Chapter 14. Boost Appliance Efficiency Standards

1. Profile

"Energy efficiency" refers to technologies, equipment, operational changes, and in some cases behavioral changes that enable our society to enjoy equal or better levels of energy services while reducing energy consumption.[1] Efforts to improve efficiency in the generation, transmission, or distribution of electricity are covered in Chapters 1 to 5 and in Chapter 10. In contrast, Chapters 11 to 15 address different policy options for making the end-user's consumption of electricity more efficient. Chapter 11 focuses on policies that establish mandatory energy savings targets for electric utilities, the achievement of which is generally funded through revenues collected from customers themselves. Chapter 12 focuses on policies that create or expand the opportunities for voluntary, market-based transactions that promote energy efficiency as an alternative or supplement to government-mandated programs or regulatory requirements. Chapter 13 focuses on an emerging type of energy efficiency program, behavioral energy efficiency, that is worthy of separate treatment because it is sometimes included within the mandated programs described in Chapter 11 and sometimes implemented as a voluntary effort outside of those programs. This chapter, Chapter 14, covers mandatory appliance efficiency standards that are imposed on manufacturers, and Chapter 15 covers mandatory building energy codes that are imposed on builders and developers.

Appliance standards set minimum energy and water efficiency requirements for selected appliances and equipment – where cost-effective – and prohibit the production, import, or sale of appliances and equipment that do not meet those requirements. Standards can be adopted by federal or state governments.[2] States cannot set efficiency standards for federally regulated products, but they can adopt standards for products not covered by federal standards. When new federal standards are developed, pre-existing state standards for those products are typically preempted by the federal standards; however, certain products could receive exemptions from this federal preemption.

Appliance standards have been one of the most cost-effective policies to generate significant energy and emissions reductions in the United States.[3] For example, the American Council for an Energy-Efficient Economy (ACEEE) and the Appliance Standard Awareness Project (ASAP) recently estimated that existing federal standards will, at the national level:

- Save consumers and businesses more than $1.1 trillion from products sold through 2035;
- Save enough energy cumulatively through 2035 to meet the current level of US energy consumption for a period of two years;
- Reduce peak demand by about 237 gigawatts (GW), or 18 percent, in 2035; and
- Cut annual carbon dioxide (CO_2) emissions in 2035 by 470 million metric tons, an amount equal to the emissions of 118 coal-fired power plants (nearly

1 In contrast, some people use the term "energy conservation" to refer to actions that reduce energy consumption but at some loss of service. Neither term has a universally accepted definition and they are sometimes used interchangeably.

2 Federal standards prohibit production for domestic sales and import; state standards prohibit the sale of products within a state's borders.

3 Critics of appliance standards dispute this point, typically arguing that the benefits attributed to appliance standards are overstated or that most of the benefits would have occurred even in the absence of such standards. However, as discussed later in Section 6, Costs and Cost-Effectiveness, the US Department of Energy and several states have continued to support cost-effective appliance standards based on strong evidence showing the benefits of these policies.

20 percent of US coal plants).[4,5]

Historically, California has been a leader in establishing state appliance standards. It first adopted standards in the 1970s, and since that time 15 other states have followed suit, many of them adopting California's standards for their own uses.[6]

This activity at the state level led to the establishment of the first federal standards under the National Appliance Energy Conservation Act of 1987, or NAECA. Together with subsequent federal standards, including those in the Energy Policy Act of 2005 and the Energy Independence and Security Act of 2007, NAECA has preempted many of the original state-specific appliance standards.[7] However, there are still 19 products regulated by state-specific standards in 11 states and the District of Columbia.[8]

Appliance standards offer several key advantages. They can have a significant impact on the market. This is because all of the products produced in or imported into the United States (e.g., refrigerators, lamps, air conditioners, and electronic motors) have to meet the applicable minimum federal efficiency standards once those standards are put into effect.[9] Because standards reduce consumption from all products produced for domestic sale or imported (or sold, in the case of state standards), they also generate significantly more energy savings than traditional energy efficiency programs, which typically target only a small fraction of the products sold in the market. And importantly, appliance standards overcome many of the key barriers that energy efficiency program administrators often encounter, namely:

- Lack of consumer awareness on benefits of efficient products;
- Lack of information on efficient products;
- Split incentives between renters and building owners;
- Financial procedures that overemphasize initial costs and de-emphasize operating costs;
- Limited stock of efficient products; and
- Manufacturer price competition.[10]

The primary challenge to using state-specific appliance standards to reduce CO_2 emissions is political feasibility. The process of adopting new standards may be long and arduous for some states. Thus, states must consider the political feasibility of doing so. States may also encounter challenges related to measuring and verifying energy and CO2 emissions savings from appliance standards, given the limited experience in this area. This is another topic of significant concern. Finally, if states allow or direct utilities and third-party program administrators to take an active role in supporting standard adoption, this approach could complicate planning for the kinds of "programmatic" energy savings described in Chapter 11 of this document. On the other hand, the involvement of additional stakeholders could improve the process and make for better outcomes.

