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Changing Institutional Procurement Behavior to Achieve Energy Savings

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ABSTRACT

Although federal policies regarding energy-efficient product procurement (EPPP) are long-standing and well-established, federal buyers do not typically request energy-efficient products when making purchases. This is a large missed opportunity: full compliance could save the U.S. federal government roughly \$500 million in energy cost annually.

In 2016, the U.S. Department of Energy's Federal Energy Management Program (FEMP) began a new set of program activities to increase federal compliance with these procurement requirements. Program interventions included increased communication with contracting officers during the solicitation process; development of enhanced, targeted training; and collection and dissemination of procurement best practices across the federal sector.

We have collected and analyzed ~2,500 solicitations from over 40 different federal agencies to evaluate the influence of these interventions. Compared to pre-intervention years (FY15 and FY11), annual compliance rates for FY16 and FY17 increased by about 10%.

This paper provides an overview of the data collection process, analysis framework, intervention method, and results of our analysis. We discuss strategies to increase compliance rates by examining institutional factors that drive procurement behavior. By combining data collection with adjustment to program implementation, we have created an iterative process that is having a demonstrable effect in improving the impact of a long-running program.

Background

The idea of utilizing public-sector procurement to achieve social, economic, and environmental goals is widespread (McCrudden, 2004). With the large market power that public procurement offers, it can bridge the gap between R&D and mass adoption of energy efficient technologies, reduce public spending, and mitigate climate change (Taylor 2008 and 2012). Procurement of energy-efficient products can be integrated into ongoing business activities, offering a simple way to achieve significant cumulative savings.

Within the U.S., the federal government is the largest single buyer of energy-consuming products (Harris and Johnson, 2002). Federal agencies have the potential to save roughly 30 trillion Btu per year (Taylor 2012) through procurement of energy-efficient products.

Policymakers have long recognized this market strength and technical potential. In the early 1990s, the U.S. Department of Energy's Federal Energy Management Program (FEMP) established a program to support procurement of energy-efficient products throughout the federal government. There are now numerous statutory and regulatory requirements that direct federal agencies to purchase energy-efficient products.

Policy outcomes have historically been difficult to study due to the scale and decentralized nature of federal procurement. One early analysis (Capanna, Devranoglu, and Loper 2008) suggested low compliance rates with energy-efficient product procurement (EPPP) regulations. This spurred additional research to understand why federal agencies are not buying

energy-efficient products despite the strong policies, obvious economic benefits, and ready availability of energy-efficient products.

This paper addresses new findings regarding federal procurement activities. We developed a series of interventions aimed at changing the purchasing behavior of federal contracting officers (COs) in an effort to increase EEP compliance. Federal COs ensure the products and services government procure are compliant with the Federal Acquisition Regulation (FAR) and “safeguard the interests of the United States in its contractual relationships” (Federal Acquisition Regulation, 1991). We recognize that federal procurement is complex, decentralized, and difficult to influence. COs work in a demanding environment of extensive, sometimes conflicting, regulations and pressure to complete their purchases quickly. They have to make decisions about a wide range of products with limited time and information. We have tried to formulate interventions that integrate into the work flow of COs to make procurement of energy-efficient products easy to achieve. Moreover, while COs play an important role, the procurement process involves many other roles (e.g., end users, technical specialists, budget planners.) We recognize the need to engage these and other organizational roles necessary to reach full compliance. While we focus our strategies on COs, our efforts are also designed to reach federal employees in various roles throughout the procurement process using social science principles.

History of EEP

The oil embargo of 1973 sparked the energy conservation movement in the U.S. as an effort to decrease reliance on foreign energy resources. This led to the enactment of the National Energy Conservation Policy Act (NECPA) in 1978, which provided initial statutory authority for federal energy management requirements. Since the early 1990s, federal agencies have been required to purchase energy-efficient products in an effort to reduce energy use and cost. Currently, five legal authorities require agencies to purchase energy-efficient products¹.

