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Mission, Money, and Process Makeover: How Federal Procurement Can Catalyze Clean Energy Investment and Innovation

DOROTHY ROBYN | AUGUST 2022

Using federal procurement to advance sustainable energy goals has had only limited success in the past. To break the pattern, the White House needs a plan that aligns with agency missions, is adequately funded, and fixes perverse budget and procurement rules.

KEY TAKEAWAYS

- Despite decades of directives, the federal fleet remains almost entirely gas-powered, federal buildings lag energy-reduction targets, and half of federal purchases of energy-using products do not comply with legal requirements for energy efficiency.
- A federal agency's mission requirements "eat sustainability directives for breakfast," because resources are limited and there is no penalty for noncompliance.
- Although sustainability requirements often entail new spending, agencies lack "the green to go green," and budget requirements—upfront funding of capital costs, limits on alternative financing, segregation of operating costs—compound the problem.
- The widespread practice of awarding contracts to the lowest bidder disadvantages clean energy choices, which often cost more upfront but yield life-cycle savings.
- To drive clean energy investment and innovation, the administration needs to leverage mission alignment where it exists, address funding needs and perverse budget rules, and overhaul the procurement process.
- Innovation should be a priority for federal sustainability, given the government's unique ability to address the demand-related market failures impeding clean energy innovation.
- To drive innovation, the administration should accelerate demonstration and procurement of clean energy technologies that meet mission needs, expand DOE's mission to better exploit federal demand, and reform energy performance contracting.

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EXECUTIVE SUMMARY

In December 2021, President Biden issued his long-awaited executive order (EO), "Catalyzing Clean Energy Industries and Jobs through Federal Sustainability," which directs federal agencies to significantly decarbonize federal vehicles, buildings, and electricity use in the next decade, and achieve net-zero greenhouse gas (GHG) emissions by 2050. The president has made federal sustainability a pillar of his plan to combat climate change. Although achievement of the EO's targets would make only a dent in U.S. emissions overall, the real aim is to use the federal government's buying power to boost ("catalyze") investment, innovation, and job creation in clean energy.

This is a compelling aim. The major impediment to the commercialization of clean energy technology is weak demand. As the country's largest energy consumer—with 650,000 vehicles, 350,000 buildings, and a $6-billion-a-year utility bill—the federal government can provide direct and visible demand for clean energy goods and services, helping pull innovative new technology into the market and accelerating its broader adoption.

While President Biden has given it more visibility, the idea of using the government's buying power to advance national energy goals is nothing new. At least since the oil crisis of the 1970s, U.S. policymakers have imposed requirements on federal assets and activities (excluding military operations) to shrink the government's energy footprint, while boosting the market for clean energy goods and services.

The impulse to impose sustainability requirements on federal purchasing and asset management (referred to here as "procurement") is understandable. For a president, it is an action he or she can take without congressional approval. For Congress, it seemingly requires no new programs or spending—merely a change in the way federal agencies buy vehicles and equipment and manage their buildings. However, decades of efforts to use federal procurement to advance sustainable energy goals have amassed a relatively poor track record. While sustainability requirements may yield benefits even when agencies fail to meet them, the chronic performance gap raises questions about the potential for sustainable procurement to catalyze investment and innovation going forward.

By contrast, federal agencies regularly use the lever of procurement to drive mission-related investment and innovation. The Department of Defense (DOD) and the National Aeronautics and Space Administration (NASA) have famously served as price-insensitive lead customers, spurring the commercialization of integrated circuits, computers, jet engines, Earth orbiting satellites, solar photovoltaics (PV), and many other technologies that have enhanced mission performance. In 2020, the Department of Health and Human Services (HHS) followed a similar playbook in committing to buy hundreds of millions of doses of a COVID-19 vaccine that did not yet exist.

This report analyzes the federal government's decades-long experience with sustainable procurement to help inform the Biden Administration's effort to catalyze clean energy investment and innovation.[1] A secondary goal is to highlight the importance of clean energy innovation and identify ways to make sustainable procurement more innovation focused.

The report is organized in six sections. Section I describes the economic case for government support for clean energy innovation and highlights the role of demand-side policies, including federal procurement. Section II sketches the history of federal sustainability and assesses the

government's track record in four areas: fleet vehicles, building operations, energy-consuming products, and renewable energy. Section III analyzes key factors that explain the poor track record of sustainable procurement compared with DOD-/NASA-style technology procurement: 1) the limited alignment of clean energy with federal agency missions, 2) inadequate funding and perverse federal budget rules, and 3) the federal procurement process itself. To deepen the analysis, Section IV looks at eight technology demonstration and procurement programs federal agencies have established, outside of the directive-driven federal sustainability regime, to advance clean energy innovation. Sections V and VI offer conclusions and recommendations to improve federal procurement policies related to clean energy.

Key Findings

Since the 1970s, U.S. policymakers have sought to use federal procurement to achieve national energy goals. This effort takes the form of requirements imposed on the purchase and operation of the federal fleet, federal buildings, and other energy-intensive goods and services. While these efforts have produced some notable successes, federal agencies have fallen short of meeting key requirements and metrics in three of the four core areas of fleet vehicles, building operations, energy-consuming products, and renewable energy:

- Despite decades of statutory and executive directives regarding sustainable vehicles and fuels, the federal fleet is still heavily dominated by gasoline-powered vehicles, and alternative fuels accounted for just 1.1 percent of federal fuel use in 2021—down from a "high" of only 3.4 percent in 2013.
- Federal agencies fell well short of a statutory requirement to reduce their building energy consumption by 30 percent by 2015 (2003 baseline). Civilian agencies came closer to meeting the goal, but DOD brought down the average, resulting in only a 21 percent government-wide decrease (seven years later, the 2015 goal has still not been met).
- Multiple statutes and directives require federal agencies to purchase energy-efficient versions of appliances, equipment, and other energy-consuming products. However, independent analysis of federal solicitations reveals that contracting personnel comply with the minimum legal requirements only about half the time.
- Federal agencies successfully met the statutory requirement to use 7.5 percent renewable electrical energy by 2013 and thereafter (in 2021, it was 10 percent). Civilian agencies met the goal largely by purchasing renewable energy certificates (RECs), and DOD deployed a large amount of solar energy on its military bases.

This report looks at three key obstacles to federal compliance with sustainability requirements:

Obstacle #1 is the limited alignment of sustainability requirements with agency missions. Federal agencies go to extraordinary lengths to perform their missions, but for most agencies, clean energy is not the mission. An agency's mission requirements "eat sustainability directives for breakfast" because resources such as funding and senior leadership attention are limited, and there is no penalty for noncompliance.

Where mission and clean energy needs *are* aligned, they can overcome the obstacles to sustainability that federal budget and procurement rules create. DOD surmounted major

procurement hurdles to deploy renewable energy because military bases are vulnerable to outages of the electricity grid, and on-base energy generation enhances their energy resilience.

Obstacle #2 is inadequate funding and perverse federal budget rules. Although sustainability requirements often entail new spending, agencies lack "the green to go green," and federal budget rules only compound the problem. The requirement for up-front funding of capital costs and limits on alternative financing impede investment in buildings and renewable energy. The segregation of acquisition and operating costs deters the purchase of vehicles and other assets that cost more up-front but offer savings over time.

Energy performance contracting (an exception to the ban on alternative financing) allows agencies to procure energy-conserving building improvements at no up-front cost. Such contracts *should* be a way for federal sales to give innovative new technology a commercial boost. Instead, contractors are incentivized to install older technology—a significant missed opportunity.

Obstacle #3 is the federal procurement process itself. The widespread practice of awarding contracts to the lowest price bid disadvantages clean energy choices insofar as they cost more up-front. Past efforts to adopt life cycle costing (LCC) have failed because of the simplicity and transparency of the low-price rule. The few clauses in the Federal Acquisition Regulation (FAR) that require consideration of energy efficiency or life cycle costs lack teeth.

Federal procurement experts believe it will take "dramatic cultural change" to inject sustainability into the federal government's purchasing practices, including a fundamental shift to LCC that takes environmental externalities into account at every stage. The Biden administration is pursuing a rulemaking to consider how best to implement such change.

Among the conclusions that follow from this analysis are these:

There is a mismatch between the policy tool (purchasing and asset management) and the policy goal of advancing clean energy. Government processes such as budgeting and procurement are designed to minimize cost and risk, and they serve vital functions (fiscal restraint, promotion of competition). Sustainable procurement is at odds with these processes insofar as it requires a willingness to spend more up-front and accept some risk as to the payoff in lower life cycle costs.

To overcome this mismatch, the administration's sustainability plan needs to leverage the alignment between agency missions and clean energy where it exists, address agency funding needs and the perverse budget rules that compound them, and overhaul the procurement process.

Standard federal procurement is even less well suited to stimulating clean energy innovation. Innovation is the riskiest and most costly phase of the technology development life cycle. To drive innovation, the government needs to take on greater risk and cost—something it generally does only to address national security needs (DOD/NASA procurement) or a grave social problem (HHS's advance purchase of COVID vaccines).

Despite this challenge, the federal sustainability effort should make innovation a priority because of the government's unique ability to address the market failures that impede innovation. Since innovation will not occur naturally as part of the sustainable procurement process, it has to be built in—through cost sharing, risk sharing, and other means. Examples include:

- Expanded use of federal technology demonstrations by customer agencies

- Accelerated procurement of clean energy technologies that meet mission needs
- Expansion of the Department of Energy's (DOE's) mission to include technology procurement and activities that exploit the federal market for clean energy technology
- Modification of the energy performance contracting process
- Provision of funds to agencies exclusively for procurement of innovative technology

Policymakers should reconsider the exemption from sustainability requirements of weapon system contracts (but not DOD operational energy—i.e., fuel). Although it would be inappropriate to subject DOD fuel use to any kind of restrictions, some of what DOD purchases as part of its weapon system contracts is commercial off-the-shelf technology or other equipment and products that could benefit from the discipline sustainability requirements are meant to provide.

Recommendations

1. The administration should provide funding for agencies to cover the higher cost of electric vehicles (EVs) and EV infrastructure, carbon-free electricity (CFE), and efforts to curb emissions from federal buildings and building materials.
2. Agencies should have access to additional funds to be used to procure especially innovative clean energy technology; the Technology Modernization Fund is a possible model.
3. The General Services Administration (GSA) should absorb the "incremental cost" of EVs by drawing money from its Acquisition Services Fund (ASF).
4. GSA should encourage agencies to use its Areawide Contract (AWC) to amortize the cost of the EV infrastructure.
5. Congress should continue to seek funding for the U.S. Postal Service (USPS) to cover the higher up-front cost of electric postal trucks. USPS should be encouraged to consider leasing the batteries.
6. Congress should protect GSA's Federal Buildings Fund. It should also authorize the Federal Capital Revolving Fund and capitalize it at the proposed amount ($10 billion).
7. The Office of Management and Budget (OMB) and the Congressional Budget Office (CBO) should examine how budget scorekeeping rules constrain efforts to achieve sustainability goals.
8. Congress should direct the National Academies of Sciences, Engineering and Medicine (NASEM) to examine energy performance contracting, including how best to incentivize energy service companies to deploy innovative technology in federal buildings and options for reducing financing costs.
9. The White House's Office of Federal Procurement Policy (OFPP) should make sustainable procurement a core competency for federal acquisition professionals.
10. OFPP should accelerate the FAR Council's Advanced Notice of Proposed Rulemaking (ANPR) on minimizing the risk of climate change in federal acquisition. It should

strengthen the enforceability of existing requirements and ensure that new requirements have teeth.

