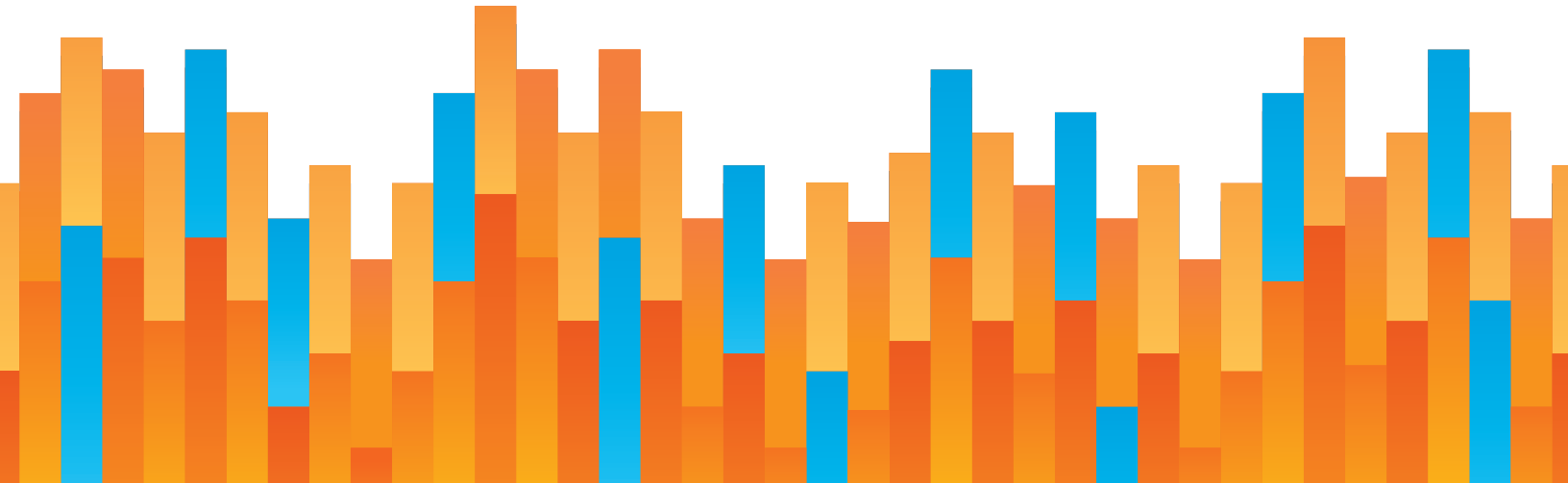
reason FOUNDATION

VOLUNTARY ENERGY STANDARDS: ISO 50001 AND THE SUPERIOR ENERGY STANDARD

by Krisztina A. Pusok and Julian Morris

April 2018



Reason Foundation's mission is to advance a free society by developing, applying and promoting libertarian principles, including individual liberty, free markets and the rule of law. We use journalism and public policy research to influence the frameworks and actions of policymakers, journalists and opinion leaders.

Reason Foundation's nonpartisan public policy research promotes choice, competition and a dynamic market economy as the foundation for human dignity and progress. Reason produces rigorous, peer-reviewed research and directly engages the policy process, seeking strategies that emphasize cooperation, flexibility, local knowledge and results. Through practical and innovative approaches to complex problems, Reason seeks to change the way people think about issues, and promote policies that allow and encourage individuals and voluntary institutions to flourish.

TABLE OF CONTENTS

PART 1

INTRODUCTION

Firms continuously seek to improve their energy efficiency in order to reduce their costs and thereby remain competitive. In addition, some firms may seek to improve energy efficiency to signal to consumers their commitment to environmental protection. Some larger firms have implemented energy management systems (EMSs) in order to achieve one or both of these objectives. Over the course of the past decade, EMSs have been developed by the International Organization for Standardization (ISO) and U.S. Department of Energy. The aims of these EMSs are (1) to provide incentives for innovation and (2) to provide information to ease decision-making among end-consumers.

Although these EMS programs are voluntary, the U.S. Department of Energy (DoE) has been involved in their development and diffusion. This brief considers the extent to which the standards are likely to achieve their aims and the role of DoE in advancing these standards. Parts 1 and 2 describe the ISO 50001 EMS and the DoE's involvement in its proliferation, which resulted in the creation of the Superior Energy Standard (SEP) standard. Part 3 discusses the intended benefits of EMSs and whether DoE's involvement is conducive to achieving those benefits. Finally, this report offers recommendations for restructuring the programs sponsored by the DoE.

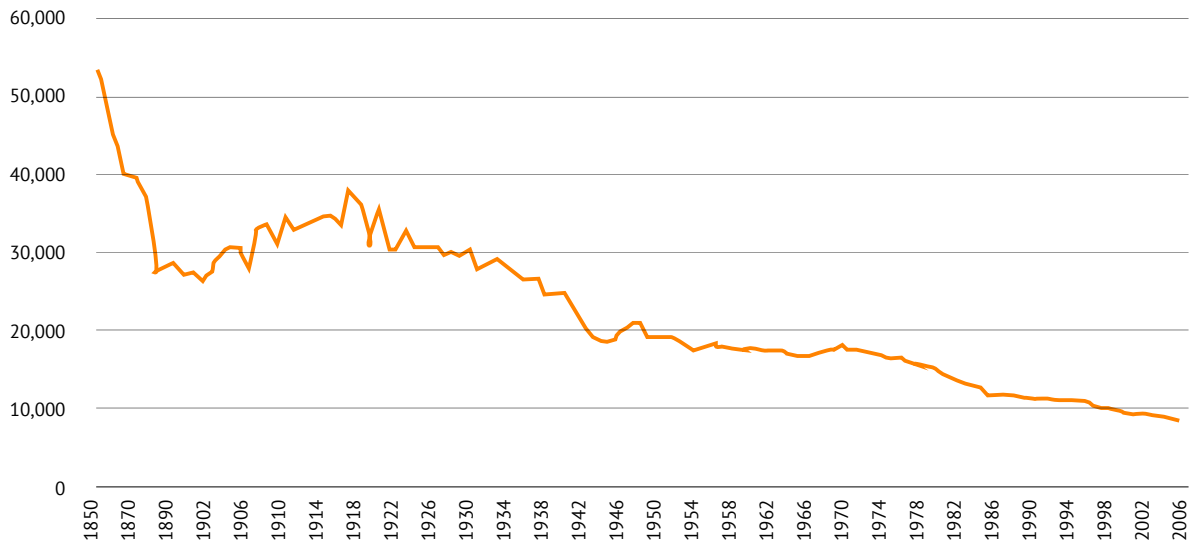
PART 2

IMPROVEMENTS IN ENERGY EFFICIENCY

Production in the United States is becoming more energy efficient (see Figure 1), and this trend can be observed starting in the mid-1800s. According to the Energy Information Administration (EIA), the energy intensity of production (energy use per real dollar of GDP) declined from 12.1 thousand Btus per dollar in 1980 to 6.1 thousand Btus in 2014—a 50% improvement, implying an average improvement in energy intensity of 2.0% per year over this period.[1] The EIA projects continued improvements in energy efficiency, vehicle fuel economy, and structural changes in the economy. By 2040 energy intensity is forecast at 37% lower than in 2016.