Beyond the long-standing history of EEP regulations, FEMP and other federal entities have an equally long history of programs to promote energy-efficient products and implement EEP policies more effectively. FEMP’s EEP program identifies roughly 70 products commonly used in the federal sector and sets required efficiency levels for those products. Where possible, FEMP leverages EPA’s ENERGY STAR program to identify efficient products. FEMP also provides purchasing guidance for these product categories. FEMP’s program is intended to make selecting energy-efficient products easy for COs by offering a centralized location to find all the relevant information needed to make a compliant purchase.

Past Research

Research conducted regarding public sector sustainable procurement policy implementation frequently recommends data consistency and active compliance tracking as ways to improve policy effectiveness (OECD, 2015; Singh, Culver, and Bitlis, 2012; Payne, Weber, and Semple, 2013); however, there have been very few efforts to consistently track rates of compliance with these mandates in the U.S. federal government, particularly at the product level.

¹ The Energy Policy Act of 2005; the Energy Security and Independence Act of 2007; Federal Acquisition Regulation (FAR) Part 23.2; Executive Order (E.O.) 13834: Efficient Federal Operations; and E.O. 13221: Energy-Efficient Standby Power Devices.

One reason for the paucity of these efforts has been the availability of procurement data. Federal procurement is both enormous in scope and decentralized in implementation. Historically, it has been difficult to collect and analyze these data effectively. However, as electronic data systems have become more common, large amounts of consolidated federal procurement data have become available. While not universal, these consolidated electronic data sets allow opportunity for analysis, providing a more complete understanding of federal procurement practices.

One source of federal procurement data is Federal Business Opportunities (FBO). FBO is a centralized web site through which all federal agencies are required to post solicitations for procurements greater than \$25,000. Although FBO is only one pathway for procurement, it captures large purchases of products and services. More importantly, it is a highly accessible, centralized, and public data source.

The Alliance to Save Energy (ASE) conducted reviews of EEPP compliance in 2008 and 2010, sampling a total of 266 solicitations listed on Federal Business Opportunities (FBO). ASE categorized a solicitation as “compliant” if it contained any reference to EEPP policies or guidelines. The 2010 review showed a compliance rate of 46% (Siciliano 2010), which suggests signs of significant improvement compared to 2008’s compliance rate of 12% (Capanna, Devranoglu, and Loper 2008).

ASE also conducted interviews with procurement officials to gauge their awareness with EEPP regulations. In 2010, 50% of procurement personnel interviewed exhibited high levels of familiarity with the regulations, up from 8% awareness in 2008. Different categories of personnel involved in procurement had drastically different awareness levels. 100% of sustainability officials exhibited a high level of awareness, while only 25% of product end-users such as facility managers or maintenance staff exhibited high awareness in the 2010 study. This indicates that there may be institutional factors hindering awareness.

Methodology

We began conducting ongoing review of solicitations posted on FBO in fiscal year 2015. Using the results from 2015, we began a series of activities and intervention to increase compliance among federal agencies in 2016. We first discuss our data collection methods, then our intervention methods.

Data Collection Methods

Solicitation collection. Similar to ASE’s studies, we used postings on FBO as a source to analyze procurement behavior and EEPP compliance. Unlike the ASE studies, we draw on the entire data set of FBO postings by using an XML file that captures all procurement activities daily. Procurement postings to FBO typically start with pre-solicitation, sources sought, or combined synopsis/solicitation, then may update into modification/amendment/cancellation or award notice. Other less common posting types include fair opportunity/limited sources justification, special notice, justification and approval, or sale of surplus property. We collect all of these postings.

Solicitation selection. Over 150,000 new contract actions are posted to FBO each year; however, the majority of these FBO contract actions are not for energy-consuming products. The first step in the review process identifies the relevant data within this large volume of postings.

To do this, we developed a software algorithm that captures solicitations that may include energy-consuming products. Demates and Scodel (2012) provides a detailed technical description of this process.

