



Green Procurement: Overview and Issues for Congress

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Summary

Economic and environmental concerns have contributed to rising interest in green procurement—a term used in various ways but that may best be described as acquisition of products and services with smaller-than-average environmental footprints. Fully assessing a product or service requires integrated evaluation of cost, performance, and impacts for a set of green factors over all stages of the life cycle. Green building is an example of this approach. More generally, complexities and information gaps may constrict assessment options. However, where choices are comparative, partial assessments may often suffice. Because of such considerations, green procurement often emphasizes particular attributes, such as recycled content, energy efficiency, and waste reduction. Labeling and certification programs such as Energy Star, as well as other approaches, may be used to identify green products and services. While the use of green procurement appears to be increasing nationally, the success of programs is often not clear. Barriers to broader adoption include inadequate information among decisionmakers, lack of common implementation standards, real and perceived cost obstacles, and market and technical uncertainties.

As a major consumer of goods and services with significant potential impacts on the environment, including human health, the federal government could arguably influence the adoption of green procurement generally and the market for green products and services. Federal green-procurement efforts focus largely on acquisition of products, even though services account for about half of federal procurement spending. Various statutes, regulations, executive orders, and policy documents require or encourage the purchase of several types of products because of their environmental attributes. Agencies are required to purchase alternative fuels and alternative-fuel vehicles, and products that are biobased, Energy Star and energy-efficient, EPEAT (a green technology labeling program), and that contain recycled content, but acquisitions may be exempt in specified circumstances. Agencies must consider purchasing alternatives to toxic and priority chemicals and ozone-depleting substances, and environmentally preferable (EPP) products and services. Only EPP and EPEAT attempt to provide an integrative approach, rather than addressing only one or a few attributes, but they lack a specific basis in enacted statutes.

The Office of Management and Budget (OMB) provides broad guidance through various policy documents, as does the Office of the Federal Environmental Executive (OFEE), housed at the Environmental Protection Agency (EPA). For some kinds of attributes, procurement criteria are set by specific agencies. EPA, the General Services Administration (GSA), OFEE, and other agencies have databases that help identify green products. OMB requires agencies to have green procurement plans and to report annually on their activities. Those reporting requirements appear to be largely qualitative, but quantitative reports are available for recycled-content and alternative-fuels products.

Green procurement raises several policy questions, especially for federal acquisitions: (1) What are the most useful and appropriate policy goals for green procurement? (2) Are the legal authorities and other means by which different green product and service initiatives have been established the most appropriate for meeting policy goals? (3) How effectively is agency implementation and performance of green procurement being assessed? (4) How successful are current programs and initiatives at meeting policy goals? (5) Are policies on the acquisition of green services sufficient? (6) Are the policies and the methods of implementing them sufficiently harmonized and integrated? (7) Are there significant gaps in the preferences for green products and services? (8) Are there implementation methods not currently used by the federal government that should be considered? (9) Is training of the acquisition workforce sufficient?

Contents

What Is Green Procurement?.....	4
Green as a Relative Concept.....	4
Green Procurement and Environmentally Preferable Purchasing.....	7
Life Cycle Stages	8
Research and Design	9
Raw Materials Acquisition	9
Manufacturing	10
Distribution.....	10
Operation and Use	11
Disposal or End of Life	11
Green Factors.....	12
Inputs.....	12
Effects	15
Evaluation Criteria.....	16
Impact.....	16
Cost	16
Performance.....	17
Life Cycle Analysis	17
Implementing Green Procurement.....	20
Labeling and Certification.....	21
Price and Cost Policies	22
Other Approaches	23
Measuring Success.....	23
Barriers to Broader Adoption of Green Procurement Practices	25
Incomplete and Imperfect Information	25
Lack of Common Standards	25
Real, Perceived, and Hidden Costs	26
Market and Technical Uncertainties.....	26
Federal Green Purchasing Initiatives	26
Market-Focused Programs.....	27
Agency-Focused Initiatives	27
Preferences for Green Products and Services	28
Federal Performance in Green Procurement.....	34
Issues for Congress	39
Green Procurement Policy Goals.....	40
Green Procurement Policy Instruments.....	41
Performance Assessment.....	41
Program Evaluation	42
Acquisition of Services	42
Integration and Harmonization of Green Procurement Initiatives	43
Possible Gaps in Current Preferences	43
Additional or Different Implementation Mechanisms	44
Training of the Acquisition Workforce.....	44

Figures

Figure 1. Green Procurement Relative to Other Approaches	5
Figure 2. Dimensions of Green Procurement and Relationships Among Major Elements	19

Tables

Table 1. Federal Procurement Spending for FY2008 by North American Industry Classification System (NAICS) Group (\$ Billions).....	3
Table 2. Entities Responsible for Providing Guidance to Federal Agencies for Green Products and Services	30
Table 3. Types of Green Products Listed in GSA and EPA’s EPP Databases by Primary Focus	32
Table 4. Federal Procurement Spending for FY2008 by Department or Agency for Selected Industries	34

Contacts

Author Contact Information	45
Acknowledgments	45

I ncreasing concerns about global warming, energy independence, and public health have contributed to a rise in public interest in so-called “green” products and services, and the development of a “green” economy.¹ A number of federal programs and activities are relevant to that interest. In addition to well-known programs aimed at the public such as Energy Star (see text box below), the federal government is itself a major consumer of goods and services, spending more than \$500 billion per year on procurement (**Table 1**), with annual spending increasing significantly in recent years.² Substantial proportions of those expenditures are on goods and services with significant environmental impacts. For example, in both FY2008 and FY2009, more than half of the funds spent on manufactured goods was for transportation equipment, and more than 15% was for information technology and other electronics and electrical products. Construction of buildings and other structures comprised 11% of spending in FY2008 and 7% in FY2009.³

Those levels of expenditure imply that greater use of green procurement practices could significantly reduce the environmental impacts of federal activities. Furthermore, federal policies and practices relating to green procurement may have significant impact on the adoption of such practices by state and local governments and the private sector. They might also serve to stimulate growth and innovation in green sectors of the national economy, potentially influencing the availability of green products and services in the marketplace and the development of associated industries.

Several relevant federal procurement requirements and programs have been established, beginning with a requirement enacted in the 1970s for federal agencies to purchase products with recycled content. That requirement and some additional initiatives focus largely or entirely on federal procurement, whereas others, such as Energy Star, a joint program of the Environmental Protection Agency and the Department of Energy, were specifically designed to have a broader market focus. These two kinds of federal efforts, which may be called agency-focused and market-focused, respectively, are distinct but not completely independent. For example, Energy Star originated as a market-focused program aimed largely at consumers, but it is now included in federal regulations relating to acquisition of energy-consuming appliances and even buildings.⁴

Most of the federal initiatives focus on specific inputs or effects that a product might have, such as energy use, recycled content, or toxicity. This approach can allow for fairly straightforward implementation of a given initiative, but it may also be criticized as not paying sufficient attention to interactions or trade-offs among various factors. In addition, evaluating the effectiveness of initiatives in implementing federal green policy can be challenging.

¹ See, for example, Joel Makower, *State of Green Business 2010* (Greener World Media, February 2010), <http://stateofgreenbusiness.com/node/1>.

² Reported spending is total dollars obligated and in FY2008 represented an increase of 15% over FY2007 and 25% over FY2006 (data generated by CRS from the Federal Procurement Data System, FPDS-NG, <https://www.fpds.gov>). However, spending in the table for FY2009 was slightly lower than FY2008 (0.3%). FPDS-NG lists all actions valued at over \$3,000 on executive-branch procurement contracts. It is the only comprehensive source for data of this kind, but commentators have repeatedly questioned the accuracy and completeness of its data. For more about FPDS-NG and concerns about the quality of its data, see CRS Report RL34718, *The Federal Funding Accountability and Transparency Act: Implementation and Proposed Amendments*, by Garrett Hatch.

³ Construction is often treated separately from services. However, for simplicity of exposition, the term *products and services* as used in this report means products, services, and construction unless otherwise indicated.

⁴ See 48 C.F.R. § 23.203 and 42 U.S.C. 17091.

Several factors contribute to this situation. A fundamental problem is that there is no general agreement on what green procurement is or how best to implement it. Also, several barriers exist to broader adoption, both within the federal government and in the broader economy. Those include inadequate information, lack of common standards, concerns about costs, and both market and technical uncertainties. Debate about the desirability or feasibility of meeting green policy goals such as reducing greenhouse-gas emissions may also create uncertainties.

However, this report does not specifically address controversies about the desirability of green policy goals, either those Congress has established in various statutes, or those specifically addressed in executive orders issued by Presidents Clinton, George W. Bush, and Obama.⁵ Those controversies are complex, often long-standing, and beyond the scope of this report, but some of the major ones are discussed in other CRS documents.⁶ This report also does not address issues specific to the complex area of federal procurement, which is also discussed in other CRS documents.⁷

Rather, the report focuses on procurement from a green policy perspective. It discusses the problem of what green procurement means, selected aspects of applicability to and implementation by federal agencies (both initiatives aimed largely at federal agencies and those with a broader focus), and issues that Congress may decide to address with respect to federal green procurement programs. Those issues include what green procurement means in the federal context; how programs and requirements should be established, assessed, and harmonized; and what gaps exist at present with respect to focus, implementation, and evaluation.

Energy Star

Energy Star is a voluntary labeling program established by EPA in 1992. It is now a joint EPA/DOE program. It is a public/private partnership designed to overcome market barriers to the adoption of energy-efficient products and services.

Residential: The agencies work with manufacturers to identify appliances and other products that are cost-effective and energy efficient. Products meeting the criteria receive an Energy Star label. The agencies provide information directly to consumers about the thousands of labeled products. Among the product categories included are office equipment, home electronics, heating and cooling (HVAC), appliances, lighting, and windows. The program has also partnered with builders to create Energy Star-qualified homes and with lenders to encourage the use of “green mortgages” to promote energy-efficient housing.

Commercial: EPA offers partnerships to businesses and other organizations that make top-level managerial commitments to adopt superior energy management. Partners continually assess energy use within their organizations and use an integrated approach in upgrading buildings. EPA provides standardized measurement tools and a recognition program to assist and promote these efforts.

Federal: The Energy Policy Act of 2005 (P.L. 109-58, known as EPACK 2005) requires federal agencies to purchase either Energy Star products or those designated as energy efficient by FEMP. The Energy Independence and Security Act of 2007 (P.L. 110-140, known as EISA) requires additionally that federal agencies lease only facilities with a recent Energy Star label.

Source: EPA, “ENERGY STAR – The Power to Protect the Environment through Energy Efficiency,” July 2003, http://www.energystar.gov/ia/partners/downloads/energy_star_report_aug_2003.pdf.

⁵ However, in most cases, it is not specifically called “green procurement” in those statutes and executive orders, as discussed later in this memorandum.

⁶ See, for example, CRS “Issues in Focus” on Greenhouse Gas Policy, and Chemicals in Commerce, and CRS Report R40168, *Alternative Fuels and Advanced Technology Vehicles: Issues in Congress*, by Brent D. Yacobucci.

⁷ See, for example, CRS “Issues in Focus” on Government Procurement.

Table I. Federal Procurement Spending for FY2008 by North American Industry Classification System (NAICS) Group (\$ Billions)

Group	Amount	
	FY2008	FY2009
Products	226.9	217.9
Transportation equipment	113.6	104.5
Computer and electrical equipment	33.2	33.1
Wholesale and Retail Trade	28.5	30.0
Metals	12.9	12.6
Petroleum and coal products	11.4	13.1
Machinery	6.7	6.4
Chemicals	4.9	8.3
Other	15.8	10.0
Services	240.4	263.8
Professional, Scientific, and Technical Services	141.3	150.8
Administrative and Support Services	36.8	39.3
Information	10.4	11.9
Transportation	10.3	10.9
Finance and Insurance	9.7	12.3
Real Estate, Rental, and Leasing	5.3	4.7
Health Care and Social Assistance	5.2	6.8
Waste Management and Remediation Services	5.1	9.0
Educational Services	4.5	5.2
Repair and Maintenance	4.0	4.4
Utilities	2.2	2.8
Other	5.9	5.7
Construction	57.2	38.7
Building construction	41.5	25.6
Heavy and Other Construction	15.7	13.2
Other	13.6	15.9
Total	538.1	536.4

Source: Analysis by CRS of data from Federal Procurement Data System (FPDS-NG), <https://www.fpds.gov>. FY2008 data are from October 2009. FY2009 data are from March 2010.

Note: Data in the FPDS-NG database are not static and may vary slightly with different runs. Figures, which are obligated dollars, should therefore be considered approximate. For descriptions of the industry groups, see U.S. Census Bureau, "2007 NAICS," September 3, 2008, <http://www.census.gov/cgi-bin/sssd/naics/naicsrch?chart=2007>. Groupings in the table are derived by CRS from descriptions of sectors and subsectors in that source, supplemented by U.S. Census Bureau, "2002 Economic Census: Summary Statistics by 2002 NAICS - United States," November 7, 2005, <http://www.census.gov/econ/census02/data/us/US000.HTM>. All Product categories except Wholesale and Retail Trade are derived from aggregation of subsector data. All Services categories correspond to sectors except Administrative and Support Services, Waste Management and Remediation

Services, Repair and Maintenance, and Other Services. The two Construction categories are derived from aggregations of subsector data within the Construction sector.

What Is Green Procurement?

Green procurement may appear to be a somewhat fuzzy concept, given the variety of ways in which it and related terms are used. There are many different practices and criteria that are called “green,” and several alternative terms that are used at least somewhat interchangeably in public discourse. In fact, the term *green* came into widespread use only in the last several years. Other terms used in various documents both historically and currently include “environmentally preferable,” “sustainable,” “affirmative,” and “socially responsible” procurement. Those and other terms may have specific meanings in some contexts but they may also be used somewhat interchangeably in other contexts. In addition, green procurement may be used in some cases to refer to purchasing of products and services with specific attributes such as energy or water efficiency, or use of biobased or recycled materials or nontoxic chemicals, without necessarily taking other factors into account.

Such variations in usage and meaning can create significant difficulties in understanding what green procurement is and in the development and implementation of policy goals. Therefore, this section of the report develops a general conceptual framework for consideration of policy issues associated with green procurement. It draws from both public- and private-sector initiatives and analyses. It discusses examples from federal programs, including those that have a focus beyond procurement by federal agencies, as well as examples involving states and the private sector. Green-procurement activities by federal agencies are discussed specifically later, in the section on “Federal Green Purchasing Initiatives.”

Green as a Relative Concept

The apparent fuzziness of green procurement as a concept can create uncertainties and even confusion that may make addressing policy issues difficult. To help avoid such problems, the following characterizations are used in this report:

- A *green product or service* can usefully be thought of as one that has a significantly smaller environmental footprint than the average or standard product or service of the same type (see **Figure 1**).
- The *environmental footprint* of a product or service can be described as its overall impact on the environment, including use of resources such as energy and water, and effects on health and other aspects of the human environment.
- *Green procurement* can be thought of as the range of processes by which such green products and services can be acquired.⁸
- *Green practices* also include related procedures and actions that result in a reduced environmental footprint, such as using products in ways that optimize their green characteristics.⁹

⁸ That characterization is similar in concept to one often used to describe green building. See CRS Report R40147, *Issues in Green Building and the Federal Response: An Introduction*, by Eric A. Fischer.

Figure 1. Green Procurement Relative to Other Approaches

Source: CRS.

Notes: The figure shows the position of green procurement along a continuum, from those with extremely high impacts to those with none. It illustrates that green procurement denotes a range of approaches that have lower environmental impact in general than standard ones.

