of energy performance and savings. This would ultimately require Federal facilities to automatically provide real-time energy use data to FEMP. Under the authority of EISA 2007 and E.O. 13693, the Task Force recommends that FEMP work with the OMB Deputy Administrator for Management, the Chairman of CEQ, the Federal Chief Information Officer, and the Federal Chief Sustainability Officer to initiate and conduct a pilot implementation study of an advance energy analytics system addressing a subset of the building portfolios of three or four leading Federal agencies. To enable timely funding, implementation, and results, the Task Force recommends that CEQ use its management fund authority[n] to support the costs of the pilot implementation study, drawing on a portion of FEMP funds and funds that the leading agencies are currently allocating to slower, less efficient, and less comprehensive strategies for compliance and performance reporting.

3. *Use the advanced energy analytics system to benchmark facilities, track and prioritize energy efficiency projects, and support a near-real-time dynamic scorecard of pilot agency performance*. Once the pilot project data analytics system has been deployed, FEMP can use it to track the real-time progress of energy efficiency projects and

[n] CEQ was established in 1969 by the National Environmental Policy Act (NEPA) [42 U.SC. § 4321 et seq. (1969)] and conducts a wide range of policy development, analysis, and interagency coordination on matters related to energy, the environment, and natural resources. See the National Environmental Policy Act of 1969 (NEPA), as amended (Pub. L. 91-190, 42 U.S.C. 4321-4347, January 1, 1970, as amended by Pub. L. 94-52, July 3, 1975, Pub. L. 94-83, August 9, 1975, and Pub. L. 97-258, **§** 4(b), Sept. 13, 1982). In support of these functions, the NEPA statute provides: "(a) There is established an Office of Environmental Quality Management Fund (hereinafter referred to as the "Fund") to receive advance payments from other agencies or accounts that may be used solely to finance study contracts that are jointly sponsored by the Office and one or more other Federal agencies...." 42 U.S.C. § 4375. See also http://www.ecfr.gov/cgi-bin/text-idx?SID&node=pt40.33.1518&rgn=div5.

associated savings in the participating agencies. For example, both appropriated and ESPC project performance can be monitored through a comparison of real-time meter data before and after implementation of ECMs. FEMP can also use the analytics results to help benchmark, customize, and prioritize energy efficiency projects, with the least-efficient and highest-consuming campuses or buildings demanding the greatest attention.

4. *Conduct RCTs, wherever feasible, to measure the returns to energy efficiency investments in Federal buildings*. The participating agencies should formulate an ex post, data-driven evaluation of their energy efficiency projects in the pilot program that relies on RCTs, where feasible, to determine the rate of return on these investments. If an RCT is infeasible, then it may be feasible to use quasi-experimental evaluation techniques. Where these techniques cannot be applied, EM&V approaches should be used, informed by recent DOE guidance.[69] This evaluation should provide critical insights into the actual performance of specific ECMs and a more accurate assessment of the performance of future projects in similar conditions. The evaluation must be developed and included in the initial design of the ECM project so that the necessary data for the evaluation are collected. Where an RCT is used, an agency would

    a. Collect a set of promising energy efficiency investments, all of which pass some benchmark based on ex ante criteria. Presumably, the cost of these potential investments will exceed the available resources.

    b. Randomly assign the projects into a treatment group, where the investments will be undertaken, and into a control group, where they will not be undertaken for a given period of time. This random assignment would lend itself to Federal installations with multiple similar buildings (e.g., base housing) but may be challenging for Federal buildings with relatively unique designs or patterns of operation (e.g., laboratories or national security facilities).

    c. Measure the savings in the treatment group, relative to the control group, and calculate the internal rate of return.

    d. Share information learned from the advanced energy analytics system and the RCTs with the private- and public-sector entities.

FEMP can use data it collects from the advanced analytics system and the ex post evaluations to compare the costs and savings of various energy efficiency projects based on real-time, observed energy usage. This information can be shared with private- and public-sector organizations (e.g., utilities, state public utility commissions, public universities) that want to establish their own energy efficiency programs. FEMP's data on the results from RCTs and quasi-experiments in particular may be useful for third parties attempting to analyze the benefits of their own efficiency projects. FEMP can also share best practices in tracking and recording real-time energy use data and enhance Federal programs such as DOE's Commercial Buildings Energy Consumption Survey or ENERGY STAR. Importantly, the emphasis on RCTs and quasi-

experiments, where applicable, can serve to increase the standards for “best practices” outside of government settings.

SECTION 3: Energy Savings Performance Contracts

RECOMMENDATION: Improve and expand the use of energy savings performance contracts (ESPCs).

3.1 Background

Federal agency use of energy performance contracting, which leverages future energy savings to pay for energy improvements today, has been U.S. policy and has operated with bipartisan support in Congress for three decades. Investment in the program, which uses energy savings performance contracts (ESPCs) as its primary tool and another performance contracting mechanism called a utility energy service contract as a secondary tool,[70, o] has ranged between roughly $500 million in 2010 and $800 million in 2014 (see Figure 7 in Introduction). These contract mechanisms, which rely on third-party investments in the energy upgrade of Federal buildings and facilities, help reduce the Federal Government's energy use, cut operating costs, and reduce carbon emissions. Performance contracting is particularly important at a time when adequate appropriated dollars are not available for direct expenditure on building energy efficiency upgrades. In the current Administration, the critical nature of ESPCs and related mechanisms has been emphasized through the President's Performance Contracting Challenge, which has set ambitious goals for ESPC implementation. Executive Order (E.O.) 13693 calls on Federal agencies to complete $4 billion in ESPCs by 2016.

In an ESPC, a Federal agency contracts with an energy service company (ESCO), following a comprehensive energy audit conducted by the ESCO of a Federal facility to identify improvements to save energy. In consultation with the Federal agency, the ESCO designs and constructs a project that meets the agency's needs and arranges the necessary private financing. The ESCO guarantees that the improvements will generate savings sufficient to pay for the project over the term of the contract and provides a measurement and verification plan to document the savings. After the contract ends, all additional cost savings accrue to the agency. Contract terms of up to 25 years are allowed.

In 1986, Congress first authorized Federal agencies to use shared energy savings contracts to privately finance energy improvements. The Energy Policy Act (EPAct) of 1992[71] extended this authority specifically to ESPCs. In 1995, the Department of Energy (DOE) established the implementing procedures and regulations for ESPCs.[72] In 1998, DOE's Federal Energy Management Program (FEMP) created the Super ESPC program for use by agencies. Super ESPCs are indefinite-delivery, indefinite-quantity contracts designed to make ESPCs as practical and cost-effective as possible for agencies to use. These "umbrella" contracts are competitively awarded to several qualified ESCOs.

[o] The Task Force report focuses primarily on ESPCs.

Agency energy performance targets significantly drive the Federal ESPC market. In April 1991, E.O. 12759 mandated a 20 percent improvement in Federal energy use. EPAct 1992 codified that goal. In March 1994, E.O. 12902 increased the Federal energy performance improvement mandate to 30 percent and required agencies to use ESPCs to achieve the goal. E.O. 13123, issued in June 1999, raised the performance target even higher to 35 percent by 2010. This goal was extended by EPAct 2005, which mandated a Federal energy performance improvement of 2 percent per year through 2015. In 2007, the Energy Independence and Security Act (EISA) made Federal ESPC authority permanent.

In October 2009, E.O. 13514 set a greenhouse gas (GHG) reduction target for Federal agencies of an aggregate 28 percent by 2020, harmonizing existing statutory efficiency mandates and raising the bar once more on agency performance. Amplifying and enabling that goal, the December 2011 *Presidential Memorandum on Implementation of Energy Savings Projects and Performance-Based Contracting for Energy Savings* directed agencies to complete $2 billion in ESPCs within 2 years. Most recently, and as noted above, E.O. 13693 of April 2015 built on the prior $2 billion goal in energy performance contracting, expanding the goal to $4 billion by 2016.[p]

3.2 Discussion

The ESPC mechanism is a critical tool for Federal energy management because it allows Federal agencies to use private financing to fund investments designed to improve energy efficiency and related energy goals. In a presentation to the Task Force, a senior Office of Management and Budget (OMB) official summarized the following ESPC benefits:[73]

- Guaranteed energy savings (although cost savings are not guaranteed)
- Private-sector expertise in energy efficiency, renewable energy, water conservation, and reduced GHG emissions
- Government technical and legal assistance throughout the life of the contract
- Project management that minimizes vulnerability to budget impacts due to equipment failure
- Non-quantifiable benefits associated with improved Federal facilities, such as healthier and safer working environments.

3.2.1 Savings Generally Meet Expectations

There is considerable evidence that ESPCs, while not without their challenges, generally achieve cost and energy savings in excess of the costs to the Federal Government. A 2015 Government Accountability Office (GAO) report reviewed about $12 billion of ESPCs awarded by seven agencies from fiscal year (FY) 1995 to FY 2014.[74] GAO drew from previous analyses of ESPCs

[p] Full-text references to all Executive orders, agency guidance, regulations, statutes, and other policies governing Federal energy performance are available at www.FedCenter.gov.

conducted by DOE's Oak Ridge National Laboratory.[75, q] GAO concluded that "[t]he cost and energy savings that contractors reported to agencies for most ESPCs met or exceeded expectations….[although] some of these savings may be overstated." GAO recommended improved oversight of ESPC projects through clearer reporting of savings, improved training, and systematic evaluations of portfolios, among other things.

In any consideration of ESPC effectiveness, it is important to emphasize the contractual nature of these legal instruments, i.e., the relevant agency has the potential for redress if the agreed upon energy savings do not materialize, assuming the missed targets are not the result of government action or inaction. This shifting of risk is an attractive element of an ESPC, but it requires effective agency oversight of the results of each performance contract-based project, as GAO recommended.[76]

One particularly promising development has been the General Services Administration's (GSA's) use of ESPCs to achieve significant energy reductions in individual Federal buildings. Through its National Deep Energy Retrofit (NDER) program, GSA achieved an average level of energy savings (38 percent) that was more than twice that of other Federal ESPC projects, including other GSA projects that were not done as part of NDER.[77] One element of GSA's success with NDER was the establishment of a central Project Management Office, which also allowed GSA to significantly reduce project cycle time (15.9 months compared to 20.9 months for other Federal ESPC projects).

3.2.2 Importance of Budget Scoring

Despite the benefits they deliver, ESPCs have their challenges, principally because of their budgetary treatment. Under the Federal Government's approach to budgeting, agencies generally must fully fund capital investments in advance, as opposed to borrowing the money and repaying it over time, as private companies and state and local governments typically do. However, in a pair of memoranda issued in 1998 and 2012, OMB specified that agencies can pay for ESPCs on an annual basis, rather than having to fully fund them up front. The logic of this deviation from normal budgetary accounting ("scoring") rules is that the Federal Government's funding commitment is not unconditional, i.e., it is contingent on there being genuine savings in the government's utility bill, such that the ESCO that guarantees savings to the government faces genuine risk.

OMB's policy on the scoring of ESPCs has made it possible for Federal agencies to undertake ESPCs on a large scale, and in fact, OMB has been centrally involved in implementing the two

[q] Another Oak Ridge study examined several factors that are typically not accounted for in ESPC cost-benefit analyses and determined that "actual cost savings to the government in ESPCs are 174 percent to 197 percent of the guaranteed savings." John Shonder, *Beyond Guaranteed Savings: Additional Cost Savings Associated with ESPC Projects* (Oak Ridge, TN: Oak Ridge National Laboratory, 2013), ORNL/TM-2013/108, http://info.ornl.gov/sites/publications/files/Pub41816.pdf.

energy performance challenges issued by President Obama. Nevertheless, pockets of resistance to this policy remain within OMB, and this has, at times, slowed ESPC project development.[r]

Importantly, the Congressional Budget Office (CBO) has never accepted OMB's overall approach to the scoring of ESPCs. In CBO's view, an ESPC represents an exercise of Federal borrowing authority, and thus, should be recorded (scored) as a new obligation at the time the government enters into the contract. Although CBO has no role in the scoring of individual Federal ESPC transactions, CBO does score relevant legislation. Thus, CBO's approach to the scoring of ESPCs has in the past doomed congressional proposals to expand the use of the ESPC mechanism, another current challenge.

Recently, however, in the FY 2016 Joint Budget Resolution, the Senate, agreeing with OMB's rather than CBO's scoring of ESPCs, directed CBO to score all legislation considered by the Senate that would increase the use of ESPCs on a net present value. This would take into account all savings and costs over the life of the contract. The House of Representatives is considering similar language regarding the scoring of ESPCs and has included it in its Budget Committee–adopted 2017 Budget Resolution.

3.2.3 Proposals to Expand the Scope of ESPCs

Although Federal agencies typically use ESPCs for discrete and often small-scale projects to improve energy efficiency, increasingly, ESPCs are being used to address more ambitious energy challenges. For example, DOE used an ESPC to install a biomass facility at the National Renewable Energy Laboratory in Golden, Colorado. At the Food and Drug Administration research complex at White Oak, Maryland, a former Navy base, GSA used ESPCs to install cogeneration facilities and a microgrid to ensure continuous power in the event of disruption (or the threat of disruption) to the commercial electric grid. For the same reason, the Navy will be installing a 15 megawatt cogeneration plant at Naval Station Norfolk in Virginia.

In some cases, however, efforts to use ESPCs for new purposes have faced resistance. A key example involves *data centers*, which are a large and growing consumer of Federal energy. In 2013, DOE proposed to use an ESPC to consolidate two data centers and replace 5,000 desktop computers with computers that are more energy efficient. The project was expected to save DOE more than $75 million. However, OMB objected on the grounds that only 3 percent of the savings would come from reduced direct energy consumption; the bulk (97 percent) of the savings would come from reduced operation and maintenance (O&M) costs, including the cost to

[r] One current scoring issue, discussed in Section 3 of this report, involves an ESPC energy sales agreement that allows a Federal agency to support the installation of a renewable energy system as part of an ESPC. In 2012, OMB issued guidance that in order for an ESPC that includes an on-site energy system to be scored on an annual basis, the Federal agency must retain title to the system at the end of the contract period. This is a problem for the company that has entered into the ESPC because it must own the renewable energy equipment in order to claim an investment tax credit and other incentives.

maintain the hardware and software. Eventually, DOE withdrew the ESPC proposal, despite high-level Departmental support.

By law, ESPCs must be used "solely for the purpose of achieving energy savings and benefits ancillary to that purpose." The law also defines an energy or water conservation measure to include improvements in operation or maintenance efficiencies.[78, 79] However, the law does not specify what qualifies as ancillary benefits (also called "energy-related savings") or the proportion of an ESPC's overall savings that can be energy-related. OMB guidance on Federal use of performance contracts provides some general criteria that projects must meet to be scored under OMB's annual budget scoring process, but it does not provide specific direction on energy-related savings.

The Task Force did not take a position on the specific data center dispute. On the one hand, energy-related savings are an important source of savings to the government, and there may well be cases where an ESPC is appropriate even if more than half of total savings come from "energy-related savings" as opposed to direct energy savings. On the other hand, one would not want to jeopardize the long-standing, bipartisan congressional support for ESPCs by extending their use into areas that may not be covered by existing law. It should be noted, however, that the pending Senate-adopted energy bill (S. 2012) clarifies that agencies cannot arbitrarily limit O&M savings, whether at a data center, facility steam system, or other types of performance contracting projects. The Senate-adopted bill also clarifies the applicability of ESPCs to plug loads in Federal leased space and also the use of renewable energy credits as a legitimate funding source for ESPCs.

The Task Force discussed several other ways in which the scope of ESPCs could be expanded. The group strongly favored the use of ESPCs to fund meter installations and related equipment in Federal buildings. Although FEMP's current guidance does not require ESPC contractors to install meters, it should do so. Meters are key to improving energy efficiency, and Federal agencies have been slow to install them for the reasons discussed in Section 2. ESPCs are a useful tool for addressing this critical shortfall.

The Task Force also discussed the expansion of ESPCs to mobility energy. The Task Force was generally not supportive of their use for repowering Department of Defense aircraft.[s] However, the group was more open to the use of ESPCs for acquisition of alternative fuel vehicles, such as plug-in cars and trucks. As Section 8 of the report discusses, in acquiring motor vehicles, the Federal Government typically must evaluate options based on their "first" cost, as opposed to their life-cycle cost—a limitation that makes electric vehicles less attractive. The use of ESPCs would enhance the ability to purchase electric vehicles on a life-cycle cost basis. As things stand today, however, vehicle acquisition is not explicitly covered under the Federal ESPC-enabling

[s] Several members of the Task Force were highly critical of using ESPCs to pay for replacing the engines on the Air Force's B-52 fleet with new, more energy efficient ones. Although the "re-engining" of the B-52 would result in significant energy savings, many Task Force members felt that if ESPCs were used in this process, it risked eroding congressional support for this important financing mechanism.

legislation. However, it may well be that plug-in vehicles or related infrastructure, like charging stations, might be bundled with standard energy conservation measures (ECMs) like lighting, building controls, and heating, ventilation, and air conditioning equipment. The cash flow of energy savings from these standard ECMs might cover payments for electric vehicle-related charging stations and other infrastructure, and maybe even the plug-in cars themselves.

3.2.4 Areas for Improvement

The Federal Government faces a number of challenges as it seeks to rely more heavily on ESPCs as a tool for Federal energy management. The Task Force identified three challenges in particular that require attention and resources.

3.2.4.1 Lack of Contracting Personnel

Lack of expertise and capacity in agency contracting personnel is a challenge to program continuity. Federal agencies often do not have sufficiently trained contracting personnel to implement ESCPs, thereby increasing project time and associated costs and restricting expansion of the ESPC program. Multiple statutory and executive mandates require agencies to catalog and report opportunities to invest in energy efficiency, but these mandates are often not implemented due to agency budgetary constraints and lack of expertise and capacity.

In a similar vein, GAO, as discussed above, concluded in 2015 that Federal agencies were not conducting adequate oversight of ESPC projects because they were, in some cases, unaware of these requirements or how to perform them.

3.2.4.2 Lack of Uniform Legal Interpretations

In addition to contracting, there is a need to better educate agency legal personnel about ESPCs and to clarify through ESPC regulations how and when to apply the Federal Acquisition Regulations to ESPCs. There has been inconsistency among Federal agencies due to differing interpretations among agency general counsel offices. This issue is considered further in Section 10, which discusses FEMP.

3.2.4.3 Lack of Quality Data

Lack of quality data on potential volume of ECMs is a challenge to program management, measurement and verification, and growth. Facility-level energy performance is often tracked through manual data entry of paper utility bills that provides no opportunity for real-time energy optimization. Widely used energy performance management software systems and services could fill this data gap—giving agencies, FEMP, and OMB a clearer view into the effectiveness of existing investments and the pipeline of attractive ECMs (see Section 2). Additionally, lack of quality data inhibits agencies from aligning energy performance investments with related potential benefits such as employee health and wellbeing due to lack of adequate performance monitoring capabilities.

3.3 Recommendations

To support the achievement of the goals established by E.O. 13693, to sustain the ESPC program's established level of performance, and to expand it to its full potential over the next 5 years, we offer the recommendations below. Overall, the incoming administration should review the status of performance contracting policy and implementation with an eye toward increasing the use of ESPCs, including their expansion to new areas.

1. *Set biannual contracting goals:* You can't manage what you don't measure, and setting clear dollar-denominated contracting goals every 2 years sustains momentum and drives accountability. The current Federal goal of $4 billion by the end of 2016 is driving ESPC performance, but there is no target beyond this point. Based on historical performance, this will result in a sharp decline in the ESPC project pipeline after the goal period ends, unless a new goal is established for the 2016–2018 period. To avoid this cliff and sustain the growth and development of the program, the Secretary of Energy should recommend ESPC contracting goals for the 2016–2018 period based on FEMP analysis of the potential future pipeline for Federal ESPCs.
2. *Maintain ESPC goals in dollar-denominated terms:* ESPC targets measured in contract dollars work better than energy performance improvement targets due to ease of measurement and clear links to economic benefits. While relevant and important to larger Federal goals, energy-based performance improvement targets require a decentralized and complex measurement and monitoring process that adds time and cost to implementation and may introduce error as utility bill data has to be entered at the local facility level (see Section 3). The clarity and urgency of dollar-denominated contracting goals with specific deadlines has enabled managers to track ESPC goal achievement, identify problems early, and take corrective action.
3. *Maintain consistent application of established annual scoring policy for ESPCs:* Past performance demonstrates that inconsistent application of established annual scoring policies for ESPCs, largely by OMB, slows the contracting process, adds cost, and diminishes agency progress towards statutory and administratively established goals. An example, mentioned above and discussed in Section 3, involves the scoring of EPSCs that incorporate renewable energy systems where an OMB decision has caused the suspension of this valuable tool for deploying renewables and potentially storage, microgrids, and other emerging technologies.
4. *Resolve ESPC controversies:* There are a number of current controversies regarding ESPCs that need to be resolved including, for example, the extent to which operational savings as opposed to energy savings can form the basis of a Federal performance contract. Another involves resolving the possibility of a "Termination for Convenience" by the government. The specific language governing Terminations for Convenience has recently become an issue of debate and the financial institutions financing ESPC projects

need resolution. FEMP has instituted a process to resolve this issue, but not all agencies see DOE as the final arbiter of this issue.

5. *Implement Section 432 of EISA:* Section 432 of EISA requires Federal agencies to identify "covered facilities" that constitute at least 75 percent of their total facility energy use as subject to the requirements of the statute. Energy and water evaluations must be performed at each covered facility every 4 years to identify potential energy and water efficiency and conservation measures. EISA requires agencies to report progress toward these requirements using FEMP's EISA 432 Compliance Tracking System. Federal agencies should place a higher priority on this requirement. At the same time, it is important that these regular reviews be done cost-effectively, including using data from smart meters and building automation systems to reduce the need for on-site visits. E.O. 13693 explicitly provides this flexibility.

6. *Incorporate renewable energy in ESPCs:* Encourage agencies to incorporate more renewable energy—as well as energy storage, microgrid, and other emerging energy technologies—into ESPCs in order to cut carbon emissions and improve resiliency of Federal facilities. New guidance is needed to: (1) clarify that renewable energy credits can be used and sold as a legitimate funding source for ESPCs and other alternative financing mechanisms,[t] and (2) allow for the monetization of the Investment Tax Credit under an ESPC that includes a lease agreement for the purchase of renewable energy (see Section 5).

7. *Allow electric vehicles and charging stations to be bundled with other traditional energy conservation measures:* If specifically allowed as part of an ESPC, electric vehicles and their charging stations could help agencies meet energy- and petroleum-reduction goals (see Section 8).

8. *Ensure strong executive leadership:* Ensure that the Federal Chief Sustainability Officer (FCSO) (formerly called the Federal Environmental Executive), working in concert with the Federal Chief Performance Officer, Deputy Director of OMB and FEMP, provides strong leadership of Federal Government-wide goals for ESPC performance, in particular, measuring and managing agency performance to support accountability and recognize success. Maintaining the leadership of the FCSO has proven crucial for convening agencies, measuring progress, celebrating success, implementing corrective action when needed, and linking performance to agency budgets (see Section 5). Ongoing tracking and reporting of the Federal ESPC project pipeline has enabled the FCSO to identify “stuck” projects, diagnose challenges, and implement continuous improvement. Sustaining this practice will support the continued improvement of the ESPC program. This should also involve agency Chief Sustainability Officers (CSOs) who are key to elevating the opportunities and challenge of Federal energy management, and ESPCs in particular, within their individual agencies. These CSOs must place a priority on their

[t] Pending Senate energy legislation would help clarify this issue (see above).

role as a high-level champion for Federal energy management in their agencies (see Section 10 regarding FEMP).