Solicitation analysis. After identifying all energy-consuming products being procured, we then identify the subset of those products in product categories that are covered by federal procurement requirements. Within that set of covered product categories, we evaluate the FAR compliance and effective compliance of each solicitation using a standardized framework shown in Figure 1. FAR compliance measures whether a solicitation has met a minimum standard of compliance with EEPP mandates. We consider a solicitation FAR compliant if it includes the appropriate FAR clause or explicitly specifies a compliant efficiency level for the covered product category it addresses. Effective compliance is a more-subjective measure that assess the likelihood of a given solicitation leading to a compliant purchase. Effective compliant solicitations are a subset of FAR compliant solicitations as graphically represented in Figure 1.

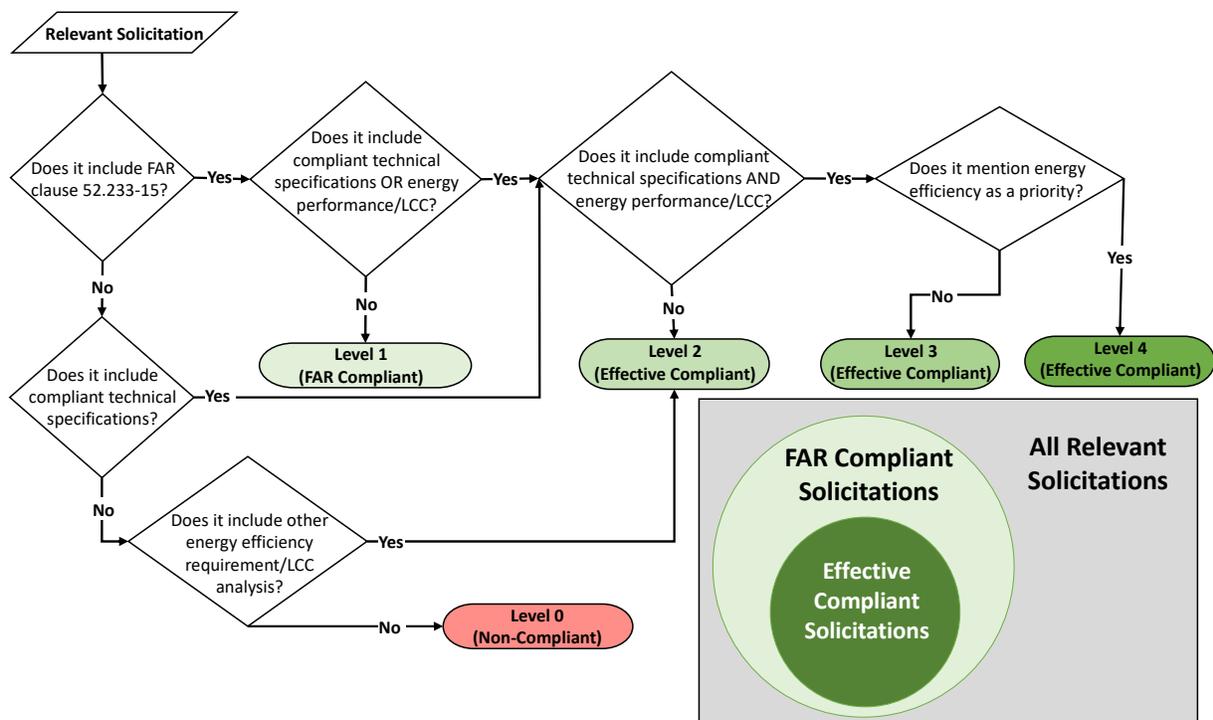


Figure 1. Solicitation review framework

Within the solicitations analyzed, there are two types of procurement, direct and indirect, which require different reviewing methods. Direct solicitations include purchase of one or more covered products, such as 30 desktop computers for an office, or a service contract for building renovation with technical specifications for equipment such as lighting, boilers, and heat pumps. We consider a direct solicitation effectively compliant if it includes compliant technical specifications as shown in the framework flowchart.

