

LBNL - 5666E

ERNEST ORLANDO LAWRENCE BERKELEY NATIONAL LABORATORY

Who Buys What? Understanding Federal Procurement of Energy Efficient Products

Prepared by
Margaret Taylor and K. Sydney Fujita

For the American Council for an Energy Efficient Economy

May 9, 2012

This work was supported by the Assistant Secretary for Energy Efficiency and Renewable Energy, Office of Building Technology, State, and Community Programs, of the U.S. Department of Energy under Contract No. DE-AC02-05CH11231.

DISCLAIMER

This document was prepared as an account of work sponsored by the United States Government. While this document is believed to contain correct information, neither the United States Government nor any agency thereof, nor the Regents of the University of California, nor any of their employees, makes any warranty, express or implied, or assumes any legal responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by its trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof, or the Regents of the University of California. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof or the Regents of the University of California.

Who Buys What? Understanding Federal Procurement of Energy Efficient Products

Margaret Taylor and K. Sydney Fujita, Lawrence Berkeley National Laboratory

ABSTRACT

Public-sector procurement in the U.S. is a climate and energy policy tool of growing importance given political failures regarding other instruments that could similarly spur the growth of markets for energy efficient technologies. The procurement tool is difficult to apply optimally, however, without understanding the potential variability in the processes of purchase for energy-consuming products in the federal sector. This paper presents preliminary results of a project designed to build knowledge on the federal procurement system and purchasing pathways for products covered under the Federal Energy Management Program's Energy Efficient Product Purchasing (FEMP EEPP) program, with an eye to improving program effectiveness. The authors reviewed the literature on the public sector procurement system and trends, and then developed a concept map of the procurement system as it relates to energy-consuming products. A focus group and telephone interview with FEMP EEPP experts helped refine the concept map, which is now being used in interviews with procurement officials across the federal government. In addition, the authors collected and analyzed data on four attributes of FEMP EEPP covered products which are relevant to federal purchasing pathways – price points, lifetimes, shipments, and energy savings potential – in order to inform a survey of experts with significant familiarity with FEMP EEPP (to develop hypothesized product purchasing pathways) and the interviews with federal procurement officials (to provide observed product purchasing pathways). The paper highlights differences and similarities between the hypothetical and observed product purchasing pathways, as well as potential connections between these pathways and energy savings potential.

Keywords: energy policy, market transformation, purchasing

Introduction

In the policy areas of climate and energy, instruments like carbon taxes and cap-and-trade programs are generally considered to be examples of “first best” policy instruments, as they internalize the negative externalities of fossil fuel combustion for energy production, and are thus, economically efficient. As these instruments do not yet exist on a national level in the U.S. and the political prospects for adopting them are not currently considered to be good, over the past few years there has been a renewed interest in maximizing the social benefits that can be obtained by “second-best” instruments (Lipsey and Lancaster 1956). One such policy tool that can be used to reduce the environmental impacts of energy production is public sector procurement. Like the first best instruments, public sector procurement can increase the demand for efficient technology, and consequently increase related private sector innovation (see Taylor 2008 for an introduction to policies that exert a “demand-pull” on clean technology innovation).