9. *Increase agency capacity for ESPC project development and contracting:* Building on existing DOE FEMP-led training programs, explore developing a FEMP "Center of Excellence" to cross-train agency personnel on ESPC project development and contracting. This would leverage the authorities of the Intergovernmental Personnel Act to provide on-the-job experience to augment seminars and other programming.
10. *Reduce ESPC project development timelines and cost:* Align the ESPC program with OMB's Strategic Sourcing Initiative to drive greater consistency in Federal ESPC contracting, thereby reducing the timelines and cost of project development for both Federal agencies and industry. This would involve work with OMB's Office of Federal Procurement Policy to develop a plan for aligning ESPC program implementation with the Strategic Sourcing Initiative that encourages agencies to join together to negotiate the best deal for the taxpayer and to eliminate inefficiencies from the contracting process. This effort should also encourage ESPC contractors to work in concert with Federal agencies to implement agency supply chain GHG management goals, as directed by E.O. 13693.
11. *Accelerate agency approval process for ESPC projects:* Once a project has been developed and approved by a Federal site, lengthy approval processes from headquarters up the chain of command can add unnecessary delays. Awareness among agency leadership on the importance of ESPC projects is vital to reducing timelines and cost. Agency CSOs can help significantly with this objective (see Section 10).
12. *Improve oversight of ESPC projects* through clearer reporting of savings, improved training, and systematic evaluations of portfolios, among other things. GAO's 2015 review of Federal ESPCs, discussed above, recommends that the Secretary of Energy direct FEMP to evaluate existing training of Federal workers and their oversight of ESPC contractors' measurement and evaluation of contract performance.
13. *Improve data and performance management systems:* As stressed in Section 2 of this report, better data and improved performance monitoring are critical to effective Federal energy management. FEMP should amend its measurement and verification guidance[80] for ESPCs to require all third parties engaging in long-term contracts for ECMs to install smart meters and sensors at the subject building. This requirement would allow no- or low-cost measures to pay for the costs of installation to the terms of the contract, provide continuous (as opposed to annual) monitoring of conservation measure performance, and feed real-time energy usage data into the FEMP database (see Section 10).
14. *Seek opportunities to align energy performance contracting with related performance improvement and savings:* Emerging research from leading institutions, including the Centers for Disease Control, is demonstrating strong linkages between building

performance and human health and wellbeing.[81] For example, indoor air pollution has demonstrated linkages to chronic disease such as diabetes, hypertension, and heart disease. Harvard University is illuminating connections between lighting quality and healthy circadian rhythms. Moreover, E.O. 13693 directs that Federal employee and visitor wellbeing be addressed in the Guiding Principles for High Performance and Sustainable Buildings. DOE, OMB, and other Federal players should explore opportunities to align ESPC projects with building improvements that support human health and wellbeing, improve the agency personnel productivity, and reduce agency costs due to absenteeism and similar issues. This might involve launching a challenge to Federal agencies to identify at least one pilot ESPC project that, in addition to energy savings, also supports the wellness of Federal employees and visitors and identifies performance measures to demonstrate results. Part of this overall effort should involve developing and applying better financial measures of non-energy benefits such as health, security, and resilience.

SECTION 4: The Federal Real Estate Footprint

RECOMMENDATION: To reduce the Federal carbon footprint, reduce the Federal real estate footprint.

4.1 Background

In 2014, federally owned buildings consumed 366 trillion British Thermal Units (BTU) of energy, which represents a 39 percent decrease from the 1975 level (600 trillion BTU) and a 12 percent decrease from the 2003 level (415 trillion BTU).[u] (See Figure 5 in the Introduction.) The Department of Defense (DOD) accounts for 57 percent of current Federal facility energy consumption, followed by the Departments of Energy (DOE) and Veterans Affairs (8 percent each), the U.S. Postal Service (USPS) (6 percent), and the General Services Administration (GSA), whose portfolio includes multi-agency Federal buildings and Federal courthouses, among other facilities (5 percent).[82]

Although it has decreased markedly, the Federal Government's facility energy consumption is still significant—and costly. In 2014, Federal agencies spent $7 billion to purchase facility energy, of which DOD accounted for $4 billion. The government's facility energy bill has continued to rise even as consumption has decreased, because of the rising unit cost of facility energy. For example, in 2003, the Federal Government paid 27 percent less in total for facility energy compared to 2014 ($5.5 billion) even though it consumed 12 percent more.

Facility energy consumption is costly to the environment as well. Facility energy contributes disproportionately to greenhouse gas (GHG) emissions because much of it comes from fossil energy, including heating fuels. Although facility energy accounts for about 39 percent of the Federal Government's total energy consumption,[83] it contributes 45 percent of the Federal Government's Scope 1 and 2 GHG emissions.[84]

Federal facility energy consumption is a function of (1) "energy intensity," as measured by the number of BTU consumed per square foot of building space, and (2) the number of square feet (sf) occupied by the Federal Government—i.e., the Federal real estate footprint. Although the Federal Government's strategy for improving its energy performance targets the former, it is essentially silent on the latter. This is a missed opportunity to highlight and address the impediments that many Federal agencies face in reducing their real estate footprints.

Based on a consideration of both economic and political factors, the Task Force believes that reducing the Federal real estate footprint should become an explicit part of the strategy for improving Federal energy performance. We make several recommendations below as to how DOE can facilitate that process.

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[u] The statistics in this section on Federal facility energy consumption, costs, and square footage come from FEMP's tables on "Site-Delivered Energy Use, Costs, and Gross Square Footage of Federal Facilities by Agency." See http://ctsedwweb.ee.doe.gov/Annual/Report/SiteDeliveredEnergyUseCostsAndGrossSquareFootageByAgency.aspx.

4.2 Discussion

4.2.1 Federal Real Estate Footprint and Facility Energy Consumption

Federally owned buildings contain about 3.18 billion gross sf of space (2014 data). With 1.89 billion sf, DOD accounts for about 60 percent of the government-wide total. Other large Federal property owners include USPS (287 million sf), GSA (211 million sf), Veterans Affairs (185 million sf), and DOE (119 sf).[v]

Figure 8[85] shows the Federal Government's total facility square footage from 1975 to the present. The Federal footprint peaked in 1987 at 3.83 billion sf. Although it has declined significantly since then, all of the decline occurred from 1987 to 2003. During that period, the Federal Government decreased its square footage by 18 percent, and total Federal facility energy consumption decreased by the same amount.

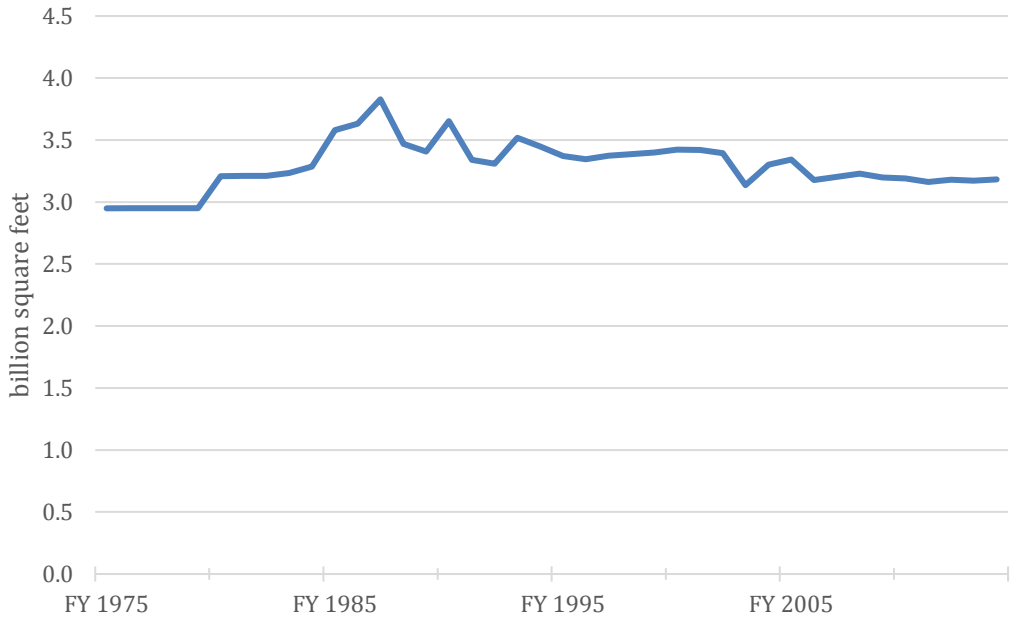

Figure 8. Federal Government facility square footage, 1975–2014 (fiscal years, billion square feet)[86]

The key driver was DOD consolidation. DOD carried out four rounds of base closures between 1988 and 1995 as part of the Base Realignment and Closure (BRAC) process. (The rounds occurred in 1988, 1991, 1993 and 1995. Because the implementation process is spread out over 6 years, the last of the four BRAC rounds was not completed until 2001.) During that 16-year period, DOD's real estate footprint shrank by 35 percent, and its facility energy consumption decreased by a corresponding 36 percent. However, during the same period, civilian agencies

[v] The Federal Government also leases a significant amount of space. Most notable is GSA, which manages about 200 million square feet of leased space. However, we exclude federally leased space from our analysis, in part, because it is impossible to isolate the cost of energy, which is typically included in the overall rental charge.

expanded their total real estate footprint by 18 percent, and their facility energy consumption increased by slightly more (22 percent).

Since 2003, the Federal real estate footprint has remained essentially the same: the current Federal footprint (3.18 billion sf) is negligibly larger than the 2003 footprint (3.13 billion sf), and the ratio of DOD to civilian square footage has remained about the same. (Although DOD held a fifth BRAC round in 2005, because the military was expanding at the time, the process was principally designed to reconfigure space rather than eliminate it.) During that same period, as noted earlier, the Federal Government's facility energy consumption has decreased by 12 percent.

Finally, note that from 1987 to 2003, the Federal Government's facility energy intensity was unchanged: the Federal Government consumed 132.4 thousand BTU (kBTU) per square foot in 1987, and in 2003, the comparable figure was 132.3 kBTU per square foot.[87] Thus, the decrease in Federal facility energy consumption during that period (18 percent) was due almost entirely to the reduction in the Federal real estate footprint. By contrast, since 2003, given that the Federal real estate footprint has stayed the same, the decrease in facility energy consumption (12 percent) can be credited to reduced energy intensity.

4.2.2 Efforts to Reduce the Federal Footprint

4.2.2.1 Department of Defense

In February, the Administration asked Congress for the authority to carry out a round of BRAC in 2019, so as to eliminate some of the base infrastructure capacity it no longer needs due to declining troop strength, among other factors. This is the latest in a series of requests for BRAC authority that the Administration has made since 2012. DOD believes its base infrastructure has about 20 percent excess capacity.[88] Based on the results of the 1990s BRAC rounds, the Office of the Secretary of Defense (OSD) estimates that a 2019 BRAC round would achieve a 5 percent reduction in capacity—or one quarter of the total excess capacity—yielding a recurring savings (avoided costs) of about $2 billion a year.[w]

For purposes of this analysis, we assume that a 5 percent decrease in DOD's infrastructure "capacity," by which OSD means plant replacement value, would result in an equivalent decrease both in DOD facility square footage and in DOD facility energy consumption.[89] Given DOD's facility energy bill is $4.08 billion a year (2014), that represents $204 million a year of recurring savings.[x] A 5 percent reduction in DOD facility energy consumption would decrease DOD's facility Scope 1 and 2 GHG emissions by between 400,000 and 1.5 million metric tons of carbon dioxide equivalent (CO_2e), based on the range of carbon intensities of the electric grid in

[w] Email communications with staff in the Office of the Assistant Secretary of Defense for Energy, Installations and Environment, December 2016.

[x] A more sophisticated calculation would take into account (1) the predicted increase in facility energy prices and (2) the expectation that DOD's facility energy intensity will continue to improve. However, those two effects are roughly equal in magnitude and therefore should cancel one another out.

affected regions.[90, y] This is equivalent to taking between roughly 85,000 and 315,000 cars off the road.[91]

DOD's goal for base infrastructure capacity reduction (5 percent) is extremely conservative.[z] Thus, for illustrative purposes, we double it—that is, we assume that BRAC would allow DOD to reduce its capacity by 10 percent (note that even that figure is only half of DOD's estimate of its excess capacity). Under that scenario, the decrease in energy consumption (10 percent) would yield $408 million a year of recurring savings. The corresponding decrease in facility Scope 1 and 2 GHG emissions would be would be between 800,000 and 3 million metric tons of CO_2e.

4.2.2.2 Civilian Agencies

The Obama Administration has made it a management priority to reduce the Federal real estate footprint. In 2011, the Administration proposed legislation to create the equivalent of a BRAC for civilian agencies.[92, aa] Although that effort failed, the Office of Management and Budget (OMB) and GSA have led several administrative initiatives to "Freeze the Footprint" and (more recently) "Reduce the Footprint."[93] OMB has also approved additional funding for GSA's effort to improve the utilization of its facilities—particularly by moving Federal tenants from leased space to federally owned space.

For civilian agencies, we think a reasonable goal is to reduce the aggregate real estate footprint by between 5 percent and 15 percent. GSA's Office of High-Performance Green Buildings informally estimates that, with adequate funding, GSA could reduce the footprint of the facilities it manages, including leased facilities, by 30 percent.[bb] Although that may be an overly ambitious footprint-reduction goal for facilities that are not managed by GSA, it suggests that there is considerable room for Federal space consolidation.[cc]

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[y] The range of GHG reductions reflects the variation in Emissions & Generation Resource Integrated Database (eGrid) factors across regions. Actual GHG reductions from reducing facility square footage will vary depending on the regions where the reductions occur. eGrid factors take into account regional variation in the carbon intensity of the grid. For example, reducing energy use in a region of the country where the grid has a high percentage of renewables will yield a different GHG reduction than reducing energy in a region that relies heavily on coal for generation. The GHG reductions given are only those in emissions from facilities. The data do not take into account reductions from other sources, such as wastewater treatment, vehicles, or fugitive emissions.

[z] OSD's 5 percent goal was calculated by taking the *average* of the capacity reductions that DOD achieved in each of the 1990s BRAC rounds (1991, 1993, and 1995). (DOD omitted the 1988 round from the calculation, presumably because it lacks sufficient data on that round's results.) However, because DOD held four BRAC rounds in quick succession from 1988 to 1995, the capacity reduction achieved in any single round was relatively small. If DOD gets the authority to hold a BRAC round in 2019, 14 years will have passed since the previous one (2005), and there will be little prospect of a subsequent (post-2019) round. Thus, it seems likely that DOD will want—and need—to eliminate more than just 5 percent of its capacity.

[aa] In addition to the Administration's bill, there have been several congressional proposals to facilitate the sale of excess civilian real property. However, as with the Administration's bill, none of the proposals has had significant support within Congress.

[bb] Email communication with Kevin Kampschroer, Director, GSA's Office of High-Performance Green Buildings, December 2016.

[cc] GSA is only responsible for a fraction of the civilian real estate footprint. Moreover, much of the GSA consolidation would occur in leased space, which—while extremely important to reducing the overall cost of Federal space usage—would not show up in the FEMP statistics on Federal facility energy consumption.

A reduction of the civilian Federal footprint in line with this goal would yield significant savings. Civilian agencies spend $3 billion a year to purchase facility energy. Thus, assuming an equivalent reduction in facility energy consumption, a 5–15 percent decrease in the civilian real estate footprint would lead to recurring savings of $150 million to $450 million a year in civilian agencies' facility energy bill. The reduction in facility Scope 1 and 2 GHG emissions is also significant: a 5 percent reduction in civilian facility energy consumption would decrease civilian agencies' facility Scope 1 and 2 GHG emissions by between 300,000 and 1.2 million metric tons of CO_2e, and a 15 percent reduction would decrease their emissions by between 900,000 and 3.6 million metric tons of CO_2e, depending on the carbon intensity of the affected regions.

4.2.3 Summary of Government-Wide Benefits

Table 2 provides a summary of the benefits of a decrease in the Federal real estate portfolio. The total savings in spending on facility energy range from about $350 million a year under the most conservative scenario (5 percent decrease in both the DOD and the civilian footprint) to $850 million a year under the most ambitious one (10 percent and 15 percent decrease in the DOD and civilian footprints, respectively). For facility Scope 1 and 2 GHG emissions, the corresponding reductions range from 700,000 to 2.7 million metric tons of CO_2e for the conservative scenario (5 percent decrease in the DOD and civilian footprints) scenario, and from 1.7 to 6.6 million metric tons of CO_2e for the more ambitious scenario (10 percent and 15 percent decrease in the DOD and civilian footprints, respectively).

Table 2. Summary of Benefits of Decreasing the Federal Real Estate Portfolio

	Reduced Energy Consumption (trillion Btu)[94]	Cost Savings (million dollars/year)[95]	Reduced GHG Emissions (million metric tons of CO_2e)[96]
DOD conservative (5 percent reduction)	10	$204	0.4–1.5
DOD ambitious (10 percent reduction)	21	$408	0.8–3.0
Civilian agencies conservative (5 percent reduction)	8	$150	0.3–1.2
Civilian agencies ambitious (15 percent reduction)	24	$450	0.9–3.6
Total government conservative (5 percent reduction for DOD and civilian agencies)	18	$350	0.7–2.7
Total government ambitious (DOD 10 percent and civilian agencies 15 percent reductions)	44	$850	1.7–6.6

4.2.4 Impediments to Reduction of the Federal Real Estate Footprint

The executive branch faces two major impediments to achieving a major reduction in its real estate footprint. The first is Congress. Although the BRAC process has been extremely successful on policy grounds—the five rounds to date have produced recurring savings of $12 billion a year—Congress has consistently rejected DOD's requests for additional BRAC authority because of the potential adverse economic impact on affected communities.[dd]

Likewise, Congress has resisted the creation of a robust process for identifying and disposing of unneeded civilian properties. In addition to the Administration bill discussed above, there have been several congressional proposals to facilitate the sale of excess civilian real property. However, none of the proposals has had meaningful support within Congress.

The second major impediment is the lack of upfront funding necessary to carry out a major consolidation of Federal civilian facilities. BRAC requires spending in advance to renovate and construct buildings at "receiving bases," as well as to prepare a closing facility for disposal. In the same way, a major civilian space consolidation would require upfront investment to allow "receiving buildings" to accommodate increased utilization and to dispose of unneeded properties. Despite the potential payoff, the funding for such investment has been lacking.

[dd] For a summary of the issue, see, for example, Michael O'Hanlon, "Bringing BRAC Back: Why Congress Needs to Get on Board with the Pentagon," *The National Interest*, September 1, 2015, http://www.nationalinterest.org/feature/bringing-brac-back-why-congress-needs-get-board-the-pentagon-13746.

4.3 Recommendations

1. *DOE should make reducing the Federal real estate footprint an explicit part of its strategy for improving Federal energy performance*. Although OMB closely tracks and the Federal Energy Management Program (FEMP) works actively to reduce agencies' facility energy intensity, there is no acknowledgement in an energy context of the value of a reduction in the facility footprint itself. As a first step, in speeches and other communications, DOE and other administration officials should recognize the connection between a smaller Federal facility footprint and improved Federal energy performance. OMB and GSA already track space utilization, and agencies have goals for increased utilization as part of the "Reduce the Footprint" initiative. However, that initiative tends to be a low priority for many in government, and Congress is downright hostile to BRAC proposals. By contrast, efforts to improve Federal energy performance enjoy broad support. By "connecting the dots" between the two sets of initiatives, DOE can reinforce the value of efforts to improve space utilization and reduce the Federal facility footprint.

2. *DOE should lead by example by reducing its own real estate footprint*. One opportunity for DOE to lead by example is the planned move of DOE's headquarters from the Forrestal Building, which GSA plans to dispose of through a sale or exchange of the property, to another location. DOE should adopt an aggressive goal for space utilization in the new facility, in part by relying more on open offices and shared space where appropriate. (The Advanced Research Projects Agency-Energy's offices, located in leased space near Forrestal, are a model in this regard.) DOE should work with GSA to identify other opportunities to reduce its real estate footprint outside of Washington, D.C. In keeping with the first recommendation, DOE should publicize its actions and challenge other agencies to do the same in the name of improved Federal energy performance.

3. *DOE should work with GSA to develop a "Space Savings Performance Contract," modeled after the energy savings performance contract (ESPC), which uses the potential savings from space consolidation to pay for the upfront investment required to achieve those savings*. Under an ESPC, an energy service company (ESCO) pays the upfront cost of an energy conservation measure in a Federal facility, and the ESCO is then repaid with the resulting utility savings to the Federal Government. Similarly, if a private developer were to front the cost of making a Federal facility more space efficient, the facility could accommodate Federal tenants that are now in leased space, and the developer could be repaid from savings to the government in the form of reduced leasing costs.

   GSA and DOD are both making it a priority to move Federal agencies out of (more expensive) leased space and into (less expensive) Federal space. However, because this typically requires capital investment in the "receiving" building, Federal funding is a major constraint. If GSA and DOD could take advantage of private investment through a "space-savings performance contract," modeled after an ESPC, they could pursue this priority effort far more aggressively. Importantly, when GSA invests in making a Federal

facility more space efficient, it does so in a way that significantly enhances the facility's energy efficiency. Thus, a space-savings performance contract would be important in its own right as a tool for achieving large-scale improvements in the energy efficiency of Federal facilities.

GSA believes it has the legislative authority to pursue this strategy if OMB blesses it. The key issue is budget scoring. In the case of ESPCs, where Federal agencies had the legal authority to engage in energy performance contracting, OMB issued a pair of memoranda that clarified that such contracting was consistent with budget scoring rules (Appendix B of Circular A-11). A similar approach might be called for here.

FEMP should work with GSA to try to develop an approach to this idea that OMB would be comfortable with in terms of budget scoring. One approach might be to try the idea out on a pilot basis, using a highly visible facility, such as the Department of Agriculture's headquarters, where there are large potential gains from improved space utilization as well as increased energy efficiency.

SECTION 5: Federal Renewable Energy Procurement

RECOMMENDATION: Improve Federal procurement of renewable energy.

5.1 Background

The Federal Government will need to make significant strides to achieve the goals for renewable energy set out in Executive Order (E.O.) 13693. By 2025, Federal agencies must procure or produce at least 30 percent of all building electric energy consumed from renewable sources, compared to just 8.8 percent in 2014, and at least 25 percent of *all* energy consumed in Federal buildings (thermal as well as electric) must come from renewable and alternative sources. Although Federal agencies can simply purchase renewable energy credits (RECs) through the rapidly expanding commercial market for green power, the Administration encourages agencies to develop new capacity, and renewable power that is produced and consumed on-site counts extra toward Federal goals.

Federal efforts to produce and procure renewable energy are driven by overlapping sets of pressures. In addition to their desire to meet environmental goals, as embodied in E.O. 13693, agencies are increasingly pursuing renewable energy as a way to reduce their facility energy costs. A third rationale for (on-site) renewable energy development is to improve the energy security of Federal facilities that are considered vulnerable to disruptions to the commercial electric grid.

Energy security has been a particular concern for the Department of Defense (DOD), which in 2012 announced that each of the three military departments would produce or procure 1 gigawatt (GW) of renewable energy capacity by 2020 (Navy) or 2025 (Army and Air Force). Military bases are almost entirely dependent on the commercial grid, and many bases are located at or near the end of transmission lines, where the risk of outages is especially high. On-site generation, when combined with a microgrid, storage capacity, and upgrades to the local distribution system, can enhance energy security by allowing a base to “island” critical functions during a grid outage.

To meet their needs, Federal agencies need access to third-party (private) financing through contracting tools such as a power purchase agreement (PPA), which is commonly used in the private sector to support the development of new energy systems. With a PPA, a developer installs a system to supply power to a facility in exchange for an agreement from the customer to buy a specified amount of the power generated by the system at an established price over a specific time period. This contractual commitment from a creditworthy customer allows the developer to finance the project.

The Department of Energy’s (DOE’s) Federal Energy Management Program (FEMP) has long urged Federal agencies to take advantage of PPAs to meet their renewable energy needs. First and most importantly, a PPA gives a Federal agency access to renewable energy with no upfront

capital costs: the agency pays for the energy on an annual basis (i.e., using current year–appropriated funds) after the project is constructed and to the extent that the system produces energy. Second, the agency is spared any responsibility for operation and maintenance of the system, and it has no decommissioning costs. Third, a PPA gives an agency the certainty of a known, long-term energy price. Finally, because that price reflects Federal and state incentives for renewable energy development (e.g., the investment tax credit for solar, the production tax credit for wind, plus accelerated depreciation), PPAs allow Federal agencies to take advantage of substantial tax benefits that they are not eligible to receive directly.

Despite the benefits that PPAs provide, Federal agencies, both military and civilian, face significant impediments to their use. In 2012, when the military departments announced their renewable energy goals, the expectation was that PPAs would be their major contracting tool. Four years later, two other tools in the contracting toolkit (General Service Administration [GSA] area-wide contracts and Enhanced Use Leases) are proving to be as important, if not more important, than PPAs. The principal advantage of these alternative tools is that they can be executed more quickly and easily than PPAs, and they provide an option in states that prohibit third-party PPAs.