These barriers are not insignificant; however, the incentive for states to address and overcome them is immense. Appliance standards have proven to be very effective policy tools that save tremendous amounts of energy – and thus the associated emissions from power plants – at the lowest possible cost. Standards also improve electric system reliability, generate new jobs, and save consumers significant amounts of money over the life of

4 Lowenberger, A., Mauer, J., deLaski, A., DiMascio, M., Amann, J., & Nadel, S. (2012, March). *The Efficiency Boom: Cashing in on the Savings From Appliance Standards.* ACEEE and ASAP. Available at: http://www.aceee.org/research-report/a123

5 The results presented here represent the study's base case/original scenario. The study also includes an alternative/conservative scenario, which assumes lower-than-expected energy savings attributable to appliance standards. In this alternative scenario, the savings attributable to the standards decline over time and become zero in the 35th year due to naturally occurring energy efficiency improvements. This scenario results in about half of the benefits of the original scenario.

6 ASAP. (2014, February). *Energy and Water Efficiency Standards Adopted and Pending by State.* Available at: http://www.appliance-standards.org/sites/default/files/State_status_grid_Feb_21_2014.pdf

7 US EPA. (2006, April). *Clean Energy-Environment Guide to Action: Policies, Best Practices, and Action Steps for States*, chapter 4, p. 4-56. Available at: http://epa.gov/statelocalclimate/resources/action-guide.html

8 Refer to the ASAP website at: http://www.appliance-standards.org/states

9 Federal standards prohibit the production for domestic sale or import of products not meeting new federal standards, whereas state standards typically prohibit the sales of products not meeting new state standards. Personal communication with Marianne DiMascio of ASAP, August 21, 2014.

10 See detailed discussion of these barriers in: Nadel, S., deLaski, A., Eldridge, M., & Kliesch, J. (2006, March). *Leading the Way: Continued Opportunities for New State Appliance and Equipment Efficiency Standards.* ACEEE and ASAP. Available at: http://www.aceee.org/research-report/a062

the equipment. This chapter discusses in more detail the benefits to be gained from appliance standards, as well as states' experience in addressing political and other barriers to implementation. Lastly, note that although appliance and equipment standards cover products that use electricity, gas, or water, this document and thus this chapter focuses only on electric appliances and equipment.

2. Regulatory Backdrop

Since 1980, manufacturers of certain appliances sold in the United States have been required to attach comparison labels to their appliances to give consumers important information about energy use. The US Federal Trade Commission's Appliance Labeling Rule currently requires EnergyGuide labels on refrigerators, freezers, dishwashers, clothes washers, room air conditioners, water heaters, furnaces, boilers, central air conditioners, heat pumps, pool heaters, and televisions. This labeling requirement is mandatory but is distinct from federal minimum efficiency standards.

More than 50 consumer products are currently subject to federal appliance efficiency standards developed by the US Department of Energy (DOE) pursuant to the National Appliance Energy Conservation Act of 1987, the Energy Policy Act of 2005, or the Energy Independence and Security Act of 2007.[11] Additional federal standards are expected to be developed in the future. However, many energy-consuming products are not subject to current or expected federal standards, including some products with significant annual electricity consumption. As a supplement to federal standards, the DOE and the EPA have collaborated in the development of the voluntary Energy Star® labeling program, which helps manufacturers identify and advertise to consumers the most efficient appliances in the marketplace.[12]

States seeking to update or develop appliance standards don't need to start from scratch. In fact, historically, many states have modeled their appliance standards after California's standards. Third-party entities such as ASAP, the Northeast Energy Efficiency Partnership (NEEP), and the Multi-State Appliance Collaborative also provide useful knowledge and materials that states can rely upon when updating or developing standards. ASAP has published model legislation for appliance standards most years since 2001, and a dozen states have enacted bills based on these models to date.[13]

Although state agencies can initiate an inquiry into appliance standards, most states typically need to go through a legislative process to establish or update appliance standards, and to authorize state agencies to regulate in this area. Depending on the state, the need for legislative action could be a primary barrier to using appliance standards to reduce CO_2 emissions. However, there are a few states – California, Oregon, and Connecticut – that have already provided state agencies (such as state energy commissions) with the administrative authority to set new standards without having to go through a new legislative process. Among these states, California has the broadest authority to adopt new standards, and the most robust rulemaking process.[14]

The determination of which approach – legislative or administrative – is more advantageous for developing new standards will vary depending on the state and its political readiness for such action. In general, the administrative process can develop standards faster than the legislative process; however, both processes are subject to some degree of political involvement. For example, when California adopted the first-ever standards for televisions, industry groups such as the Consumer Electronics Association actively lobbied against the development of the standard.[15]

11 For more detail, refer to the DOE website at: http://energy.gov/eere/buildings/appliance-and-equipment-standards-program

12 Energy Star® is thus distinct from appliance standards, the subject of this chapter. Traditional energy efficiency programs, such as those described in Chapter 11 of this document, often provide incentives for consumers to voluntarily purchase Energy Star® products.