Indirect solicitations do not include the purchase of energy-consuming products at the time of contract initiation, but they enable the possibility that the purchase may occur in the future. Indirect solicitations are service contracts such as Architectural/Engineering (A/E) services, Indefinite Quantity Indefinite Delivery (IQID), Multiple Award Task Order Contract (MATOC), design-build, or design-bid-build construction contracts. We deem an indirect

solicitation effectively compliant if it includes language that requires the contractor to procure energy-efficient products in the future.

Intervention Methods

Our programmatic interventions are intended to engage, educate, and enable COs when soliciting for an energy consuming product to purchase energy-efficient products, with the goal of increasing EEPP compliance rates. The primary responsibilities of a CO are ensuring contracts are not violating the law and free of fraud and corruption, thus COs are experts in procurement process and the law, not energy efficiency or building equipment. Therefore, we work to develop interventions that align with the perspective of COs or other procurement officials and make it easier for them to purchase energy-efficient products.

Resources. We inspected hundreds of solicitations and noticed that many made reference to ASHRAE 90.1². Therefore, we created a set of efficiency requirement tables³ that mirror efficiency requirement tables from ASHRAE 90.1. This enables COs to easily incorporate the proper purchasing requirement set by FEMP and ENERGY STAR into the solicitations.

Our review also identified many exemplary solicitations related to procurement of energy-efficient products. We utilized those solicitations to develop a “Contracting for Efficiency Best Practices Guide”⁴ that offers step-by-step instruction to incorporate efficiency requirements into solicitations for various products and services. The guide provides pathways to compliance for all notice types (presolicitation, sources sought, and solicitations), sample contract language extracted from the exemplary solicitations, and model contract language that can be copied and pasted directly into a working solicitation. The guide emphasizes the importance of integrating specific energy-efficiency requirements throughout the solicitation (thus meeting effective compliance) rather than only including the applicable FAR clause. We also incorporated the ASHRAE-like tables into the guide.

These two resources educate and enable COs to communicate the specific energy-efficiency requirements to vendors, enhancing the likelihood of the vendor providing an energy-efficient product in response.

Training. After publishing the best practice guide, we promoted using it by developing a “Contracting for Efficiency” on-demand video training. The training encourages COs to participate by providing Continuing Education Units, something many procurement officials are required to acquire annually. The Contracting for Efficiency training focuses on the procedural details of the procurement process itself. Similar to the guide, the training approaches energy efficiency from the CO’s perspective. It educates COs about the legal requirements and economic benefits of buying energy-efficient products, then provides guidance on identifying

² ASHRAE 90.1 is an international building standard that provides minimum requirements for energy efficient designs for buildings except for low-rise residential buildings

³ Link for the tables: www.energy.gov/eere/femp/incorporate-minimum-efficiency-requirements-heating-and-cooling-products-federal

⁴Link for Best Practices Guide:

https://www.energy.gov/sites/prod/files/2016/10/f33/femp_best_practices_guide_for_procurement.pdf

which products are subject to EEPP regulations, creating compliant contracts, and verifying the delivery of energy-efficient products.

Outreach. As ASE’s studies showed, awareness regarding EEPP mandates is generally low. We implemented a direct email outreach activity during the pre-solicitation process to engage with COs, educate them about EEPP mandates, and enable compliance by providing the resources discussed above. Since we drew on contact information drawn from our solicitation review process, we were able to target procurement officials actively involved in procuring energy-consuming products rather than trying to reach a generic federal buyer.

We focused on two types of messages: an opportunity-for-improvement email and a congratulatory email. We sent the improvement email if the presolicitation or sources sought notice we identified might lead to the procurement of a product in a covered product category. The message contained EEPP mandates and links to the procurement resources we created. In doing this, we intended to make it easier for COs to create a fully compliant solicitation by providing all the tools and information they need. We sent a congratulatory email to COs that posted exemplary solicitations, providing positive reinforcement and appreciation.