Civilian agencies face their own impediments to the use of PPAs. The key one is contract duration. In contrast to DOD, which can sign PPAs with terms of up to 30 years, civilian agencies must rely largely on GSA's utility contracting authority under Part 41 of the Federal Acquisition Regulation (FAR) System, which is limited to a 10-year term—less than what renewable energy developers typically need to make the economics of a deal workable.

Another contracting option available to civilian and military agencies alike is the Western Area Power Administration (WAPA) (see Section 6), which has the authority to facilitate long-term PPAs on a Federal agency's behalf. While the resources being procured can be external to the WAPA service territory, one limitation to the use of this authority is that the Federal loads being served must be located in WAPA's service territory.

As an additional obstacle to the acquisition of renewable energy using third-party financing, Federal agencies can no longer develop on-site renewable energy as part of an Energy Savings Performance Contract Energy Services Agreement (ESPC-ESA). The ESPC-ESA, a PPA-like arrangement, has been an important way for agencies to acquire on-site generation. However, because of a conflict between requirements imposed by the Office of Management and Budget (OMB) and the Internal Revenue Service (IRS), that contracting tool is currently unavailable to Federal agencies.

5.2 Discussion

Below, we examine how Federal agencies are acquiring renewable energy in the face of these and other impediments to PPAs and PPA-like arrangements. First, we look at the military's use of PPAs, the impediments to PPAs, and the two approaches being used in place of PPAs. Next, we describe several innovative PPAs recently awarded by GSA and consider their broader

implication. Finally, we look at the limitations on the use of two other contracting tools that should play a more important role than they do—the ESPC ESA and WAPA's PPA authority.

5.2.1 Department of Defense

Four years after the military departments announced their ambitious 1-GW goals, the Army and the Air Force are making steady progress toward achieving them, largely through the development of large-scale solar projects on military bases; the Navy, with 1.25 GW of off-site and on-site capacity in the procurement pipeline, will surpass its goal well ahead of schedule. The military services are using three main contracting tools, which we discuss, in turn, below.

5.2.1.1 Power Purchase Agreements: Section 2922a

Section 2922a of Title 10 of the U.S. Code gives the Secretary of a military department the authority to enter into PPAs with terms of up to 30 years "for the provision and operation of energy production facilities on real property under the Secretary's jurisdiction or on private property and the purchase of energy produced from such facilities." Section 2922a covers any type of energy, not just renewable. As discussed later, DOD interprets "provision" to mean the development of a new energy production facility but not the supply of an existing facility.

Since 2011, the military services have completed about 10 PPA transactions, and another 5 or so transactions are in the pipeline. Almost all of them use Section 2922a PPA authority.[ee]

Most Section 2922a deals involve the installation of *on-site* renewable energy facilities. For example, in 2014, the Army awarded a 20-year PPA to ReEnergy Holdings, which will supply 100 percent of the electricity requirements for Fort Drum, New York, from a 60-megawatt (MW) biomass power plant located on the base. As part of the contract, ReEnergy will link the plant to two substations on Fort Drum so that the base can maintain mission-critical functions if a grid outage occurs. At Redstone Arsenal, Alabama, the Army has announced its intent to award a 25-year PPA to SunPower. Under the proposed agreement, the Army will procure 18,000-MW-hours a year of on-site, solar-generated electricity at a price equal to or less than what it pays for power from the grid.

The services have also used Section 2922a authority to develop *off-site* power, which is wheeled through transmission lines to one or more bases. The Navy has made the greatest use of off-site PPAs, because its electric load is often concentrated in locations (seaports) that lack the land needed for on-site renewable energy generation.

Finally, the Army recently signed a Section 2922a PPA for a *hybrid* on-site and off-site project at Fort Hood, Texas, that could become a model for other PPAs. Under the 28-year agreement, Apex Clean Energy will provide 15 MW of on-site solar and 50 MW of off-site wind power. The on-site system, 63,000 solar panels covering 132 acres, will increase the base's energy resilience, and the off-site facility will strengthen the economic viability of the project. (The transaction

[ee] The military services have made some use of WAPA's PPA authority as well. We discuss that authority below under "Other Contracting Tools."

also includes conventional, market-procured generation.) The 65 MW of renewable capacity will supply nearly half of Fort Hood's energy needs, and the Army estimates that it will pay $168 million less over the life of the contract than it would have paid for traditional power—a savings of 25 percent.

5.2.1.2 Impediments to the Use of 10 U.S.C. 2922a

Although Section 2922a remains an important tool, the services are making less use of it than anticipated. There are three key impediments to greater use of Section 2922a.

One major impediment is *state regulation*. PPAs between a customer and a third-party (private) owner of a renewable electricity system are not legally recognized in many states and utility services territories, and they are specifically disallowed in several states.[97, ff] While several commentators have urged DOD to ignore outright state restrictions on PPAs, Federal preemption is seen as a "nuclear" option.[gg]

A second impediment to the use of Section 2922a is *DOD's complex contracting process*, which requires the use of both the FAR and the Defense FAR Supplement, (DFARS). The defense procurement process is cumbersome under the best of circumstances. In the case of PPAs, it is even more complex, because the FAR and the DFARS are not designed for long-term commercial energy transactions.

If a Section 2922a project is to be built on a military base (as most are), the contracting process becomes even more complex because of the need to supplement the energy services agreement with a real estate agreement that addresses security (site access) and environmental issues. This requirement adds organizational complexity as well, because the military service's acquisition and real estate offices—two groups that rarely interact—must collaborate. Whether the project is on-site or off-site, Section 2922a contracts must go to the Office of the Secretary of Defense for final approval, which adds yet more oversight.

The complexity of the procurement process in part reflects the perceived risk entailed in long-term PPAs. A major sticking point has involved "assignment rights," referring to the ability of the private owner to transfer ownership of the facility to another party. There is a natural tension

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[ff] Three States—North Carolina, South Carolina, and Florida—each of which has a large military presence, prohibit third-party solar PPAs. See Keith McAllister, *Barriers to Military Installations Utilizing Distributed Generation from Renewable Energy Resources: Third Party Power Purchase Agreements* (Raleigh, NC: Department of Energy, Southeast Clean Energy Application Center, 2011), http://southeastchptap.rlmartin.com/Data/Sites/4/documents/policy/3rd_Party_PPA_Whitepaper_20110518.pdf. Until recently, Georgia, which has a major military presence, also had such a prohibition, and it currently allows only residential and extremely small commercial PPAs.

[gg] For a statement of the case for Federal preemption, see Reed Smith, "The Policy Context for Military Renewables: Rethinking State Regulatory Issues," in *Renewable Energy for Military Installations: 2014 Industry Review* (Washington, DC: American Council on Renewable Energy, 2014), 7–11, http://www.acore.org/renewable-energy-for-military-installations. Although, as a legal matter, DOD can preempt state utility laws under certain circumstances, as a practical matter, it rarely does so. In addition to the fact that the military must work hand-in-glove with states, contractors, who deal with state regulators on a day-to-day basis, are reluctant to challenge their authority. Finally, such challenges generally result in litigation, which delays project completion.

between the military's desire to limit those rights for security and other reasons and the private parties' desire to organize and operate the business in a standard commercial manner.[98, hh] Although these differences can be resolved, they add time and effort to an already complex process.

A third impediment to the use of Section 2922a is *statutory limitations*—particularly, the limitation on where projects can be located. DOD lawyers read the statute to mean that the Secretary of a military department can site a project only on land under the jurisdiction of *that Secretary* (or on private land). Thus, the Navy can put a Section 2922a project on a Navy base but not on an Air Force or an Army base. Although some in the industry dispute DOD's statutory interpretation, the military can get around that particular limitation using land transfer authority. The bigger statutory impediment, which no one disputes, is the exclusion of other non-private land from the scope of Section 2922a, including land controlled by another Federal agency, land owned by a state or local government, or land held in trust for an Indian tribe. For example, most National Guard facilities would be off-limits for a Section 2922a project because they are State-owned.

Some in the industry also dispute DOD's interpretation of Section 2922a as being limited to the development of new energy facilities. Industry representatives maintain that the statutory language encompasses existing as well as new facilities, and that this more expansive interpretation is consistent with the aim of the statute to promote renewable energy. DOD counters in part that an existing facility, having already been financed, does not require a long-term government commitment. Although an analysis of the competing arguments is outside the scope of this report, we note that DOD's narrower interpretation is consistent with Administration policy, which states a preference for the use of PPAs to support new facilities rather than to contract for power from existing facilities.

5.2.2 GSA Area-wide Contract with Section 2668 Easement

In an effort to reduce the time it takes to acquire renewable energy through a Section 2922a PPA, the Army is employing an alternative contracting approach that relies on GSA's area-wide contracting (AWC), a standing, 10-year agreement that GSA negotiates with all regulated public utilities so that a Federal agency can order electricity or natural gas from its local utility at pre-approved rates. With this approach, the Army provides the local utility with a long-term, sole-source easement to land on a base under Section 2668 of Title 10, and the utility builds and operates a renewable facility on the base, the power from which flows to the grid (typically via a

[hh] The assignment of rights is normal under the FAR for purposes of financing, but in the energy sector, it is not uncommon for the contractor to create a special purpose entity to own and operate the energy production facility and provide the power. This practice runs counter to the government's expectation that it will deal with the entity it contracted with, not a substitute. The tension over assignment rights is most pronounced in two areas: financial risk to the government and access to military bases. With respect to the latter, for security reasons, DOD insists on having unquestioned control over who can come on the base. It also has an interest in who owns and manages the company, providing it is an energy production facility, if foreign control is involved.

substation on the base). The Army then buys power from the grid at preapproved rates, unaffected by the renewable energy facility, under the existing AWC.

The Army and GSA first used this approach in 2014 at Fort Huachuca, Arizona, to allow Tucson Electric Power (TEP), the regulated utility, to develop a 17-MW solar photovoltaics (PV) project on a 68-acre parcel of land on the base. (TEP selected E.ON to design and build the project but TEP will own, operate, and maintain it.) The Army provided a 30-year easement to the land, and the Army and TEP agreed on the terms of an "exhibit" to the GSA AWC. The transaction was completed in a matter of months—far less than the time required for a typical Section 2922a deal.

Based on its success at Fort Huachuca, the Army used the same approach to develop a 30-MW solar PV project at each of three bases in Georgia (Forts Stewart, Gordon, and Benning). Known collectively as "Georgia 3X30," the three projects will all be owned and operated by Georgia Power, a regulated public utility and a subsidiary of the Southern Company. The projects, which represent 18 percent of the energy that the Army consumes in Georgia, are scheduled to begin delivering power to the grid by the end of the 2016.

5.2.3 Criticism of the Approach

The Army/GSA AWC approach uses the same basic mechanism as a PPA to develop renewable energy capacity: the solar installer fronts the cost of the installation, which is then paid down through the electricity it generates. The key difference is that the installer is the regulated utility as opposed to a commercial renewable energy developer. The AWC/easement approach differs from a PPA in another way. Whereas with an on-site PPA, the customer buys and consumes the power generated by the renewable facility, with the AWC/easement approach, the renewable energy flows to the grid, and the military customer buys generic power from the grid.

Not surprisingly, some renewable energy developers have criticized the Army's use of AWCs to acquire renewable energy, because they see it as helping to bolster local utility monopolies rather than spurring competition. They note that DOD pays higher prices for energy under this approach because private developers, who may be able to more efficiently monetize the tax benefits available for renewable energy development, are not permitted to compete. Renewable energy developers also point out that, in its role as a "general contractor," the local utility subcontracts the construction and operation of the facility through a process that may lack transparency and competition—the hallmarks of a government-run process.

Although there is some merit to these concerns, the military cannot be expected to ignore the advantages of working with local utilities. For example, as the local utility, TEP was uniquely positioned to streamline the interconnection process through the TEP-owned Fort Huachuca substation, thus reducing interconnection costs and improving system reliability. More broadly, the TEP and Georgia Power projects reflect a shift in the energy sector: many electric utilities are embracing renewable energy, in response to the carrot of commercial opportunities as well as the stick of state Renewable Portfolio Standard (RPS) requirements.[99] Precisely because utilities are

now challenging renewable energy firms for the development segment of the value chain, developers' criticisms need to be viewed in part as a reflection of commercial competition.

5.2.4 Enhanced Use Leasing (Section 2667)

In an approach somewhat similar to the Army's, the Navy and the Air Force are employing their long-term leasing authority under Section 2667 of Title 10 to develop renewable energy. Known informally as Enhanced Use Leases (EULs), this authority allows a military service to make "non-excess" base property available in exchange for cash or in-kind consideration at or above market value. The services view EULs as a way to generate revenue from under-utilized assets—typically, outlying land that they want to retain as a buffer.

As a tool for energy generation, EULs differ from the AWC/easement approach in two ways. First, the developer must be selected competitively; thus, in most states, the military service is not limited to working with the local utility. Second, the military base does not need to purchase power from the on-site energy developer—in fact, it cannot do so, as part of the EUL. (With an AWC, even though the Army is not consuming the electrons generated on-site, it must buy power from the local utility.) Some commercial developers shun EULs because they must secure an off-taker for the power, and creditworthy, long-term renewable energy off-takers are hard to find. As a result, many of the military's EULs rely on the local utility as the developer.

The Navy has 500 MW of EUL projects—which it describes as "on-base generation for off-base consumption"—in the pipeline. For example, Georgia Power is developing 86 MW of solar PV on four Navy and Marine Corps bases in Georgia, and sister subsidiaries of Southern Company are building solar projects on bases in Florida and Mississippi.

For the Air Force, which has long taken advantage of Section 2667 for non-energy projects, the authority is proving useful for renewable energy development. A typical Air Force EUL project is the 10-MW solar array that Arizona Public Service is building on Luke Air Force Base, outside of Phoenix, under a 30-year lease for which the Air Force will receive a total of $5 million in rent. The Air Force recently executed a 40-year EUL for a 10-MW solar project on a landfill at Joint Base McGuire, Dix, Lakehurst; the developer Starwood Energy-EMI will sell the power to a utility off-taker, and the Air Force will receive rent.

5.2.5 AWCs, EULs, and Energy Security

Although the power generated under both EUL and AWC projects flows to the grid, the projects nevertheless contribute to the (future) energy security of a base. This is because, with either approach, the military services now routinely arrange to have the power from the on-site renewable facility diverted to the base in the event of a grid outage. When combined with the necessary investments and technology, the ability to access an on-site renewable energy facility directly will allow a base to island critical functions during such an outage.

Toward that end, as in-kind consideration for a EUL, the Navy is getting upgrades to the base's electrical distribution system. These upgrades, when combined with power storage and a

microgrid, will enable the Navy base to island key functions. The Army and the Air Force cite energy security as a rationale for on-site generation, and both services emphasize that they are making their projects "microgrid-ready" (although it is not always clear what that means). However, the Navy is alone in devoting resources (in the form of in-kind consideration for EULs) to the necessary upgrades.

5.2.6 GSA's Innovative PPA Awards

Although civilian Federal agencies can enter into PPAs, the main tool available to them to do so is GSA's Part 41 authority, which is limited to 10 years. Renewable energy developers and their financiers typically insist on a longer-term (at least 15–20 years) contract to make the economics of a power deal workable and to more closely reflect the useful life of a wind turbine or solar array. As a result, GSA and other civilian agencies have made only limited use of their Part 41 PPA authority, and they have expressed a strong desire for the 30-year authority that DOD has.

Recently, however, GSA awarded three PPAs for off-site renewable energy projects that broke new ground. All three projects are in the PJM grid (the power will be wheeled to Federal facilities in PJM's territory). For two of the projects—a 140-MW wind farm in Bureau County, Illinois, and a 6-MW solar farm on Maryland's Eastern Shore—the developers agreed to a simple 10-year term. The third project, for a 75-MW solar farm in Somerset County, Maryland, is based on a PPA that includes only a 10-year term and a "true" option for an additional 10 years. With a "true" option, there is no assumption that the option will be exercised and no penalty if the customer (GSA) does not exercise the option.

In another ground-breaking move, GSA awarded two "10+10" PPAs for *on-site* renewable energy—one with SolarCity Corporation for the installation of solar PV on nine Federal facilities in Northern California and Nevada, and the other with WGL for the installation of rooftop solar on 18 buildings housing Federal and quasi-Federal agencies in Washington, D.C.[ii] Under the "10+10" structure, the PPA has a 10-year term and a conventional ("non-true") 10-year option—i.e., GSA must pay a penalty if it does not exercise the option to renew the PPA.

Although GSA broke new ground with these PPAs, all five projects boast extremely strong market conditions and thus may not be typical of what GSA can negotiate elsewhere. The off-site projects are located in a highly competitive and transparent market (PJM) in which renewable energy credits (RECs) sell at a premium. Thus, even if GSA fails to extend the contracts, the developers should be able to find other off-takers. Similarly, the on-site projects are located in two markets (Washington, D.C., and California) where the price of conventional utility power (and solar carve-out RECs in the case of Washington, D.C.) is sufficiently high to make the economics work on a shorter-term project. (Presumably, the on-site PPAs carry a penalty because the equipment is on Federal property and will have to be removed if the option is not exercised. With an off-site PPA, equipment removal is not an issue.)

[ii] The PPA with SolarCity resulted from an aggregated procurement that GSA did in partnership with DOE, the Environmental Protection Agency (EPA), and the U.S. Forest Service.

In short, market conditions in many parts of the country probably would not make it economically feasible to have a PPA based on a 10-year term, or any kind of "10+10" arrangement. For that reason, GSA and other civilian agencies will continue to want the authority to enter into longer-term PPAs.

5.2.7 Other Contracting Tools

Below we briefly examine two other tools for acquiring renewable energy that could potentially play a more important role in helping Federal agencies reach their renewable energy goals.

5.2.8 ESPC Energy Sales Agreement

An ESPC ESA is a PPA-like arrangement that allows a Federal agency to support the installation of a renewable energy system as part of an ESPC. Because the term of an ESA can go out to 25 years—the maximum length of an ESPC—ESAs have been a valuable tool for agencies seeking to expand their access to on-site renewable power.[jj]

However, in 2012, OMB specified that, for an ESPC that includes an on-site energy source to be scored on an annual basis, the Federal agency "must retain title to the installed capital goods at the conclusion of the contract."[kk] This created a dilemma for energy service companies (ESCOs), who must own the equipment in order to claim the investment tax credit and other tax incentives.

DOE is actively exploring ways to meet OMB's concerns without jeopardizing ESCOs' ability to comply with IRS requirements to claim the investment tax credit. (On February 2, 2016, DOE issued a Request for Comments seeking input from stakeholders on one possible approach to address these issues.) For the time being, however, the use of ESPC ESAs has come to a halt.

5.2.9 WAPA PPA Authority

WAPA is a Federal power marketing administration (PMA) that markets and transmits hydroelectric power in 15 states in the central and western United States (see Section 6). Using its power marketing authority and the authority of the Economy Act, WAPA can facilitate long-term PPAs on behalf of Federal agencies for projects in its service territory. Specifically, WAPA signs a long-term PPA with a private renewable energy developer and concurrently enters into an interagency agreement with the agency that will use and ultimately pay for the power. WAPA requires a binding commitment from the agency that it will be able to cover the payments over the life of the contract.

WAPA's authority covers renewable energy (and renewable energy credits) generated on Federal sites as well as off-site generation that is wheeled to a Federal site, as long as all activities, with the exception of energy generation, take place in WAPA's 15-state service territory. The

[jj] The utility energy service contract (UESC) has also been a valuable tool for the procurement of renewable energy. We exclude UESCs from this discussion, however, because Federal agencies do not face impediments to using them to acquire renewable energy as they do with ESPCs.

[kk] OMB Memorandum M-12-21, "Addendum to OMB Memorandum M-98-13 on Federal Use of Energy Savings Performance Contracts (ESPCs) and Utility Energy Service Contracts (UESCs)," September 28, 2012.

geographic restrictions represent the most significant limitation on WAPA's authority. In addition, in a state with a regulated utility market, WAPA must have the cooperation of the utility that provides power to the Federal site. Currently, WAPA is the only PMA that provides this service.

DOD has made use of WAPA's PPA authority in addition to its own (Section 2922a). Recently, the Navy executed an interagency agreement with WAPA, and WAPA contracted with Sempra U.S. Gas & Power to purchase power generated at a 150-MW solar project in Arizona.[ll] The power will be wheeled to 14 Navy and Marine Corps bases in California.

5.3 Recommendations

The Administration has not asked Congress for the longer-term PPA authority that civilian agencies desire, nor has it sought to clarify or expand the statutory language in Section 2922a regarding where energy facilities can be sited. Presumably, the reason is the prospect of adverse scoring by the Congressional Budget Office (CBO)[mm] (see Section 3). Consistent with the Administration's desire to avoid having CBO score any proposed legislation regarding PPAs, the recommendations below are limited to changes that do not require legislation.

1. *DOE should make it a high priority to resolve the industry uncertainty regarding OMB and IRS requirements that has effectively eliminated the ESPC ESA as a contracting tool for renewable energy projects.*

   Federal agencies are relying heavily on ESPCs to improve the energy performance of their facilities, both because they lack the resources to fund such improvements directly and because the Administration has issued ambitious goals for energy performance contracting. Agencies need the ability to contract for renewable energy as part of the ESPC process.

   Although FEMP is working actively to resolve the apparent conflict between OMB and IRS requirements, key players outside of DOE are not treating it as a priority. DOE should elevate this issue internally, and within the White House and OMB, in an effort to resolve it within the next few months.

2. *FEMP and the National Renewable Energy Laboratory (NREL) should identify opportunities to use the Fort Huachuca/Georgia 3X30 model for renewable energy*

[ll] Sempra U.S. Gas & Power is an unregulated subsidiary of Sempra Energy, an energy services holding company. Other subsidiaries of Sempra Energy include the regulated utilities San Diego Gas & Electric Company and Southern California Gas Company.

[mm] In 2009, the Senate proposed to allow civilian agencies (1) to enter into renewable energy PPAs for terms of up to 30 years and (2) to use ESPCs for a variety of new purposes. CBO estimated that the proposed changes to long-term contracting authority would add $2.0–$2.5 billion in direct spending over 10 years (2010–2019). CBO argued that using PPAs and ESPCs to finance facilities intended to produce electricity for Federal consumption is equivalent to exercising borrowing authority, and that, consistent with government-wide accounting principles, the budget should record those commitments as new obligations at the time the government enters into the contracts. See CBO's cost estimate for S.1462, the American Clean Energy Leadership Act of 2009, as reported by the Senate Committee on Energy and Natural Resources, September 30, 2009, https://www.cbo.gov/publication/41330.

development on other Federal campuses (including other military bases). DOE should work with OMB to set a concrete goal for the number of such transactions the Federal Government will award by the end of 2016, 2017, and 2018.

FEMP has been focusing on large campus energy management, recognizing that most Federal energy use occurs on campuses. DOD accounts for about half of the top 450 Federal campuses as measured by energy use, followed by Veterans Affairs (107), DOE (27), Department of Justice (26), and GSA and NASA (10 each). With an emphasis on the campuses that consume the most energy, FEMP has been looking at opportunities for renewable energy development, using (among other things) NREL's Renewable Energy Optimization platform.

To complement this effort, FEMP and NREL should identify those campuses and military bases that are best suited to the use of the Fort Huachuca/Georgia 3X30 contracting tool (see above), which DOD's experience suggests is an expedient way to deploy large-scale, on-site renewable energy capacity. While the amount of energy that a campus consumes (FEMP's current focus) can be a secondary consideration in choosing sites, the primary consideration should be the relative suitability of alternative sites for this demonstrated contracting approach. Factors include whether the campus/base is covered by an AWC, state RPS requirements, proximity to transmission lines, and the cost of needed upgrades to the transmission or distribution infrastructure.

Because such a transaction can be completed in a matter of months, not years, DOE should work with OMB to set a concrete target for the number of transactions that the Federal Government will award by the end of 2016, 2017, and 2018.

3. *DOE should explore the potential for other PMAs to play the same valuable role in renewable energy that WAPA plays.*

   WAPA is the only PMA that purchases renewable energy resources on behalf of Federal agencies. Although each PMA has its own organic statute, it seems quite possible that other PMAs have the equivalent authority even though they are not currently exercising it.

   DOE's General Counsel should examine the organic statutes of the other PMAs (Bonneville Power Administration, Southwest Power Administration, and Southeast Power Administration) to determine whether their broad authorities, like WAPA's, cover the purchase of renewable energy resources on behalf of Federal agencies in their respective service territories. If so, FEMP should provide financial support, as it does with WAPA, to encourage such activities.