13 Refer to ASAP website at: http://www.appliance-standards.org/content/state-savings-state-appliance-standards.

14 Personal communication with Marianne DiMascio of ASAP, August 21, 2014 and Josh Craft of NEEP, August 26, 2014. Also refer to: General Statute of Connecticut, Section 16a-48(3)B of Chapter 298, and: Oregon Administrative Rules 330-092-0065.

15 Personal communication with Marianne DiMascio of ASAP, August 21, 2014. Also refer to: NRDC. *Fact Sheet on California's Proposed Energy Efficiency Standards for Televisions.* Available at: http://docs.nrdc.org/energy/files/ene_09091801b.pdf, and: California Energy Commission. (2009, November). *California Approves New Energy Efficient TV Regulations.* Available at: http://www.energy.ca.gov/releases/2009_releases/2009-11-18_tv_regulations.html

And although New York gave administrative authority to state agencies to develop standards for certain products in 2005, the agency has not exercised that authority to date.[16,17] In contrast, when there is general support for the effort among legislators, the state energy office, and local and regional advocacy groups, it is possible for a state to pass a new bill through the legislative process in as short as one to two years.[18]

Regardless of the path used (legislative or administrative), states often engage in similar processes to establish new standards. Steps in the process typically include the following, although the level of effort could differ widely by state:

- **Gain stakeholder input.** This process varies widely by state. For example, some states have a series of informal meetings in which a handful of key stakeholders (e.g., key legislators, state agencies, and local and regional public interest groups) convene and draft new legislation. States that don't require new legislation to establish new standards also seek stakeholder input. They may solicit comments from various stakeholders, including manufacturers, or hold formal public hearings.[19] Among such states, California is considered to have the most robust public hearing and stakeholder process.
- **Conduct benefit-cost analysis and related studies.** Several states have conducted benefit-cost analyses of new standards or reviewed such analyses conducted by others. California runs a rulemaking process in which utilities fund Codes and Standards Enhancement (CASE) reports and evaluate benefits and costs of new standards. Many other states typically review existing studies conducted in California or by advocacy and research organizations such as ASAP and ACEEE.[20]
- **Define and establish draft appliance standards.** This process typically defines covered products, effective dates, efficiency standards, test methods, certification and labeling procedures, inspection and enforcement procedures, penalties for noncompliance, procedures for appeals, waivers and other exceptions, and contact information for the agencies involved.
- **Monitor, review, and modify the program as needed.** Based on stakeholder responses and market trends, some states have made specific program modifications, including revisions to covered products, efficiency levels, and effective dates, as well as process improvements such as more frequent stakeholder input cycles and more transparent public information processes.[21]

Another approach to implementing appliance standards is for state public utility commissions to allow or direct utilities and third-party energy efficiency program administrators to support adoption of standards. These program administrators would then receive credit from the associated energy savings toward the kinds of "programmatic" energy savings goals described in Chapter 11. This idea is discussed in more detail later in this chapter.

Following that approach, utilities in California developed a statewide code and standard support program in 2001. Since that time, a growing number of states have examined the role of utilities in supporting codes and standards (C&S). This trend intensified recently because the

16 Refer to the *Database of State Incentives for Renewables & Efficiency (DSIRE)* at: http://www.dsireusa.org/

17 However, some of the standards drafted in New York helped to advance the process for federal appliance standards. Personal communication with Andrew deLaski of ASAP on September 11, 2014.

18 Personal communication with Marianne DiMascio of ASAP, August 21, 2014.

19 In Connecticut, stakeholders always have opportunities to provide public comments. The Department of Energy and Environmental Protection can hold a public hearing to hear their views directly. Depending on the number of requests, the Department also has an obligation to hold a hearing. Personal communication with Michele Melley of Connecticut Department of Energy and Environmental Protection on August 29, 2014.

20 Lee, A., Groshans, D., Gurin, C., Cook, R., & Walker, T. (2012, August). *Raising the Bar – Getting Large Energy Savings Through Programs That Support Energy-Efficiency Codes and Standards.* Proceedings of the 2012 ACEEE Summer Study on Energy Efficiency in Buildings. Available at: http://www.cadmusgroup.com/wp-content/uploads/2012/12/590-ACE3-Codes-Standards-Paper-Final.pdf

21 Supra footnote 7 at chapter 4, pp. 4-60 to 4-61.

American Recovery and Reinvestment Act required states to adopt the latest national model energy codes for buildings as a condition of receiving federal American Recovery and Reinvestment Act funds. As a result, more states now focus on exploring the role of building energy codes in utility energy efficiency programs; however, at least Massachusetts, Minnesota, and Arizona established or are exploring frameworks for program administrators to promote both building energy codes *and* appliance standards.[22]

