The Role of Energy Efficiency in Deep Decarbonization

by Kit Kennedy

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Summary

The Deep Decarbonization Pathways Project Report calls for major increases in building and equipment efficiency to reduce U.S. greenhouse gas emissions by at least 80 percent from 1990 levels by 2050. While the U.S. Department of Energy efficiency standards program is one of the most successful U.S. policies in driving energy savings, carbon reductions, and consumer savings, it will need to be made even stronger and an integrated suite of additional and more ambitious energy-efficiency laws and regulations at the federal, state, and local level will be needed to meet this goal. Additional action from private actors, such as utilities and businesses, will also be necessary. This Article, excerpted from Michael B. Gerrard & John C. Dernbach, eds., *Legal Pathways to Deep Decarbonization in the United States* (forthcoming in 2018 from ELI Press), discusses the various legal and policy pathways at the federal, state, and local levels to ensure that the energy efficiency of residential, commercial, and industrial products continues to improve at the scale and speed necessary to meet the "80% by 2050" goal.

I. Introduction

The Deep Decarbonization Pathways Project (DDPP) report emphasizes the major increase in building and equipment efficiency that will be needed to reduce U.S. greenhouse gas (GHG) emissions by at least 80% from 1990 levels by 2050.[1] This Article will discuss legal and policy pathways at the federal, state, and local levels to ensure that the energy efficiency of residential, commercial, and industrial products, including lighting, consumer electronics, and computer servers, continues to improve at the scale necessary to meet this "80% by 2050" goal.

The DDPP policy report observes that in a decarbonized energy system, investment in clean technologies such as high-efficiency appliances and equipment will need to increase sixfold in residential buildings and triple in commercial buildings.[2] The DDPP policy report also notes that some of the fundamental paradigms behind energy-efficiency standards and other energy-efficiency policies will need to adjust in order to help drive deep decarbonization. These include such potential changes as shifting from a focus on reducing primary energy use to a focus on reducing carbon emissions, and incentivizing fuel switching from fossil fuel-derived natural gas to renewable gas and electrification, as the electric grid is increasingly decarbonized.

Today, residential appliances, commercial appliances, industrial equipment, and lighting products account for a significant percentage of U.S. energy use and carbon emissions.[3] The residential and commercial end-use sectors

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1. James H. Williams et al., Energy and Environmental Economics, Inc. et al., Pathways to Deep Decarbonization in the United States, US 2050 Report, Volume 1: Technical Report xiv (2015), *available at* http://usddpp.org/downloads/2014-technical-report.pdf. A 2017 Natural Resources Defense Council (NRDC) report, *America's Clean Energy Frontier: The Pathway to a Safer Climate Future* (Vignesh Gowrishankar & Amanda Levin), *available at* https://www.nrdc.org/resources/americas-clean-energy-frontier-pathway-safer-climate-future, finds even greater potential for energy efficiency. The NRDC report concludes that the United States can meet its 2050 climate goals based primarily on clean energy technologies, including by implementing energy-efficiency technologies and systemwide approaches to reduce total U.S. energy demand by 40%.
2. James H. Williams et al., Energy and Environmental Economics, Inc. et al., US 2050 Report, Volume 2: Policy Implications of Deep Decarbonization in the United States 24 (2015), *available at* http://usddpp.org/downloads/2015-report-on-policy-implications.pdf. In residential buildings, investment in clean technologies will increase from $35 billion annually today to $220 billion in 2050, and in commercial buildings, the increase will be from $70 billion annually today to $210 billion annually in 2050.
3. Residential appliances comprise products used in the home such as refrigerators, air conditioners, clothes washers, and dishwashers. Commercial prod-

accounted for 21% and 18%, respectively, of carbon dioxide (CO_2) emissions from fossil fuel combustion in 2014.[4] Both sectors rely chiefly on electricity for meeting energy demands, with 68% and 75%, respectively, of their emissions attributable to electricity consumption for lighting, heating, cooling, and operating appliances; the remaining emissions were due to natural gas and petroleum consumption for heating and cooking.[5] Carbon emissions from the residential and commercial sectors have increased by 16% and 24%, respectively, since 1990.[6] The increase in carbon emissions from the residential sector reflects an increase in the number of U.S. households and associated square footage. Energy intensity per household has declined during this period due in large part to increased energy efficiency of household products; structural shifts in the residential sector also play a large part.[7]

In both the residential and commercial sectors, growth in electricity consumption has slowed over the past 15 years and is expected to slow even further. Residential electricity sales grew just 1.1% per year from 2000-2015, according to the U.S. Energy Information Administration (EIA) of the U.S. Department of Energy (DOE).[8] In its 2016 reference case, EIA predicts that residential sales will grow at an even lower rate, just 0.3% per year through 2040, noting that increases in residential efficiency, particularly in lighting (as well as increased deployment in rooftop solar), will offset expected growth in the number of U.S. households and increased electricity use for cooling and other miscellaneous uses.[9]

Commercial-sector electricity sales also grew just 1.1% per year from 2000-2015 and EIA predicts that the growth rate will decline to 0.8% annually through 2040 as energy-efficiency improvements in lighting and refrigeration, increased deployment of on-site solar, and commercial combined heat and power (CHP) systems partially offset electricity increases from computers and miscellaneous uses.[10] For the industrial sector, electricity sales increased by 0.7% per year from 2000-2015 and EIA predicts that industrial electricity sales will increase by 1.1% per year from 2015-2040 due to expected increases in industrial activity.[11]

The challenge addressed in this Article is to identify legal pathways to improve the efficiency of residential, commercial, and industrial appliances and equipment at much faster rates than EIA assumes in order to achieve the U.S. decarbonization goals set forth in the DDPP. The primary focus is on mandatory energy-efficiency standards at the federal and state levels. The DOE standards program, described in Part II, is one of the most successful U.S. energy-efficiency policies in driving energy savings, carbon reductions, and consumer savings. Further strengthening federal and state energy-efficiency standards will play a critical role in driving the needed efficiency investments. Appliance, product, and equipment efficiency standards (often simply referred to as "appliance standards" or "energy-efficiency standards") require that specific products achieve a minimum level of energy or water efficiency. At the national level, these standards are set either by the U.S. Congress or DOE, and are then periodically reviewed and updated by DOE.

The federal energy-efficiency standards program covers consumer, commercial, and industrial products, as well as lighting in all three categories.[12] Under federal law, federal efficiency standards generally preempt state standards for federally regulated products, with some significant exceptions, as discussed in Part II.D. But a number of states currently maintain active programs mandating minimum efficiency levels for products not covered by the federal program and these programs have also proven successful. Establishing enforceable, minimum energy-efficiency standards for appliances and products helps to overcome market barriers to energy efficiency, including consumer lack of information and "split incentives" such as the differing economic incentives with respect to energy efficiency for landlords, who tend to purchase appliances for their ten-

ucts comprise products used in businesses such as commercial air conditioning systems and walk-in coolers and freezers. Industrial products comprise products used in manufacturing such as motors and air compressors.

4. U.S. Environmental Protection Agency, Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2014, at 2-13, ES-12 (2016) (EPA 430-R-16-002) (explaining that electricity consumption for lighting, heating, cooling, and operating appliances accounts for 68% and 75%, respectively, of carbon emissions from the residential and commercial end-use sectors, which respectively account for 21% and 18% of U.S. carbon emissions from fossil fuel consumption), *available at* https://web.archive.org/web/20160808153417/https://www3.epa.gov/climatechange/Downloads/ghgemissions/US-GHG-Inventory-2016-Main-Text.pdf.
5. *Id.*
6. *Id.*
7. U.S. Energy Information Administration, Drivers of U.S. Household Energy Consumption, 1980-2009 (2015), *available at* https://www.eia.gov/analysis/studies/buildings/households/pdf/drivers_hhec.pdf. Note that the U.S. Energy Information Administration (EIA) reference case includes implementation of the Clean Power Plan.
8. EIA, Annual Energy Outlook 2016 Early Release: Annotated Summary of Two Cases 18 (2016), https://www.eia.gov/outlooks/aeo/er/pdf/0383er(2016).pdf.
9. *Id.*; *see also* EIA, *U.S. Energy Demand Slows Except for Industrial, Commercial Sectors*, Today in Energy, Apr. 29, 2015, http://www.eia.gov/todayinenergy/detail.cfm?id=21012.
10. *Id.*
11. *Id.*
12. Consumer products covered under the Energy Policy and Conservation Act (EPCA) can be found at 42 U.S.C. §6295. The statute defines a "consumer product" as a product that "in operation consumes, or is designed to consume, energy or . . . water; and . . . which, to any significant extent, is distributed in commerce for personal use or consumption by individuals." *Id.* §6291(l). Commercial and industrial products covered by EPCA are found at EPCA §§342 and 346 and 10 C.F.R. pt. 431. "Industrial equipment" includes products that (1) in operation consume, or are designed to consume energy; (2) are distributed in commerce for industrial or commercial use to any significant extent; and (3) are not covered under the consumer product program. 42 U.S.C. §6311(2)(A)(i).

ants and may prefer to buy the cheapest models, and renters, who typically pay the energy bills and may favor the most energy-efficient models.[13]

Policies requiring mandatory minimum energy-efficiency standards are most effective if they are integrated with other legal approaches that help to incentivize the development and accelerate the penetration of increasingly efficient products. As a result, this Article also discusses legal pathways that encourage energy efficiency in ways that complement energy-efficiency standards, including labeling programs such as the federal ENERGY STAR® program, which encourage consumers to purchase products that are more efficient than federal minimum standards; financial incentives such as tax credits, which reward consumers for purchasing more-efficient products and manufacturers for producing them; state utility energy-efficiency programs, which accelerate the uptake of efficient products by making it easier for utility customers to make their homes and businesses more efficient; and voluntary industry approaches to encourage industry and businesses to make their operations and products more efficient for business reasons. When well-integrated and synchronized, this suite of legal pathways, combined with mandatory energy-efficiency standards, creates a virtuous cycle where the energy efficiency of appliances and products is ever improving, as today's voluntary premium energy-efficient products lead to tomorrow's mandatory standards.

For greater context—and because these policies also drive energy efficiency in appliances and products, this Article also touches on legal pathways that limit carbon pollution, establish overarching energy-efficiency goals, and reform the way that utilities are regulated. Carbon policies encourage energy efficiency by putting a price on carbon and requiring power plant owners to internalize the pollution and public health impacts of fossil fuel generation. Some carbon policies also create revenue streams for energy efficiency. Overarching energy-efficiency goals require all segments of the economy to become more efficient and reforming utility regulation helps to align utility business interests with energy efficiency.

In sum, to meet the scale of the deep decarbonization challenge, an integrated suite of additional and more ambitious energy-efficiency laws and regulations will be needed at the federal, state, and local levels to drive the necessary energy-efficiency investments, and additional action will be needed from private actors such as utilities and businesses. Given the threatened rollbacks of climate and clean energy laws, regulations, and standards under the current presidential administration and Congress, greater and more ambitious effort will be needed at the state, local, and private levels to continue to make progress until the federal government is ready to lead again.

13. John Dernbach, Acting as if Tomorrow Matters: Accelerating the Transition to Sustainability 198-99 (2012).

II. Federal Energy-Efficiency Standards: Regulatory Framework

A. *The DOE Energy-Efficiency Standards Rulemaking Process*

The Energy Policy and Conservation Act (EPCA),[14] as amended, requires DOE to set new or amended standards at the highest efficiency level that is "technologically feasible and economically justified."[15] In deciding whether a standard is economically justified, EPCA provides that DOE must consider seven factors: (1) the economic impact of the standard on manufacturers and consumers of the product; (2) the savings in operating costs throughout the estimated average life of the covered product compared to any increase in price that is likely to arise from the adoption of the standard; (3) the total projected amount of energy or (as applicable) water savings likely to result from the implementation of the standard; (4) any lessening of the utility or performance of the covered product likely to result from implementation of the standard; (5) the impact of any lessening of competition among manufacturers, as determined by the attorney general, that is likely to result from the imposition of the standard; (6) the need for national energy and water conservation; and (7) any other factors DOE considers relevant.[16]

DOE may not issue a new or revised standard if it determines that the standard will not result in "significant" conservation of energy or water.[17] Likewise, DOE may not issue a standard that would make certain basic product characteristics like performance, reliability, or capacity unavailable in the market.[18] As noted above, DOE must issue standards at the highest energy-efficiency level that is technologically feasible and economically justified.[19] To ensure that energy-efficiency standards become continually stronger over time as technology improves, EPCA also contains an "antibacksliding" provision that prohibits the Secretary from prescribing an amended standard that would increase the energy or water use of a covered product.[20]

EPCA requires DOE to consider strengthening existing energy-efficiency standards at regular intervals, given that technology improves over time. Under the original legisla-

14. 42 U.S.C. §§6201 et seq. References to EPCA in this Article refer to the appliance efficiency standards provisions of EPCA, which are found at *id*. §§6291-6309 (consumer products) and §§6311-6317 (industrial and commercial products). DOE's implementing regulations for these provisions of EPCA are found at 10 C.F.R. pts. 430 (residential products) and 431 (industrial and commercial products).
15. 42 U.S.C. §6295(o)(2); *see also* Natural Res. Def. Council v. Herrington, 768 F.2d 1355, 15 ELR 20781 (D.C. Cir. 1985).
16. 42 U.S.C. §6295(o)(2)(B)(I)-(VII) (consumer products); 42 U.S.C. §6313(a)6)(B)(ii) (commercial and industrial products).
17. *Id*. §6295(j)(3)(B)(I).
18. *Id*. §6295(o)(4) (consumer products); 42 U.S.C. §6313(a)(6)(B)(iii)(II)(aa) (commercial and industrial products).
19. *Id*. §6295(o)(2).
20. *Id*. §6295(o)(1) (consumer products); 42 U.S.C. 6313(a)(6)(B)(iii)(I) (commercial and industrial products); *see also* Natural Res. Def. Council v. Abraham, 355 F.3d 179 (2d Cir. 2004) (holding that EPCA's antibacksliding provision prevents DOE from weakening an energy-efficiency standard after it has been published in the *Federal Register*).

tion, DOE was typically required to update each standard twice by specified mandatory deadlines. Under a provision added by EISA in 2007, DOE is required to review each existing standard at least once every six years.[21] This provision requires DOE, by six years after the last final rule, to issue either a proposed rule or a determination not to change the standard. If DOE issues a proposed rule, it must issue the final rule within two years.[22] DOE also has the authority to establish standards for new product categories if DOE determines that they present opportunities for significant energy savings.[23] DOE is also generally required to review the testing procedures used to assess a product's compliance with efficiency standards every seven years.[24] In practice, DOE undertakes many standard-setting rulemakings concurrently with rulemakings that establish or revise testing procedures.[25]

Rulemakings to set or revise efficiency standards for each appliance generally go through a process with four phases, each of which provides an opportunity for public input.[26] In the first phase, DOE publishes a framework document that outlines the legal authority and analytical and procedural principles that will guide the rulemaking for that particular product.[27] DOE solicits comments on specific questions related to that product and framework document. In the second phase, DOE conducts a preliminary analysis of the technical and economic characteristics of a particular product, publishes its analysis of the impacts of potential revised standards, and requests public comments.[28] In the third phase, DOE issues a notice of proposed rulemaking (NOPR) that proposes a minimum efficiency level for the product, which must meet all of the required statutory criteria discussed above, including that this efficiency level is the highest that is technologically feasible and economically justified.[29] In the final phase, DOE considers additional public comments on the NOPR and issues the final rule, establishing a mandatory efficiency standard.[30]

This four-phase rulemaking process generally takes about three years to complete. The statute generally requires that the resulting final rule give manufacturers three to five years to comply with the new standard.[31] Although most efficiency standards go through this process, a significant number of efficiency rules result from consensus agreements between manufacturers and efficiency advocates, reflecting the key historical role of such agreements in the development of national efficiency standards.

The mandatory six-year periodic review of existing standards is designed to allow DOE to adopt stronger energy-efficiency rules in response to medium-term changes in technology, market dynamics, and consumer preferences that result in the potential for greater efficiency levels. In addition, the statute authorizes DOE to make shorter term adjustments to standards as needed in response to special circumstances or rapid changes in equipment technology. Specifically, if a manufacturer believes the current DOE testing procedures do not accurately reflect a product's energy use in light of changes to a product's features or design, it may petition DOE for a waiver.[32] Smaller manufacturers—those with annual gross revenues below $8 million—can apply for a temporary exemption from part or all of a standard for a specific product.[33]

DOE has on several occasions undertaken efforts to review and improve its process for developing appliance efficiency standards. In 1996, the Department published guidance that, among other things, provided greater detail on its rulemaking process and the considerations employed to develop or amend standards.[34] The stated goals of this guidance included increasing the predictability of rulemaking, providing for full consideration of nonregulatory (i.e., voluntary) approaches, and broadly streamlining and increasing the transparency of the rulemaking process.[35]

A product may become subject to a federal efficiency standard through legislation, or through a DOE determination to classify it as a "covered product," subject to specific findings made on the basis of a rulemaking.[36] DOE also has some latitude to interpret the scope of a currently covered product class more expansively. However, in a 2013 case, *Hearth, Patio & Barbecue Ass'n v. U.S. Department of Energy*, the D.C. Circuit signaled that there are limits on DOE's ability to include new products in existing standards through an expanded definition of the product class. In 2009, DOE proposed a rule that would have made "vented hearth heaters" subject to the efficiency standard for "direct heating equipment," which had been created by Congress.[37] The proposed rule defined "direct heating equipment" to include gas heaters that simulate fireplaces but to exclude decorative fireplaces that do not provide

21. 42 U.S.C. §6295(m)(1)-(2) (residential products); *id*. §6313(a)(6)(C)(i) (industrial and commercial products).
22. *Id*. §6295(m)(3) (residential products); *id*. §6313(a)(6)(C)(iii) (commercial and industrial products).
23. *Id*. §6295(o)(6)(D)(i)(I) (residential products); see also a similar authority granted to the Secretary for commercial and industrial products, 42 U.S.C. §§6311(1)(L), 6312(b).
24. *Id*. §§6293(b)(3), 6314(a)(1)(A). The statute also provides that when DOE finds that the additional cost to the consumer will be less than three times the value of the energy and water savings during the first year of the new standard, there is a rebuttable presumption that the standard is economically justified.
25. DOE Energy Conservation Program for Consumer Products: Test Procedure for Ceiling Fans Notice of Proposed Rulemaking, 10 C.F.R. §439 (2014).
26. DOE EERE, *Standards Development and Revision*, http://energy.gov/eere/buildings/standards-development-and-revision (last visited Oct. 8, 2017).
27. *Id*.
28. *Id*.
29. *Id*.
30. *Id*.
31. 42 U.S.C. §6295 (consumer products); 42 U.S.C. §6313 (commercial and industrial products).
32. 10 C.F.R. §431.401(a)(1) (2014) and *id*. §430.27(a)(1) (2014) (describing regulations applicable to test procedure waivers for commercial equipment and appliances, respectively).
33. 42 U.S.C. §6295(t).
34. 10 C.F.R. §430, app. A to subpt. C. This is often referred to as the "Process Improvement Rule," but is guidance, rather than a rule, as noted in §§1 and 5(a)(2) of app. A.
35. *Id*. at §1.
36. 42 U.S.C. §§6292(a)(20), (b) (consumer products); 42 U.S.C. §§6311(1)(L), 6312(b) (commercial and industrial products).
37. 706 F.3d 499, 502, 43 ELR 20034 (D.C. Cir. 2013).

significant amounts of heat. The following year, however, DOE issued a final rule that differed from the proposed rule.[38] The final rule included a broader definition of "vented hearth heaters" that included decorative fireplaces, but then exempted from the efficiency standards "purely decorative" fireplaces, by way of a safe harbor based on four criteria.[39]

Industry groups challenged this rule, and the D.C. Circuit agreed, finding that Congress' unambiguous intent in EPCA and its subsequent amendments was to exclude decorative fireplaces from the class of "direct heating equipment."[40] The court rejected the idea that providing a safe harbor for decorative fireplaces was equivalent to excluding decorative fireplaces from the definition of the covered class of products. The safe-harbor approach, the court observed, was a form of "backdoor regulation" because manufacturers would need to redesign decorative fireplaces to comport with the four safe-harbor criteria.[41] The court emphasized that DOE was authorized to establish a new standard for decorative fireplaces, but only by undergoing the established process for adding a new product category to the group of "covered products."