4. *FEMP should work with DOD to explore incorporating standard clauses into the DFARS so that the parties to a PPA negotiation can focus on the material issues. FEMP should consider doing something similar for the FAR.*

The defense contracting process is a major barrier to the use of Section 2922a PPAs. If the process were less complex and time-consuming, the military services would find more opportunities to use it, and the services might receive more attractive PPA prices in the end. Although civilian agencies have made little use of their PPA authority for other reasons, the FAR creates challenges for them as well.

DOD has taken steps to improve its process. The Services are relying increasingly on the Defense Logistics Agency (DLA), which does centralized acquisition of fuel and other commercial commodities, to negotiate their Section 2922a contracts. DLA strives for uniformity across transactions (the fact that each service has a different approach creates a challenge for industry). Moreover, DLA considers energy purchased under Section 2922a to be a commercial item, which allows for more flexibility in the process. In addition, several DOD offices have drafted standard language for a Section 2922a contract, based in part on input from industry. Most significant, the Office of the Secretary of Defense provided a draft template to DLA and the services, and it pre-cleared any Section 2922a contracts insofar as the final document relies on the language in the template.

FEMP should work with DOD to explore the utility of incorporating various standard clauses, most of which are not unique to PPAs, into the DFARS. These clauses deal with such issues as environmental protection, insurance, security, and land access. Arguably, including these clauses in the DFARS would allow the parties to focus on the material issues in a transaction such as the financing. If appropriate, FEMP should lead a parallel effort aimed at the FAR.

SECTION 6: The Federal Power Marketing Administrations

RECOMMENDATION: Increase the role of the Federal Power Marketing Administrations in renewable energy deployment and transmission development.

6.1 Background

The Federal Power Marketing Administrations (PMAs), an arm of the Department of Energy (DOE), market and deliver electricity generated at federally owned and operated hydropower facilities[nn] primarily to "preference customers"—municipally owned electric utilities and rural electric cooperatives—"at the lowest possible rates to consumers consistent with sound business practices."[oo] Rates to preference customers generally are set to recover operating costs plus an amount to repay the Federal Government's investment in the hydropower dams. Though not always the case, PMA power rates are normally lower than wholesale market electric rates. The Federal Government first assumed a role in marketing power to preference customers in 1906 when President Theodore Roosevelt signed the Town Sites and Power Development Act.

As indicated in Figure 9, there are four PMAs within DOE:

1. The Bonneville Power Administration (BPA), which operates in the Pacific Northwest
2. The Western Area Power Administration (WAPA), which serves parts of 15 states in the West, Midwest, and Texas
3. The Southwestern Power Administration (SWPA), which serves parts of six states in the Mid-South
4. The Southeastern Power Administration (SEPA), which markets hydropower to customers in parts of 10 southeastern states.

[nn] These hydropower facilities are run by the Army Corp of Engineers, Bureau of Reclamation and International Boundary and Water Commission.

[oo] See e.g., The Flood Control Act of 1944, 16 U.S.C. 825s.

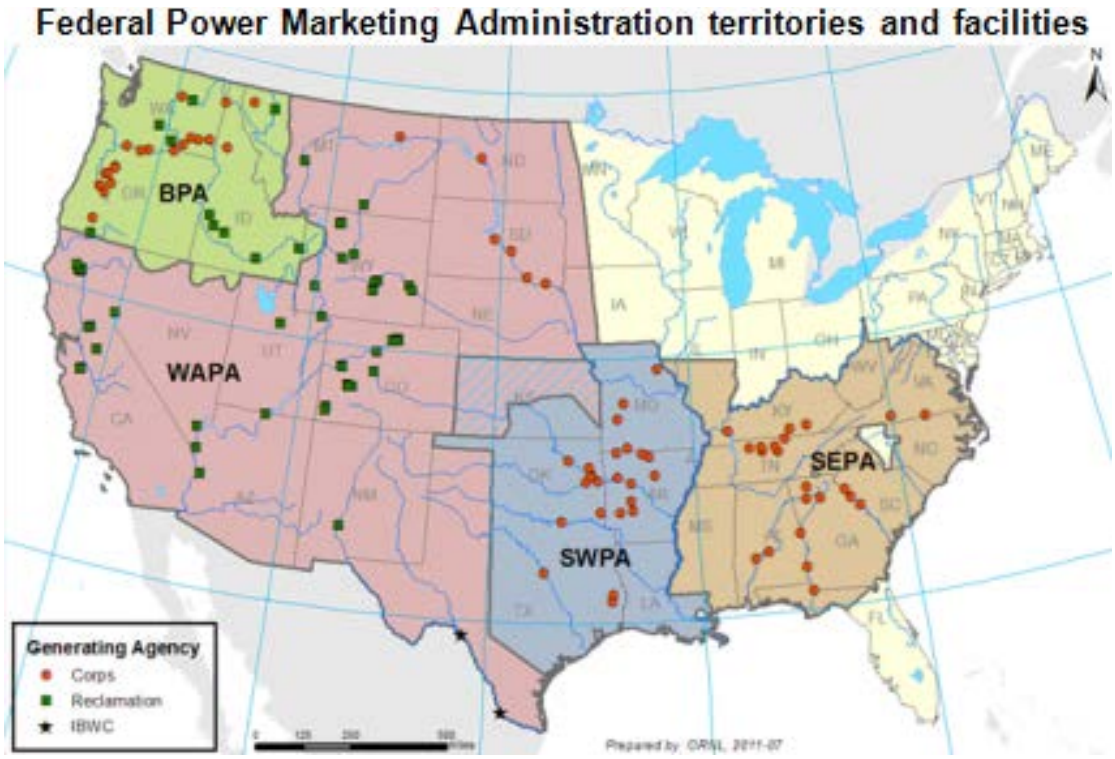


Figure 9. Federal PMAs[100]

Each PMA operates pursuant to a different enabling statute. BPA, for instance, has an obligation to meet the full power needs of the preference customers in its region unless the customers choose to self-supply (generate and/or purchase) some or all of their requirements.[101] That compels BPA to acquire additional resources to meet the demand placed on its system in excess of the hydropower output in the region. The other PMAs are only obligated to market to their preference customers the amount of power expected to be generated from the Federal hydropower facilities in their regions. These entities must only acquire additional resources when generation at the hydro projects falls below contractual commitments. In some cases, PMAs are able to sell excess hydropower (above the amount contractually obligated to the preference customers) at market prices.

All of the PMAs, except for SEPA, also own and operate high-voltage electric transmission facilities. BPA, for example, owns 75 percent of the high-voltage transmission system in the Pacific Northwest. WAPA owns and operates more than 17,000 circuit miles of high-voltage transmission in its service territory. As a result, the Federal Government, through WAPA and BPA, is the largest transmission owner in the western United States. Importantly, WAPA and SWPA also have authority to utilize third-party financing to upgrade existing transmission facilities,[102] and, under the 2009 American Recovery and Reinvestment Act, WAPA has borrowing authority to fund transmission projects to facilitate the development of renewable electric generation.[103] BPA has separate borrowing authority pursuant to which it can construct electric transmission in the Pacific Northwest.[104]

Through its ownership and management of the PMAs, the Federal Government sells electricity at wholesale in 30 states and operates transmission assets in 20 states, providing service to utility distribution systems covering approximately 42 percent of the continental United States.[pp] This makes DOE a significant participant in several electricity markets—most notably in the West.

Most of the provisions of Title II of the Federal Power Act—governing the sale and transmission of electric power—apply primarily to investor-owned utilities and subject them to significant Federal Energy Regulatory Commission (FERC) regulation. However, most rural electric cooperatives, as well as government-owned utilities—including the PMAs—are considered "non-jurisdictional" to FERC—i.e., they are not subject to FERC regulation. Section 211 of the Federal Power Act does, however, provide FERC with limited authority to prevent PMAs and other large, non-jurisdictional utilities from engaging in discriminatory conduct. FERC recently used this authority to prohibit BPA from curtailing wind power on its system without partially compensating wind-power generators.[105]

FERC also has imposed a "reciprocity" requirement on non-jurisdictional transmission providers, like BPA and WAPA. If they refuse to provide transmission service to generators in a manner consistent with FERC's open-access transmission rules imposed on jurisdictional utilities, then the non-jurisdictional utility is not entitled to non-discriminatory transmission service from jurisdictional utilities.[106] Reciprocity has not proven to be an effective tool for persuading non-jurisdictional utilities to voluntarily comply with FERC's open-access policies because other transmission-owning utilities are not in a position to discriminate against the PMAs, which are dominant market participants.

6.2 Discussion

PMA customers and the organizations that represent them have consistently opposed efforts to subject the PMAs to greater FERC oversight. They view the PMAs as existing mainly to serve the interests of the preference power customers—municipally owned electric utilities and rural electric cooperatives—and are concerned that they might lose control over the PMAs' missions and have reduced access to low-price power if FERC requires Federal utilities to operate under the same rules applicable to jurisdictional utilities.

PMA customers hold an equally wary view of DOE oversight of PMAs. Although each PMA technically reports to the Deputy Secretary of Energy, the customers and their allies in Congress have traditionally pushed back if they perceive DOE is interfering with PMA management.

In 2012, then Secretary of Energy Chu sent a memorandum to each of the PMA administrators directing that they take a series of actions, including the following:

- Upgrading their transmission infrastructure

[pp] The Tennessee Valley Authority, a much larger utility, is a government corporation run by an independent board but is not technically a Federal utility subject to governmental oversight.

- Instituting rate changes in order to promote energy efficiency, demand response, integration of variable resources, and electric vehicle deployment
- Improving collaboration with other transmission owners to enhance reliability
- Working with Congress to update the statutes pursuant to which the PMAs operate.[107]

Members of Congress, other stakeholders, and the PMAs themselves were essentially not briefed in advance of the issuance of the memorandum, thereby creating a strong negative reaction to both the process and substance of the memorandum and basically scuttling the initiative before it began.[108] To this day, the 2012 memo is a rallying cry that PMA customers and their congressional representatives employ to argue against DOE intervention in PMA policies and actions.

6.3 Recommendations

The Secretary of Energy should work with the PMAs to develop and build public support for a series of PMA initiatives that could help achieve several key energy policy goals, including:

- Enhancing electric grid reliability
- Diversifying the electric generation resource mix
- Expanding transmission capacity
- Helping utilities comply with the Clean Power Plan and state Renewable Portfolio Standards

These initiatives should also benefit the PMAs and their traditional customers by

1. More efficiently utilizing the transmission grid
2. Increasing access to lower-cost power that can be used to supplement the output of federally owned hydropower dams
3. Increasing economic development, especially in the rural areas served by the PMAs.

In order to assess these opportunities, related challenges, and potential next steps the Secretary of Energy and the PMAs should convene a series of stakeholder meetings.

Beyond helping to meet these broad-ranging goals, there are several specific initiatives outlined below that the PMAs could pursue to promote increased development of renewable electric generation, particularly in the western United States where the renewable resource potential is sizable but several barriers exist, including an inadequate transmission grid.

Pursuing these initiatives at this time makes sense for several reasons: the cost of renewable energy sources, like wind and solar, has dropped dramatically in the last few years, putting them more closely in line with fossil and hydropower generation; the need for new transmission capacity, especially in the West, has risen substantially; the mainstream business and finance community has embraced the deployment of renewables in an unprecedented fashion; and the

climate imperative looms large and, importantly, may cut the water available for hydropower generation at Federal dams.

At the same time, it will be critical for the PMAs and the Department to pursue this strategy in a coordinated and transparent fashion. As Secretary Chu experienced, emotions run deep among PMA customers, other stakeholders, Members of Congress representing the PMA regions, and other government officials. The Secretary and the PMA administrators must lay the groundwork with all interested parties, especially the northwest congressional delegation and state governors, and convince PMA customers and stakeholders that the actions contemplated will not adversely affect their electric rates or reliability of service and that, in fact, participation by PMAs in these initiatives can further advance economic development, cleaner air, lower rates, and better service.

Below are specific policies and actions that BPA and WAPA should consider pursuing to benefit renewable energy development, grid expansion, and electricity market coordination, especially in the West. SWPA and SEPA are probably each too small to have a sizable impact on broad-scale renewable energy development in the regions they serve, but they may be able to work with the private sector and DOE leadership to facilitate development and deployment of specific renewable energy and transmission projects.

6.3.1 Investment in Additional Transmission Capacity

The western U.S. is blessed with tremendous potential for additional solar, wind, and geothermal power development. One of the most significant barriers, however, is that some of the best renewable resources are located in remote areas far away from load. There are insufficient levels of available transmission capacity in parts of the region, particularly in the Southwest, and in some cases, access to low-cost private capital is problematic because cost allocation for large-scale transmission capacity is extremely difficult across multiple states.

The PMAs have substantial tools that can increase U.S. transmission capacity, and there can be cost and other advantages associated with transmission built by the PMAs. For instance, as Federal entities, PMAs have eminent domain authority and have access to low-cost capital. Section 1222 of the Energy Policy Act (EPAct) of 2005 authorizes the Secretary of Energy, acting through WAPA or SWPA, to "design, develop, construct, operate, maintain, or own….an electric power transmission facility and related facilities" needed to upgrade existing transmission facilities owned by SWPA or WAPA or in connection with new facilities located in any state in which SWPA or WAPA operates. BPA has similar transmission development authority under the Federal Columbia River Transmission System Act.[109]

Importantly, WAPA and SWPA also have authority to utilize third-party financing to upgrade transmission facilities,[110] and, under the 2009 American Recovery and Reinvestment Act, WAPA has borrowing authority to fund transmission projects to facilitate the development of

renewable electric generation.[111] BPA has separate borrowing authority pursuant to which it can construct electric transmission in the Pacific Northwest.[112, qq]

WAPA has developed and operates a vast percentage of the western U.S. electric grid and could do more. It should explore utilizing its range of authorities to improve its transmission system through upgrades of current facilities and construction of additional facilities to enable the increased flow of renewable electricity to major population centers, including Los Angeles, Las Vegas, Phoenix, and Denver.[113] BPA should also consider potential grid upgrades, including the construction of new transmission capacity in the Northwest to further enable renewable energy development pursuant to its transmission development authority under the Federal Columbia River Transmission System Act.[114]

PMA engagement in new transmission development and financing under existing authority is not always simple to achieve. Thus, WAPA took a step toward co-investing with others in transmission, but WAPA preference customers raised concerns that this would raise their rates unnecessarily.[rr] DOE recently utilized its PMA transmission development authority. Acting through SWPA, under Section 1222 of EPAct 2005, Energy Secretary Moniz announced a Record of Decision to participate in development of the Clean Line transmission project from Oklahoma-Tennessee to the southeastern United States.[115] However, an amendment was offered to a comprehensive Senate energy bill to prohibit use of eminent domain authority in these kinds of circumstances unless affected governors, public utility commissions, and tribes concur. The amendment was defeated 55–42.[116]

In light of these sorts of situations and as discussed above, DOE and the PMAs must use their transmission development authority in a coordinated and transparent fashion that both addresses preference customer concerns about electricity rates and considers landowner interests, while at the same time advancing national economic, security, and environmental interests in deploying clean, low-cost power.

6.3.2 Participation in Regional Markets/Coordination

Unlike much of the rest of the country, the West, outside of California, does not have any organized electricity markets with regional transmission organizations (RTOs). Organized markets tend to enable the integration of variable energy resources such as wind and solar more efficiently and cost-effectively. PMA preference customers and policymakers in the various PMA regions have, for the most part, opposed joining RTOs because of fear of loss of local control and concern that their preference power benefits would be diluted. Added to this resistance is FERC's lack of regulatory authority over major municipal and cooperative utilities in the region, as well as the PMAs. Thus, in the early 2000s, BPA was heavily involved in

[rr] H.R. 2915–112th Congress (2011–2012), "The American Taxpayer and Western Area Power Administration Customer Protection Act of 2011," was introduced to repeal the WAPA transmission borrowing authority. The legislation was not enacted but was considered at a hearing held by the U.S. House of Representatives, Subcommittee on Water and Power of the Committee on Natural Resources, on September 22, 2011.

discussions to form an RTO in the Northwest, but that effort failed after preference power customers and policymakers in the region strongly objected. Recently, however, the Upper Great Plains Region of WAPA joined the Southwest Power Pool (SPP) RTO. WAPA is to be commended for this step and should consider taking similar action with respect to its Western Interconnection facilities as well. Other PMAs should also examine the option of RTO participation.

In the near term, there is another—less comprehensive—regional initiative for which PMA participation could both be beneficial and achievable. PacifiCorp and the California Independent System Operator recently formed an Energy Imbalance Market (EIM) that balances electricity supply and demand in the areas served by the Independent System Operator and PacifiCorp by sharing generating resources and dispatching them on an economic basis. In addition to enhancing reliability and reducing the overall cost of electricity for participating customers, the EIM can dramatically reduce the costs of integrating intermittent resources, such as solar and wind, which are currently much higher in the West (outside of California) than in other regions with RTOs.[ss]

BPA had been developing an alternative approach to the EIM, along with investor- and municipal-owned utilities in the region, but those efforts recently stopped after several of the investor-owned utilities decided to join the EIM instead. BPA and those parts of WAPA outside SPP should consider participating in the EIM. Further, BPA, and WAPA with DOE technical and legal assistance, should explore with FERC how PMA participation in the EIM could be structured to minimize FERC regulation pursuant to the Federal Power Act in order to avoid strong opposition to EIM participation from PMA customers. There is every reason to believe FERC would be as accommodating as possible if it would attract BPA and WAPA into a large western EIM.

BPA and WAPA should also participate more closely with other regional utilities in the various transmission-planning processes occurring in the region in the aftermath of FERC Order No. 1000, which reforms FERC's electric transmission planning and cost allocation requirements for public utility transmission providers.[117] To date, BPA, in particular, has avoided engaging in an ongoing regional transmission process involving investor-owned utilities in the Northwest primarily for fear of being subject to Order No. 1000's transmission cost-allocation mechanisms.

6.3.3 Practices to Facilitate Renewable Energy Development

BPA and WAPA should also review their existing practices and identify further actions that the PMAs could take to promote renewable development without impairing their ability to satisfy

[ss] For instance, wind integration costs in the Electric Reliability Council of Texas (ERCOT) are approximately $0.50 per megawatt-hour (MWh). See Jurgen Weiss and Bruce Tsuchida, "Integrating Renewable Energy into the Electricity Grid: Case Studies Showing How System Operators Are Maintaining Reliability," The Brattle Group, on behalf of the Advanced Energy Economy Institute, June 2015, https://mseia.net/site/wp-content/uploads/2012/05/AEEI-Renewables-Grid-Integration-Case-Studies.pdf. BPA, on the other hand, has recently charged $5.70 per MWh for wind integration in in its control area.

their statutory responsibilities. All of the PMAs should maximize their acquisition of renewable energy when purchasing power to supplement their hydropower resources. BPA engages in the most significant level of non-hydro resource acquisitions, but even SWPA, SEPA, and WAPA are required to purchase power to make up for inadequate hydropower levels caused by droughts. Some of these purchases should come from renewable resources, particularly as these resources are increasingly cost competitive.

SECTION 7: Renewable Energy Development on Federal Lands

RECOMMENDATION: Address regulatory and program barriers to expanding renewable energy development on Federal lands.

7.1 Background

Executive Order 13693, "Planning for Federal Sustainability in the Next Decade," directs Federal agencies to lead efforts in achieving national greenhouse gas reductions and support preparations for the impacts of climate change.[118] As we search for additional renewable and alternative energy solutions, Federal lands and/or assets can be a significant factor in supporting clean energy deployment. To unlock the full potential of our public lands, the United States must accelerate and scale up renewable energy development on public lands but do so in a way that protects wildlife and ecosystems using an effective and efficient regulatory process. There is a long-standing system in place for the development of coal, oil, and natural gas on public lands—and millions of acres of Federal lands devoted to this purpose—but the approach to deploying renewables on Federal lands is very much a work in progress.

The Department of Energy (DOE) is well positioned to coordinate and help speed the deployment of renewables on Federal lands in an environmentally responsible way. Although the Secretary of the Interior has primary jurisdiction over both the public lands siting issues and the key wildlife-related regulatory issues associated with renewable energy projects, DOE can assist the Department of the Interior (DOI) in addressing the structural, ecological, and regulatory challenges to accomplishing these goals, including the following:

- Helping to lead a collaborative effort with agency managers, policymakers, wildlife experts, and lawyers to prioritize and directly address regulatory barriers to appropriately sited clean energy projects through pending Federal agency rulemakings under the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act
- Facilitating and sponsoring the latest research and science surrounding risk to species, effectiveness of wildlife impact mitigation, and technological advances in the clean energy industry
- Helping to bring together stakeholders to consider a more effective application of the National Environmental Policy Act (NEPA) to clean energy deployment on public lands.

7.2 Discussion

Since passage of the Energy Policy Act (EPAct) of 2005, Federal land management agencies have taken substantial steps to foster renewable energy development on public lands. Spurred by the EPAct's mandate to approve 10,000 megawatts (MW) of renewable energy on public lands by 2015, Federal agencies ramped up interagency efforts and resources to work through a

backlog of more than 400 renewable energy permit applications for development on public lands and met the goal 3 years early.

At the start of 2009, not one utility-scale solar project application had been approved. Today, 9,763 MW of solar energy have been permitted, 3,864 MW are under construction, and 1,559 MW of solar energy are active on Federal lands.[119] Much of this can be credited to improvements in the way DOI revamped its energy-permitting processes—including greater focus on interagency coordination, early stakeholder outreach, prioritization of engagement, and significantly increased resources dedicated to permits.[120] The Western Solar Energy Program is a hallmark of this effort, which included prioritizing development zones that had high solar resources and low environmental and other resources conflicts. Demonstrating the success more broadly, the Bureau of Land Management (BLM) has approved permits for more than 50 commercial-scale renewable projects on public lands, with a process timeline average that has decreased from 4 years to 1.5 years.[121]

Despite these gains, much more work is needed to accomplish actual construction of the approved projects and assure their delivery of the electricity to the grid, and to institutionalize these accelerated methods of producing more clean energy on Federal lands. For example, wind energy on public lands has not moved forward as substantially or quickly as solar. Since 2009, only 469 MW of approved wind projects have been developed and are operating on Federal lands.[122] A 1,000-MW project has been delayed for a number of reasons, including attempting to work through Bald and Golden Eagle Protection Act requirements. The project also faces difficulties in siting a major new transmission line,[123] a problem that limits new wind and solar development more generally. The strong recent focus on streamlined permitting and priority projects has slowed as resources have dwindled for Federal land management agencies. Wildlife concerns and permitting, particularly with respect to avian species, not only affect progress on wind energy, but are also starting to affect consideration of utility-scale solar energy projects as well.

7.2.1 Addressing Avian Impacts

Legal uncertainty about how best to address avian and other species impacts in the context of clean energy development is one of the more significant barriers to both conservation and energy development. The deployment of clean energy is associated with avian impacts and mortality for a range of species under the protection of the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act, as well as avian and other species under the Endangered Species Act.[124] Many of these impacts and population-level risks are still not well understood, in light of significant deficits in biological data and research surrounding risk assessment and effective mitigation measures needed to address harm.[125] Statutory and regulatory frameworks established decades ago have not kept pace with our modern industrial society. Specifically, in the case of the Migratory Bird Treaty Act, enacted almost a century ago, the strict liability "taking" prohibition is in desperate need of clarification.[126] Recently, two companies have been prosecuted for impacts to avian species resulting from wind facilities.[127, 128] Yet, at the same

time, only one eagle take permit has been issued to a wind farm, and guidance for solar projects is virtually nonexistent. Natural gas, hydropower, and other forms of clean energy development face similar challenges.

Until an updated and more effective regulatory and enforcement framework is established to clearly and predictably lay out in advance the process and parameters for assessing and approving authorizations for takings, a strong disincentive to new clean energy development on Federal lands will persist, and a majority of currently operating wind and solar projects will remain under a cloud of legal risk that may jeopardize ongoing energy production.