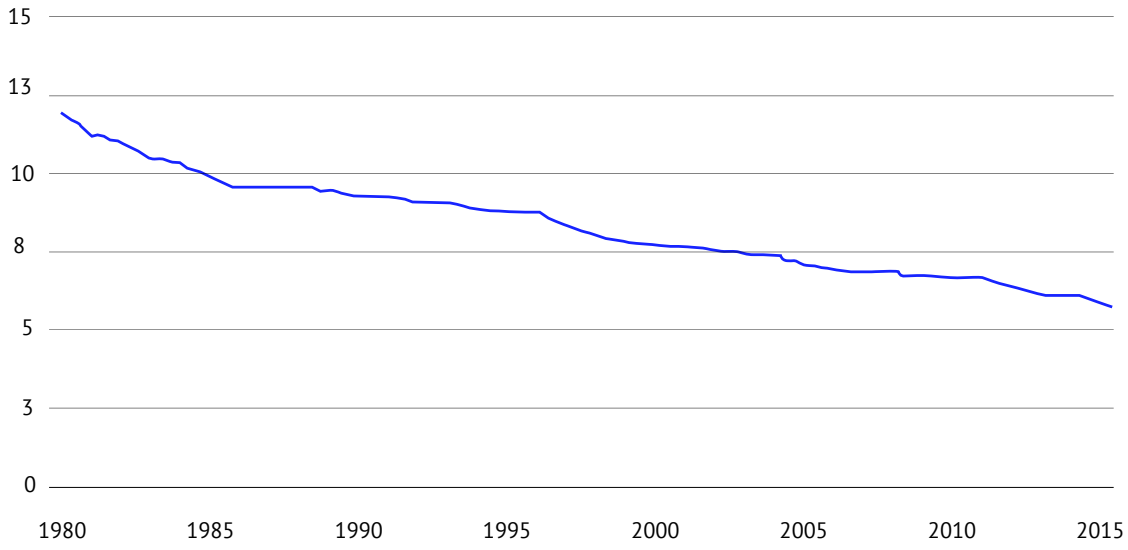
[1] Nadel, Steven, R. Neal Elliott, and Therese Langer. *Energy efficiency in the United States: 35 years and counting.* Report E1502. Washington, DC: American Council for an Energy-Efficient Economy, June 2015.

FIGURE 1: DECREASES IN U.S. ENERGY INTENSITY (BTUs) PER $ OF GDP, 1850–2006



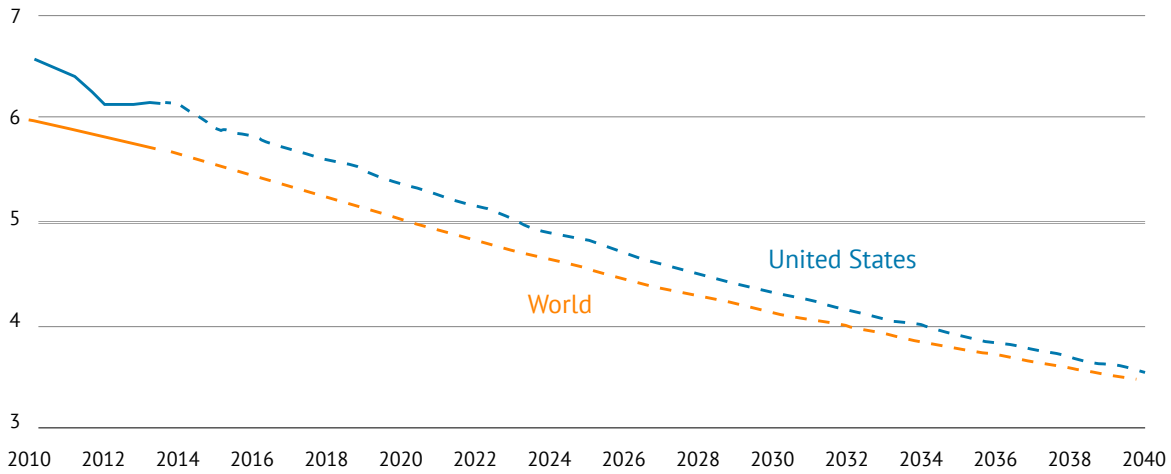
Source: National Academy of Sciences, National Academy of Engineering, and National Research Council. 2010. *Real Prospects for Energy Efficiency in the United States*. Washington, DC: The National Academies Press. https://doi.org/10.17226/12621.

FIGURE 2: ENERGY INTENSITY IN THE U.S.: TOTAL PRIMARY ENERGY CONSUMPTION (IN THOUSANDS OF BTUs) PER $ OF GDP



Source: Graph compiled using U.S. Energy Information Administration's International Energy Statistics Online Dataset. ND.

FIGURE 3: ENERGY INTENSITY FORECASTS (THOUSANDS OF BTUs), U.S. VS WORLD, 2010–2040



Source: U.S. Energy Information Administration's International Energy Statistics Online Dataset.

Many larger firms seeking to reduce costs are advancing national energy efficiency significantly through "Energy Management Systems" (EMSs). Proponents expect these programs to be a major contributing factor in improving current and future energy efficiency.

PART 3

THE DEVELOPMENT OF VOLUNTARY ENERGY MANAGEMENT STANDARDS

For more than a century, businesses have sought ways of using energy more efficiently to keep costs down. Beginning in the 1990s, a number of large companies began developing "energy management systems" to integrate methods for reducing energy use more systematically throughout the organization, including in management practices and production processes. Examples include:[2]

- Dow Chemical, which achieved a 22% improvement in energy efficiency between 1994 and 2005, leading to $4 billion in savings;
- United Technologies Corporation, which reduced global GHG emissions by 46% per revenue dollar from 2001 to 2006. During 2006–2015, United Technologies Corporation reduced its GHG emissions by 32%, the use of water by 37%, waste by 43%, and air chemical emissions by 65%. These results have combined for cost savings of more than $100 million;[3]

[2] McKane, Aimee. "Thinking Globally: How ISO 50001-Energy Management can make industrial energy efficiency standard practice." Lawrence Berkeley National Laboratory, 2010. Web. https://escholarship.org/uc/item/92d8q553 29 Jan. 2018.

[3] United Technologies. "Environment, Health, and Safety." Web.<http://www.utc.com/Corporate-Responsibility/Environment-Health-And-Safety/Pages/Default.aspx> Accessed 29 Jan. 2018.

- Toyota's North American Energy Management Organization, which reduced energy use per unit by 23% between 2002 and 2010; meanwhile, the company-wide energy efficiency improvements saved $9.2 million in its North America division between 1999 and 2010;
- InterfaceFLOR, a carpet manufacturer, which reduced its energy intensity for manufactured carpet by 35% from 1994 to 2004.

Proponents cite a number of different drivers for the adoption of EMSs: operational competitive motivations (costs, productivity), commercial competitive motivations (market, image, customers), and relational motivations (regulators, local organizations). The success of EMSs at large companies such as those mentioned above led to the development of a set of standards for such systems.

In June 2011, the International Organization for Standardization (ISO) published the ISO 50001 standard, which is intended to provide a framework for businesses to integrate energy management into their organizations, management practices, and operational processes.

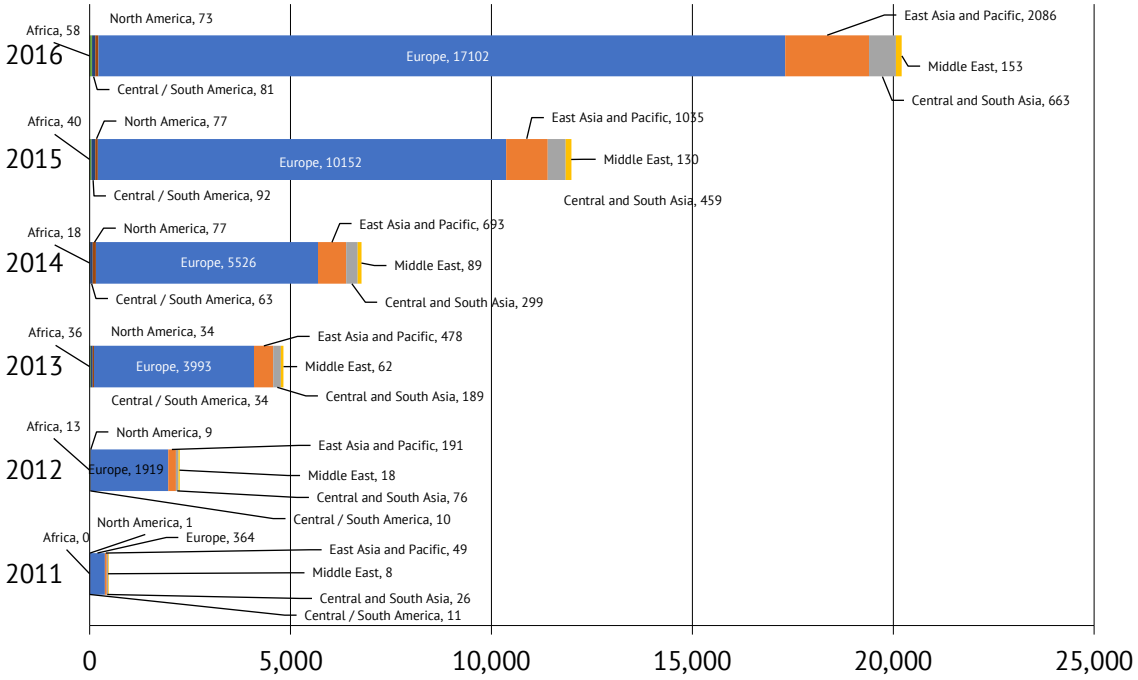
ISO is an international standard-setting body comprising representatives from various national standards organizations (governmental and private bodies). ISO is perhaps best known for its many product standards, such as those for film speed.[4] However, it has also produced a number of management system standards, including widely adopted standards for quality management (ISO 9000 series) and environmental management (ISO 14000 series). These standards specify benchmarks for management systems that an organization can use to enhance its performance on environmental or quality metrics. They are meant to apply to any organization, regardless of size, type and nature, and target the quality/ environmental aspects of its activities, products and services that the organization determines it can either control or influence over the life cycle of the product or service—from the extraction of raw materials to disposal residuals.