11. Federal agencies should undertake pilot projects, such as GSA's 2014 procurement of Domestic Delivery Services (DDS), to test the feasibility of the concepts identified in the ANPR.
12. Congress should establish a program, similar to the Experimental Technology Incentives Program (ETIP), to conduct experiments on how federal procurement can more effectively drive innovation in clean energy and other sectors.
13. DOE should expand its mission focus to include technology procurement and activities that exploit federal demand to drive clean energy innovation, including committing in advance to purchase output from DOE-supported demonstrations and other sources, and technology-specific partnerships with customer agencies such as DOD.
14. The administration should increase support for federal demonstrations of pre- and early-commercial clean energy technologies by DOD, GSA, and other customer agencies.
15. The administration should work with agencies to accelerate the procurement of clean energy technologies that meet mission requirements, including the need for energy-resilient military bases and DOD operational energy needs.
16. OMB and the Council on Environmental Quality should set up a process to determine whether/how to extend sustainability requirements to weapon system contracts (but not DOD operational fuel use).

I. THE ECONOMIC RATIONALE FOR FEDERAL SUPPORT FOR CLEAN ENERGY INNOVATION

Private firms systematically underinvest in clean energy innovation because of several market failures. Firms underinvest in innovation, generally, because the spillover of knowledge to non-investors can make it hard to capture the benefits. Clean energy innovation, in particular, faces additional barriers, including the mispricing of fossil fuels (the market price does not reflect the full social costs of GHG emissions and other damaging effects), split incentives (as when a landlord underinvests in energy efficiency because the tenant pays the energy bills), and other market impediments due to inadequate information.[2] These barriers reduce the demand for clean energy technologies, which in turn limits innovators' willingness to invest in their development.

To counter the impediments to privately funded clean energy innovation, the public sector can pursue two complementary approaches. Government can increase the *supply* of innovation—also known as "technology push" or "supply push." In 2022, DOE will spend about $8.6 billion on energy research, development, and demonstration (RD&D).[3] DOD also invests heavily in energy research and development (R&D). The R&D tax credit is another, less direct means of technology push.[4]

In addition, government can bolster the *demand* for clean energy technology—also known as "demand pull" or "market pull." Market demand stimulates technology innovation and diffusion in two basic ways. First, the prospect of a large and growing market encourages private firms to

invest in innovative new technologies. Second, growing demand generates immediate feedback from early users, which supports product and process innovation responsive to market needs.[5]

User feedback also facilitates technology adoption and diffusion. Lack of information on how clean energy technologies perform is a significant impediment to their widespread adoption. To be of value, advanced lighting or a condensing boiler must provide the same or better service at a lower life cycle cost than traditional technologies do. Life cycle cost, in turn, depends on factors such as the level of skill required to operate the new technology, maintenance requirements, and user acceptance.[6] Early adopters provide just such information—an extremely valuable activity that the market on its own will undersupply because the early adopters are uncompensated (i.e., the information is a public good).[7]

Because weak demand is the major impediment to commercialization of clean energy technology, federal policies that create demand are critical to innovation.[8] The most basic approach is carbon pricing, which increases the demand for less polluting technology by forcing emitters to bear the cost of their emissions. Unfortunately, U.S. policymakers have been loath to impose significant costs on fossil fuels.[9] More politically acceptable policies to stimulate demand include tax subsidies such as those for wind and solar energy production, and environmental regulation such as fuel economy standards for vehicles and efficiency standards for appliances.

Government procurement represents another demand-pull policy tool. The federal government is the country's largest consumer of energy, which it uses to conduct military operations; operate 350,000 buildings; power computers, appliances, and other energy-consuming equipment; and run 650,000 fleet vehicles. Thus, energy figures prominently in the goods and services the federal government buys (see box A). As an enlightened customer, the federal government could provide direct demand for clean energy technology, thereby encouraging innovation. And as an early adopter, it could facilitate the adoption and diffusion of clean energy technology more broadly.

BOX A: Federal Contracting and Sustainable Energy

In 2020, direct federal spending on contracting totaled $665 billion—up from $586 billion in 2019—or about 40 percent of nondiscretionary federal spending.[10] Large parts of the federal contracting budget are not covered by sustainability requirements. DOD weapon system contracts, which represent 30 to 40 percent of all federal contracting, are explicitly exempt.[11] By their nature, most service contracts, which account for 60 percent of all federal contracts (and a sizable share of DOD's weapon system contracts), are not covered. Federal spending that is directly covered by sustainability requirements includes vehicle acquisition and operation and maintenance (O&M) ($5 billion per year), facility energy ($6 billion per year), and energy-consuming products (billions of dollars per year). Sustainability requirements are relevant for federal spending on building construction, renovation and O&M, more broadly, which is about $60 billion per year (that back-of-the-envelope estimate includes the purchase of facility energy and some energy-consuming products).

II. SUSTAINABLE PROCUREMENT: ORIGINS AND EFFECTIVENESS

The use of federal procurement to advance national energy goals goes back at least five decades. In response to the 1973 Arab oil embargo, President Nixon directed the federal government to reduce its energy consumption in 1974 by 7 percent from the 1973 level (he set a comparable nationwide goal of 5 percent). Nixon left the precise means of conservation up to the discretion of agency heads but specified that agencies should acquire fuel-efficient vehicles, reduce air conditioning use in federal buildings, and cut back on travel. President Ford extended the directive, calling for 15 percent less federal energy consumption in 1975 compared with 1973.

Beginning in 1975, Congress addressed federal energy use as part of a series of major energy laws. Box B highlights some of these statutes, which went well beyond the Nixon/Ford directives in terms of the scope, specificity, and stringency of the requirements on federal agencies. Most relevant to this report are the Energy Policy Act of 1992 (EPACT 1992), the Energy Policy Act of 2005 (EPACT 2005) and the Energy Independence and Security Act of 2007 (EISA).

BOX B: Key Energy Statutes

- In the *Energy Policy and Conservation Act of 1975*, Congress set average fuel economy standards for federal fleets and directed the president to develop and implement a 10-year plan for energy conservation in federal buildings.
- The *National Energy Conservation Policy Act of 1978* directed the newly created DOE to institutionalize performance targets for federal buildings and called for federal agencies to conduct building energy audits and retrofit 1 percent of audited space annually.
- The *Federal Energy Management Improvement Act* of 1988 set the first statutory goal for reduced energy consumption by federal buildings. That same year, the *Alternative Motor Fuels Act* directed agencies to acquire the "maximum practicable" number of light-duty vehicles fueled by alcohol or natural gas.
- In *EPACT 1992*, Congress increased the target for reduced building energy consumption, changed it from a "goal" to a "requirement," and directed agencies to undertake conservation measures with a payback period of less than 10 years. The act also called for federal supply agencies to buy products that would yield significant life cycle energy savings, and for most light-duty vehicle acquisitions to be alternative-fueled vehicles.
- In *EPACT 2005,* Congress established its first renewable energy goals for federal agencies. It also required agencies to justify the purchase of any eligible product that was not in the top quartile of its product category for energy efficiency.
- The *Energy Independence and Security Act of 2007* set new requirements for reduced energy consumption by federal buildings and for the type of fuel consumed by the federal fleet.

U.S. presidents since Nixon have addressed federal sustainability by issuing EOs that reaffirm and often exceed existing statutory requirements. President Clinton established an "affirmative procurement program" for environmentally preferable products and set the first goal for reduction of (facility-related) GHG emissions. President Bush maintained support for the Clinton policies and set a new target for reduced building energy use that Congress codified in EISA. President

Obama issued EOs in 2009 and 2015, which President Trump largely revoked, that broadened the mandate to address GHG emissions in federal operations and set deadlines for federal fleet electrification. See box C for a description of President Biden's December sustainability EO, Executive Order 14057.

BOX C: Executive Order 14057

President Biden's December sustainability EO directs agencies to:

- acquire 100 percent zero-emission vehicles by 2035, including 100 percent light-duty zero-emission vehicles by 2027;
- achieve a net-zero emissions building portfolio by 2045, including a 50 percent emissions reduction by 2032 compared with a 2008 baseline;
- achieve net-zero emissions in the goods and services procured by 2050; and
- purchase or produce 100 percent carbon pollution-free electricity (CFE) by 2030, of which 50 percent must be CFE on a 24/7 basis.

While the Biden EO is built around the same four building blocks as past orders (vehicles, building operations, energy-consuming products, and renewable energy), the targets are more ambitious. They also reflect more interest in innovation. For example, the 24/7 CFE target is designed to drive innovation in the "clean, firm" sources of power (e.g., zero-carbon fuels, carbon capture and storage, and nuclear energy) that will be needed to supplement intermittent sources such as solar and wind.[12] As with prior sustainability EOs, spending by DOD on operational energy and weapon system contracts is exempt. Moreover, as an independent agency, USPS, which is the second-largest federal energy consumer (DOD is first), is not subject to the EO.

Track Record

The use of sustainable procurement to advance national energy goals has produced numerous successes. Federal requirements spurred the market for recycled paper in the 1970s and a George W. Bush EO led industry to make low standby power a customary feature of office electronic equipment. Many state and local governments followed the federal lead in requiring the purchase of products with an Energy Star eco label.

These and other success stories notwithstanding, agency compliance with federal sustainability requirements has often fallen short, as measured by (among other metrics) a "stoplight" (red-yellow-green) scorecard OMB issues semiannually. These shortfalls in turn have limited the government's impact on private investment and innovation in clean energy.

The following is a short summary of the federal government's (largely pre-Biden) track record in four key areas: vehicles, building operations, energy-consuming products, and renewable energy.