B. Carbon Benefits and Co-Benefits of Federal Energy-Efficiency Standards

The DOE energy-efficiency standards program has helped consumers and businesses achieve significant reductions in energy consumption. According to DOE data, the efficiency standards currently in place are expected to save 70 quadrillion Btu (quads)[42] of energy by 2020 and 132 quads through 2030.[43] For consumers, these energy savings translate to $63 billion in savings on their energy bills in 2015, and $2 trillion in cumulative energy bill savings through 2030.[44] As noted above, federal standards save 5.3 quads annually, making the DOE program the second most significant energy-efficiency policy in terms of energy savings.[45]

These efficiency savings translate into significant reductions in carbon emissions. As described above, President Obama made efficiency standards a cornerstone of his Climate Action Plan and set and achieved a goal of reducing carbon emissions by three billion metric tons by 2030 through energy-efficiency standards.[46] According to the Appliance Standards Awareness Project (ASAP), standards already completed will provide about 20% of the emissions reductions that would be needed for the United States to meet its 2025 target under the Paris Agreement on climate change (if the current planned withdrawal of the United States from the agreement is not effectuated or if the United States eventually rejoins the agreement).[47]

A common concern regarding proposed appliance standards is that they will increase the up-front costs of affected products. However, recent historical experience has not shown this to be the case; on the contrary, the cost of many covered products comes down after DOE standards come into effect. A 2013 study of nine rulemakings found that DOE's projections consistently overestimated the price increase resulting from new or updated standards.[48] Whereas DOE predicted an average price increase of $148 across the nine product classes, the average actual change in price was a *decrease* of $12.[49] For some big-ticket appliances, the long-term gains in affordability after the establishment of appliance standards have been even more striking. For example, the average price of a household refrigerator, adjusted for inflation, has fallen by about half since refrigerators first became subject to California's efficiency standard in 1978 even as the average volume of refrigerators has increased by about 18%.[50]

C. Benefits of Energy-Efficiency Standards for Low-Income Consumers

In addition to analyzing up-front product costs in general, recent DOE rulemakings have also analyzed the impact of standards specifically on low-income households, senior-only households, and households living in multifamily housing. These consumer subgroup analyses take into account the specific energy-consumption characteristics of these households, which tend to spend a larger share of their income on energy bills, and generally find that efficiency standards are beneficial for the majority of low-income and senior households because the reduction

38. *Id.*
39. *Id.* at 504.
40. *Id.*
41. *Id.* at 508.
42. A Btu is a commonly used measure of the heat content of fuels. It is the quantity of heat required to raise the temperature of one pound of liquid water by one degree Fahrenheit at the temperature that water has its greatest density (approximately 39 degrees Fahrenheit). A quadrillion Btu (known as a quad) is 1 followed by 15 zeros Btu of energy. As an example, the United States as a whole used about 98 quads of energy in 2013. *See* EIA, *Energy Units and Calculators Explained—British Thermal Units (Btu)*, https://www.eia.gov/energyexplained/index.cfm?page=about_btu (last updated June 13, 2017).
43. John Cymbalsky, DOE, Appliance and Equipment Standards Program 4 (2016), https://energy.gov/sites/prod/files/2016/04/f30/Cymbalsky%2C%20John_Standards.pdf. *Id.*
44. *Id.*
45. Appliance Standards Awareness Project (ASAP), *Appliance Standards Rank as #2 Energy-Saving Tool in US*, https://appliance-standards.org/image/appliance-standards-rank-2-energy-saving-tool-us (last visited Oct. 8, 2017).
46. DOE, Secretary Ernest Moniz Cabinet Exit Memo 3 (2017), https://www.energy.gov/sites/prod/files/2017/01/f34/Department%20of%20Energy%20Cabinet%20Exit%20Memo.pdf.
47. Andrew deLaski et al., ASAP & American Council for an Energy-Efficient Economy, Next Generation Standards: How the National Energy Efficiency Standards Program Can Continue to Drive Energy, Economic, and Environmental Benefits 2 (2016), *available at* https://appliance-standards.org/sites/default/files/Next%20Gen%20Report%20Final_1.pdf. Many of the legal pathway recommendations in this chapter are drawn from this comprehensive report.
48. Steven Nadel & Andrew deLaski, ASAP & American Council for an Energy-Efficient Economy, Appliance Standards: Comparing Predicted and Observed Prices 17 (2013), *available at* http://www.appliance-standards.org/sites/default/files/Appliance_Standards_Comparing_Predicted_Expected_Prices.pdf.
49. *Id.* at iv.
50. ASAP, Average Household Refrigerator Energy Use, Volume, and Price Over Time (2016), https://appliance-standards.org/sites/default/files/refrigerator_graph_Nov_2016.pdf.

in energy bills for these households outweighs any increase in the first cost of the product.[51]

Energy-efficiency standards are also particularly important for renters and families living in multifamily housing—groups that are statistically more likely to be low-income—because they overcome an obstacle to energy efficiency known as the "split incentive" problem. Renters typically do not have the ability to select or control the types of appliances and equipment found in their homes and yet they usually pay the energy bills associated with them. On the other hand, landlords typically select and pay for appliances, while not paying the utility bills, which means that they do not have an incentive to invest in anything but the cheapest equipment they can purchase. Minimum efficiency standards protect renters by ensuring that any appliance purchased by a landlord will meet a minimum energy-efficiency threshold.[52] Energy-efficiency standards also have a host of non-energy benefits for consumers and low-income consumers, including increased comfort and service as well as reduced air pollution.[53]

D. Federal Preemption and State Energy-Efficiency Standards

EPCA, as amended by NAECA, contains preemption provisions that generally prevent states from establishing state energy-efficiency standards that are higher than those set at the federal level, with a number of important exceptions. The statute provides that national standards preempt state regulations "concerning the energy efficiency, energy use or water use" of a product covered by a federal standard.[54] The definition of a state "regulation" is any "law, regulation or other requirement" of a state or its subdivisions.[55]

In general, federal preemption bars state regulation of any federally covered product, even before a federal efficiency standard takes effect (meaning the effective date specified in the *Federal Register* for codification in the *Code of Federal Regulations*).[56] However, there are a number of exceptions to this timing rule, including a significant exception for states with preexisting state energy-efficiency standards: these standards may stay in effect until the compliance date of a federal standard.[57] Two additional significant exceptions to federal preemption under EPCA are discussed below. The statute also includes several specific exemptions from preemption, such as many that apply to the timing of certain California and other state energy-efficiency standards.[58]

1. State Efficiency Standards for Products That Are Not Federally Regulated

Because EPCA's preemption provisions only apply to products that are covered by the federal program, states are free to establish energy-efficiency standards for products that are not regulated by the federal government. State efficiency standards play an important role in increasing the efficiency of product categories that are not covered by the federal efficiency program. As described below, California's appliance energy-efficiency standards program is the most comprehensive and well established, but as of May 2017, the District of Columbia and 10 other states including New York and Texas have enacted at least one energy and water efficiency standard for a product not covered by a federal standard.[59]

The efficiency savings achieved by these state standards can be substantial. California, the first American jurisdiction to establish appliance standards, continues to have the most active state efficiency standards program and to serve as a model for other states. In 2014, the California Energy Commission (CEC) issued draft regulations for 15 new efficiency standards for products not regulated by the federal government. These were projected to save 9,800 gigawatt hours (gWh) of electricity a year, and result in annual savings of $2 billion. As of May 2017, CEC had finalized state efficiency standards for most of these products.[60]

51. *See* Lauren Urbanek, *Standards Ease Energy Burden for Low Income Families*, NRDC, June 21, 2016, https://www.nrdc.org/experts/lauren-urbanek/standards-ease-energy-burden-low-income-families.
52. For a discussion of the importance of energy-efficiency standards for renters in overcoming the split incentive problem, see Mark Cooper, Consumer Federation of America, Energy Efficiency Performance Standards: The Cornerstone of Consumer-Friendly Energy Policy (2013), *available at* http://www.consumerfed.org/pdfsf/Energy_Efficiency_Performance_Standards_Report.pdf.
53. *Id.* at 38-39.
54. 42 U.S.C. §6297.
55. *Id.* §6297(a)(2)(A); *see generally* Alexandra B. Klass, *State Standards for Nationwide Products Revisited: Federalism, Green Building Codes, and Appliance Efficiency Standards*, 34 Harv. Envtl. L. Rev. 335 (2010), *available at* http://scholarship.law.umn.edu/cgi/viewcontent.cgi?article=1036&context=faculty_articles.
56. 42 U.S.C. §6297(b).
57. *Id.* §6295(ii).
58. *See*, *e.g.*, *id.* §6297(b)(1)(A).
59. ASAP, Energy and Water Efficiency Standards Adopted by State (2016), http://www.standardsasap.org/sites/default/files/State_status_grid.pdf. The states that have enacted such standards are Arizona, California, Colorado, Connecticut, Georgia, Maryland, New Hampshire, New York, Oregon, Rhode Island, Texas, and Washington, as well as the District of Columbia. EPA's SEE Action program has developed a helpful guide for state appliance standards programs. *See* U.S. EPA, Energy and Environment Guide to Action: State Policies and Best Practices for Advancing Energy Efficiency, Renewable Energy, and Combined Heat and Power sec. 4.4 (2015) (EPA 430-R-15-003), *available at* https://www.epa.gov/sites/production/files/2015-08/documents/guide_action_full.pdf.
60. These included standards for faucets, toilets, and urinals; air filters and dimming ballasts; light-emitting diode (LED) and multifaceted reflector (MR) lamps; pool pump motors and portable electric spas; computers, monitors, and displays; network equipment; and commercial clothes dryers. The standards for toilets, urinals, and faucets were approved by the Office of Administrative Law on May 15, 2015, following an Executive Order issued by the governor speeding up the process. *See* CEC, Notice of Filing and Printing Only and STD. 400 Notice Publication/Regulation Submission, Docket No. 15-AAER-04 (May 2015), http://docketpublic.energy.ca.gov/PublicDocuments/15-AAER-04/TN204662_20150519T152407_Notice_of_Filing_and_Printing_Only_and_STD_400_Notice_Publicati.pdf. *See also* CEC, Final Statement of Reasons and Updated Informative Digest Proposed Amendments to Appliance Efficiency Regulations, Commission, Docket No. 15-AAER-1 (July 2016), http://docketpublic.energy.ca.gov/PublicDocuments/15-AAER-01/TN212057_20160701T135801_Updated_FSORballastsairfilters.pdf. The standards for computers, monitors, and displays were adopted by CEC on December 14, 2016. *See* CEC, Resolution Adopting Regulations, Resolution, Docket No. 16-1214-7 (Dec. 2016), http://docketpublic.energy.ca.gov/PublicDocuments/16-AAER-02/TN214895_20161219T113702_Resolution_No_1612147.

In April 2017, CEC announced the start of an appliance efficiency rulemaking process for eight additional products, with plans to set energy and/or water efficiency standards for five products (commercial and industrial fans and blowers, sprinkler spray bodies, tub spout diverters, irrigation controllers, and general service lamps). For another three products (set-top boxes, low-power mode and power factors, and solar inverters), CEC plans to establish energy-efficiency road maps, working with stakeholders, which will result in white papers that set forth a policy pathway for increasing efficiency in these products with milestones for increased product efficiency over time. CEC will track progress toward these road map milestones and may convert them to appliance standards over time if progress is not made.[61]

Since the early 2000s, California's investor-owned utilities have emerged as influential advocates for new state efficiency standards, as part of California's overall commitment to energy efficiency as a key energy resource and means to combat climate change.[62] Under California statute, the California Public Utilities Commission (CPUC) is mandated "to meet unmet resource needs with all available energy efficiency and demand reduction that is cost-effective, reliable and feasible."[63] To do that, CPUC sets energy-efficiency goals for investor-owned utilities. Since 2005, CPUC has allowed its utilities to count, toward their overall programmatic efficiency savings targets, some of the savings from their work to advocate for state and federal efficiency standards.[64]

Additionally, CEC requires manufacturers to certify that their products comply with DOE's federal energy-efficiency standards as well as with state energy-efficiency standards,[65] and provides that each federal energy-efficiency standard will be adopted as California state law in the event that a federal standard is "repealed or becomes inoperable, inapplicable, or otherwise invalid as federal law."[66] Similarly, in May 2017, the Vermont Legislature enacted, and Vermont Gov. Phil Scott signed into law, legislation that adopts current federal energy-efficiency standards for appliances and equipment, "so that the same standards will be in place in Vermont should the federal standards be repealed or voided."[67] This is an important precedent that other states should follow.

2. Exemptions From EPCA's Federal Preemption Provisions

As noted above, there are several ways for states to adopt regulations concerning a federally covered product without triggering preemption. The two most significant pathways are discussed below.

First, EPCA provides that states may request from DOE a waiver from preemption that would allow the adoption of a more-stringent state-level standard. The state requesting a waiver must demonstrate "unusual and compelling" state or local interests, which must in turn be "substantially different in nature or magnitude than those prevailing in the United States generally."[68] This requires a showing that the costs, benefits, burdens, and reliability of the savings resulting from the state standard make state-level regulation "preferable or necessary" compared to alternative approaches.[69]

State requests for preemption waivers are rare: as of this writing, only two states have ever made such a request and both were rejected.[70] However, in one of these cases—a request by California for a waiver from a federal clothes washer standard—DOE's denial of the waiver was reversed and remanded by the U.S. Court of Appeals for the Ninth Circuit, which found that California had indeed demonstrated that a waiver was warranted.[71] However, ultimately, California did not need to pursue a state standard for clothes washers because DOE issued a federal clothes washer energy-efficiency standard that met California's needs.[72]

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pdf. The standards for air filters and dimming ballasts were approved by the Office of Administrative Law on June 30, 2016. *See* CEC, 2015 Appliance Efficiency Rulemaking for HVAC Air Filters, Dimming Fluorescent Ballasts, and Heat Pump Water Chilling Packages, Docket No. 15-AAER-01 (July 2016), http://docketpublic.energy.ca.gov/PublicDocuments/15-AAER-01/TN212511_20160729T153716_OAL_Approval_2015_Appliance_Efficiency_Rulemaking.pdf. The standards for LED and MR lamps were issued in January 2016. *See* News Release, CEC, Energy Commission Adopts Lighting Standards to Save Californians More Than $4 Billion in Electricity Costs (Jan. 27, 2016), http://www.energy.ca.gov/releases/2016_releases/2016-01-27_adoption_of_lighting_standards_nr.html. Rulemakings are underway for portable electric spas, pool pumps and motors, and commercial clothes dryers. *See* CEC, *Current Appliance Efficiency Rulemakings*, http://www.energy.ca.gov/appliances/rulemaking.html (last visited Oct. 8, 2017). For a complete list of CEC appliance efficiency standard regulations, see CEC, 2016 Appliance Efficiency Regulations (2017) (CEC-400-2017-002), *available at* http://www.energy.ca.gov/2017publications/CEC-400-2017-002/CEC-400-2017-002.pdf.

61. CEC, Invitation to Participate in Phase II Pre-Rulemaking (May 2017), http://docketpublic.energy.ca.gov/PublicDocuments/17-AAER-05/TN217523201705 10T135340_Invitation_to_Participate_Presentation.pdf.
62. National Association of Clean Air Agencies, Implementing EPA's Clean Power Plan: A Menu of Options 14-7 (2015), *available at* http://www.4cleanair.org/sites/default/files/Documents/NACAA_Menu_of_Options_LR.pdf.
63. Cal. Pub. Util. Code §454.5; CPUC, Regulating Energy Efficiency (2016), *available at* http://www.cpuc.ca.gov/uploadedFiles/CPUC_Public_Website/Content/News_Room/Fact_Sheets/English/Regulating%20Energy%20Efficiency%200216.pdf.
64. *Id.*; *see also* Adam Cooper & Lisa Wood, Institute for Electric Efficiency, Integrating Codes and Standards Into Electric Utility Energy Efficiency Portfolios (2011), *available at* http://www.edisonfoundation.net/iei/publications/Documents/IEE_IntegratingCSintoEEPortfolios_final.pdf.
65. Cal. Code Regs. tit. 20, §1608(g).
66. *Id.* §1605(a)(2). In 2005, the U.S. Court of Appeals for the Ninth Circuit upheld this and related provisions from a federal preemption challenge brought by appliance manufacturers. Air Conditioning & Refrigeration Inst. v. Energy Res. Conservation & Dev. Comm'n, 410 F.3d 492, 35 ELR 20026 (9th Cir. 2005).
67. An Act Related to Miscellaneous Energy Issues, Act No. 42, H. 411 (Vt. 2017), http://legislature.vermont.gov/assets/Documents/2018/Docs/ACTS/ACT042/ACT042%20Act%20Summary.pdf.
68. 42 U.S.C. §6297(d).
69. *Id.*
70. State Petitions for Exemption From Federal Preemption, https://energy.gov/eere/state-petitions-exemption-federal-preemption (last visited Dec. 12, 2017).
71. California Energy Comm'n v. U.S. Dep't of Energy, 585 F.3d 1143, 1155 (9th Cir. 2009).
72. 77 Fed. Reg. 32308, 32309 (May 31, 2012).

Second, under certain circumstances, EPCA exempts from preemption state energy building codes that include pathways that encourage the installation of products at higher efficiency levels than required by federal standards, such as super-efficient furnaces or heating, ventilation, and air conditioning products (HVAC) equipment, so long as the state building energy code meets seven criteria.[73] The scope of this preemption exemption for state building energy codes and the showing needed to establish these factors have been litigated in two challenges to building energy codes in the past decade. At the core of these building code preemption disputes is the issue of whether the building code offers alternative compliance pathway options that meet the criteria for building code preemption exemption or whether the pathway that includes super-efficient equipment is in effect the only available or practicable option, in violation of the third criterion, which prohibits state building energy codes that "require" product efficiency levels higher than federal standards.[74]

In 2007, the city of Albuquerque, New Mexico, enacted a building efficiency code that allowed builders and renovators to choose among three compliance options, or "pathways." Two of the three pathways were "performance-based," hinging respectively on Leadership in Energy and Environmental Design (LEED) certification and on achieving energy-efficiency levels that were 30% higher than that of a baseline building. The third compliance pathway was based on the efficiency of specific building components, including HVAC products.[75]

The heating and cooling manufacturer trade association Air-Conditioning, Heating, and Refrigeration Institute, joined by a group of HVAC manufacturers and distributors, challenged the code, and the U.S. District Court for the District of New Mexico granted a preliminary injunction in favor of the plaintiffs, in part because it found that the code "required" a covered product to have an efficiency standard higher than that required by federal law.[76] As a result, the court found that the code violated one of the seven statutory conditions for an exemption from preemption, and was therefore preempted by federal law.