Building on the popularity of ISO 9001 and ISO 14001, ISO developed energy-specific management standards. This culminated in the launch of ISO 50001, which uses a similar methodology to ISO 14001 concerning the creation, structure, and implementation of

[4] ISO has continued to update its "film" standards for use in the digital realm. For example, see ISO 12232:2006 available at: https://www.iso.org/standard/37777.html?browse=tc

management process, as well as auditing by a third party. As of 2016, about 20,000 facilities had implemented ISO 50001, of which only 43 are in the U.S. (see Figure 3).

FIGURE 4: NUMBER OF ISO 50001 CERTIFICATIONS WORLDWIDE, 2011–2016



	2011	2012	2013	2014	2015	2016
Africa	0	13	36	18	40	58
Central / South America	11	10	34	63	92	81
North America	1	9	34	77	77	73
Europe	364	1919	3993	5526	10152	17102
East Asia and Pacific	49	191	478	693	1035	2086
Central and South Asia	26	76	189	299	459	663
Middle East	8	18	62	89	130	153

Source: International Organizations for Standardization. ISO 2017 Survey of Certifications. "ISO 50001—data per country and sector—2011 to 2016" (excel dataset with graphs). Available at: https://isotc.iso.org/livelink/livelink?func=ll&objId=18808772&objAction=browse&viewType=1

ISO 50001 specifies standards for an energy management system, involving management commitment, effective monitoring, measurement and analysis of several variables and management review of the results.[5] It does not provide specific performance criteria with respect to energy efficiency.[6] As with other ISO management system standards, ISO 50001

[5] Antunes, Pedro, Paulo Carreira, and Miguel Mira da Silva. "Towards an energy management maturity model." *Energy Policy 73* (2014): 803-814. Web < https://www.sciencedirect.com/science/article/pii/S0301421514003838> 29 Jan. 2018.

[6] Chiu, Tsung-Yung, Shang-Lien Lo, and Yung-Yin Tsai. "Establishing an integration-energy-practice model for improving energy performance indicators in ISO 50001 energy management systems." *Energies* 5.12 (2012): 5324-5339. Web < http://www.mdpi.com/1996-1073/5/12/5324/htm> 29 Jan. 2018.

was designed to be implemented by any type of organization, independent of size, type of business, or geographical location. However, in practice, ISO 50001 has mainly been implemented almost exclusively by large companies in OECD countries.

Proponents emphasize that ISO 50001 was designed to provide a system whereby firms can assess, manage and thereby reduce energy usage and associated emissions.[7] It aimed to help companies understand baseline energy usage; identify, prioritize and record opportunities for improving energy performance; and develop and execute action plans that use energy performance indicators to target reducing energy consumption.[8]

[7] Clapp, Jennifer and Jason Thistlethwaite. "Private voluntary programs in environmental governance: Climate change and the financial sector." *Business and climate policy: Potentials and pitfalls of voluntary programs* (2012): 43-76.

[8] Chiu, Lo, and Tsai. "Establishing an integration-energy-practice model for improving energy performance indicators in ISO 50001 energy management systems."

PART 4

GOVERNMENT INVOLVEMENT: THE ROLE OF THE DEPARTMENT OF ENERGY AND THE SUPERIOR ENERGY PERFORMANCE PROGRAM

Transnational private standards are developed by a handful of international non-governmental bodies, principally: the International Accounting Standards Board (IASB), which sets global accounting standards; the International Electrotechnical Commission (IEC), which sets product and process standards for the electrical and electronics industries; and the International Organization for Standardization (ISO), which sets product and process standards in all industries, except those covered by the IEC. Jointly, the IEC and ISO account for about 80% of all international product standards.[9] Governments may be

[9] Büthe, Tim and Walter Mattli. "International Standards and Standard-Setting Bodies." *The Oxford Handbook of Business and Government*. Oxford/NewYork: Oxford University Press, 2011. 440-471. Print.

indirectly involved in the proliferation of these private standards by inducing the adoption or use of standards without mandating them.

Some governments establish voluntary standards directly. Starting in the 1990s, several national standards-setting bodies established energy management systems. Australia developed its Energy Efficiency Opportunities Program, which is mandatory for corporations using more than 0.5 PJ[10] of energy per year, but otherwise voluntary. Canada developed the EcoEnergy Efficiency for Industry Program, which supports the early implementation of ISO 50001. South Korea introduced a "voluntary energy saving through partnership" program, energy management diagnostic tools, and training for energy managers.[11]

The U.S. government has been experimenting with the idea of energy management system standards since the introduction of the Management System for Energy (MSE 2005) standard in 2005.[12] More recently, the U.S. Department of Energy (DoE) has been involved in promoting the development of ISO 50001 and supporting its implementation through programs such as the 50001 Ready Recognition Program, the Clean Energy Ministerial Working Group, the Federal Energy Management Program, and the Superior Energy Performance (SEP) Certification Program. Until this year, the DoE had been gradually increasing its budget to expand the SEP and ISO 50001 market. It did this through the Industrial Technical Assistance (ITA) program, now renamed "Advanced Manufacturing Technical Partnerships," whose role is, in part, to "advance strategic energy management through Superior Energy Performance (SEP)" and to "recruit and recognize the early adopter facilities to build and expand the SEP market." The ITA program's budget rose from $22.5M in 2014 to $23.5M in 2015 and then jumped to $28.5M in 2016. The DoE requested an increase to $29.5M for 2017.[13] However, in its 2018 budget request, DoE cut its allocation for Advanced Manufacturing Technical Partnerships to $13.5M, a more than 50% reduction from 2016–2017.[14] Most of the cuts come from removing funding for Industrial Assessment Centers, which are not directly related to SEP/ISO 50001.[15]

[10] A petajoule (PJ) is 1015 joules. A joule is 0.239 calories. So, 0.5 PJ is about 1014 calories, or 1011 kilocalories (food calories).

[11] Büthe and Mattli. "International Standards and Standard-Setting Bodies."

[12] Piñero, Edwin. "ISO 50001: setting the standard for industrial energy management." *Green Manufacturing News* (2009): 21-24.

[13] "FY 2017 Congressional Budget Request." Department of Energy. DOE/CF-0121 Volume 3. February 2016. Web. <https://energy.gov/sites/prod/files/2016/02/f29/FY2017BudgetVolume3_2.pdf > 29 Jan 2018.

[14] "FY 2018 Congressional Budget Request." Department of Energy. DOE/CF-0130 Volume 3. May 2017. Web. <https://energy.gov/sites/prod/files/2017/05/f34/FY2018BudgetVolume3_0.pdf> 29 Jan 2018.

[15] Ibid.