Energy efficiency plays a prominent role in the emissions guidelines for CO_2 emissions from existing power plants that the EPA proposed in June 2014, citing its authority under section 111(d) of the Clean Air Act, as part of its "Clean Power Plan." [23] The EPA determined that the "best system of emission reduction" for existing power plants under the Clean Air Act consists of four "building blocks," one of which is end-use energy efficiency. Although states will not be required to include energy efficiency in their 111(d) compliance plans, the emissions rate goals for each state are based on an assumption that a certain level of energy savings (and thus, emissions reduction) is achievable. The level of savings that the EPA used to set each state's emissions rate goals is based on the demonstrated performance of leading states with respect to the kinds of ratepayer-funded energy efficiency programs described in Chapter 11 and a meta-analysis of energy efficiency potential studies; the EPA did not explicitly consider what is achievable through the adoption of state appliance efficiency standards. However, states will apparently be able to use state appliance efficiency standards to reduce emissions and comply with any final regulation, so long as the standards go beyond "business as usual" projections of energy demand and are enforceable.

3. State and Local Implementation Experiences

According to ASAP, 16 states have adopted appliance and equipment standards since 2001, covering about 35 products.[24] Since then, many of the state standards have been preempted by federal appliance standards (e.g., the Energy Policy Act of 2005 and the Energy Independence and Security Act of 2007).

As of September 2014, 11 states and the District of Columbia still have their own appliance standards in effect, covering approximately 20 product types (as shown in Table 14-1).[25] Such standards apply to products not covered by any of the current federal standards, or to those that have greater efficiency requirements than federal standards.

22 NEEP, Institute for Electric Efficiency, & Institute for Market Transformation. (2013, February). *Attributing Building Energy Code Savings to Energy Efficiency Programs.* Available at: http://www.neep.org/attributing-building-energy-code-savings-energy-efficiency-programs. Also see: Supra footnote 20.

23 Refer to: US EPA. (2014, June). *40 CFR Part 60 – Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units; Proposed Rule.* Federal Register Vol. 79, No. 117. Available at: http://www.gpo.gov/fdsys/pkg/FR-2014-06-18/pdf/2014-13726.pdf

24 Supra footnote 6.

25 Supra footnote 8.

Table 14-1

States With Efficiency Standards in Effect[26]

Product	AZ	CA	CT	DC	GA	MD	NV	NH	OR	RI	TX	WA
Battery Chargers		2012							2013			
Compact Audio Equipment		2004 (TBD)	2011						2007			
DVD Players and Recorders		2004	2011 (TBD)						2007			
External Power Supplies		2012										
Faucets				2010								
General Service Lamps: Incandescents plus CFLs, GSLED, GSOLED		2008					2007					
Hot Food Holding Cabinets		2004	2007	2007		2007		2008	2007	2006		2009
Luminaires		2008										
Mercury Vapor Lamp Ballasts										2005		
Metal Halide Lamp Fixtures		2009										
Pool Pumps	2009	2009	2007									2009
Portable Electric Spas	2009	2004	2007						2007			2009
Televisions		2009	2011 (TBD)						2013			
Urinals		2007			2010						2009	
Vending Machines		2004										
Water Closets		2007			2010						2009	
Water Dispensers		2004	2007	2007		2007		2008	2007	2006		2009
Wine Chillers		2002										

Figure 14-1 shows the states that have standards in effect today, as well as states whose standards have been entirely preempted by federal standards since 2001.

Two states that provide useful examples of implementation experiences – demonstrating both the legislative and administrative approaches – are California and Connecticut.