Specifically, the court found that the third compliance pathway was a per se violation of the statutory requirement that a local code not "require" an efficiency level higher than the federal standard. Although the court was less certain about the performance-based compliance pathways, it was persuaded by the plaintiffs' claim that these pathways would in practice also require builders to purchase products with efficiency levels higher than those mandated by the federal standard. By way of example, the court explained that under the Albuquerque code, a homeowner who replaced a furnace with a federally compliant furnace would be forced to make additional changes to the home in order to comply with the local code.[77] Significantly, when designing and writing its building code, Albuquerque appeared to be unaware of, or did not focus on, EPCA's preemption provisions and the seven factors that would need to be demonstrated for the code to be exempted from provision.[78] The court ultimately granted summary judgment to the plaintiffs on their preemption claims.[79]

In contrast, the state of Washington designed and adopted a state building energy code in 2009 with EPCA's preemption provisions clearly in mind and, as a result, prevailed against a similar EPCA federal preemption challenge.[80] Washington's amended 2009 code offered builders three avenues for compliance, two of which encouraged builders to choose from among a menu of energy reduction methods. Several of these methods included purchasing products with higher efficiency levels than the federal standard, but others did not.[81]

In 2009, various building industry associations and other companies sued the Washington State Building Code Council, alleging that the part of the code that involved use of super-efficient equipment was preempted by EPCA. A federal district court rejected the preemption challenge and dismissed the complaint.[82] The Ninth Circuit affirmed the following year.[83]

Washington's code allowed builders to select from three compliance pathways: (1) a system analysis performance pathway; (2) a building envelope trade off performance pathway; and (3) a prescriptive requirements pathway. Builders who opted for pathway 2 or 3 achieved their compliance score by choosing from 13 different options contained in Chapter 9 of the code.[84] For example, the builder could install particular types of high-efficiency HVAC equipment, construct an efficient envelope, or meet certain air leakage thresholds.[85]

The district court found that the Washington code included compliance options that would not "require" the use of covered products more energy-efficient than the federal baseline,[86] and thus did not run afoul of EPCA's second preemption exemption criterion. Of the 13 options provided to builders, only four concerned products exceeding EPCA's energy conservation standards, leaving ample room for builder discretion.[87] In addition, the district court held that the fact that the other building code compliance pathways may cost builders more money than the

73. 42 U.S.C. §6297(f)(3).
74. *Id.* §6297(f)(3)(B).
75. Air Conditioning, Heating & Refrigeration Inst. v. City of Albuquerque, No. 08-633, 2008 WL 5586316, at *2 (D.N.M. Oct. 3, 2008).
76. *Id.* at *11.
77. *Id.* at *8.
78. *Id.* at *12.
79. Air Conditioning, Heating & Refrigeration Inst. v. City of Albuquerque, 835 F.2d 1133 (D.N.M. 2010).
80. Building Indus. Ass'n v. Washington State Bldg. Code Council, 683 F.3d 1144, 1148 (9th Cir. 2012) (*Washington II*).
81. *Id.* at 1149.
82. Building Indus. Ass'n v. Washington State Bldg. Code Council, No. 3:10-cv-05373-RJB, 2011 U.S. Dist. Lexis 12316, at *41 (W.D. Wash. Feb. 7, 2011) (*Washington I*).
83. *Washington II*, 683 F.3d at 1155.
84. *Washington I*, 2011 U.S. Dist. Lexis 12316, at *4.
85. *Id.*
86. *Id.* at *9.
87. 42 U.S.C. §6297(f)(3)(E); *Washington I*, 2011 U.S. Dist. Lexis 12316, at **13-14.

super-efficient pathway, does not mean that the super-efficient pathway is "required" or trigger preemption in and of itself.[88]

In affirming the district court's decision, the Ninth Circuit observed, "[s]everal options under Chapter 9 call for higher efficiency covered products . . . and the remaining options do not. Builders can choose. They do not have to use higher efficiency products."[89] The Ninth Circuit also rejected the plaintiffs' contention that the costs associated with the less-efficient options effectively "coerced" builders into selecting more energy-efficient products.[90] Unlike the Albuquerque code, Washington did not impose any penalties on builders who chose not to use high-efficiency products. Therefore, no coercion occurred.[91]

In its analysis of the third requirement for exemption from preemption, the court explained that it means a building code must "give credits in proportion to energy use savings without favoring particular products or methods."[92] Washington's credit system was based on a well-known computer model, against which plaintiffs offered no credible evidence.[93] In accepting the state's methods, the court noted that "in EPCA, Congress recognized that some variation will be inevitable" and "reductions of energy consumption in different contexts can be compared meaningfully only through quantitative estimates."[94] The state's methodology produced values that were proportionate enough to satisfy this standard.[95]

Some commentators have observed that the distinction between the two codes is so subtle as to be unclear,[96] and that states or localities therefore face uncertainty about how to ensure that their building codes do not "require"—through a combination of their textual provisions and economic practicalities—the purchase of higher efficiency products. However, Washington's building code was considerably more sophisticated and better supported than Albuquerque's. The contrasting fates of the two codes also underlines the importance of designing and drafting building energy-efficiency codes with EPCA's preemption provisions clearly in mind and ensuring that there is a robust and clear record reflecting that the seven criteria for preemption exemption have been considered and met. More broadly, the larger menu of compliance options provided by the Washington code suggests that giving builders more choices and flexibility will insulate building codes from arguments that are preempted because they "require" higher efficiency products.

88. *Washington I*, 2011 U.S. Dist. Lexis 12316, at *29.
89. *Washington II*, 683 F.3d at 1151.
90. *Id.*
91. *Id.* at 1152.
92. *Id.* at 1153.
93. *Id.* at 1153-54.
94. *Id.* at 1154.
95. *Id.* at 1155.
96. *See, e.g.*, Shari Shapiro, *Decision in* BIA v. Washington *Does Not Clarify When Energy Efficient Codes Are Preempted by Federal Law*, Green Building L., July 13, 2012, http://www.greenbuildinglawblog.com/2012/07/articles/litigation/decision-in-bia-v-washington-does-not-clarify-when-energy-efficient-codes-are-preempted-by-federal-law/; Jeffrey Pike, *A Tale of Two Codes: The Influence of* Albuquerque *and* Washington *on Green Building*, 41 B.C. Envtl. Aff. L. Rev. 201 (2014), *available at* http://lawdigitalcommons.bc.edu/ealr/vol41/iss1/6.

III. Legal Pathways for Scaling Up Appliance and Product Energy Efficiency

The federal government, states, cities, and the private sector all have important roles in scaling up energy efficiency. This part discusses and recommends legal pathways to increase energy efficiency in residential, commercial, and industrial products for each of these entities. Part III.A. covers legal pathways for the federal government (including both legislative and administrative approaches) to increase appliance energy efficiency, including through establishing carbon policies, overarching energy-efficiency goals, and through reforms to the federal energy-efficiency standards program.

Part III.B. covers legal pathways for state governments to increase appliance energy efficiency, again including both legislative and administrative approaches and addressing the full gamut of policies, including policies to limit carbon pollution; establishing overall efficiency goals; improving utility regulatory design to incentivize utilities to encourage energy efficiency; expanding utility energy-efficiency programs; strengthening state building energy codes; and establishing state energy-efficiency standards. Part III.C. describes legal pathways for cities and localities to encourage energy efficiency. Part III.D. addresses legal pathways for industry, businesses, and utilities to increase energy efficiency for themselves and their customers.

A. *Energy-Efficiency Legal Pathways: Federal Government*

The federal government has a major role to play in both encouraging and mandating energy efficiency. The recommendations below discuss: (1) **overarching and complementary legal pathways** for the federal government to encourage energy efficiency; and (2) **specific legal pathways** to establish stronger federal energy-efficiency standards for products.

1. Overarching and Complementary Federal Energy-Efficiency Legal Pathways

While this Article focuses on recommendations for legal pathways on energy-efficiency standards for appliances and equipment, at the outset, it is important to review briefly the overarching and complementary legal approaches to decarbonization that will help to incentivize the deployment of energy efficiency. Scaling up energy efficiency requires both mandatory measures—such as energy-efficiency standards and mandatory energy-efficiency goals—and voluntary measures—such as energy-efficiency labeling and incentive programs. Policymakers should carefully integrate and synchronize these two different approaches so that they

create a virtuous cycle: initial mandatory standards establish a minimum efficiency floor, then voluntary measures lead to further innovation and higher levels of efficiency, which then allows higher mandatory efficiency standards to be established.

❑ *Federal carbon policy*. Realizing the full potential of energy efficiency in the United States will require that the country move forward with legal pathways on carbon regulation and carbon pricing so that the true costs of fossil fuel power generation are visible. As of this writing, the Clean Power Plan adopted by EPA under the Obama Administration has been stayed by the U.S. Supreme Court and the Trump Administration EPA has proposed a rule to repeal it.[97] Ultimately, however, in order to achieve deep decarbonization goals, the United States will need to implement the Clean Power Plan, or a similar set of requirements based on the Clean Air Act's requirements with respect to limiting carbon pollution from new and existing power plants. The United States will also need to do more to address methane pollution from oil and gas production.[98] Congress should also consider enacting a carbon tax as an additional strategy for promoting decarbonization (but not in lieu of full implementation of the Clean Air Act or complementary federal energy-efficiency policies).

❑ *Federal energy-efficiency legislation*. Congress has the power to mandate or encourage energy efficiency in a number of ways in addition to EPCA's energy-efficiency standards requirements that would be complementary to EPCA and encourage deeper levels of appliance and equipment efficiency.

First, Congress should enact legislation to create a federal energy-efficiency resource standard (EERS), which would be a national energy-efficiency goal for electric and natural gas utilities. It could also include savings from improved building codes and equipment efficiency standards, CHP, and distribution system efficiency. The American Council for an Energy-Efficient Economy (ACEEE) has advocated for a national EERS with a goal of 20% electricity and 12% natural gas savings by 2030, including savings from efficiency programs, improved building codes and equipment standards, CHP, and distribution system efficiency gains. ACEEE estimates that federal EERS legislation with these goals could save the United States more than 5 quads of energy annually or about 5.55% of the total energy consumed in 2015. CO_2 emissions reductions would total almost 300 million metric tons in 2030—equivalent to taking 47 million automobiles off the road. Consumers would cumulatively save a net $145 billion in lower energy bills by 2040 (net present value after investments) and the bill would also create 400,000 net jobs in 2030.[99]

Federal EERS legislation should also establish specific goals for energy-efficiency savings from the low-income sector in order to ensure that utilities invest in energy efficiency in affordable, multifamily buildings and in efficiency programs geared toward low-income consumers. In 2015, the American Energy Efficiency Act[100] was introduced in the Senate, and a similar bill was introduced in the House. It proposed a 20% electricity savings and 13% natural gas savings target by 2030 (with annual added savings rising to 1.75% for electricity and 1% for gas).[101]

Second, Congress should use tax policy to promote energy efficiency by providing tax credits for energy-efficient appliances, equipment, and buildings and by removing tax policies that discourage energy efficiency and promote the use of fossil fuels. Prior to 2017, a number of federal energy-efficiency tax incentives were in place, including: (1) a 10% tax credit to homeowners for efficiency improvements, up to $500; (2) a tax credit for builders for constructing homes that use 50% less energy (compared to the 2006 International Energy Conservation Code) for heating and cooling and a $1,000 tax credit for newly manufactured homes that achieve 30% energy savings for heating and cooling or meet ENERGY STAR requirements; and (3) a tax credit that encouraged energy efficiency in commercial and multifamily buildings. However, all of these tax incentives expired at the end of 2016.[102]

Congress should reenact and consider strengthening these tax credits to increase the credit and to increase the energy savings levels associated with the credit. Congress should also remove disincentives to energy efficiency from the tax code, with a focus on rules that require efficiency investments, such as high-efficiency heating and air conditioning systems and lighting, to be depreciated over decades, sometimes up to 40 years.[103]

Third, Congress should expand funding and ensure full implementation of key federal low-income energy programs, including the Low Income Home Energy Assistance Program, which primarily provides energy bill assistance for low-income consumers, and the Weatherization Assistance Program (WAP), which addresses the longer term energy needs of low-income homeowners by making repairs that reduce energy bills, such as installing insulation and air sealing, and sometimes includes upgrades or repairs to heating and cooling systems.[104] About 81%

97. Proposed Rule, *Repeal of Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units*, 82 Fed. Reg. 48035 (Oct. 16, 2017); *see also* Lisa Friedman & Brad Plumer, *E.P.A. Announces Repeal of Major Obama-Era Carbon Emissions Rule,* N.Y. Times, *at* https://www.nytimes.com/2017/10/09/climate/clean-power-plan.html?_r=0 (last visited Oct. 7, 2917).
98. U.S. EPA, *Clean Air Act Overview—Air Pollution: Current and Future Chal lenges*, https://www.epa.gov/clean-air-act-overview/air-pollution-current-and-future-challenges (last updated June 7, 2017).
99. ACEEE, Energy Efficiency Resource Standard (EERS) (2016), http://aceee.org/sites/default/files/eers-121316.pdf.
100. S. 1063, 114th Cong. (2015).
101. ACEEE, *Energy Efficiency Resource Standard (EERS)*, http://aceee.org/topics/energy-efficiency-resource-standard-eers (last visited Oct. 8, 2017).
102. *Energy Efficiency Tax Incentives to Expire on December 31, 2016*, Alliance to Save Energy, Dec. 22, 2016, http://www.ase.org/resources/energy-efficiency-tax-incentives-expire-december-31-2016.
103. ACEEE, Executive Summary: Tax Reforms to Advance Energy Efficiency 1 (2013), *available at* http://aceee.org/files/pdf/summary/e132-summary.pdf.
104. U.S. Department of Health and Human Services Office of Community Services, *Low Income Home Energy Assistance Program (LIHEAP)*, https://www.acf.hhs.gov/ocs/programs/liheap (last visited Oct. 8, 2017); New York

of federal low-income program support goes to bill assistance and about 14% of program support goes to energy-efficiency measures.[105] Increased investment in federal low-income energy-efficiency programs could complement low-income bill assistance by increasing energy affordability.[106] A typical year in WAP operations delivers $340 million in energy savings, supports 8,500 jobs, and has a program-wide benefit-cost ratio of 4:1.[107] Yet President Trump's proposed FY18 budget would eliminate the WAP program altogether.[108]

2. Federal Energy-Efficiency Appliance and Equipment Standards: Legislative and Regulatory Pathways

This section recommends a number of legal pathways to strengthen the federal energy-efficiency standards program described above in Part II.

❑ *Make preemption more flexible*. The issue of preemption in efficiency standards presents a policy tradeoff. On the one hand, a more flexible preemption system would allow states greater autonomy to set policies consistent with their environmental and economic policy needs and to continue their role as laboratories of new efficiency standards. On the other hand, a stronger preemption system provides the nationwide uniformity and certainty that manufacturers believe that they need to make long-term planning decisions and avoid the complexities that could be caused by a "patchwork" of multiple state standards.

Even bearing this balance in mind, a more flexible preemption system would have many advantages. Not only would it open the door to higher standards and greater efficiency savings in some states, but may also accelerate adoption of higher standards at the federal level. Indeed, many of the products currently covered by federal standards were first subject to state standards.[109] Moreover, as discussed above, across many different administrations, DOE has fallen behind on issuing and updating energy-efficiency standards, causing significant backlogs. This means that stronger federal efficiency standards that would be technologically and economically justified are not adopted, and yet states are still preempted from regulating these products. Under a more flexible preemption system, state leadership could continue to play a constructive role even in product categories already covered by federal standards, by providing proof that higher standards are commercially, technically, and administratively feasible.

In practice, a more flexible preemption provision could take various forms. One option would be to amend EPCA's federal preemption provisions[110] to allow multiple states to set a shared standard different from the federal standard. This would mitigate the concerns about a 50-state patchwork by limiting the number of state standards and maintaining some uniformity across states.[111] At the same time, it would open the door to collaborative standards among neighboring states, such as higher standards for air conditioning in warm-weather states, as well as to collaboration among like-minded states interested in higher efficiency standards. Several such states already cooperate on standards for non-preempted products under the Multi-state Appliance Standards Collaborative.[112]

Another option would be to expand the use of so-called "sunset" provisions, meaning a legislative provision that expires by a specified date. In this context, a sunset provision could provide for automatic waiver from preemption if DOE fails to issue a final rule for a specific product by a certain deadline. Such sunset provisions may be particularly helpful to mitigate the stifling impact of federal preemption during periods when DOE rulemaking has stalled.

A third approach would be to amend EPCA to change the methodology that DOE must follow in setting a new or updated standard. Specifically, the current methodology that bases standards on a balance of technical and economic feasibility could be replaced with a methodology that bases standards on the most efficient products on the market. This much more aggressive approach, a version of which has been adopted in Japan, provides a strong incentive for manufacturers to ramp up investments in energy efficiency.[113]

❑ *Broaden DOE's authority to cover new products*. DOE may establish standards for additional consumer products not already covered by EPCA through a rulemaking process if certain criteria are met.[114] Similarly, DOE may establish standards for additional commercial and industrial products through a rulemaking process.[115]

State Homes and Community Renewal, *Weatherization Assistance Program (WAP)*, http://www.nyshcr.org/Programs/WeatherizationAssistance/ (last visited Oct. 8, 2017). The LIHEAP authorizing statute is found at 42 U.S.C. §§8621-8630; the WAP authorizing statute is found at *id*. §§6861-6873.

105. Ariel Drehobl & Lauren Ross, Energy Efficiency for All & ACEEE, Lifting the High Energy Burden in America's Largest Cities: How Energy Efficiency Can Improve Low Income and Underserved Communities 26-28 (2016), *available at* http://energyefficiencyforall.org/sites/default/files/Lifting%20the%20High%20Energy%20Burden_0.pdf.

106. *Id*. at 31.

107. News Release, Alliance to Save Energy, Alliance to Save Energy Calls for Congress to Reject Budget Proposal (May 23, 2017), http://www.ase.org/news/alliance-save-energy-calls-congress-reject-budget-proposal.

108. *Id*.

109. California Energy Commission, Energy Efficiency Standards in CA (2012), http://www.energy.ca.gov/appliances/documents/CAEnergyEfficiencyStandards.pdf.

110. EPCA's general preemption provision is found at 42 U.S.C. §6297(c). As discussed above, EPCA also provides for a number of exceptions and exemptions from preemption.

111. Alexandra B. Klass, *State Standards for Nationwide Products Revisited: Federalism, Green Building Codes, and Appliance Efficiency Standards*, 34 Harv. Envtl. L. Rev. 335, 359 (2010), *available at* http://scholarship.law.umn.edu/cgi/viewcontent.cgi?article=1036&context=faculty_articles.

112. Multi-State Appliance Standards Collaborative, *Homepage*, http://www.appliancestandards.org/ (last visited Oct. 8, 2017).

113. *See* Yutaka Nagata, Energy Efficiency Standards for Japanese Appliances 9-236 (2006), http://www.eceee.org/static/media/uploads/site-2/library/conference_proceedings/ACEEE_buildings/2006/Panel_9/p9_21/paper.pdf.

114. 42 U.S.C. §6292(b).

115. 42 U.S.C. §§6311(1)(L); 6312(b).

But confusingly, DOE's ability to establish standards for additional consumer products not listed in EPCA could be read to be constrained by another statutory provision, which states that the average per household energy use by the product must exceed 150 kilowatt hours (kWh) per year, in addition to meeting a separate threshold for aggregate national energy use and several other requirements.[116] However, miscellaneous electrical loads from relatively small appliances—such as DVD players, audio equipment, and set-top boxes—are a growing portion of energy consumption but may not individually meet the required threshold for coverage.[117] Congress should consider clarifying this issue and providing a lower standard, perhaps 75 kWh per year, to give DOE more flexibility to encourage efficiency gains in this growing area of loads.