Vehicles

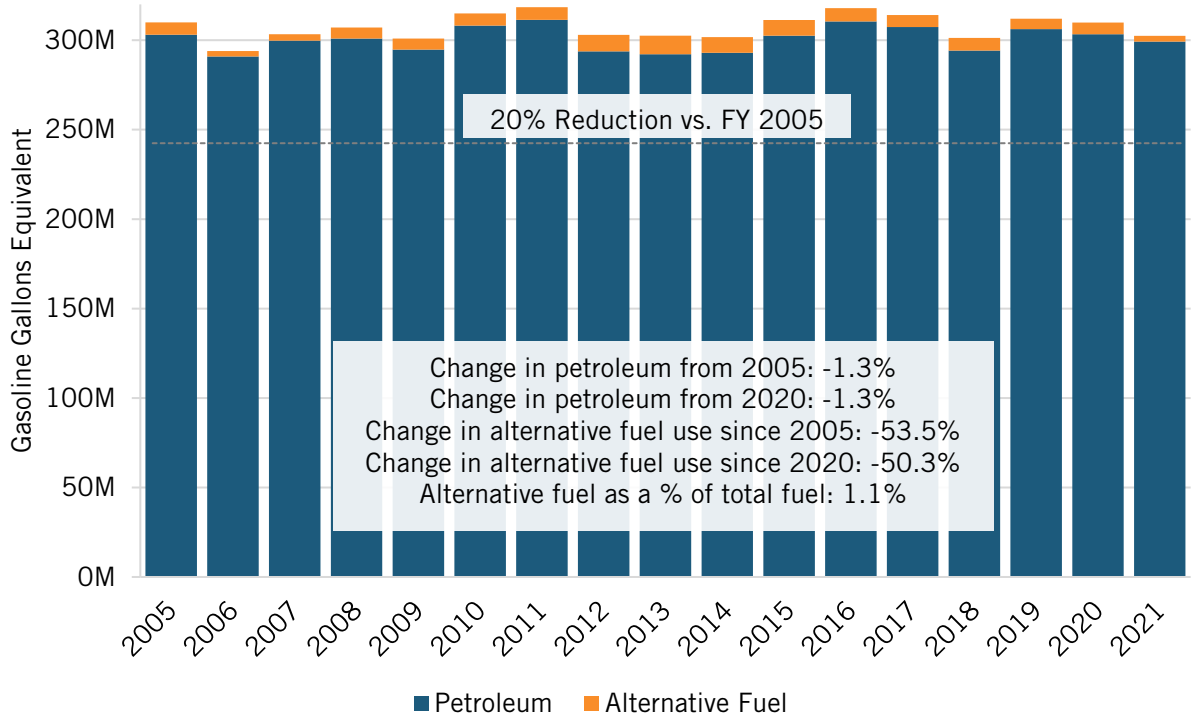
The federal government has 657,000 nontactical vehicles, of which 242,000 are operated by civilian agencies, 181,000 by DOD, and 234,000 by USPS. Turnover in the federal fleet totals 50,000–60,000 vehicles a year. In 2021, government vehicles consumed 368 million gallons of

gasoline or gasoline equivalent at a cost of $764 million. USPS accounted for 54 percent of the fuel use and 67 percent of the fuel cost.[13]

Despite decades of statutory and presidential directives, the federal fleet is still dominated by traditional gasoline-powered vehicles. Of the 56,000 vehicles acquired in 2021, 38,000 were gasoline powered, 9,000 were E85 "flex-fuel" vehicles (vehicles that can run on gasoline or gasoline-ethanol blends of up to 85 percent ethanol), and 247 were EVs.[14] Setting aside questions about the sustainability of E85 fuel, what is most telling is that the flex-fuel vehicles operate almost entirely using conventional fuels because of the dearth of E85-refueling stations: In 2021, the average federal flex-fuel vehicle consumed only 35 gallons of E85.[15] As shown in figure 1, alternative fuels (largely E85) accounted for just 1.1 percent of total federal fuel use in 2021, down from the "high" of only 3.4 percent in 2013; and fleet petroleum use was just 1.3 percent below the 2005 level, compared to the EISA target of 20 percent (by 2015).

USPS's procurement of a Next Generation Delivery Vehicle (NGDV) to replace its iconic mail truck represented the single biggest opportunity to transform the federal fleet and in doing so drive investment in EV technology and supply chains.[16] Despite the advantages of electrification for last-mile delivery—and in spite of the EPACT 1992 directive on alternative-fueled vehicles—in February 2021, USPS opted for a new fleet that would consist largely (90 percent) of gasoline-powered trucks because of the higher up-front cost of the electric version. In July 2022, following a lawsuit by states and environmental groups and the confirmation of two new members of the USPS Board of Governors, USPS announced it will make 40 percent of its new trucks electric (up from 10 percent).[17] See the appendix for more detail.

Figure 1: Federal government fleet petroleum and alternative fuel use[18]



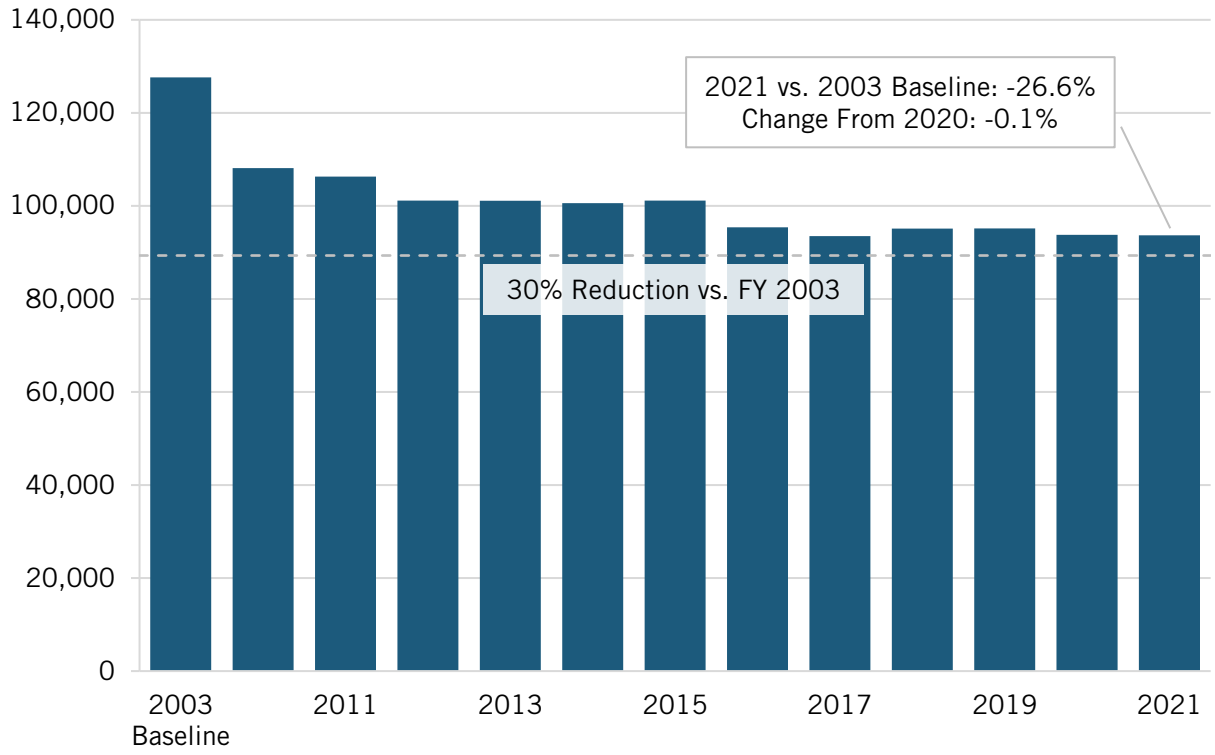
Building Operations

The federal government owns or leases some 350,000 buildings with a footprint of more than three billion square feet, which is six times the commercial office space in Manhattan. With hundreds of military bases, DOD accounts for 80 percent of the buildings and 70 percent of the space in the federal portfolio. The second-largest portfolio belongs to GSA, which manages 380 million square feet (only 200 million of which is federally owned) in 9,600 buildings that it rents to civilian agencies at market rates. Federal buildings consume 345 trillion British Thermal Units (BTUs) of energy a year (largely electricity and natural gas), at a cost of $6 billion, of which DOD accounts for 58 percent.[19]

Federal buildings have been the target of dozens of statutory and executive directives aimed at improving energy efficiency and environmental sustainability.[20] The most prominent building-energy directive is an EISA provision that required agencies to reduce the energy-use intensity (EUI) of their buildings by 3 percent a year, or 30 percent, from 2005 to 2015, relative to a 2003 baseline. (EUI is calculated as BTUs consumed per square foot.)

As shown in figure 2, the federal government failed to meet the EISA requirement, decreasing its building EUI by only 21 percent by the end of 2015. Civilian agencies came closer to meeting the EISA target, but with an EUI reduction of less than 1 percent a year, DOD brought down the government-wide average. At the end of 2021, the federal government had reduced its EUI by just 27 percent—still shy of the 2015 target.

Figure 2: Federal government building energy use intensity (Btu per gross square foot)[21]



Energy-Consuming Products

Federal agencies spend tens of billions of dollars a year on energy-consuming products other than vehicles. These products include heating and cooling equipment such as boilers, chillers, and heat pumps; appliances such as clothes washers, refrigerators, and freezers; outdoor and indoor lighting systems; and information technology and electronics ranging from desktop computers to uninterruptable power supply systems. The federal government is the single largest U.S. customer for such products, which account for a nontrivial share of the energy used in federal buildings.

EPACT 1992, EPACT 2005, and various EOs require agencies to purchase energy-efficient products, where "energy efficiency" is denoted by an Energy Star label or compliance with a comparable designation by DOE's Federal Energy Management Program (FEMP). In 2011, these overlapping requirements were codified in the FAR, the legal underpinning for federal procurement. They apply not just to products delivered from the vendor to the government but also to products acquired by contractors at government facilities or furnished or specified by contractors for government use.

Analysts at DOE's Lawrence Berkeley National Laboratory (LBNL) track the degree to which federal contracting personnel comply with these requirements, based on solicitations posted on a website that lists all federal procurements valued at more than $25,000. The analysts distinguish between "legal (or FAR) compliance" (did the solicitation meet the minimum requirements under the FAR?) and "effective compliance" (did it contain additional language that increases the likelihood of getting a responsive offering?).