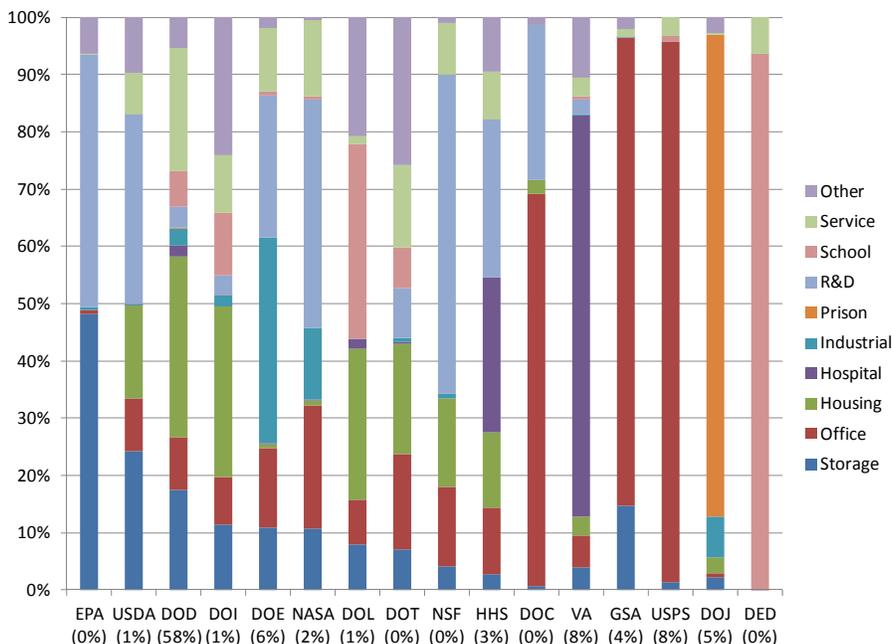
The Federal Energy Management Program’s Energy Efficient Product Purchasing program (FEMP EEPP) is an example of a public sector procurement tool that has the potential to provide a significant demand-pull for efficient technology by harnessing the purchasing power of the federal government. Although its origins date back almost two decades, its mandate today is based on requirements that federal agencies purchase energy-consuming products that are ENERGY STAR qualified, meet FEMP-designated efficiency requirements, have low-standby power of 1 watt or less, or are WaterSense labeled. These requirements stem from several laws and regulations (e.g., the Energy Policy Act (EPAAct) of 2005, the Energy Independence and Security Act (EISA) of 2007, and Executive Order 13514) and are codified in Sub-Part C Part 23 of the Federal Acquisition Regulation (FAR).¹ The FEMP EEPP has traditionally focused on providing technical assistance and guidance for federal buyers of a set of products (roughly 80 today) that fit into the categories of: (1) commercial & industrial equipment; (2) construction/plumbing; (3) lighting & fans; (4) food service equipment; (5) commercial appliances; (6) residential appliances; (7) office equipment; and (8) home electronics. FEMP EEPP assistance efforts include: providing online information resources regarding efficiency requirements, life cycle cost effectiveness calculations, and tips on selection and use of compliant products; working to incorporate performance levels for energy efficient products into guide/master specifications for federal agencies; helping federal supply sources like the U.S. General Services Administration (GSA) and the Defense Logistics Agency (DLA) to identify relevant products in the online listings and catalogs they make available to federal buyers; and offering training programs to federal agencies on energy efficient product procurement.

The federal government is quite large and complex, however, with fifteen executive departments, roughly seventy independent agencies and corporations (the majority of which reside in the executive branch), and numerous boards, commissions, quasi-official agencies, private regulatory corporations, and government enterprises. In 2011, U.S. federal spending was \$3.598 trillion, and it is estimated that the government spends well over \$200 billion annually on procurement (Thai 2001). The federal sector is thought to be responsible for 2.2% of U.S. energy

¹ The FAR is the principal set of rules which govern acquisition of goods and services across the federal sector. Its purpose is to try to ensure a “uniform standard and control” of federal purchasing. Although the FAR provides a centralized administrative structure, the federal procurement system simultaneously has a decentralized administrative structure “allowing for flexibility to meet unique requirements” of agencies (Thai 2001).

consumption and 10% of U.S. energy-consuming product purchases (Harris and Johnson 2002). Figure 1 displays data on the energy consumption of major federal departments and independent agencies and the square footage of their buildings by type. Note the great variation in the distribution of major building types across departments and agencies, which have significantly different policy missions.

Figure 1: Major Federal Departments and Independent Agencies according to Share of Federal Energy Consumption and Distribution of Building Type.



Source: Author calculations based on data on federal energy usage compiled by Pacific Northwest National Labs from reports to Congress under FEMP.

This variation in agency mission and energy consumption indicates that the purchase of the wide variety of products covered by the FEMP EEPP is unlikely to be uniform across the federal sector. Indeed, interview studies with a sample of officials involved in federal contracting indicate that procurement activities are organized quite differently across agencies (Alliance to Save Energy 2012). Procurement officials appear to have a high awareness of sustainability in general, but much lower levels of awareness of the existence and specifics of EEPP requirements (Capanna, Devranoglu et al. 2008; Siciliano 2010). Meanwhile, studies of government contracting compliance with one of the major FEMP-related provisions of FAR Part 23 – the incorporation of a clause from FAR Part 52.223-15 in all contracts and solicitations when acquiring or specifying energy-consuming products – suggest that only 7-46% of federal purchases meet requirements (ibid.).

This finding, however, needs to be considered in light of some of the broader trends in federal purchasing over the last twenty years. Of particular relevance is the increasing decentralization of federal purchases, which has been supported in part by technology and in part by a growing shortage in the federal acquisition workforce, coupled with increasing demands on that workforce (Drabkin and Thai 2003). Today, the bulk of federal purchasing is done directly

through purchase cards (p-cards) or other so-called “rapid purchasing techniques” like electronic retailers/supply catalogs, which often do not involve procurement officials in the transaction process. P-cards are particularly noteworthy; these credit cards, which are primarily used for “micro-purchases” under \$3,000, account for roughly 2% of federal spending but 85% of total procurement transactions (Gupta and Palmer 2008). To date, it is unclear how large the volume of energy-consuming products is that occurs through p-cards, however.