❑ *Explicitly authorize multiple efficiency metrics*. In many cases, a single metric does not accurately capture the efficiency of products that consume, for example, both electricity and water. Several standards established directly by Congress already include multiple metrics, such as both energy use and water use for clothes washers.[118] However, with respect to standards set by DOE, the department has generally interpreted EPCA as preventing the department from issuing a new standard with multiple metrics.[119] Some legislators have floated amendments that would eliminate this uncertainty and expressly grant DOE the authority to issue standards with multiple metrics, but no such amendment has been enacted.[120] Congress should grant DOE this authority. The technical and market feasibility of meeting such a standard would still be subject to the "economically justified" test at the rulemaking phase.[121]

❑ *Reduce compliance lead times for amended standards*. Currently, EPCA requires that DOE must provide specified compliance lead times after publication of a final rule for manufacturers to prepare to comply with an amended efficiency standard—this period must be three years for certain categories of products and five years for others.[122] Additionally, EPCA requires a five-year compliance lead time period for efficiency standards for all newly covered products.[123] EPCA should be amended to give DOE the discretion to establish shorter compliance lead times when needed and appropriate, which would provide for faster adoption of higher efficiency products, and might be appropriate for products with shorter design cycles, such as computers. EPCA provides for three-year lead times for currently covered products, and even shorter lead times have been shown to work in California. The minimum compliance lead time for standards established by CEC is one year.[124]

❑ *Continue establishing and updating currently authorized standards*. Simply by maintaining current practices and updating standards for currently covered products—assuming currently available technology, test procedures, and rulemaking methodologies—DOE could achieve an additional reduction of 4.3 quads and 200 metric tons of CO_2 annually by 2050 according to a 2016 analysis by ASAP.[125]

There is significant potential for additional efficiency gains even in product areas that have already seen multiple updates to their efficiency standards. Six of the top 10 covered products with the highest potential efficiency gains, as calculated by ASAP, have already been subjected to multiple updates.[126] This is due in part to the fact that certain large appliances, such as refrigerators, have large annual sales volume and continue to account for a large proportion of energy use by homes or businesses.[127] It is also a testament to the fact that manufacturers continue to invent new ways of improving the efficiency of these big-ticket products.

To tap into this potential for further efficiency gains, DOE should take two sets of actions. First, DOE should continue to update existing standards promptly, as required by EPCA's statutory schedule of deadlines for amended standards, including the six-year review process described above. Congress should approve budgets for DOE's Appliance Standards and Building Codes Program at a level sufficient to support the staff and resources needed to complete these rulemakings on time. Second, DOE should make full and active use of its statutory authority to classify additional consumer products as covered products when the statutory criteria for coverage, described above, are met. Following these recommendations would also ensure that consumers would continue to save more money on lower energy bills, increasing overall consumer purchasing power and strengthening the U.S. economy as well as lowering carbon emissions.

116. *See id*. §6295(l); *but see id*. §6292(b) (allowing DOE to establish new groups of covered products with a lower threshold).
117. *See generally* EIA, Analysis and Representation of Miscellaneous Electrical Loads in NEMS 1 (2017), *available at* https://www.eia.gov/analysis/studies/demand/miscelectric/pdf/miscelectric.pdf.
118. 42 U.S.C. §6295(g).
119. *Appliance Standards Improvement Act of 2009: Hearing on S. 598 Before the Senate Committee on Energy and Natural Resources*, 111th Cong. 16 (2009) (statement of Steven Nadel, Executive Director, ACEEE), https://www.gpo.gov/fdsys/pkg/CHRG-111shrg49840/html/CHRG-111shrg49840.htm.
120. *See*, *e.g.*, Press Release, Senator Bob Menendez, In Preparation for Hearing on Appliance Energy Efficiency Standards, Menendez Details Amendments He May Pursue in Legislation (Mar. 20, 2009), https://www.menendez.senate.gov/news-and-events/press/in-preparation-for-hearing-on-appliance-energy-efficiency-standards-menendez-details-amendments-he-may-pursue-in-legislation.
121. *Appliance Standards Improvement Act of 2009: Hearing on S. 598 Before the Senate Committee on Energy and Natural Resources*, 111th Cong. 16 (2009) (statement of Steven Nadel, Executive Director, ACEEE), *supra* note 119.
122. 42 U.S.C. §6295(m)(4)(A)(ii). For most industrial and commercial products, amendments apply the later of either three years after publication of the final rule establishing the standard or six years after the effective date of the current standard. 42 U.S.C §6313(a)(6)(C)(iv).
123. *Id*. §6295(l)(2).
124. *See*, *e.g.*, Letter From Dave Ashuckian, Deputy Director, Efficiency Division, CEC (June 30, 2016) (Air Filters, Deep Dimming Ballast, and Heat Pump Water-Chilling Packages Regulations: Implementation and Frequently Asked Questions), http://www.energy.ca.gov/appliances/documents/Deep_dimming_ballast_outreach_letter.pdf.
125. deLaski et al., *supra* note 47, at vi.
126. *Id*. at 16.
127. *Id*.

❑ *Continue to use the social costs of carbon in rulemaking.* DOE currently monetizes benefits from carbon reductions in the cost-benefit analyses that accompany its rules, using the values developed by the Interagency Working Group (IWG) on the Social Cost of Carbon (SCC).[128] The IWG developed these values in an effort to create uniformity in federal agencies' use of SCC values.[129] The IWG released initial SCC values in 2010 and revised them upwards in May 2013.[130]

As discussed above, EPCA requires DOE to establish energy-efficiency standards "to achieve the maximum improvement in energy efficiency" that is "technologically feasible and economically justified."[131] In considering whether an efficiency standard is "economically justified," DOE must consider seven factors including "the need for national energy . . . conservation" and "other factors the Secretary considers relevant."[132] DOE first included carbon costs in considering the economic justification for efficiency standards in a proposed rulemaking for cooking products in 2008.[133] DOE has used the IWG SCC values in most energy-efficiency standards rulemakings since 2010, using the revised IWG SCC values in its rulemakings since 2013.[134] To date, to the author's knowledge, DOE has never relied on SCC to select an energy-efficiency level for an efficiency standard that was not already cost-justified based on other, non-carbon factors.[135]

Some stakeholders have argued that the IWG SCC calculations understate the true cost of carbon emissions.[136] On the other hand, industry groups and other critics of DOE's use of SCC in efficiency standards rulemaking criticize it on various methodological points, claiming that it is inappropriate to consider global carbon reduction benefits in efficiency standards rulemaking, and that the purported carbon reduction benefits are speculative and diffuse, whereas the increase in consumers' up-front costs is concrete and immediate.[137]

DOE could allow SCC to play a more central role in rulemaking by including it in consideration of whether a new standard is "economically justified." Specifically, EPCA authorizes the Secretary to assess economic justification by considering, inter alia, "other factors the Secretary considers relevant."

This may open the door to rules that would be more aggressive or better geared toward carbon reductions. Still, absent other changes to DOE's mandate, the resulting standards themselves would need to be defined in terms of primary energy use, rather than carbon reductions.

In a 2016 decision, *Zero Zone, Inc. v. U.S. Department of Energy*,[138] the U.S. Court of Appeals for the Seventh Circuit addressed these critiques and approved DOE's utilization of SCC in EPCA appliance energy-efficiency standards rulemakings. In March 2014, DOE published new energy-efficiency standards for commercial refrigeration equipment (CRE) pursuant to EPCA.[139] It used the 2013 SCC to generate the value of emissions per year per metric ton avoided,[140] and included this result as an environmental benefit in its analysis as to whether the rule was economically justified.[141] Several manufacturers and manufacturer trade associations brought petitions for review challenging the new CRE efficiency standards rule on both substantive and procedural grounds.[142] Among them, the petitioners argued that EPCA does not allow DOE to consider environmental factors, including the SCC. The court rejected these arguments and ruled in favor of DOE on all claims, denying the petitions for review in their entirety.

Most significantly, the Seventh Circuit held that the agency did not act arbitrarily and capriciously by considering SCC in determining whether the new rule was economically justified.[143] The court found that EPCA "specifically *requires* DOE to consider 'the need for national energy . . . conservation'" as part of its analysis of

128. The 2013 IWG consisted of the Council of Economic Advisers, the Council on Environmental Quality, the Departments of Agriculture, Commerce, Energy, and Transportation, EPA, the National Economic Council, the Office of Management and Budget, the Office of Science and Technology Policy, and the Department of the Treasury. *See* IWG SCC, Technical Support Document: Technical Update of the Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866, at 1 (2013), https://web.archive.org/web/20150224163136/https://www.whitehouse.gov/sites/default/files/omb/inforeg/social_cost_of_carbon_for_ria_2013_update.pdf.

129. U.S. Government Accountability Office, Regulatory Impact Analysis: Development of Social Cost of Carbon Estimates 5-6 (2014) (GAO-14-663), *available at* http://www.gao.gov/assets/670/665016.pdf.

130. *Id.* at 7.

131. 42 U.S.C. §6295(o)(2)(A); *see also* Natural Res. Def. Council v. Herrington, 768 F.2d 1355, 1362, 15 ELR 20781 (D.C. Cir. 1985).

132. 42 U.S.C. §6295(o)(2)(B)(i).

133. *See* Notice of Proposed Rulemaking and of Public Meeting, 73 Fed. Reg. 62033, 62109-11 (Oct. 17, 2008).

134. *See* Energy Conservation Standards for Standby Mode and Off Mode for Microwave Ovens, 78 Fed. Reg. 36316, 36318 (June 17, 2013).

135. Typically, the economic benefits of a proposed DOE energy-efficiency standard outweigh the economic costs even before monetized SCC values are added to the benefits side of the equation. *See, e.g.*, Brief for Respondents at 34, Zero Zone, Inc. v. U.S. Dep't of Energy, 832 F.3d 654, 46 ELR 20137 (7th Cir. 2016) (explaining that the economic savings of revised energy-efficiency standards for commercial refrigeration products outweighed the economic costs even before factoring the monetized benefits of SCC); Denial of Landmark Legal Foundation Petition for Reconsideration, 78 Fed. Reg. 79643, 79646 (Dec. 31, 2013) (in denying a petition for reconsideration claiming that DOE's use of SCC values in the microwave oven rulemaking was in error, DOE notes that while SCC values "may or may not" affect DOE's final determination in energy-efficiency standards rulemaking, in this instance the SCC analysis did not impact DOE's determination of the standard because the economic benefits of the rule outweighed the costs even without consideration of SCC).

136. *See, e.g.*, Comment Letter From Environmental Defense Fund et al., to Lucy deButts & Elizabeth Kohl, DOE 4 (May 16, 2014) (Notice of Proposed Rulemaking for Energy Conservation Standards for General Service Fluorescent Lamps and Incandescent Reflector Lamps), http://policyintegrity.org/documents/Final_Joint_Comments_to_DOE_on_SCC.pdf.

137. *See, e.g.*, *Home Appliance Energy Efficiency Standards Under the Department of Energy—Stakeholder Perspectives: Hearing Before the Subcommittee on Energy and Power of the House Committee on Energy and Commerce*, 114th Cong. (2016) (prepared statement of Sofie E. Miller, Senior Policy Analyst, George Washington University Regulatory Studies Center), http://docs.house.gov/meetings/IF/IF03/20160610/105034/HHRG-114-IF03-Wstate-MillerS-20160610.pdf.

138. *Zero Zone, Inc.*, 832 F.3d 654.

139. *Id.* at 660.

140. Energy Conservation Standards for Commercial Refrigeration Equipment, 79 Fed. Reg. 17726, 17777 (Mar. 28, 2014).

141. *Zero Zone, Inc.*, 832 F.3d at 666.

142. *Id.* at 667.

143. *Id.*

economic justification of an energy-efficiency standard.[144] Noting that DOE had explained that consideration of this factor includes the potential environmental benefits from such energy savings, of which SCC forms an essential part, the court held that "[w]e have no doubt that Congress intended that DOE have the authority under EPCA to consider the reduction in SCC."[145] The court similarly found that DOE's use of the IWG SCC values was neither arbitrary nor capricious, rejecting methodological concerns to the IWG analysis raised by the petitioners, and finding that DOE's response to these concerns was reasonable and supported by the record.[146]

Next, petitioners attacked DOE's cost-benefit analysis, claiming that DOE overestimated the benefits afforded by the new standards, while underestimating the costs. Specifically, they contended that DOE arbitrarily considered long-term benefits, but not costs.[147] In rejecting that argument, the court approved DOE's explanation that while the overall national impact was calculated relative to equipment shipped over a 30-year period, the impact of energy savings necessarily extends until all equipment shipped during that period is retired from the market.[148] Regarding CO_2 emissions reduction, SCC's discount rate concentrates the benefits of carbon reduction over a long period into an annual value, such that these long-term benefits are in fact compared to the costs of achieving these reductions year by year within the 30-year period.[149] Finally, the court noted DOE reasonably concluded that "the reduction of carbon over thirty years would have long-term effects on the environment but that the increased costs over thirty years would not have long-term effects on employment."[150] DOE did not "ignore" these costs, although the petitioners disagreed with its conclusions.

Petitioners further argued that DOE inappropriately considered global benefits but only domestic costs.[151] DOE answered that GHG emissions create global externalities and that the United States cannot solve climate change alone.[152] Therefore, the benefits of carbon reduction have global effects that can be appropriately considered.[153] Petitioners were unable to identify any global costs that ought to have been balanced against these benefits.[154] The court thus found that "DOE acted reasonably when it compared global benefits to national costs."[155]

In sum, the *Zero Zone* decision not only strongly affirmed DOE's use of SCC in its consideration of whether a new energy-efficiency standard is economically justified, but also, through its holding that DOE is required to consider the need for national energy conservation in establishing efficiency standards, made clear that DOE must take SCC values into account in its rulemakings.

The Trump Administration, however, has indicated that it is moving in a different direction on use of the SCC. On March 28, 2017, President Trump issued an Executive Order entitled Presidential Executive Order on Promoting Energy Independence and Economic Growth, which directed federal agencies to take a number of actions to undo climate and clean energy policies established by President Obama.[156] Section 5 of this Executive Order directed that "[t]he Interagency Working Group on Social Cost of Greenhouse Gases (IWG) . . . shall be disbanded" and that the IWG's documents providing SCC calculations "shall be withdrawn as no longer representative of governmental policy."[157]

However, despite this Executive Order, the IWG SCC findings still stand and are based on scientific evidence and conclusions that continue to be valid. Moreover, the Seventh Circuit's *Zero Zone* decision, requiring use of the SCC in DOE efficiency standards rulemakings, is also unaffected by the Executive Order. As a result, DOE will expose itself to a high degree of legal risk if it chooses to ignore the SCC in future efficiency standards rulemakings.

Moving forward, the next administration should make the use of SCC in DOE's energy-efficiency standards more consistent. In at least some instances, DOE has determined that higher energy-efficiency standards are not economically justified without considering SCC values.[158] DOE should consider SCC values consistently in all of its efficiency rulemakings and determinations.

❑ *Define the scope of current standards more expansively.* Although the D.C. Circuit's decision in *Hearth, Patio & Barbeque Ass'n* set some limits on the ability of DOE to interpret currently authorized product categories expansively, DOE has some flexibility to extend coverage of existing standards to products that are currently excluded. DOE should consider exercising that authority. For example, the current standards for small motors apply only to specific motor technologies, and could be expanded to include others. Other product areas subject to existing standards whose scope could be extended include fluorescent lamps, commercial electric lights, and CRE.[159]

144. *Id.* at 677. While not reaching this issue, the court also noted that:
> DOE probably also had the authority to consider environmental benefits under 42 U.S.C. §6295(o)(2)(B)(i)(l), which allows the agency to consider "the economic impact of the standard on the manufacturers and on the consumers of the products subject to such standard." Environmental benefits have an economic impact. Further, DOE would have the authority to consider environmental benefits under 42 U.S.C. §6295(o)(2)(B)(i)(VII), which allows DOE to consider "other factors the Secretary considers relevant."

Zero Zone, Inc., 832 F.3d at 677 n.24.
145. *Zero Zone, Inc.*, 832 F.3d at 677.
146. *Id.* at 678.
147. *Id.*
148. *Id.* at 679; 79 Fed. Reg. at 17777 (Mar. 28, 2014).
149. *Zero Zone, Inc.*, 832 F.3d at 679; 79 Fed. Reg. at 17777 (Mar. 28, 2014).
150. *Zero Zone, Inc.*, 832 F.3d at 679.
151. *Id.*
152. *Id.*; 79 Fed. Reg. at 17779 (Mar. 28, 2014).
153. 79 Fed. Reg. at 17779.
154. *Zero Zone, Inc.*, 832 F.3d at 679.
155. *Id.*
156. Promoting Energy Independence and Economic Growth, Exec. Order No. 13783, 82 Fed. Reg. 16093 (Mar. 28, 2017), https://www.whitehouse.gov/the-press-office/2017/03/28/presidential-executive-order-promoting-energy-independence-and-economi-1.
157. *Id.*
158. *See*, *e.g.*, Energy Conservation Standards for High-Intensity Discharge Lamps, 80 Fed. Reg. 76355, 76356 (Dec. 5, 2015).
159. deLaski et al., *supra* note 47, at 28.

❑ *Reform testing procedures*. Every efficiency standard requires a testing procedure to measure the efficiency of the covered product, and DOE is required to periodically review these procedures. Testing methodologies can make a large difference not only in how a product's efficiency is evaluated, but also in the types of energy-saving innovations manufacturers are incentivized to undertake.

For example, when the testing procedure for clothes washers began to take into account the effect of their spin speed on energy use by clothes dryers, manufacturers had a strong incentive to design higher spin-speed washers that removed more moisture from clothes.[160] As another example, a recent update to the test procedures for clothes dryers that took into account settings that allowed consumers to set a desired dryness level revealed a larger gap in efficiency between the best- and worst-performing products.[161]

The large diversity of product settings, and the proliferation of products whose energy use responds to software updates and Internet connectivity, pose a challenge to existing test methods. To meet this challenge, DOE could focus efforts to update testing procedures on high-priority products, identified both by their large absolute efficiency savings potential as well as by the availability of well-understood improvements to current testing methodologies. For example, the Northwest Energy Efficiency Alliance and California investor-owned utilities have recently found that testing clothes dryers with real clothing and varying load sizes yields different and likely more-accurate efficiency measures than current DOE testing methods.[162]

In addition to focusing on specific high-priority products, DOE should also take into account technological trends and developments that cut across many product types, such as increases in appliances that include software updates and user-selectable modes of operation. In recent updates to test procedures, DOE has already taken steps to address these changes.

❑ *Better address overall system savings*. Many products covered by existing standards operate as part of larger product or building systems, which consist of various pieces of related or interconnected equipment. Examples include lighting and air conditioning, climate control systems, and office electronics. There are large efficiency opportunities available from improving overall system efficiency (e.g., by improving the way that these products interact with each other). For instance, refrigeration products that include lighting can incorporate occupancy controls, which are sensors that will turn the lights in supermarket refrigerator cases on when a person is nearby and then turn them off again when the person moves away down the aisle.

However, DOE is only authorized to issue standards applied to manufacturers and importers of products, rather than to their operators. Nevertheless, there may be opportunities for DOE to encourage manufacturers to pursue higher levels of system-level efficiency. For example, DOE could provide higher efficiency ratings for products sold as packages rather than individually. As an example, fans sold with a more efficient variable-speed drive could get a higher efficiency rating than fans sold without one.[163]

❑ *Address connected products and standby modes*. A growing number of "connected" or "network enabled" products often consume power when on "network standby," waiting to resume connection to the network.[164] These products, often identified as part of the "Internet of things," include "smart" products that consumers can control via their phones or the Internet, such as televisions, white goods, lamps, and lighting systems.[165]

The proliferation of products with Internet connectivity presents both challenges and opportunities for improving these products' energy efficiency. On the one hand, connected products may consume energy continuously in order to maintain connectivity, and they may be subject to software or user controls that significantly change their energy consumption, making their efficiency more difficult to reliably measure. On the other hand, these products might also provide fine-grained data on energy consumption, helping manufacturers and consumers achieve greater energy savings.