Results

FY15 – FY17 Solicitation Review

Table 1 summarizes our results. ASE’s methods did not differentiate between FAR and effective compliance, so we considered their definition of compliance to be FAR compliance. We assessed this cumulative set of solicitation in four main ways⁵:

- by agency, to identify the most active agencies procuring covered products;
- by offices within an agency, to identify trends and uncover potential institutional factors that play a role in compliance;
- by type (i.e. direct vs indirect), to see what types of contracts agencies pursue; and
- by product category, to estimate the number of each product solicited and develop product-specific compliance rates.

Table 1. Annual Compliance rate for U.S. Federal Government

Year	FAR Compliance	Effective Compliance	Number of Solicitations
FY2008 (ASE)	12%	N/A	164
FY2010 (ASE)	46%	N/A	102
FY2015	49%	31%	819
FY2016	56%	41%	876
FY2017	58%	42%	710
Cumulative (FY2015 – FY2017)	55%	38%	2405

⁵ All analytical dimensions can be broken down further beyond the four ways discussed; for example, we can examine contract type by office within an agency, or identify which products are most frequently purchased by which agencies.

Compliance by agency. We totaled the number of reviewable solicitations by agency and developed agency-specific compliance rate cumulatively for FY2015 through FY2017. The Army, Navy, Air Force, and Department of Veterans Affairs (VA) had the most solicitations; the General Services Administration (GSA) had relatively higher compliance rates at 74%; and the Department of Labor (DOL) had relatively lower compliance rates at 27%. A summary of the top 10 agencies by number of solicitations is shown in Figure 2.

Federal agencies operate under centralized regulation and law, but FAR compliance⁶ varied substantially among agencies. We hypothesize that this is the result of organizational structures that support or hinder energy-efficient purchasing.

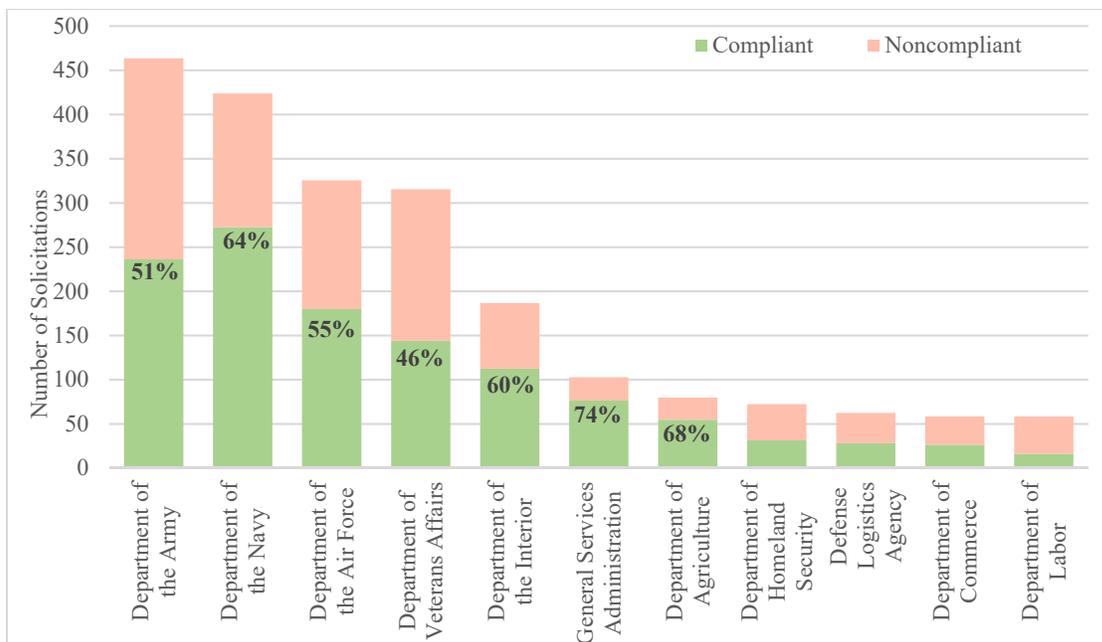


Figure 2. Number of solicitations and FAR compliance rate by agency (FY2015 – FY2017 cumulative)