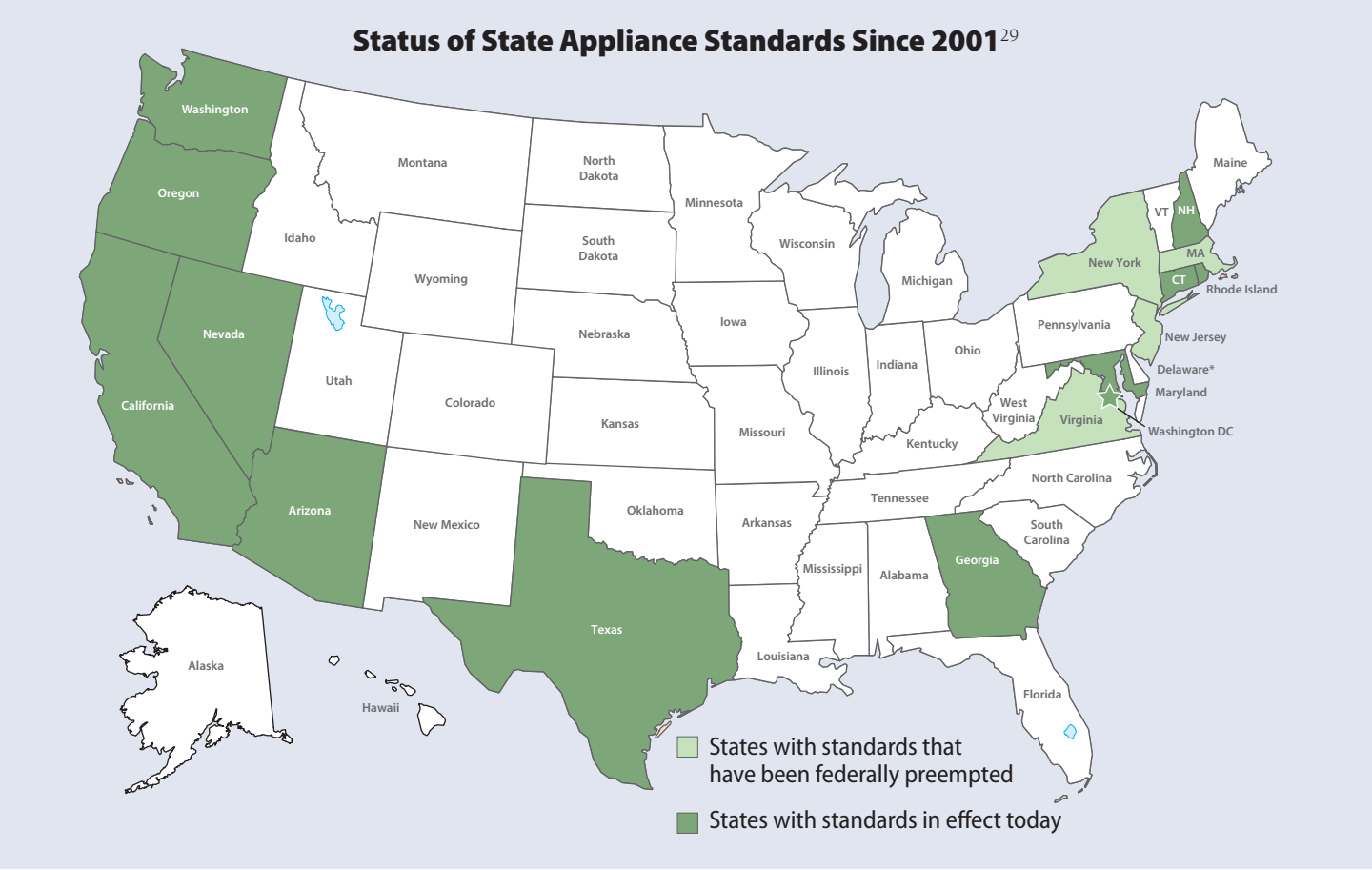
California was the first state in the country to adopt appliance and efficiency standards. Since 1976, California has set minimum energy efficiency standards for a wide range of appliances and equipment, including all major household appliances, air conditioners, furnaces, and water heaters.[27] California paved the way for other states and eventually the federal government to begin setting appliance standards. When the federal government decided not to issue standards under its legislative mandate in 1982, several other states developed appliance standards based on the California standards, which helped create the consensus for new federal legislation in 1987 (the NAECA) and the Energy Policy Acts of 1992 and 2005.[28] More recently, between 2010 and 2012, California introduced efficiency standards for televisions, battery chargers, and external power supplies, making it the first state in the

26 Supra footnote 8.

27 California Energy Commission. (2012, February). *2011 IEPR (Integrated Energy Policy Report)*, p. 66. Available at: http://www.energy.ca.gov/2011_energypolicy/

28 Supra footnote 7 at chapter 4, p. 4-56.

Figure 14-1



nation to set standards for these appliances.[30, 31]

It is also notable that California is the first state that has allowed investor-owned utilities (IOUs) to support the development of new appliance standards and building codes as part of their energy efficiency programs, and to count savings from those policies toward programmatic savings goals. When electric deregulation occurred in California in the 1990s, market transformation – including appliance standards – gained significant attention as an approach to prevent energy efficiency from being lost in the transition to deregulated utilities. California utilities advocated in support of C&S in the process before the California Energy Commission.[32]

Around 2001, the state's four IOUs launched a

29 Synapse Energy Economics (2015). *Status of State Appliance Standards Since 2001*. Based upon information found at http://www.appliance-standards.org/.

30 Refer to ACEEE website at: http://database.aceee.org/state/california

31 The majority of stakeholders supported these standards, although a few opposed them. The supporters of the TV standard (which was adopted by the California Energy Commission by a unanimous 5-0 vote) included the largest manufacturer of flat-screen TVs in the nation, Vizio; television component manufacturers 3M and Agoura Technologies; the LCD Television Association; and all three major California electric utility companies. (See: http://www.energy.ca.gov/appliances/tv_faqs.html) Supporters of the battery standard included the Power Sources Manufacturers Association, which represents companies that manufacture components to enable more efficient battery chargers, and the state's three investor-owned utilities. (See http://www.energy.ca.gov/appliances/battery_chargers/documents/Chargers_FAQ.pdf) The Consumer Electronics Association, among others, opposed this standard and asserted it would have a net negative impact on consumers. For a summary of the public comments in support of and opposed to the battery charger standard, and the California Energy Commission's responses, see: http://www.energy.ca.gov/appliances/battery_chargers/documents/2012-09-14_Summary_and_Response_to_Public_Comments.pdf