The current statutory framework only authorizes DOE to issue standards for individual types of classes of products, so additional congressional authorization and guidance would likely be necessary for DOE to set horizontal standards across product types.

Additionally, moving forward, in considering standards and test procedures, DOE should address, among other considerations, the energy use attributable to connectivity and the potential for connected devices to circumvent efficiency standards without the innovation that connected products can offer.[166]

❑ *Continue and enhance coordination with ENERGY STAR*. Behind the DOE appliance and equipment standards and the CAFE vehicle fuel economy standards, the ENERGY STAR voluntary labeling program is one of the largest federal energy-saving policies, saving about 3.8 quads annually.[167]

Historically a partnership between EPA and DOE, currently managed mostly by EPA, ENERGY STAR gener-

160. *Id.* at 22.
161. Christa Marshall, *Battle Over Obama's Rules Hits the Home Stretch*, E&E News, Apr. 8, 2016, http://www.eenews.net/stories/1060035325.
162. Christopher Dymond et al., Clothes Dryer Testing: Testy Testing Makes for Better Transformation 9-126 (2014), http://aceee.org/files/proceedings/2014/data/papers/9-852.pdf.
163. *See* deLaski et al., *supra* note 47, at 33-34.
164. *See* Vida Rozite & Hans-Paul Siderius, Making Smart Products and Systems Efficient 9-321 (2014), http://aceee.org/files/proceedings/2014/data/papers/9-167.pdf; International Energy Agency, More Data, Less Energy—Making Network Standby More Efficient in Billions of Connected Devices 6 (2013), *available at* https://www.iea.org/publications/freepublications/publication/MoreData_LessEnergy.pdf.
165. International Energy Agency, *supra* note 164, at 30.
166. *See* deLaski et al., *supra* note 47, at 34-35.
167. ASAP, *supra* note 45.

ally identifies the highest efficiency products in a particular category and allows manufacturers to add the "ENERGY STAR" label to those products.[168] The ENERGY STAR program and the DOE energy-efficiency standards program complement each other: they both require investments in testing and monitoring the efficiency of appliances and equipment, and they both provide incentives for manufacturers to increase the efficiency of their products. Today, there is significant overlap in the products that the two programs cover.[169]

A 2009 memorandum of understanding between DOE and EPA provides the broad framework for collaboration on the ENERGY STAR program, among other initiatives.[170] Within this framework, DOE leads the development of product testing procedures and metrics, and provides technical support to ENERGY STAR testing procedures more broadly.[171] EPA also consults with DOE when considering adding products to the ENERGY STAR program.

Continued and enhanced coordination between DOE and EPA on the timing and substance of ENERGY STAR ratings and DOE rulemakings would yield additional benefits for the two programs, both in the form of cost reduction, more effective policymaking, and greater clarity and certainty for manufacturers.

At the time of this writing, President Trump's proposed FY18 budget would eliminate funding for the ENERGY STAR program. The program, which costs about $50 million per year to administer, saves consumers more than $34 billion per year in reduced energy costs—an astounding 680:1 benefit-cost ratio. It has enjoyed strong bipartisan support for 25 years.[172] Congress should reject any effort to eliminate or reduce funding for the ENERGY STAR program.

3. Policies to Accelerate Turnover and Penetration of Energy-Efficient Appliances

One factor impairing the efficiency gains that can be accomplished through minimum standards is the relatively low turnover rates for many consumer appliances. For example, an estimated 60 million refrigerators, over one-third of refrigerators in use in the United States, are more than 10 years old.[173] Therefore, even after an efficiency standard becomes effective, it may take several years before the higher efficiency appliances penetrate much of the market.

At the state and local levels, various types of programs have been deployed to accelerate turnover and penetration. As discussed below in Part III.B., many utilities run rebate programs to encourage consumer take-up of energy-efficient products, such as light bulbs with the ENERGY STAR label.[174] Utilities also run refrigerator recycling programs that, together with discounts and tax incentives, can significantly accelerate penetration of energy-efficient appliances. For instance, for many years, Southern California Edison ran a program that offered customers a rebate on a new efficient refrigerator if they gave up their old one, which the utility then recycled. By 2012, Southern California Edison had recycled one million refrigerators and the program had avoided the emission of an estimated 3.9 metric tons of CO_2.[175] State utility regulators should encourage utilities to put these programs into place.

A larger scale national program could take a form similar to that of the Car Allowance Rebate System (CARS), more commonly known as "Cash for Clunkers." The CARS program, administered by the National Highway Traffic Safety Administration and passed as part of a federal supplemental appropriations bill in 2009 to stimulate the economy, provided consumers with a voucher for trading in an older and less fuel-efficient vehicle and purchasing a newer more-efficient vehicle.[176] The amount of the voucher rebate varied according to the difference in fuel efficiency between the old and new vehicle.[177] The CARS program led to at least a slight improvement in fuel economy and a reduction in carbon emissions, although it has been criticized as not being cost effective.[178] Importantly, the CARS program also fulfilled its economic stimulus goals by

168. Following a memorandum of understanding entered into in 2009, EPA became the lead agency managing the ENERGY STAR program. Previously, DOE and EPA jointly managed the program. *See* Memorandum of Understanding on Improving the Energy Efficiency of Products and Buildings Between the U.S. Environmental Protection Agency and the U.S. Department of Energy 1 (renewed Sept. 30, 2009), http://energy.gov/sites/prod/files/2013/12/f5/epa_doe_mou.pdf.

169. *See* U.S. EPA, ENERGY STAR Overview of 2015 Achievements (2016), https://www.energystar.gov/index.cfm?fuseaction=home.downloadfile&file=F84267790DF5B5F22EB9D715BC7BEC4F2E6F21C078AD0D8DB716916D20CB04C3778CC40ABE8B9DBF508BE77DAD9A753D5EAA2CFC510D5530702AC176F23ACA67F51939211384A8256F097182F6234B80CC51C3BB639D51552DAB56D4A545B4EC0A1834599E2CC67FED80CAC1E997504293B84EC41C9D129FBE039474F3C98A8321B1284EE9213E9B9B52BC5BDE81FBE6&app_code=publications&env_name=other. Introduced by EPA in 1992 with a focus on computers, monitors and printers, ENERGY STAR expanded to include major residential appliances in the mid-1990s in part through a partnership between EPA and DOE. Later, the program grew into other product areas including lighting, building fixtures such as windows and doors, consumer electronics, and commercial food service products. As of 2015, ENERGY STAR covered more than 70 product types, and more than five billion products had been sold with the ENERGY STAR label.

170. Memorandum of Understanding, *supra* note 168.

171. *Id.* at 3.

172. News Release, Alliance to Save Energy, More Than 1,000 Companies Call for Strengthening ENERGY STAR Program (Apr. 25, 2017), http://www.ase.org/news/more-1000-companies-call-strengthening-energy-star-program-0.

173. ENERGY STAR, *Refrigerators*, https://www.energystar.gov/products/appliances/refrigerators (last visited Oct. 8, 2017).

174. Cathaleen Chen, *Why Compact Fluorescent Lightbulbs Will Be Off the Market Soon*, Christian Sci. Monitor, Feb. 1, 2016, http://www.csmonitor.com/Environment/2016/0201/Why-compact-fluorescent-lightbulbs-will-be-off-the-market-soon.

175. Ralph Cavanagh, *One Million Refrigerators and Counting . . .* , NRDC, May 25, 2012, https://www.nrdc.org/experts/ralph-cavanagh/one-million-refrigerators-and-counting.

176. Ted Gayer & Emily Parker, Brookings Institution, Cash for Clunkers: An Evaluation of the Car Allowance Rebate System 1 (2013), *available at* https://www.brookings.edu/wp-content/uploads/2016/06/cash_for_clunkers_evaluation_paper_gayer.pdf.

177. *Id.*

178. *Id.* at 12. *See also* Marianne Tyrrell & John C. Dernbach, *The "Cash for Clunkers" Program: A Sustainability Evaluation*, 42 U. Tol. L. Rev. 467, 480-81 (2011), *available at* https://papers.ssrn.com/sol3/papers.cfm?abstract_id=1766098.

increasing automobile sales, by some estimates contributing $4 to $7 billion to the U.S. gross domestic product and saving or creating more than 60,000 jobs in automobile manufacturing and sales, and in related industries.[179]

Although no similar program for appliances has been attempted at the national level, federal funds have been used to support state efforts to promote appliance turnover. The American Recovery and Reinvestment Act of 2009 (ARRA, also known as the stimulus bill) established a $300 million DOE grant program to fund state schemes providing customers with rebates for purchases of energy-efficient appliances.[180] This program, known as the State Energy Efficient Appliance Rebate Program (SEEARP), ultimately led to the issuing of more than 1.7 million rebates, totaling $264 million.[181] SEEARP was designed primarily as a stimulus program, and only secondarily as an energy-efficiency policy, and it suffered from some design and implementation flaws.[182] But its basic success in causing consumers to purchase efficient appliances shows that federal funds can be used effectively to accelerate large-scale penetration of energy-efficient appliances.

Like the CARS program, the SEEARP program was dependent on ARRA stimulus funds and ended when those funds were no longer available. Congress and the executive branch should consider identifying additional sources of funding for a well-designed federal program to encourage the acceleration of energy-efficient appliances into the market. Until such a federal program is developed, states should develop their own "cash for clunkers" programs such as the refrigerator rebate program discussed above.

B. Energy-Efficiency Legal Pathways: States

While the federal government plays a primary role in establishing national energy-efficiency standards for appliances and equipment, states play a primary role in promoting energy-efficient appliances, equipment, and buildings in crucial other ways, including through the adoption of state carbon pollution laws and policies, smart utility regulation, development of complementary efficiency programs, adoption of stronger state energy building codes, and state legislation establishing energy-efficiency goals and targets. These state legal pathways are described in Part III.B.1. below. All of these state legal pathways can in turn support the development of stronger federal and state energy-efficiency standards programs through helping to incentivize and commercialize the development and use of increasingly energy-efficient products.

Moreover, although, as discussed above, EPCA's preemption provisions generally bar states from establishing energy-efficiency standards for products that are federally regulated, EPCA also provides exemptions and exceptions from federal preemption, and states can still directly establish energy-efficiency standards for some appliances and equipment that are covered by EPCA through a number of legal pathways, and can of course also establish standards for products that are not regulated by EPCA. Additionally, states can in some circumstances obtain waivers from federal preemption, as discussed above in Part II.F. State legal pathways on mandatory efficiency standards are described in Part III.B.2. below.

1. Overarching and Complementary State Energy-Efficiency Legal Pathways

❑ *State and regional carbon policy legal pathways*. Ultimately, the federal government will need to establish federal carbon pollution standards and other carbon policies in order to meet U.S. deep decarbonization goals. But states can and should establish their own carbon pollution policies either on their own, such as California's economywide carbon cap-and-trade legislation,[183] or as part of a regional approach such as the nine-state northeast Regional Greenhouse Gas Initiative (RGGI), through which participating states have established carbon caps for the power sector.[184] As this Article goes to press, state leadership on climate is particularly important, as federal climate and clean energy policies are threatened with rollbacks. State carbon pollution laws, regulations, and policies will serve to drive investments in energy efficiency by helping to internalize fossil fuel generation costs. Regional approaches such as RGGI also support state energy-efficiency initiatives because most proceeds from the auctions that are held for the required carbon allowances go to support state energy efficiency and renewable energy efforts.[185] Each state should develop state or regional carbon pollution standards and other carbon reduction policies, designed with the goal of complimenting and enhancing state clean energy policies.

❑ *Complementary state energy-efficiency legal pathways*. There are a number of key legal pathways that states can adopt to maximize energy-efficiency levels statewide and also encourage and promote the use of more-efficient appliances and products. These include adoption of state legislation or regulation that establishes mandatory state energy-efficiency goals; adoption of utility regulatory design reforms that encourage electric and natural gas utilities to support and invest in energy efficiency; adoption of energy-efficiency programs (run by utilities or other providers) for customers with specified investment levels, including for low-income customers; and adoption of financing mechanisms for energy efficiency.

State energy-efficiency resource standards. Although the federal government can and should establish a federal EERS, until this happens, states can and should establish

179. *Id.* at 479-80.

180. Subid Wagley et al., Lessons Learned From the State Energy Efficient Appliance Rebate Program 2-366 (2014), http://aceee.org/files/proceedings/2014/data/papers/2-71.pdf.

181. *Id.* at 2-367.

182. *Id.*

183. CEC, *Clean Energy & Pollution Reduction Act—SB 350 Overview*, http://www.energy.ca.gov/sb350/ (last visited Oct. 8, 2017).

184. RGGI, *Homepage*, https://www.rggi.org/ (last visited Oct. 8, 2017).

185. RGGI, *CO_2 Auctions*, http://www.rggi.org/market/co2_auctions (last visited Oct. 8, 2017).

state-specific goals for energy efficiency that will help to drive forward progress on energy-efficiency programs and policies of all kinds, including policies that either encourage or directly require more-efficient appliances, products, and buildings. A state-level EERS establishes specific, long-term targets for energy savings that utilities or non-utility program administrators must meet through customer energy-efficiency programs. Depending on state law, states can adopt an EERS through legislation or regulation. EERS can apply to either electricity or natural gas utilities, or both.

As of this writing, 26 states have policies in place that establish specific energy savings targets that utilities or non-utility program administrators must meet through customer energy-efficiency programs.[186] The strongest EERS requirements exist in Massachusetts and Rhode Island, which require more than 2.5% new savings annually.[187] States can also develop energy-efficiency goals and targets through utility regulatory proceedings, either statewide or utility-specific.

Depending on their design, state EERS and other forms of energy-efficiency utility goals can provide important incentives for utilities to advocate actively for stronger federal and state energy-efficiency appliance and equipment standards. As noted above, California allows its utilities to receive credit for verified energy savings from their demonstrated advocacy in support of federal and California energy-efficiency standards (and building codes as well) toward meeting their required energy savings goals.[188] Moreover, California now allows verified energy savings, from utility codes and standards advocacy, to be counted toward utility incentive payments for superior energy-efficiency performance.[189] Arizona has also established utility program policies that provide utilities with credit for energy-efficiency savings from utility activities in support of codes and standards. Massachusetts is also considering such policies.[190]

To achieve the levels of deep decarbonization needed to meet U.S. 2050 emissions reduction goals, each state should adopt an EERS with an initial annual savings level of 2.5% and periodically reexamine and strengthen the savings level as more-efficient technologies evolve. Each state should consider allowing utilities to receive credit toward these goals for verified energy savings from utility support for appliance and equipment energy-efficiency standards.

Utility regulatory design. While energy-efficiency mandates can drive considerable progress on energy efficiency, achieving maximum cost-effective levels of energy efficiency also requires that utility rate design be reformed to remove disincentives for electric and natural gas utilities to invest in energy efficiency. Utility rate design should instead create a utility business model where utility shareholder interests are aligned with making appliances, equipment, and buildings more efficient. Under traditional forms of rate regulation, utilities and their shareholders lose revenues and profits if their customers use energy more efficiently because utility revenues are tied to energy sales. One important way to remove this disincentive is for utility regulators to adopt "revenue decoupling," a form of rate design that severs the link between energy sales and revenues by providing for annual adjustments that prevent fluctuation in sales from resulting in over- or under-collection of revenues.[191] As of January 2017, 16 states have adopted revenue decoupling mechanisms for electric utilities and 23 states have adopted revenue decoupling mechanisms for natural gas utilities.[192]

But removing regulatory disincentives, while necessary, is not enough to bring about full utility alignment with energy-efficiency goals. States should allow utilities to recover the prudently incurred costs of energy-efficiency programs and should also adopt performance-based shareholder incentives for investor-owned utilities to ensure that utility investment in energy efficiency is at least as attractive, from a shareholder perspective, as an investment in generation and electric grid infrastructure.[193] These efficiency incentives can further build support for strong and effective utility efficiency programs, including support for appliance and equipment energy-efficiency standards.

Finally, New York is leading an effort to consider more radical reforms to the utility business model, aimed at moving away from baseload power sources to greater reliance on distributed energy resources (DERs) such as energy efficiency, demand response, and on-site energy sources such as rooftop solar. Under New York's Reforming the Energy Vision (REV) initiative,[194] the New York Public Service Commission is directing utilities to take on a new distributed system platform role, coordinating and integrating distributed resources into grid operation, with incentives for success.[195]

In one REV pilot project, Consolidated Edison (Con Ed), after identifying the need for 50 megawatts of supply and originally proposing a $1.3 billion substation to meet growing demand, instead developed and moved for-

186. ACEEE, *Energy Efficiency Resource Standard (EERS)*, http://aceee.org/topics/energy-efficiency-resource-standard-eers (last visited Oct. 8, 2017).

187. *Id.*

188. Allen Lee et al., Raising the Bar—Getting Large Savings Through Programs That Support Energy-Efficiency Codes and Standards 6 (2012), http://www.cadmusgroup.com/wp-content/uploads/2012/12/590-ACE3-Codes-Standards-Paper-Final.pdf.

189. *Id.* at 7.

190. *Id.* at 7-8.

191. Lisa Wood et al., Recovery of Utility Fixed Costs: Utility, Consumer, Environmental, and Economist Perspectives 35, 37 (Lawrence Berkeley National Laboratory, Report No. 5, 2016), *available at* https://emp.lbl.gov/sites/all/files/lbnl-1005742.pdf.

192. NRDC, Electric and Gas Decoupling in the U.S. (2017) (on file with author).

193. ACEEE, *Performance Incentives*, http://aceee.org/sector/state-policy/toolkit/utility-programs/performance-incentives (last visited Oct. 8, 2017); Jim Lazar, Regulatory Assistance Project, Electricity Regulation in the U.S.: A Guide ch. 12 (2d ed. 2016), *available at* http://www.raponline.org/wp-content/uploads/2016/07/rap-lazar-electricity-regulation-US-june-2016.pdf.

194. New York State, *DPS—Reforming the Energy Vision: About the Initiative*, http://www3.dps.ny.gov/W/PSCWeb.nsf/All/CC4F2EFA3A23551585257DEA007DCFE2?OpenDocument (last updated Aug. 10, 2017).

195. Eleanor Stein, *New York REV Shows Utilities and Regulators How to Manage Change*, Util. Dive, Mar. 3, 2016, http://www.utilitydive.com/news/new-york-rev-shows-utilities-and-regulators-how-to-manage-change/415002/.

ward with an alternative plan to consider dozens of non-traditional demand reduction strategies and DERs in an effort to reduce system costs, defer utility investment, and reduce carbon and other air pollution emissions. Specifically, Con Ed is spending about $200 million to incentivize customers in the area to enroll in demand response and energy-efficiency programs, to get them to shave a total of 41 megawatts of energy use at the moments when the substations are under the most stress. Another 11 megawatts of utility-side battery storage will provide additional stability for the substations, which have to contend with an unusually long 12-hour peak period.[196]

Other states, including California, Illinois, Maryland, Massachusetts, Minnesota, Ohio, and Rhode Island, are also considering grid modernization and utility business model design reforms, similar to REV.[197] The REV model offers an interesting and promising alternative to traditional utility regulation, although it should be accompanied by regulatory approaches such as EERS or other forms of energy-efficiency goals until it is demonstrated that more market-oriented approaches are fully delivering required energy-efficiency levels.

To summarize: states, through their public utility regulatory commissions or legislatures, should adopt utility rate designs that align utility interests with energy efficiency, such as decoupling, and also should consider performance-based ratemaking designs that include incentives for superior utility energy-efficiency performance. States should also consider more transformative changes to the traditional utility business model such as those contemplated by the New York REV proceeding, in conjunction with mandatory energy-efficiency targets and savings.