Compliance by office. We further explored agency-level compliance by examining FAR compliance in smaller organizational units (“offices”) within the same agency. We developed office-level results within the Army, Navy, Air Force, Department of Interior (DOI), and GSA⁷. As shown in Figure 3, FAR compliance within the same agency varied significantly. The variation in FAR compliance at both agency and office levels suggests that there may be organizational behavior and organizational culture factors that play an important role in impeding the ability of procurement officials to solicit energy-efficient products.

⁶ We can also examine effective compliance, but we have focused on FAR compliance because it is easier to understand and easier to defend as a federal procurement requirement. Note that it is also the more optimistic result.

⁷ VA is excluded from this analysis because there are 79 offices (typically broken down by regions), resulting in a limited dataset for each office.

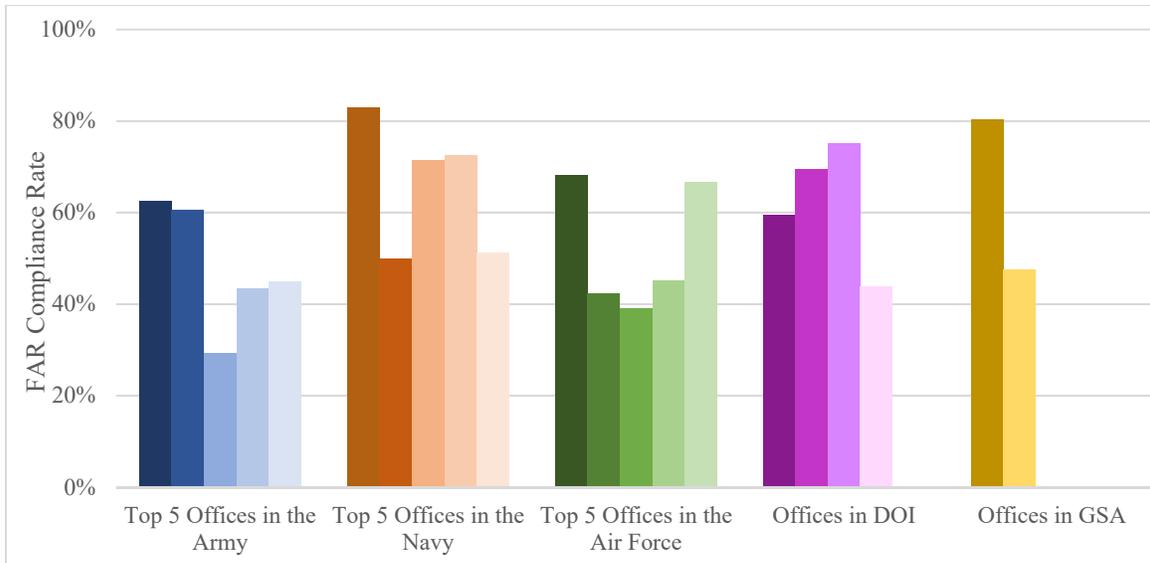


Figure 3. FAR compliance by offices within agency arranged by number of solicitations

Compliance by solicitation type. As discussed previously, we identified two types of solicitations: direct and indirect. Indirect solicitations are typically harder to evaluate. For example, many agencies solicited for design-build construction services under one firm, which meant that the design drawings and technical specifications do not yet exist for the construction project being solicited. We therefore had no visibility through the FBO solicitation into the specifications for the future procurement of covered products that would occur in the construction process. As shown in Table 2, compliance rates among indirect solicitations were much lower compared to direct solicitation. Moreover, many of the evaluation factors that were included were not as specific or stringent as we might have hoped with regard to energy performance.