All told, it appears clear that there is great potential for variation in the people, products, and processes of purchase for energy-consuming products in the federal sector. An improved understanding of this variation could not only help the FEMP EEPP target its resources more strategically and increase its effectiveness, but also inform the development of the policy lever of public sector procurement for climate and energy goals more generally.

This paper presents the efforts the FEMP EEPP program has made first to understand the embedded mental models the program has been using to think about the “who, what, and how” of federal sector procurement of energy-consuming products. Making this shared understanding tangible was an important step in developing an effective methodology for the conduct and analysis of a series of structured, telephone-based interviews with a large set of procurement officials from across the federal government. The paper presents initial interview results, as they compare to the hypotheses of FEMP EEPP experts. Note that this is an ongoing research project, and many more interviews will be complete by the time of the ACEEE conference.

Methodology

Who Buys and How: Internal Concept Mapping of Federal Procurement of Energy-Consuming Products

In order to have the expertise of federal procurement officials “in the field” usefully contribute to FEMP EEPP knowledge of the federal procurement system and inform program strategy, the program’s existing ontology (i.e., “the formal, explicit specification of the shared understanding of the concepts and relationships” in the system (Strauss and Corbin 1998)) needed to be developed. The first step in doing this was to establish the vocabulary and known trends of the system in which the FEMP EEPP operates through a review of: the literature on public sector procurement generally, relevant sections of the FAR, and previous research on federal sector energy-consumption.

Actors. A large variety of actors potentially play roles in the purchase of energy-consuming products in the federal sector. Perhaps only two are involved in every purchase, by definition: the “end-user,” who is the employee that will need the product to perform his or her government duties; and the “manufacturer” of the product. Since manufacturers typically deliver their products to customers (end-users) via “vendors,” these actors also play a prominent role in most purchases, regardless of the type of product.

Other actors involved in meeting the purchasing needs of government employees are more specific to the federal procurement system. This system is commonly depicted as having five core elements which involve many different actors: (1) high-level policy making and management; (2) authorization and appropriation; (3) procurement regulations; (4) procurement

functions in operations; and (5) feedback (see, e.g., Thai 2001).² A number of actors within the “procurement functions in operations” element will be involved to varying degrees in energy-consuming product purchases for end-users. Although these actors have a range of titles (see footnote 2), for simplicity they can be referred to collectively as “procurement officials.” Note that the literature on public sector procurement consistently points to the many competing demands on procurement officials. Memorably, Thai (2001) groups these demands between “procurement goals,” such as “quality, timeliness, cost..., minimizing business, financial, and technical risks, maximizing competition, and maintaining integrity,” and “non-procurement goals,” such as “economic goals (preferring domestic or local firms), environment protection or green procurement ..., social goals (assisting minority and woman-owned business concerns), and international relations goals.”

Procurement officials handle a wide variety of products, but some energy-consuming products may be purchased by third-parties that provide ongoing services to the federal government. One example of such a “service vendor” would be an energy service company (ESCO) which might purchase products covered by the FEMP EEPP (e.g., commercial and industrial equipment) through the course of designing and implementing energy efficiency projects for government facilities.

Pathways. There are multiple channels through which a product can be purchased for an end-user in the federal government. The largest distinction between these “pathways” is whether there is a role for the procurement official as part of the transaction: end-users can purchase products directly from vendors through rapid purchasing techniques like purchase cards and electronic procurement (referred to here as “direct” pathways); or they can purchase products indirectly from vendors through the cooperation of procurement officials who can issue purchase orders and solicit product and service contracts (referred to here as “indirect” pathways).³ Table

² “Policy-making and management” in the U.S. primarily occurs from congressional laws and oversight (especially through the GAO), as well as through executive orders and guidance as to the “make or buy” decision of whether government functions should be performed in-house or via external contract. “Authorization and appropriations” are performed by Congress, with input from agencies. “Procurement regulations” include the FAR (which is developed and maintained through an executive agency, the Office of Federal Procurement Policy, with assistance from three Acquisition Regulatory Councils representing departments and agencies) and agency supplements that are consistent with the FAR. “Procurement functions in operations” are conducted by a variety of professionals, including: senior procurement executives; contracting officers; contract specialists; contract negotiators; contract administrators; contract price/cost analysts; contract termination specialists; procurement analysts; buyers; procurement officers; program managers, etc. These professionals are often directly involved in the purchase of “goods, services, and capital assets as authorized and funded” as well as in ensuring compliance with applicable regulations. Procurement operations can occur at multiple organizational levels, including sub-agency operations and more centralized agency procurement offices. “Feedback” comes from procurement professionals within departments and agencies, as well as from government organizations tasked with oversight. See Thai (2001) for more detail.