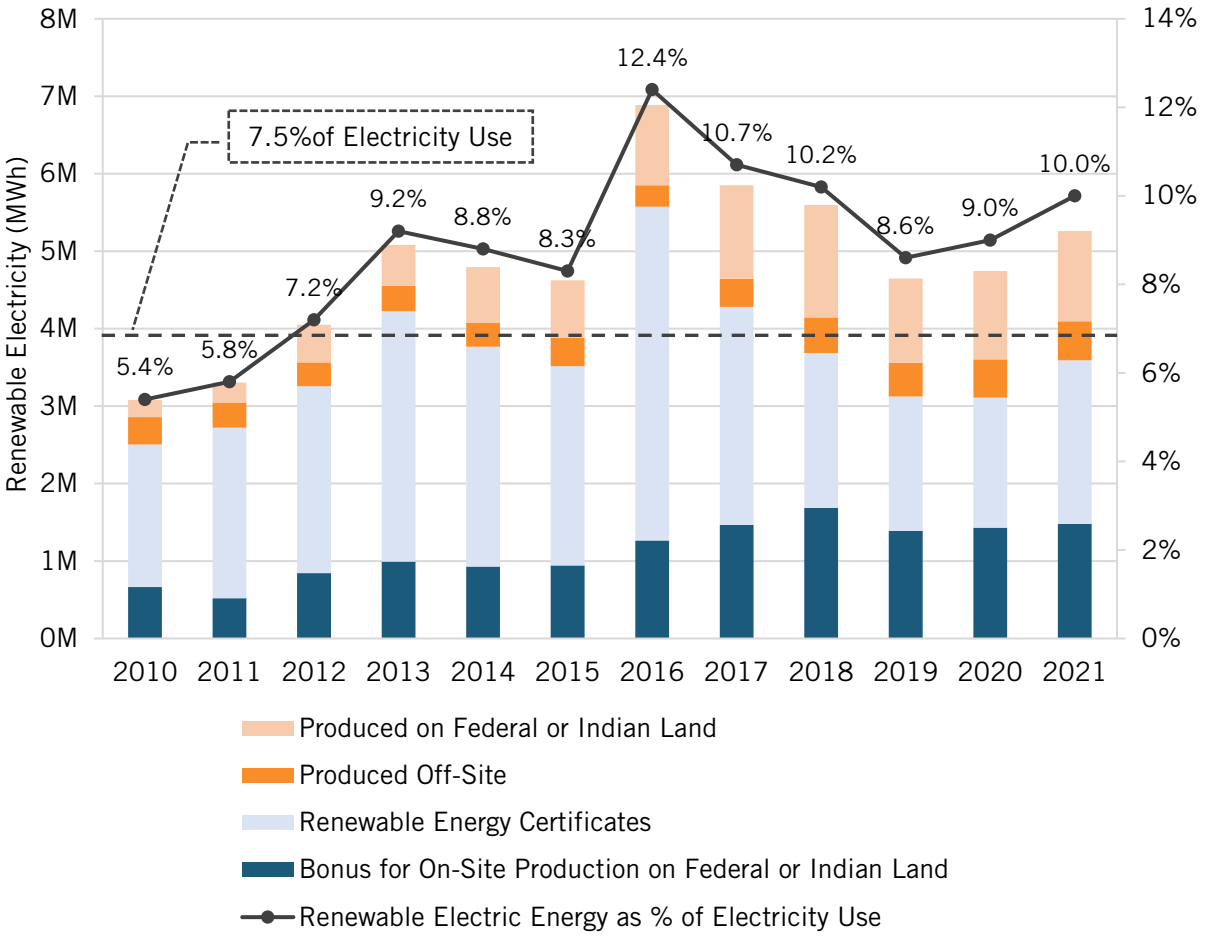
Compliance levels are low by either measure. According to LBNL, agencies comply with FAR requirements only 55 percent of the time. The effective compliance rate is a mere 38 percent.[22] Simply stated, federal buyers are requesting energy-efficient products only about half the time, which means the benefits of the sustainability requirements are going unrealized nearly as often as not.[23]

Renewable Energy

The federal government buys 54 terawatt hours of electricity annually—about the same amount used by Greece.[24] Most of that power is purchased by GSA and DOD's Defense Logistics Agency (DLA). Both agencies buy electricity and natural gas in deregulated retail markets as well as wholesale markets. In addition, GSA maintains a 10-year contract for energy services (known as an AWC) with most regulated utilities in the United States, so that federal customers in that utility's service area can purchase electricity and natural gas at pre-negotiated rates.

EPACT 2005 required agencies to use renewable energy in an amount equal to at least 7.5 percent of their facility electricity use by 2013 and every year thereafter. As shown in figure 3, the federal government met that EPACT goal, using 9.2 percent renewable electrical energy in 2013—up from 3.4 percent in 2008. Agencies met the goal largely by purchasing RECs. During the Trump administration, agencies reduced their REC purchases, and renewable energy as a share of federal electricity use dropped by a third—although it has remained above the EPACT target, and it was 10.0 percent in 2021.

Figure 3: Federal government renewable electricity use[25]



The EPACT metric actually understates the federal government's achievement because the Army, Navy, and Air Force have deployed a large amount of utility-scale renewable energy (largely solar) that does not count toward the EPACT goal. (EPACT counts only power that is consumed on site, whereas much of the power generated on DOD bases is exported to the grid.)

III. KEY OBSTACLES TO SUSTAINABLE PROCUREMENT

Why have federal agencies repeatedly failed to meet the requirements for sustainable procurement? In a nutshell, sustainability requirements are an unfunded and unenforced mandate on budget-strapped agencies whose mission does not include clean energy. The higher up-front cost of many clean energy technologies poses a particular challenge because of the nature of the federal budget and federal procurement processes. By contrast, DOD-/NASA-style technology procurement is mission driven, and most such procurement is adequately funded because appropriations follow mission. In fact, as early adopters, DOD and NASA often pay a premium for higher-performing technologies. This section looks at three key obstacles to sustainable procurement: the limited alignment of clean energy with federal agency missions, inadequate funding and perverse federal budget rules, and the federal procurement process itself.

Obstacle #1: Limited Alignment With Agency Missions

Federal agencies exist to carry out specific missions, many of which have deep historic roots. Everything about a federal agency—its budget, organization, staffing, and culture—is presumptively designed to achieve the agency's mission. Anyone who has worked in government knows that agencies go to extraordinary lengths to perform their missions.

Mission needs are a powerful driver of innovation, among other things. With its large internal market, DOD has been especially effective in using procurement to advance mission-enhancing innovation, as Robyn and Marqusee described:

> First, because of its mission and deep pockets, DOD often chooses to pay a premium for higher performing technologies. This is key because the earliest versions of major innovations are typically characterized by high capital and operating costs, and limited reliability. As a technology matures and improves with use by, and feedback from, the military, it becomes cost competitive. Second, the scale of DOD's buying power can attract new entrants to an embryonic industry, thereby stimulating competition. High-volume government procurement also can drive additional cost reductions and quality improvements, ultimately stimulating broader adoption of the innovation by commercial users.[26]

Requirements for sustainable procurement face a major handicap in that they are not mission aligned: That is, for most federal agencies, clean energy is not the mission. Although sustainability requirements are a legitimate tool for improving federal energy management, they rarely advance an agency's mission directly, and are often seen as competing for resources that could go to support mission needs.

In defending their initial decision to purchase largely gasoline-powered vehicles, USPS officials distinguished between the agency's core mission—"to provide universal postal service in a financially self-sufficient manner"—and what they see as a public policy goal to electrify the federal fleet.[27] The official who ran the NGDV procurement testified that USPS recognized the "larger national interest in moving toward an energy efficient … future" but that "every additional dollar spent on buying electric vehicles is one fewer dollar that can be spent on … other critical capital needs and operational objectives."[28] While that is arguably a narrow view of the USPS mission, it seems to have informed the NGDV procurement.

Mission also helps explain LBNL's findings on energy-efficient product procurement. While the overall compliance with FAR requirements was low, as noted earlier, LBNL also found significant variation in compliance rates both across agencies and within agencies. LBNL researchers attribute the variation to "institutional factors" such as leadership support for sustainable procurement. A not-inconsistent explanation is mission alignment: The agencies and agency units with the highest compliance rates are ones whose mission includes facility energy management (e.g., GSA's Public Buildings Service and the Navy's Facilities Engineering Systems Command) or resource management, more generally (e.g., the departments of Interior and Agriculture). Conversely, the agencies and units with the lowest compliance rates are those whose missions are largely unrelated to sustainability (e.g., the departments of Commerce, Labor, and Homeland Security).[29]

Similarly, mission goes a long way in explaining the contrasting records of the two largest federal real property holders—DOD and GSA—with respect to building energy requirements. GSA routinely exceeds federal sustainability targets, and GSA-managed federal buildings, which have seen a 50 percent drop in energy consumption since 2008, are more energy efficient than their commercial counterparts.[30] The key reason: Efficient management of federal real property is the mission of GSA's Public Buildings Service. DOD's poor track record on the same metric reflects the lack of perceived mission alignment: The military services chronically underinvest in their building infrastructure, including building energy management, to pay for operational demands. Many DOD buildings lack advanced meters to track their energy consumption because of concerns about their cost or cybersecurity.

DOD's contrastingly strong record on renewable energy is not an anomaly but rather an example of mission alignment. Military bases depend on the commercial electricity grid, which is vulnerable to outages due to severe weather and manmade threats. On-base energy generation—together with microgrid and storage technology—enables a base to maintain power to critical loads if the grid goes dark. Although most of its renewable energy projects were begun during the Obama administration, DOD continued to deploy renewable energy assets during the Trump Administration, albeit at a slower pace, and it maintained funding for an Obama-era test bed program that helps transition advanced microgrid technology to market (see section IV).

In short, DOD takes seriously the deployment of renewable energy because having energy-resilient military bases is key to mission performance. To be sure, energy efficiency also contributes to bases' energy security ("the most secure electron is one that is never consumed"). However, the link is less direct.[31]

DOE's FEMP was created to help agencies achieve sustainability goals that are not core to their mission. FEMP has done a good job helping agencies plan for electrification of their fleets and has been a champion for energy performance contracting (but see the following caveat regarding innovation). However, FEMP is chronically under-resourced, and it lacks standing in an agency (DOE) that is fundamentally devoted to R&D.[32]

Obstacle #2: Inadequate Funding and Perverse Federal Budget Rules

A closely related reason federal agencies fail to meet sustainability requirements is funding constraints and perverse federal budget rules. Because appropriations follow mission, sustainability requirements often amount to unfunded mandates. Although many elected officials appear to believe that agencies can simply redirect their existing procurement budgets, in reality, requirements often entail new spending because of the (initially) higher cost of clean energy (see box D on the "green premium") or the need to replace infrastructure that is still functional. Simply stated, "It takes green to go green."

BOX D: The "Green Premium"

The "green premium" is the additional cost of a clean energy technology over one that emits more GHGs. Although not all clean energy technologies are priced at a premium, many are. One explanation for the green premium is the mispricing of fossil fuels. A plant-based burger costs more than one made from ground beef because the latter doesn't reflect the true cost of the methane emitted by livestock.[33] A second explanation is the technology life cycle: Clean energy technologies,

like early innovations in any sector, tend to have higher capital and operating costs. As a technology matures and vendors gain experience and production scale, these costs decline. Third, clean energy technologies tend to be more capital intensive, resulting in a higher up-front cost offset by lower operating costs. For example, EVs have a higher sticker price than internal combustion engine (ICE) vehicles do because of the cost of the battery, but an electric powertrain requires less maintenance (fewer parts, no oil changes). As battery costs continue to decline (technology maturation), the life cycle costs of electric and ICE vehicles are approaching parity. Although the sticker-price gap is also shrinking, EVs will likely remain somewhat pricier because they are more capital intensive.