In this view, the industry average or *standard* at any given time is generally not considered green.¹⁰ Consequently, as products, services, and practices currently thought of as green become standard practice within an industry, the threshold for something to be considered green would change—moving to a level of environmental impact that is lower than the new standard.¹¹

Most products and services acquired through procurement activities are likely to be subject to some environmental constraints—for example, they may be subject to environmental regulations, or the industry standard may incorporate environmental protections for other reasons. Consequently, those exhibiting more *extreme impacts* are unlikely to be considered standard practice, as illustrated in **Figure 1**. At the same time, having lower impact than what is currently standard does not necessarily mean that a practice is a *sustainable* one—that is, maintaining an environmental footprint that is small enough that it will not impede future human activity and the functioning of ecosystems.¹²

Green procurement practices may also include those that have no net environmental impact (or *zero impact*, as shown in the figure), which is unattainable in most instances at present, except in some cases for some attributes such as energy (see also the section on “Life Cycle Analysis” below). For example, the Energy Independence and Security Act of 2007 (EISA, P.L. 110-140) set a goal of zero net energy use by 2030 for new federal buildings.¹³ In theory, at least, a product

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⁹ For example, a programmable thermostat for a furnace or air conditioner can provide significant energy savings, but purchasing the device is not sufficient. The programming features must be used appropriately, or no energy savings will result.

¹⁰ However, in some cases, businesses may attempt to promote nongreen practices as green. This practice, known as “greenwash,” is more likely to be an issue for products or services that are not certified under an established green program or label such as Energy Star. However, it can sometimes be an issue even for such an established program. See, for example, Office of Inspector General, *The Department’s Management of the ENERGY STAR Program*, DOE/IG-0827 (Department of Energy, October 2009), <http://www.ig.energy.gov/documents/IG-0827-508.pdf>.

¹¹ Some observers make this point by claiming that green procurement is more appropriately called greener procurement.

¹² Sustainability may also have various meanings in different contexts. A widely cited definition, in the context of development, is “meet[ing] the needs of the present without compromising the ability of future generations to meet their own needs” (United Nations, *Report of the World Commission on Environment and Development: Our Common Future*, A/42/427, June 1987, <http://www.un-documents.net/wced-ocf.htm>; commonly known as the Brundtland Commission Report). Executive Order 13514, “Federal Leadership in Environmental, Energy, and Economic Performance,” defines it as meaning “to create and maintain conditions, under which humans and nature can exist in productive harmony, that permit fulfilling the social, economic, and other requirements of present and future generations” (74 Fed. Reg. 52126 (October 8, 2009)).

¹³ Sec. 433 modifies 42 U.S.C. § 6834(a)(3) to require that buildings “be designed so that the fossil fuel-generated energy consumption of the buildings is reduced, as compared with such energy consumption by a similar building in fiscal year 2003” by a percentage that increases every five years, culminating in a 100% reduction (i.e., zero net energy (continued...))

or service could even have a positive environmental impact, at least for some elements, such as a building that produces more energy than it uses, for example via solar panels, and returns the surplus to the grid.

The relative approach to green procurement described here may appear to create difficulties for implementation to the extent it makes green a moving target, depending on the current industry average. However, it does not preclude an approach incorporating a fixed target such as zero impact.¹⁴ It can also be seen as an application of the well-established business practice of continual improvement.¹⁵ And it is consistent with a common feature in the development and maintenance of voluntary consensus standards,¹⁶ which are usually reviewed and updated on a periodic basis as technology, practices, and requirements evolve. Current federal law encourages the use of such standards by federal agencies in general,¹⁷ and some specific standards are referenced in some provisions in federal laws relating to environmental policy.¹⁸ States may also reference such standards, for example in building codes and procurement requirements for agencies.¹⁹ Some sets of consensus standards have been developed specifically with respect to green procurement, for example in information technology (IT), as discussed later in this report.

This use of green as a relative concept has several potential advantages. It allows for broad application of practices and standards to different products and services, and for adaptation to the specific conditions faced by different sectors and industries. It arguably facilitates the use of performance standards rather than design standards, and the former are generally regarded as preferable.²⁰ It also permits gradual and continual reduction in environmental impact over time—

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use) by 2030.

¹⁴ Of course, if zero-impact became the industry standard practice, it would no longer be considered green under a strictly relative definition. Rather, that would be limited to practices that enhanced green factors, such as by removing excess greenhouse gases from the atmosphere or restoring lost ecosystem functions from a landscape.

¹⁵ See, for example, ASQ, “Continuous Improvement,” 2009, <http://www.asq.org/learn-about-quality/continuous-improvement/overview/overview.html>.

¹⁶ See, for example, International Organization for Standardization, “ISO - Standards development processes - How are standards developed?,” 2009, http://www.iso.org/iso/standards_development/processes_and_procedures/how_are_standards_developed.htm. Note that *standards* in this sense differs in meaning from *standard practices* or *industry standards*. The latter refer to practices and characteristics that are usual or typical for a particular sector or industry, whereas the former usually refers to a *documentary standard*, which is a consensus document, approved by a recognized organization, that provides “rules, guidelines, and characteristics for activities or their results” (Christine R. DeVaux, *A Guide to Documentary Standards*, NISTIR 6802 (National Institute of Standards and Technology, December 2001), <http://ts.nist.gov/Standards/Conformity/upload/ir6802.pdf>).

¹⁷ Section 12(d) of the National Technology Transfer Advancement Act of 1995 (P.L. 104-113), as amended, (15 U.S.C. § 272 note) states, “all Federal agencies and departments shall use technical standards that are developed or adopted by voluntary consensus standards bodies, using such technical standards as a means to carry out policy objectives or activities determined by the agencies and departments,” except where they would be “inconsistent with applicable law or otherwise impractical.” Office of Management and Budget Circular A-119 provides guidance for implementing this provision.

¹⁸ For example, a provision in EISA relating to energy-efficiency standards for industrial equipment requires the Secretary of Energy to “establish an amended uniform national standard for the product at the minimum level specified in the amended ASHRAE/IES Standard 90.1” (§ 305(b)(2)).

¹⁹ For example, California requires that “All carpet purchased by ... state agencies shall meet the NSF/American National Standards Institute 140-2007 standard at its PLATINUM level” (State of California, “Carpet Purchases to Meet Environmentally Preferable Criteria,” Management Memo MM 1—01, State Administrative Manual, December 31, 2009, http://www.documents.dgs.ca.gov/osp/sam/memos/MM10_01.pdf).

²⁰ DeVaux, *A Guide to Documentary Standards*. Performance standards focus on functional requirements, whereas design standards focus on specific characteristics. Although both are useful and often form elements of a particular (continued...)

for example, gradual reduction in energy use or production of pollutants. Finally, it avoids the inherent problems with defining what *green* is in a more fixed or absolute sense.

However, some observers may prefer a different meaning. Some may argue that simply taking environmental issues into account is sufficient to practice green procurement. Others may express concerns about a relative approach being more difficult to apply to specific cases, presenting unpredictably shifting goals, not accounting for inherent limitations in reducing environmental footprints, or permitting slower progress toward goals than some may desire.

For example, use of recycled content in paper products would generally be regarded as a green practice. If the goal for that practice is set at a particular percentage, such as 50%, of such content, then it is relatively easy for a manufacturer to conform and for buyers to assess whether a given product does so. But if the goal is to have more recycled content than average, a manufacturer or buyer would have to know what that average was to assess what a green percentage would be. Furthermore, if the average were 75% recycled content, then only paper with higher percentages would be considered green. If the average were 100%, no paper would be considered green with respect to recycled content. Finally, setting a high specific target, such as 100%, may result in more rapid increases in average recycled content than setting a relative goal.

Such objections can be met in several ways. For example, documentary standards can be used, where targets are set by an independent entity and can be revised as conformance improves. A proxy or indicator such as a green label can be used to indicate whether a product meets the standard. That is one approach used, for example in green IT, as discussed later.

Also, green practices are not limited to only one factor or attribute, such as percentage of recycled materials, but involve integration of several across the life cycle of a product or service. Even if a maximum is reached for one element, options for improvement are likely to remain for others. In addition, the relative sense in which the term green is used in this report captures the range of meanings given to it by different stakeholders in a way that is comparatively clear and consistent and retains the utility of the concept.

Green Procurement and Environmentally Preferable Purchasing

Finally, some may argue that green procurement as described here is simply a synonym for environmentally preferable procurement, or EPP, which was introduced in the 1990s (see “Federal Green Purchasing Initiatives” below).²¹ However, EPP refers to various specific programs and initiatives,²² usually involving explicit comparison of alternative products or

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documentary standard, the former are generally preferred where applicable because they are less restrictive and are thought more likely to encourage innovation. However, assessment of conformance may be more complex for performance standards.

²¹ For example, that is how the Responsible Purchasing Network defines the term (Responsible Purchasing Network, “Factsheet: Buying Green on Cooperative Contracts,” 2009, http://www.responsiblepurchasing.org/includes/cooperative_contracts.pdf). The federal definition of environmentally preferable products and services is those having “a lesser or reduced effect on human health and the environment when compared with competing products or services that serve the same purpose” (see the text box on EPA’s Environmentally Preferable Purchasing Program (EPP) below).

²² For example, the state of California has implemented an EPP initiative (California Integrated Waste Management Board, “Environmentally Preferable Purchasing (EPP) Home Page,” January 1, 2010, <http://www.ciwmb.ca.gov/EPP>), (continued...)

services, whereas green procurement is used here in a broader sense that includes a variety of other approaches, such as zero-impact initiatives.²³ Definitions of EPP used by various nonfederal entities often follow closely the federal description, but some entities define it differently.²⁴

A salient feature of the concept of green procurement described above is that it is multidimensional, usually involving an *integrated evaluation* of criteria such as cost, performance, and impact of a product or service with respect to a set of *green factors* over the entire *life cycle*, from design through disposal. These three dimensions—life cycle, green factors, and evaluation criteria—are discussed below, followed by a discussion of considerations relating to implementation.

Life Cycle Stages

The stages of the product or service life cycle can also be divided in various ways, but for purposes of this report, the following six stages will be discussed:

- research and design,
- raw materials acquisition,
- manufacturing,
- distribution,
- operation or use, and
- disposal or end-of-life.

The relative importance of those stages will vary depending on the kind of product or service being considered. Raw materials acquisition, manufacturing, and disposal are unlikely to be direct factors in acquisition of services in many cases, but they will play an indirect role, depending on the degree to which the service provider engages in green product-procurement practices.

For example, some consultants may use only green IT products, such as those listed under the Energy Star or EPEAT²⁵ labeling programs, and may follow green practices in end-of-life

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and at least 90 governmental and nongovernmental organizations, including corporations, in the United States have reported implementing EPP policies (Responsible Purchasing Network, *Responsible Purchasing Trends*, 2009, http://www.responsiblepurchasing.org/publications/trends_2009.pdf).

²³ In fact, the federal EPP initiative is often treated as one of several kinds of green procurement in federal documents, as discussed later in this report. Nevertheless, green procurement as described here does have more characteristics in common with EPP than with other federal initiatives—specifically, both incorporate relative assessments and take an integrated, multifactor, life cycle approach.

²⁴ For example, the City of Boulder, Colorado, has defined an environmentally preferable product with respect to specific attributes, as “a material or product which is durable, repairable, reusable, or recyclable; has a minimum of packaging, toxic content or chemical hazard potential; is resource or energy efficient in any or all phases of its manufacture, use, and disposal; or in its use or disposal minimizes or eliminates the City’s potential environmental liability” (Scot Case, *Environmental Purchasing Policies 101: An Overview of Current EPP Policies* (Commission for Environmental Cooperation and the North American Green Purchasing Initiative, March 25, 2004), <http://www.cec.org/files/PDF/NAGPI%20Policy%20Paper2e.pdf>).

²⁵ Environmental Protection Agency, *Energy Star—the Power to Protect the Environment through Energy Efficiency*, July 2003, http://www.energystar.gov/ia/partners/downloads/energy_star_report_aug_2003.pdf. Green Electronics Council, “Welcome to EPEAT,” 2006, <http://www.epeat.net/default.aspx>. EPEAT is an acronym for the Electronic (continued...)

management of products they use. Some cleaning services may use environmentally preferable cleaning products.²⁶ In the latter case, failure to use green products could also have direct consequences for the service recipient, for example if the products contained chemicals with adverse health effects.

Research and Design

All products and services that come to market are designed in some manner before they are produced, and that preliminary stage may also involve performing various types of research and development. New kinds of products may require a substantial research effort before they can be designed. Such activities may involve processes with significant environmental impacts. Also, the characteristics set at the design stage can affect impacts and other criteria throughout the life cycle. As with many features, green characteristics work best if they are built in rather than added on.²⁷

Nevertheless, this stage is often omitted in discussions of life cycle aspects of green procurement. That may be because in many cases, acquisitions are of products or services already available in the marketplace. However, institutional green procurement programs can have an influence at this stage, most obviously for acquisitions that require custom design and manufacture. For ready-made products and services, assessment may be made of the degree to which candidates for procurement were specifically designed both to reduce environmental impacts throughout the life cycle (sometimes called design for the environment)²⁸ and to facilitate recycling and other aspects of end-of-life management (sometimes called design for recycling).

Raw Materials Acquisition

The kinds of materials from which a product is manufactured may substantially affect the environmental footprint of the product. For example, mining or logging may have low to high impact, depending on the practices of the companies involved, through energy and water use, waste production, and effects on health and ecosystems. Green guidelines and practices have been developed to reduce such impacts by changing the processes by and sources from which raw materials are obtained, including increasing the use of recycled and renewable resources.

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Product Environmental Assessment Tool.

²⁶ See, for example, Environmental Protection Agency, "Greening Your Purchase of Cleaning Products: A Guide For Federal Purchasers," August 10, 2009, <http://www.epa.gov/epp/pubs/cleaning.htm>.

²⁷ A classic example is in the construction of buildings, where it is widely recognized that making a building green by retrofitting is more expensive and less effective than incorporating green features in the design phase (see CRS Report R40147, *Issues in Green Building and the Federal Response: An Introduction*).

²⁸ One example is the Toxics Use Reduction Institute (TURI) at the University of Massachusetts (<http://www.turi.org>), which does research to find alternatives to toxic chemicals. See also Daniel Sarewitz, "A tale of two sciences," *Nature* 462 (November 19, 2009): 566. See also Environmental Protection Agency, "Design for the Environment (DfE)," November 10, 2009, <http://www.epa.gov/oppt/dfc>.

Examples are requirements and programs to reduce by-catch in commercial fishing,²⁹ reduce mining pollution,³⁰ and increase use of recycled content and biobased materials in products.

Manufacturing

The impacts of processes used in manufacturing products and developing services also vary. Manufacturing processes may differ in the efficiency of input use, the amount and kind of waste generated, and environmental effects on ecosystems and human health. Such impacts may be reduced by manufacturers through various means, ranging from improvements focusing on individual factors such as amounts and sources of energy used, to integrated approaches such as lean manufacturing techniques, which aim to reduce waste and improve efficiency throughout the manufacturing process.³¹

Distribution

This life cycle stage includes the various processes involved in distributing a product or service to users once it has been manufactured or developed. It includes such things as packaging, marketing, transportation, storage, and sales. For commercial off-the-shelf (COTS) products and services—that is, those that are ready-made and available to the general public, rather than those that are expressly manufactured for a buyer to custom specifications—this is usually the stage at which buyers can first assess costs and impacts of potential acquisitions.

In addition to manufacturers claims, various aids have been created by different government and private entities to assist both government and private-sector buyers in identifying green COTS products and services. For example, among federal agencies, the Environmental Protection Agency (EPA) provides public access to databases of products assessed as environmental preferable through various criteria.³² The General Services Administration (GSA) also provides information on green products through its website.³³ The U.S. Department of Agriculture (USDA) has an online catalogue of biobased products listed under its BioPreferred program, which focuses on renewable biobased products.³⁴ States such as California, Pennsylvania, and Washington have online guides to help buyers identify green products and services, as do some municipal government entities in states such as Minnesota, and organizations such as the National Association of Counties (NACO) and the Northwest Product Stewardship Council.³⁵ Private-

²⁹ See, for example, National Oceanic and Atmospheric Administration, “Fisheries Interactions/Protected Species Bycatch,” 2009, <http://www.nmfs.noaa.gov/pr/interactions>. *By-catch* refers to the harvesting by fishing operations of unwanted species, such as dolphins or porpoises being caught in tuna nets, or sea turtles by shrimp trawlers.

³⁰ See, for example, Environmental Protection Agency, “Mining Waste,” January 13, 2009, <http://www.epa.gov/osw/nonhaz/industrial/special/mining>.

³¹ Environmental Protection Agency, *Lean Manufacturing and the Environment: Research on Advanced Manufacturing Systems and the Environment and Recommendations for Leveraging Better Environmental Performance*, EPA100-R-03-005, October 2003, <http://www.epa.gov/lean/leanreport.pdf>.