³ A “purchase card” is a business credit card that is primarily used for micro-purchases under \$3,000. “Electronic procurement” (or “e-procurement”) refers to the use of internet-based systems to search for, source, negotiate, order, and track purchases, usually through portals that have pre-competed products, such as GSA Advantage Vaidya, K., S. A. Sajeev, et al. (2006). “Critical Factors that Influence e-Procurement Implementation Success in the Public Sector.” *Journal of Public Procurement* 6(1&3): 70-99. A “purchase order” is “an offer by the government to buy supplies or services, including construction and research and development, upon specified terms and conditions, using simplified acquisition procedures” (FAR 2.101). A “contract” is a “mutually

1 illustrates the comparative volume and expenditures associated with two of these pathways, the direct pathway of p-cards and the indirect pathway of contracts (procurements reported through Standard Forms 281 and 279 are all contracts).

Table 1: Procurements by Reporting Method

Reporting Method	# of Purchases	Dollars/Purchase	Million Dollars
Purchase Cards	23,343,003	\$523	\$12.23
Standard Form 281* (≤\$ 25,000)	9,328,187	\$1,644	\$15.34
Standard Form 279* (>\$25,000)	519,780	\$391,528	\$203.50
Total	33,190,879		\$231.07

Source: Thai (2001)

Concept Map and Focus Group. The authors synthesized this material and generated an initial “concept map” to capture what we believed were the key actors, pathways, and relationships involved in the purchase of energy-consuming products in the federal system (Novak 1998). We then shared the resulting concept map with a focus group of a dozen FEMP EEPP experts (with an additional telephone interview conducted a week later) and modified the concept map in order to reflect the shared understanding of the group. Figure 2 presents the modified figure, which was incorporated into the interview protocol with federal procurement officials.

This concept map has three parts. First, the upper left hand part represents the five core elements of the general federal procurement system. Second, the upper right hand part breaks out the third element of the procurement system, “procurement regulations.” It presents the major sections of the FAR, with a special emphasis on the distinction between “procurement goals” (sub-sections A, B, C, E, F, and G) and “non-procurement goals” (sub-section D, with only one of its parts related to energy and water efficiency in a cluster of affirmative acquisition goals that includes occupational safety and a drug-free workplace). It also provides a placeholder for agency supplemental regulations. Finally, as a result of the focus group with FEMP EEPP experts, the upper right hand part of the concept map also includes a call-out to the guide and/or master specifications put together centrally by some agencies.⁴

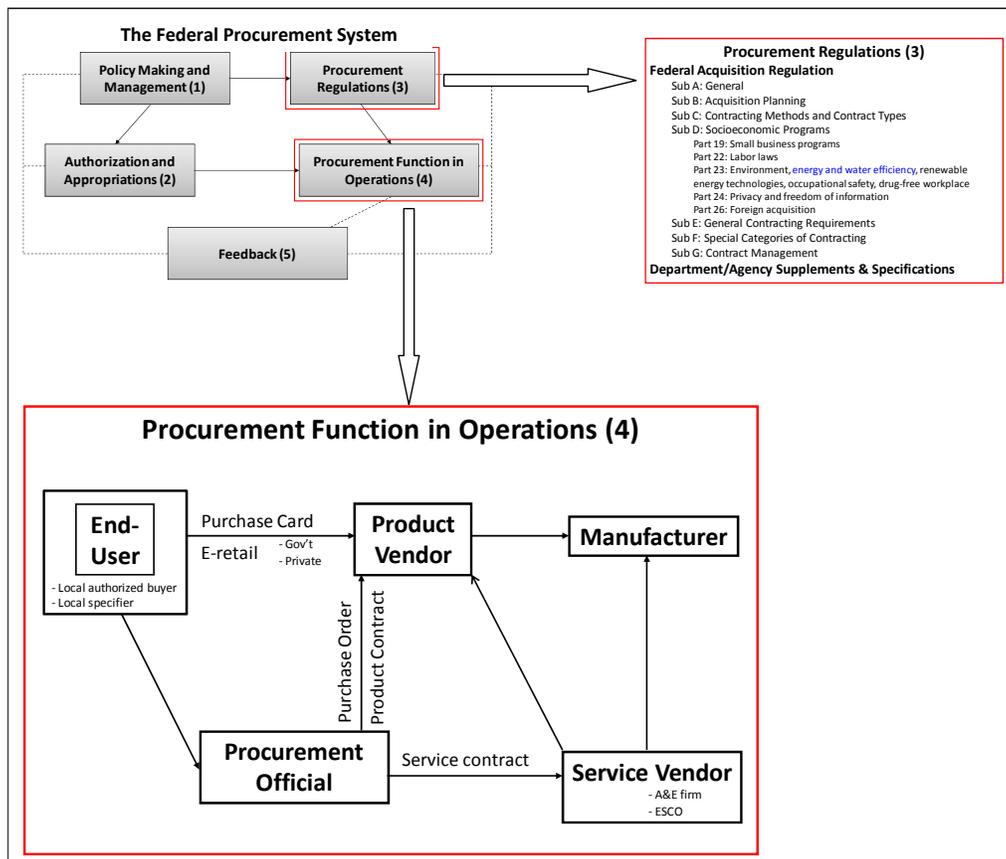
The bottom part of the concept map, which breaks out the fourth element of the procurement system, “procurement functions in operations,” represents the bulk of the activity that occurs in order to meet end-user needs for energy-consuming products in the federal sector. It represents actors in boxes and purchasing pathways as labels on arrows that link actors. Although most of this part of Figure 2 matched the authors’ initial concept map, two significant changes were made to respond to the focus group and interview process. First, a box was drawn to “orbit” the end-user box and thereby represent two actors that operate in the purchase process at a level that is administratively closer to the end-user than the more centralized operations