This is a critical juncture for renewable energy and wildlife policy. The Fish and Wildlife Service (FWS) is currently examining rulemaking options for authorizing incidental take and providing compliance assurance under both the Migratory Bird Treaty Act[129] and the Bald and Golden Eagle Protection Act.[130] Both clean energy industry advocates and conservation organizations have called on DOI and FWS, which are responsible for implementing both statutes, for much needed changes and workable solutions through these rulemakings, as well as advocating for priority research for moving forward with renewable energy development that appropriately avoids, minimizes, and mitigates for impacts to migratory birds and other wildlife. Additional engagement is needed to ensure that FWS and other partner agencies sustain the needed support—in terms of funding, staff, and broad stakeholder consultation and engagement—to set up a framework that will address the complexity of risk assessment and proven mitigation options for avian impacts from renewable energy projects.

7.2.2 Modernizing the Permitting Process

Notwithstanding the substantial gains in permitting of renewable energy projects on Federal lands since enactment of EPAct 2005, in order to sustain and expand on that success, the process for permitting must become more predictable and efficient. BLM and other agencies in DOI with regulatory responsibilities that pertain to renewable energy projects on public lands (including FWS, the National Park Service, and the Bureau of Indian Affairs) have begun to address these challenges. For example, by embracing a development approach that employs “smart from the start” principles, solar permitting times have shrunk from multiple years to as little as 10 months. However, barriers to greater success remain.

The major barrier is that, under the antiquated administrative law construct used to approve onshore renewable resources, developers do not receive a firm right to the project. To elaborate, BLM permits and manages Federal wind and solar resources as right-of-ways (ROWs)—a conveyance whose administrative underpinnings date back to the 19th century. Historically, ROWs were granted primarily for the construction and repair of infrastructure, including roads, ditches, and railways, and agencies had the discretion to move and/or modify ROW permits when circumstances dictated. Rather than using the awkward ROW permitting tool to approve wind and solar projects on public lands, it would be preferable if the law gave BLM clear authority to lease surface lands for wind or solar project developments, as it does for oil, gas, coal, and other minerals-related projects.

Another barrier to the development of renewable energy resources on public lands is the way that developers compensate the Federal Government. Whereas holders of mineral leases pay a success-based fee (royalty), a ROW permit holder compensates the government primarily through a rental payment. Rental charges kick in as soon as a permit is issued, and they are imposed whether energy is produced or not. DOI would benefit from having additional administrative flexibility to encourage renewable energy development in prioritized development areas or zones, and clearer authority to collect appropriate fees or royalties from wind and solar projects, including, for example, fees that are based on the generation of electricity from the site.

Another barrier to the development of renewable energy resources on public lands is the way that DOI is organized. In contrast to the Department's fossil energy programs, under which thousands of oil and gas drilling permits are processed annually, there is not a similar concentration of expertise in BLM offices that can be applied to the permitting of renewable energy programs. Additional resources and a more mature structure would help ensure that developers have a predictable and consistent place to access agency support when contemplating or embarking upon the permitting process. A deeper examination of how to coordinate more effectively with other Federal and State agencies is also needed to institutionalize efforts to expand renewable energy development on Federal lands and ensure that megawatts of electricity are actually delivered.

7.3 Recommendations

The coming year will be crucial in institutionalizing a framework for meeting our future clean energy goals, including those articulated in the Clean Power Plan[131] and the President's Climate Action Plan,[132] and for addressing barriers to scaling up environmentally responsible clean energy on public lands.

7.3.1 Near Term: 2016–2017

1. DOE should partner with DOI, which has primary responsibility over permitting of renewable energy projects on public lands, to conduct a collaborative, consensus-oriented process geared toward lowering the risk of delay, litigation, and uncertainty surrounding wildlife impacts from renewable energy development. Leaders from conservation organizations and industry have already joined together at the highest level to signal agreement on the importance of this issue and have offered a suite of recommendations to DOI and FWS for ensuring species conservation while increasing certainty for renewable energy. This process should not only encompass FWS work on incidental take, but should also consider the appropriate application of categorical exclusions and programmatic environmental impact statement activity under NEPA.
2. DOE can also work with DOI to prioritize the formulation of a new and improved permitting roadmap for future renewable energy development on public lands by convening a joint dialogue with stakeholders and developers to discuss roadblocks hindering permitting success, while also assessing lessons learned from the previous 6

years of permitting utility-scale projects.[tt] Historical precedent has already demonstrated that DOE can help DOI advance the effective permitting of renewables on the Federal estate. When DOE partnered with BLM in developing a solar zone framework, the funding support that DOE provided helped channel resources in a manner that ensured that projects permitted in zones would have the greatest chance of success. Similarly, there is an opportunity for DOE and DOI to develop additional improvements to the permitting process for the next generation of clean energy projects. The outcome of this process should be ready for use by the incoming administration.

7.3.2 Over the Next Several Years

1. DOE should take a leading role and increase research funding on both technological and mitigation practices that can assure continuously improving levels of species conservation. DOE should work more closely with and support data collection and research by the resource agencies concerning biological risk assessment, population and community level impacts, and more creative and effective mitigation policies, incentives, and practices. It is worth emphasizing the critical role that effective mitigation can play in accelerating permitting, including by diffusing controversy.
2. Assuming a reasonable consensus emerges on improvements to regulations and management practices that produce practical success on the ground in implementation, and is consistent with DOI's responsibilities as the lead agency under the relevant land management and wildlife statutes, DOE should work with DOI and other agencies, stakeholders, and Congress to consider ways to incorporate the improvements into legislation governing clean energy development and species conservation on public lands. Such legislation would provide sustained certainty for clean energy development on public lands.

[tt] An improved permitting framework should incorporate the following components:

- A process that adequately identifies lands that will economically support the viable deployment of wind and solar resources; as equally critical, a process that will identify and avoid the most environmentally sensitive areas of environmental interest
- Procedures that ensure that critical and sensitive environmental resources are safeguarded from the impacts of potential leasing decisions
- Guidelines that ensure the opportunity for robust public participation before and during the leasing process
- A process to effectively determine legitimate leasing interest that will result in the meaningful deployment of wind and solar resources
- Measures that will ensure that the receipts collected from the production of renewable energy result in a fair return to the taxpayer, balanced with a system of incentives that confer distinct advantages to leases that commit to reducing a project's environmental impacts while also implementing mitigation strategies to offset such impacts.

SECTION 8: Alternative Fuel Vehicles

RECOMMENDATION: Improve Federal deployment of alternative fuel vehicles.

8.1 Background

The U.S. transportation sector relies on oil for 92 percent of its delivered energy.[133] This dependence has significant impacts on U.S. economic and national security by linking the health of the economy to a commodity whose price is set in an often-volatile, unpredictable global oil market. Oil is also responsible for 43 percent of U.S. greenhouse gas (GHG) emissions,[134] and approximately one-third of U.S. GHG emissions are attributable to the transportation sector.[135]

Alternative fuel vehicles (AFVs) powered by non-petroleum fuels—including biofuels, electricity, natural gas, and hydrogen—can play a significant role in strengthening U.S. energy security and reducing emissions. Over the past decade, U.S. and global automakers have invested tens of billions of dollars to develop an increasingly diverse range of AFVs that are safe and reliable and generally meet or exceed the performance expectations of customers.[uu] Today, a large and growing number of models are available in the light-, medium-, and heavy-duty segments. For example, the Department of Energy (DOE) estimates that there are approximately 50 plug-in electric vehicle (PEV) models—inclusive of both plug-in hybrid electric and battery electric vehicles—available for purchase as of early 2016.[vv] There are an estimated 410,000 PEVs already operating on U.S. roads.[ww] Approximately 130 light-duty flex-fuel (E85) vehicle models, which can operate on gasoline or any mixture of gasoline containing up to 85 percent ethanol, are also offered.[xx] Far smaller numbers of natural gas- and hydrogen-powered light-duty vehicle models are available at present.[yy] There are also more than 100 medium- and heavy-duty AFVs available, including buses, refuse trucks, delivery trucks, and tractors.[zz]

[uu] See, for example, "Nissan's Carlos Ghosn Seeks Revenge for the Electric Car," *Environment360*, May 4, 2011, http://e360.yale.edu/feature/nissans_carlos_ghosn_seeks_revenge_for_the_electric_car/2398/, or Bernie Woodall, Paul Lienert, and Ben Klayman, "Insight: GM's Volt: The Ugly Math of Low Sales, High Costs," *Reuters*, September 10, 2012, http://www.reuters.com/article/us-generalmotors-autos-volt-idUSBRE88904J20120910.

[vv] *Alternative Fuel Data Center*, Department of Energy, Alternative Fuel and Advanced Vehicles, http://www.afdc.energy.gov. Includes variants of the same model (e.g., automatic or manual transmission).

[ww] Estimates based on data from hybridcars.com.

[xx] *Alternative Fuel Data Center*, Department of Energy, Alternative Fuel and Advanced Vehicles, http://www.afdc.energy.gov. Includes variants of the same model.

[yy] *Alternative Fuel Data Center*, Department of Energy, Alternative Fuel and Advanced Vehicles, http://www.afdc.energy.gov. Includes variants of the same model.

[zz] *Alternative Fuel Data Center*, Department of Energy, Alternative Fuel and Advanced Vehicles, http://www.afdc.energy.gov. Includes variants of the same model.

The Federal Government, as the largest vehicle fleet operator in the country,[136, 137] is well situated to be a significant force in the market for AFVs. Greater Federal adoption of advanced technology vehicles would send a strong signal to automakers that there is a market for AFVs, help to drive down lifetime vehicle costs, and contribute to GHG emissions reductions. By placing large orders that replace significant portions of regional Federal fleets, the government can contribute to an accelerated pace of technological advancement and cost reduction in AFV drivetrain components, such as batteries, electric motors, and natural gas storage tanks. Large fleet purchases will also give stakeholders throughout the AFV supply chain the long-term stability needed to justify significant investments in labor and equipment. Such large fleets would also generate important data and lessons regarding vehicle use and help scale up the industry supply chain, ultimately saving agency funds and taxpayer dollars.

8.2 Discussion

Fleets are well situated to be among the early adopters of AFVs, due to fleet managers' cost-oriented and usage-case-based approach. The lower operation and maintenance (O&M) costs of electric vehicles (EVs) make the economics of plug-in hybrid electric vehicles (PHEVs) and all-electric vehicles especially compelling to certain fleet owners for whom the cost of ownership across the service life of the vehicle is often an important metric when making a purchasing or leasing decision.[138] These cost calculations are particularly relevant in higher mileage applications and in cases where upfront costs can be offset by adjusting battery sizes, extending ownership periods, using lightweight vehicle components, and utilizing innovative financing models. For medium- and heavy-duty applications, especially for vehicles traveling long distances, natural gas may present a more compelling case as an alternative fuel.[aaa]

8.2.1 Opportunity for Improvement

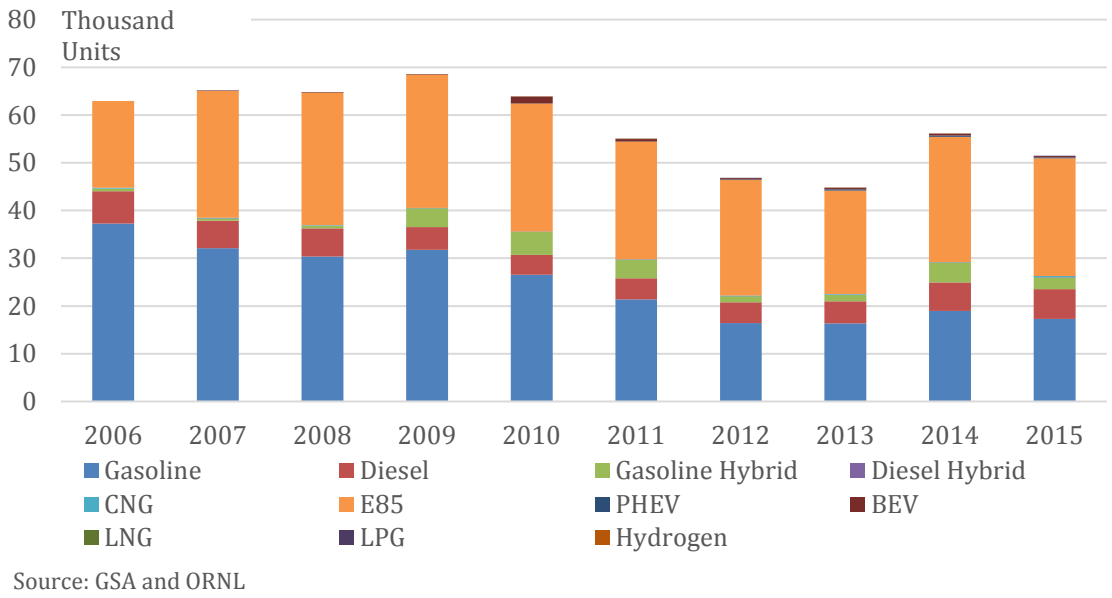
The Federal Government's opportunity for leadership has been recognized through several statutory requirements, Executive orders, and Presidential memoranda concerning the Federal fleet over the last 25 years—the most recent being President Obama's 2015 Executive Order (E.O.) 13693.[139, bbb] This Executive order requires agencies to begin

[aaa] See, for example, Amy Myers Jaffe, Rosa Dominguez-Faus, Allen Lee, Kenneth Medlock, Nathan Parker, Daniel Scheitrum, Andrew Burke, Hengbing Zhao, and Yueyue Fan, *Exploring the Role of Natural Gas in U.S. Trucking* (Davis, CA: University of California, Davis, Institute of Transportation Studies, Sustainable Transportation Energy Pathways program, 2015), https://www.ge.com/sites/default/files/2015%2002%20Exploring%20the%20Role%20of%20Natural%20Gas%20in%20US%20Trucking.pdf.

[bbb] Such statutory requirements include E.O. 13693, which revoked E.O. 13423 of January 24, 2007; E.O. 13514 of October 5, 2009; Presidential Memorandum of December 2, 2011 (Implementation of Energy Savings Projects and Performance-Based Contracting for Energy Savings); Section 1 of Presidential Memorandum of February 21, 2012 (Driving Innovation and Creating Jobs in Rural America through Biobased and Sustainable Product Procurement); Presidential Memorandum of December 5, 2013 (Federal

planning so that 20 percent of all new agency passenger vehicle acquisitions are zero-emission vehicles or PHEVs by December 31, 2020, and 50 percent by December 31, 2025.[140] E.O. 13693 also calls for agencies to reduce fleet-wide per-mile GHG emissions by 30 percent by fiscal year (FY) 2025, relative to a baseline of emissions in FY 2014.[141]

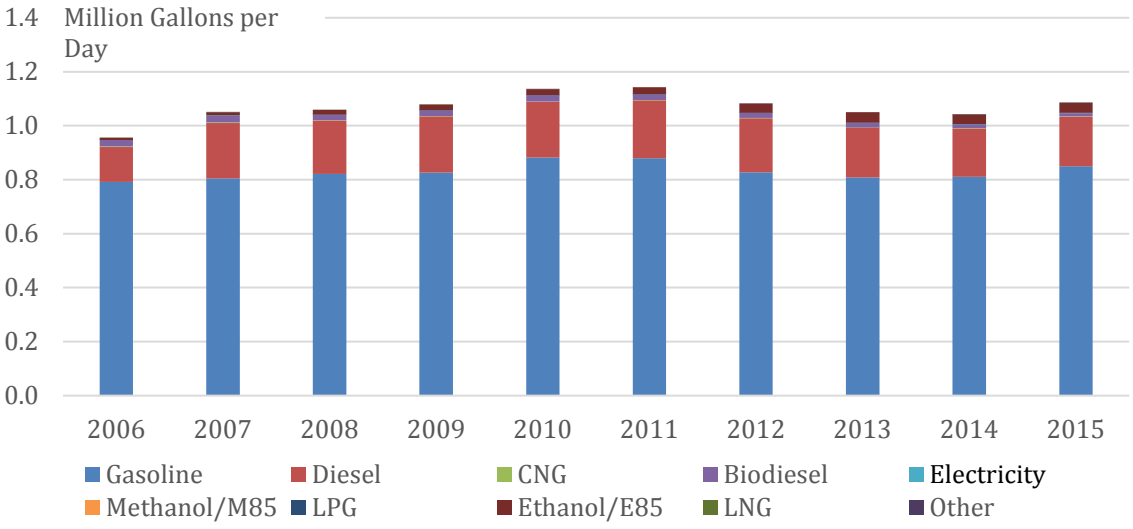
As noted above, the goals in E.O. 13693 are only the most recent in a long history of efforts to diversify the Federal fleet. Despite two decades of statutes and Executive orders that direct agencies to purchase efficient and advanced vehicles, agencies often choose to meet the requirements by purchasing vehicles with the lowest upfront capital cost. As shown in Figure 10 and Figure 11 below, this has often meant purchasing flex-fuel vehicles that—while capable of running on E85—operate on traditional petroleum fuels due to a lack of access to E85-refueling stations.[142, 143] Thus, although alternative fuel vehicle *acquisition rates* have come close to meeting the requirements in the Energy Policy Act (EPAct) of 1992 (which require that 75 percent of new acquisitions be AFVs),[144] actual alternative fuel *use* in Federal fleets was only 4.7 percent of total fleet fuel consumption in 2015,[145] and the average government flexible-fuel vehicle uses less than 70 gallons of E85 a year.[146, 147, 148] This accomplishes very little in improving U.S. energy security and only benefits an already mature technology.



Source: GSA and ORNL

Figure 10. E85 flexible-fuel vehicles dominate new Federal vehicle acquisitions
Acronyms: CNG - compressed natural gas; LNG - liquefied natural gas; LPG - liquefied petroleum gas; PHEV - plug-in hybrid electric vehicle; and BEV - battery electric vehicle.

Leadership on Energy Management); and Presidential Memorandum of May 24, 2011 (Federal Fleet Performance).



Source: GSA and ORNL

Figure 11. Fuel consumed by Federal fleets, FY 2006–2015
Acronyms: LPG - liquefied petroleum gas; CNG - compressed natural gas; and LNG - liquefied natural gas.

8.2.2 Federal AFV Adoption

With more than 400,000 non-tactical vehicles[149] and $1.2 billion in annual fuel costs,[150] the Federal Government has a significant opportunity in the AFV market with the potential for major impact on AFV supply-chain development and cost reduction. Greater Federal adoption of AFVs would demonstrate that these vehicles can meet a wide range of transportation needs, generate important data and lessons regarding the use of AFVs, and help ensure a ready market for AFVs. Federal Government investment would support industry efforts to scale production and reduce AFV costs—critical to attracting new customers—while ultimately saving agency funds, protecting American taxpayers, and reducing emissions. In short, a significant effort to incorporate AFVs into the Federal fleet could catalyze adoption by state and local governments, as well as businesses and consumers.

The Federal fleet is largely controlled by three departments: the General Services Administration (GSA) (39 percent), the U.S. Postal Service (USPS) (33 percent), and the Department of Defense (DOD) (28 percent).[151] About 81 percent of federally owned vehicles are light duty, 12 percent are medium duty, and 7 percent are heavy duty.[152]

The Federal Government can play a critical role in driving scale throughout the AFV-production supply chain. By placing large orders that replace significant portions of regional Federal fleets, the government can contribute to an accelerated pace of technological advancement and cost reduction in AFV drivetrain components, such as batteries, electric motors, and natural gas storage tanks. Large fleet purchases will also

give stakeholders throughout the AFV supply chain the long-term stability needed to justify significant investments in labor and equipment.

Figure 12 illustrates why, when looking at opportunities for the Federal Government to adopt AFVs, substantial attention should be paid to the USPS fleet. With more than 208,000 vehicles, USPS has a fleet larger than the fleets of all the military services combined, and more than twice the size of the largest commercial fleet in the Nation.[153]

Not only is the USPS fleet immense, it is well suited to the use of AFVs. Many USPS vehicles are centrally parked, facilitating the use of alternative fuel infrastructure. The stop-and-go nature of mail delivery makes the postal fleet ideally suited to take advantage of the regenerative braking of current hybrid EVs on the market. According to a 2009 report by the USPS Office of Inspector General, the average daily mail-delivery driving distance is 18 miles, making many USPS's vehicles well suited for right-sized EV batteries or smaller PHEV batteries.[154] Finally, the average age and usage patterns of vehicles currently in the postal fleet lead to high maintenance costs, a challenge that AFVs could help address.[155]

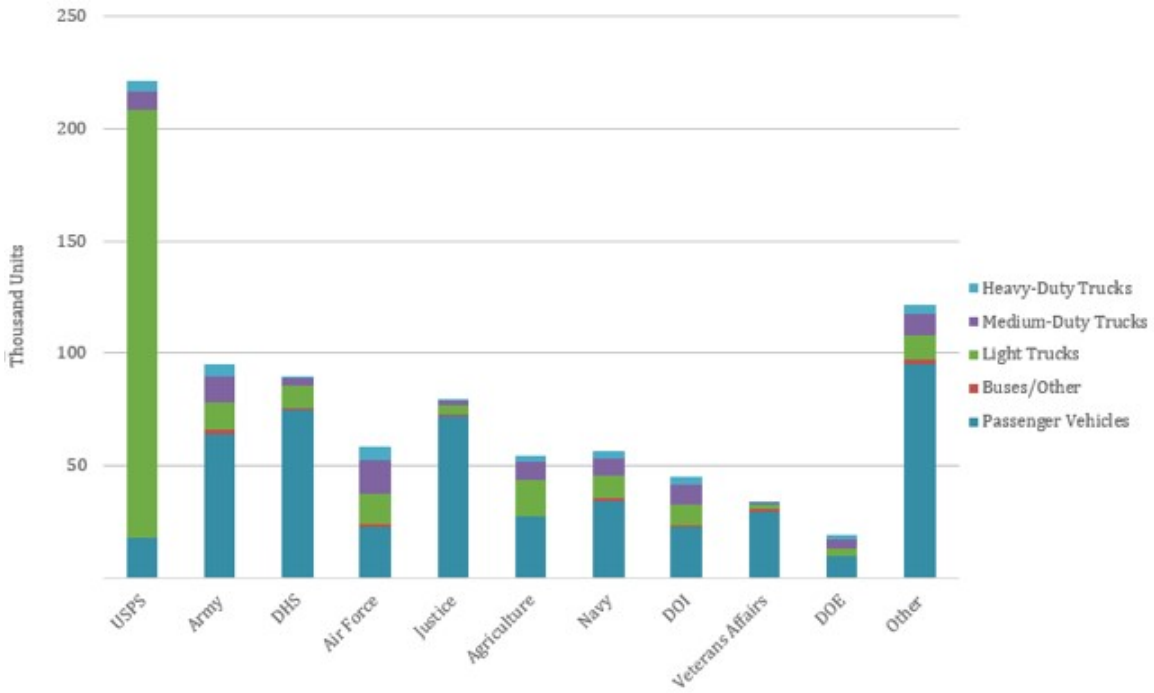


Figure 12. Federal fleets: top 10 agencies by vehicle type[156]

Although USPS is facing significant financial challenges,[157] the agency has announced its plans to replace its aging fleet of Grumman Long Life Vehicles, the iconic "mail truck," with up to 180,000 "Next-Generation Delivery Vehicles" (NGDVs) that are designed to operate for 20–25 years. USPS is currently in the middle of a multi-year process to select the new vehicle.[158] However, analysis prepared by a public policy economic research firm, Keybridge LLC, for the organization Secure America's Future Energy found that an

alternative approach that combines lightly modified "off-the-shelf" vehicles (some of which are replaced after at least 12 years) with AFVs for shorter routes, could generate approximately $1.9 billion in savings for USPS over 24 years, mostly through reduced fuel and maintenance costs.[159]

8.3 Recommendations

There are several steps that the Federal Government could take to increase AFV use in the Federal fleet. The recommendations below address some of the most common challenges related to the acquisition and operation of AFVs: the cost and financing of vehicles; AFV-fueling infrastructure; and an inadequate understanding of AFVs—their costs and functionality.