³² Environmental Protection Agency, “Environmentally Preferable Purchasing (EPP),” November 7, 2007, <http://www.epa.gov/epp>.

³³ General Services Administration, “Environmental Products Overview,” June 29, 2009, <http://www.gsa.gov/Portal/gsa/ep/channelView.do?pageTypeId=17110&channelPage=%2Fep%2Fchannel%2FgsaOverview.jsp&channelId=-24454>.

³⁴ U.S. Department of Agriculture, “BioPreferred,” 2009, <http://www.biopreferred.gov/Default.aspx>.

³⁵ California Department of Resources Recycling and Recovery, “Green Guide: California Greenin’,” 2010, <http://www.calrecycle.ca.gov/EPP/Procurement/GreenGuide/default.htm>; Commonwealth of Pennsylvania, “Green (continued...)”

sector organizations such as Green Seal and the Green Electronics Council also provide lists of products.³⁶ Such aids are discussed further in the “Labeling and Certification” section (see also **Table 3**).

Buyers purchasing custom rather than COTS products and services may have greater capability to ensure the use of green practices in various stages of the life cycle. This may be especially true for large institutions such as the federal government, large states, and major corporations, who are more likely than small purchasers to be able to use their buying power as leverage to achieve such goals.

Operation and Use

A range of impacts may occur at this stage, some of which may be apparent to the purchaser and some not. They include such things as energy use by appliances and vehicles, water use by plumbing fixtures; and release into indoor air of potentially harmful volatile chemicals (called off-gassing) by furniture, furnishings, and building materials.

The degree to which green practices are used at this stage also affects impacts. For example, some users may waste large amounts of paper, ink, and energy through inefficient or unnecessary printing practices; power management of computer systems may not be used effectively; and vehicles may be driven or maintained in ways that compromise efficiency measures.

Products also vary in the length of their useful life. Some, such as disposable cellular phones, may be designed to be discarded after a short period of use. Others, such as modular computers, may be specifically designed to be readily repaired and upgraded rather than discarded when they fail, or in response to technological advances. However, product maintenance and repair may also have environmental impacts, and repair rather than replacement may also affect performance.

Disposal or End of Life

The fate of a product after its useful life has ended may also have significant impacts. Products may be discarded into landfills, refurbished and reused, or recycled—disassembled and parts and materials recovered and reused. Each of those alternatives will have impacts that vary with the kind of product and the processes chosen. While reuse and recycling are generally considered environmentally preferable where possible, the ways in which those processes are carried out can vary significantly in impact. For example, computers and other electronics may be recycled for disposal. It may not be possible to determine before disposal how items will be recycled. Such “e-

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Procurement,” n.d., http://www.portal.state.pa.us/portal/server.pt/community/green_procurement/5247/green_procurement_home/491348; Department of Ecology, State of Washington, “What Is Environmentally Preferable Purchasing?,” n.d., <http://www.ecy.wa.gov/beyondwaste/epp.html>; Solid Waste Management Coordinating Board, “Environmentally Preferable Purchasing Guide,” April 25, 2008, <http://www.rethinkrecycling.com/government/eppg>; National Association of Counties, “NACo’s Environmental Purchasing Starter Kit,” 2009, http://www.countyengineers.org/Template.cfm?Section=New_Technical_Assistance&template=/ContentManagement/ContentDisplay.cfm&ContentID=16814; Northwest Product Stewardship Council, “Northwest Product Stewardship Council,” September 22, 2009, <http://www.productstewardship.net/index.html>.

³⁶ Green Seal, “Green Seal,” n.d., <http://www.greenseal.org/index.cfm>; Green Electronics Council, “Welcome to GEC,” 2009, <http://www.greenelectronicscouncil.org>.

waste” is often exported.³⁷ Recycling by recipients may be performed in ways that are dangerous to the health of workers and damaging to the local environment.

Another method used to reduce the impact of disposal is leasing or other forms of “product takeback” at the end of the life cycle. With this approach, a vendor of a product agrees to accept those disposed of by users and recycle them or make them available for reuse. An automobile trade-in is a classic example of this approach, but it is used increasingly with other kinds of products such as electronics.³⁸

Green Factors

The main *green factors*,³⁹ the major determinants of the environmental footprint of a product or service, can be divided into two types, *inputs* and *effects*. Inputs discussed in this report include energy, materials, and water; environmental effects include those on ecosystems, health, and waste production. While green factors can be viewed in other ways, the set described here is likely to capture all the major attributes usually considered important.⁴⁰

Inputs

Energy

Energy is often the most prominently considered green factor, because of its economic importance and the environmental impacts of the various methods of generation. Some input of energy is involved at different life cycle stages for all products and services, but its importance may vary substantially across stages for different kinds of acquisitions.

The operation stage is arguably the easiest for which this input can be measured and controlled for any given product, and most attempts to rate or label products with respect to this input focus on such *use energy*. Examples of ratings are Annual Fuel Utilization Efficiency (AFUE)⁴¹ for

³⁷ See CRS Report R40850, *Managing Electronic Waste: Issues with Exporting E-Waste*, by Linda Luther.

³⁸ See, for example, Northwest Product Stewardship Council, “Electronic Equipment and Product Stewardship,” June 29, 2009, <http://www.productstewardship.net/productsElectronicsNWStates.html>.

³⁹ Another term often used in the context of green procurement is *environmental attributes*. However, the term is used somewhat differently in different contexts. For example, in some cases it refers to a characteristic that is considered beneficial to the environment (see Federal Trade Commission, “Part 260 - Guides for the Use of Environmental Marketing Claims,” April 12, 2007, <http://www.ftc.gov/bcp/grnrule/guides980427.htm>, C.F.R. Part 260). In other cases it may refer to a specific list of characteristics such as the potential for skin irritation or air pollution by a chemical (see Environmental Protection Agency, “Green Cleaning - Environmental Attributes Defined,” January 28, 2010, <http://www.epa.gov/epp/pubs/products/cleanattribut.htm>).

⁴⁰ For example, a White House document from 2001 categorizes attributes as relating to natural resources use, human health and ecological stressors, hazardous factors associated with materials, and “positive attributes” such as recyclability (White House Task Force on Recycling, *Greening the Government: A Guide to Implementing Executive Order 13101*, February 2001). A European Commission study lists the following impacts: energy, land, resource, water, eutrophication, greenhouse gas, smog, acidification, and waste (European Commission, *Environmental Impact of Products (EIPRO)*, EUR 22284 EN, Technical Report Series, May 2006, http://ec.europa.eu/environment/ipp/pdf/eipro_report.pdf).

⁴¹ Commonly expressed as a percentage, AFUE “measures the amount of fuel converted to space heat in proportion to the amount of fuel entering the furnace” (Environmental Protection Agency and Department of Energy, “Furnaces Key Product Criteria,” 2009, http://www.energystar.gov/index.cfm?c=furnaces.pr_crit_furnaces).

furnaces, Seasonal Energy Efficiency Ratio (SEER)⁴² for air conditioning, and EPA fuel economy estimates for motor vehicles. The most widely known labeling system is probably Energy Star. Programs aimed at energy conservation or efficiency in procurement, including Energy Star, tend to focus on use energy rather than that consumed in other life cycle stages.⁴³ However, other programs may address energy use at other stages, such as the development of renewable or other green energy sources that may be used by manufacturers.

Energy used during other stages is called *embedded energy* or *embodied energy*.⁴⁴ However, embodied energy may be used by some to refer to all energy used during the life cycle, including use energy. This is how it is defined by the Department of Energy (DOE).⁴⁵ It may therefore be most helpful to distinguish between the two terms, defining embodied energy as total energy and embedded energy as total energy minus use energy; that is the usage adopted for this report. Impacts from life cycle stages other than use and operation may be called embedded impacts.⁴⁶

In some cases, embedded energy may be substantial. For example, concrete exterior walls in buildings may have some advantages over wood, but concrete has much higher embedded energy.⁴⁷ However, there appears to be no widely accepted methodology for applying the concept broadly to purchasing decisions, and little information is available for many products. Some observers also argue that considering embedded energy as a separate factor can lead to erroneous conclusions, and that an integrated life cycle assessment is the best way to capture the total energy footprint of a product or service.

One complicating factor for measuring embedded energy is the nature of the energy sources used. For example, if a product with lower embedded energy is manufactured using nonrenewable sources of energy such as fossil fuels, or renewable sources that are produced in ways that have significant environmental impacts, such as on ecosystems, that product may have a greater overall environmental impact than an alternative product with higher levels of embedded energy from more sustainable sources.⁴⁸

⁴² SEER is the ratio of the cooling power of equipment and the electricity the equipment consumes (Environmental Protection Agency and Department of Energy, “What is SEER? EER? HSPF?,” 2009, http://energystar.custhelp.com/cgi-bin/energystar.cfg/php/enduser/std_adp.php?p_faqid=3041).

⁴³ Exceptions include green building (see CRS Report R40147, *Issues in Green Building and the Federal Response: An Introduction*) and environmentally preferable purchasing programs (see footnote 35 and the text box on EPA’s Environmentally Preferable Purchasing Program (EPP)).

⁴⁴ For example, one inventory program describes embodied energy as “the total primary energy consumed during resource extraction, transportation, manufacturing and fabrication of a product” (Sustainable Energy Research Team, University of Bath, “Embodied Energy & Carbon,” 2007, <http://www.bath.ac.uk/mech-eng/sert/embodied>). Note that this definition does not include either use energy or energy consumed at end-of-life processes.

⁴⁵ Department of Energy, *2008 Buildings Energy Data Book*, November 2008, p. 1-32, http://buildingsdatabook.eren.doe.gov/docs%5CDataBooks%5CSEP_2008_BEDB.pdf. This meaning has been in use since at least the 1970s (see, for example, Committee on Science and Technology, Subcommittee on Energy Research, Development, and Demonstration, “Energy Accounting as a Policy Analysis Tool,” committee print, 94th Cong., 2nd sess. (Washington: GPO, 1976).

⁴⁶ See, for example, Department for Environment, Food, and Rural Affairs, UK, *Progress Report on Sustainable Products and Materials*, July 2008, p. 24, <http://www.defra.gov.uk/environment/business/pdf/prod-materials-report0708.pdf>.

⁴⁷ Department of Energy, *2008 Buildings Energy Data Book*, Tables 1.6.2 and 1.6.3 Carbon emissions also tend to be higher for concrete.

⁴⁸ Methods have been developed for taking such variables into account in the field of energy analysis, but it is a very complex discipline, and its usefulness for procurement policy is not clear. For an overview, see Cutler J. Cleveland and (continued...)

Materials

The materials used in a product can contribute substantially to its environmental footprint. The choice and use of materials may have impacts on resource depletion, pollution, embodied energy, and health, among other factors. Green materials may have significant recycled content, be made from renewable biological resources (so-called “biobased” products), or be created with processes that use low amounts of energy and produce low amounts of pollutants. They may also be designed to reduce health risks such as those from off-gassed formaldehyde and other volatile organic compounds (VOCs).

For many kinds of products, for example paper, this factor may exhibit the highest potential impacts at life cycle stages other than use and operation. In such cases, embedded impacts may be of greater importance than use impacts.

Water

Water is a critical resource, and the adequacy of clean freshwater supplies is increasingly a matter of national and global concern.⁴⁹ Water is also an important resource at many stages of the life cycles of various products and services. As with energy, its importance varies depending on the product or service and the stage of the life cycle. For example, one U.N. study has estimated that the impact on water resources from production of a pair of leather shoes is 1.6 times that for a ream of paper and 250 times that for a microchip.⁵⁰ For none of these is water likely to be a significant resource at the use stage. That is not the case with other products, perhaps the most obvious being plumbing fixtures and irrigation equipment.

Embedded impacts are likely difficult to assess accurately for individual products and services for several reasons, such as regional variations in water supply and the degree to which used water is contaminated and requires processing before reuse. As with energy, most of the focus from the green-procurement perspective has been on the use stage, at which this input may be more readily measured and controlled. For example, the Energy Policy Act of 1992 (EPACT 1992, P.L. 102-486) established water-use standards for certain plumbing fixtures (42 U.S.C. 6295); EPA’s Water Sense labeling program⁵¹ lists water-efficient plumbing fixtures and other products; and rebate incentives for water efficiency have been established in some states.⁵² However, attempts have

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Robert Costanza, “Net energy analysis,” August 22, 2008, http://www.woearth.org/article/Net_energy_analysis.

⁴⁹ See, for example, CRS Report RL34580, *Drought in the United States: Causes and Issues for Congress*, by Peter Folger, Betsy A. Cody, and Nicole T. Carter.

⁵⁰ A.K. Chapagain and A.Y. Hoekstra, *Water Footprints of Nations*, Value of Water Research Report Series No. 16 (UNESCO-IHE, November 2004), p. 42, <http://www.waterfootprint.org/Reports/Report16Vol1.pdf>. The estimates are based on a measure of water use called virtual water content, which is the volume of water used to produce a product (including production of crops for products with biobased content). The estimates given in the report were 8,000 liters of water for a pair of leather shoes, 10 liters for one sheet of letter-sized (A4) paper (one ream is 500 sheets), and 32 liters for one microchip.

⁵¹ Environmental Protection Agency, “WaterSense,” October 8, 2009, <http://www.epa.gov/OW-OWM.html/water-efficiency/index.htm>.

⁵² Examples include Austin, TX (<http://www.ci.austin.tx.us/watercon>); the Southern California Water District (<http://socialwatersmart.com>); and Seattle, WA (http://www.savingwater.org/business_WSTP.htm).

been made to develop measures of what might be called embodied water (by analogy with embodied energy). One such approach is the “water footprint.”⁵³

Effects

Ecosystem

The term ecosystem is often thought of popularly as referring to natural biological systems largely separate from human civilization. However, in reality humans are embedded in and rely on services provided by ecosystems for such things as freshwater, food and other biobased products, and oxygen, as well as less tangible services relating to quality of life, such as recreation and existence value.⁵⁴

Impacts of products and services on ecosystems therefore have broad application to green procurement. A full assessment would require consideration of a wide range of direct and indirect effects across all life cycle stages and spatial and temporal scales.⁵⁵ That is likely to be difficult in many cases, and controversial in at least some.

Health

Several factors can influence the health impacts of products and services. Some impacts are related to the kinds of materials used, such as heavy metals, VOCs, asbestos,⁵⁶ or other potentially toxic substances. Other factors, such as radiation, the quality of lighting, effectiveness of climate control equipment in buildings, and ergonomic design of furniture, can also have significant impacts on health.⁵⁷

Such impacts may occur at various stages. For example, the potentially toxic materials used in computers do not generally pose a health hazard for users, but they can pose hazards at both the manufacturing and disposal stages. For some materials, such as metals, impacts from the ways

⁵³ Water Footprint Network, “Water Footprint,” 2010, <http://www.waterfootprint.org/?page=files/home>. An attempt to develop an international standard has also been initiated (see Sebastien Humbert, “ISO Standard on Water Footprint: Principles, Requirements and Guidance” (presented at the UNEP Water Accounting and Efficiency Stocktaking Workshop, Paris, France, November 23, 2009), <http://www.unep.fr/scp/water/documents/Presentations/ISO%20Activities%20on%20Water%20Accounting%20%28Sebastien%20Humbert%29.pdf>).

⁵⁴ See, for example, National Research Council, *Perspectives on Biodiversity: Valuing Its Role in an Everchanging World* (Washington, DC: National Academy Press, 1999): “Existence values are values that are not predicated on use, in the ordinary sense of that word; that is, people gain utility from, or have preferences concerning, states of the world” (p. 84). This kind of value is difficult to measure and may be somewhat controversial, as are other kinds of so-called nonmarket values measured most commonly by contingent valuation techniques.

⁵⁵ This is briefly discussed in Environmental Protection Agency, “Final Guidance on Environmentally Preferable Purchasing for Executive Agencies,” 64 Fed. Reg. 45810 (August 20, 1999). More detailed discussion can be found in White House Task Force on Recycling, *Greening the Government*. This guide refers specifically to several ecosystem impacts in the context of green procurement: endangered species, wetlands loss, fragile ecosystems, erosion, and animal welfare.