binding legal relationship obligating the seller to furnish the supplies or services (including construction) and the buyer to pay for them.” (FAR 2.101). In this paper, we distinguish between “product contracts” and “service contracts” based on the presence or absence of service vendors in the procurement. Much of construction is done via contract, with solicitation of contract bids by vendors.

⁴ These specifications provide explicit requirements for materials and equipment to be used in construction or renovation of federal facilities (e.g., the Unified Facilities Guide Specifications, the Federal Guide for Green Construction, etc.)

overseen by procurement officials. The first of these actors, the “local authorized buyer,” represents authorized p-card holders and similar actors who may undertake direct purchases on behalf of the end-user. The second of these actors, the “local specifier,” represents those who are tasked with maintaining federal facilities and who therefore play a role in defining purchase needs for items such as construction and industrial equipment (e.g., boilers, chillers, etc.), which many end-users benefit from. Second, the rapid procurement techniques originally put forward by the authors included p-cards and a blanket “e-retail” pathway. The focus group felt it was important that in representing the latter pathway, the concept map distinguish between the e-retail channels of government (i.e., the federal supply catalogs GSA Advantage and DLA Emall) and the private sector (e.g., pre-competes catalogs with Staples, Grainger, etc.).

Figure 2: Federal Procurement Model for Energy-Consuming Product Procurement that Emerged from Focus Group Discussion amongst FEMP EEPP Experts



What’s Bought and How: Internal Identification of the Attributes of FEMP EEPP Products with Relevance to Federal Sector Procurement Pathways

As mentioned above, the FEMP EEPP program represents roughly 80 products that fit into the categories of: (1) commercial & industrial equipment; (2) construction/plumbing; (3) lighting & fans; (4) food service equipment; (5) commercial appliances; (6) residential appliances; (7) office equipment; and (8) home electronics. These categorizations are helpful in

understanding the program's range, but are not necessarily helpful in connecting the underlying products to the direct and indirect purchase pathways and actors that the program could target in efforts to provide technical assistance, training, etc. to increase the uptake of energy and water efficient products in the federal sector.

After reviewing the literature and the FAR, four attributes of FEMP EEPP products emerged as potentially important to this study. First, the price points of the products should have some degree of correlation with procurement pathways (this is implicit in Table 1, for example). Second, the lifetime of the products should affect how frequently they are purchased by federal departments and independent agencies, and should therefore relate to the familiarity the relevant actors have with the FEMP EEPP offerings and underlying mandates. Third, the volume of federal shipments of the products should similarly affect actor familiarity (i.e., procurement officials should have less familiarity with products that are rarely needed by end-users), but also affect the setting of FEMP EEPP programmatic priorities. Fourth, the energy savings associated with the more efficient version of each product should affect the setting of FEMP EEPP programmatic priorities.