8.3.1 Recommendations to Lower the Cost of AFVs and Make Them More Competitive with Conventional Vehicles

1. *Account for the full life-cycle cost of vehicles in making purchase decisions.* When fleet managers choose which vehicles to buy, they often pay greater attention to the upfront capital costs than to the O&M costs. In some situations, funding for these cost categories may even come from separate accounts. The government should ensure that Federal fleet managers examine the full life-cycle costs of purchasing or leasing and also operating and maintaining a vehicle when making purchase or lease decisions. In 2014, GSA awarded a new 5-year contract to United Parcel Service and Federal Express for the delivery of small packages for government clients.[160] As part of its efforts to reduce the government's carbon footprint, GSA directed bidders to account for the carbon footprint of a company's services through the modeling of the government's Social Cost of Carbon (SCC)[ccc] associated with that company's expected shipments under the contract.[161] This requirement favored bidders who used AFVs with smaller carbon footprints than conventional vehicles. Likewise, when making decisions as to what vehicles to purchase or lease for use in the Federal fleet, agencies should account for the vehicle's carbon footprint by using the Federal Government's estimate of the SCC to determine the lifetime social cost of each vehicle technology, and then directly incorporate this figure into the agency's total cost of ownership calculation. This approach will encourage the use of AFVs because their higher acquisition costs are not only offset by their lower O&M costs, but will also take into account the benefits of their smaller carbon footprint. This approach also directly responds to the direction in E.O. 13693 to reduce fleet-wide per-mile GHG emissions by 30 percent by FY 2025, relative to a 2014 baseline.[162]

[ccc] The SCC is the monetized value of the climate damages from the release of a ton of carbon dioxide (CO_2).

2. *Find ways to directly offset the higher upfront costs of plug-ins.* The military services have been exploring ways to cut the overall costs of EVs and achieve cost parity with conventional vehicles. Beginning in 2010, the Air Force led a DOD-wide effort that determined that Vehicle-to-Grid (V2G) services were an attractive model for achieving this objective in the military's fleet of 200,000 non-tactical vehicles. V2G provides the grid operator a source of frequency regulation and peak demand shaving and enhances military mission support functions such as back-up power to critical infrastructure, mobile power in remote locations, and micro-grid optimization. In the process, V2G generates revenue for the military services and, thereby, cuts the overall cost of PEVs. Building on these opportunities, the Los Angeles Air Force Base now serves as the flagship location for a DOD demonstration project that has replaced its entire general service vehicle fleet with EVs. Fort Hood and Joint Base Andrews are also participating in this project. DOD leases conventional trucks from GSA but pays for the EV conversion. If the technology proves feasible and reliable, DOD and GSA will work to establish the conversion kits as an equipment item on the GSA schedule.

3. *Develop new financing models to cut EV costs.* GSA worked with the Air Force and utility owner-operator Southern Company to create a financing model that reduces the cost of EV sedans and pays for the required infrastructure, e.g., charging stations. Southern used GSA's areawide public utility contract authority (see Section 5) to incorporate the additional infrastructure costs into the monthly electricity bill, allowing the utility and the Air Force to amortize these significant expenses over time. The end result was the installation of a fast-charging station near multiple Air Force installations in Southern Company service territory (Georgia, Alabama, Mississippi, and the Florida Panhandle). In exchange, the Air Force committed to a baseline level of use sufficient to pay back the utility's investment. Any public use of the charging station is expected to generate a profit for the utility. Under this arrangement, the Air Force was able to bring the overall cost of EVs in line with the cost of conventional vehicles. This model should be replicable by other Federal agencies and can be expanded in any region where GSA areawide agreements exist with a willing utility partner.

4. *Work with states on bulk purchases.* Allowing Federal agencies to work with states to make bulk purchases can drive down costs. In 2012, Oklahoma and Colorado led a multi-state agreement in which states issued a joint request for proposals for the purchase of natural gas vehicles for themselves and local governments.[163] Automakers responded by offering several vehicle models at a savings of up to $8,000 per vehicle over the best previously available price.[164] While the program ended because most participating states could not find ways

to conveniently fuel natural gas vehicles, Oklahoma is planning to initiate a new agreement that is broadened to include all AFVs.

   a. DOE's Federal Energy Management Program (FEMP) and GSA should work together and explore the opportunity for the Federal Government to join with the states in seeking to lower the cost of AFVs for fleet managers at all levels of government. If FEMP and GSA identify legal obstacles to entering into such agreements with the states, they should report them to the Secretary of Energy and the GSA Administrator and recommend changes to the applicable laws, regulations, or requirements that would allow them to work with the states.

5. *Consider appropriating funds to directly offset the incremental cost of AFVs to agencies.* As explained above, AFVs often have high upfront capital costs that are offset over a vehicle's lifetime by lower O&M costs. While the lower O&M costs will help lower vehicle life-cycle costs, agencies may not have the funds available to incur these higher initial costs because budgets are tight, or because capital and operating costs are funded separately and one cannot easily offset the other. This situation may make it difficult for a Federal fleet manager to purchase AFVs. GSA and DOE should seek funding to establish a program that offsets some portion of the incremental costs of AFVs and any associated infrastructure purchased by Federal agencies. Directly appropriating funds for that purpose would allow agencies to procure AFVs without taking scarce funds away from agencies' core missions. Such a program could also provide data that would provide more transparency regarding the cost of using AFVs in place of conventional gasoline-powered vehicles. While finding funds for this purpose will likely be difficult in the current environment, there is value in making transparent the opportunity cost of the current approach.

6. *GSA and DOE should report on key issues in Federal AFV procurement.* GSA and FEMP should examine the various financing, bureaucratic, oversight and other potential obstacles to Federal AFV deployment and make recommendations on how to

   a. Resolve the difficulty that fleet managers have in paying for the incremental cost of AFVs, and the extent to which those difficulties result in most agencies choosing flexible-fuel vehicles, the AFVs with the lowest incremental cost, and then operating them on gasoline instead of E85. This analysis should include the regularly occurring situation where the separation of capital and operating expenses undermines the ability to make the lowest-cost decision.

b. Consider the carbon footprint, and related costs, of different vehicles and how this information might be better reflected in the data that Federal fleet managers use to make vehicle purchase decisions.

c. Provide opportunities for Federal agencies to lease vehicles at a lower cost from third parties as compared to GSA[ddd]

d. Overcome technical or policy obstacles to lowering the life-cycle cost of using an AFV, including how, for example, uncertainty about the residual value of vehicle batteries affect life-cycle vehicle costs

e. Increase opportunities for Federal agencies to monetize Federal and State tax credits, rebates, and/or grants[eee]

f. Identify opportunities for Federal agencies to acquire AFVs through energy savings performance contracts.

8.3.2 Recommendations to Increase the Use of Alternative Fuels and the Availability of Alternative Fueling Infrastructure

1. *Increase use of E85 in the Federal flexible-fuel vehicle fleet.* The Federal Government owns approximately 196,000 flexible-fuel vehicles, which agencies purchased to meet AFV requirements.[165] However, as mentioned above, the agencies generally do not use E85 in the vehicles because this fuel is often not conveniently available near where the vehicles are used. In 2015, for instance, 55,000 AFVs were waived from meeting EPAct 2005 alternative fuel use requirements because the vehicles were housed more than 5 miles or a 15-minute drive from an E85 refueling station, and additional flexible-fuel vehicles that did not obtain waivers may still have not used E85.[166] As part of the waiver process, agencies submit addresses where exempt vehicles are located, so anyone can easily identify where there are high concentrations of federally owned flexible-fuel vehicles without access to E85.[167] The Federal Government should identify 20 areas where the government has a high concentration of flexible-fuel vehicles without access to E85, and either contract with private fuel providers for convenient access to E85 for the vehicles or install its own fueling infrastructure, so as many government-owned flexible-fuel vehicles as possible can operate on E85.

2. *Right-size charging infrastructure*. Commercial facilities often focus on installing revenue-grade Level-2 charging infrastructure to charge PEVs because of the faster charging times and the availability of chargers that measure the power so

[ddd] See, for example, information on the Navy program about EV leasing: www.fbo.gov/index?s=opportunity&mode=form&id=19c6594692a67f72cf7845fcce90348a&tab=core&_cview=1.

[eee] See, for example, 26 U.S.C. § 30D(f)(3).

that the provider can recover the cost of the power. Agencies should, however, explore the opportunities for non-revenue-grade Level-1 charging infrastructure, which is far less costly, even though it charges more slowly and does not meter the power used. With the average vehicle in the Federal fleet traveling less than 35 miles a day, many vehicles can meet their agencies' needs with slower overnight charging, instead of faster charging during the day. Moreover, the incremental cost of charging infrastructure that collects data to charge customers for the power they use often exceeds the cost of the power itself.[168] Agencies should identify where it would be more cost-effective to buy less expensive infrastructure and not charge for the power. If government regulations prove an obstacle to not charging for power, then GSA and DOE should propose changes to the Administration and Congress.

3. *Expand utility partnerships to develop charging infrastructure.* Utilities are good partners to find the lowest-cost electricity rate for EV charging using their rate analysis tools. Utilities are also potential partners for charging infrastructure. There are a multitude of utility programs that invest in beyond-the-meter charging infrastructure. Southern California Edison, Southern Company, and Kansas City Power & Light have existing programs, while Puget Sound Energy, Pacific Gas & Electric, and San Diego Gas & Electric have proposed programs. Federal agencies can also help by recommending to public utility commissions in all states that they expand utility-charging infrastructure investments. Federal agencies can also explore the use of utility energy service contracts (UESCs) and areawide contracts (see Section 5 of this report). UESCs are typically used for distributed energy resources, energy efficiency, and water efficiency improvements. UESCs are limited-source contracts between Federal agencies and their serving utility, typically using GSA or site-specific arrangements. There is precedent for EV charging stations to be included as part of larger projects.[fff] The utility develops and builds the project paid for by the Federal agency with their choice of appropriated funds or financed through a utility-arranged third party. Areawide contracts are another way Federal facilities may be able to pay for EV infrastructure as a service through a fixed fee or tariff, with the local utility owning and operating the infrastructure.[169]
4. *Examine Federal facilities and interstate highways for potential public charging infrastructure*. The Federal Government could provide charging at publicly accessible Federal facilities such as post offices, Veterans Affairs buildings, Federal historic sites/monuments/parks, military facilities, Social Security

[fff] One such example is a Federal Aviation Administration project in Palmdale, California. This project included a 950-kilowatt solar carport with eight Level-2 EV chargers, as well as heating, ventilation, and air conditioning system upgrades, interior and exterior LED (light-emitting diode) lighting upgrades, energy management system upgrades, and water conservation.

Administration offices, etc. There are, for example, more than 50,000 post offices in the United States. On a related front, the Federal Government, through the Federal interstate highway system, might provide land, financing, or other kinds of support for high-speed EV charging at key interstate exits that would serve both travelers and local residents. DOE should examine these and related options, including new direction under the 2015 Fixing America's Surface Transportation Act (FAST Act) for Federal employee vehicle charging, as discussed below.

5. *Prioritize USPS opportunity.* USPS should take advantage of its need to replace its light-duty vehicle fleet to maximize the deployment of AFVs. There is resistance to the adoption of AFVs because of their higher incremental cost and USPS's precarious financial standing. At a time when USPS has discussed ending Saturday delivery of mail to cut costs, it is understandably difficult to contemplate increasing capital costs for new vehicles. Nevertheless, USPS operates the Nation's largest fleet of vehicles, and for the reasons discussed above, it presents a significant opportunity for the Federal Government to promote the use of AFVs, and in the process help bring the costs of AFVs in line with those of conventional vehicles. The challenge of higher incremental costs stems in part from the USPS' NGDV purpose-built design.[ggg] The USPS argument citing higher procurement costs for EVs may be misplaced given the recent pricing for the Chevrolet Volt and the Nissan LEAF. Incremental costs could be minimized if vendors are rewarded for proposals that use an existing, commercially available EV powertrain configuration.

   Additionally, as part of its solicitation of 180,000 NGDVs, USPS should reward vendors that offer EV procurement options that can also be tailored to regional needs. Soliciting bids for a single, 50-state NGDV performance specification unnecessarily increases the cost of an EV option by requiring the battery pack to be oversized to meet the USPS's most challenging delivery route. Rather than a one-size-fits-all specification, the USPS should reward vendors that offer an EV specification with "plug-and-play" optionality to adjust the size of battery packs to minimize overall procurement costs. A USPS-DOE analysis of regional variations would assist with identifying how many EVs need a certain battery pack size.[hhh] Any EV bid should also account for the residual value of used batteries and identify a process for the vendor to repurchase or credit USPS for the used batteries.

[ggg] The current NGDV specification requires a van-type configuration with right-hand drive, curbside sliding doors for both driver and cargo access, a minimum interior height of 6 feet, 4 inches, and a maximum length of 230 inches, or just more than 19 feet.

[hhh] Such an analysis might examine differences in travel patterns as measured by daily vehicle miles traveled, as well as electricity prices and average annual ambient temperature (which can have an impact on electric vehicle range). Regional variation could be initially defined as the eight U.S. Census Divisions.

Finally, USPS should evaluate increased driver satisfaction and productivity that may occur with EVs. Anecdotal evidence suggests there are driver benefits attributable to significantly lower vehicle vibration, a lack of engine noise, and no vehicle exhaust.

8.3.3 Recommendations to Increase Understanding and Awareness of AFVs

1. *Examine variability in vehicle usage*. GSA and FEMP should work together to identify and periodically publish trends within the Federal fleet, including travel patterns measured as daily vehicle miles traveled, fuel, and electricity prices. Evaluations of specific fleets, and more specifically how certain employee classifications use vehicles, would be used to create more tailored AFV procurement strategies/plans.

2. *Develop new pilot programs.* Documenting, disseminating, and encouraging additional AFV pilot projects can help agencies identify more creative ways to meet the mandate of E.O. 13693. As explained above, in 2014, the Los Angeles Air Force Base became the first Federal facility to replace 100 percent of its general-purpose vehicle fleet with PEVs.[170] The project is not just a demonstration of the ability of AFVs to meet a wide range of transportation needs, but also demonstrates the ability of a fleet of plug-in vehicles to provide power and services to the local electrical grid.[171] The vehicle chargers support the vehicles' Vehicle-to-Grid (V2G) capabilities, and the vehicles on the base can provide the grid with sufficient power for nearly 150 homes, enhancing grid reliability while promoting energy security and reducing vehicle emissions.[172] FEMP and GSA should work together to identify additional opportunities for the Federal Government to initiate pilot programs to promote the use of AFVs, including PEVs, within the Federal fleet. Like the Los Angeles Air Force Base program, these pilot projects can demonstrate the capabilities of AFVs and identify how to overcome any challenges related to their use.

3. *Establish support systems for fleet managers.* EV user groups (both online and in person) can increase the education of Federal fleet managers on EVs and charging stations and should be expanded. These allow managers and employees to share best practices and respond to questions.[iii] Existing databases (DOE, Database of State Incentives for Renewables and Efficiency [DSIRE], FEMP sustainable fleet, and Alternative Fuels Data Center [AFDC]) should be expanded to be as comprehensive, up-to-date, and solution-oriented as possible, including, e.g., lifetime cost comparison of EVs to their gasoline or diesel counterparts, utility rates, financing and education programs, research, development, and

[iii] See, for example, FEMP's website for information about sustainable Federal fleets: https://federalfleets.energy.gov.

demonstration programs, and other incentives. The High-Efficiency Truck Users Forum (HTUF) is one such example. HTUF is a national program of private and public fleets that encourages production and use of medium- and heavy-duty high-efficiency trucks and buses.[173] HTUF has been operated by CALSTART for about a decade in partnership with, and under contract to, the U.S. Army Tank Automotive Research, Development, and Engineering Center (TARDEC).

8.3.4 Recommendations to Support AFV Charging for Federal Employees

1. *Advance new Fixing America's Surface Transportation Act authority for Federal employee vehicle charging.* The FAST Act, discussed above, contains explicit authorization from Congress for Federal agencies to deploy charging stations at Federal facilities for use in charging personal EVs, on a reimbursable basis.[jjj] The Council on Environmental Quality (CEQ) is now working on guidelines implementing the legislative language. DOE, GSA, CEQ, and Office of Management and Budget (OMB) should identify any remaining financing, bureaucratic oversight, and other potential obstacles to the Federal Government offering employees and contractors workplace charging.

   DOE's Idaho National Laboratory recently reported results of an analysis from the largest collection of light-duty PEV and charging infrastructure demonstrations in the world.[174] The key finding was that public charging infrastructure is not needed everywhere to enable EV adoption. Instead, the focus should be on building charging infrastructure at homes, workplaces, and public "hot spots" that serve multiple venues. In addition, DOE's Workplace Charging Challenge reports that more than 80 percent of charging takes place at home or the workplace and that employers that provide charging have six times the number of people driving a PEV than those without charging infrastructure.

   As a major employer, the Federal Government should offer workplace charging. The non-postal Federal workforce grew to more than 2.1 million in FY 2015. For many of these employees, their daily commute is less than 40 miles,[175] and their vehicles sit idle during the workday. As such, it could be a less expensive option to pursue grade Level-1 charging infrastructure as a mechanism to incentivize Federal employees to buy EVs. Level-1 charging translates into about 4.5 miles of range per hour of charging. If a Federal employee's EV sits for 8 hours, it should have more than enough charge for a return trip home for many employees. With

[jjj] See Section 1413(c) on page H8707: "Section 1413(c) authorizes the GSA Administrator, or the head of a Federal agency, to install, construct, operate, and maintain on a reimbursable basis a battery recharging station (or allow, on a reimbursable basis, the use of a 120-volt electrical receptacle for battery recharging) in a parking area that is in the custody, control, or administrative jurisdiction of the GSA or the Federal agency for the use of only privately owned vehicles of Federal employees and others who are authorized to park in such area to the extent such use by only privately owned vehicles does not interfere with or impede access to the equipment by Federal fleet vehicles."

the proliferation of solar photovoltaic electricity generation, there is also growing interest in identifying new sources of electricity demand during daylight hours to avoid solar electricity curtailment tied to oversupply. Workplace charging is a valuable strategy for creating just such demand.

CEQ and GSA should also review Federal property and building procurement and leasing regulations and either require or incentivize prospective bidders to include some amount of Level-1 workplace charging in bids. Charging infrastructure also supports other sustainability program goals as adding vehicle infrastructure can provide additional Leadership in Energy and Environmental Design certification benefits.

2. *Add AFVs as part of the U.S. Government Rental Car Program*. The U.S. Government Rental Car Agreement Number 4[176] governs the renting of vehicles (passenger cars, sports utility vehicles, station wagons, passenger vans, and small pick-up trucks) by military members, employees of the Federal Government, and USPS employees while in official travel status.[177] DOE, GSA, CEQ, and OMB should review the U.S. Government Rental Car Program and either require or incentivize rental car companies to bid AFV options into the central database on a daily basis. Federal travelers should then be encouraged to use the AFV option, when available.

SECTION 9: Federal Technology Test Beds

RECOMMENDATION: Expand the role of military bases and Federal buildings as technology test beds.

9.1 Background

Although emerging technologies hold great promise for improving energy performance in the built environment, they face major impediments to commercialization and adoption. In contrast to sectors such as biotechnology or information technology, in which technical advances provide the customer with a new capability or the basis for a new business, advanced energy technologies serve largely to lower the cost of an already low-cost commodity (electricity and heat). Thus, a building owner is disinclined to pay a premium for a new technology, preferring to wait and adopt a proven technology later on. The fragmented structure of the building sector compounds the problem, since the savings to any individual building owner are small.[178]

A key problem is the lack of evidence-based data on the performance of the technologies under real-world conditions. For example, component technologies are highly cost-sensitive: to be of value, a light-emitting diode light fixture or a condensing boiler must provide the same or better service at reduced life-cycle costs than more traditional technologies. Life-cycle costs, in turn, depend on factors such as the level of skill required to operate the technology, maintenance requirements, and tenant acceptance. Absent real-world performance data that address these and other factors, a potential user cannot evaluate true life-cycle costs.

The same is true for new systems approaches to energy control and management, which integrate component technologies across an entire building or campus of buildings. Although these approaches promise dramatic gains in energy performance, their effectiveness depends on a host of conditions, such as the nature of building operations (e.g., working hours of 9 a.m. to 5 p.m. versus 24/7), the variability of loads, and human interactions, to name a few.

It is impossible to evaluate how these factors affect the performance of the technology outside of a real-world building environment. The lack of data on real-world performance and cost inhibits both the development and the deployment of new energy technologies for the built environment. As the largest U.S. consumer of facility energy, the Federal Government has a direct self-interest in seeing this major barrier to technology commercialization and adoption reduced. As the owner of some 350,000 buildings—with more than 3 billion square feet of space—the Federal Government is uniquely positioned to help address the need for data on the performance of these technologies under real-world conditions.

Early in the Obama Administration, the Department of Defense (DOD) and the General Services Administration (GSA), the two largest Federal property managers, independently created programs to use their facilities as "test beds" for technologies that they wanted to see commercialized and adopted. With 150 formal demonstrations completed or underway, the two programs are showing exciting results and filling an important gap in the innovation process that the Department of Energy's (DOE's) support for building energy technologies does not adequately address. However, the programs are oversubscribed, and their budgets are declining.

In this section, we review the DOD and GSA test bed programs and recommend a set of actions for DOE to take to foster these valuable programs and take better advantage of the unique role they play.

9.2 Discussion

The Federal Government has an extensive history as an early adopter of new technology, including, but not limited to, technology whose development it has supported. DOD in particular has long played that role. The U.S. military has 150 years of experience as a sophisticated first user of new technology and an early, market-creating customer. Examples include jet engines, aircraft, nuclear propulsion, radar, integrated circuits, the Global Positioning System, and the Internet.

GSA also has been an early adopter of innovation in a range of areas, including building energy efficiency and sustainability. GSA consistently exceeds the Federal Government's sustainability goals, and GSA buildings are more energy efficient than their commercial counterparts. GSA views innovative technology as critical to its continued ability to lead by example.

9.2.1 DOD's Installation Energy Test Bed

DOD is a powerful engine of technological innovation by any measure, and a key reason is that the military is the customer for the technology it develops. The *sine qua non* of DOD's customer-driven approach to innovation is rigorous testing and evaluation of new technology—also known as demonstration and validation, or "dem-val." As with training, where the military's motto is "we train as we fight," dem-val is carried out in settings designed to mirror battlefield conditions.

DOD created the Installation Energy Test Bed in 2009, as part of the Environmental Security Technology Certification Program (ESTCP), DOD's highly successful dem-val program for environmental technology.[kkk] The ESTCP Energy Test Bed began as a one-

[kkk] ESTCP was created in 1995 to spur the commercialization of advanced environmental technologies that were seen as critical to carrying out the military mission. The initial focus was on technologies to address groundwater contamination and other types of environmental cleanup. Taking a page from DOD's weapons systems playbook, ESTCP used DOD cleanup sites as a distributed test bed on which to demonstrate and validate the performance of pre-commercial technologies selected through a competitive process. Armed

year (FY2010) effort, with $17 million in stimulus funding, to demonstrate energy technologies that could improve the performance of DOD's hundreds of thousands of buildings but that faced impediments to commercialization and/or widespread adoption. DOD subsequently included the program in its 5-year budget at nearly double that amount, but actual funding peaked in FY 2012 at $29 million and has declined by about 10 percent a year to its current level of about $21 million.

Using a competitive process that has been heavily oversubscribed, ESTCP's Energy Test Bed selects technologies that are "out of the garage but not yet on the shelf"—i.e., pre-commercial and very early commercial technologies. The program has five technology focus areas:

1. Tools and processes for design, assessment, and decision making
2. Advanced components to improve building energy efficiency
3. Advanced building energy management and control technologies
4. On-site energy generation
5. Advanced microgrid and storage technologies.

The teams that are selected receive funding—typically a few million dollars spread over several years—to help pay for the demonstrations.

Modeled after ESTCP's environmental program, the Energy Test Bed is structured to help transition technologies to the commercial market and onto military bases. First, project teams are industry led, although many include participants from universities and national laboratories. Second, applicants must show that they have a path to commercialization—i.e., the ability to manufacture, market, and maintain the technology-turned-product. This has been an insurmountable hurdle for a number of small start-up firms. Third, the test bed is "distributed"—i.e., the demonstrations take place on individual bases. This approach, which distinguishes the DOD (and GSA) test bed from DOE's Energy Hub and Lawrence Berkeley's FlexLab, allows demonstrations to take place under real-world conditions with involvement by key players, including base engineers and support staff, whose buy-in is critical.

The evaluation process is rigorous, data-driven, and transparent. Although the ESTCP staff works with a project team to develop its metrics and collect the all-important baseline data,[lll] the team is responsible for measuring the results. ESTCP's philosophy is

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with the data from these demonstrations, the technology firms were able to successfully transition their technologies to market, and DOD then purchased them as a commercial customer. ESTCP has played a similarly key role in the commercialization and deployment of environmental technologies, ranging from advanced coatings for vehicles and equipment to detection of unexploded ordnance.

[lll] Getting good baseline data is critical to proper measurement of how a new technology changes the energy performance of a building. Because facility energy usage varies by season, it is important to have baseline

that if they trust a team enough to give it several million dollars, they trust it to measure the results accurately.