⁵⁶ Asbestos is present in many older buildings and is still used in some construction materials (Environmental Protection Agency, “Asbestos in Products and Buildings,” December 10, 2008, <http://www.epa.gov/asbestos/pubs/pubs.html>).

⁵⁷ Environmental Protection Agency, “Green Indoor Environments,” October 14, 2008, <http://www.epa.gov/iaq/greenbuilding>.

raw materials are originally acquired via mining operations and are processed, such as in smelters, can also pose health risks both to workers and to the public.

Waste

Waste reduction is a common theme of green purchasing programs. Impacts from wastes may occur in several ways. For example, they may be toxic, flammable, or corrosive. According to EPA, more than 46 million tons of hazardous wastes were generated in the United States in 2007.⁵⁸

However, even nonhazardous wastes can be environmentally harmful in ways such as the consumption of energy for disposal, impacts on ecosystems from disposal sites, and resource depletion in cases where recyclable waste is discarded. Impacts may occur at various stages of the life cycle in addition to the disposal phase for a given product or service. In fact, more than two-thirds of U.S. hazardous waste in 2007 was produced by the chemical manufacturing industry.⁵⁹

Evaluation Criteria

The discussion above describes the role of individual green factors, considered over the life cycle, in determining the environmental footprint of a product or service. However, such a description is not sufficient for making informed decisions about whether to acquire a particular product or service. An integrated assessment is needed that uses appropriate criteria. Cost⁶⁰ and performance are important in addition to environmental impact (including on human health).⁶¹ Low environmental impact may be of little consequence if a product or service is so costly or performs so poorly in comparison to alternatives that it is not competitive in the marketplace. Other criteria such as availability may also be relevant.

Impact

An overall characterization of impact requires integration of individual impacts from the sets of inputs and effects across all the stages of the life cycle. Reversibility of the impacts must also be taken into account. For example, some chemical pollutants are far more persistent in the environment than others, and some ecosystems recover more quickly from disturbance than others. Some toxins accumulate in the bodies of humans and other species, whereas others are quickly metabolized. Depletion of nonrenewable resources is not reversible.

Cost

While the most obvious component of cost is price, an evaluation of costs across the life cycle includes the total monetary costs to the user of acquiring, operating, maintaining, and disposing

⁵⁸ Environmental Protection Agency, *The National Biennial RCRA Hazardous Waste Report (Based on 2007 Data)*, EPA 530-R-08-012, November 2008, <http://www.epa.gov/osw/inforesources/data/br07/national07.pdf>.

⁵⁹ *Ibid.*

⁶⁰ The term *cost* as used here includes more than just purchase cost (see the section on “Cost”).

⁶¹ One of EPA’s “guiding principles” for environmentally preferable purchasing is titled “Environment + Price + Performance = Environmentally Preferable Purchasing” (Environmental Protection Agency, “Final Guidance.”).

of an item. Green purchasing evaluations can expose hidden costs, such as disposal costs, that may otherwise be invisible to those making the purchasing decisions. They may also include indirect costs borne by the purchaser such as medical expenses for hazardous items.

Consequently, a simple assessment of price can be misleading. For example, one study reported that several years ago, the New York Department of Sanitation rejected a proposed purchase of a new fluid for cleaning collection trucks, even though it was environmentally superior, because it cost \$0.75 more per gallon than the fluid then in use. However, the price did not take into account other cost factors that would have shown that rather than costing more, the new cleaner would have led to substantial savings.⁶²

In addition, externalities may lead to costs borne broadly by the public that would not be reflected in the cost to the purchaser. For example, agroforestry practices that lead to erosion can have adverse impacts on fisheries or water supplies that may not be paid by the producer and therefore would not be passed on to the purchaser in the price of the product.

Performance

Performance refers to how well a product or service accomplishes the functions for which it was acquired. If a reduction in impacts is accompanied by a significant reduction in performance, acquisition may not be cost-effective.

A fairly common perception about green products and services is that they cost more and may not perform as well as standard products. However, there are many cases where green procurement may lead to the acquisition of products and services that are superior in performance to standard ones.⁶³ This may be especially relevant given that according to a recent survey, most institutional purchasers rate product performance as the most important factor in making purchase decisions.⁶⁴

Life Cycle Analysis

A full examination of options in green procurement involves an integration of the evaluation criteria across the set of green factors and life cycle stages. That involves a life cycle assessment or analysis (LCA), which can be described as a method for analyzing the environmental impacts of something throughout its lifespan, from initial creation through destruction or disposal.⁶⁵ This is also known as a “cradle-to-grave” evaluation. A general international standard for such assessments has been developed (ISO 14040 and 14044).⁶⁶ Development of at least one U.S. life cycle impact assessment standard (SCS-002) has been initiated.⁶⁷

⁶² The proposed cleaner was much more concentrated than the one then in use and had lower preparation and disposal costs, for a total projected annual cost of \$2,874, compared to \$30,527 for the alternative. See Science Applications International Corporation, *Environmentally Preferable Purchasing* (The New York City Department of Sanitation, April 2001), p. 7, <http://www.nyc.gov/html/nycwasteless/downloads/pdf/eppmanual.pdf>.

⁶³ See, for example, City of Portland, Oregon, “Buying Green Case Studies,” 2009, <http://www.portlandonline.com/omf/?c=44701>.

⁶⁴ Responsible Purchasing Network, *Responsible Purchasing Trends*.

⁶⁵ Generally, the term *life cycle assessment* is used to refer only to this kind of environmental assessment and should not be confused with similar terms with different meanings, such as life cycle management.

⁶⁶ See International Standards Organization, “13.020.10:Environmental management,” http://www.iso.org/iso/iso_catalogue/catalogue_ics/catalogue_ics_browse.htm?ICS1=13&ICS2=20&ICS3=10. See also Environmental (continued...)

LCA usually consists of several stages: An initial stage defines the goals and scope of the analysis, including what is to be assessed, the context of the assessment, and the limits of the analysis. That is followed by an inventory of inputs and effects, an assessment of impacts, and an evaluation of the results.⁶⁸ Some tools for making such assessments have also been developed, including the Building for Environmental and Economic Sustainability (BEES) tool developed by the National Institute of Standards and Technology (NIST).⁶⁹ While it was developed for use in green building projects, the application is broadly applicable; for example, it has been adapted for use in USDA's BioPreferred program. Another example from the building sector is the Athena Institute's EcoCalculator.⁷⁰

An extension of the standard cradle-to-grave life cycle approach is called cradle-to-cradle. It has been described as an attempt to apply the principles of natural biological cycles to product cycles by creating an explicit connection between the end of a product's life cycle and the beginning.⁷¹

Life cycle analysis can also help ensure that evaluation includes interactions and trade-offs among factors and life cycle stages. A classic example of interaction between inputs and effects is in buildings, where attempts to improve energy efficiency by using products that reduce leakage of air to the outside may permit the build-up of potentially harmful air pollutants, contributing to the phenomenon of "sick building syndrome."⁷²

Another example involves incandescent versus fluorescent lightbulbs. While the latter are widely recognized as more energy efficient, concerns have been raised about the extent to which the presence of mercury in the latter counterbalances their advantage in energy efficiency, by posing an environmental hazard from that toxic metal. Some life cycle analyses have found, however, that more mercury is released into the environment over the life cycle of an incandescent bulb, on average, than a fluorescent one, especially in areas where electricity is generated from coal.⁷³

An example involving trade-offs relating to the length of the operational stage of the life cycle is the relative impacts of concrete versus wood for the framing and walls of buildings. Concrete can be much more durable than wood and may have other potential benefits, such as fire safety, but

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Protection Agency, "LCA 101," October 17, 2008, <http://www.epa.gov/ord/NRMRL/lcaccess/lca101.html>.

⁶⁷ Leonardo Academy, "Development of the SCS-002 Life-Cycle Impact Declarations Standard," December 10, 2009, <http://www.leonardoacademy.org/programs/standards/life-cycle/development.html>.

⁶⁸ Science Applications International Corporation, *Life Cycle Assessment: Principles and Practice*, EPA/600/R-06/060 (Environmental Protection Agency, May 2006), <http://www.epa.gov/ord/NRMRL/lcaccess/pdfs/600r06060.pdf>.

⁶⁹ National Institute of Standards and Technology, "BEES 4.0," August 20, 2007, <http://www.bfrl.nist.gov/oea/software/bees>.

⁷⁰ The institute states that the tool uses data developed by the institute and data from the U.S. Life-Cycle Inventory (LCI) database developed by the Department of Energy (see Athena Sustainable Materials Institute, "EcoCalculator," April 20, 2009, <http://www.athenasmi.org/tools/ecoCalculator/index.html>; National Renewable Energy Laboratory, Department of Energy, "U.S. Life-Cycle Inventory Database," 2010, <http://www.nrel.gov/lci/>).

⁷¹ See MBDC, *Cradle to Cradle Certification Program, Version 2.1.1*, September 2008, http://www.mbdc.com/docs/Outline_CertificationV2_1_1.pdf, and **Table 3**.

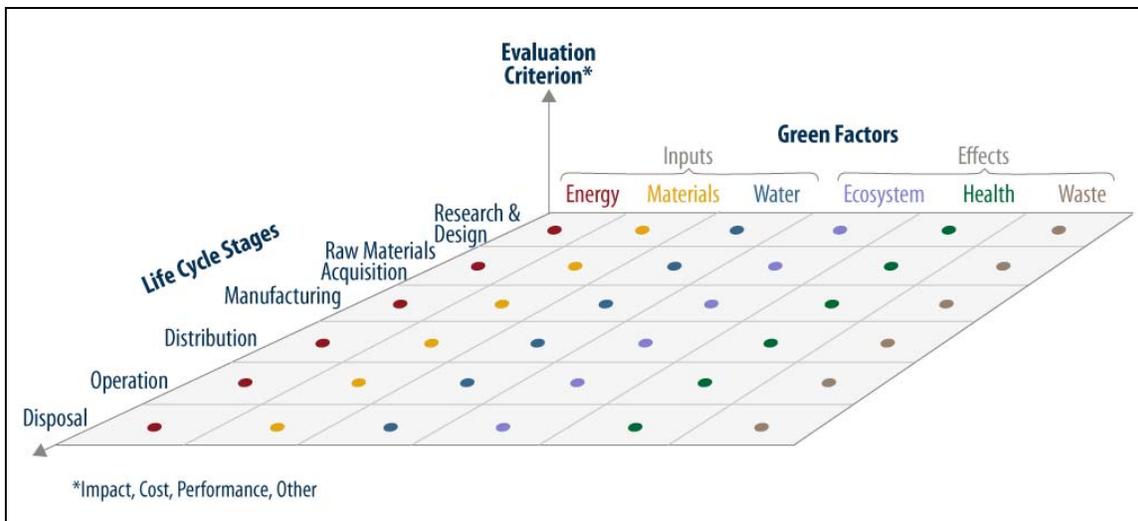
⁷² See, for example, Commission for Environmental Cooperation, "Green Building in North America," 2008, <http://www.cec.org/greenbuilding>.

⁷³ See, for example, Laurie Ramroth, *Comparison of life-cycle analyses of compact fluorescent and incandescent lamps based on rated life of compact fluorescent lamp*, Report No. C08-12 (Rocky Mountain Institute, February 2008), http://www.rmi.org/cms/Download.aspx?id=1393&file=C08-02_CFL_LCA.pdf.

the high embedded energy and other impacts of concrete can potentially offset such benefits in low-rise buildings where wood is an option.⁷⁴

Figure 2 depicts a conceptual model of the relationships among the green factors, life cycle stages, and evaluation criteria. In this three-dimensional graphical representation, each element is depicted as a dot on a horizontal matrix, with the criteria forming the third dimension. In making a full assessment using this model, a value for each criterion would need to be determined for each of the 36 elements in the matrix (in the graph, values would be represented by columns of different heights). That would need to be done for each candidate in an acquisition and the results compared to make a decision.

Figure 2. Dimensions of Green Procurement and Relationships Among Major Elements



Source: CRS.

Notes: The figure shows a conceptual model of the relationships among the three major dimensions of green procurement as described in this report—green factors, life cycle stages, and evaluation criteria. It illustrates that a green procurement assessment involves an integrated evaluation, using appropriate criteria, of green factors (inputs and effects) across all stages of the product or service life cycle. The number of elements and the complexity of the approach implies that in practice, decisions will often need to be made with very limited information about most elements.

A model of such complexity may be limited in its usefulness in practice, especially for customers making purchase decisions.⁷⁵ But it illustrates both some of the central features of green

⁷⁴ For example, a comparison of concrete and wood reveals much higher estimates for concrete of measures of potential impacts on energy, ecosystems, and health (Athena Institute, “EcoCalculator”). However, concrete may have lower impacts by other measures, depending for example on the degree to which companies use green practices in creating and using those materials.

⁷⁵ Using such a complex approach would involve fairly sophisticated mathematical modeling of effects across the life cycle, as well as information about the various elements, and as a result is unlikely to be feasible or practical for most procurement decisionmakers. Such analysis may be done for or used in technical studies (see, for example, Department for Environment, Food, and Rural Affairs, UK, *Progress Report*) or with the aid of tools such as BEES, but it is unlikely to be of direct use to many purchasers, such as small businesses. However, it may be particularly useful in the design stage, especially by manufacturers, and large purchasers such as the federal government in developing (continued...)

procurement, as discussed above, and some of the difficulties that can be involved in making an accurate assessment. For example, little information may exist in many cases about many of the elements in the matrix.

Also, alternative products and services being considered for a given acquisition may vary substantially in values for different elements and criteria in ways that are difficult to compare. However, such analyses can be used, for example, by trusted third parties who perform such analyses to determine if products meet green certification or labeling criteria, as is discussed in the next section. In addition, assessments may be facilitated by the development and application of standard models and techniques.

Implementing Green Procurement

The discussion above provides a conceptual framework for consideration of policy issues relating to green procurement that might come before Congress, in particular with respect to development, facilitation, and implementation of green procurement in the marketplace, and its adoption and implementation by federal agencies. Several points from the discussion above are particularly relevant to such development and implementation:

- The term *green procurement* covers a range of approaches to acquisition of products and services that have a smaller-than-average environmental footprint.
- The reduction in the environmental footprint of products and services acquired through green-procurement practices may range from marginal to substantial (see **Figure 1**), depending on the specific policies and approaches taken, among other factors.
- A full assessment of a product or service involves an integrated evaluation of several factors across the life cycle of that product or service (see **Figure 2**).
- There are likely to be interactions and trade-offs among different green factors and life cycle stages that would need to be taken into account in any such assessment.
- Information for many of the elements involved may be difficult to assess accurately.
- As a result, assessments may be potentially very complex and may need to be made on substantially incomplete information or through use of proxy measures such as green labels.
- However, because choices are usually comparative—is one choice greener than the others?—full assessments may not usually be required for decisions. Nevertheless, failure to consider a sufficient set of elements may lead to erroneous conclusions.

(...continued)

specifications for custom-made goods and services. Also, tools that may be developed to reduce the resources required to perform any given assessment may facilitate broader use. Finally, third-party certifying organizations may perform such analyses to determine whether a product or service should receive certification.

Because of such characteristics and complexities, and other factors such as the ways in which programs, policies, and regulations tend to be developed by both governments and private industry, green procurement initiatives often emphasize particular attributes, such as recycled content, energy efficiency, water use or footprints, waste reduction at end of life, and reduction in hazardous chemicals.⁷⁶

Green procurement may also be complicated by other factors, such as legal requirements or commitments. For example, with respect to international free trade, one author has cautioned that federal “green purchasing regulations must be carefully crafted to avoid the appearance of providing hidden subsidies to U.S. contractors; otherwise, trade disputes will arise through the World Trade Organization.”⁷⁷

Several approaches to implementing green purchasing programs have been developed by various government and private-sector organizations, and some examples are discussed below.⁷⁸

Labeling and Certification

One of the most widespread and easiest-to-use approaches to implementation of green procurement is through third-party labeling and certification programs. Examples include

- Energy Star, a joint market-focused energy-efficiency program of EPA and DOE;⁷⁹
- EPEAT, a green electronics label developed by a private, non-profit organization from a recognized technical standard with partial funding from EPA and since adopted by the federal government;⁸⁰
- Green Seal, a private, non-profit environmental certification standard that covers a variety of products and services;⁸¹ and
- Cradle to Cradle (C2C), a private certification program intended to recognize green producers that “close the loop” between disposal and manufacturing, thereby approaching zero-impact.⁸²

One organization has identified more than 80 labels relating to green products and services in use in North America and more than 300 worldwide,⁸³ and the use of labels appears to be on the

⁷⁶ A number of governmental and nongovernmental initiatives relating to such attributes are discussed in this report. With respect to corporate initiatives, an often-cited example is the efforts the Coca-Cola Company has made with respect to the water footprints of their products. See, for example, The Coca-Cola Company, *Replenish Report*, January 2010, http://www.thecoca-colacompany.com/citizenship/pdf/replenish_2010.pdf.