State energy-efficiency programs. State energy-efficiency programs, typically established by state law or by state public utility commission orders, are a central means for delivering energy-efficiency improvements to customers, including both electricity and natural gas. Energy-efficiency programs can be carried out either by utilities, government agencies, or independent third-party energy-efficiency administrators. Energy-efficiency programs offer a range of financial, technical, and other assistance to customers to help them use energy more efficiently, typically with differing program options for residential, low-income residential, commercial, and industrial customers. As some examples, energy-efficiency programs may offer energy audits for homes and businesses; distribute more efficient products such as compact fluorescent (CFL) and light-emitting diode (LED) bulbs for free or at low cost; and offer financial rebates or low-cost financing for the purchase of energy-efficient lighting and appliances. Some programs will also aim to transform markets for efficient products and engage in energy-efficiency marketing and education efforts.[198]

While markets are developing for energy-efficiency services, particularly for large customers, state energy-efficiency programs remain a vital standby for providing most customers with energy-efficiency services. In 2015, total spending for state electricity efficiency programs was $6.3 billion; total spending for state natural gas efficiency programs was $1.4 billion.[199] According to ACEEE, savings from electricity efficiency programs in 2015 totaled 26.5 million megawatt hours; estimated natural gas savings for 2015 totaled 345 million therms.[200] Most state energy-efficiency programs are run by utilities; others are run by independent administrators. Typically, funding for energy-efficiency programs is provided by a small per kWh charge on electricity and natural gas bills that is established by the state's public utility commission.

States should design and implement effective energy-efficiency programs to achieve annual energy savings equal to at least 2% of utility electricity sales (the current average is 0.71% savings) and increase over time. These programs should (1) be subject to periodic independent evaluation and measurement of energy savings; (2) include portfolios of energy-efficiency programs aimed at all major customer classes, including residential, business, and industrial customers, and with a special focus on lower income households, who bear the highest energy burden in terms of ration of energy costs to income; and (3) include market transformation programs aimed at encouraging the manufacture, sale, and use of more-efficient products through strategies such as technology development and manufacturer incentives.[201] These programs compliment federal and state energy-efficiency programs by helping to accelerate the uptake of more-efficient products and create strong markets for them, as well as by further spurring technological innovation.

State building codes. Commercial and residential buildings account for approximately 41% of all energy consumption and 72% of electricity usage in the United States. Building energy codes and standards set minimum requirements for energy-efficient design and construction for new and renovated buildings, assuring reductions in energy use and GHG emissions over the life of buildings.[202]

196. Jeff St. John, *Can Distributed Resources Replace $1B in Substation Upgrades? New York Will Soon Find Out*, Greentech Media, Dec. 22, 2014, https://www.greentechmedia.com/articles/read/con-eds-200m-distributed-energy-plan-gets-the-green-light.

197. Krysti Shallenberger, *The Top 5 States for Utility Grid Modernization and Business Model Reform*, Util. Dive, Apr. 3, 2017, http://www.utilitydive.com/news/the-top-5-states-for-utility-grid-modernization-and-business-model-reform/439550/.

198. For a full description of energy-efficiency programs, see Consortium for Energy Efficiency, CEE Annual Industry Report, 2016 State of the Efficiency Program Industry: Budgets, Expenditures, and Impacts (2017), *available at* https://library.cee1.org/system/files/library/13159/2016_CEE_Annual_Industry_Report.pdf.

199. ACEEE, United States 1 (2016), http://aceee.org/sites/default/files/pdf/state-sheet/2016/usa.pdf.

200. *Id.*

201. Fact Sheet, NRDC, Doing More and Using Less: Helping Electricity and Natural Gas Utilities Help Save Consumers $700 Billion (Oct. 2012), https://www.nrdc.org/sites/default/files/doing-more-using-less-FS.pdf; Lazar, *supra* note 193, at chs. 17, 21.

202. Olga V. Livingston et al., Pacific Northwest National Laboratory, Building Energy Codes Program: National Benefits Assessment, 1992-2040 iii (2014) (PNNL-22610 Rev 1), *available at* https://www.energycodes.gov/sites/default/files/documents/BenefitsReport_Final_March20142.pdf.

As discussed above, well-designed state building codes can encourage the use of energy-efficient equipment such as heating and cooling systems that are more efficient than required by federal energy-efficiency standards for those products as long as the code provides other pathways for compliance that meet the requirements of EPCA's exception for building code preemption. EPCA's preemption clause should not cause states to hesitate to develop stronger building codes that include a compliance path based on use of equipment that is more efficient than the minimum efficiency levels required by federal law. Instead, states should carefully review the preemption clause and ensure that the factors that justify an exception from preemption are reflected in the building code's design.

Other state legal pathways to encourage energy efficiency. States can adopt legislation and programs that encourage the use of energy-efficient appliances and equipment through tax policy, financial incentives, labeling programs, and financing policies. A number of states offer personal income tax deductions for the purchase of energy-efficient equipment[203]; others offer commercial and personal tax credits for energy-efficient equipment. Many states have authorized energy-efficiency financing programs, such as property-assessed clean energy programs, which provide financing for energy-efficiency retrofits that is paid back via a surcharge on the property's tax assessment; and on-bill financing programs, through which utilities provide financing for energy-efficiency improvements that are then paid back via a surcharge on the customer's utility bill.[204] Finally, at least three states (Connecticut, New York, and Rhode Island) have established "green banks," which leverage private-sector capital by providing additional financing for clean energy projects, including large energy-efficiency retrofit projects.[205] States should consider adopting all of these financial incentives and financing programs for energy efficiency.

2. State Energy-Efficiency Appliance and Equipment Standards Legal Pathways

As described above in Part II.F., federal preemption provisions generally bar states from establishing state energy-efficiency standards for appliances and equipment that are covered under EPCA, but states retain the authority to establish energy-efficiency standards for appliances and equipment that are not covered under EPCA. Eleven states, most prominently California, have established state energy-efficiency standards for an array of appliances and products.[206] In most cases, state legislation is required to establish state energy-efficiency standards. In some states such as California, enabling legislation is enacted that directs or allows state agencies to establish a program for the adoption of energy-efficiency standards with considerable discretion and flexibility as to which products to regulate and the required levels of efficiency.[207] In other states, the establishment of each state standard requires separate legislation and required efficiency levels are prescribed by the legislation.[208]

State appliance and equipment energy-efficiency standards can produce energy savings, consumer bill reductions, and carbon-saving benefits at two levels. First, there are significant energy savings opportunities for energy-efficiency standards covering product categories not covered by federal law. A 2017 ASAP study examined potential savings from 21 products that are not subject to federal preemption and found that the adoption of standards for these products could result in potential cumulative energy savings of up to 590 terawatt hours and 1,640 trillion Btu of natural gas, assuming that a sufficient number of states adopted these standards to cause only compliant products to be sold nationally. Cumulative potential CO_2 emissions savings by 2035 are 320 million metric tons.[209] Even before this tipping point is reached, states can capture a share of these savings by adopting state-level energy-efficiency standards for these products.

Second, the history of EPCA demonstrates that when states begin to adopt energy-efficiency standards for products not regulated by EPCA, manufacturers will turn to Congress and DOE to seek coverage for these products under EPCA in order to secure a single national standard.[210] Even if Congress or DOE fails to act, adoption by just a few states may be sufficient to convince manufacturers to market only compliant products in all states. For example, in establishing a national energy-efficiency standard for battery chargers at the level already established as a state standard by California and Oregon, DOE found that 95% of battery chargers sold nationally already complied with these state energy-efficiency standards.[211] Thus, the adoption of state standards is one important strategy to encourage the development of federal standards.

That leads to the following recommendations: First, states should enact legislation requiring the establishment

203. Database of State Incentives for Renewables and Efficiency, *Tax Deduction for Home Energy Audits and Energy Efficiency Improvements*, http://programs.dsireusa.org/system/program/detail/3068 (last updated May 5, 2016).

204. *Financing Energy Efficiency Improvements*, Alliance to Save Energy, Feb. 14, 2011, http://www.ase.org/resources/financing-energy-efficiency-improvements.

205. Other states have similar clean energy finance or loan programs. Andrew Belden et al., Union of Concerned Scientists, Financing Clean Energy: Cost-Effective Tools for State Compliance With the Clean Power Plan 2 (2015), *available at* http://www.ucsusa.org/sites/default/files/attach/2015/07/financing-clean-energy.pdf; NRDC, Green & Resilience Banks: How the Green Investment Bank Model Can Play a Role in Scaling Up Climate Finance in Emerging Markets 13-14 (2016), *available at* https://www.nrdc.org/sites/default/files/green-investment-bank-model-emerging-markets-report.pdf.

206. ASAP, *States*, https://appliance-standards.org/states (last visited Oct. 8, 2017).

207. *See*, *e.g.*, Warren-Alquist State Energy Resources Conservation and Development Act, Cal. Pub. Res. Code §§25402 et seq.

208. *See*, *e.g.*, N.Y. Energy Law §§16-102 to 16-108.

209. Joanna Mauer et al., ASAP & ACEEE, States Go First: How States Can Save Consumers Money, Reduce Energy and Water Waste, and Protect the Environment With New Appliance Standards 1 (2017), *available at* https://appliance-standards.org/sites/default/files/States%20Go%20First.pdf.

210. *Id*. at 2-3.

211. Energy Conservation Program: Energy Conservation Standards for Battery Chargers, Final Rule, 81 Fed. Reg. 38266, 38297 (June 13, 2016).

of cost-effective state energy-efficiency standards for appliances and products that are not preempted by EPCA or adopt such standards by regulation if statutory authority already exists. The most-effective legislation will establish efficiency standards programs like California's that provide the appropriate state energy agency with broad flexibility to establish efficiency standards rather than requiring separate legislative enactment for each standard. ASAP regularly produces model legislation, including proposed new product standards.[212] In addition, several states' decades-long experience with appliance standards can provide a valuable model and set of best practices for administration, design, and implementation of state-level appliance standards programs.[213]

Second, with respect to appliances and products that are covered by EPCA and are thus preempted, states should consider seeking waivers of preemption for products where there is a specific state justification for seeking a waiver of preemption and establishing a more-stringent state standard.[214]

Third, states should follow the example set by California and Vermont, discussed above, and adopt the federal energy-efficiency standards that have been established by DOE as identical state standards in the event that federal standards are repealed or revoked. As a precautionary measure, this will ensure that if DOE fails to enforce federal standards, or in the unlikely event that Congress repeals EPCA, states would continue to be able to implement and enforce federal efficiency standards as state standards.

Fourth, states should actively participate in the development of appliance energy-efficiency standards by Canada's environmental and clean energy agency, Natural Resources Canada. Natural Resources Canada is an international partner in EPA's voluntary ENERGY STAR program and also maintains its own mandatory appliance energy-efficiency standards program, which is very similar to that of the United States.[215] By participating in the development of stronger energy-efficiency standards for products manufactured or sold in Canada, states can help to move the market for energy-efficient products in the United States and also to increase the likelihood that DOE will ultimately adopt these stronger standards, given the proximity and similarities between the two countries.[216]

C. *Energy-Efficiency Legal Pathways: Cities and Localities*

Cities and localities have many legal pathways by which to pursue energy efficiency. Cities can adopt, via legislation, agency action, or executive order, many of the same energy-efficiency policies recommended above for the federal government and state governments. Thus, cities can establish carbon reduction and sustainability policies that can include establishing energy-efficiency goals; adopt and fully enforce city building energy-efficiency codes (unless preempted by state law); establish city tax deductions or credits for the purchase of energy-efficient equipment; and establish financing programs for energy efficiency.[217]

One of the most important ways that cities can encourage energy efficiency and the use of energy-efficient equipment is through the adoption of city legislation that requires the "benchmarking" of large buildings to establish data on existing energy-efficiency levels and then policies that either require or encourage the "retrocommissioning" of city buildings, which is typically done through performing energy audits and implementing the energy-efficiency measures identified.[218] All cities should consider adoption of benchmarking ordinances, as well as energy audit and energy savings implementation measures.

D. *Energy-Efficiency Legal Pathways: Industry, Businesses, and Utilities*

Ultimately, as discussed above, much stronger federal and state government carbon regulation and mandatory energy-efficiency requirements will be needed for the private sector to meet U.S. deep decarbonization goals. However, private governance and voluntary actions by industry, businesses, and utilities can play a role in keeping the United States on track and also help to create the favorable political climate that will be needed for strong government action to reduce carbon emissions. Effective private governance and voluntary actions to reduce carbon emissions and improve

212. ASAP, *State Savings From State Appliance Standards*, https://web.archive.org/web/20160807043239/https://appliance-standards.org/content/state-savings-state-appliance-standards (last visited Oct. 8, 2017).

213. U.S. EPA, Energy and Environment Guide to Action: State Policies and Best Practices for Advancing Energy Efficiency, Renewable Energy, and Combined Heat and Power sec. 4.4 (2015) (EPA 430-R-15-003), *available at* https://www.epa.gov/sites/production/files/2015-08/documents/guide_action_full.pdf.

214. *Id.* at 4-77.

215. Natural Resources Canada administers and monitors use of the ENERGY STAR name and symbol in Canada under an agreement with EPA. Canada became an international partner in the program in 2001. *See* Natural Resources Canada, *About ENERGY STAR*, https://www.nrcan.gc.ca/energy/products/energystar/about/12529 (last visited Oct. 8, 2017). An overview of Natural Resources Canada's three-part energy-efficiency program, including its energy-efficiency standards program, can be found at *Introduction to the Regulations*, https://www.nrcan.gc.ca/energy/regulations-codes-standards/6859 (last modified Sept. 18, 2017).

216. The United States, Canada, and Mexico have worked together since at least 2001 to harmonize energy policy, including on energy-efficiency standards and labeling programs. *See* North American Energy Working Group, North American Energy Efficiency Standards and Labeling (2013), *available at* https://energy.gov/sites/prod/files/2013/12/f5/naewg_report.pdf.

217. For a list of municipal energy-efficiency policies, see the following: ACEEE, *Local Energy Efficiency Policy*, http://aceee.org/portal/local-policy (last visited Oct. 8, 2017); Montgomery County, Maryland, has established a green bank, Department of Environmental Protection, *Montgomery County Green Bank*, https://www.montgomerycountymd.gov/green/energy/green-bank.html (last visited Oct. 8, 2017); New York City has established the New York City Energy Efficiency Corporation, which plays a similar role to a green bank, Factsheet, New York City Energy Efficiency Corporation, Finance Your Next Clean Energy Project With NYCEEC (Jan. 2017), https://www.nyceec.com/wp-content/uploads/About-NYCEEC.pdf.

218. A list of U.S. city benchmarking ordinances can be found at WegoWise, *Energy Disclosure Compliance*, https://www.wegowise.com/compliance (last visited Oct. 8, 2017).

energy efficiency can take a number of forms. Two key recommended actions are described below.

1. Embrace Sustainability

Private-sector actors can embrace sustainability by creating sustainability programs headed by high-level management with binding corporate sustainability actions and goals that include specific commitments to energy efficiency, among other forms of sustainability. Ceres, a leading nongovernmental organization that works to promote corporate sustainability, has produced a sustainability road map that provides detailed actions that corporations and utilities can take to improve sustainability in their operations, supply chain, transportation and logistics, and products and services—and also provides the business case for doing so. The Ceres sustainability road map includes a recommendation that corporations commit to reduce GHG emissions by 25% from their 2005 baseline by 2020, by improving energy efficiency of operations by at least 50% and reducing electricity demand by at least 15%.[219] Private-sector participants should commit to this recommendation.

2. Embrace Energy-Efficiency Private Governance Standards

Several private-sector organizations work to create voluntary industry standards that include energy-efficiency standards. These include the International Organization for Standardization (ISO),[220] the International Code Council (ICC),[221] and ASHRAE (formerly the American Society of Heating, Refrigerating, and Air-Conditioning Engineers).[222] The ISO is an independent, nongovernmental international organization with a membership of 163 national standards bodies, which develops voluntary, consensus-based, international standards, including climate-related and energy-efficiency standards.[223] The ISO 50001 energy management standards provide a framework for businesses and other organizations to improve the energy efficiency of their operations through a number of steps, including establishing an energy baseline; adopting energy performance indicators, objectives, targets, and action plans necessary to deliver results that will improve energy performance in accordance with the organization's energy policy; implementing the energy management action plans; monitoring and measuring progress and reporting the results; and continually improving energy performance.[224]

The ICC and ASHRAE are similarly international nongovernmental groups that bring members together to develop model energy-efficiency codes and standards. ICC's and ASHRAE's model building energy-efficiency codes, after review by DOE, often form the basis for state building energy codes.[225] By joining these voluntary organizations, participating in the development of strong energy-efficiency standards and codes, and by committing to follow these codes and standards, private-sector actors can make significant advances toward achieving progress on energy efficiency.

IV. Legal Pathways for Increasing Energy Efficiency in Lighting, Consumer Electronics, Computers, and Data Centers, and in the Industrial and Commercial Sectors

Lighting, consumer electronics, computers and data centers, and the industrial and commercial energy sectors each present significant opportunities for increased energy efficiency, as well as some specific hurdles to overcome, in order to seize these opportunities. As in Part III, legal pathways that lead to the achievement of maximum energy-efficiency levels in these areas will require an integrated approach at both the federal and state levels that combines continued research and development (R&D), energy-efficiency incentive programs, and the adoption of increasingly stringent product efficiency standards. Part IV.A. covers legal pathways to improve lighting efficiency; Part IV.B. covers legal pathways to improve computer and data center energy efficiency; and Part IV.C. covers legal pathways to improve industrial and commercial efficiency.

A. Lighting Efficiency

Lighting accounts for a significant percentage of U.S. electricity usage and associated carbon emissions. EIA estimates that in 2015, about 404 billion kWh of electricity were used for lighting by the residential sector and the commercial sector in the United States.[226] This was about 15% of the total electricity consumed by both of these sectors and about 10% of total U.S. electricity consumption.[227] Residential lighting consumption was about 149 billion kWh or about 11% of total residential electricity consumption in 2014, making lighting the second largest

219. Andrea Moffat et al., Ceres, The 21st Century Corporation: The Ceres Roadmap for Sustainability 13 (2010), *available at* https://www.ceres.org/sites/default/files/2017-05/Ceres_Roadmap_for_Sustainability_2010.pdf; *see also* Ceres, The Ceres Roadmap for Sustainability (2017), *available at* https://www.ceres.org/sites/default/files/reports/2017-03/Ceres_Roadmap_Expectations%202016.pdf.
220. ISO, *About ISO*, https://www.iso.org/about-us.html (last visited Oct. 8, 2017).
221. ICC, *International Energy Conservation Code® Resource Page*, https://www.iccsafe.org/about-icc/government-relations/international-energy-conservation-code-resource-page/ (last visited Oct. 8, 2017).
222. ASHRAE, *Homepage*, https://www.ashrae.org/ (last visited Oct. 8, 2017).
223. ISO, ISO and Energy: Great Things Happen When the World Agrees 2-9 (2016), *available at* https://www.iso.org/files/live/sites/isoorg/files/archive/pdf/en/iso_and_energy.pdf.
224. ISO, *ISO 50001:2011 (en)*, https://www.iso.org/obp/ui/#iso:std:iso:50001:ed-1:v1:en (last visited Oct. 8, 2017).
225. DOE, *Building Energy Codes Program*, https://www.energycodes.gov/development (last updated Apr. 25, 2017).
226. EIA, *Frequently Asked Questions: How Much Electricity Is Used for Lighting in the United States?*, https://www.eia.gov/tools/faqs/faq.cfm?id=99&t=3 (last updated May 23, 2017).
227. *Id.*

source of residential electricity usage.[228] The commercial sector, which includes commercial and institutional buildings, and public street and highway lighting, consumed about 258 billion kWh for lighting, equal to about 19% of commercial-sector electricity consumption in 2015.[229] In 2010, 52 billion kWh were consumed for lighting in manufacturing facilities, which was equal to about 1.3% of total U.S. electricity usage.[230] The DDPP technical report estimates that as of 2010, residential and commercial lighting together accounted for 5% of CO_2 emissions from fossil fuel combustion.[231] Fortunately, lighting efficiency is already significantly improving and the potential for future improvement is huge.