The authors collected and analyzed data on these four attributes of FEMP EEPP products, drawing from several sources: (1) federal energy efficiency standard Technical Support Documents (TSDs) and supporting spreadsheets; (2) product information provided on the FEMP and Energy Star websites; (3) a sample of price data from the GSA Advantage website; and (4) product density in buildings and other data from the most recent Residential Energy Consumption Survey (RECS) and Commercial Buildings Energy Consumption Survey (CBECS).⁵ Some of the results of this analysis were used to create a scatter-plot of FEMP EEPP products along two axes, product price and product lifetime. This scatter-plot was broken down into four quadrants, with FEMP EEPP products primarily fitting into the first three: (1) expensive and frequently purchased (e.g., computers); (2) expensive and infrequently purchased (e.g., commercial boilers); (3) inexpensive and frequently purchased (e.g., fluorescent tube lamps); and (4) inexpensive and infrequently purchased (e.g., DVD players). One of the results of the completed interview project with procurement officials "in the field" will be an altered scatter-plot for an indicative subset of FEMP EEPP products in which the symbol of each product data-point will be the pathway most often mentioned by procurement officials (e.g., the boiler data-point symbol will represent its purchase pathway, such as purchase order or product contract). The reason for the indicative subset of products in the final scatter-plot is because we felt that the full set of ~80 products would be too overwhelming for focus group and interview subjects.

A product price and lifetime scatter-plot of 27 of the FEMP EEPP products (three per category) was introduced in the internal focus group and interview process described above, and became an important element of the interviews with federal procurement officials that are ongoing. In addition, three individuals with at least ten years' experience working with the FEMP EEPP program participated in a brief survey that followed up on the pathway modifications that resulted from the focus group work on Figure 2. In this survey, participants were asked to provide their personal hypotheses of which pathways would be most commonly used to purchase which products in the federal sector; the pathways options were limited to those

⁵⁵ For an analysis of the potential and actual energy-savings from FEMP EEPP products under different scenarios, which also drew from these data, see 2012 ACEEE Summer Study Panel 14, paper #1175.

in Figure 2 and an “other” category, although participants were able to provide commentary that helped clarify their hypotheses. These hypotheses will be used in helping adjust the program’s strategy when the full results of the interviews with federal procurement officials are analyzed.

Who, What, How: External Interview Design and Implementation

In April 2012 the authors began a series of telephone interviews with federal procurement officials in order to get a better understanding of the variation across the federal sector regarding the procurement process for energy-consuming products. The protocol was developed with guidance from the literature on qualitative research (see, e.g., Rosenthal and Rosnow 2007), the input of four university social science researchers, and a pilot interview with a procurement specialist at Lawrence Berkeley National Laboratory (LBL). In the interviews, we discuss the subject’s sense of how well Figure 2 represents the purchase process for energy-consuming products in his or her organization, discuss the full purchase process for one of three sub-samples of the 27 indicator products (using the visual anchor of the product price and lifetime scatter-plot in combination with a “grand tour” style question), solicit suggestions on how to ensure that only energy and water efficient products get purchased by the federal sector, and request referrals to other interview subjects. Subjects are being identified through three primary lists and their associated referrals.⁶

Results

Table 2 presents preliminary results of “who buys what” FEMP EEPP products in the federal sector, based on a limited sample of interviews (four agency experts from three agencies) and survey participants (three FEMP EEPP experts with at least ten years of program experience). It lists the indicator products within each of the main product categories that were used in internal focus groups and internal and external interviews, and presents federal shipment and energy savings per product estimates for these products (these latter data were coded for presentation in Table 2 according to a rating scale of very low, low, medium, high, and very high in order to improve visualization). The last five columns of Table 2 list the procurement pathways identified in Figure 2, grouped according to whether the end-user is usually able to purchase a product directly or indirectly, through the active effort of the procurement official in the transaction (text is blue in direct pathways and black in indirect pathways). The cell contents in these columns incorporate the following symbols: “A” means the pathway was identified in connection with the product in question by an agency subject during the course of a formal interview; “F” means the pathway was identified for the product by a FEMP EEPP expert (“F2”

⁶ The first list is 115 email addresses used in Alliance to Save Energy (2012). Understanding Federal Compliance with Energy Efficiency Procurement Requirements: Procurement Forecast Review. The authors compiled the second list of 800+ emails and 100+ phone numbers from regional federal procurement directories maintained by the Small Business Administration (SBA) for five of the six areas of the country (the SBA does not maintain a directory for the sixth area). The third list is a subset of ~100 email subscribers to the FEMP EEPP newsletter. To date, only the first list and part of the second list have been contacted, as well as the referrals that have come up in the course of attempting to arrange interviews. At a minimum, we will interview at least one expert from each executive department and the major energy-consuming independent agencies, although in most cases we expect to interview more than one individual.

indicates that two FEMP EEPP experts identified a given pathway for a given product); and “A/” and “F/” indicate that the agency and FEMP EEPP expert, respectively, felt that at least two pathways were appropriate for a given product. When agency experts and FEMP EEPP experts agree on a product pathway, the cell is colored green; when there is no overlap between the agency expert and the FEMP EEPP expert, the cell is colored red.