⁷⁷ Christopher Robey, “Beyond Compliance: Environmental Sustainability in Federal Green Purchasing,” *Contract Management* 49, no. 5 (May 2009): p. 20.

⁷⁸ For further discussion of these and other approaches, see, for example, Jerrell Cogburn and Dianne Rahm, “Environmentally Preferable Purchasing: Who is Doing What in the United States,” *Journal of Public Procurement* 5, no. 1 (2005): 23-53; Case, *Environmental Purchasing Policies* 10.

⁷⁹ Environmental Protection Agency and Department of Energy, “Energy Star,” 2009, <http://www.energystar.gov>. See also the Energy Star text box above.

⁸⁰ Green Electronics Council, “Welcome to EPEAT.”

⁸¹ Green Seal, “Green Seal.”

⁸² MBDC, *Cradle to Cradle Certification Program, Version 2.1.1*.

⁸³ Big Room, Inc., “Ecolabelling.org: Who’s deciding what’s green?,” 2010, <http://ecolabelling.org/>.

rise.⁸⁴ Such labels and certifications may vary in quality and emphasis. Some, such as EPEAT, may be based on technical standards promulgated or recognized by standard-setting organizations such as the American National Standards Institute (ANSI) or the International Organization for Standardization (ISO).⁸⁵ Such standards are developed through a voluntary consensus process involving experts and other stakeholders and are periodically updated. Other labels may be based on criteria developed internally by the labeling entity. If a labeling program has insufficient quality control, it may not reflect the promised environmental performance. In some cases, labels may not reflect any green characteristics, a practice known as “greenwash.”⁸⁶

Some labels or certifications focus primarily on a single factor, such as energy use or water, and some involve evaluations of the designated factor only or largely during the operations stage of the life cycle. That is the case, for example, with Energy Star. A focus on a single factor and life cycle stage has benefits in comparative simplicity of evaluation and ease of understanding by potential users, but it could mask trade-offs involving interactions with other factors or effects at other life cycle stages.⁸⁷

Alternatively, labels may be based on a broad set of multifactor or multiattribute standards applied across the life cycle, such as EPEAT and Cradle-to-Cradle. However, such broad, integrative standards may be difficult and time-consuming to develop and keep up-to-date, and as a result, they may apply to relatively few products and may become obsolete. This may be one reason why the federal government uses a variety of certification or labeling systems in its agency-focused initiatives, and why many other organizations use third-party labels and standards as criteria for green procurement decisions, rather than performing the necessary assessments themselves.⁸⁸

Price and Cost Policies

Green products and services may cost more than standard equivalents.⁸⁹ In at least some cases, higher acquisition costs may be offset by other savings, as discussed elsewhere in this report.⁹⁰ Some organizations have implemented policies designed to address such problems. One approach used by various institutions is called price premiums,⁹¹ where institutional policies permit purchasers to pay a somewhat higher price for a product or service that meets green criteria. This

⁸⁴ TerraChoice Environmental Marketing, *The Seven Sins of Greenwashing: Environmental Claims in Consumer Markets*, April 2009, http://sinsofgreenwashing.org/?dl_id=4.

⁸⁵ ISO has developed standards for ecolabeling that are used, for example, by Green Seal (International Organization for Standardization, “ISO 14020:2000 - Environmental Labels and Declarations—General Principles,” 2009, http://www.iso.org/iso/iso_catalogue/catalogue_tc/catalogue_detail.htm?csnumber=34425). Green Seal is also accredited by ANSI to develop standards, and some Green Seal standards are also ANSI standards (Green Seal, “How Green Seal Sets Environmental Standards,” 2010, <http://www.greenseal.org/certification/standards.cfm>).

⁸⁶ The term has also been defined more broadly as “the act of misleading consumers regarding the environmental practices of a company or the environmental benefits of a product or service.” According to one study, about half of the environmental claims for products that were for sale in various stores were vague or could not be proven (TerraChoice Environmental Marketing, *The Seven Sins of Greenwashing*).

⁸⁷ This may be fairly common, according to one study (*ibid.*).

⁸⁸ Responsible Purchasing Network, *Responsible Purchasing Trends*.

⁸⁹ But see the section on “Barriers to Broader Adoption of Green Procurement Practices” below.

⁹⁰ See the sections on “Cost” and “Measuring Success.”

⁹¹ This approach may also be called a *price preference* by some organizations, such as state and municipal governments (Case, *Environmental Purchasing Policies 101*).

approach can help overcome a common problem in the development of green products, namely that economies of scale may keep prices high as long as the market is small. However, the approach can be wasteful because it may reduce price-competitive incentives among providers. Usually, such green price premiums are comparatively small in practice, reportedly ranging from 3%-15% in one study of state and municipal governmental purchasing programs, but they do not appear to be used for federal green procurement programs.⁹² The use of this approach also appears to be declining, according to one recent study.⁹³

Some organizations address the problem of the kinds of offsets described above by using life cycle cost analyses to determine if savings at other life cycle stages compensate for higher acquisition costs for a product or service. Some state and local governments have also replaced policies based solely on bid prices with what is often called a “best-value” approach.⁹⁴ The term may be given different meanings by different institutions, but generally it refers to an effort to take into account, in addition to price, a range of other considerations, such as performance and environmental impact, in making procurement decisions.

Other Approaches

Additional implementation methods used by various organizations may include establishing broad policy goals,⁹⁵ use of training and awareness programs, and establishment of cross-functional “green teams” of purchasers, end-users, managers, and environmental experts to facilitate implementation. Another approach is to modify specifications so as to require specific green attributes, such as recycled content or low toxicity, for desired products and services. The way specifications are written may be especially important in avoiding inadvertently precluding green products (for example, specifications that would preclude use of recycled content by specifying “virgin” content).

Measuring Success

A major challenge for both governmental and nongovernmental green procurement programs is how to determine if they are successful in reducing environmental impacts while maintaining or improving cost-effectiveness and performance. Tools have been developed that can be used to estimate the effects of green procurement. Generally, these appear to focus on planning rather than performance assessment.⁹⁶

⁹² For example, Cincinnati, Ohio, established a 3% price preference for products containing recycled materials in 1994, and King County, Washington, established a price preference of up to 15% for recycled paper products in 1995 (*ibid.*, pp. 11-13). Price preferences or premiums are not mentioned in the sections of the Federal Acquisition Regulations relating to green procurement (48 C.F.R. Part 23).

⁹³ Responsible Purchasing Network, *Responsible Purchasing Trends*.

⁹⁴ Examples include Oregon and Massachusetts (Case, *Environmental Purchasing Policies 101*, pp. 14-15). The Federal Acquisition Regulations include best value as part of the “Vision” (“All participants in the [Federal Acquisition Regulations] System are responsible for making acquisition decisions that deliver the best value product or service to the customer. Best value must be viewed from a broad perspective and is achieved by balancing the many competing interests in the System. The result is a system which works better and costs less” (48 C.F.R. § 1.102-1(b)); however, its explicit use appears to be limited in practice.

⁹⁵ For example, they may specify a percentage of contract dollars or total number of acquisitions that are to be green products or services.

⁹⁶ See, for example, Environmental Protection Agency, “Promoting Green Purchasing: Tools and Resources to (continued...)”

Success of single-attribute programs, such as increasing recycled content, may be relatively easy to measure. Others, such as those using complex labeling standards, may be more difficult. However, little information may be available even for single-attribute initiatives. For example, in 2001, the Government Accountability Office found that federal agencies could not track the purchases of products with recycled content required by federal law.⁹⁷ According to a 2009 survey of governmental and nongovernmental organizations, only 20% of responding organizations with green-purchasing programs quantified the impacts of their programs.⁹⁸

The Green Electronics Council has attempted to improve assessments by requiring EPEAT subscribers to report sales of labeled products. The organization then used those figures, in conjunction with the criteria that labeled products are required to meet, to estimate reductions in toxic materials, solid waste, and energy use over the life cycles of the products. However, those figures are projections, not proven savings.⁹⁹

In 2001, the National Institute of Governmental Purchasing surveyed green procurement among federal and nonfederal government agencies in the United States and Canada.¹⁰⁰ The institute found that one-third of municipal government agencies and one-fifth of nonfederal agencies had green procurement initiatives, but fewer than one in 20 federal agencies had programs. About two-thirds of agencies recognized the Energy Star label, even though energy was listed as a priority by only one-fifth. About 5% of agencies had established goals, but fewer than 20% of those had met them. The obstacles most commonly cited were lack of awareness, conflicting priorities, decentralization of procurement decisions, and inadequate guidance.

A more recent (2009) survey of public- and private-sector organizations suggests a substantial increase in the prevalence of initiatives, but not necessarily improved performance.¹⁰¹ About three-quarters reported having green procurement policies in 2009, much higher than previous figures, but the organizations also reported that those policies influence fewer than one-fifth of procurement budgets.

The city of Portland, OR, has performed several case studies of the costs and benefits of green-purchasing practices by various city bureaus.¹⁰² Among the purchases studied were transportation

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Quantify the Benefits of Environmentally Preferable Purchasing,” October 12, 2006, http://www.epa.gov/epp/tools/epp_metrics.pdf; European Commission, *Environmental Impact of Products (EIPRO)*; Federal Facilities Environmental Stewardship and Compliance Assistance Center, “Acquisition (formerly Buying Green),” October 29, 2009, <http://www.fedcenter.gov/programs/buygreen>.

⁹⁷ Government Accountability Office, *Federal Procurement: Better Guidance and Monitoring Needed to Assess Purchases of Environmentally Friendly Products*, GAO-01-430, June 2001, <http://www.gao.gov/new.items/d01430.pdf>. No more recent assessments appear to have been done.

⁹⁸ Responsible Purchasing Network, *Responsible Purchasing Trends*, p. 16. The percentage was even lower (18%) for state government programs (Responsible Purchasing Network, *Responsible Purchasing Trends 2009: The ‘State’ of Sustainable Procurement*, 2009, http://www.responsiblepurchasing.org/publications/trends2009_naspo.pdf).

⁹⁹ Green Electronics Council, *Environmental Benefits of 2008 EPEAT Purchasing*, September 2009, http://www.epeat.net/Docs/Report2008_FullReport_R5.pdf.

¹⁰⁰ National Institute of Governmental Purchasing, *NIGP Survey of Green Procurement Initiatives*, July 2001, <http://www.nigp.org/eweb/resourcelib/private/research/green.pdf>.

¹⁰¹ TerraChoice Environmental Marketing, *2009 EcoMarkets Summary Report*, September 2009, <http://www.terrachoice.com/files/2009%20EcoMarkets%20Summary%20Report%20-%20September%2018,%202009.pdf>.

¹⁰² City of Portland, Oregon, “Buying Green Case Studies.”

equipment and supplies, electricity, electronic equipment, inks, and paints. The city found environmental benefits in all cases. In some, such as antifreeze and inks, green products were found to exhibit performance superior to that of standard products. In most cases, the products reportedly reduced the city's acquisition or operational costs as well.

Barriers to Broader Adoption of Green Procurement Practices

As the discussion above implies, several barriers exist to the broader adoption of green procurement practices by both organizations and consumers. Some of those barriers are discussed below.¹⁰³

Incomplete and Imperfect Information

Information barriers tend to fall into two categories: lack of knowledge and incorrect information. The former includes both ignorance about the role of green procurement among potential practitioners and how it can be applied, and gaps in understanding about impacts. The latter includes both misperceptions about what green procurement is and how it can be applied, and misleading claims (greenwash) or other misuse. Training and education of procurement personnel and decisionmakers may be used to help reduce ignorance and misinformation, and regulations and guidelines from government agencies, among other methods, may be used to address misinformation and misuse.¹⁰⁴ Both government and private organizations may also provide information and guidance to consumers, as discussed elsewhere in this report. However, considerable research and analysis may be needed to fill current gaps in understanding about impacts.

Lack of Common Standards

The wide range of meanings applied to green procurement and other practices, as well as the absence of broadly accepted assessment and implementation standards, may create both controversy and confusion that can impede the adoption of green procurement and the meeting of policy goals. It may also contribute to the proliferation of green labels of varying accuracy and value.

The apparent success of programs such as Energy Star and EPEAT provide evidence that this barrier can be overcome, and current efforts to develop LCA standards (see the section on "Life Cycle Analysis" above) may further help to reduce this impediment, but only if such a standard becomes commonly accepted and widely used. Adoption by large industry and government purchasers may facilitate that process.

¹⁰³ See also CRS Report R40670, *Energy Efficiency in Buildings: Critical Barriers and Congressional Policy*, by Paul W. Parfomak, Fred Sissine, and Eric A. Fischer; several of the barriers discussed here are similar to those analyzed in that report with respect to buildings.

¹⁰⁴ For example, the Federal Trade Commission has developed guidance on the use of environmental marketing claims, both generally and with respect to recycling, compostability, and other end-of-life management claims, as well as recycled content, source reduction, reusability of containers, and damage to atmospheric ozone (Federal Trade Commission, "Part 260 – Guides.")

Real, Perceived, and Hidden Costs

Among the more significant cost barriers are real and perceived cost premiums associated with green procurement.¹⁰⁵ Other barriers include cost externalities—that is, costs that are born by persons other than the purchaser and are not included in the price¹⁰⁶—and situations in which financial interests of different parties involved are misaligned, which is sometimes referred to as the principal-agent problem.¹⁰⁷ Such barriers may be especially difficult to overcome, except perhaps for misperceptions about cost.

Market and Technical Uncertainties

Uncertainties may include concerns about the stability of market demand for green products and services, which can vary with the costs of inputs such as energy, as well as risks that a nonstandard technology may not be effective in meeting green performance goals, and reluctance to invest in a significant immediate acquisition in a situation such as lighting where technologies are rapidly changing. Those barriers may also be particularly difficult to overcome.

Federal Green Purchasing Initiatives

As stated in the introduction to this report, federal initiatives relating to green purchasing of products and services can usefully be organized into two categories based on their primary focus:

- agency-focused initiatives intended to facilitate the procurement of green products and services by federal agencies, and
- market-focused programs aimed at the availability of green products and services in the broader economy.¹⁰⁸

Those categories are not mutually exclusive. Programs that are primarily market-focused, such as Energy Star and BioPreferred, may also affect federal acquisitions.¹⁰⁹ Information on green initiatives developed specifically for federal procurement, such as EPP (see text box below), may be available to the public through an agency website or other source. Agency-focused initiatives may also influence the broader market in at least two other ways. First, nonfederal organizations

¹⁰⁵ Green products and services are often perceived as being more expensive or less well-performing than standard alternatives, although there are many examples where such trade-offs do not in fact occur and a green design may also be a good design for both price and performance. However, investment in the assessments required to implement green procurement provide a significant first-cost barrier, especially for smaller enterprises.

¹⁰⁶ For example, pollutants put into waste streams may have impacts that are either broadly felt across a large population (such as greenhouse gases) or may affect completely different populations (such as acid rain).

¹⁰⁷ A classic example is from tenant-landlord relationships, in which a landlord has little incentive to improve the energy efficiency of a building if the tenant pays for utilities, and the tenant has little incentive in the absence of a lease period that is long enough to permit recoupment of the investment.

¹⁰⁸ A number of federal regulatory programs, such as those relating to toxic substances, may result in greener products and services in the marketplace. However, since one effect of such regulations is to make such products and services industry standard, discussion of those programs is beyond the scope of this report, which focuses on practices that are greener than the standard ones. For a discussion of current legislative issues associated with such regulatory programs, see CRS “Issues in Focus” on *Energy, Environment, and Resources*.