The standard incandescent light bulb, invented by Thomas Edison and largely unchanged over the past century, converts more than 90% of the electricity that it consumes into waste heat rather than lighting. Over the past several decades, and accelerating in the last decade, there has been vast progress in the deployment of newer forms of lighting that are much more efficient, decreasing the amount of energy used for lighting in residential, commercial, and industrial applications. CFLs emerged over the past few decades and are much more efficient than standard incandescent light bulbs. However, the rapid deployment over the past decade of LED lighting, a form of solid-state lighting (SSL), provides the most dramatic opportunities for lighting efficiency.[232] While CFL bulbs include small amounts of mercury, requiring proper recycling,[233] LED lighting is mercury-free,[234] a significant non-energy benefit.

Based on modeling that takes into account existing law and regulation as well as expected improvements in technology and cost reductions, DOE conservatively estimates that LEDs will constitute about 30% of U.S. lighting installations by 2020, with annual energy savings of 1.5 quads.[235] By 2035, DOE estimates that widespread adoption of LED lighting could lead to a dramatic 75% reduction in energy consumption for lighting compared to a non-LED scenario, with estimated annual savings of 5.1 quads, which is equivalent to about 5% of total annual U.S. energy consumption, or nearly the total annual energy consumed by 45 million U.S. homes today.[236]

While for many years the first cost of LED bulbs was higher than either ordinary incandescent, halogen, or CFL bulbs, that cost is declining rapidly and is now increasingly competitive with the cost of other types of bulbs.[237] Moreover, the energy bill savings from using LED bulbs more than outweigh the additional first cost, providing significant net benefits to consumers. Based on a June 2017 survey and study, the Consumer Federation of America (CFA), a nongovernmental consumer advocacy organization, estimates that a household using at least 20 light bulbs can save $1,000 or more in a decade by using new LED bulbs rather than traditional incandescent or halogen bulbs, taking into account both the cost of the bulbs and the electricity savings over a 10-year period.

The CFA survey of 60-watt equivalent, non-dimmable, soft white light bulbs found, for example, that each of 17 LED bulbs had a total 10-year cost of no more than $15.40, while each of 15 incandescent or halogen bulbs had a total cost of at least $61. The average 10-year cost of the LEDs was $13.70, while the average 10-year cost of the incandescents and halogens was $69.49. Since homes use an average of more than 20 light bulbs, CFA concludes that consumers now relying on incandescents and halogens can save about $1,000 over this period by switching to LEDs.[238] Lighting efficiency in the United States over the past decade has been driven by a combination of forces, including federal and state energy-efficiency standards legislation and regulation; building code improvements; research, development, and deployment (RD&D) and innovation initiatives; voluntary labeling and incentive programs; and industry efforts and market forces.[239]

1. Federal Lighting Efficiency Legislation and Regulation

Congress has provided DOE with the authority to regulate the efficiency of certain lighting products since the enactment of NAECA in 1987, which included minimum efficiency standards for fluorescent lamp ballasts and incandescent reflector lamps.[240] Congress strengthened the standards for these lighting products and extended DOE's authority to residential and commercial lighting efficiency in EPAct 1992,[241] and added additional performance standards for lighting equipment in EPAct 2005.[242]

228. *Id. See also* EIA, *Frequently Asked Questions: How Is Electricity Used in U.S. Homes?*, https://www.eia.gov/tools/faqs/faq.cfm?id=96&t=3 (last updated Feb. 28, 2017).
229. EIA, *supra* note 226.
230. *Id.*
231. Williams et al., *supra* note 1, at A-4.
232. *See* Committee on Assessment of Solid State Lighting et al., Assessment of Advanced Solid State Lighting (2013), *available at* https://www.nap.edu/catalog/18279/assessment-of-advanced-solid-state-lighting.
233. U.S. EPA, *Compact Fluorescent Light Bulbs (CFLs)*, https://www.epa.gov/cfl (last updated June 22, 2017).
234. DOE, *Frequently Asked Questions: Lighting Choices to Save You Money*, https://energy.gov/energysaver/frequently-asked-questions-lighting-choices-save-you-money (last visited Oct. 8, 2017).
235. Navigant Consulting, Energy Savings Forecast of Solid-state Lighting in General Illumination Applications 18 tbl. 4.1 (DOE EERE 2016) (DOE/EE-1467), *available at* https://energy.gov/sites/prod/files/2016/10/f33/energysavingsforecast16_0.pdf.
236. *Id.* at vii-vi.
237. Brian F. Gerke et al., Lawrence Berkeley National Laboratory, Recent Price Trends and Learning Curves for Household LED Lamps From a Regression Analysis of Internet Retail Data (2015) (LBNL-184075), *available at* https://eta.lbl.gov/sites/all/files/publications/lbnl-184075.pdf.
238. Press Release, CFA, Incandescent and Halogen Light Bulbs Cost Four to Five Times as Much Over Time as Do New LED Light Bulbs (June 5, 2017), http://consumerfed.org/press_release/incandescent-halogen-light-bulbs-cost-four-five-times-much-time-new-led-light-bulbs/.
239. Committee on Assessment of Solid State Lighting et al., *supra* note 232, at 19.
240. *Id.*
241. *Id.*
242. *Id.* at 20.

The most significant policy boost to lighting efficiency thus far occurred in 2007, when Congress enacted EISA,[243] which amended EPCA to include a number of important and transformative provisions on lighting efficiency. Section 321 of EISA established a two-tiered approach to strengthening the efficiency of the standard residential screw-based light bulb.[244]

First, EISA established initial energy-efficiency standards (known as "Tier 1 standards") for "general-service incandescent lamps," which is the technical name for the traditional type of household incandescent light bulb, with a medium screw base and clear, frosted, and soft white finishes.[245] The initial EISA efficiency standards required that light bulbs use 25%-30% less energy to provide the same level of lighting.[246] The standards were technology-neutral and could be met by efficient halogen, incandescent, CLF, and LED bulbs. However, the efficiency standards were set at a level which, in effect, meant that the manufacture or import of traditional incandescent light bulbs would be phased out over a three-year period from 2012-2014, with the phaseout dates to take effect one year earlier in California.[247] Certain bulb types were exempted from these standards.[248]

While these initial light bulb efficiency standards went into effect as planned, they proved politically controversial, particularly with the rise of the conservative Tea Party movement.[249] Efforts in the 112th Congress to repeal the EISA lighting efficiency standards failed; however, in 2011, a rider was added to the federal budget that prohibits DOE from implementing or enforcing the EISA lighting efficiency standards. This rider was attached to each subsequent budget resolution,[250] but was eventually removed in the FY17 budget resolution. As of this writing, there is a legislative effort to reimpose the rider, but thus far it has not been put back into place.[251]

Regardless of the rider, U.S. manufacturers, who supported the EISA lighting efficiency standards, committed to implement them anyway and the rider has not stood in the way of significant progress on light bulb efficiency.[252] Significantly, while almost all inefficient incandescent bulbs are manufactured outside of the United States, thousands of U.S. jobs have been created in recent years to design, test, and produce the next generation of energy-saving light bulbs, with manufacturing and production facilities located in California, North Carolina, and under construction in New York, among others.[253]

Second, EISA also included provisions aimed at developing a second set of more stringent energy-efficiency standards for light bulbs, known as "Tier 2 standards." EISA directed DOE to conduct a rulemaking to revise the EISA light bulb efficiency standards that would take effect in 2020, to consider whether the scope of covered light bulbs should be expanded and to consider a minimum standard of 45 lumens per watt for light bulbs.[254] EISA also included a "backstop" energy-efficiency standards provision requiring that if this second rulemaking was not completed by January 1, 2017, or did not establish standards that are greater than or equal to 45 lumens per watt, a legislative "backstop" energy-efficiency standards provision will go into effect in 2020, which will require an efficiency standard of 45 lumens per watt.[255]

In March 2016, DOE commenced the required EISA rulemaking to revise the initial EISA lighting provisions and also to revise the definition of "general service lamps" to eliminate some of the exemptions.[256] DOE issued a final rule on January 19, 2017, at the close of the Obama Administration.[257] The final rule updates the definition for general service lamps, excluding certain exemptions and retaining others.[258] However, DOE did not publish a final rule amending the lighting standards by January 1, 2017.[259] Because DOE did not meet this deadline, EISA's Tier 2 "backstop" energy-efficiency standards provision will go into effect in 2020.[260]

The consumer and energy savings from EISA's backstop Tier 2 energy-efficiency standards will be significant, especially combined with the expanded definition of the general service light bulbs that the standard will apply to as a result of DOE's January 2017 rule updating that definition. While the standards are technology-neutral, as a practical matter, as of today, only LED light bulbs can meet the 45 lumens per watt standard, which will require light bulbs to use about 65% less energy than ordinary incandescent bulbs.[261] Once the Tier 2 standards are fully

243. 121 Stat. 1492, §321(a)(3)(F).
244. *Id*. §321.
245. *Id*. §321(a)(1)(A).
246. EIA, *Light Bulb Standards Begin Taking Effect in 2012*, Today in Energy, Dec. 2, 2011, https://www.eia.gov/todayinenergy/detail.php?id=4150.
247. 121 Stat. 1492, §321(a)(3); *see also* 10 C.F.R. §430.32.
248. 121 Stat. 1492, §321(a)(3).
249. Edward Wyatt, *Give Up Familiar Light Bulb? Not Without Fight, Some Say*, N.Y. Times, Mar. 11, 2011, http://www.nytimes.com/2011/03/12/business/energy-environment/12bulb.html. *See also* Jim Snyder, *Congress Spares Incandescent Bulbs in Victory for U.S. Tea Party*, Bloomberg, Dec. 17, 2011, http://www.bloomberg.com/news/articles/2011-12-16/incandescent-light-bulb-spared-in-u-s-lawmakers-spending-bill.
250. The Consolidated Appropriations Act, 2016, Pub. L. No. 114-113, §312, 129 Stat. 2419 (2015), and its predecessors contain the same appropriations restriction including, but not limited to, the Consolidated and Further Continuing Appropriations Act, 2015, Pub. L. No. 113-235, §313, 128 Stat. 2326 (2014), the Consolidated Appropriations Act of 2012, Pub. L. No. 112-74, §315, 125 Stat. 879 (2011), and the Consolidated Appropriations Act, 2014, Pub. L. No. 113-76, §322, 128 Stat. 180, which continued the same restriction in FY14 ("None of the funds made available in this Act may be used—(1) to implement or enforce section 430.32(x) of title 10, Code of Federal Regulations").
251. Ari Natter, *Congress Is Still Fighting Over Energy-Efficient Light Bulbs*, Bloomberg, July 27, 2017, https://www.bloomberg.com/news/articles/2017-07-27/house-renews-fight-on-efficient-light-bulbs-as-industry-moves-on.
252. *Id*.; *see also* Committee on Assessment of Solid State Lighting et al., *supra* note 232, at 20.
253. Fact Sheet, NRDC, New Light Bulb Energy Efficiency Standards Will Save Consumers Billions, Reduce Harmful Pollution, and Create Jobs 2 (Jan. 2017), https://www.nrdc.org/sites/default/files/lighting-standards-2016-FS.pdf.
254. 42 U.S.C. §6295(i)(6)(A)(iii).
255. *Id*. §6295(i)(6)(A)(v).
256. 81 Fed. Reg. 14528, 14548 (Mar. 17, 2016).
257. 82 Fed. Reg. 7276 (Jan. 19, 2017).
258. *Id*. at 7286. *Id*.
259. *Id*. at 7316.
260. *Id*.; *see also* 42 U.S.C. §6295(i)(6)(A)(v).
261. NRDC Fact Sheet, *supra* note 253, at 1.

in effect, U.S. electricity costs will be reduced by $12.5 billion annually, saving the average household about $100 per year. The standards will also avoid tens of millions of tons of carbon emissions, equivalent to the emissions of 30 new power plants.[262]

According to a Lawrence Berkeley National Laboratory report, the combination of the EISA backstop Tier 2 standards and the expanded definition of general service lamps could result in energy savings of 27 quads for light bulbs sold from 2020-2049—that is greater than the energy consumed by the entire U.S. residential sector in 2016 (20 quads), reducing CO_2 emissions by 540 million metric tons by 2030—equivalent to the CO_2 emissions from 157 coal-fired power plants for one year.[263] However, at least a portion of these savings could possibly be at risk in the future. In March 2017, the National Electrical Manufacturers Association (NEMA) filed a petition for review challenging DOE's expanded definition of general service lamps. In July 2017, NEMA and the Trump Administration DOE settled the lawsuit, with DOE agreeing to take initial steps toward potentially reassessing the definition rules.[264]

DOE should move forward to educate consumers about this new set of standards and should implement and enforce them fully when they go into effect. DOE should retain the current definition of general service lamp.

2. Federal Lighting RD&D

RD&D has played a significant role in incentivizing lighting efficiency and there are still significant opportunities for RD&D to lead to the development of even more-efficient forms of lighting. Most of these opportunities focus on the development of more-efficient forms of "solid-state" lighting—this is a category of lighting technology that uses semiconducting materials to convert electricity into light. It includes both LEDs, which are now increasingly widely in use in the United States, and organic LEDs, which are used today in some specific applications (e.g., cell phones) but are mainly in the demonstration phase for more general applications.[265] According to DOE, despite recent rapid advances, the potential energy-efficiency benefits of SSL have only just begun to be realized: "[w]hen it comes to U.S. energy savings, almost 95% of its potential remains untapped. Continued innovation and breakthroughs in materials, processes, product designs, control systems, and manufacturing are still needed to realize the full potential of the technology."[266]

DOE supports several programs to advance SSL technology and science. Most of this work takes place within the DOE EERE's Building Technologies Program, which oversees emerging technologies including SSL. EPAct 2005 and EISA included provisions directing DOE to carry out a Next Generation Lighting Initiative to support SSL RD&D.[267] These provisions directed DOE to support RD&D and commercial application activities related to advanced SSL technologies.[268]

In response, DOE has developed the Solid-State Lighting program (DOE SSL program) with the goal of developing a comprehensive national strategy to build collaborative efforts with the lighting industry and research community to guide SSL technology innovation. The DOE SSL program has been involved in SSL RD&D for more than a decade. DOE SSL program RD&D investments span the spectrum from core technology research and product development to manufacturing and technology application RD&D. The DOE SSL program strategically partners with private industry and industry associations to accelerate the development of SSL, including with the Next Generation Lighting Industry Alliance, the Illuminating Engineering Society of North America, and the International Association of Lighting Designers.[269]

Through this program, since 2000, DOE has funded more than 250 SSL R&D projects, which have resulted in more than 260 patents applied for or awarded. There are millions of SSL products currently on the market that are based at least in part on DOE-funded R&D. Those products have contributed to more than $2.8 billion in energy bill savings for consumers so far—a remarkable return on the total DOE SSL program investment of about $350 million.[270]

DOE should maintain and fully fund this cost-effective program in order to continue to develop the next generation of SSL.

3. Federal Voluntary and Labeling Programs

Federal voluntary and labeling programs have played an important role in improving lighting efficiency by educating consumers and encouraging manufacturers to develop more-efficient lighting products. The ENERGY STAR appliance labeling program, jointly run by EPA and DOE, did not initially include lighting products, but began to do so in the mid-1990s, and now includes bulbs and other lighting products. ENERGY STAR light bulbs must be 75% more efficient than the traditional incandescent bulb; both CFLs and LEDs can earn the ENERGY STAR label.[271] ENERGY STAR bulbs must also meet lighting

262. *Id.*

263. Colleen L.S. Kantner et al., Lawrence Berkeley National Laboratory, Impact of the EISA 2007 Energy Efficiency Standard on General Service Lamps 34 (2017) (LBNL-1007090), *available at* https://www.eenews.net/assets/2017/05/04/document_gw_04.pdf.

264. Settlement Agreement, National Elec. Mfrs. Ass'n v. U.S. Dep't of Energy (4th Cir. July 7, 2017) (No. 17-1341) (on file with author).

265. Enviro Energy Partners, *Solid State Lighting Glossary*, http://www.enviroep.com/solid-state-lighting-led/solid-state-lighting-glossary (last visited Oct. 8, 2017).

266. DOE EERE, *About the Solid-State Lighting Program*, https://energy.gov/eere/ssl/about-solid-state-lighting-program (last visited Oct. 8, 2017).

267. EPAct 2005 §912; EISA §321.

268. *Id.*

269. DOE EERE, *supra* note 266.

270. DOE EERE, *supra* note 266.

271. U.S. EPA, ENERGY STAR Summary of Lighting Programs: September 2015 Update 2 (2015), *available at* https://www.energystar.gov/ia/partners/downloads/FINAL_2015_ENERGY_STAR_Summary_of_Lighting_Programs.pdf.

quality performance requirements related to color, turn-on time, and other features. These additional requirements address concerns about lighting quality for more-efficient bulbs that some consumers identified when these newer types of more-efficient bulbs began to enter the market.[272]

DOE also offers the High Performance Outdoor Lighting Accelerator program for utilities, which is designed to demonstrate best practices for accelerating the adoption of high-efficiency outdoor lighting and improving system-wide replacement processes at the municipal level.[273] The goal is to accelerate the deployment of high-performance street and outdoor lighting to reach at least 50% of a county's inventory over the next few years.

The federal government should continue to fully fund the ENERGY STAR program and invest in labeling, RD&D, and accelerator programs on lighting to complement mandatory efficiency standards for lighting, speed the uptake of efficient lighting, and promote technological advances that will allow the establishment of even stronger lighting efficiency standards in the future. Cities should work with DOE to conduct analysis, secure funding, and install outdoor lighting systems. States or regions should also join in a collaborative and supportive role.

4. Model and State Building Codes

Building energy codes also play an important role in promoting lighting efficiency. Building codes address the installed power and/or energy use of lighting installations in new construction and in existing buildings that undergo a major renovation. The model energy codes adopted by ASHRAE and the ICC both cover lighting, typically by setting a maximum lighting power density and by prescribing minimum lighting controls that must be used in commercial and industrial buildings. States are required by EPAct 1992 to adopt the latest version of a model building code or to develop one that is equivalent,[274] but some lag behind. States should move quickly to adopt and enforce the latest model energy code.

5. State Lighting Efficiency Legislation and Programs

State law, regulation, and policies can significantly influence lighting efficiency. CEC adopted stronger state light bulb efficiency standards in January 2016, which will go into effect in 2018-2019, having received special exemption in EISA to have these standards go into effect one year before the EISA Tier 2 backstop standards take effect.[275] CEC estimates that these standards will save Californians more than $4 billion in electricity costs over the first 13 years that the standards are in effect and conserve enough electricity to power 400,000 homes.

In addition, some 36 states provide incentives for the use of energy-efficient lighting through rebate, loan, or tax incentive programs. These programs tend to take the form of energy-efficiency incentives that cover lighting, among other products. Some states have enacted legislation authorizing programs that provide low-interest loans for energy-efficiency projects or offer grants or rebates.[276] These state programs often work in coordination with the EPA ENERGY STAR program.[277] While other states will not be able to establish energy-efficiency standards for light bulbs (because only California received an exemption through EISA), all states can and should develop robust policies such as these to encourage the use of increasingly efficient bulbs.