Table 2. Indirect vs Direct Solicitations compliance rate (FY2015 – FY2017, cumulative)

Solicitation Type	FAR Compliance	Effective Compliance	# of Solicitations
Indirect	34%	12%	748
Direct	64%	50%	1655

Figure 4 shows direct solicitations have persistently increased compliance rates in the past three fiscal years, while compliance rates for indirect solicitations have fluctuated. This demonstrates the need to improve contracting for energy-efficient projects, since indirect solicitations are typically larger (thus have more savings opportunities) and last longer.

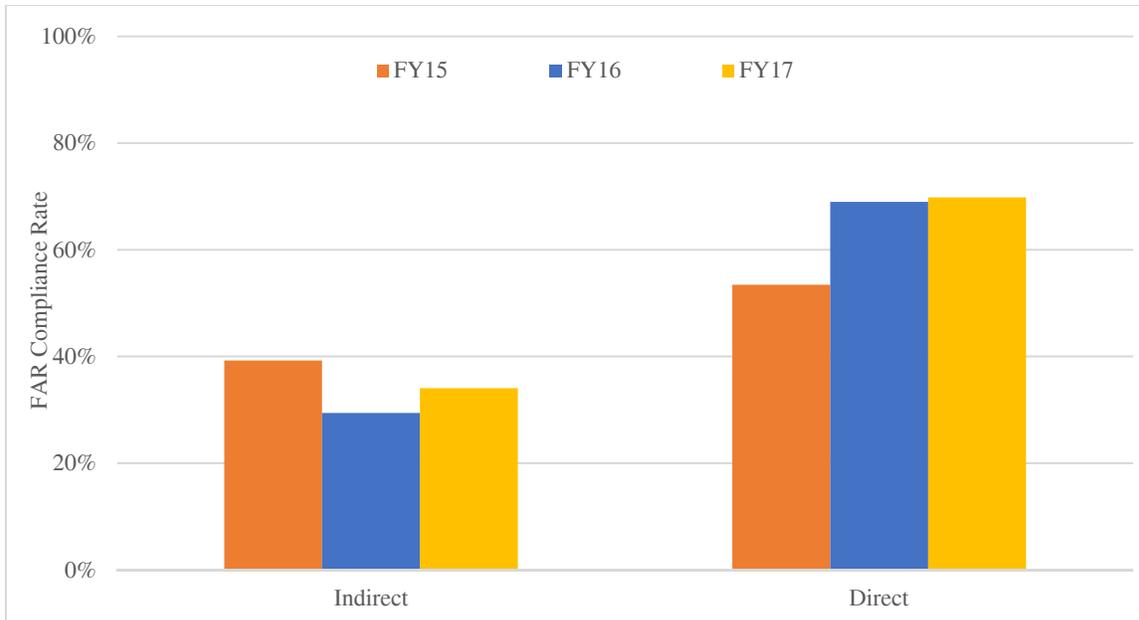


Figure 4. Annual FAR compliance rate for indirect vs direct solicitations

Compliance by product type. Of the 63 product categories covered by FEMP or ENERGY STAR, we found solicitations for 62 of those categories⁸. Previous research on the energy savings potential from procurement of energy-efficient products identified a number of product categories as having a particularly high savings potential. The top five products included fluorescent ballasts, commercial boilers, water-cooled chillers, enterprise servers, and commercial dishwashers (Taylor and Fujita, 2012). We saw those in our dataset as displayed in Table 3 (highlighted in yellow). We did not see fluorescent ballasts in the dataset, presumably due to the high adoption of LED luminaires and resulting phase-out of fluorescent lightings in the marketplace. The number of solicitations for fluorescent ballasts or luminaires decreased by about 90% from FY2015 to FY2017.