¹⁰⁹ See 48 C.F.R. Subparts 23.2 and 23.4. Unlike for Energy Star, the BioPreferred program name is not mentioned in the regulation except as part of a URL to which contracting officers are referred (<http://www.usda.gov/biopreferred>).

may adopt some version of a federal initiative, as has happened with EPP.¹¹⁰ Second, the size of federal procurement operations—about \$500 billion per year—means that federal green procurement programs have a significant potential to affect the availability of green products and services in the marketplace, as well as other aspects of the green economy. Given the size and potential impact of the agency-focused initiatives, most of this section addresses those activities rather than market-focused programs.

Market-Focused Programs

Several federal initiatives are either primarily market-focused or have significant market-focused components. Some of those programs are administered by EPA, and some by other agencies. Several are mentioned below in the section on “Preferences for Green Products and Services” and elsewhere in this report.¹¹¹ While some of the programs are cited in EPA’s EPP database,¹¹² there does not appear to be a comprehensive central federal source for access to such information.

In addition to the guides and labeling programs developed by other federal agencies, the Federal Trade Commission has developed a set of general resources to assist consumers interested in acquiring green products.¹¹³ Perhaps the best known of these resources is the Green Guides.¹¹⁴ The stated purpose of these voluntary guides is to assist industry in ensuring that environmental marketing claims made for various products and services are not false or misleading.

Agency-Focused Initiatives

Modern federal efforts in green procurement focus largely on acquisition of products. Those efforts arguably began with the enactment of the Resource Conservation and Recovery Act of 1976 (RCRA, P.L. 89-272, as amended), which set requirements for federal purchase of products with recovered or recycled content. Since then, various statutes,¹¹⁵ regulations,¹¹⁶ executive orders,¹¹⁷ policy documents,¹¹⁸ and agency programs have required or encouraged federal

¹¹⁰ See the section on “Green Procurement and Environmentally Preferable Purchasing.”

¹¹¹ For a discussion of federal market-focused programs relating to green building, see CRS Report R40147, *Issues in Green Building and the Federal Response: An Introduction*.

¹¹² Environmental Protection Agency, “Database of Environmental Information for Products and Services,” April 2, 2010, <http://yosemite1.epa.gov/oppt/epstand2.nsf>.

¹¹³ Federal Trade Commission, “FTC Consumer Information - Energy & the Environment: Environment,” August 11, 2009, <http://www.ftc.gov/bcp/menus/consumer/energy/environment.shtm>.

¹¹⁴ Federal Trade Commission, “Part 260 - Guides.”

¹¹⁵ In addition to RCRA, they include the Clean Air Act Amendments of 1990 (P.L. 101-549), the Energy Policy Act of 1992 (EPACT 1992, P.L. 102-486), the Farm Security and Rural Investment Act (P.L. 107-171), the Energy Policy Act of 2005 (EPACT 2005, P.L. 109-58), and the Energy Independence and Security Act of 2007 (EISA, P.L. 110-140).

¹¹⁶ See especially 48 C.F.R. Part 23.

¹¹⁷ See especially Executive Order 13423, “Strengthening Federal Environmental, Energy, and Transportation Management,” *Federal Register* 72, no. 17 (January 26, 2007): 3919-3923; and Executive Order 13514, pp. 52117-52127. For a discussion of the relationship between those two executive orders, see CRS Report R40974, *Executive Order 13514: Sustainability and Greenhouse Gas Emissions Reduction*, by Richard J. Campbell and Anthony Andrews.

¹¹⁸ The term *policy documents* here means a federal agency document, other than an enacted statute, an executive order, or a regulation, that is used to set, implement, or interpret policies. Examples cited elsewhere in this report are Office of Management and Budget, “Instructions for Implementing Executive Order 13423,” March 29, 2007, http://www.fedcenter.gov/_kd/Items/actions.cfm?action=Show&item_id=6825&destination=ShowItem; Department of (continued...)

agencies to purchase specific products or types of products because of their environmental attributes,¹¹⁹ as discussed below.

EPA's Environmentally Preferable Purchasing Program (EPP)

This program is the only multiproduct, multiattribute, life-cycle-based green procurement program in the federal government, except for certain green building initiatives. Environmentally preferable products and services are characterized as those having “a lesser or reduced effect on human health and the environment when compared with competing products or services that serve the same purpose.” This initiative is therefore the closest in concept to green procurement as discussed in this report.

EPA's guidance for EPP emphasizes five principles:

1. EPP should integrate environmental, pricing, and performance considerations.
2. Prevention of pollution should be the primary motivation in implementing EPP.
3. EPP should be based on a life cycle approach involving multiple environmental attributes.
4. Agencies should compare environmental attributes of different products and services in determining environmental preferability.
5. Determining environmental preferability requires comprehensive, accurate, and meaningful information about environmental performance.

Established in 1993 in Executive Order 12873, EPP has not been specifically authorized by statute but has been continued by subsequent executive orders and is incorporated in the Federal Acquisition Regulations (48 C.F.R. Subpart 23.7). However, the regulation is arguably one of the weakest of the federal preferences related to green procurement (see text).

Unlike with some single-attribute preferences, EPP does not rely on a specified certification system. Instead, it draws together a variety of federal, private, and international certifications, lists, and standards from which agencies may choose (see **Table 3**).

Sources: Environmental Protection Agency, “Final Guidance on Environmentally Preferable Purchasing for Executive Agencies,” *Federal Register* 64, no. 161 (August 20, 1999): 45810-45858;———, “Environmentally Preferable Purchasing (EPP),” November 7, 2007, <http://www.epa.gov/epp>; Office of Management and Budget, “Instructions for Implementing Executive Order 13423,” March 29, 2007, http://www.fedcenter.gov/_kd/items/actions.cfm?action=Show&item_id=6825&destination=ShowItem.

Preferences for Green Products and Services

Some federal government-wide initiatives focus narrowly on specific kinds of products.¹²⁰ Others, commonly called preferences, are more general and pertain to types of goods and services that share specified environmental attributes. Currently, there are eight such preferences:

- alternative fuels and alternative fuel vehicles,
- alternatives to ozone-depleting substances,
- alternatives to toxic and priority chemicals,

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Defense, “Department of Defense Green Procurement Program Strategy,” November 2008, <http://www.acq.osd.mil/dpap/cpic/cp/docs/USA001967-08-DPAP.pdf>.

¹¹⁹ See footnote 39.

¹²⁰ For example, § 104 of EISA contains a requirement that “[i]n the case of electric motors of 1 to 500 horsepower, agencies shall select only premium efficient motors that meet a standard designated by the Secretary [of Energy]” (119 Stat. 610).

- biobased products,¹²¹
- energy-efficient products,¹²²
- environmentally preferable purchasing, or EPP (see text box above),
- EPEAT products,¹²³ and
- recovered or recycled materials.

Currently, agencies *are required*¹²⁴ to purchase alternative fuels and alternative-fuel vehicles, and biobased, Energy Star and energy efficient, EPEAT-registered, and recycled-content products, although *acquisitions may be exempt* in specified circumstances. Agencies *must consider* purchasing alternatives to toxic and priority chemicals and ozone-depleting substances, and EPP products and services.

Only EPP and EPEAT attempt to provide an integrative approach to green procurement.¹²⁵ The others each address only one or a few attributes. However, EPP and EPEAT, along with alternatives to toxic and priority chemicals, are also the only of those preferences that have no specific basis in enacted statutes.

Most of the preferences listed above apply only to products, despite the fact that about half of federal procurement spending is for services (see **Table 1**). EPP applies to both products and services, although little guidance appears to be available from EPA with respect to the latter.¹²⁶ That is especially true for professional, scientific, and technical services, which comprise about half of federal procurement expenditures for services. The energy-efficiency preference also applies to services, specifically for energy-savings performance contracts, in which agencies partner with energy service companies to improve savings in energy use by the agencies.¹²⁷ Preferences may also apply to products used by service providers.¹²⁸

Consistent with the current federal emphasis on single attributes, the Obama Administration's Office of Federal Procurement Policy recently described "green purchasing" as including, although not limited to, procurement of "recycled materials; energy-efficient materials or appliances; water saving processes or appliances; environmentally preferable processes, materials, or appliances; and biobased products or materials."¹²⁹ EPA, in contrast, characterizes

¹²¹ See, for example, U.S. Department of Agriculture, "BioPreferred."

¹²² This includes products listed by Energy Star and by the Federal Energy Management Program (FEMP; Department of Energy, "Federal Energy Management Program," October 21, 2009, <http://www1.eere.energy.gov/femp>).

¹²³ See text box on page 36.

¹²⁴ For regulations, see Part 23 of the Federal Acquisition Regulation (48 C.F.R. Part 23), available at <https://www.acquisition.gov/far>. Relevant statutes are listed in footnote 115.

¹²⁵ However, green building can also be considered as a special kind of green procurement that also involves a multiattribute, integrative approach. See CRS Report R40147, *Issues in Green Building and the Federal Response: An Introduction*.

¹²⁶ See Environmental Protection Agency, "Database of Environmental Information for Products and Services."

¹²⁷ Department of Energy, "Federal Energy Management Program: Energy Savings Performance Contracts," September 3, 2009, <http://www1.eere.energy.gov/femp/financing/espcs.html>.

¹²⁸ See, for example, 48 C.F.R. § 23.405, stating that contracting officers should refer to lists of EPA- and USDA-designated items of recovered-material and biobased products "when purchasing services that could include supplies that contain" such materials.

¹²⁹ See Office of Management and Budget, "Federal Procurement Policy - Green Acquisition," 2009, (continued...)

green procurement as essentially synonymous with EPP: “Green Purchasing refers to the practice of preventing waste and pollution by considering environmental impacts, along with price, performance, and other traditional selection factors, when making purchasing decisions.”¹³⁰

In addition to implementing the requirements mentioned above, some agencies have broader responsibilities. OMB provides broad guidance through various policy instruments, such as implementing instructions for executive orders,¹³¹ policy letters,¹³² and planning documents.¹³³ Some of those responsibilities are shared with the Office of the Federal Environmental Executive, housed at EPA.

Table 2. Entities Responsible for Providing Guidance to Federal Agencies for Green Products and Services

Federal Initiative	Agency or Organization			
	EPA	DOE	USDA	GEC
Energy				
Energy Star	X	X		
Federal Energy Management Program		X		
Water				
WaterSense	X			
Materials				
Recovered (recycled) content	X			
Non-ozone-depleting substances	X			
Products with low or no toxic or hazardous constituents	X			
Biobased products			X	
Alternative fuels and vehicles		X		
Multiattribute				
EPEAT				X
Environmentally preferable products	X			

Source: CRS.

(...continued)

http://www.whitehouse.gov/omb/procurement_index_green.

¹³⁰ Environmental Protection Agency, *Integrating Green Purchasing into Your Environmental Management System (EMS)*, EPA 742-R-05-001, April 2005, p. 38, <http://www.epa.gov/epp/pubs/ems.htm>.

¹³¹ See, for example, Office of Management and Budget, “Instructions for Implementing Executive Order 13423.”

¹³² See, for example, Office of Management and Budget, “Policy Letter 92-4,” November 2, 1992, http://www.whitehouse.gov/omb/procurement_policy_letter_92-4.

¹³³ Office of Management and Budget, “FY 2008 Reporting on Green Purchasing Requirements,” Memorandum for Federal Agency Environmental Executives and Agency Senior Procurement Executives, October 20, 2008, http://www.whitehouse.gov/omb/procurement/green/fy2008_report_on_green.pdf.

Notes: See text for further explanation of individual initiatives. EPA: Environmental Protection Agency; DOE: Department of Energy; USDA: U.S. Department of Agriculture; GEC: Green Electronics Council, a private nonprofit organization.

For some kinds of preferences, criteria, which may be standards or even lists of products, are set by specific agencies: DOE and EPA for energy, USDA for biobased, and EPA for recovered materials and certain other types (see **Table 2**). The implementing instructions for Executive Order 13423 state that agencies should use EPA's WaterSense-labeled products and programs to meet water-efficiency requirements, and that DOE will provide guidance on alternative fuels.¹³⁴ With respect to hazardous and toxic substances, EPA is designated as the lead agency in the implementing instructions, but there appears to be no specific requirement for development of a list of alternatives. Rather, the emphasis is on reduction in the use of such constituents by individual agencies. EPEAT is a private-sector program but was developed with the assistance of EPA.¹³⁵

There are several government databases containing information about green products, and several of them are publicly accessible. EPA has developed a database listing EPP product and service categories that both agencies and the public can use in making green-purchasing decisions.¹³⁶ EPA also has lists of products elsewhere on its website that have been identified under other programs, such as the Significant New Alternatives Program (SNAP) for alternatives to ozone-depleting substances¹³⁷ and WaterSense.¹³⁸ The USDA has also developed a database listing renewable biobased products currently designated under its BioPreferred label.¹³⁹

GSA provides access to green products and services through its purchasing system available to government agencies.¹⁴⁰ Its online system identifies products registered or identified according to 14 standards and other sets of criteria, including federal requirements such as those for energy, recycled content, emissions, and biobased products, as well as nonfederal programs such as EPEAT and Green Seal.

GSA is also generally responsible for disposing of surplus equipment and other items designated as personal property by federal agencies. However, there appear to be no provisions for GSA to recycle such property if it is not transferred or sold. Property that cannot be used, donated, or sold is returned to the originating agency for disposal.¹⁴¹ Agencies may have procedures for recycling of such property.

¹³⁴ Office of Management and Budget, "Instructions for Implementing Executive Order 13423."

¹³⁵ See Green Electronics Council, "Welcome to EPEAT."

¹³⁶ Environmental Protection Agency, "Database of Environmental Information for Products and Services."

¹³⁷ Environmental Protection Agency, "Significant New Alternatives Policy (SNAP) Program," October 19, 2009, <http://www.epa.gov/Ozone/snap/index.html>.

¹³⁸ Environmental Protection Agency, "WaterSense."

¹³⁹ Biobased products are commercial or industrial products or ingredients other than food or feed that are composed of biological materials and for which there is not a mature market. The focus is on renewable materials. See Department of Agriculture, "BioPreferred."

¹⁴⁰ General Services Administration, "Environmental Products Overview." State and local government agencies may also make purchases through GSA.

¹⁴¹ General Services Administration, "Recycling Personal Property Disposal," July 10, 2009, <http://www.gsa.gov/Portal/gsa/ep/channelView.do?pageTypeId=17110&channelPage=%2Fep%2Fchannel%2FgsaOverview.jsp&channelId=-24484>.

Table 3 lists the kinds of green product and service certifications and labels available through the GSA online catalog or schedule and EPA’s EPP database. As the table shows, there are more than 20 designations altogether in the two databases, covering several green factors. Both databases contain integrative or multiattribute labels, but most labels focus on only one or two attributes. Most designations refer to specific standards by various agencies and organizations, but the GSA schedule contains four that are more general: Recycled, Biobased, Non-Toxic, and Environmentally Friendly. Unlike the GSA catalog, the EPA database does not list product choices directly but provides electronic links to separate lists, including the GSA schedule.