6. State and Federal Lighting Incentive Programs

Utility incentive programs, adopted as part of energy-efficiency programs that are typically mandated by utility regulators, and sometimes in response to state legislation, have similarly supported lighting efficiency improvements by distributing efficient light bulbs for free or providing for rebates.[278] Federal tax policy also provides financial incentives for lighting efficiency. For instance, EPAct 2005 included a tax deduction for energy-efficient commercial buildings, the specifications for which include enhanced lighting efficiency.[279] DOE has also created financial incentives for continued manufacturer innovation in lighting efficiency in the form of a prize program called the Bright Tomorrow Lighting Prize, or "L Prize," that is awarded to manufacturers that develop a plan to manufacture cutting-edge efficient bulbs at reasonable cost. The L Prize competition is the first government-sponsored technology competition designed to spur development of ultra-efficient SSL products to replace current less-efficient lighting products.

Both the federal government and states should continue to invest in programs that provide financial incentives for the use and manufacturing of efficient lighting. These approaches also provide a helpful complement to mandatory efficiency standards by driving demand for more-efficient lighting and driving technology advances further.

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272. Committee on Assessment of Solid State Lighting et al., *supra* note 232, at 23-24.
273. DOE Better Buildings, *Outdoor Lighting*, https://betterbuildingssolutioncenter.energy.gov/accelerators/outdoor-lighting (last visited Oct. 8, 2017).
274. Committee on Assessment of Solid State Lighting et al., *supra* note 232, at 25-26.
275. News Release, CEC, Energy Commission Adopts Lighting Standards to Save Californians More Than $4 Billion in Electricity Costs (Jan. 27, 2016), http://www.energy.ca.gov/releases/2016_releases/2016-01-27_adoption_of_lighting_standards_nr.html; CEC, Energy Efficiency Standards for Lighting Frequently Asked Questions (CEC-400-2015-041-FS), *available at* http://www.energy.ca.gov/2015publications/CEC-400-2015-041/CEC-400-2015-041-FS.pdf. EISA provides an exemption from preemption for California and Nevada, which allows state lighting efficiency standards in those states to go into effect as of January 1, 2018, under specified circumstances. 42 U.S.C. §6295(i)(6)(A)(vi).
276. Abby Harder & Emily Beard, *Energy Efficient Lighting*, Nat'l Conf. St. Legislatures, June 2, 2016, http://www.ncsl.org/research/energy/energy-efficient-lighting.aspx.
277. *Id.*
278. Committee on Assessment of Solid State Lighting et al., *supra* note 232, at 27.
279. *Id.*

B. Computer and Data Center Energy Efficiency

Today, consumer and commercial electronics of all types constitute a product sector that accounts for ever-increasing energy consumption and carbon emissions. In 2011, end-user electronic devices accounted for 1.15% of global carbon emissions, up from 0.78% in 2002; by 2020, end-use devices are expected to account for 1.38% of global emissions.[280] Computers represent a major share of the energy usage and carbon impacts associated with the electronics product sector, accounting for about 60% of the sector's carbon emissions in 2011.[281] Moreover, the information technology (IT) infrastructure that is necessary to support computers and their programs and applications is also highly energy- and carbon-intensive. Yet, the laws and policies needed to require or incentivize computers and data centers to become more efficient are still in their infancy today. Much more can and must be done to address efficiency in this sector in order to meet the DDPP's 2050 carbon goals.

1. Computer Efficiency

The 300 million computers in U.S. homes and businesses represent one of the largest energy users in the electronics category. U.S. computer and monitor electricity consumption in U.S. homes and businesses is estimated to total 95 billion kWh annually, more than the electricity use of all the households in California, and costs consumers $10 billion a year.[282] There are ample technology pathways to improving computer energy efficiency. As one major example, idle power, which constitutes 50%-77% of a computer's lifetime energy consumption, could be reduced by half using readily available off-the-shelf components and tweaking system power management settings. If all computers achieved a 30% average energy reduction, U.S. consumers could save $3 billion a year, reduce electricity use by 29 billion kWh annually—equal to the power consumed by all the households in the cities of Los Angeles and Chicago combined—and reduce CO_2 emissions by 20 million metric tons, without any impact on computer performance or user convenience.[283]

Although the federal ENERGY STAR program has established voluntary labeling standards for more-efficient computers and monitors,[284] there are no federal energy-efficiency standards for computers and monitors. However, in December 2016, CEC became the first U.S. jurisdiction to adopt mandatory energy-efficiency standards for computers.[285] These standards will play a very important role in curbing computer energy waste. The CEC standards cover desktop computers, laptops, small-scale servers, workstations, and monitors; they will go into effect between 2018 and 2021.[286] Combined, and once fully implemented, these standards will save 2,332 gWh of electricity per year—enough electricity to power 350,000 California homes—and reducing consumer bills by $373 million annually.[287] Since California is home to one out of eight U.S. consumers, manufacturers are likely to implement energy-saving measures for all computer models, rather than maintain a separate inventory specifically for California.[288] Therefore, CEC efficiency standards for computers, when finalized, will provide a major prod for computer energy efficiency nationwide.

EPCA does not establish federal energy-efficiency standards for computers or require DOE to do so. However, as discussed above, EPCA provides DOE with authority to classify additional products not specified in the statute as "covered products" for which it may establish energy-efficiency standards, as long as DOE finds that such a designation is "necessary for the purposes of EPCA" and per-household energy usage of the product exceeds 100 kWh per year.[289] In 2012, DOE initiated the process of establishing such a "covered product" finding for computers, which was the first step toward establishing national energy-efficiency standards for computers, but has not made significant progress toward completing the process.[290] Given the current lack of progress on federal efficiency standards as of this writing, DOE should step aside and allow California to implement its own computer efficiency standards, which will also drive the national market for computer efficiency. DOE can act to establish a national standard at the California level or higher in the future.

2. Data Center and Computer Server Efficiency

Data centers and computer servers represent a rapidly growing source of electricity consumption and are a key driver in the building of new power plants in some regions. A computer server is a computer that provides services or

280. Global E-Sustainability Initiative, GeSI SMARTer 2020: The Role of ICT in Driving a Sustainable Future 208 (2012), *available at* http://www.indiaenvironmentportal.org.in/files/file/SMARTer%202020%20-%20The%20Role%20of%20ICT%20in%20Driving%20a%20Sustainable%20Future.pdf.

281. *Id.* at 22.

282. NRDC, Issue Brief: Slashing Energy Use in Computers and Monitors While Protecting Our Wallets, Health, and Planet 1-2 (2016), *available at* https://www.nrdc.org/sites/default/files/slashing-energy-use-computers-monitors-ib.pdf.

283. *Id.*

284. U.S. EPA, ENERGY STAR Program Requirements for Computers 1 (2016), https://www.energystar.gov/ia/partners/product_specs/program_reqs/Computers_Program_Requirements.pdf.

285. *Energy Commission Adopts First-in-the-Nation Energy Efficiency Standards for Computers and Monitors*, CEC, Dec. 14, 2016, http://calenergycommission.blogspot.com/2016/12/energy-commission-adopts-first-in.html.

286. CEC, Energy Efficiency Standards for Computers and Monitors, Frequently Asked Questions 2 (CEC-400-2016-026-FS), http://www.energy.ca.gov/2016publications/CEC-400-2016-026/CEC-400-2016-026-FS.pdf.

287. *Id.* at 1.

288. Pierre Delforge, *California Approves Nation's 1st Computer Energy Standards*, NRDC, Dec. 14, 2016, https://www.nrdc.org/experts/pierre-delforge/california-approves-nations-1st-computer-energy-standards.

289. 42 U.S.C. §6292(b).

290. DOE EERE, *Appliance and Equipment Standards Rulemakings and Notices—Rulemaking for Computer and Backup Battery Systems*, https://www1.eere.energy.gov/buildings/appliance_standards/rulemaking.aspx/ruleid/78 (last visited Oct. 8, 2017).

other resources to other computers. Data centers are facilities that contain IT equipment including computer servers used for data processing, data storage devices, and networking devices.[291] The nation's nearly three million data centers consumed an estimated 70 billion kWh in 2014—equivalent to all the electricity required to power all of the households in Washington and Virginia combined, and accounting for 1.8% of total U.S. electricity consumption.[292] A 2007 EPA report first looked at trends in energy use and energy costs of data centers and computer servers in the United States, recommending the development of energy performance metrics as well as ENERGY STAR standards.[293] In May 2009, ENERGY STAR issued criteria for computer servers and began developing criteria for data centers, which would focus on power supply unit efficiency, active state efficiency, idle state efficiency, and power management.[294]

In 2016, DOE released an update to the 2007 EPA report, further detailing the opportunities and need to reduce energy use from data centers by employing existing technology.[295] Decommissioning unused servers, putting idle servers into a lower power sleep mode, consolidating lightly used servers, and improving cooling mechanisms are examples of efficiency practices that could reduce energy waste by up to 45% by 2020. Massive server farms, such as those run by Amazon and Google, have made strides in energy use reduction by employing best practices. However, the vast majority of data center energy use is consumed in small, medium, and large corporate data centers.

These smaller operations are lagging behind in efficiency due in part to lack of awareness and inducement for efficiency, highlighting the need for utility incentive programs that would cut waste by data centers of all sizes.[296] Although data center efficiency standards may be premature, states can adopt policies and programs to encourage improvement in data center efficiency. Additionally, the IT industry can take these steps voluntarily:

- *Adoption of a simple server utilization metric*. One of the biggest efficiency issues in data centers is underutilization of servers. Adoption of a simple metric, such as the average utilization of the server central processing unit(s) (CPU), would help resolve that issue. Measuring and reporting CPU utilization would be one simple and affordable way of gauging data center efficiency that could be used immediately to drive greater IT energy savings.
- *Rewarding efficient behaviors and overcoming split incentives*. Data center operators, service providers, and multi-tenant customers should review their internal organizational structures and external contractual arrangements and ensure that incentives are aligned to provide financial rewards for efficiency best practices. Multi-tenant data center stakeholders—those served by a single facility where they lease space, power, and Internet connectivity—should develop a "green lease" contract template to make it easier for all customers to establish contracts that incentivize, rather than stand in the way of, energy savings.
- *Disclosure of data center energy and carbon performance*. Public disclosure can drive behavior change and efficiency improvements. In their corporate and social responsibility reports, industry leaders in data center efficiency should voluntarily disclose operational performance metrics, such as fleetwide server utilization levels, and organizational performance (e.g., how they address split incentive issues internally and externally). States could also consider adopting a disclosure requirement for data center energy usage and carbon performance.[297]

C. Industrial and Commercial Efficiency

Legal Pathways to Deep Decarbonization in the United States[298] includes a chapter that examines in depth the carbon emissions footprint of the U.S. industrial sector and ways to improve industrial energy and emissions efficiency, focusing on needed changes to industrial technologies, market policies such as carbon taxes to require industries to internalize the cost of carbon pollution, regulatory policies under the Clean Air Act, and with a special focus on the role of materials efficiency in improving the efficiency of the industrial sector. This section will briefly discuss the potential for energy-efficiency improvements in the U.S. industrial and commercial sectors, barriers to industrial efficiency, and specific short- to medium-term legal and policy approaches to overcoming these barriers and improving industrial and commercial efficiency.

291. Pierre Delforge et al., NRDC & Antithesis, Data Center Efficiency Assessment: Scaling Up Energy Efficiency Across the Data Center Industry: Evaluating Key Drivers and Barriers 9 (2014), *available at* https://www.nrdc.org/sites/default/files/data-center-efficiency-assessment-IP.pdf.

292. Pierre Delforge, *The Power of Efficiency to Cut Data Center Energy Waste*, NRDC, June 30, 2016, https://www.nrdc.org/experts/pierre-delforge/power-efficiency-cut-data-center-energy-waste; Arman Shehabi et al., Lawrence Berkeley National Laboratory, United States Data Center Energy Usage Report ES1 (2016) (LBNL-1005775), *available at* https://pubarchive.lbl.gov/islandora/object/ir%3A1005775/datastream/PDF/view.

293. U.S. EPA, Report to Congress on Server and Data Center Energy Efficiency Public Law 109-431, at 89 (2007), https://www.energystar.gov/ia/partners/prod_development/downloads/EPA_Datacenter_Report_Congress_Final1.pdf.

294. U.S. EPA, ENERGY STAR Program Requirements for Computer Servers 5 (2009), https://www.energystar.gov/ia/partners/product_specs/program_reqs/computer_server_prog_req.pdf.

295. Shehabi et al., *supra* note 292, at ES-3.

296. Delforge, *supra* note 292.

297. These recommendations are drawn from an NRDC report, NRDC, America's Data Centers Are Wasting Huge Amounts of Energy 5 (2014), https://www.nrdc.org/sites/default/files/data-center-efficiency-assessment-IB.pdf.

298. Legal Pathways to Deep Decarbonization in the United States (Michael B. Gerrard & John C. Dernbach, eds., ELI Press forthcoming 2018).

1. Potential for Industrial Energy Efficiency

The industrial sector accounts for just under one-third of the energy use and CO_2 emissions in the United States.[299] The U.S. industrial sector has significant untapped energy-efficiency potential.[300] According to several studies, the industrial sector in the United States likely has potential for cost-effective energy-efficiency improvements that could reduce current energy usage by a range of 14%-22% of current energy usage over a decade, with further opportunities after that for efficiency improvement through additional R&D.[301] Most of this potential is cost effective, with attractive payback for investments (by one estimate, a 4:1 return on investment).[302]

2. Barriers to Industrial Energy Efficiency

Despite the success of many corporations in pursuing energy efficiency and the attractive payback for many industrial energy-efficiency investments, significant barriers exist to fully realizing the potential of industrial energy efficiency. These barriers include: imperfect information about opportunities and available solutions; lack of specialized knowledge and staff who are not motivated or technically capable of making energy-efficiency improvements; reactive rather than strategic energy decisionmaking; perceived risk of making efficiency investments; split incentives; constrained access to capital; and lack of corporate or executive support.[303]

3. Approaches to Improving Industrial Energy Efficiency

The following are some key approaches that can be used to overcome these barriers and increase industrial energy efficiency in the short to medium term:

❑ *Energy-efficiency standards for industrial and commercial equipment*: Industrial and commercial energy-efficiency standards help to overcome the barriers to industrial efficiency identified above by requiring minimum energy-efficiency standards for commonly used industrial and commercial products. Through EPAct 1992 and subsequent amendments, Congress has included minimum energy-efficiency standards for certain types of industrial and commercial equipment in the DOE energy-efficiency standards program as well as a process for DOE to revise these standards periodically, similar to the residential energy-efficiency standards regulatory process.[304] Pursuant to these requirements, DOE has currently established energy-efficiency standards for more than 20 types of industrial and commercial equipment, including automatic commercial ice makers, pumps, commercial packaged air conditioners and heat pumps, distribution transformers, and electric motors.[305]

Congress or DOE should consider expanding the industrial and commercial products that are covered by DOE standards either by legislation or DOE regulation.

❑ *Implementation of strategic energy management (SEM) practices*: SEM practices help to overcome barriers to industrial energy efficiency by building management and operator awareness of energy efficiency and identifying holistic practices to improve efficiency at industrial facilities. In contrast to policy approaches that focus on promoting energy-efficiency technology and supporting the installation of new, more-efficient equipment or processes, SEM practices seek to promote operational, organizational, and behavior changes that result in greater efficiency gains on a continuing basis. A growing number of state energy-efficiency programs are focused on training corporations on SEM practices and encouraging, and in some cases funding, the hiring of energy managers to provide leadership for developing and implementing SEM practices.[306] All states should adopt such programs.

❑ *Greater utilization of CHP technologies*: Industrial companies can produce heat and power simultaneously from the same energy source; this cogeneration process is known as CHP. Waste heat from industrial processes or

299. National Academies Press, The Power of Change: Innovation for Development and Deployment of Increasingly Clean Electric Power Technologies 107 (2016), *available at* https://www.nap.edu/catalog/21712/the-power-of-change-innovation-for-development-and-deployment-of.

300. *See generally* NRDC Comments on U.S. Environmental Protection Agency's Proposed Carbon Pollution Emission Guidelines for Existing Stationary Sources, Docket No. EPA-HQ-OAR-2013-0602, at §7.4.3 (submitted Dec. 1, 2014), https://www.nrdc.org/sites/default/files/air_14120101b.pdf.

301. Gowrishankar & Levin, *America's Clean Energy Frontier*, *supra* note 1, at 23-24; Hannah Choi Granade et al., McKinsey and Co., Unlocking Energy Efficiency in the U.S. Economy 75 (2009), http://www.mckinsey.com/client_service/electric_power_and_natural_gas/latest_thinking/~/media/mckinsey/dotcom/client_service/epng/pdfs/unlocking%20energy%20efficiency/us_energy_efficiency_full_report.ashx; National Research Council, National Academy of Sciences and National Academy of Engineering, Real Prospects for Energy Efficiency in the United States, tbl. 4.5, *available at* https://www.nap.edu/catalog/12621/real-prospects-for-energy-efficiency-in-the-united-states.

302. Hannah Choi Granade et al., McKinsey and Co., Unlocking Energy Efficiency in the U.S. Economy, *supra* note 301, at 75.

303. Daniel Trombley, ACEEE, One Small Step for Energy Efficiency: Targeting Small and Medium-Sized Manufacturers 8 (2014), *available at* http://aceee.org/sites/default/files/publications/researchreports/ie1401.pdf; Steve Sorrell et al., Barriers to Industrial Energy Efficiency: A Literature Review 14 (United Nations Industrial Development Organization, Working Paper No. 10/2011, 2011), *available at* http://sro.sussex.ac.uk/53957/1/WP102011_Barriers_to_Industrial_Energy_Efficiency_-_A_Literature_Review.pdf; National Academies Press, America's Energy Future: Technology and Transformation 185-89 (2009), *available at* https://www.nap.edu/catalog/12091/americas-energy-future-technology-and-transformation National Academies Press, *supra* note 299, at 107.

304. 42 U.S.C. §§6311-6317.

305. DOE Office of Energy Efficiency and Renewable Energy, *Standards and Test Procedures*, http://energy.gov/eere/buildings/standards-and-test-procedures (last visited Oct. 8, 2017).

306. State and Local Energy Efficiency Action Network, Industrial Energy Efficiency: Designing Effective State Programs for the Industrial Sector 18 (2014), *available at* https://www4.eere.energy.gov/seeaction/system/files/documents/industrial_energy_efficiency.pdf.

from on-site electricity generation can be used to produce additional electricity and steam to warm buildings or to assist in industrial processes. While 82 gigawatts (GW) of CHP systems (9% of U.S. power capacity) are found at 4,100 sites and in each U.S. state, the untapped potential for CHP technologies is from 50-200 GW.[307] According to one study, fewer than 10% of industrial facilities are using CHP technology.[308] States can encourage the use of CHP technologies through incentive programs and by including them within the scope of EERS.

V. Conclusion

Accelerating and deepening the pace of energy-efficiency improvements to residential, commercial, and industrial products is crucial to meeting U.S. deep decarbonization goals at least cost. While much progress has already been made, there is major potential to do more. Multiple legal pathways are available to the federal government, states, and cities to both encourage and require greater levels of energy efficiency, and the private sector can also play a role. It is critically important to seize these opportunities. Success in improving energy efficiency will also lead to significant benefits for consumers, low-income consumers, public health, and the economy.

307. Vignesh Gowrishankar et al., NRDC, Combined Heat and Power Systems: Improving the Energy Efficiency of Our Manufacturing Plants, Buildings, and Other Facilities 3 (2013), https://www.nrdc.org/sites/default/files/combined-heat-power-IP.pdf.
308. National Academies Press, Power of Change, *supra* note 299, at 108.