Impediments to Procurement of Sustainable Vehicles, Buildings, and Renewable Electricity

Budget-strapped federal agencies lack "the green to go green," and federal budget rules compound the problem—particularly for efforts to decarbonize vehicles, buildings, and electricity use. Consider vehicles. The (discretionary) federal budget is constructed and appropriated annually, and the funding an agency receives for fleet acquisition is separate from that for O&M. A fleet manager has an incentive to buy the vehicles with the lowest purchase price—currently, ICE vehicles—in order to maximize the value obtained in the current budget cycle. The fact that ICE vehicles will be more expensive than EVs to operate and maintain is secondary because the O&M costs will show up in future budget cycles and will not directly affect the funding for fleet acquisition.

In theory, vehicle leasing provides a way to overcome the EV green premium because the purchase price is amortized and lease charges reflect EVs' lower O&M costs. However, GSA's "incremental cost" rule limits the appeal of leasing. To elaborate, GSA, which buys vehicles in bulk at large discounts and then sells or leases them to individual agencies, requires agencies that lease an EV to pay up-front the difference between the GSA-negotiated price of an EV and its lowest-price ICE counterpart. GSA justifies this charge as necessary to maintain the liquidity of its self-financing procurement operation.[34] But given the magnitude of the charge, which ranges from $9,000 to $20,000 for battery electric sedans and sport utility vehicles, it serves as its own deterrent to EV acquisition.[35]

Procurement of sustainable building systems and upgrades is even more challenging because of the chronic underfunding of federal facilities. DOD often takes funds out of infrastructure to pay for operational exigencies, as previously noted, and over the last 11 years, Congress has diverted $10.3 billion in rent receipts from GSA's Federal Buildings Fund to cover *non-GSA expenses*.[36] This habitual underinvestment raises O&M costs (a poorly insulated building costs more to heat and cool), and has resulted in a backlog of $165 billion in maintenance and repair projects.[37] As a senior official in one of the military services said privately, "The department would never handle maintenance of our … military hardware the way we do [our base] infrastructure."[38]

As with vehicles, federal budget rules contribute to the problem. Because the federal government lacks a capital budget, major building renovations must be fully funded up-front, and agencies cannot take advantage of third-party (i.e., private) financing—equivalent to trying to buy a home without access to a mortgage.[39] President Biden has asked Congress to create a "Federal Capital Revolving Fund" that would spread the costs of major (civilian) capital projects over a period of up to 15 years. While this proposal represents much-needed change, it has languished in

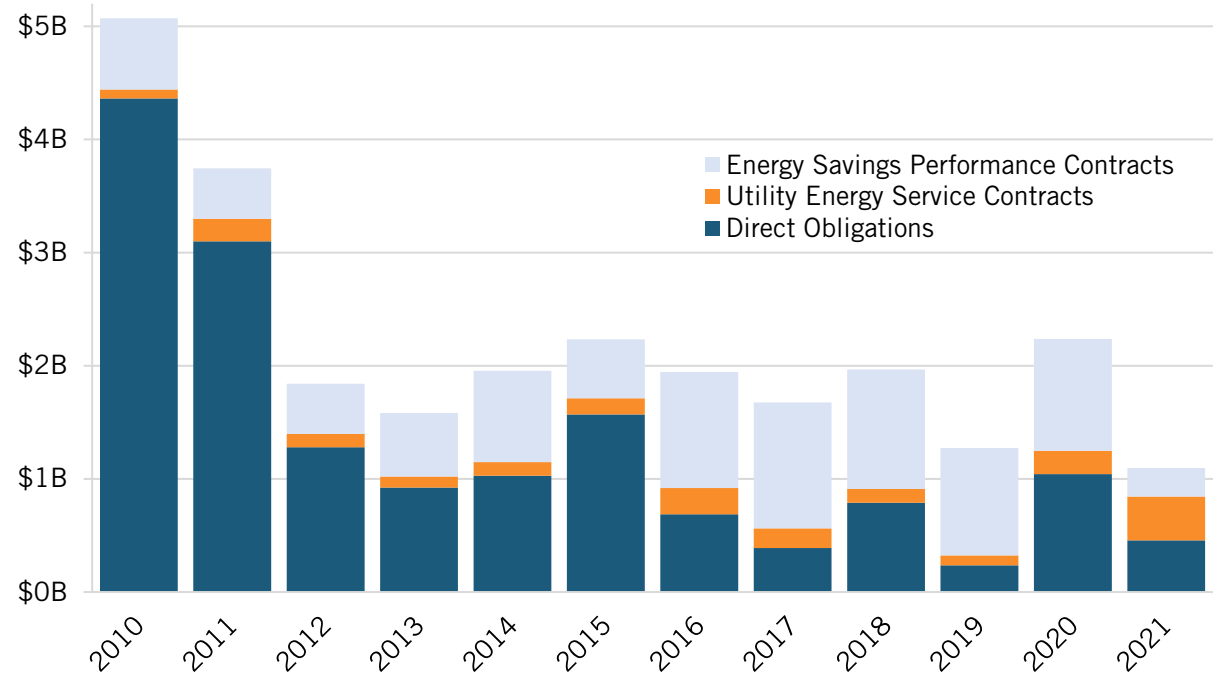
Congress (the Trump Administration initially proposed it), and the size of the fund currently envisioned ($10 billion) is a drop in the bucket.

Budget scorekeeping rules similarly impede the procurement of renewable electricity. Although civilian agencies can enter into power purchase agreements (PPAs), the main tool available to them is GSA's Part 41 authority, which is limited to 10 years. This is too short a period to make the economics of many power deals workable (DOD has 30-year PPA authority). The Biden administration has not asked Congress for the longer-term PPA authority that civilian agencies want, presumably because CBO would score it adversely based on its view that PPAs must be fully funded in advance.[40] Similar OMB/CBO concerns about budgetary scoring are reportedly hampering GSA efforts to negotiate long-term contracts with utilities in order to meet the Biden administration's 24/7 CFE requirement.

The Unfulfilled Promise of Energy Performance Contracting

One of the few exceptions to restrictions on third-party financing is energy performance contracting. Under an energy savings performance contract (ESPC), an energy service company (ESCO) installs and maintains energy-conserving equipment in a federal building at no up-front cost to the agency in exchange for a share of the resulting utility savings. Since OMB (but not CBO) greenlighted their use, agencies have relied heavily on ESPCs and similarly structured utility energy service contracts (UESCs) to meet their requirements for reduced building EUI.[41] The Obama White House took the extraordinary step of "challenging" (i.e., directing) federal agencies to complete $4 billion in energy performance contracts between 2011 and 2016. Of the nearly $18 billion federal agencies invested in building energy efficiency improvements from 2012 to 2021, more than $9 billion, or 53 percent, took the form of ESPCs or UESCs. Looking just at the last five years (2017–2021), ESPCs and UESCs accounted for 65 percent of agencies' investment in building energy efficiency improvements. See figure 4.

Figure 4: Federal government investment in facility energy efficiency improvements[42]



Energy performance contracting is a valuable tool without which federal agencies would be unable to undertake many cost-effective projects. ESPC-enabled "deep energy retrofits" have allowed GSA to achieve significant energy savings and a range of nonenergy benefits, including reduced vacancy rates (tenants are happier) and better building utilization (the downsizing of mechanical equipment frees up space).

These benefits come at a price, however: Fully 30 percent of the cost of an ESPC goes for financing.[43] (ESCOs typically work with boutique financing firms that manage the payment stream for what is often a 20–25 year contract.) Given the federal government's ability to borrow money at ultra-low rates, it is fair to question whether agencies should incur such costs.

Costs aside, energy performance contracting falls short from an innovation standpoint. ESPCs *should* be a major channel for the deployment of innovative building energy technologies. In this way, federal agencies would get access to the latest technologies, and federal sales could help suppliers gain a foothold in the commercial market. In reality, however, ESCOs deploy older technology because the structure of the contract, which guarantees the savings for each individual project, makes them risk averse. For example, ESCOs held off including LED lighting in their projects until the cost declined significantly. As one senior GSA official said privately, ESCOs simply take technology off the shelf, and often it isn't even "best of shelf."

ESCOs themselves acknowledge the problem but, understandably, do not see it as their job to solve it. FEMP, whose job it should be, has done little to explore potential remedies.[44] This is an enormous missed opportunity for the federal government to pull innovative new technology into the market.

Efforts to Secure the "Green to Go Green"

To its credit, the Biden administration has tried to get federal agencies "the green to go green." The Build Back Better (BBB) bill included nearly $13 billion for that purpose, including $6 billion to cover the incremental cost of electric postal trucks and the related charging infrastructure, $3 billion for similar costs associated with electrification of the nonpostal fleet, and $3.75 billion to help reduce emissions from federal buildings and building materials.[45] Months after BBB appeared dead, many of its energy provisions were revived in the Senate-passed Inflation Reduction Act, which the House is likely to approve.

The FY 2022 appropriations bill, which Congress passed in March, was another effort to get federal agencies the funds to comply with the president's ambitious sustainability plan; however, it yielded little. For example, of the $600 million that was in the president's budget for (nonpostal) fleet electrification, only about $100 million made it into the final bill.

Obstacle #3: Federal Procurement Process

A third obstacle to agency compliance with sustainability requirements is the federal procurement process itself. The widespread reliance on a lowest-price approach to awarding contracts disadvantages clean energy goods and services, and the few FAR provisions that require contracting officers to consider energy efficiency or life cycle costs lack teeth.

Purpose of Public Procurement

The federal procurement system is a massive and complex process, comprising millions of transactions a year valued at hundreds of billions of dollars. The FAR is thousands of pages long. Acquisition reform laws passed in the 1990s, together with advances in technology, have led to significant changes in federal contracting, including less reliance on the traditional "supply" agencies (GSA and DLA), increased use of e-commerce, and leaner agency staffing.

The fundamental purpose of the procurement system is to obtain goods and services at the best possible value, in terms of price and quality, to meet agency missions. That said, federal contracting has long been used to address nonprocurement, or policy, objectives as well, as evidenced by prevailing wage requirements, set-asides for small and disadvantaged businesses, and Buy American mandates.[46]

Steve Kelman, who led OFPP during the Clinton administration, has cited two problems with making nonprocurement objectives a major focus of the procurement system. One is that the restrictions on competition imposed to meet those objectives serve to increase the price or reduce the quality of what the government buys. Even more problematic, nonprocurement objectives reduce the focus of the system on getting a good deal. In Kelman's view, failure to concentrate on that fundamental goal "has been the bane of our procurement system and a significant reason for procurement underperformance."[47]

Experimental Technology Incentives Program and Life Cycle Costing

Sustainability requirements may be less objectionable to procurement purists in that many of the requirements embody life cycle cost analysis, or LCC. LCC gained prominence in the 1970s as a result of the ETIP, a visionary initiative begun by the Nixon administration to see whether procurement, regulation, and other standard government functions could be used to stimulate technological innovation. Based on controlled experiments and technology demonstrations, ETIP recommended that the federal government replace its practice of obtaining goods and services at the minimum up-front cost with one that sought to minimize the total cost of ownership. ETIP also recommended increased use of performance (as opposed to design) specifications and value-incentive clauses (i.e., shared savings) in federal contracts.[48] (See section IV for more detail on ETIP.)