Table 3. Types of Green Products Listed in GSA and EPA’s EPP Databases by Primary Focus

Logo or icon	Description	GSA	EPA EPP
Energy			
	Energy Star: Complies with U.S. Department of Energy (DOE) and U.S. Department of Environmental Protection Agency’s (EPA) Energy Star Program.	X	X
	FEMP: Meets DOE’s Federal Energy Management Program (FEMP) energy-efficiency levels.	X	X
Materials			
	Recycled: Contains recycled content consistent with EPA guidelines.	X	
	Comprehensive Procurement Guideline compliant: Certified to meet or exceed EPA’s Recovered Material Advisory Notice (RMAN) standard.	X	X
	Biobased: Commercial or industrial items utilizing biological products or renewable domestic agricultural (plant, animal, and marine) or forestry materials.	X	
	USDA BioPreferred: Commercial or industrial products or ingredients other than food or feed that are composed of biological materials and for which there is not a mature market. The focus is on renewable materials. This logo is not listed separately in the GSA schedule, but some items listed under “Biobased” are designated as BioPreferred.	X	
	PRIME: Included in the U.S. Navy’s Plastics Removal in Marine Environment (PRIME) program. Items in the PRIME program require biodegradable packing materials.	X	
Health and Waste			
	California South Coast Air Quality Management District compliant: Certified to meet or exceed applicable air emissions standards established by the California South Coast Air Quality Management District.	X	

Logo or icon	Description	GSA	EPA EPP
	EPA Design for the Environment: “Best-in-class” wet chemical-based formulations and products through comparisons of toxicity and fate profiles to identify the safest ingredients within a distinct functional class (e.g., surfactants, solvents).		X
	EPA Significant New Alternatives Program (SNAP) Approved: Meets the SNAP criteria requirement as a suitable substitute for ozone-depleting substances.	X	
	NESHAP compliant: “As applied” formulation certified to meet applicable volatile organic compound (VOC) and hazardous air pollutant emission limits as established by the National Emissions Standards for Hazardous Air Pollutant (NESHAP) regulations (40 C.F.R. Part 63). Most items in this category are also listed as “Environmentally Friendly.”	X	
	Non-Toxic item	X	
Multiattribute or Other			
	Environmentally Friendly: Multipurpose icon for items containing specific environmental attributes or features such as water conserving, lead-free, chlorine-free, ozone-safe, low-VOC, etc. as described in the item detail.	X	
	EPA Environmental Technology Verification (ETV): Evaluated under the ETV Program and found to be an innovative technical solution, beneficial to human health or the environment.	X	
	EPEAT: Certified as meeting requirements for energy conservation, materials, life cycle management (including disposal), and other factors contained in a standard developed and promulgated by the Institute of Electrical and Electronic Engineers (IEEE).	X	
	GreenSeal Seal of Approval: Certified to meet or exceed voluntary standards for environmental preferability as established by GreenSeal.	X	X
	McDonough Braungart Design Chemistry (MBDC): Certified as designed for cradle-to-cradle life cycle sustainability based on environmental chemistry, material flows management, and industrial and architectural design.		X
	Scientific Certification Systems (SCS): Certified for environmental, sustainability, food quality and food purity claims.		X
Various	International: Includes labels from programs in Canada, European Union, Japan, and Nordic countries.		X

Sources: General Services Administration, 2009 GSA Global Supply Catalog: Environmental Products, 2009, <http://apps.fss.gsa.gov/cmls/search.cfm?keyword=2009%20GSA%20Global%20Supply%20Catalog%20Environmental%20Products>; Environmental Protection Agency, “Environmentally Preferable Purchasing (EPP)”; Department of Agriculture, “BioPreferred”; Green Electronics Council, “Welcome to EPEAT”; MBDC, Cradle to Cradle Certification Program, Version 2.1.1; Scientific Certification Systems, “Scientific Certification Systems,” 2009, <http://www.scs-certified.com/index.php>; U.S. Navy, “Plastics Removal in the Marine Environment,” 2006, <http://www.navy.mil/oceans/PRIMEFS.pdf>.

Note: Primary focus (Energy, Materials, and so forth) is a CRS estimate based on the description. Some designations may also have focuses related to more than one green factor; for example, PRIME materials are also ecosystem-related and types involving air emissions are also waste-related. Designations included in the table are only those explicitly listed in the relevant GSA catalogs and EPA’s Environmentally Preferable Purchasing

database; for example, EPA's WaterSense label is not currently included in either database. Logos and icons are from the sources.

The Office of the Federal Environmental Executive also produces a database of green products as a tool for federal agencies to use in procurement. It contains green products designated by EPA, USDA, and DOE, with respect to Energy Star, FEMP, WaterSense, recycled and biobased content (including BioPreferred), alternative fuels, and SNAP, as well as EPEAT, with links to relevant sources.¹⁴²

Federal Performance in Green Procurement

Gauging the degree to which the various federal green-purchasing requirements have been applied is difficult. Agencies vary greatly in the amounts of procurement they engage in (see, for example, **Table 4**), with the Department of Defense (DOD) accounting for almost three-quarters of total federal procurement spending in FY2008, more than 15 times as much as the next highest-spending agency, DOE.

Table 4. Federal Procurement Spending for FY2008 by Department or Agency for Selected Industries

Department/Agency	Amount (\$ Billions)			
	Total	Transportation Equipment	Information Technology	Building Construction
Defense	396.2	109.2	19.1	36.1
Energy	24.8	0.0	0.4	0.2
National Aeronautics & Space Administration	15.0	1.8	0.9	0.2
Veterans Affairs	14.8	0.0	1.1	1.7
Homeland Security	14.2	0.7	3.1	0.3
Health and Human Services	13.7	0.0	2.2	0.1
General Services Administration	12.7	1.3	2.4	1.3
State	6.1	0.4	0.7	0.8
Justice	6.1	0.0	1.4	0.2
Agriculture	5.3	0.0	0.7	0.0
Transportation	4.8	0.0	0.7	0.1
Treasury	4.5	0.0	1.2	0.0
Interior	3.8	0.0	0.7	0.2
Agency for International Development	3.5	0.0	0.0	0.0
Commerce	2.5	0.0	1.1	0.1
Labor	1.8	0.0	0.3	0.0
Education	1.4	0.0	0.3	0.0

¹⁴² Office of the Federal Environmental Executive, "Green Products Compilation," April 2, 2010, http://www.fedcenter.gov/Documents/index.cfm?id=11767&pge_prg_id=26960.

Department/Agency	Amount (\$ Billions)			
	Total	Transportation Equipment	Information Technology	Building Construction
Environmental Protection Agency	1.4	0.0	0.2	0.0
Other	5.2	0.1	2.5	0.3
Grand Total	537.8	113.6	39	41.6

Source: Analysis by CRS of data from Federal Procurement Data System (FPDS-NG), October 2009, <https://www.fpds.gov>.

Note: Industries correspond to those in **Table I**, except for information technology, which includes both products and services relating to computers, peripheral devices, and related items. Slight differences in totals in the two tables are the result of minor differences in the way the reports on which they are based were generated. **Table 4** includes only FPDS-NG data from FY2008, because they are expected to be less subject to change at the level of disaggregation shown than the more recent FY2009 data; however, total procurement expenditures in the database for the agencies listed were similar for the two years.

Federal Green IT Procurement

The information technology (IT) used by the federal government has a significant environmental footprint:

- Federal agencies invest about \$70 billion in computers and related resources each year. About \$10 billion of that amount is spent on products and about \$30 billion on services, with the rest invested in agency personnel and other costs.
- IT is an increasingly important component of other products and services, such as telephony, television and radio, transportation, and buildings.
- Almost 10% of electricity use in federal office buildings is for electronics.
- It takes eight gallons of water to make one computer chip.
- IT often contains lead, mercury, and other toxic chemicals.
- Most federal computers are replaced after only three years, less than half their design life.
- Agencies dispose of about 750,000 computers and monitors each year.
- Many recycling operations for computers and other “e-waste” items are overseas and are often not subject to effective environmental regulation.

Several federal policies and programs have been established to promote the greening of federal IT. Among them are the following:

EPEAT. For the types of IT products registered with the Electronic Product Environmental Assessment Tool (EPEAT) label, at least 95% of agency acquisitions are to consist of registered products. Products are evaluated according to criteria in a technical standard from the Institute of Electrical and Electronic Engineers (IEEE). To qualify, products must meet requirements for energy conservation, materials, life cycle management (including disposal), and other factors. At present, only desktop and laptop computers and monitors are registered. Standards for servers, mobile devices, and other products are in development. Also, the EPEAT requirements relate only to product acquisition, not services, which comprise more than half of federal IT procurement.

Energy Efficiency. Agencies are to procure energy-efficient products, either Energy Star or FEMP-designated, enable the energy-saving features on all Energy Star computers and monitors, and acquire products with low standby power requirements.

Life Cycle. Agencies are to extend the useful life of electronics for at least four years whenever possible and are to ensure that they are then reused, donated, sold, or recycled in an environmentally sound manner.

Electronic Stewardship Plan. Each agency must have a plan describing how it will meet the goals above and report on progress in meeting those goals.

Federal Electronics Challenge. This EPA program assists agencies in meeting green IT goals and provides recognition for success. Agencies must participate in the challenge or implement an equivalent program. Sixteen agencies participated in 2009, accounting for about 90% of federal IT procurement spending. For FY2008, participants reported an 88% success rate in acquiring EPEAT-registered products; 98% reuse, recycling or selling of IT taken out of service; and an average useful life of 45 months; but only 38% of computers with Energy Star power-management features enabled.

Cloud Computing. Recent federal initiatives in cloud computing—the use of shared, networked computer resources for data storage, applications, and other IT services—also hold significant promise for greening federal IT through reduction in energy use and hardware requirements.

Sources: Cate Berard, “Federal Electronics Stewardship 101” (presented at the 2009 Federal Environmental Symposium, Bethesda, MD, June 16, 2009), http://www.fedcenter.gov/_kd/go.cfm?destination=ShowItem&Item_ID=12426; A.K. Chapagain and A.Y. Hoekstra, *Water Footprints of Nations*, Value of Water Research Report Series No. 16 (UNESCO-IHE, November 2004), <http://www.waterfootprint.org/Reports/Report16Vol1.pdf>; Green Electronics Council, “Standards Development Process and Participation,” 2009, <http://www.epeat.net/StandardsDevelopment.aspx>; General Services Administration, “Apps.Gov,” https://www.apps.gov/cloud/advantage/main/start_page.do; Peter Mell and Tim Grance, “The NIST Definition of Cloud Computing v1.5,” October 7, 2009, <http://csrc.nist.gov/groups/SNS/cloud-computing/cloud-def-v1.5.doc>; Office of Management and Budget, “Federal IT Dashboard,” June 12, 2009, <http://it.usaspending.gov/>; ———, “Instructions for Implementing Executive Order 13423,” March 29, 2007, http://www.fedcenter.gov/_kd/items/actions.cfm?action=Show&item_id=6825&destination=ShowItem; Analysis by CRS of data from Federal Procurement Data System (FPDS-NG), October 2009, <https://www.fpds.gov>.

DOD's dominance was also reflected in specific areas of substantial procurement spending that have been the subject of federal green-procurement initiatives—transportation equipment (e.g., alternative fuels¹⁴³), information technology (electronic stewardship¹⁴⁴), and building construction (green building¹⁴⁵). Agency totals for procurement spending for those three industry groups are also presented in the table. Among them, the most comprehensive federal initiatives currently for green procurement are for information technology (see text box above).

OMB requires agencies to report annually on their activities in green procurement. However, those reporting requirements appear to be largely qualitative.¹⁴⁶ There does not appear to be any broad requirement for or practice of federal agencies reporting the extent of their green purchases.

However, quantitative reporting is required for the recycled content and alternative fuels preferences. For the former, reports can be generated through the Federal Procurement Data System (FPDS-NG).¹⁴⁷ Such purchases were reported as totaling \$35.9 billion in FY2008, comprising about 7% of total procurement expenditures. Less than 1% of those purchases, totaling \$333 million, were reported as exempt from the requirement because of performance, price, or time constraints.¹⁴⁸ Even those data are limited, since many relevant purchases are not included because they fall below the reporting threshold or for other reasons.

For alternative fuels, DOE requires agencies to report annually on vehicle acquisitions and fuel consumption.¹⁴⁹ According to DOE, agencies largely met or exceeded the requirements for FY2007, acquiring almost twice the required number of alternative fuel vehicles, and exceeding the target for alternative fuel consumption by almost 20%.¹⁵⁰

¹⁴³ See, for example, CRS Report R40168, *Alternative Fuels and Advanced Technology Vehicles: Issues in Congress*, by Brent D. Yacobucci.

¹⁴⁴ See, for example, House Subcommittee on Government Management, Organization, and Procurement, Committee on Oversight and Government Reform, *IT Procurement and Disposal: Application of the Federal Government's Green Policies in the Life Cycle Management of IT Assets.*, 2009, http://oversight.house.gov/index.php?option=com_content&task=view&id=4627&Itemid=28.

¹⁴⁵ CRS Report R40147, *Issues in Green Building and the Federal Response: An Introduction*.

¹⁴⁶ See, for example, Office of Management and Budget, "FY 2008 Reporting on Green Purchasing Requirements." The memorandum states in part,

Section 6002 of the Resource Conservation and Recovery Act (RCRA) and section 9002 of the Farm Security and Rural Investment Act (FSRIA) require the Office of Federal Procurement Policy (OFPP) to report to Congress every two years on the actions taken by federal agencies to implement the purchasing requirements of these statutes. E.O. 13423 (Order) requires the OMB Director to issue instructions concerning implementation of the Order's acquisition requirements and periodic evaluation of agencies' implementation of the Order. It also directs the Federal Environmental Executive to report to the President every two years on agencies' activities to implement the Order. Heads of agencies are directed to provide reports on agency implementation as required.

¹⁴⁷ In 2001, the Government Accountability Office reported that a White House task force had recommended including information on recycled-content purchases in the FPDS (Government Accountability Office, *Federal Procurement: Better Guidance and Monitoring Needed to Assess Purchases of Environmentally Friendly Products*).

¹⁴⁸ Percentages are estimates derived from reports generated by CRS using the FPDS, <https://www.fpds.gov>.

¹⁴⁹ 42 U.S.C. § 6374(a)(3)(E)(ii) requires the Secretary of Energy to monitor compliance of agency fleets with alternative-fuel vehicle requirements and to report annually to Congress on the level of compliance, including annual reductions in use of petroleum-based fuels and any problems in acquiring alternative fuels.

¹⁵⁰ Department of Energy, *Federal Fleet Compliance with EPACT and E.O. 13423: Fiscal Year 2007, 2009*, http://www1.eere.energy.gov/femp/pdfs/fed_fleet_report_2007.pdf.

Environmental Management Systems (EMS)

Executive Order 13423 requires that agencies implement environmental management systems “at all appropriate organizational levels” and use them as “the primary management approach for addressing the environmental aspects of internal agency operations and activities.”

An EMS is a specified set of processes and practices for assisting an organization in reducing the environmental impacts of its activities. The processes are designed to incorporate continuous improvement and involve planning, implementing, assessing, and revising. A set of international standards have been developed to assist organizations in establishing such systems.

OMB’s implementing instructions for the executive order specify that “sustainable acquisition” is to be among the goals addressed by the EMS. Agencies are to report annually on implementation.

Sources: Executive Order 13423, “Strengthening Federal Environmental, Energy, and Transportation Management,” *Federal Register* 72, no. 17 (January 26, 2007): 3919-3923; International Organization for Standardization, “ISO 14000 essentials,” 2009, http://www.iso.org/iso/iso_14000_essentials; Office of Management and Budget, “Instructions for Implementing Executive Order 13423,” March 29, 2007, http://www.fedcenter.gov/_kd/Items/actions.cfm?action=Show&item_id=6825&destination=ShowItem; Federal Facilities Environmental Stewardship and Compliance Assistance Center, “Environmental Management Systems (EMS),” November 17, 2009, <http://www.fedcenter.gov/programs/EMS>.

A January 2009 report to Congress from the Office of Federal Procurement Policy describes agency compliance with the green purchasing requirements in E.O. 13423.¹⁵¹ As part of that compliance, OMB requires agencies to have “formal, written, documented green purchasing plans, policies and/or procedures for the implementation of the statutory and executive order requirements to purchase green products and services.”¹⁵² According to the 2009 report, all agencies have such plans in place and have demonstrated compliance in “representative acquisitions.”

Plans for at least some agencies are comprehensive. For example, DOD has developed a department-wide strategy that requires each organization involved in procurement to have a green procurement plan and to integrate or coordinate that plan with the environmental management system (EMS) that agencies were also required to establish under that and other executive orders (see text box above).¹⁵³ The Defense Logistics Agency also provides both a database of products analogous to that of GSA and a reporting capability for green procurement that appears to be more extensive than that available through FPDS-NG.¹⁵⁴

DOE guidance on green procurement also stipulates that plans should be integrated with the agency’s EMS.¹⁵⁵ The guidance also lays out reporting requirements.

¹⁵¹ Office of Federal Procurement Policy, Office of Management and Budget, *Report on Agency Implementation of Buy-Recycled and Buy-Biobased Requirements in the Resource Conservation and Recovery Act and the Farm Security and Rural Investment Act*, January 16, 2009, http://www.whitehouse.gov/omb/assets/procurement_green/rcra_and_fsria_rpt.pdf.