ESTCP Energy Test Bed demonstrations are playing a critical role in the commercialization of a broad range of energy technologies. For example,

- 3M's daylight redirecting films can redirect up to 80 percent of the natural light from a window to interior space as far as 40 feet away. 3M installed the films in six DOD buildings, scattered across three climate zones, which were selected in part based on the availability of "control" space that would allow for a side-by-side comparison. The demonstration showed that it was necessary to position a "diffusion film" in front of the redirecting film to reduce glare. 3M has spent many months making that change and is reportedly close to a commercial release of daylight redirecting films.
- Simuwatt Energy Audit is a cloud-based software that lowers the time and cost to perform walk-through building energy audits while preserving the data to facilitate portfolio-wide tracking, reporting, and decision making. In this case, ESTCP supported the development of the technology—by concept3D, in partnership with National Renewable Energy Laboratory—as well as its demonstration. The demonstrations at six DOD facilities allowed concept3D to refine the software solution, which it subsequently made available commercially. In addition to Simuwatt, ESTCP has supported the demonstration of a number of innovative auditing and diagnostic technologies, including FirstFuel Software, which audits the performance of a building remotely using only utility-provided advanced meter data supplemented by publicly available data.
- General Electric's Microgrid Control System uses dynamic real-time algorithms and an energy management dashboard to control the complex interactions among electrical demand, heat and power generation, energy storage, and power distribution. General Electric perfected the Microgrid Control System during a multi-year demonstration at a Marine Corps base in California, which led directly to General Electric's commercial release of the technology. Advanced microgrids are critical to DOD because they offer a more robust and cost-effective approach to ensuring installation energy security than the current one (back-up generators). ESTCP has funded more than a dozen microgrid and storage technology demonstrations to evaluate alternative approaches and configurations.
- United Technologies Corporation's (UTC's) continuous commissioning technology uses automatic sensors and advanced modeling to adjust building controls in real time to maintain optimal performance. Although the technology

data that cover the relevant time period. It is not unusual for ESTCP and a project team to delay the start of performance data collection by six months or a year, so as to get good baseline data.

has been used in a few high-profile buildings to reduce energy use by half, UTC's goal is to make it cost-effective for deployment at scale. UTC demonstrated the technology at two DOD sites: Great Lakes Naval Training Center in Chicago, and the Army's Construction Engineering Research Lab in Champaign, Illinois. Using the results of its U.S. tests (including one at DOE's Energy Hub), UTC undertook larger demonstrations that, while still pre-commercial, were carried out for commercial customers in Asia. Having worked out major kinks and automated some of the more labor-intensive steps, UTC is preparing to make the technology available in several other parts of the world.

Although the companies it supports are highly motivated to commercialize their technologies, the ESTCP Energy Test Bed facilitates the process by posting detailed reports documenting every demonstration and by communicating the results through webinars and other outreach efforts. Deployment of the technologies across DOD's building portfolio is challenging because the military's approach to carrying out building retrofits and new construction is highly decentralized. With DOD relying largely on energy savings performance contracts (ESPCs) (see Section 3) to do efficiency upgrades, energy service companies (ESCOs) will be a critical deployment mechanism.

9.2.2 GSA's Green Proving Ground

GSA established the Green Proving Ground in 2010 to improve the performance of its buildings (reduced carbon emissions, lower operating costs, and higher tenant satisfaction) and to spur the market for innovative building technologies that have broad deployment potential if they prove out. GSA's portfolio is more homogeneous than DOD's: most GSA facilities look and function like commercial office buildings. That makes GSA buildings an appealing test site for energy technology firms that want to target the commercial office market, which has been described as the unpicked fruit of the energy efficiency movement.

Like its DOD counterpart, the Green Proving Ground is a distributed test bed, designed to take advantage of the real-world operating environment of GSA buildings. As another parallel to the ESTCP test bed, the Green Proving Ground selects technologies for demonstration through a competitive process that is oversubscribed.

However, the Green Proving Ground differs from the ESTCP Energy Test Bed in key ways that reflect GSA's culture and mission. First, GSA typically demonstrates technologies that are commercially available but whose market penetration is limited. Stated differently (and to oversimplify), whereas the ESTCP Energy Test Bed supports *technology* demonstrations, the Green Proving Ground supports (early) *product* demonstrations. Second, GSA contracts with DOE national laboratories to provide third-party evaluation of the demonstrations. Third, the Green Proving Ground provides no funding to the vendors/teams whose technologies are selected for demonstration. Instead,

the vendor provides the technology to GSA as an unrestricted gift for purposes of evaluation, and GSA pays for the installation and (third-party) evaluation.[mmm]

Because the Green Proving Ground takes less risk than ESTCP in its choice of technologies, most (about 85 percent) of the demonstrations are successful from a strictly technical perspective. Nevertheless, the demonstrations provide GSA—and the commercial building market, more broadly—with critical data about the real-world performance and cost-effectiveness of the technologies. For each technology that it deems suitable for deployment in Federal buildings, the Green Proving Ground recommends one of three options to GSA staff:

- *Retrofit:* introduce the new technology immediately
- *End-of-life replacement*: at the end of the life of existing equipment, replace it with the new technology
- *New construction:* use the new technology only in new construction.

The Green Proving Ground has put considerable emphasis on deployment. For example,

- GSA tested a so-called "maglev" chiller—a variable-speed compressor that uses magnetic levitation (maglev) technology to eliminate heat, noise, and vibration—in a government building in Pine Bluff, Arkansas. Based on the test results (42 percent energy savings and a payback of less than 5 years), in 2014, GSA recommended that the product be deployed as an end-of-life replacement for rotary screw chillers in all of its facilities. Based on that recommendation, maglev chillers have been installed at 51 GSA building sites, and another 77 installations are pending.
- GSA tested a condensing boiler, which captures heat lost through steam in conventional boilers, at six locations and found that it was more efficient than even a high-efficiency boiler under favorable conditions (where the temperature of return water can be kept below 130 degrees). GSA recommended end-of-life replacement of conventional boilers where that constraint can be met, and it has made the substitution at 62 building sites.

GSA is facilitating deployment of Green Proving Ground–tested technologies using various financing tools. The key tool is ESPCs. For example, in the majority of cases, the installation of maglev chillers and condensing boilers in GSA buildings is financed by ESCOs through ESPCs. GSA Schedules are another important tool. As one example, GSA listed a network of wireless sensors that monitor environmental conditions and power consumption in data centers—one of the first technologies that the Green Proving

[mmm] GSA uses its gift authority to acquire technologies for demonstration because (unlike DOD) it does not have the authority to award funds to vendors for research and development, and use of more traditional procurement methods is not considered practical.

Ground demonstrated—on a GSA Schedule, making it easy for other Federal agencies to purchase the product.

9.2.3 Relationship of ESTCP and GSA Test Beds to DOE

DOE's Buildings Technologies Office provides support both for research on emerging technologies and for diffusion of technology through the Commercial Building Initiative. As shown in Figure 13, there is a significant gap between those two thrusts ("innovation" and "diffusion") on the technology-maturity continuum. Specifically, the Building Technologies Office provides little or no funding either for technology "translation," referring to the pre-commercial and early commercial product development stage when the value proposition of a new technology is unclear or ill-defined, or for technology "adoption," the stage during which a new technology has only limited commercial availability and support and distribution partnerships are lacking.[nnn]

The DOD and GSA Test Bed programs address this gap. ESTCP's Energy Test Bed focuses principally on helping to move technologies through the translation stage of the continuum and secondarily on the technology adoption stage. The Green Proving Ground is focused principally on technology adoption and, to a lesser extent, on technology diffusion.

With that continuum in mind, ESTCP has, in the past, proposed having the DOE Building Technologies Office identify promising technologies in its emerging technologies portfolio and encourage the technology developers/vendors to apply for funding from ESTCP's Energy Test Bed. Under this proposed construct, if a technology is selected, the Building Technologies Office and ESTCP would share the cost of demonstrating it on a military base. ESTCP partnered with DOE's SunShot Initiative to demonstrate a DOE-funded solar technology, and the arrangement proved extremely beneficial to both programs. DOD got a cutting-edge solar array at a discount on one of its bases, and DOE had its chosen technology tested at scale in a real-world setting with the prospect of the military as a major customer.[ooo]

[nnn] This information comes from Jeffrey Marqusee's presentation to the Task Force, September 11, 2015. Dr. Marqusee is the Chief Scientist at Noblis. Previously, he directed DOD's Strategic Environmental Research and Development and ESTCP programs, including ESTCP's Energy Test Bed. He also advised GSA on the Green Proving Ground as a consultant. Figure 12 is taken from his presentation, "Role of Demonstrations in Energy Technology Innovation."

[ooo] In 2012, SunShot awarded $25 million to Soitec, a French semiconductor manufacturer, to operate a large factory in southern California as part of SunShot's effort to foster a competitive U.S. solar manufacturing base. ESTCP agreed to demonstrate the technology at the 1-megawatt scale on two separate bases (ultimately, the demonstration went forward at only one base, Fort Irwin, in California's Mojave Desert). Under the arrangement that DOD and DOE worked out, SunShot provided the photovoltaic modules to the military at no cost, and ESTCP paid for the balance of the system and its installation. Although Soitec subsequently exited the solar business, it continued to support the demonstration at Fort Irwin.

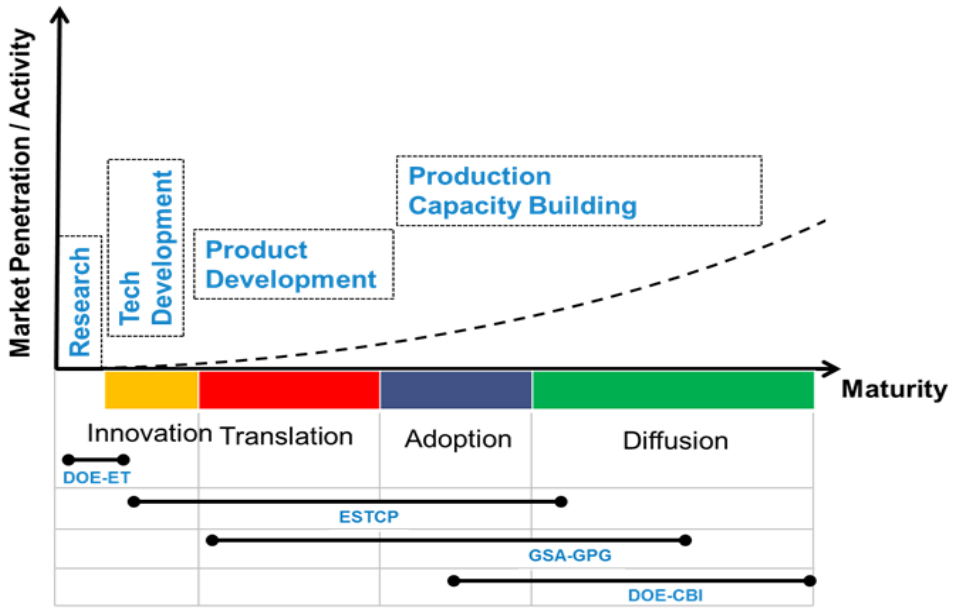

Figure 13. Technology maturity continuum[179]

Although the envisioned partnership between ESTCP and the Building Technologies Office never came about, largely because of funding shortfalls, the idea remains a powerful one. It would allow DOD to take greater advantage of the emerging technologies that DOE is funding. No less important, DOE would get the benefit of lessons learned from real-world testing of its technologies.

The latter point is key. DOE's research and development process has long been criticized for being driven largely by "technology push," with little attention to the complementary dynamic of market-based "demand pull." A major reason for this asymmetry is that DOE, by its nature, lacks the internal market that makes DOD such a powerful engine of innovation. One way for DOE to introduce much-needed demand pull into its research and development process is by working more closely with DOD, GSA, and other Federal and quasi-governmental agencies (e.g., the U.S. Postal Service) that are large customers for building energy technology.

Recently, DOE has begun partnering with GSA to identify promising technologies in support of their respective High Impact Technology Catalyst and Green Proving Ground programs. The High Impact Technology Catalyst program, part of DOE's Commercial Building Initiative, facilitates the assessment of cost-effective, underutilized technologies in commercial buildings. Although this is a very worthwhile partnership, and it strengthens DOE's role in technology diffusion, it does not address the lack of DOE support for late-stage technology development and early (pre-commercial) product development.

9.3 Recommendations

1. *DOE should create a focused program within the Office of Energy Efficiency and Renewable Energy (EERE) to address late-stage "innovation" (pre-product technology development) and "translation" (pre-commercial product development), with an emphasis on technology demonstrations in government facilities.*

   DOE, through its Building Technologies Office, should lead a government-wide effort to support late-stage "innovation" and "translation" of energy technologies for the built environment. Such technologies cover a number of areas, including energy assessment and decision-making tools; components and equipment; systems approaches to energy management and control; and integration of energy supply and demand. Although DOE supports many of these technologies at either end of the technology-maturation continuum (research and diffusion), it does not support the important intermediate stages of pre-product technology development (late-stage innovation), and pre-commercial product development (translation). Technology demonstration and validation are key to filling this critical gap. Technologies for the built environment face a number of impediments to commercialization and widespread adoption. If these technologies are to transition successfully to the marketplace, they will need to undergo extensive demonstration and validation in real buildings. The Federal Government's portfolio of buildings is ideally suited for this activity.

   To start, DOE's EERE should explicitly connect the Building Technologies Office's support for emerging technologies (technology push) to the dem-val activities in operational buildings in DOD, GSA, and elsewhere (demand pull). The ESTCP-SunShot partnership, albeit limited, is a model. EERE should ensure that, through the appropriate incentives and feedback loops, the lessons learned and opportunities identified through this real-world testing in buildings serve to inform the work of the Building Technologies Office.

   More broadly, DOE should foster and "own" building energy dem-val activities across the Federal Government through high-level leadership, coordination, and shared funding. DOE should take advantage of, not duplicate, what DOD's Energy Test Bed and GSA's Green Proving Ground are doing: as large facility owners, DOD and GSA (and possibly other entities such as USPS) are uniquely positioned to carry out this dem-val role. However, the Federal Government's building energy dem-val efforts, including a host of less formal efforts that are ongoing, require high-level direction and coordination.

   Some of these efforts also require modest financial support from DOE. Dem-val of technologies for the built environment is not seen as a key to missions in most agencies. In DOD, in particular, support for the Energy Test Bed, which is run out

of the Office of the Secretary of Defense, is fragile (many in DOD see it as DOE's job), and the budget is likely to continue to decline.

2. *DOE should identify one or more ways to address the risk that use of advanced technology poses to ESCOs and other third-party financers*.

   DOD and GSA are relying heavily on ESCOs and other third parties to finance their investments in energy efficiency and renewable energy through ESPCs and related financing mechanisms. These third-party-financed projects should be a major channel for deployment of the technologies that are being demonstrated in Federal buildings through programs such as DOD's Energy Test Bed and GSA's Green Proving Ground. Through such deployment, the Federal Government can help to kick-start the commercial market for the innovative technologies that are successfully demonstrated.

   This deployment is not occurring, however, because ESCOs and other third-party financers have an incentive to minimize risk on individual projects.[ppp] This leads these entities to use older, proven technology, rather than the kinds of innovative technologies coming out of the DOD and GSA test bed programs. (Although GSA's successful use of ESCO financing to install maglev chillers and condensing boilers shows how the process should work, those technologies were far more mature than most of the ones that undergo demonstration and validation.)

   ESCOs themselves acknowledge the problem, and while DOE officials have recognized it as a concern, they have never treated it as a priority. Given the importance of third-party-financed projects to the Federal Government's facility energy strategy, DOE should make it a priority to address the problem. Possible approaches include a mechanism that allows a Federal agency to share the risk with the third-party financer and the use of (fourth-party) insurance.

   DOE should ask an outside body of experts such as the National Research Council to examine this issue and evaluate alternative options for addressing it. This process need not entail a lengthy study. Rather, the National Research Council (or other body) could convene a workshop of stakeholders and financial experts to examine the issue. Alternatively, DOE might suggest that the White House Office of Science and Technology Policy task the Science and Technology Policy Institute with examining the issue.

[ppp] This disincentive to adopt innovative technologies is a recognized issue with ESPCs and the ESCOs that perform them. The clearest evidence comes from the experience with ESCOs that are part of larger companies that are themselves developing technologies to improve building energy efficiency. Rather than use the new technology that its parent company has developed, the ESCO will typically use an off-the-shelf solution to minimize financial risk.

3. *DOE should identify and facilitate other mechanisms to speed the government-wide deployment of innovative energy technologies for the built environment, including (but not limited to) the technologies demonstrated in Federal facilities.*

   The Federal Government represents an enormous potential market for innovative energy technologies for the built environment, including, but not limited to, technologies demonstrated in Federal buildings. To leverage this demand pull, EERE should work with DOD and GSA to set "performance targets" for various building energy services (heating, cooling, lighting, indoor air quality, etc.). The performance targets should be technology-agnostic to give industry maximum flexibility to innovate. The performance targets should be higher than those associated with current EERE energy efficiency standards, and the process for setting the performance targets should be flexible to allow for a continued raising of the bar.

   To leverage the broader commercial market for innovative building energy technologies, EERE should work with organizations that provide third-party certification for green buildings. The goal would be to have technologies that have successfully gone through the DOD and GSA test bed programs recognized by the widely known building certification programs.

SECTION 10: Federal Energy Management Program

RECOMMENDATION: Strengthen FEMP's budget, standing, and relationships.

10.1 Background

The Department of Energy's (DOE's) Federal Energy Management Program (FEMP) plays a key role in advancing progress in energy management across all Federal agencies and providing energy leadership to the Nation. FEMP is the progeny of the Federal Energy Office, an executive agency first created in 1973 by President Richard Nixon and tasked with advising the president on domestic and foreign policies related to all energy matters.[180] In the 1974 Federal Energy Administration Act, the Federal Energy Office was reformulated as the Federal Energy Management Program.[181] FEMP is one of 10 program offices within the Office of Energy Efficiency and Renewable Energy (EERE) and operates day to day within the energy efficiency sub-office (Figure 14).[182] FEMP is positioned within EERE to coordinate technologies and expertise from the other programs to advance the energy goals of the Federal Government.

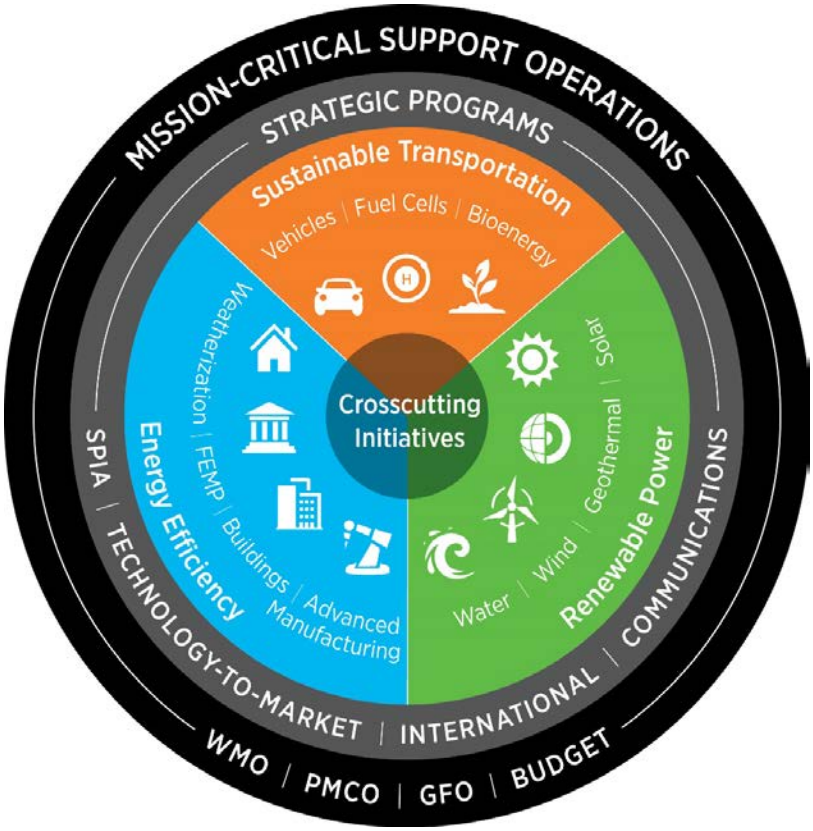

Figure 14. DOE Office of Energy Efficiency and Renewable Energy organization[183]

10.1.1 FEMP's Efforts

FEMP has a number of responsibilities. Important efforts include the following:

10.1.1.1 Energy Savings Performance Contract (ESPC) Assistance

FEMP assists Federal agencies in their use of energy savings performance contracts (ESPCs). FEMP staff help in several ways: advising agencies on scoping, procurement, and performance requirements for energy conservation measures (ECMs); helping agencies select third-party energy service companies (ESCOs); finalizing contracting terms and project approval; and monitoring project implementation and performance.

FEMP has also tackled a number of issues related to the ESPC process. For example, it implemented a fast-track ESPC "ENABLE" program for small Federal projects (under $5 million) that employ well-established ECMs (e.g., heating, ventilation, and air conditioning [HVAC] system replacement; lighting replacement; simple HVAC controls installation; and solar photovoltaics). FEMP also created eProject Builder, a tool that standardizes the collection, calculation, and reporting of performance data for ESPCs across the government. eProject Builder produces ESPC task order schedules and provides a secure online system for easily accessing, tracking, and reporting ESPC project data through the life of the contract for a portfolio of projects.[184]

10.1.1.2 Better Buildings Data Center Challenge

Recognizing a significant opportunity to increase energy efficiency in data centers (which used 1.8 percent of the total energy consumed in the United States in 2014), FEMP and DOE established the Better Buildings Data Center Challenge. Companies and agencies that own or operate data centers can partner with DOE in one of two ways: committing to reduce the energy intensity of their portfolio (including data centers) by at least 20 percent within 10 years or increasing the energy efficiency of at least one data center by at least 25 percent within 5 years. As of May 2016, there were 36 Better Building Data Center Partners, including Staples, Home Depot, the Environmental Protection Agency, National Aeronautics and Space Administration (NASA), and seven DOE national laboratories.[185, 186] FEMP has also created a Center of Expertise for Energy Efficiency in Data Centers. The Center aggregates metering and resource guides, efficiency actions, profiling software, and practitioner training to make it easier for companies and agencies to improve their data center energy efficiency.[187]

10.1.1.3 Federal Energy Efficiency Fund (FEEF)

The Federal Energy Efficiency Fund (FEEF) Program provides direct funding to Federal agencies for technology deployment in first-of-a-kind clean energy projects that may not otherwise be developed due to internal obstacles. This program is also a front-end management tool to encourage well-designed projects with replicable results. FEMP awarded eight projects in 2014 and four projects in 2015.[188] According to FEMP, for the

2014 and 2015 FEEF awards, agencies submitted plans to leverage $23 of project investment for each dollar of FEMP project funding.

10.1.1.4 Customer Service

The Customer Service program forms 1-year strategic partnerships with specific agencies to accelerate accomplishments of key Federal energy management goals and build agency capability and independence. These partnerships cut across FEMP program areas including building retrofits, alternative fuel vehicles (AFVs), and innovative technologies. Strategic Partnerships to date have included work with the Department of Transportation, the Department of State, the U.S. Forest Service, and the Department of the Interior. FEMP and the Department of Transportation won a prestigious Presidential GreenGov Award for their partnership in 2014.[189]

10.1.1.5 Additional Support

FEMP also provides additional support to agencies through programs that

- Gather data from all agencies and report on Federal Government progress towards energy management goals, acting as the government-wide scorekeeper for the Office of Management and Budget (OMB) and the White House Council on Environmental Quality (CEQ) sustainability performance metrics
- Train energy managers through programs certified by the International Association for Continuing Education and Training. Roughly 9,500 people registered for FEMP training in 2015.
- Offer technical assistance to agencies to identify energy efficiency and renewable energy technologies and successfully implement them in their buildings and fleets
- Provide resources and tools for purchasing energy- and water-efficient products
- Track agency progress on requirements of Section 432 of the Energy Independence and Security Act of 2007 (EISA) to audit facilities and report findings, implemented projects, and annual building benchmarking metrics
- Provide guidance and assistance to reduce petroleum consumption and increase alternative fuel use
- Develop and share strategies, best practices, and resources to implement sustainable design practices within Federal buildings and campuses and meet the Guiding Principles for High Performance Sustainable Building.