Table 2: Federal Shipments, per unit Energy Savings, and Hypothesized vs. Reported Pathways of Selected Products

Category	Product	Federal Shipments (Units)	Energy Savings per Product (kWh/yr)	Purchase Method				
				Direct		Indirect		
				Purchase card	E-retailer	Purchase order	Product contract	Service contract
Commercial and Industrial Equipment	Commercial boiler	Very low (0<X<1,000)	Very high (>100,000)			A, F		F2
	Commercial air conditioner	Medium (10,000<X<100,000)	Low (100<X<1,000)	A		F		F2
	Chiller	Very low (0<X<1,000)	High (10,000<X<100,000)			F		A, F2
Construction/ Plumbing	Residential lavatory faucet	Medium (10,000<X<100,000)	Low (100<X<1,000)		A/	A/		F2
	Commercial lavatory faucet	Medium (10,000<X<100,000)	Low (100<X<1,000)		F	A		F2
	Showerhead	Medium (10,000<X<100,000)	Low (100<X<1,000)	A	F			F2
Lighting & Fans	Fluorescent tube lamp (bulb)	Very high (>1,000,000)	Very low (0<X<100)		A, F	A/, F		F
	Fluorescent ballast	Very high (>1,000,000)	Very low (0<X<100)		F	A, F		F
	Compact fluorescent light bulb	High (100,000<X<1,000,000)	Very low (0<X<100)	A	F	F		F
Food Service Equipment	Commercial oven	Low (1,000<X<10,000)	Medium (1,000<X<10,000)			A		F2
	Commercial refrigerator	Low (1,000<X<10,000)	Low (100<X<1,000)			A		F2
	Pre-rinse spray valve	Medium (10,000<X<100,000)	Medium (1,000<X<10,000)	A				F2
Commercial Appliance	Water cooler	Medium (10,000<X<100,000)	Low (100<X<1,000)			A		F2
	Refrigerated vending machine	Low (1,000<X<10,000)	Medium (1,000<X<10,000)					A, F2
	Commercial clothes washer	Low (1,000<X<10,000)	Low (100<X<1,000)	A			F	F
Residential Appliance	Refrigerator	High (100,000<X<1,000,000)	Low (100<X<1,000)		F	A	F	F
	Room air conditioner	Medium (10,000<X<100,000)	Low (100<X<1,000)		F	F		F
	Microwave	Medium (10,000<X<100,000)	Very low (0<X<100)	A, F	F			
Office Equipment	Desktop computer	High (100,000<X<1,000,000)	Low (100<X<1,000)		A, F			F
	Computer monitor	High (100,000<X<1,000,000)	Very low (0<X<100)		F		A	F
	Enterprise server	Medium (10,000<X<100,000)	Low (100<X<1,000)					A, F2
Home electronics	DVD player	Medium (10,000<X<100,000)	Very low (0<X<100)	A, F/	F, F/	A		
	Television	Medium (10,000<X<100,000)	Low (100<X<1,000)		F	A	F	
	Set-top box	Medium (10,000<X<100,000)	Very low (0<X<100)	A				F2
Residential equipment	Natural gas water heater	Medium (10,000<X<100,000)	Very low (0<X<100)	F/	A, F/	A/		F, F/
	Residential furnace	Medium (10,000<X<100,000)	Very low (0<X<100)	F/	F/			F, F/
	Residential heat pump	Low (1,000<X<10,000)	Medium (1,000<X<10,000)	F/	F/			A, F, F/

A	Pathway identified by an interview subject based at a federal agency
F	Pathway identified by a FEMP expert
F2	Pathway identified by 2 FEMP experts
A/	One of the multiple pathways identified for a product by an interview subject based at a federal agency
F/	One of the multiple pathways identified for a product
Green	A product pathway on which an agency expert and a
Red	The agency choice of pathway for a product which the agency and FEMP experts do not agree upon

First, it is interesting to note that all three FEMP EEPP experts do not agree on any given product pathway; this also holds in the one instance, thus far, in which more than one agency expert weighed in on a product's pathway, and may well be the case for federal agencies generally as more interviews are conducted (the agency experts were only asked explicitly about 9 products, while the FEMP EEPP experts were asked about all 27, although one of the FEMP EEPP experts did not provide hypotheses for all products). Agency experts and at least one FEMP EEPP expert agree on 11 of 27 product pathways, they disagree on 14 of 27 product pathways, and there is no agency expert data on two other product pathways because the agency organization in question does not purchase the given product.