¹⁵² Office of Management and Budget, “FY 2008 Reporting on Green Purchasing Requirements.”

¹⁵³ Department of Defense, “Department of Defense Green Procurement Program Strategy.”

¹⁵⁴ Defense Logistics Agency, “Green Procurement Report (GPR),” October 1, 2009, <http://www.dlis.dla.mil/erlsgrpr/default.asp>. In an FY2006 report to Congress, DOD identified attributes for which it tracked procurement as including recovered and recycled materials, energy efficient, low volatile organic compounds, water conserving, and asbestos alternatives (see Department of Defense, *Fiscal Year 2006 Defense Environmental Programs Annual Report to Congress*, 2007, Appendix W, <https://www.denix.osd.mil/portal/page/portal/denix/environment/ARC/FY2006DEP>).

¹⁵⁵ Department of Energy, “U.S. Department of Energy Environmentally Preferable Purchasing Program Handbook,” (continued...)

The January 2009 report¹⁵⁶ cited above stated that most agencies were monitoring compliance and developing corrective actions where necessary. However, the report also recognized the difficulties with collection of data on green purchasing but stated that new requirements are being drafted for the FPDS-NG that would permit routine capture of green-purchasing data.

Implementation and performance of green procurement programs are also tracked by OMB through agency submissions for performance scorecards on energy, transportation, and environment. The environmental submissions include information on EMS, green purchasing, green buildings, electronic stewardship, compliance plans, and implementation strategies. Agencies can receive one of three different scores—green (denoting success), yellow (mixed performance), or red (serious flaws).¹⁵⁷ Of the 25 agencies in the January 2009 summary, only four scored green for their overall environmental performance—Commerce, DOE, EPA, and Treasury. Nine scored yellow, and 11 scored red, including DOD and GSA.¹⁵⁸ GSA's scorecard noted deficiencies in green procurement auditing, implementation of an agency-wide plan, and compliance monitoring. Specific information relating to the scorecard rating was not available for DOD.

Issues for Congress

The discussion above raises several policy issues that Congress may consider in examining federal efforts in green procurement and determining whether any legislative initiatives might be appropriate. Questions raised include the following:

- What, if any, are the most useful and appropriate policy goals for green procurement?
- Are the means by which different green-procurement preferences, programs, and other initiatives have been established the most appropriate for meeting policy goals?
- How effectively are agency implementation and performance of green procurement being assessed?
- How successful are current programs and initiatives at meeting policy goals?
- Are policies on the acquisition of green services sufficient?
- Are the preferences and the methods of implementing them sufficiently harmonized and integrated?
- Are there significant gaps in the various federal preferences for types of green products and services?

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April 2008, <http://www.hss.doe.gov/pp/epp/EPP-DOE-Handbook-rev12.pdf>.

¹⁵⁶ Office of Federal Procurement Policy, *Report on Agency Implementation of Buy-Recycled and Buy-Biobased Requirements*.

¹⁵⁷ Juan D. Lopez, "OMB Scorecards: Energy, Transportation, and Environmental Management," January 30, 2007, http://www.federalelectronicschallenge.org/resources/docs/omb_scorecard.pdf.

¹⁵⁸ For summary scorecards, see Federal Facilities Environmental Stewardship and Compliance Assistance Center, "EO 13423," November 9, 2009, http://www.fedcenter.gov/_kd/go.cfm?destination=Page&Pge_ID=3286.

- Are there implementation methods not currently used by the federal government that should be considered?
- Is training of procurement officials sufficient?

The issues are explored and further characterized below.

Green Procurement Policy Goals

Green procurement requirements and other initiatives can be used to help meet several policy goals. Perhaps the most obvious and direct is the reduction of the environmental footprint of federal activities with respect to a set of green factors such as those described in this report. Related to that is cost savings through reduction of inputs such as energy, water, and materials. Another goal could be to use procurement leverage or market-focused initiatives to actively facilitate the development of green industries and other aspects of the green economy. Also, federal programs could help provide better ways to meet such goals, for example through facilitating the maturation of life cycle assessment methods and the development of standards.

Some broad goals are contained in executive orders and related policy documents.¹⁵⁹ Congress might find useful an integrated assessment of such goals and options for achieving them. Also, some observers may question more broadly whether green procurement is an appropriate focus for federal policy. A discussion of the complex and often long-standing controversies about the desirability of green policy goals in general is beyond the scope of this report, but an assessment of green procurement policy might include an evaluation of the appropriateness of the goals Congress has already established in various statutes, as well as those specifically addressed in executive orders issued by Presidents Clinton, George W. Bush, and Obama, in addition to new policy proposals.

Also, given the lack of a commonly accepted characterization of what green procurement involves, especially in the context of other concepts and approaches such as sustainable procurement, an examination of green procurement and other relevant concepts, including whether they should be defined in legislation, might also be considered as part of an examination of policy goals.¹⁶⁰ In addition, an assessment might include examination of how green procurement policy goals interact with other goals of federal procurement policy.

¹⁵⁹ For example, E.O. 13423 sets a policy goal that federal agencies “conduct their environmental, transportation, and energy-related activities under the law in support of their respective missions in an environmentally, economically and fiscally sound, integrated, continuously improving, efficient, and sustainable manner” (p. 3919), and OMB’s implementing instructions state that in meeting this goal, “[e]ach agency shall consider life-cycle costs and savings in planning and making determinations about investments in all capital assets, services, and procurements....” (p. 4). E.O. 13514 sets the goal of the federal government leading by example in the creation of a “clean energy economy,” and lists several relevant policies, including “leverag[ing] agency acquisitions to foster markets for sustainable technologies and environmentally preferable materials, products, and services” (p. 52117).

¹⁶⁰ For example, should green procurement be considered the integrated, continuous-improvement approach to reducing the environmental footprint of procured products and services described in the first part of this report? Is it a synonym for EPA’s existing EPP program? Is it an umbrella term describing any procurement activity that takes environmental matters into account, no matter how limited?

Green Procurement Policy Instruments

The particular method used by the federal government to establish a green-procurement policy or requirement can have implications both for the degree to which it will be implemented and the ease with which it may be modified or revoked. In general, statutory requirements such as those for recycled content and alternative fuels are likely to be more fully implemented than a conditional preference such as EPP established by executive order but not by an enacted statute.

Among the various methods available, policy documents¹⁶¹ provide the most flexibility but the least potential stability, as the executive branch can modify or revoke them at any time without necessarily considering congressional input or public comments. Statutes, in contrast, provide significant stability because Congress must enact legislation to revoke or modify them.

However, the comparative difficulty of changing statutes may also make it more difficult for government to adjust policies established by them when external conditions change. That may be especially the case if the statute establishes a fixed design standard rather than a flexible performance requirement. For example, a statutory requirement to use a specific kind of alternative fuel might impede adoption of emerging alternatives that may be substantially better for meeting energy-policy goals. However, a specific design standard is often simpler to implement than a performance standard.

Executive orders and regulations based on them may be instituted, revised, or revoked without congressional action, but Congress has the opportunity to review executive orders and regulations before they take effect, and the public generally has the opportunity during the rulemaking process to comment on proposed regulations or proposed modifications to existing regulations. Those two instruments therefore arguably fall somewhere between policy documents and enacted statutes in terms of their flexibility and stability, but unless they are specifically based on enacted statutes, they also give primary authority to the executive branch for any resulting green procurement requirements, policies, and programs.

Given the broad range of green-purchasing preferences (see the section on “Preferences for Green Products and Services”) and the variation in the strength of their applicability, stability, and flexibility, Congress may opt to examine whether any modifications would be desirable. In some cases, Congress has chosen to create statutory authority for an existing preference, as when it provided a statutory basis in the Farm Security and Rural Investment Act of 2002 (P.L. 107-171) for preferences for biobased products that already existed under executive orders and regulations.

Performance Assessment

The methods currently used to track agencies’ performance in green procurement, including those contained in environmental scorecards and reports to Congress, focus largely on processes, not outcomes. They tend to examine whether agencies have programs and policies in place rather than quantitative measures of the results of those programs and policies. Also, to the extent that reporting requirements are fragmented, it may be difficult for Congress to assess the degree to which agencies are successfully engaging in integrated green-procurement activities that

¹⁶¹ See footnote 118.

adequately address interactions among the various green factors across the life cycles of products and services.

Agency environmental management systems (see EMS text box above) could provide a mechanism for integrated performance tracking and assessment, but only if agencies collect appropriate life cycle data on relevant acquisitions, including procurement amounts, useful life, and end-of-life management. OMB has directed agencies to consider life cycle costs in procurement planning,¹⁶² but the degree to which the information they collect for that purpose would need to be supplemented to be useful for EMS analyses is not clear.

Program Evaluation

While performance assessment is important for determining how well existing programs are being implemented, it does not provide a method for examining how well a program or a set of programs is meeting intended policy goals. Some entities have performed studies about outcomes from programs relating to federal green purchasing preferences,¹⁶³ but there does not appear to have been any broader, independent examination¹⁶⁴ of the success of those programs and initiatives in meeting broader policy goals such as those discussed above. Such an examination might be useful to Congress in determining whether programs should be modified, expanded, or replaced.

Acquisition of Services

Roughly half of all federal procurement spending is for services.¹⁶⁵ However, many of the green purchasing preferences apply only to products. For example, while recovered-content products are preferred in contracts for goods valued at over \$10,000, they are preferred in contracts for services only for solid waste management.¹⁶⁶

Such restricted applicability may limit the ability of the federal government to use its purchasing power to leverage the availability and cost-effectiveness of green products and services in the marketplace, while broader use of such leveraging may help stimulate the development of green

¹⁶² See footnote 159.

¹⁶³ See, for example, Environmental Protection Agency, *Energy Star—the Power to Protect the Environment*; Green Electronics Council, *Environmental Benefits of 2008 EPEAT Purchasing*, September 2009, http://www.epeat.net/Docs/Report2008_FullReport_R5.pdf.

¹⁶⁴ There are some GAO studies, but they have focused on specific initiatives or activities associated with green procurement. See, for example, Government Accountability Office, *Federal Electronics Management: Federal Agencies Could Improve Participation in EPA's Initiatives for Environmentally Preferable Electronic Products*, GAO-10-196T, October 27, 2009, <http://www.gao.gov/new.items/d10196t.pdf>; ———, *Federal Procurement: Better Guidance and Monitoring Needed to Assess Purchases of Environmentally Friendly Products*.

¹⁶⁵ Percentages vary from year to year and depend also on how the calculation is done. Data from Table 1 yield a result of 45% for FY2008 and 49% for FY2009, whereas a recent report cited a figure of 64% for FY2004 and 60% for FY2005 (See Acquisition Advisory Panel, Report of the Acquisition Advisory Panel to the Office of Federal Procurement Policy and the United States Congress, January 2007, p. 440, http://www.acquisition.gov/comp/aap/24102_GSA.pdf; the figures are from a custom analysis performed for the panel by FPDS). The figures cited in that report may treat construction as a service; the percentage of total spending on services without construction for FY2005, calculated by CRS from FPDS-NG data, was 54%, with construction comprising an additional 6% of total spending.

¹⁶⁶ 42 U.S.C. § 6962(f).

industries, to the extent that is a policy goal. However, the cost and effectiveness of such efforts is not clear.

Some recent proposals are seen as having had the potential to extend the product preferences to additional service contracts, although none have yet been so extended. The George W. Bush Administration proposed substituting green products for equivalent non-green products in the “performance” of service contracts.¹⁶⁷ That proposal could have required contractors to use green products when doing work for the government even when that work did not involve the supply or delivery of products to federal agencies or facilities. However, the proposal was never finalized.

President Obama’s Executive Order on “Federal Leadership in Environmental, Energy, and Economic Performance” (E.O. 13514) contains provisions that could potentially have a similar effect. However, it is unclear whether they will be interpreted to such effect in either regulations or other policy implementation, and Congress does not appear to have provided any general guidance to agencies on the applicability of green purchasing preferences and programs to various services.

Integration and Harmonization of Green Procurement Initiatives

The federal approach to green procurement is arguably largely piecemeal and fragmented. The emphasis has largely been on single-attribute preferences, with the exception of EPP, which was designed in a way that could permit it to serve as a framework for an integrated, life cycle approach to federal green procurement.¹⁶⁸ However, it has been implemented as just one among the various preferences, and a comparatively weak one. It has no specific basis in enacted statute and no requirement for formal determination of exemptions.

Additionally, there appears to be significant ambiguity about which type of green product or service agencies should procure in situations where multiple types could meet their needs. For example, the FAR requires agencies to acquire recovered-content products instead of biobased ones when both types would meet agency needs.¹⁶⁹ However, no similar guidance exists for the other types of preferred products and services discussed in this report. That leaves agencies without guidance in determining whether, for example, they should procure Energy Star or FEMP-designated products, or recovered-content or environmentally preferable products. Such issues could potentially be addressed through an interagency mechanism such as the Interagency Sustainability Steering Committee established under E.O. 13423 and its working group on acquisition and materials management. An examination of the role of these bodies may be useful in determining how best to effect improved integration and harmonization of the various initiatives.

Possible Gaps in Current Preferences

While EPP is arguably broad enough in concept to include all the factors involved in green procurement, its current limitations in comparison with single-attribute preferences have led to

¹⁶⁷ See 72 Fed. Reg. 73907-08.

¹⁶⁸ See Environmental Protection Agency, “Final Guidance.”

¹⁶⁹ 48 C.F.R. § 23.405(c).

some gaps in practice in the coverage of the green factors and life cycle approach discussed in this report. Three gaps that are particularly notable are

- the focus of the energy-efficiency preference on use (or operational) energy rather than life cycle energy,
- the lack of an explicit preference with respect to water use and footprints,¹⁷⁰ and
- the absence of specific green requirements for end-of-life management for government property such as information technology.

Also, EPP is among the weakest of the preferences, since it does not require any specific percentages or amounts of environmentally preferable acquisitions and is not accompanied by any requirement for contractor certification.

At present, there is also no single, generally accepted, multiattribute life-cycle-based certification or labeling system that procurement officials can use for all green products and services, as, for example, EPEAT provides for information technology. There is not even a single, well-coordinated list of green products for federal agencies to use, but rather several lists maintained by different agencies. In the absence of such resources and stronger requirements, significant gaps in preferences are liable to persist and the federal green procurement process is likely to remain relatively complex and opaque. However, given the complexities of the procurement process, the potential for success and possible disadvantages of bridging those gaps are not clear and might be difficult to ascertain.

Additional or Different Implementation Mechanisms

Some foreign, state, and local governments have mechanisms for implementing green procurement that the federal government does not use. To the degree that Congress finds the current level of green procurement by federal agencies inadequate, or agencies have difficulties implementing green procurement, Congress could promote additional or different implementing mechanisms. Doing so could include granting agencies additional legal authorities.

Training of the Acquisition Workforce

Given concerns that have been expressed about the capabilities of the acquisition workforce,¹⁷¹ Congress could explore whether the current workforce can adequately implement existing or proposed requirements and policies pertaining to green procurement.¹⁷² Certain requirements, most notably those involving environmentally preferable products, may be difficult for the existing workforce to implement because agencies must consider multiple attributes of products when determining which product to purchase. This is a more complex determination than

¹⁷⁰ The FAR states only that it is government policy “to acquire supplies and services that promote ... water efficiency” (48 C.F.R. § 23.202) and that agencies must “employ acquisition strategies that ... promote ... water conservation” (48 C.F.R. § 23.703(b)), but there are no more explicit requirements, unlike with energy efficiency and some other preferences.

¹⁷¹ See, for example, “OFPP Calls for 5-Percent Increase in the Civilian Acquisition Workforce,” *92 Fed. Cont. Rep.* 311 (Nov. 3, 2009).

¹⁷² Cf. Kellie Lunney, “Green Government,” *Government Executive*, August 1, 2008, http://www.govexec.com/story_page.cfm?articleid=40616.

ascertaining whether a product possesses a single attribute, such as energy efficiency, and agencies might need information about vendors' production methods to make such determinations. Proposed requirements focused on products' sustainability or life cycle costs could be difficult to implement for similar reasons.

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