4.1 THE SUPERIOR ENERGY STANDARD

The DoE developed the Superior Energy Performance (SEP) certification program to encourage industrial facilities to implement energy management systems based on the ISO 50001 standard. The DoE created the SEP program after a research project,[16] undertaken by Lawrence Berkeley National Laboratory in collaboration with the DoE, estimated that U.S. businesses could save more than 20% of total energy use across all factories in the country.[17] The SEP program's stated goals are: "to drive continual improvement in energy performance; develop a transparent system to validate energy performance improvements and management practices; encourage broad participation throughout industry; and support and build the energy efficiency market and workforce."[18]

This program seeks to provide industrial facilities with a road-map for achieving continual improvement in energy efficiency while maintaining or improving competitiveness. As ISO 50001 is a central element in its implementation, SEP certification requires applicants to pass an audit that assesses conformity of the energy management system and verifies the claimed improvement in energy performance.[19] When entering the SEP program, facilities receive a series of training sessions to assist with implementation. Participating organizations and businesses receive tailored assistance from the DoE's Industrial Technologies Program (ITP) support teams to implement an energy management system that will conform to ISO 50001.[20] Additionally, the U.S. DOE Energy Performance Indicator (EnPI) software tool is provided to facility staff to assist in calculating improvements in energy performance. The tool normalizes energy consumption for relevant variables such as weather, production, moisture content, etc. By meeting the requirements of the SEP standard, businesses demonstrate their ability to manage their energy use better, improve energy performance, and apply an accredited methodology for measuring and verifying energy efficiency and energy intensity improvements.[21]

16 The analysis offers a comparative overview of existing energy management standards in 10 countries/ regions: Denmark, Ireland, Japan, Korea, the Netherlands, Sweden, Thailand, United States, EU, and China.

17 Lambert Garry. "ISO 50001 pilot programme: US companies implement standard with government support." *ISO Focus 2*.5 (2011): 11-14. Web < https://www.iso.org/news/2011/05/Ref1615.html> 29 Jan. 2018.

18 McKane, Aimee. "Superior Energy Performance: Getting the Most Value from ISO 50001- Energy Management Systems." Lawrence Berkeley National Laboratory, March 13 2012. Web. <https://energy.gov/eere/amo/downloads/superior-energy-performance-getting-most-value-iso-50001> 29 Jan. 2018.

19 Lambert. "ISO 50001 pilot programme."

20 The Georgia Institute of Technology is the technical lead for the DoE-ITP Energy Management Demonstration Program, while Penn State University provides the consultant team for some participating companies.

21 Lambert. "ISO 50001 pilot programme."

Like ISO 14001, ISO 50001 and the SEP program are both process and performance-based standards. They signal that the firm has implemented a management system that documents the firm's energy consumption aspects and impacts, and identifies an energy efficiency process. Companies participating in the SEP program voluntarily collect data, measure and monitor their energy performance, and receive third party verification and external recognition for their energy performance improvements. Specifically, facilities that achieve SEP certification obtain ANAB (ANSI-ASQ National Accreditation Board) accredited third party verification for conforming to the ISO 50001 energy management standard and for achieving a defined level of improvement in energy efficiency for each facility.

The current SEP program allows two pathways to achieve certification, both requiring conformance to ISO 50001. The Energy Performance Pathway is based on the percentage of energy performance improvement over a three-year achievement period, as measured against a baseline year, while the Mature Energy Pathway allows the achievement period to be as long as 10 years and uses an SEP Scorecard to earn points for energy management best practices and energy performance improvements beyond the minimum certification requirements. In the absence of objective benchmarking, however, this pathway could mean that companies that start with worse energy efficiency will more easily meet the performance standard.

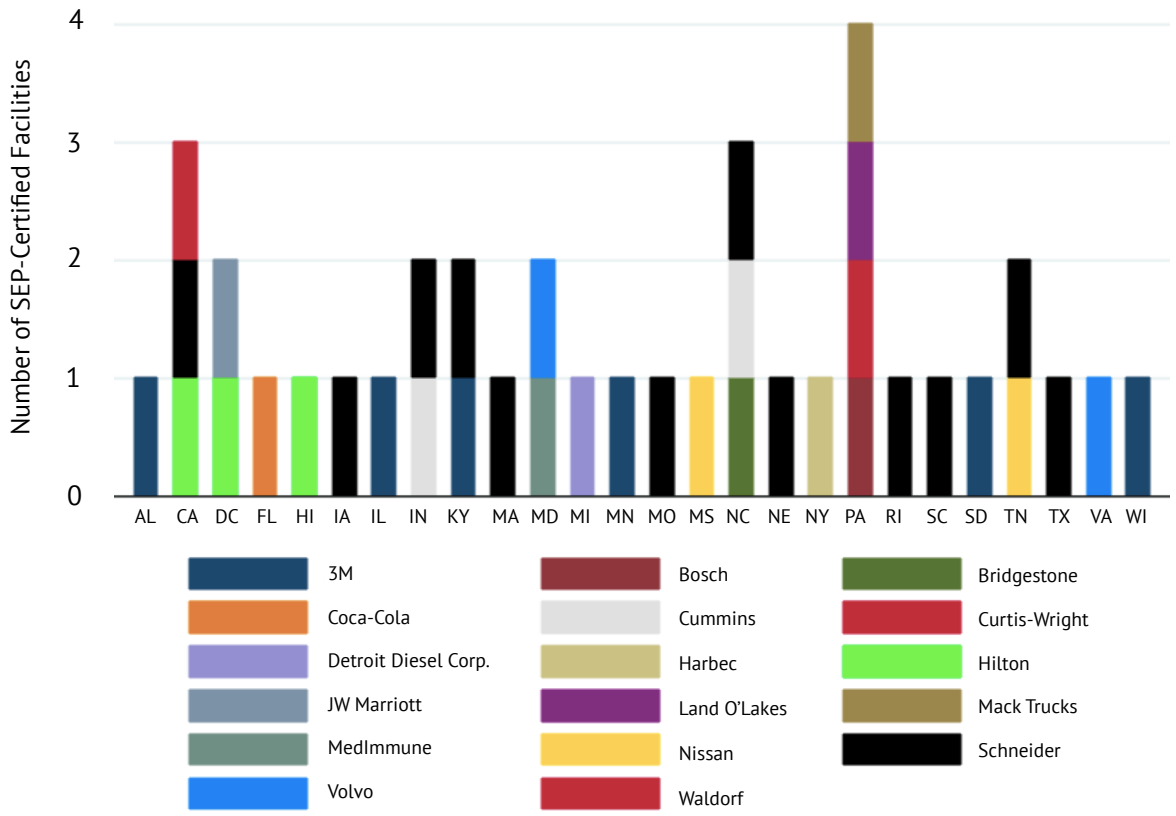
The second pathway was developed for facilities that have been engaged in energy efficiency activities for some time and places a greater emphasis on enhancing and maintaining an energy management system.[22]

Only 17 companies have so far earned SEP certification for one or more facilities in the U.S., of which five followed the Mature Energy Pathway and reported improvements over 10 years in one or more facilities.[23] Most SEP-certified facilities are registered in Pennsylvania, where Bosch, Curtis-Wright, Land O'Lakes, and Mack Trucks each owns a SEP-certified facility (see Figure 4). Schneider Electric owns the most SEP-certified facilities across 12 states, while 3M Company is second with SEP-certified facilities across six states (see Figure 5).

[22] McKane, Aimee, Paul Scheihing, Tracy Evans, Sandy Glatt and William Meffert. *The Business Value of Superior Energy Performance.* No. LBNL-188930. Lawrence Berkeley National Laboratory, 2015. Web <https://www.osti.gov/scitech/biblio/1237499> 29 Jan. 2018.