32 Supra footnote 20.

coordinated statewide program to advocate for C&S. They engaged in various activities such as preparing technical reports on C&S (titled "Codes and Standards Enhancement [CASE] reports"), testifying in public hearings, and working with industry.[33] These efforts led to adoption of new C&S that became effective in 2005 to 2006. In the 2006 to 2009 program cycle, the California Public Utilities Commission for the first time allowed the utilities to claim 50 percent of the verified savings from C&S toward their goals, and in the next program cycle (2010 to 2012), the Commission allowed 100-percent credit.[34]

California's appliance and equipment standards have significantly reduced energy usage. The California Energy Commission estimated that appliance efficiency standards adopted between 1976 and 2005 saved 18,761 gigawatt-hours (GWh) in 2010. This represents 6.7 percent of the state's electricity peak load and is roughly the amount of energy produced annually by California's two largest power plants. The California Energy Commission estimated these standards saved consumers about $2.68 billion in 2010 based on an average electric rate of 14 cents per kilowatt-hour (kWh). Without including the impact of the latest appliance standards recently adopted, these existing standards were forecast to save 27,116 GWh per year by 2020 (approximately 8.6 percent of projected load in 2020).[35]

Connecticut enacted efficiency standards through legislative actions in 2004, 2007, and 2011. In 2004, Connecticut General Statute 16a-48 established minimum efficiency standards for eight products, under the jurisdiction of the Connecticut Office of Policy and Management and the Department of Public Utility Control.[36] These standards cover torchiere lighting fixtures, building transformers, commercial refrigerators and freezers, traffic signals, exit signs, large packaged air conditioning equipment, unit heaters, and commercial clothes washers. Standards for five of the eight products were preempted by the federal standards included in the Energy Policy Act of 2005.[37] According to NEEP, Connecticut's 2014 appliance standards were projected to save residents and businesses more than $380 million in energy costs by 2020, conserve over 430 GWh of electricity, reduce summer peak electricity demand by over 125 MW, and avoid about 65,000 metric tons of carbon.[38]

In 2007, Connecticut adopted standards for eight additional products; three of these standards were later preempted by the Energy Independence and Security Act of 2007.[39] In January 2011, the Connecticut General Assembly passed Bill 1243 (Public Act No. 11-80) to institute additional standards for compact audio players, televisions, and DVD players and recorders. These standards are based on California Code of Regulations, Title 20. As of today, there are several appliance standards in Connecticut that have not been preempted by any federal appliance standards. They are as follows (dates listed in parentheses signify the year the standard took effect):

- Bottle-type water dispensers (2009);
- Commercial hot food holding cabinets (2009);
- Hot tubs (2009);
- Swimming pool pumps (2010);
- Compact audio equipment (2014);[40]
- DVD players and recorders (2014); and
- Televisions (2014).[41]

Public Act No. 11-80 also includes some language that has provided legislative authority to the Department and the Commissioner of Energy and Environmental Protection to review or adopt appliance standards in Sec. 102. (d)(3)(B):

> *The department, in consultation with the Multi-State Appliance Standards Collaborative, shall identify additional appliance and equipment efficiency standards. The commissioner shall review all California standards and may review standards from other states in such collaborative.*

33 CASE reports evaluate the costs and benefits of specific energy efficient appliances and equipment.

34 Supra footnote 20.

35 Supra footnote 27.

36 Supra footnote 16.

37 Refer to ACEEE website at: http://database.aceee.org/state/connecticut

38 Refer to: Supra footnote 7 at chapter 4, p. 4-63. Also refer to: NEEP. (2004, May). Connecticut Adopts New Energy Efficiency Product Standards. [Press release].

39 Refer to ACEEE website at: http://database.aceee.org/state/connecticut

40 Effective January 1, 2014, Connecticut law required compact audio players, DVD players, and recorders to comply with energy efficiency standards (Connecticut General Statute §16a-48).

41 Refer to Supra footnote 39. Also refer to Supra footnote 16 and Supra footnote 8.

The commissioner shall issue notice of such review in the Law Journal, allow for public comment and may hold a public hearing within six months of adoption of an efficiency standard by a cooperative member state regarding a product for which no equivalent Connecticut or federal standard currently exists, the department shall adopt regulations in accordance with the provisions of chapter 54 adopting such efficiency standard unless the department makes a specific finding that such standard does not meet the criteria in subparagraph (A) of this subdivision.[42]

These examples demonstrate that states can use a variety of approaches to implement appliance standards in support of greenhouse gas (GHG) reduction efforts.