LCC was hardly a new concept. Private firms had used it for decades to evaluate alternative investment opportunities for plant and equipment; and DOD had tried it, recognizing that "sustainment" (operation, repair, and maintenance) accounted for most of the total ownership cost of a weapon system.[49] However, ETIP's proposal to use LCC more broadly—which was embraced by the recently created OFPP as well as GSA's Federal Supply Service (now the Federal Acquisition Service)—marked a notable shift in federal procurement policy.[50]

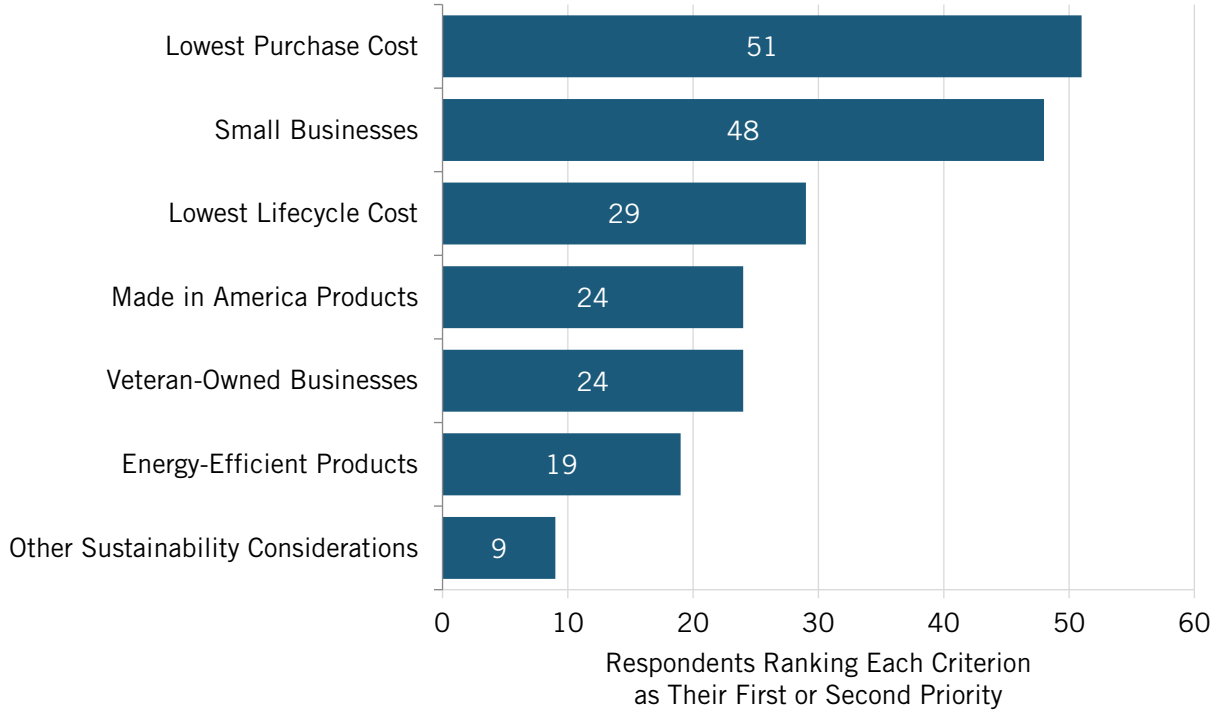
Resilience of the Lowest-Price Principle

Despite this embrace of LCC at the policy level, for many types of procurements—including purchases of energy-consuming products—contracting personnel still tend to follow the lowest-price rule: Of those bids that meet the government's minimum technical requirements, the lowest-price offer is preferred.

LBNL analysts surveyed federal personnel involved in the procurement of energy-consuming products, including facility managers and staff, contracting officers, and contract specialists.

Consistent with other studies of contracting personnel, respondents said getting the lowest purchase cost was their highest priority, whereas buying energy-efficient products was their next-to-lowest priority. Perversely, they ranked "lowest life cycle cost" as less important than "lowest purchase cost."[51] See figure 5.

Figure 5: Highest priorities reported by federal procurement staff[52]



The dominant reason the lowest-price approach to procurement has been so resilient is its relative simplicity and transparency: It is straightforward to compare bids on the basis of purchase cost, whereas LCC is more complex and subjective. The lowest-price approach also reduces uncertainty because the costs are known. By contrast, the promise of lower costs in the future can be speculative and hard to verify.[53]

Because it is transparent and straightforward, the lowest-price rule serves to encourage price competition among bidders and discourage favoritism on the part of the contracting official. It also reduces the risk of a protest by a losing bidder, which can significantly delay a procurement. So important are these functions to the fundamental goal of public procurement in countries around the world that the lowest-bid principle has sometimes been prescribed by law.[54]

Yet another reason the lowest-price rule remains entrenched is its compatibility with the federal budget process, which, as previously discussed, focuses on annual spending and largely ignores the potential for life cycle savings. As a former head of Army acquisition put it, "DOD never makes financial decisions, only budget decisions."[55]

Overcoming the "Tyranny of Low Price"

Steven Schooner, a national expert on federal procurement law and policy, views "the tyranny of low price" as a pernicious impediment to the fundamental procurement reform needed to

address climate change.[56] However, it is not the only problem he sees. The FAR says very little about sustainable procurement, according to Schooner and Markus Speidel: The most meaningful provision was "quietly jettisoned" as part of the 1990s acquisition reform process. Remaining provisions, including the one added in 2011, do not figure prominently in the FAR and lack teeth.[57]

Schooner argues that it will take "dramatic cultural change" to inject sustainability into the federal government's purchasing practices. According to Schooner and Speidel, "Sustainability needs to become part of our professional community's every-day thinking, nomenclature, policy, practice, and self-assessment."[58] Schooner and Evan Matsuda advocate a fundamental shift to LCC, with environmental externalities taken into account at every phase of the procurement process (i.e., generating requirements, drafting solicitations and evaluation factors, evaluation and negotiation, and post-award contract management). They argue that government could shift much of that burden (and opportunity) to the private sector, incentivizing bidders to incorporate high-quality information in their proposals.[59]

Toward that end, in 2014, GSA ran a pilot procurement for DDS that explicitly considered the social cost of carbon (SCC). DDS is a multi-billion-dollar contract that all federal agencies are required to use for global air and ground small package delivery services. GSA asked bidders to report the emissions associated with their deliveries during the previous year along a specified set of package routes. It then used the federal government's SCC tool to calculate the economic impact of each bidder's estimated emissions. In evaluating bidders' proposals (the contract ultimately was awarded to FedEx and UPS), GSA considered those estimated impacts, together with price bids and information on past performance.

The GSA pilot faced a number of challenges, and it raised questions as to whether carbon accounting was sufficiently precise to be used in a legalistic process such as federal procurement. Nevertheless, it illustrates the potential impact of using procurement as a way for the federal government to put a shadow price on carbon.[60]

FAR Council's ANPR

In October 2021, in response to a May 2021 EO on climate-related financial risk, the Federal Acquisition Regulatory Council published an advance notice of proposed rulemaking (ANPR), "Minimizing the Risk of Climate Change in Federal Acquisitions."[61] The FAR Council, which helps coordinate and direct federal procurement policy, sought feedback on several challenging issues, including how (or whether) to:

- consider GHG emissions and their social costs over the life cycle of the goods or services being procured;
- create evaluation preferences for offers that achieve reductions in GHG emissions and/or their social costs (and tools for assessing those offers);
- incorporate and mitigate climate-related financial risk into federal procurements; and
- ensure that an increased focus on the social cost of GHG emissions in procurement decisions does not adversely impact small businesses.[62]

An interagency team is reviewing responses to the ANPR, and a report and draft rule are forthcoming.[63]

IV. CLEAN ENERGY TECHNOLOGY PROCUREMENT: SOME EXAMPLES

The federal government has at various times tried to leverage its role as a customer explicitly to stimulate technological innovation in clean energy. Although driving innovation in clean energy is just one of several rationales for federal sustainability requirements, it is an increasingly important one. Thus, an examination of these more innovation-centric initiatives, not all of which have been successful, may help to inform the administration's sustainability effort.[64]

Experiments in Using Federal Procurement to Foster Innovation

Two of the initiatives—one of which (ETIP) was discussed briefly—had as their primary goal to identify whether and how government procurement could be used cost effectively to stimulate clean energy innovation (ETIP looked at nonenergy technologies as well).

Experimental Technology Incentives Program

ETIP was run by the Department of Commerce's National Bureau of Standards (now the National Institute of Standards and Technology) from 1972–1982 to identify ways standard government functions could increase the uptake of new technology by the private sector. ETIP's greatest legacy was its procurement-focused activities, which introduced incentives such as LCC, performance specifications, and shared savings into use in many federal and state agencies. GSA's Federal Supply Service and the Veterans Health Administration created their own experimental technology divisions, and several other countries set up programs to emulate ETIP.[65]

Using an experimental approach informed by sector-specific analysis and an understanding of technology development more broadly, ETIP sought to develop an empirical basis for public procurement policy. ETIP "piggy-backed" on planned procurements to test whether, say, an LCC approach to procuring electric water heaters or air conditioners for computer facilities would incentivize vendors to introduce more energy-efficient products. Experiments ran for three years, and the results were compared to "control" procurements that used the traditional, lowest-price approach to vendor selection. ETIP also supported "demonstration-experiments," which tested the feasibility of new technologies and identified the minimum economic scale of production.[66]

ETIP developed sophisticated frameworks to indicate when an incentive such as LCC would be effective based on where a product was in its development cycle, the size of the government market in relation to the minimum production scale, and other variables.[67] ETIP explored more speculative incentives as well, such as compensating suppliers for contributing an innovation and extending contract periods for products that incorporated new technology.

ETIP also weighed in on debates over energy technology policy, which was a national priority. To stimulate the commercialization of synthetic fuel, ETIP recommended that government purchase fuel for its own use at a price above the market value of equivalent sources, provided it was produced using an innovative and previously uncommercialized process. And to convince skeptics that solar energy was feasible, ETIP proposed putting a full-scale solar facility on a military base. Congress adopted ETIP's synthetic fuels idea in its 1980 legislation creating the Synthetic Fuels Corporation, and in 1978, in its authorization of $4 billion in military construction, Congress required that all new military family housing units and 25 percent of other new facilities be equipped with solar heating and cooling systems—equivalent to a $100 million-a-year order for an industry with annual sales of only $150 million.[68]

Federal Procurement Challenge

In the mid-1990s, DOE's FEMP established the Federal Procurement Challenge in response to parallel provisions in EPACT 1992 and a 1994 EO that directed DOE to use federal purchasing to accelerate the market introduction of new energy-efficient technologies.[69] The initiative was modeled loosely after DOD/NASA technology procurements although, rather than serving as the customer, DOE aggregated demand across multiple buyers in federal, state, and local governments as well as the private sector.