10.1.2 FEMP Budget

FEMP's budget of $27 million for fiscal year (FY) 2016 is unchanged from the FY 2015 budget[190] (Figure 15). In FY 2016, DOE simplified the FEMP program budget structure into three subcategories. This gives FEMP more flexibility to respond to the dynamic

needs of Federal agencies across major areas, such as building energy efficiency, renewable energy, fleet vehicle energy use, and the use of performance contracting. The FY 2017 DOE budget request proposes to increase FEMP funding to $43 million with the largest increase coming in the FEEF program, with a proposed increase from $3 million in FY 2016 to $15 million in the FY 2017 request.

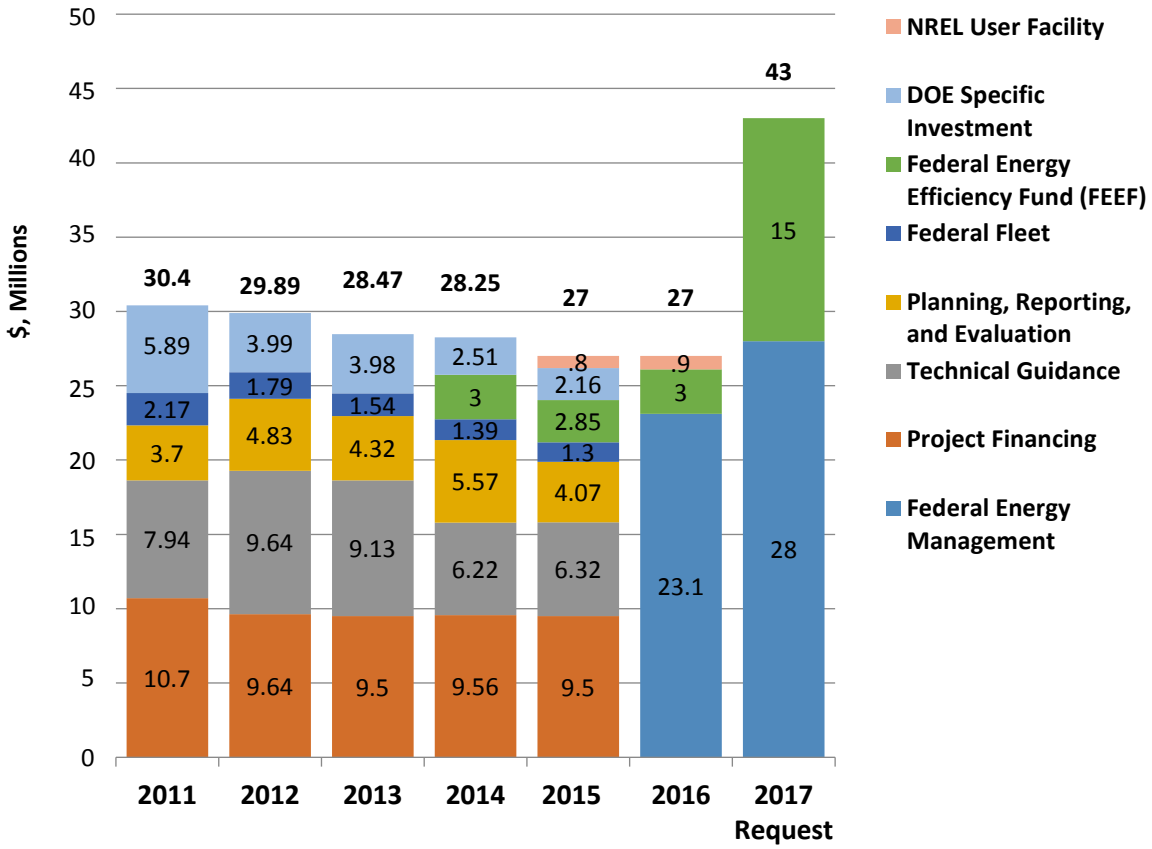

Figure 15. FEMP budget, FY 2011–2017 request[191]
Acronym: NREL – National Renewable Energy Laboratory.

10.2 Discussion

FEMP has major responsibilities and provides important tools in meeting the current Executive order on Federal energy management and related statutory obligations. The office carries out its duties with a very modest budget and staffing. Overall, it has done a commendable job in the face of limited resources and multiple challenges.

FEMP's work figures prominently in the various sections of this report, from its efforts with respect to ESPCs (Section 3) and evaluation, measurement, and verification (Section 2), to its work to advance Federal deployment of AFVs (Section 8) and improve Federal procurement of renewable energy (Section 5). This section looks at two key FEMP

challenges: first, a limited budget; and second, organizational issues, including FEMP's standing within DOE, relationships Administration-wide, and its role nationally.

10.2.1 FEMP's Budget Challenges and Opportunities

FEMP's budget, hovering between $27 and $30 million for the last several years, is a very modest one given its responsibilities relative to a total Federal energy budget of more than $23 billion. Although the Obama Administration has made Federal energy management a priority, as evidenced by two Executive orders and a number of Presidential challenges and events, FEMP's budget has not kept pace. As noted above, the FY 2017 budget request of $43 million includes a major requested increase for a key FEMP initiative: FEEF. While this is a substantial increase, it does not get FEMP to a level where it can fully meet its responsibilities pursuant to Federal statutes and Presidential Executive orders. The Task Force believes that with greater funding, FEMP could do significantly more to advance Federal energy management. Below, we highlight key challenges and opportunities for FEMP where additional funding is necessary.

10.2.2 FEEF

FEEF was established by the Energy Policy Act of 1992 to promote energy efficiency and renewable energy deployment in the Federal sector, especially projects with a high degree of replicability. According to FEMP, two rounds of FEEF funding to date—$5 million in 2014 and $2.85 million in 2015—leveraged about $23 of project investment for each dollar of FEMP project funding. Prominent projects include a combined heat and power installation at NASA's Johnson Space Center with more than 23 percent reduction in annual energy use and $3 million in annual energy savings, and potential application at nine more NASA centers. The Department of State, leveraging FEEF funds, is deploying renewable energy and on-site energy storage at 10 overseas posts in Latin America with potential extension to 275 posts worldwide. Also, in its FY 2017 budget request, FEMP proposed using future FEEF funds to advance "deep retrofit projects," as pioneered by the General Services Administration (GSA), across the Federal Government (see Section 3).

10.2.3 Support for Technology Demonstration and Validation Efforts

FEMP could also play a stronger role in promoting earlier-stage technology demonstration and validation ("dem-val") efforts, as discussed in Section 9. This could involve helping to connect the DOE-EERE Building Technologies Office's support for emerging technologies ("technology push") to the dem-val activities in operational buildings in the Department of Defense (DOD), GSA, and elsewhere ("demand pull"). The DOD Environmental Security Technology Certification Program (ESTCP)–DOE SunShot partnership, albeit limited, is a model. More broadly, DOE could foster building energy dem-val activities across the Federal Government through high-level leadership, coordination, and shared funding. DOE should take advantage of, not duplicate, what

DOD's ESTCP Energy Test Bed and GSA's Green Proving Ground are doing: as large facility owners, DOD and GSA (and possibly other entities such as the U.S. Postal Service) are uniquely positioned to carry out this dem-val role. However, the Federal Government's broader building energy dem-val efforts, including a host of less formal efforts that are ongoing, require high-level direction and coordination that FEMP might logically provide.

In the FY 2017 budget request FEMP proposed using FEEF funds for first-of-a-kind technology adoption. This could include stimulating the use of technologies emerging from DOD and GSA test bed demonstrations as part of Federal ESPC projects. As discussed in Section 3, ESCOs and ESPCs are a potentially powerful tool for initial deployment of the technologies that DOD and GSA are demonstrating. The challenge is that ESPC contractors have an incentive to minimize risk on individual projects, leading to a default to older proven technologies. In Section 3, the Task Force urges FEMP to address this problem, and the funding from the FEEF program is a potential way to "buy down" the risk in an ESPC deploying an innovative technology. However, there are other potential funding approaches, beyond FEEF, that FEMP might take to achieve this objective.

10.2.4 Metering Acceleration

As discussed in Section 2 of this report, only a small fraction of Federal facilities and buildings are metered, either with traditional or advanced meters. The FEMP office indicates that metering is often challenging to install at many locations, because of the difficulties energy managers in particular agencies have in demonstrating their life-cycle cost-effectiveness. Adding to this dilemma, the meters that have been installed often are different from each other and do not have consistent functions. Additionally, there are rising concerns about cybersecurity issues related to advanced meters and associated sensors and controls (see below). There are two potential steps FEMP could take to address this challenge: first, develop standard meter specifications for use across the Federal Government; and second, establish a fixed operations and maintenance savings amount resulting from metering that can be used in metering purchase decisions (so-called "deemed" savings). Based on these steps, FEMP could establish a government-wide meter-buying program using the deemed savings and standard meter specifications.

10.2.5 Data Management

Data from existing meters is being collected by a variety of systems and methods. As a result, significant amounts of personnel time and budget must be spent to collect the data and aggregate it, and it often is not being used to actively manage facility and building operations. Presently, data for the annual report on Federal goals is gathered by FEMP through a large Excel workbook that is emailed among agencies and DOE. This data is received only once per year, and is usually only the total consumption for the agency for

a year (except for electricity, which is reported at the Emissions & Generation Resource Integrated Database [eGRID] sub-region). There is no real ability to develop or assist with tools to analyze consumption data.

There is a significant opportunity to develop, purchase, and require use of a common data aggregation system across the Federal Government. Such a system would decrease costs and improve understanding of Federal energy consumption by enabling more sophisticated and frequent analysis. The results of this analysis could, in turn, stimulate further energy reductions.

10.2.6 Federal Utility Bill Management

An additional major missed opportunity is the way the Federal Government manages payment of utility bills, totaling about $7 billion annually in FY 2014.[192] In sum, the Federal Government's utility bills are received and paid by an array of personnel at various levels, including facility managers and other agency officials scattered across a range of different offices. As a result, the payment process is highly fractured and inconsistent, and the analysis of, and learning from, the bills themselves is limited. The data on these bills are often not accessible to FEMP, to say nothing of the relevant energy manager at a particular agency.

The private sector has often turned to third-party utility bill-management firms to handle their utility bills. These firms receive the bill, analyze its accuracy, enter the information into a broader companywide database, and pay the bill. (Some bills have errors that these companies correct, sometimes in the favor of their customer.)

The Federal Government should explore the potential for a third-party utility bill payment system as increasingly used in the private sector. The utility bill management effort would include utility bill payment, entry of utility data into ENERGY STAR Portfolio Manager, and analysis of the utility bills. It also could connect to the data management efforts discussed above.[qqq]

10.2.7 Cybersecurity

The cybersecurity issue looms large in the work of the Federal Government across multiple agencies and at the highest levels of the Administration. In 2015, DOE released cybersecurity guidance to the energy sector to meet the objectives of the Cybersecurity Framework released by the National Institutes of Standards in 2014.[193]

The Task Force has heard issues raised about cybersecurity in the context of Federal energy management. There are two primary areas of concern, although the Task Force

[qqq] The recent National Defense Authorization Act calls for the Secretary of Defense and Secretary of Energy to "develop a pilot program to investigate the utilization of utility data management services to perform utility bill aggregation, analysis, third-party payment, storage, and distribution." S. 2943, 114th Cong., Title III Subtitle B § 304 (2016), https://www.congress.gov/114/bills/s2943/BILLS-114s2943pcs.pdf.

did not explore either in depth. The first is the implications of advanced building energy analytical systems (discussed in Section 2) for cybersecurity. The second area involves risks around access to energy data—collected by a range of meters, sensors, etc.—including whether it might reveal sensitive building or facility information.

While the Task Force did not study the cybersecurity implications of advanced energy analytical systems in depth, two different factors have emerged. On the one hand, there is concern that smart meters and sensors and related analytical and management systems, installed in Federal buildings (and potentially grid-connected vehicle fleets), could increase the vulnerability of government agencies to cyber attack. On the other hand, there is a view that these systems can provide both cybersecurity detection and protection capability.

There is a need to clarify these and related cybersecurity issues around advanced energy analytical and management systems in the Federal Government. This is an area beyond FEMP's expertise, and the Federal Government should, therefore, consider creating a task force, with budget support, that could address this challenge, including experts from key agencies, the private sector, and standard-setting bodies (the DOE-EERE Building Technology program has already begun some work in this area). This task force might also address the data access issues discussed next.

With regard to access to energy data, the 2007 EISA requires all Federal agencies to release their energy consumption data to the public through FEMP's Compliance Tracking System. FEMP has been unable to release this data for DOD and some Federal facilities managed by other agencies because the data has been declared sensitive. However, there is no clear and consistent process for determining if the data is actually sensitive and to what degree. Among the key questions are what data needs to be secure and how secure does the data need to be? FEMP is clear that this determination is not its business, but the office believes that it could help those who make security decisions better understand what energy data is, how it is acquired, and whether and how it might reveal sensitive facility information.

A multi-agency task force, with budget support, could help define the security requirements around energy use data. This task force, which might be combined with the one suggested above to review advanced energy analytic and management systems, would include representatives from DOD, DOE, the Central Intelligence Agency, and other relevant national security agencies. This task force would address key issues including what makes energy data secure or unsecure; how an agency determines if its data is secure or not; what can be done to make it secure; and how data might be altered to make it releasable, e.g., "anonymize" the site by zip code.

10.2.8 Organizational Issues and Related Relationships

In part because its budget is so small, FEMP lacks the clout—inside of DOE and within the Federal Government more broadly—to have the desired impact. It also faces some intra-government "relationship" issues that are independent of its budget. Finally, the Federal Government's management of its energy use has a great deal of connection to energy management in the private sector and at the state and local level and FEMP could play a greater role on these fronts

10.2.9 Organizational Clout

FEMP is a small program with a limited budget and, thus, does not generally have the profile or influence that a program with its major administration-wide responsibilities—and explicit congressional and Presidential direction— it needs to have in order to get its job done.

In addition to increasing FEMP's budget, one way to increase its clout may be to change its position in the DOE hierarchy. FEMP sits within DOE's EERE. The FEMP Director reports to the Deputy Assistant Secretary (DAS) of Energy for Energy Efficiency who in turn reports to the Assistant Secretary for Energy Efficiency and Renewable Energy.

There are clear advantages to the placement of FEMP in EERE, especially its close relationship with relevant EERE programs that are key to its work; in particular, building technologies, renewables, and vehicles. However, for a program with FEMP's responsibilities and breadth—literally the entire U.S. Federal Government—and the prospect of a rising budget, questions have arisen about its relatively low-profile placement within EERE and DOE more broadly. Two levels down from a Senate-confirmed Federal official does not give the FEMP director the day-to-day clout that he or she needs to advance a key opportunity or resolve an important issue. The EERE Assistant Secretary or DAS can take the lead in particular circumstances, but they have a broader mandate and limited time.

In the last couple of years, alternatives have been discussed, such as raising FEMP to a DAS level within EERE, moving the program to a different office within DOE, or shifting it entirely to a different agency or placement within the Executive Office of the President.

It is not uncommon for advocates of an executive branch program to argue that the program should be moved to the White House to increase its impact. However, that position rarely makes sense because the White House, as a general matter, does not and should not run programs. For that reason, the Task Force does not support moving FEMP out of DOE.

Furthermore, the Task Force believes that FEMP's responsibilities across key energy areas—building efficiency, clean energy deployment, and alternative fuel vehicles—

make its DOE home within EERE compelling programmatically. If, as recommended above, FEMP's budget is significantly increased, consideration should be given to raising the FEMP director position to an EERE DAS level, perhaps by combining it with other related EERE offices, including the State Energy Program. Alternatives include combining FEMP with the current EERE DAS for Administration (and creating a DAS for Administration and Government Programs) or having FEMP report directly to the EERE Principal DAS. FEMP's profile might also be raised organizationally by playing a greater role on relevant Secretarial-level committees and working groups. In any event, FEMP should be better integrated day to day with the key EERE programmatic offices.

10.2.10 FEMP Roles and Relationships

OMB plays a significant role in government-wide progress on Federal Energy management, in particular ensuring that direction is clear and budgets are adequate in meeting executive and legislative goals. While current OMB leadership has generally been supportive of FEMP's efforts to carry out its responsibilities, members of the committee heard from a number of individuals inside and outside government that individual OMB staff can sometimes frustrate progress. One continuing example has been ESPC implementation, a critical tool in Federal energy efficiency efforts, especially under President Obama's Performance Contracting Challenge, and one of FEMP's highest priorities. Two issues, in particular, loom large in FEMP's ESPC work: scoring of ESPCs and the scope of ESPC coverage. Section 3 of this report discusses these issues and FEMP's role in addressing them. As the committee and its members interviewed several government and industry leaders, a consistent theme emerged. While OMB ESPC scoring policy has been consistent for almost three decades, intermittent scoring questions raised by particular OMB staff have slowed or stalled agency ESPC project development. Sometimes senior OMB officials, while sympathetic, do not intervene to eliminate obstacles to ESPC implementation erected by career OMB staff. There is a similar dynamic from time to time regarding questions about the scope of ESPCs, for example how to treat projects where savings from projects are based more on ancillary operational savings than direct energy savings. Overall, consistent OMB support is imperative for projects to move in a timely fashion through the Federal system.

Another key FEMP relationship is with the DOE General Counsel. The DOE General Counsel provides FEMP with important guidance and support. While generally supportive, FEMP sometimes gets into time-consuming discussions over the interpretation of relevant statutes, slowing progress on key Federal energy management goals in conflict with Executive Order (E.O.) 13693 and congressional direction. In the case of ESPCs, recent debates have ensued over several issues including energy versus ancillary savings, how much ESPC savings must be returned to the Treasury Department versus accruing to the relevant agency, and how Congress is notified of pending ESPCs. In a number of situations, the DOE General Counsel's challenge is the range of opinions

across multiple agencies on key legal questions affecting Federal energy management. One answer may be to form a "council of counsels" that can sort through these legal issues and accelerate their resolution.

Another important FEMP relationship is with CEQ. CEQ's Federal Chief Sustainability Officer (CSO, formerly the Federal Environmental Executive) plays a prominent role in Federal energy management, and his or her relationship to FEMP is an important one. E.O. 13693 also directed each agency to designate a CSO. Typically, these agency CSOs have served this role in addition to their main position. There is an opportunity for agency CSOs to hold a dedicated full-time position, allowing them to focus solely on sustainability at the agency. This would allow the CSO, for example, to develop guidelines in key areas, such as the assignment of facility energy managers, incorporation of energy goals in the work of agency officials, and development of quarterly progress reviews on sustainability issues. Cutting the other direction, however, an agency CSO might have more clout within an agency if he or she also occupied another senior role, e.g., at the Assistant Secretary level.

Another key FEMP relationship is with GSA's Office of Federal High-Performance Green Buildings. GSA owns a major proportion of the Federal civilian building stock, and the GSA green buildings office helps the Federal Government minimize its footprint through efficient use of energy, water, and resources, and by creating healthy productive workspaces. EISA 2007 created this office, and it works closely with FEMP to support E.O. 13693 and Federal sustainability. FEMP integrates its programs, such as the Better Buildings Challenge and eProject Builder, with GSA's implementation programs, such as the National Deep Energy Retrofit and Green Proving Ground.

10.2.11 FEMP's National Role

Another opportunity for FEMP is to play a stronger national role, since, as one FEMP official put it, "physics doesn't change from one building to another," whether commercial or Federal. What Walmart is pursuing on lighting should apply to Federal buildings and vice versa, recognizing, of course, that there can be differences between private-sector and Federal facilities, particularly when it comes to national security and economic motivations. In his 2009 "Sustainability Executive Order" (E.O. 13514), President Obama stressed that "the Federal Government must lead by example." Leading by example means more than just achieving a target for energy or carbon reduction. Historically, the Federal Government has played an important role as an early adopter of new technology, helping to kick-start commercial markets that would otherwise be slow to develop (see Section 9).

There is an opportunity for FEMP to connect how it carries out Federal energy management to how the Nation pursues energy management more broadly. In several instances to date, FEMP has built these connections to the private sector as well as state

and local sectors. In developing the eProject Builder database, for example, FEMP developed a tool that can be used not only for Federal ESPCs, but also for ESPCs for state and local facilities. This tool standardizes the structure and calculations of ESPC projects, and its use beyond the Federal market would help standardize ESPC contracts across multiple markets, allow benchmarking across contracts, and bring greater transparency to ESPCs overall. In the Better Buildings Data Center Challenge, FEMP determined that Federal facilities working with private facilities together generated more interest than Federal facilities alone. Thus, when DOE launched the Data Center Challenge, it included both Federal and non-Federal data centers. This, among other things, allowed comparison of Federal and private sector data centers spurring healthy competition. FEMP should increasingly compare Federal and private-sector performance more broadly, including in office buildings, data centers, hospitals, vehicle fleets, etc. and, as appropriate, work to build common methods and mechanisms to increase their energy performance.

10.3 Recommendations

1. Following a careful review of the overarching challenges and opportunities in Federal energy management (a number of which are articulated in this report) the next administration should seek significant increases over time in FEMP's budget beginning in FY 2018. The incoming Secretary should review FEMP's budget, both with respect to current work and high priority areas for potential additional funding. Based on discussions with FEMP officials, there are priority funding areas, discussed above, involving FEEF, technology demonstration and validation efforts, metering acceleration, data management, federal utility bill management, and cybersecurity. There are a number of other areas discussed in this report where additional funding would advance key Federal energy management goals.
2. The incoming administration should review OMB's approach to key aspects of FEMP's work, including, among other things, ESPC scoring and scope.
3. The incoming administration should review and determine an approach to cybersecurity in FEMP's work. The current FEMP office has suggested the creation of a task force to review these issues.
4. The incoming administration should review the activities of the CEQ CSO in the area of Federal energy management and the role that FEMP might play in his or her work. This review should also include the role of individual agency CSOs.
5. The incoming DOE Secretary should review the current organizational placement and structure of FEMP within DOE's EERE, but the Task Force believes that FEMP's placement within EERE is compelling programmatically.
6. The incoming Secretary of Energy should review the work of the DOE General Counsel's Office in addressing key legal issues facing FEMP's programmatic

efforts. This should involve consideration of the role of other Federal agency counsels, procurement officials, and other DOE offices, focused on how to improve and accelerate the resolution of key legal issues in Federal energy management. This might involve forming a “council of (agency) counsels” to address these matters.

7. FEMP should expand its efforts to integrate Federal, State, and private sector energy management including in office buildings, data centers, hospitals, vehicle fleets etc. and, as appropriate, work to build common methods and mechanisms.
8. FEMP should look for opportunities to promote energy technology dem-val efforts, currently led by DOD and GSA, within DOE and other agencies. This should include finding means to incorporate technologies advanced by dem-val efforts in Federal ESPCs.

Endnotes

[1] Exec. Order No. 13693, 80 Fed. Reg. 15869 (March 25, 2015).

[2] Table A-1, "Total Site-Delivered Energy Use in All End-Use Sectors, by Federal Agency," *Comprehensive Annual Energy Data and Sustainability Performance*, Department of Energy, Federal Energy Management Program, June 1, 2016, http://ctsedwweb.ee.doe.gov/Annual/Report/TotalSiteDeliveredEnergyUseInAllEndUseSectorsByFederalAgencyBillionBtu.aspx.

[3] "Federal Government Energy/Water Use and Emissions in 2015," *Comprehensive Annual Energy Data and Sustainability Performance*, Department of Energy, Federal Energy Management Program, June 1, 2016, http://ctsedwweb.ee.doe.gov/Annual/Report/Report.aspx.

[4] Table A-2, "Government-Wide Site-Delivered Energy Use and Costs in All End-Use Sectors," and Table A-6, "Site Delivered Energy Use and Cost by End-Use Sector and Energy Type by Federal Agency," *Comprehensive Annual Energy Data and Sustainability Performance*, Department of Energy, Federal Energy Management Program, June 1, 2016, http://ctsedwweb.ee.doe.gov/Annual/Report/Report.aspx.

[5] Table A-3, "Site-Delivered Energy Use, Costs, and Gross Square Footage of Federal Facilities by Agency," *Comprehensive Annual Energy Data and Sustainability Performance*, Department of Energy, Federal Energy Management Program, June 1, 2016, http://ctsedwweb.ee.doe.gov/Annual/Report/Report.aspx.

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