4. GHG Emissions Reductions

As explained in Chapter 11, the magnitude of emissions reductions attributable to energy efficiency measures depends first and foremost on the amount of energy that was (or will be) saved. However, the emissions reductions that result from those energy savings also depend on when energy was (or will be) saved, and which marginal electric generating units (EGUs) reduced (or will reduce) their output at those times. Over the longer term, the more significant impact of energy efficiency programs and policies is that they can defer or avoid the deployment of new EGUs. Over that longer term, the avoided emissions will thus depend not so much on the characteristics of existing EGUs, but on the costs and development potential for new EGUs.

In either the near term or the longer term, GHG emissions reductions are proportional to energy savings, but not necessarily on a one-to-one basis (i.e., a one-percent reduction in energy consumption could reduce emissions by more or less than one percent, depending on how the emissions rates of the marginal or deferred EGUs compare to the system average emissions rates). Chapter 11 describes three methods for quantifying the short-term emissions impacts of energy efficiency programs: the average emissions method, the marginal emissions method, and the dispatch modeling method. Over a longer time period, the emissions rates of new natural gas-fired EGUs may represent a better proxy for avoided emissions.

As previously noted, ACEEE and ASAP recently estimated that existing federal standards will, at the national level, reduce annual CO_2 emissions in 2035 by 470 million metric tons, an amount equal to the emissions of 118 coal-fired power plants (nearly 20 percent of US coal plants).[43] Using the DOE's own estimates, by 2030 federal appliance standards will result in a cumulative reduction of 6.8 billion tons of CO_2 emissions, equivalent to the annual GHG emissions of 1.4 billion automobiles.[44] And as just one example of what's already happening at the state level, according to NEEP, Connecticut's 2014 appliance standards will avoid about 65,000 metric tons of carbon by 2020.[45]

ASAP and ACEEE have also produced several reports analyzing the impacts of both federal and state appliance standards from energy, environmental, and economic perspectives. These include the 2005, 2006, and 2008 "Leading the Way" reports, which estimate the impacts of recommended new appliance standards for each state that went beyond the then-most-recent federal appliance standards – either by implementing more aggressive standards or by covering additional products.

ASAP and ACEEE's most recent publicly available analyses of recommended potential state appliance standards are provided on ASAP's website for each state, and cover 10 consumer products, as shown in Table 14-2.[46] Their latest analysis added a few new consumer products such as double-ended quartz halogen lamps, portable electric spas, and room air cleaners to their previous analysis conducted about two years ago, but also removed several products that were included in the previous analysis for various reasons, including delays in standard development in California and new federal initiatives to establish some of those standards.[47,48]

42 Supra footnote 41.

43 Supra footnote 4.

44 Refer to the DOE website at: http://energy.gov/eere/buildings/appliance-and-equipment-standards-program

45 Supra footnote 38.

46 Refer to Supra footnote 8.

47 Details of the previous analysis are found in: Supra footnote 4.

48 Another reason for excluding some of the products is that, unlike the previous analysis that had a long-term view, the current analysis focuses on near-term standards that ASAP and ACEEE recommends states adopt in the next few years. Personal communication with Marianne DiMascio of ASAP on February 26, 2015.

Table 14-2

Illustrative New State Standards Assessed by ASAP and ACEEE

Consumer Product Types
Battery Chargers
Commercial Dishwashers
Double-Ended Quartz Halogen Lamps
Faucets (lavatory)
Hot Food Holding Cabinets
Portable Electric Spas
Room Air Cleaners
Water Dispensers
Toilets
Urinals

Consistent with the practices of the "Leading the Way" studies, ASAP and ACEEE applied the following four major criteria to select these standards:

- A standard would achieve significant energy savings;
- A standard is known to be very cost-effective for purchasers and users of the product;
- Products meeting the recommended standards are readily available today; and
- A state standard could be implemented at very low cost to the state.[49]

ASAP and ACEEE have estimated savings in electricity, natural gas, water, and CO_2 emissions in 2025 and 2035 for each state. They have also estimated utility bill savings, as well as payback period, benefit/cost ratio, and net present value. As an example, Table 14-3 demonstrates savings in energy and CO_2 emissions for Florida from this analysis. Among other products, battery chargers have the largest energy savings potential.

If these new standards are adopted and become effective in 2017 in Florida, they would be expected to save over 1400 GWh of electricity and 740 thousand metric tons of CO_2 in 2035. The potential electricity savings in 2035 equates to about 0.6 percent of today's electricity consumption in the state. Furthermore, states including Florida are likely to have opportunities to adopt additional standards for other consumer products such as computer equipment and game consoles as California is currently developing standards for these products.[51]

Table 14-3

Potential Energy Savings and CO_2 Reductions From New State Appliance Standards in 2035 for Florida[50]