DOE led or facilitated a number of technology procurements. In one, which was implemented by a consortium of electric utilities, a manufacturer (Whirlpool) was induced to introduce a line of refrigerators that exceeded DOE energy efficiency standards by 30–40 percent. In another, several manufacturers were persuaded to introduce screw-based subcompact fluorescent lamps (CFLs) that would fit in many more lighting fixtures than the existing CFLs. In yet another technology procurement, DOD committed to spend $20 million to buy six million light bulbs that would use significantly less electricity than conventional incandescent bulbs do, last three times as long, and cost no more than $3.00 each.

DOE conducted formal and informal evaluations of individual procurements from which lessons include the importance of nonenergy benefits in attracting buyers (e.g., the lower noise level of energy-efficient washers allowed building operators to extend the hours of common-area laundry rooms), and the need for a sustained market to attract manufacturers (DOD's $20 million light bulb commitment failed to attract any bids because there was no guarantee of continued demand). DOE also learned which technologies lend themselves to a technology procurement. For example, mass-produced consumer items such as light bulbs are challenging because it takes so many buyers to establish an entry market. Other lessons concerned when to combine a technology procurement with other policies, such as coordinated rebates and voluntary or mandatory efficiency standards. For example, in some cases, manufacturers were reluctant to participate in a technology procurement for fear "success" would lead DOE to impose a more ambitious efficiency standard.

Use of Procurement to Advance Specific Technologies

Several initiatives have had as their goal to use federal procurement to advance particular clean energy technologies or classes of technologies.

Federal Photovoltaic Utilization Program

Federal R&D efforts significantly advanced solar PV technology in the 1970s, and DOE's Federal Photovoltaic Utilization Program, which ran from 1978 to 1981, was designed to reduce market uncertainties and accelerate the development of a commercially viable solar PV industry. DOE gave federal agencies the funds to purchase PV cells that met their respective requirements—a decentralized approach that encouraged agency participation but reduced the desired impact. A number of the applications agencies pursued (e.g., remote solar installations in national parks) had only modest commercial potential. Moreover, because the agencies sought to minimize the price they paid for PV cells, the government purchases did not reward advances in technology performance, as DOD/NASA purchases of semiconductors had done two decades earlier.[70]

DOD EV/Vehicle-to-Grid Initiative

In the Obama administration, the Air Force led a DOD-wide effort to make the business case for adopting plug-in hybrid EVs in the medium-duty vehicle category, where DOD thought it had sufficient demand to sustain a new market entrant. To achieve cost parity with conventional vehicles, the Air Force explored the potential for the plug-in hybrid EVs on a military base to generate revenue by discharging energy into the grid during high-demand periods. In addition to providing vehicle-to-grid (V2G) services, DOD envisioned that the EVs could provide backup power to the base in the event of a grid outage.

DOD held multiple "industry days" to gauge vendor interest and developed grid-integration software that proved to have commercial applicability. The Air Force also worked with a major utility to explore a financing model that would allow DOD to use GSA's areawide contracting authority to amortize the cost of the required infrastructure (e.g., charging stations) over time.

Although the effort eventually fell apart (GSA's incremental-cost charge was one impediment), the Air Force tested the V2G concept at Los Angeles Air Force Base, which had electrified its general service vehicle fleet. The base worked with the state of California and the local utility on a multiyear demonstration project that has informed state policies to promote V2G technology.

Navy Support for Advanced Biofuels

Because liquid fuel is indispensable to the military, DOD has periodically supported the development of alternatives to petroleum-based fuels. In the 1970s, the Air Force conducted and funded R&D on coal-based synthetic fuel, and from 2007 to 2011, the Defense Advanced Research Projects Agency (DARPA) BioFuels program spent $100 million to explore cost-competitive technologies for making jet fuel from biomass. Beginning around the same time, the Navy and Air Force set ambitious targets for replacing petroleum with drop-in alternative fuels, and in 2012, using authority provided by Title III of the Defense Production Act (DPA), the Navy partnered with DOE and the Department of Agriculture on a $500 million project to incentivize the construction of advanced biorefineries.

The Navy's advanced biofuels project was extremely controversial. Navy Secretary Ray Mabus justified it on security grounds, arguing that having biofuel production facilities in strategic global locations would reduce the risk of rivals disrupting DOD's fuel supply lines. Critics argued that subsidies to production were a flawed policy and that, in any event, biofuel supply lines would face the same threat of disruption.[71] Two biorefinery projects broke ground in 2018, but additional funding is unlikely because of the perceived lack of direct military utility.[72]

More recently, DOD has used R&D funds to explore the potential for in situ production of alternative fuels. The Air Force is funding a carbon-transformation firm, Twelve, to demonstrate that it can convert carbon dioxide into an operationally viable aviation fuel called E-Jet.[73] The ability to produce fuel on-site in a contested environment would be a game changer for DOD. While the technical and commercial obstacles remain significant, the endeavor cannot be criticized for lacking military utility.[74]

Technology Demonstration

In the first major energy bill it passed in response to the 1970s oil crisis, Congress directed DOE's predecessor agency, along with GSA, to establish an Advanced Building Efficiency Test Bed program to foster innovation in building technologies by supporting and demonstrating

advanced engineering designs, components, and materials. While there is no institutional memory of such a program, several decades later, GSA and DOD each created something comparable.

Environmental Security Technology Certification Program and GSA Proving Ground

In 2009–2010, DOD and GSA independently created programs to use their facilities as test beds to demonstrate and validate innovative new energy technologies for the built environment.[75] The aim was to facilitate the commercialization and deployment of these technologies so the federal government could acquire them as a commercial customer. Since then, the Installation Energy Test Bed, run by DOD's Environmental Security Technology Certification Program (ESTCP), and the GSA Proving Ground (GPG) have completed several hundred formal technology demonstrations, helping fill an important gap in the facility energy innovation process.

The demonstrations serve three functions. First, they reduce risk by allowing developers to test and refine their technology under real-world conditions. Second, demonstrations collect and disseminate granular data on technology performance and cost under operational conditions, including factors such as maintenance costs, the level of skill required to operate the technology, and tenant acceptance. Third, demonstrations allow users themselves to get direct experience with the technology in the field.

The technologies demonstrated by ESTCP are typically precommercial ("out of the garage but not yet on the shelf"), which means that if DOD becomes an early adopter, it can kick-start the market for a new technology. ESTCP spent more than a decade supporting rigorous field testing of precommercial microgrids to help vendors address technical challenges and transition their systems to market. Now, as military services begin to procure commercial microgrids in large numbers, DOD is a market maker. GSA's GPG (formerly known as the Green Proving Ground) targets technologies that are commercially available but whose market penetration is limited. As a centralized buyer, GSA can deploy GPG-tested technologies throughout its portfolio.

SunShot-ESTCP Collaboration

In 2012, DOE's SunShot program awarded $25 million to French semiconductor manufacturer Soitec to operate a large factory in California as part of SunShot's effort to foster a competitive U.S. solar PV manufacturing base. ESTCP agreed to demonstrate the technology at scale on two military bases. (Ultimately, the demonstration went forward at only one base, Fort Irwin, in California's Mojave Desert.) SunShot provided the PV 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. Soitec's market exit notwithstanding, the collaboration showed the substantial benefits of such a partnership for the two federal agencies: DOD received a cutting-edge solar array at a discount on one of its military 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.

V. CONCLUSIONS

The federal sustainability regime has endured for nearly five decades because of its strong political appeal. The imposition of sustainability requirements on federal contracting by Congress or the president requires no new appropriations, and it checks multiple boxes: reducing dependence on foreign oil, cutting federal energy costs, curbing GHG emissions, transforming

clean technology markets, creating jobs, and leading by example. However, OMB's own scorecard suggests that there is considerable slip between cup and lip.

First, mission priorities drown out sustainability directives because funding and senior leadership attention are limited and there is no penalty for noncompliance. To paraphrase Peter Drucker's observation about corporate culture and corporate strategy, a federal agency's mission needs eat non-mission requirements for breakfast. By the same token, where mission and clean energy needs *are* aligned, that combination can overcome the stubborn obstacles to sustainability that federal budget and procurement rules create. DOD surmounted major procurement hurdles to deploy large-scale solar energy projects on military bases, and GSA manages to set energy efficiency records even as Congress diverts $1 billion a year from the Federal Buildings Fund.[76]

Note that agencies can be myopic when it comes to the relevance of clean energy and sustainability to their mission. USPS's stance on fleet electrification seems counter to an agency tradition of innovation that gave us post roads, the Pony Express, and airmail contracts that jump-started the U.S. airline industry.[77] DOD's indifference to energy efficiency on its bases is another example of mission myopia. (DOD had a similar blind spot regarding the wasteful use of energy at forwarding operating bases before it suffered heavy casualties defending fuel convoys in Iraq and Afghanistan.) As the adverse effects of climate change increase, more agencies will likely see the relevance of clean energy for their mission.

Second, there is a mismatch between the policy tool (government purchasing and asset management) and the policy goal of advancing clean energy. Government processes such as budgeting and procurement are designed to minimize risk and (up-front) cost. Despite their drawbacks, these processes serve vital functions—fiscal restraint in the case of budgeting; transparency and encouragement of price competition in the case of procurement—which is why they are so deeply ingrained. Sustainable procurement is at odds with these processes insofar as it requires a willingness to spend more up-front and accept risk as to the promised payoff in lower life cycle costs.

To drive investment and innovation in clean energy—and to break the historical pattern—the administration's sustainability plan needs to leverage mission alignment where it exists, address agency funding needs and the perverse budget rules that compound them, and overhaul the procurement process.

Third, standard government procurement is even less well suited to stimulating clean energy innovation. Innovation is the riskiest and most costly phase of the technology development life cycle. To drive innovation, the government needs to take on greater risk and cost—something it generally does only to address national security needs (DOD/NASA technology procurement) or a grave social problem (HHS's advance purchase of COVID vaccines).[78] Absent such needs, government procurement and budgeting processes favor widely available goods and services because of their lower risk and first cost.

Despite these challenges, the federal sustainability effort should make innovation a priority, as the federal government is uniquely positioned to address the market failures that impede clean energy innovation. Should a federal agency install traditional double-pane windows to reduce its building energy consumption, or should it deploy more costly electrochromic glass—a novel technology

that blocks solar heat gain, enabling a building to use a smaller chiller—to help transform the market? The answer seems obvious.