FEMP EEPP experts hypothesized that direct purchase pathways were relevant to 15 of 27 products, although only 5 of them were p-cards; by contrast, agency experts reported that direct pathways were relevant to 12 of 27 products, with 8 of these p-cards (in only 2 of these p-card products did agency and FEMP EEPP experts agree: on the medium shipment and very low energy savings potential products of microwaves and DVD players). Trends are not yet generally observable on the basis of federal shipments, energy savings potentials and agreement/disagreement between agency and FEMP EEPP experts, other than in the three cases in which the product has a "very low" rating on one attribute and a "very high" rating on another; in these instances – boilers, fluorescent tube lamps, and fluorescent ballasts – agency and FEMP EEPP experts agree on the product purchase pathways.

Note that agency experts generally agreed with the accuracy of Figure 2 as a representation of procurement in their organizations, although each would modify the figure to some extent (one agency would eliminate e-retail as an option for end-users because the mission of the organization involves a high degree of coordination for energy-consuming products; one would modify the figure to think of "procurement officials" as occurring at a regional level, with on-site procurement officials clustered in the end-user box and concentrating on purchases under \$85,000, with relatively heavy use of p-cards; and the third would emphasize under "e-retail" the importance of pre-negotiated blanket purchase agreements and business-to-business solutions).

Suggestions from agency experts about how to ensure that the federal sector procures only energy efficient products have, to date, primarily focused on the potential role that the vendor community could play in limiting the purchasing options of end-users.

Conclusion

The complexity of the federal procurement system poses a daunting challenge to policy-makers interested in leveraging the power of public sector purchasing to pursue such "non-procurement" goals as energy and water efficiency. Although procurement regulations like the FAR are designed to ensure some degree of consistency for the purchasing function in operations across the federal government, the sheer diversity of agency missions and energy consumption patterns guarantees some degree of variability across the federal sector with regard to the people and purchasing pathways of energy-consuming products.

This paper has shown that it is possible, however, to provide a functional concept map of this system – its actors, pathways, and regulations/specifications – in the context of energy-consuming products in order to inform efforts to promote their uptake. This project has also

shown that characterizing these products according to attributes like price, lifetime, shipments, and energy savings potential can provide further guidance to improve the effectiveness of public sector procurement as a “demand-pull” policy tool.

Acknowledgements

The authors gratefully acknowledge the contributions of Christopher Payne and Andrew Weber, particularly in motivating this study. The work described was funded by the FEMP EEPP program of the U.S. Department of Energy’s Office of Energy Efficiency and Renewable Energy under Lawrence Berkeley National Laboratory Contract No. DE-AC02-05CH11231.

References

- Alliance to Save Energy (2012). Understanding Federal Compliance with Energy Efficiency Procurement Requirements: Procurement Forecast Review.
- Capanna, S., S. Devranoglu, et al. (2008). A Review of Federal Agency Compliance with Energy-Efficient Procurement Laws. Washington, D.C., Alliance to Save Energy.
- Drabkin, D. and K. V. Thai (2003). U.S. Federal Government Procurement: Structure, Process, and Current Issues. International Purchasing and Supply Education and Research Association's Comparative Public Procurement Cases Workshop. Budapest, Hungary, International Purchasing and Supply Education and Research Association.
- Gupta, M. and R. J. Palmer (2008). "A Brief History and Review of Purchasing Card Use by the U.S. Government: 1990-2005." Journal of Public Procurement **8**(2): 174-199.
- Harris, J. and F. Johnson (2002). Potential Energy, Cost, and CO2 Savings from Energy Efficient Government Purchasing. 2000 ACEEE Summer Study on Energy-Efficient Buildings. Asilomar, CA.
- Lipsey, R. and K. Lancaster (1956). "The general theory of second best." Review of Economic Studies **24**: 11-32.
- Novak, J. D. (1998). Learning, Creating, and Using Knowledge: Concept Maps as Facilitative Tools in Schools and Corporations. Mahwah, N.J., Lawrence Erlbaum Associates.
- Rosenthal, R. and R. Rosnow (2007). Essentials of Behavioral Research: Methods and Data Analysis. New York, McGraw-Hill.
- Siciliano, G. (2010). 2010 Review of Federal Agency Compliance with Energy-Efficient Procurement Laws. Washington, D.C., Alliance to Save Energy.
- Strauss, A. and J. Corbin (1998). Basics of qualitative research: Techniques and procedures for developing grounded theory. Thousand Oaks, Sage.
- Taylor, M. (2008). "Beyond technology-push and demand-pull: Lessons from California's solar policy." Energy Economics **30**(6): 2829-2854.
- Thai, K. V. (2001). "Public Procurement Re-Examined." Journal of Public Procurement **1**(1): 9-50.
- Vaidya, K., S. A. Sajeev, et al. (2006). "Critical Factors that Influence e-Procurement Implementation Success in the Public Sector." Journal of Public Procurement **6**(1&3): 70-99.