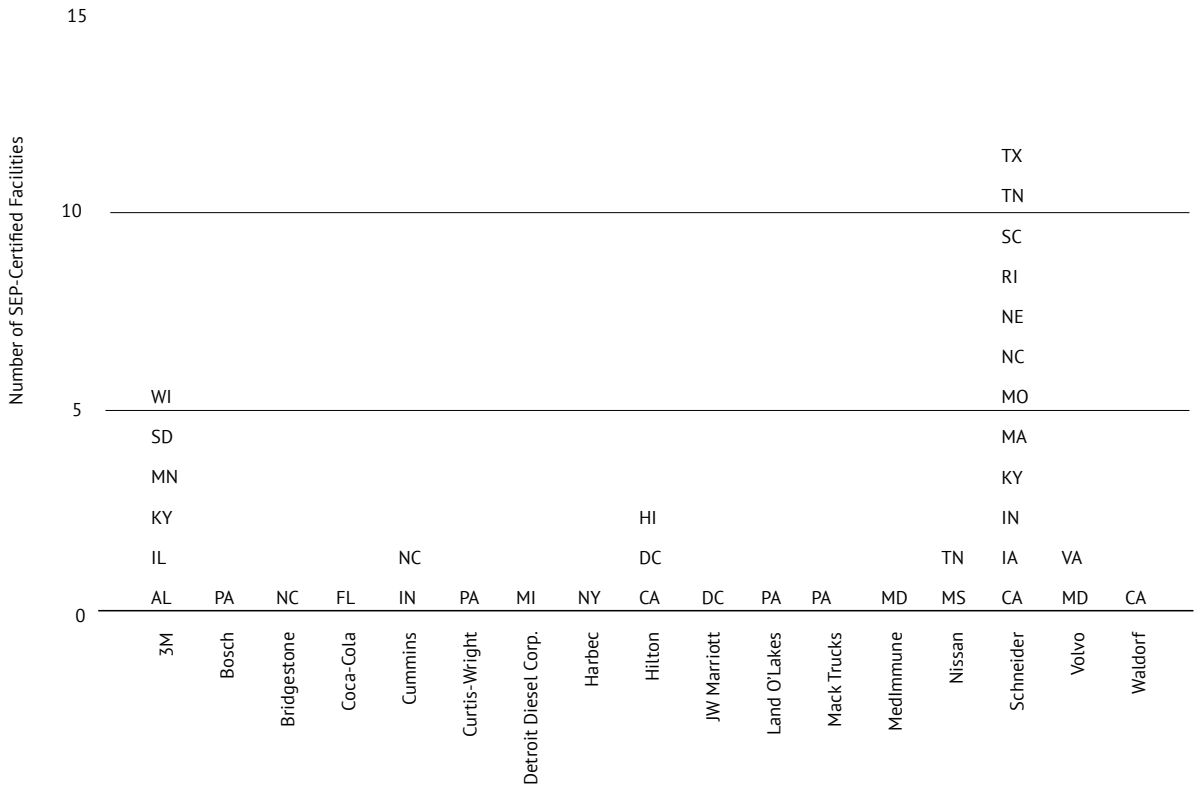
[23] Department of Energy. *Certified Facilities.* energy.gov, Web. <https://energy.gov/eere/amo/certified-facilities> Accessed 29 Jan. 2018.

FIGURE 5: NUMBER OF U.S. SEP-CERTIFIED FACILITIES BY STATE



Source: Author's calculations based on data from US Department of Energy's Superior Energy Performance facilities information list. Available at: https://energy.gov/eere/amo/certified-facilities

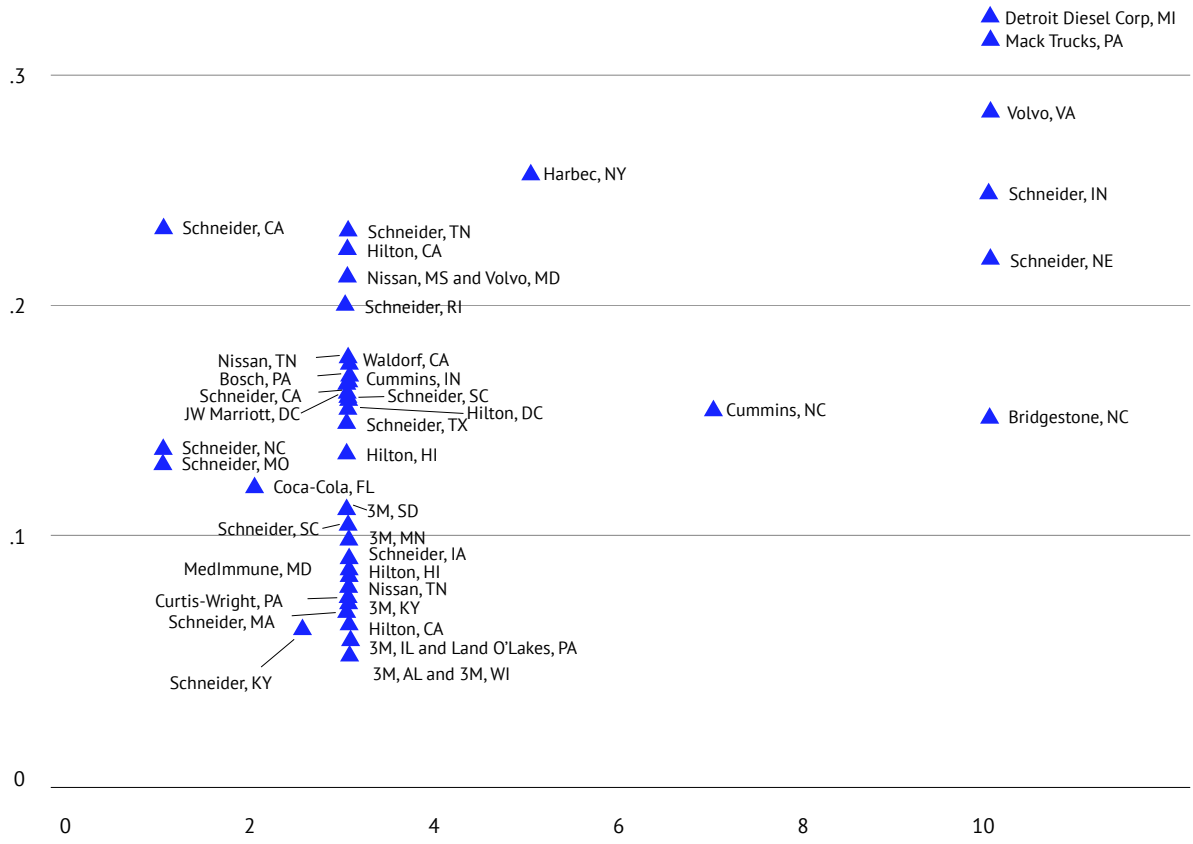
FIGURE 6: SEP-CERTIFIED U.S. COMPANIES BY FIRM



Source: Author's calculations based on data from US Department of Energy's Superior Energy Performance facilities information list. Available at: https://energy.gov/eere/amo/certified-facilities

Improvements in energy performance can vary across industries and facilities. The greatest improvements in energy performance have been registered at the Detroit Diesel Corporation facility in Michigan (32.5% over 10 years), followed closely by a Mack Trucks facility in Pennsylvania (31.6% over 10 years) (see Figure 7). In both cases, improvements were achieved over a 10-year period. The fastest improvements were reported at a Schneider Electric facility in California (23.4% over 15 months). By contrast, a Bridgestone facility in North Carolina reported the slowest improvements in energy performance (15.1% over 10 years). While improvements in energy performance can vary in time length, the DoE's cost-benefit assessments promise 5.6% to 30.6% improvement in energy performance over three years for SEP-certified facilities.

FIGURE 7: ENERGY PERFORMANCE IMPROVEMENTS IN U.S. SEP-CERTIFIED FACILITIES



Note: The DoE calculates the energy performance improvement as one minus the SEP Energy Performance Indicator (SEnPI) (or 100% minus the SEnPI expressed as a percent), where the SEnPI is the ratio of reporting-period energy consumption to baseline energy consumption where one or both of these values is adjusted so that the two consumption amounts correspond to consistent conditions.
Source: Author's calculations based on data from US Department of Energy's Superior Energy Performance facilities information list. Available at: https://energy.gov/eere/amo/certified-facilities

A 2015 research report sponsored by the DoE highlighted alleged "international" interest in SEP, stating that "Interest in SEP is rising internationally. There are already two SEP-certified facilities in Canada and one in Mexico, providing a strong basis for North American collaboration among the U.S., Canadian, and Mexican governments."[24] However, implementation of SEP at three plants in countries bordering the U.S. hardly amounts to international proliferation of SEP.