Since innovation will not occur naturally as part of the sustainable procurement process, it has to be built in—through cost-sharing, risk-sharing, and other means. Actions to make federal sustainability more innovation focused might include the following:

- *Expand the use of federal technology demonstrations by customer agencies:* By collecting and disseminating granular data on technology performance and cost under operational conditions, demonstrations address a significant impediment to the adoption and diffusion of clean energy technology. (Dissemination is key: Unlike vendors, the federal government makes the results of demonstrations public.) Grid-integration and other technologies that are key to decarbonization of buildings all require extensive demonstration and validation. Even technologies to electrify space and water heating, while relatively mature, face impediments to adoption such as high cost and lack of validated performance data—impediments that demonstrations can address.
- *Accelerate the procurement of clean energy technologies that meet mission needs:* To take advantage of the alignment of sustainability and (some) agency missions, the administration could accelerate the procurement of clean energy technologies that meet mission requirements. For example, technologies that enhance the energy security of DOD bases and other federal campuses include advanced microgrids, long-duration energy storage, very small modular reactors (vSMRs), and enhanced geothermal systems. As another example, DOD is pursuing technologies to meet operational energy needs that are aligned with civilian clean energy challenges. These include thin-film solar PV, space-based solar, wide bandgap semiconductors for power electronics, energy generation in austere environments, better batteries, and mobile microgrids.79 For some of these technologies, the DPA might be an appropriate tool.
- *Expand DOE's mission to emphasize technology procurement and the federal market:* Although it lacks the large internal market DOD enjoys, with the appropriate authority and funding, DOE could pursue various ways to exploit the federal market for cutting-edge clean energy technology. DOE could:
  - leverage the internal market it does have—say, by decarbonizing all 17 National Laboratories (not just 4, as planned);
  - partner more closely with DOD on the development and demonstration of clean energy technologies that meet its mission needs;[80]
  - purchase early versions of innovative commercial technology that meets federal needs (e.g., low carbon cement and zero-carbon fuels); and
  - aggregate public and private demand to accelerate the market introduction of new technologies, as it did with the Federal Procurement Challenge.

  Whether or not there is a federal market for it, DOE, acting as a customer, could:
  - commit in advance to purchase the initial output from demonstration facilities its new Office of Clean Energy Demonstrations (OCED) will support (e.g., power from

an experimental offshore wind facility, fuel from an advanced biorefinery, or steel from a first-of-a-kind low-carbon steel production plant); and

  - use the DPA to facilitate the production and procurement of precommercial and early commercial clean energy technology.

- *Modification of energy performance contracting:* ESCOs need an incentive to deploy innovative technology in federal buildings so that agencies get the benefit of the new technology—and federal sales can give it a commercial boost. Options could include cost-sharing or risk-sharing. To reduce the financing costs for energy performance contracts, the federal government could create a revolving capital fund (i.e., self-finance). Alternatively, the government could work with a single (private) financing entity.
- *Qualified provision of "the green to go green"*: Agencies should have access to additional funds to be used to procure innovative technology such as EVs, 24/7 CFE, and technology demonstrated in a federal technology demonstration program. One model is the Technology Modernization Fund, which provides federal agencies with funding and technical expertise for high-impact IT projects.[81]

A final conclusion concerns DOD. In 2020, DOD consumed 682 trillion BTUs, which was 80 percent of total federal energy use and 15 times the consumption of the next-largest federal energy user (USPS). As section II shows, DOD's performance on specific sustainability targets often makes or breaks the federal performance overall. Thus, in setting sustainability requirements, policymakers need to be more attuned to DOD's strengths and limitations.

Policymakers also should reconsider the exemption from sustainability requirements of weapon system contracts (but not DOD operational energy—i.e., fuel). It would be inappropriate to subject DOD operational fuel, which supports U.S. military forces and activities overseas, to any kind of use restrictions. However, DOD weapons contracts, which account for 30 to 40 percent of all federal procurement, include commercial off-the-shelf technology, equipment, and materials that consume energy directly or indirectly (embodied carbon). Such procurements might well benefit from the discipline sustainability requirements are meant to provide.

VI. RECOMMENDATIONS

This section offers recommendations to address the obstacles to sustainable procurement examined in the report in order of their urgency: inadequate funding and perverse federal budget rules, an ill-suited procurement process, and the lack of alignment between clean energy and (most) agency missions.

Capitalize the President's Federal Sustainability Plan

1. The administration should secure funding to allow agencies to cover the higher cost of EVs and EV infrastructure and to curb emissions from federal buildings and building materials. BBB included $6.75 billion for these purposes.
2. Agencies should have access to additional funds to be used to procure especially innovative clean energy technology; the Technology Modernization Fund is one model.
3. GSA should absorb the "incremental cost" of EVs by drawing money from its ASF, a revolving fund used to finance GSA's procurement operation. Investment in GSA's

flagship fleet program is one function of the ASF, and GSA has waived the incremental cost of EVs in past promotion pilots. Although GSA may resist doing this on a larger scale, OMB should ensure it happens.[82]

4. GSA should also encourage agencies to use its AWC to amortize the cost of the EV infrastructure. Under an AWC, the local utility can fund the up-front cost of the charging infrastructure and electrical upgrades with the assurance the federal customer will repay the cost over 10 years as part of its utility bill.[83]

5. Congress should continue to seek funds for USPS to cover the higher up-front cost of electric postal trucks. (BBB included $6 billion for this purpose.) USPS should be encouraged to consider leasing the batteries, which would significantly reduce the up-front cost of the electric trucks and allow USPS to swap in new batteries periodically, taking advantage of the rapid improvements in battery performance and costs.

6. Congress should protect GSA's Federal Buildings Fund so that the rents paid by federal tenants can be used in their entirety to pay for building upkeep, including sustainability improvements. Congress should also approve the Federal Capital Revolving Fund and capitalize it at the proposed amount of $10 billion.

7. OMB and CBO should examine how budget scorekeeping rules constrain efforts to achieve sustainability goals. A major focus should be how scoring impedes the use of lowest-life-cycle-cost contracts for federal vehicles, buildings, and CFE.

8. Congress should direct NASEM to examine energy savings performance contracting. Among other things, NASEM should examine: 1) how the federal government's use of energy performance contracting can better advance clean energy innovation, 2) how to reduce the high cost of financing energy performance contracts, and 3) how best to incorporate the value of decarbonization into the contract evaluation and award process.

Reform the Federal Procurement Process

9. OFPP should make sustainable procurement a core competency for federal acquisition professionals and work with educational institutions (the Defense Acquisition University, the Federal Acquisition Institute), professional organizations (National Contract Management Association), and the broader oversight community on a concrete set of plans to make sustainable procurement part of the "policy, practice, skill set, nomenclature, training, certification, and … culture."[84]

10. OFPP should accelerate the FAR Council's ANPR, strengthen the enforceability of existing provisions related to LCC and energy efficiency, and ensure that new provisions have teeth.

11. Federal agencies should undertake pilot projects, such as GSA's 2014 procurement of DDS, to test the feasibility of the concepts identified in the ANPR. Every federal agency should undertake at least one pilot, ideally for a mission-relevant product or service.

12. Congress should establish an ETIP-like program to examine how federal procurement can more effectively drive innovation in clean energy and other sectors.

Leverage Agency Missions

13. The administration should expand the use of federal technology demonstrations of clean energy technology by DOD, GSA, and other customer agencies.

14. The administration should work with agencies to accelerate the procurement of clean energy technologies that meet mission needs, including for energy-secure military bases and DOD operational energy. As the natural entity to serve as an early adopter of (stationary) vSMRs, DOD should consider whether there are actions it could take (e.g., advance purchase commitments) that would speed the commercialization and regulatory approval process for them. DOD and DOE should partner more closely on the testing and demonstration of long-duration energy storage technologies, among others.

15. DOE should expand its mission to include a focus on technology procurement and activities that exploit opportunities for using federal demand to drive clean energy innovation.

16. OFPP and the Council on Environmental Quality (CEQ) should set up a process to determine whether/how to extend federal sustainability requirements to DOD weapon system contracts (but not operational fuel use).

APPENDIX: THE U.S. POSTAL SERVICE'S NEXT-GENERATION DELIVERY VEHICLE PROCUREMENT

USPS operates 212,000 delivery vehicles, two-thirds of which are the boxy white right-hand-drive trucks familiar to Americans from their decades of use. In 2015, USPS launched a formal process to replace the iconic mail truck, appropriately named the Long Life Vehicle (LLV), with an NGDV. Last-mile delivery is a poster child for electric propulsion, as evidenced by the decisions by Amazon, UPS, and FedEx to go all-in on EVs. Thus, clean energy advocates were taken aback in February 2021 when USPS selected Oshkosh Defense, a military contractor that had never built a battery-electric vehicle, over two experienced EV manufacturers, to produce up to 165,000 NGDVs under a contract worth billions of dollars. The other shoe dropped when Postmaster General Louis DeJoy announced that, absent congressional funding, USPS planned to limit EVs to 10 percent of the NGDV fleet because of their higher up-front cost.[85] Although the House of Representatives approved $6 billion to cover the incremental cost of electric NGDVs, the funds were part of the now-defunct BBB bill.

USPS fanned the fire of controversy in December 2021 when it issued its final environmental impact statement (EIS) on the NGDV procurement, as required by the National Environmental Policy Act (NEPA). The EIS contained serious flaws, including cherry-picked numbers and assumptions that understated the costs for gasoline-powered NGDVs and overstated them for EVs. In addition to its results-driven analysis, the EIS revealed unflattering details about Oshkosh's gasoline-powered vehicle, including its poor fuel efficiency: With the air conditioning turned on, NGDVs will get only 8.6 miles per gallon of fuel—just a trace better than the (non-air conditioned) LLV. And Oshkosh's seemingly inflated payload weight allows the vehicle to qualify (barely) as a heavy-duty truck, thus evading federal fuel economy standards, not to mention EPACT 1992 requirements.[86]

In April 2022, 16 states and 2 environmental groups sued USPS under NEPA to block its purchase of the gasoline-powered vehicles,[87] and a House oversight committee has ordered USPS to turn over confidential records on the vehicles' environmental impact and costs.[88] In June, following the confirmation of two new members of the USPS Board of Governors, DeJoy announced that he would reorganize certain operations to improve efficiency and accommodate more EVs; and in July, USPS announced that it would make 40 percent of its new trucks EVs.[89] In early August, the Senate passed—and the House is expected to approve—a smaller reincarnation of BBB, the Inflation Reduction Act, which includes $3 billion for electric postal trucks.

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About the Author

Dorothy Robyn is a senior fellow with ITIF's Center for Clean Energy Innovation, a member of ITIF's board, and a senior fellow with Boston University's Institute for Global Sustainability. She served as the deputy under secretary of Defense for Installations & Environment in the Department of Defense (DOD), where she had DOD-wide oversight of U.S. military bases around the world and led DOD's facility energy initiative (2009–2012). She also served as commissioner of Public Buildings in the General Services Administration (2012–2014). From 1993 to 2001, she was special assistant to the president for Economic Policy on the staff of the White House National Economic Council. Dr. Robyn previously was an assistant professor at Harvard's Kennedy School, a principal with The Brattle Group, and a guest scholar at the Brookings Institution. She has an MPP and a Ph.D. in public policy from the University of California, Berkeley.

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ENDNOTES

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