Table 3. Top 15 covered product categories by frequency of solicitation, sorted by FAR compliance (FY2015 – FY2017 cumulative)

Product Categories	FAR Compliance	Effective Compliance	# of Solicitations
Air-Source Heat Pumps (Residential)	81%	57%	72
Electric Chillers, Water-Cooled	80%	61%	71
Refrigerators (Residential)	79%	68%	38
Room Air Conditioners (Residential)	78%	55%	58
Computers	75%	68%	209
LED Luminaires	72%	54%	118
Enterprise Servers	68%	60%	208
Clothes Washers (Commercial)	68%	63%	81

⁸ Set-top and cable boxes did not appear in our FBO dataset because those are usually small purchases under \$25,000 and provided by cable companies.

Imaging Equipment	64%	46%	121
Dishwashers (Commercial)	64%	52%	42
Boilers (Commercial)	62%	40%	85
Displays and Monitors	58%	49%	59
Uninterruptible Power Supplies	57%	48%	60
Refrigerators and Freezers (Commercial)	53%	49%	47
Electric Chillers, Air-Cooled	49%	31%	105

Intervention Outcomes

Intervention Effectiveness. We implemented the series of interventions at the beginning of FY2016. As shown in Table 1, both FAR and effective compliance rates increased for all solicitations post-intervention (FY2017 and FY2016) by about 10% compared to pre-intervention periods of FY2015. We conducted two 2-tailed Z-tests at 95% confidence interval comparing FY2015 vs. FY2016 and FY2015 vs. FY2017. The differences in FY2016 and FY2017 compared to FY2015 were statistically significant; i.e., the change in compliance rate were unlikely to be the result of natural random fluctuation in the data. This suggests the efforts initiated during FY16 likely have a positive effect in EEPP program. Furthermore, we have noticed COs utilized the language from the Contracting for Efficiency best practice guide.

Table 4. Values used in and results from the Z-test

	# of FAR compliant solicitations (X)	Total Relevant solicitations (N)	Percent compliant (p)	Z-value ⁹
FY2015	404	819	49%	n/a
FY2016	494	876	56%	-2.98
FY2017	414	710	58%	-3.51

Resources. Since the initial offering of Contracting for Efficiency training, about 60 participants have taken the training. 64% of trainees were from the public sector, while the rest were either vendors or other large institutions. However, only a few were contracting officers or procurement officials. The majority of participants were either engineers, project managers, or facility managers, who often are in the position of specifying product details to the contracting officers.

There have been roughly 100 unique downloads of the Best Practices guide since the initial publishing date in April of 2016. Since there are thousands of procurement officials in the federal government, the traffic for these resources is low. This suggests that more targeted engagement is needed.

Outreach. At end of FY17, we have sent out 124 of the “improvement” type and 7 of the “congratulatory” type. We received 12 responses from the improvement messages. Several respondents stated that they are not required to include an energy efficiency requirement at the

⁹ The critical value for 95% confidence interval is +/-1.96. All tested against FY2015 values

stage of presolicitation and sources sought, but that it would be included in the solicitation; the rest were of appreciative nature.

Conclusion

Our analysis indicates significant potential for achieving energy savings. We have empirical evidence that suggests our targeted behavioral-based interventions can improve EEPP program effectiveness and achieve energy savings. The ongoing monitoring of procurement activities allows us to continuously develop data-driven program adjustments and evaluate performance. We hope to unravel the complex procurement system by reiterating this process. We wish to further explore the role of institutional factors that influence purchasing behavior and understand why there are large variations among agencies, offices, solicitation types, and products. With that understanding, we likely can achieve higher compliance without additional burdens on procurement staff. In addition, our analysis can be leveraged to enhance program operation by examining properties such as most solicited products and agencies with high purchase volumes.

We believe this process can be applied for other environmental attributes (e.g., BioPreferred, EPEAT, WaterSense, etc.) in other large institutional contexts. As previously discussed, institutional procurement can have significant positive societal impacts. There are few efforts capitalizing on its benefits due to barriers such as effective feedback and decentralized data. The framework presented has the potential to overcome those barriers and unlock more innovative approaches to improve the institutional procurement system.

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