[24] Ibid.

PART 5

THE EFFECTS OF VOLUNTARY ENERGY PROCESS STANDARDS

As noted, ISO 50001 is a process standard, not a performance standard. It does not provide an ideal level of or any certain base values for energy performance, but rather provides detailed guidelines on how to integrate energy management into an organization.[25] Following ISO 50001 guidelines is intended to:

a) boost innovation by encouraging technological research, development and diffusion, which would drive down costs and bring forward new technologies; and

b) provide information to ease decision-making by informing consumers and end-users through labelling and energy audits.[26] The ultimate intended effect is to increase energy efficiency and reduce energy use, thereby reducing costs. The next section assesses the extent to which it achieves these goals.

[25] Böttcher, Christian and Martin Müller. "Insights on the impact of energy management systems on carbon and corporate performance. An empirical analysis with data from German automotive suppliers." *Journal of Cleaner Production* 137 (2016): 1449–1457. Web < https://www.sciencedirect.com/science/article/pii/S0959652614006003> 29 Jan. 2018.

[26] McKane, Aimee, Graziella Siciliano and Pamela de los Reyes. *Promoting Strong ISO 50001 Outcomes with Supportive National Infrastructure.* No. LBNL-188776. Lawrence Berkeley National Laboratory, 2015. Web <https://www.osti.gov/scitech/biblio/1236173> 29 Jan. 2018.

5.1 WILL ISO 50001 AND THE SEP PROGRAM GENERATE WIDESPREAD BENEFITS IN REDUCED ENERGY USE AND ASSOCIATED EMISSIONS?

In principle, voluntary energy and environmental standards have the potential to create benefits for a wide range of companies in both public and private sectors. Researchers at the University of Bratislava claim that if ISO 50001 were applied widely across the world, it could influence up to 60% of world energy consumption.[27] The researchers found further that energy systems optimized with ISO 50001 criteria can attain average system efficiency gains of 20%–30% and provide a model that helps organizations systematically plan and manage their energy use.[28]

However, several criticisms have been levelled at ISO 50001 and other energy management systems. First, it has been observed that the current energy management standards are just models of good practice, but not excellence models. The ISO 50001 model provides a good basis for improving energy management in industries that have well-defined and well-structured processes, but it does not necessarily facilitate achieving the best energy performance (as would an excellence model). Companies in industries that do not have well-defined and well-structured processes in place and that rely solely on EMSs to improve their energy performance might not get similar benefits from implementing ISO 50001. This is problematic since proponents suggest that the EMS model is universally applicable across sectors and facilities. So, if it were applied universally and did not on average generate a positive return on investment, it would be economically inefficient. On the other hand, this could also suggest that there is room for improvement, for example through the development of alternative standards.

Second, uptake of ISO 50001 is unlikely to be nearly as wide as the Bratislavan researchers claim. The number of sites certified to ISO 50001 remains small (a total of about 20,000 as of 2016, of which only 47 were in the U.S.) even compared to the number certified to ISO 14001 (approximately 363,000 as of 2016, of which 5,582 were in the U.S.), and tiny

[27] Majernik, Milan, Martin Bosak, Lenka Stofova and Petra Szaryszova. "Innovative model of integrated energy management in companies." *Quality Innovation Prosperity= Kvalita Inovacia Prosperita* 19.1 (2015): 22. Web <http://www.qip-journal.eu/index.php/QIP/article/view/384> 29 Jan. 2018.

[28] Ibid.

compared to the number certified to ISO 9001 (a total of over one million sites, as of 2016, of which only over 30,474 were in the U.S.).[29]

One important reason for low adoption of the ISO 50001 certification process seems straightforward: firms seem to encounter barriers and challenges during implementation, including the integration of energy management and technology, formulation of energy performance indicators, mitigation of technological bottlenecks for improving energy efficiency, and management of third-party certification.[30] A 2013 study sponsored by the DoE estimated that the average cost for facilities to develop, implement, and certify to ISO 50001 and SEP is $319,000 on average.[31] The bulk of this cost is associated with internal staffing time. Additionally, third party verification of conformity with ISO 50001 and achievement of SEP energy performance improvement targets is an SEP certification requirement. The average cost for all third-party auditing and certification is around $19,000, ranging between $16,000 and $20,000 depending on the size of the audited facility.[32] As one might expect, the cost of ISO 50001 and SEP program certification is marginally higher than ISO 50001 certification alone.[33]

As for the prospects of global implementation, researchers at the University of Waterloo found that ISO 50001 certification fails to recognize the technical and financial limitations of firms in developing countries.[34] Additionally, ISO 50001 was developed primarily for large companies, the frameworks being too complicated for organizations that lack professional and financial resources for implementation.[35]

Third, the effects on innovation are not clear. Proponents claim that management standards can have operational benefits. For example, ISO 14001 gives operational benefits in terms of product innovation, cycle time, efficiency, flexibility, overall productivity, product performance, product quality, defects, quality assurance, and process

[29] International Organization for Standardization. "ISO Survey of certifications to management system standards" Dataset. Web <http://isotc.iso.org/livelink/livelink?func=ll&objId=18808772&objAction=browse&viewType=1> 29 Jan. 2018.

[30] Chiu, Lo, and Tsai, "Establishing an integration-energy-practice model for improving energy performance indicators in ISO 50001 energy management systems."

[31] Therkelsen, Peter, Aimee McKane, Ridah Sabouini and Tracy Evans. *Assessing the costs and benefits of the superior energy performance program.* No. LBNL-6349E. Ernest Orlando Lawrence Berkeley National Laboratory, 2013. Web < https://www.osti.gov/scitech/biblio/1165470> 29 Jan. 2018.

[32] Ibid.

[33] Ibid.

[34] Clapp and Thistlethwaite. "Private voluntary programs in environmental governance: Climate change and the financial sector."

[35] Ngai, E. W. T., D.C.K. Chau, J.K.L. Poon and C.K.M. To. "Energy and utility management maturity model for sustainable manufacturing process." *International Journal of Production Economics* 146.2 (2013): 453-464. Web <https://www.sciencedirect.com/science/article/pii/S0925527312005105> 29 Jan. 2018.

optimization.[36] Yet, these claims lack supporting evidence in the case of ISO 50001. The question of whether standards in general support innovation or not remains unresolved.[37] For example, a European EMS analysis shows that while management systems in general are associated with process innovations, they are not linked with product innovations.[38] Such evidence, however, is largely based on studies of management systems such as ISO 9001 and ISO 14001, and cannot be generalized to include the effects of ISO 50001. This issue has received little attention so far, and studies on it are lacking. More systematic research is needed to assess the effects of ISO 50001 on innovation before drawing further policy implications.

Fourth, and related to the second and third points, even if ISO 50001 were widely adopted, it might not have the intended effects. Research shows that there are two main (related) reasons why companies decide not to invest in an energy management program:[39]

- First, for most companies, energy is not considered a business strategic opportunity. The International Energy Agency (IEA), in its *International Energy Outlook 2013* report, states that "In most sectors and countries, energy is a relatively minor component of the calculation of competitiveness, even if energy expenditure may be of major importance in energy-intensive industries." This puts energy out of the strategic context of the business.
- Second, implementation of third-party certified energy management programs is not considered a profitable investment for most firms. The time and costs associated with an energy management system are relatively high, and are perceived by most firms as an expense, not as an investment.

In general, firms know best where efficiencies can be made within their own business structures. Energy management systems designed for large, energy-intensive businesses are simply ill-suited to the needs and interests of the vast majority of businesses. For those firms, it makes more sense to strive for improvements on their own terms and in their own

[36] Marimon, Frederic and Martí Casadesús. "Reasons to Adopt ISO 50001 Energy Management System." *Sustainability* 9.10 (2017): 1740. Web < http://www.mdpi.com/2071-1050/9/10/1740/htm> 29 Jan. 2018.

[37] Laskurain, Iker, Iñaki Heras-Saizarbitoria and Martí Casadesús. "Fostering renewable energy sources by standards for environmental and energy management." *Renewable and sustainable energy reviews* 50 (2015): 1148-1156. Web < https://www.sciencedirect.com/science/article/pii/S1364032115005183> 29 Jan. 2018.

[38] Wagner, Marcus. "Empirical influence of environmental management on innovation: evidence from Europe." *Ecological Economics* 66.2-3 (2008): 392-402. Web <https://www.sciencedirect.com/science/article/pii/S0921800907005010> 29 Jan. 2018.

[39] Uriarte-Romero, Rafael, Margarita Gil-Samaniego, Edgar Valenzuela-Mondaca and Juan Ceballos-Corral. "Methodology for the successful integration of an Energy Management System to an operational environmental system." *Sustainability* 9.8 (2017): 1304. Web <http://www.mdpi.com/2071-1050/9/8/1304/htm> 29 Jan. 2018.

ways, which would be a more efficient way of achieving environmental and energy sustainability. Firms know where and how to address inefficiencies, which would increase incentives to innovate. By implementing initiatives that increase business performance, firms are motivated to forge changes that positively affect their competitive advantage (e.g. efficiency, brand, new products, markets).

5.2 DO ISO 50001 AND SEP PROVIDE USEFUL INFORMATION TO CONSUMERS?

A 60-country survey of consumer attitudes conducted in 2015 by Nielsen found that 66% of respondents said they were willing to pay more for "sustainable" brands.[40] But there is a disconnect between what consumers say and what they do. In the U.S., for example, the market for household cleaning products claiming to be environmentally superior peaked in 2010—at around 3%—and dropped at an annual rate of over 2% up to 2016, according to website marketresearch.com.[41] It seems likely that this applies more widely. As such, surveys reporting favorable attitudes toward "sustainable" or "environmentally friendly" products and services do not paint an accurate picture of demand for such goods and services.[42]

The reality is that premium priced "green" goods are a minority preference, with a very small market. A 2010 study found that 65% of consumers say they are *not* prepared to pay more for "green" products.[43] Being a survey, this likely grossly exaggerates the actual proportion of people willing to pay more for such products. Most people prioritize quality, price, operational cost, and health concerns above environmental concerns.

While most consumers are not willing to pay a premium for "green" goods, many are willing to pay a premium for goods that cost less to operate—resulting in net savings. That likely

[40] McCaskill, Andrew. "Consumer-Goods' Brands That Demonstrate Commitment to Sustainability Outperform Those That Don't." *Press Room*. 12 Oct. 2015. Web. <http://www.nielsen.com/us/en/press-room/2015/consumer-goods-brands-that-demonstrate-commitment-to-sustainability-outperform.html > 29 Jan. 2018.

[41] Stewart, Caitlin. "3 Reasons Sales of Green Household Products Are Dropping." Web blog post. Market Research Blog 29 March 2016. Web. <https://blog.marketresearch.com/3-reasons-green-household-product-sales-are-dropping> 29 Jan 2018.

[42] Joshi, Yatish and Zillur Rahman. "Factors affecting green purchase behaviour and future research directions." *International Strategic Management Review* 3.1-2 (2015): 128-143. Web < https://www.sciencedirect.com/science/article/pii/S2306774815000034> 29 Jan. 2018.

[43] Vermillion, Leslie J. and Justin Peart. "Green marketing: Making sense of the situation." Allied Academies International Conference. *Academy of Marketing Studies. Proceedings.* Vol. 15. No. 1. Jordan Whitney Enterprises, Inc, 2010. Web <https://search.proquest.com/openview/6bf66a6a728c1793e6b33c1e3988ca4a/1?pq-origsite=gscholar&cbl=38768> 29 Jan. 2018.

explains the success of the Energy Star program. Begun as a voluntary product-labeling program in 1992, the Energy Star program is now a joint effort of the U.S. Environmental Protection Agency (EPA) and the U.S. DoE to promote the consumer purchase of energy-efficient products.[44] The program claims to have helped Americans save over $34 billion in energy costs in 2015 alone and to have contributed to cumulative energy cost savings of $430 billion since 1992.[45] (These figures do not include the higher cost of more energy-efficient appliances, so the net savings are likely considerably lower.)

Proponents of EMSs say that an expected benefit of these standards is to provide information and ease decision-making by informing end-users (i.e. consumers of products manufactured by EMS-certified businesses) through labelling. While that may be the intention,[46] there is no evidence that EMSs trigger changes in consumer behavior. Indeed, we found no evidence that ISO 50001 certification is promoted to end-users. Moreover, unlike labels such as "Energy Star," EMSs are not performance standards, so it is unclear how they might enable consumers to make product comparisons relating to total cost of ownership, or even total energy use.[47]

5.3 ENVIRONMENTAL MANAGEMENT STANDARDS AS A SIGNALING TOOL FOR QUALITY AND COMPLIANCE WITH REGULATION

Environmental management standards such as ISO 14001 may signal a firm's commitment to and conformity with environmental policies and regulations (compliance with environmental regulations is a pre-requisite for ISO 14001 certification). Businesses concerned about complying with environmental regulations may require suppliers to have or obtain ISO 14001 certification—especially those operating in overseas markets where the environmental regulations may be unfamiliar and there may be a greater need to signal

[44] Brown, Rich, Carrie Webber and Jonathan G. Koomey. "Status and future directions of the ENERGY STAR program." *Energy* 27.5 (2002): 505-520. Web <https://www.sciencedirect.com/science/article/pii/S036054420200004X> 29 Jan. 2018.

[45] National Awareness of ENERGY STAR® for 2016. *About Energy Star*. energystar.gov, Web. <https://www.energystar.gov/about/origins_mission/energy_star_numbers > Accessed 29 Jan. 2018.

[46] Laskurain, Iker, Iñaki Heras-Saizarbitoria and Martí Casadesús. "Fostering renewable energy sources by standards for environmental and energy management."

[47] Ibid.

compliance to regulators.[48] As such, firms active in foreign markets are more likely to adopt ISO 14001. A similar effect may be occurring with regard to ISO 50001 in jurisdictions where governments have mandated compliance with that EMS.

[48] Ozusaglam, Serdal, Stéphane Robin and Chee Yew Wong. "Early and late adopters of ISO 14001-type standards: revisiting the role of firm characteristics and capabilities." *The Journal of Technology Transfer* (2017): 1-28. Web < https://link.springer.com/article/10.1007/s10961-017-9560-5> 29 Jan. 2018.

PART 6

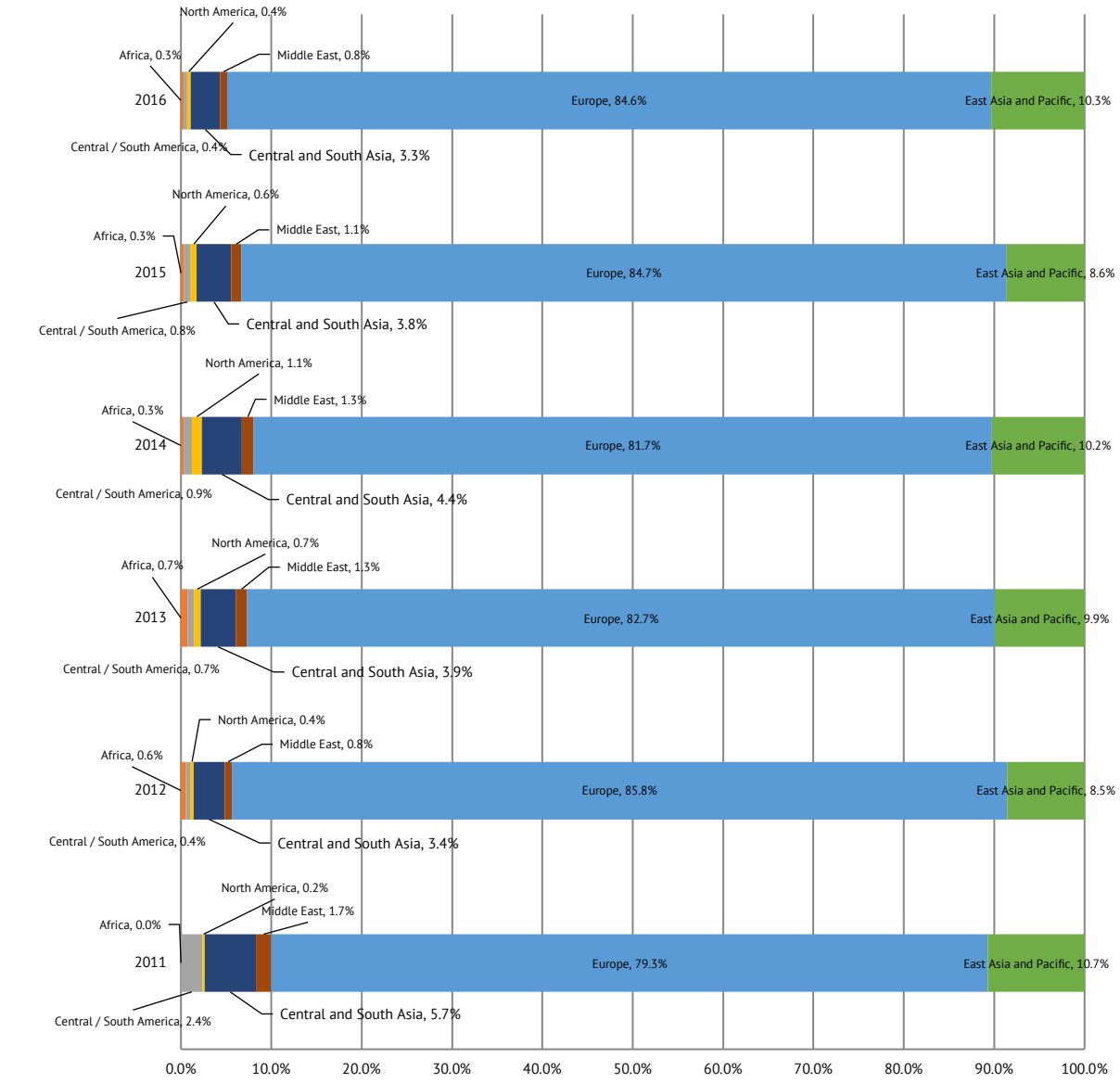
CONCLUSION

According to the International Organization for Standardization, more than 20,000 sites worldwide achieved ISO 50001 certification in 2016, increasing almost 70% in just over a year. The growth of ISO 50001 is expected to accelerate as an increasing number of companies integrates ISO 50001 into their corporate sustainability strategies and stakeholders' requirements. The diffusion of ISO 50001, however, is geographically disproportionate, with the overwhelming majority of ISO 50001 certifications being in Europe (over 80%) and Asia (about 10%) (see Figure 8). ISO 50001 take-up in the U.S. is very low (47 certifications). The extremely small number of certified sites is evidence that either the standards are not suitable for the vast majority of U.S. companies, or that the way they have been promoted is unsuitable.

As for the proliferation of SEP, DoE's target market for 2023 is to get to 1,000 SEP-certified facilities.[49] There are currently 43 SEP-certified facilities in the U.S., so reaching 1,000 by 2023 would require an average compound annual growth rate of 70%. That seems highly unlikely.

[49] McKane, Aimee, Peter Therkelsen, Alice Napoleon, Jennifer Kallay and Kenji Takahashi. "Superior energy standard: Guide for the Development of Energy Efficiency Program Plans." Prepared for the U.S. Department of Energy Lawrence Berkeley National Laboratory, 2015. Web <https://betterbuildingssolutioncenter.energy.gov/resources/superior-energy-performance-sep-guide-development-energy-efficiency-program-plans> 29 Jan. 2018.

FIGURE 8: DISTRIBUTION OF ISO 50001 CERTIFICATIONS WORLDWIDE



	2011	2012	2013	2014	2015	2016
Africa	0.0%	0.6%	0.7%	0.3%	0.3%	0.3%
Central / South America	2.4%	0.4%	0.7%	0.9%	0.8%	0.4%
North America	0.2%	0.4%	0.7%	1.1%	0.6%	0.4%
Central and South Asia	5.7%	3.4%	3.9%	4.4%	3.8%	3.3%
Middle East	1.7%	0.8%	1.3%	1.3%	1.1%	0.8%
Europe	79.3%	85.8%	82.7%	81.7%	84.7%	84.6%
East Asia and Pacific	10.7%	8.5%	9.9%	10.2%	8.6%	10.3%

Source: International Organizations for Standardization. ISO 2017 Survey of Certifications. "ISO 50001—data per country and sector—2011 to 2016" (excel dataset with graphs). Available at: https://isotc.iso.org/livelink/livelink?func=ll&objId=18808772&objAction=browse&viewType=1

Proponents view EMSs as an innovative and effective means to motivate industry to improve energy efficiency and reduce greenhouse gas emissions.[50] While EMSs may be a useful tool for larger, energy-intensive facilities, it is not clear that they will be able to achieve this wider objective given their limited applicability to smaller scale, less energy-intensive facilities.

ISO 50001 and SEP currently are primarily targeted at and benefit only a small number of large energy users. As such, DOE's involvement in their development and promotion is effectively a subsidy to these large firms, with limited if any benefits to the wider economy or the environment. Moreover, the DOE is crowding out alternative private providers, such as the American National Standards Institute (ANSI), that might otherwise take a more active role.

Even with DOE's involvement, private companies are beginning to get more involved in implementation. Recently, Schneider Electric started offering consulting services (EcoStruxure Energy and Sustainability Services) to help industrial consumers with their implementation process of ISO 50001.

If the DOE were to cease its involvement in ISO 50001 and SEP, it is possible that private standards-setting bodies such as ANSI would develop a range of energy management system standards that would be suitable for firms and facilities of varying sizes and complexity. (This might include ANSI or another organization taking over SEP as a standard for large industrial users—if it deemed the standard to be suitable.) Absent the DOE's involvement, industrial producers and consumers will determine whether such standards are useful or not.

[50] Price, Lynn, Ernst Worrell, Jonathan Sinton and Jiang Yun. "Voluntary agreements for increasing energy-efficiency in industry: case study of a pilot project with the steel industry in Shandong Province, China." (2003). Web < https://escholarship.org/uc/item/6mr9h4v5> 29 Jan. 2018.

ABOUT THE AUTHORS

Krisztina A. Pusok is a research associate at Reason Foundation. Krisztina's work focuses on environment and energy policies, and the regulation of innovations and technologies in the agri-food sector.

Krisztina completed her Ph.D at the University of Missouri, where she conducted extensive research on public-private partnerships and voluntary industry standards. She has had responsibility for building partnerships with non-profit organizations, the private sector, and academic research institutions, as well as engaging students in finding sustainable solutions to hunger. Krisztina also has a master's degree in international security studies from University of St Andrews in the U.K. and a bachelor's degree in international relations and international business from Webster University in Austria.

Julian Morris is vice president of research at Reason Foundation. He has written extensively on the law and economics of innovation, risk regulation, and environmental protection. He is the author, most recently, of *The WHO's Opposition to Tobacco Harm Reduction: A Threat to Public Health? The Paris Agreement: An Assessment,* and *CAFE and ZEV Standards: Environmental Effects and Alternatives*.

In addition to his role at Reason, Julian is a Senior Scholar at the International Center for Law and Economics and a Fellow of the Royal Society of Arts. He previously founded and ran International Policy Network, was a Visiting Professor at the University of Buckingham,

a member of the Council of the School of Pharmacy, and director of the environment and technology program at the Institute of Economic Affairs.

Julian graduated from the University of Edinburgh with a degree in economics, has master's degrees from University College London and the University of Cambridge, and a law degree from the University of Westminster.