Products	Electricity (GWh)	Natural Gas (BBTU)	CO_2 (1000 tons)
Battery Chargers	836.5	-	415.7
Small Consumer Chargers	795.1	-	395.1
Small Non-Consumer Chargers	11	-	5.5
Large Chargers	30.4	-	15.1
Commercial Dishwashers	41.1	205.8	31.4
electricity	41.1	-	20.4
natural gas	-	205.8	10.9
Double-Ended Quartz Halogen Lamps	0	-	0
Faucets (lavatory)	67.6	465.5	58.3
electricity	67.6	-	33.6
natural gas	-	465.5	24.7
Hot Food Holding Cabinets	22.9	-	11.4
Portable Electric Spas	10.9	-	5.4
Room Air Cleaners	410	-	203.7
Water Dispensers	37.2	-	18.5
TOTAL	**1,426**	**671**	**744**

5. Co-Benefits

In addition to GHG emissions reductions, appliance standards will provide a variety of co-benefits that are accrued from energy use reduction in buildings and through the power grid to electric generation. These co-benefits include cost savings and reductions in other air pollutant emissions. The air emissions co-benefits depend on the same factors that were discussed with respect to GHG emissions reductions.

The potential co-benefits of appliance standards for society and the utility system are summarized in

49 These criteria are the same as those used for the 2006 ASAP and ACEEE paper: Supra footnote 10. Also based on personal communication with Marianne DiMascio of ASAP.

50 Refer to ASAP analysis for Florida, available at: http://www.appliance-standards.org/states

51 Information on California's standard rulemaking process is available at: http://www.energy.ca.gov/appliances/rulemaking.html

Table 14-4

Co-Benefits of Appliance Standards

Type of Co-Benefit	Provided by This Policy or Technology?
Benefits to Society	
Non-GHG Air Quality Impacts	Yes
Nitrogen Oxides	Yes
Sulfur Dioxide	Yes
Particulate Matter	Yes
Mercury	Yes
Other	Yes
Water Quantity and Quality Impacts	Yes
Coal Ash Ponds and Coal Combustion Residuals	Yes
Employment Impacts	Yes
Economic Development	Yes
Other Economic Considerations	Yes
Societal Risk and Energy Security	Yes
Reduction of Effects of Termination of Service	Yes
Avoidance of Uncollectible Bills for Utilities	Yes
Benefits to the Utility System	
Avoided Production Capacity Costs	Yes
Avoided Production Energy Costs	Yes
Avoided Costs of Existing Environmental Regulations	Yes
Avoided Costs of Future Environmental Regulations	Yes
Avoided Transmission Capacity Costs	Yes
Avoided Distribution Capacity Costs	Yes
Avoided Line Losses	Yes
Avoided Reserves	Yes
Avoided Risk	Yes
Increased Reliability	Yes
Displacement of Renewable Resource Obligation	Yes
Reduced Credit and Collection Costs	Yes
Demand Response-Induced Price Effect	Yes
Other	Yes

Table 14-4.[52] Although not shown in Table 14-4, appliance standards can also produce substantial benefits for the participating customers who purchase an efficient appliance, including reduced future energy bills, other resource savings (e.g., septic, well pumping), reduced operations and maintenance costs, increased employee productivity, and more comfortable indoor environments. Low-income consumers may see additional benefits unique to their circumstances.

6. Costs and Cost-Effectiveness

As noted earlier, federal appliance standards have proven to be one of the most cost-effective policies to generate emission reductions in the United States.[53] ACEEE and ASAP recently estimated that existing federal standards will, at the national level, save consumers and businesses more than $1.1 trillion from products sold through 2035.[54] By the DOE's own estimates, federal standards saved consumers about $55 billion on their utility bills in 2013, and by 2030, cumulative operating cost savings from all standards in effect since 1987 will reach over $1.7 trillion.[55] But as discussed later in this section, another recent research paper

52 Lazar, J., & Colburn, K. (2013, September). *Recognizing the Full Value of Energy Efficiency (What's Under the Feel-Good Frosting of the World's Most Valuable Layer Cake of Benefits).* Montpelier, VT: The Regulatory Assistance Project. Available at: http://www.raponline.org/document/download/id/6739

53 Critiques against appliance standards argue that regulation is not needed because the appliance market is functioning well to promote optimal levels of energy efficiency, and that most of the efficiency gains from new appliances are due to technological improvements induced by energy price changes, not regulations. For example, see the Consumer Electronics Association's "Innovation is the Real Driver of Energy Savings," available at: http://www.ce.org/News/News-Releases/Press-Releases/2012-Press-Releases/Innovation-is-the-Real-Driver-of-Energy-Savings.aspx. However, there is substantial evidence refuting this view. For example, an August 2014 study by Neubauer of ACEEE, "Cracking the TEAPOT: Technical, Economic, and Achievable Energy Efficiency Potential studies," reviewed 45 recent potential studies and found these studies identified 6 to 32 percent of remaining cost-effective energy savings potential (or 0.3 to 2.9 percent of average annual incremental savings). These studies present strong evidence that the market alone is not sufficient to capture all cost-effective energy savings. In addition, M. Cooper's October 2013 report, "Energy Efficiency Performance Standards: The Cornerstone of Consumer-Friendly Energy Policy," summarizes numerous studies on: (1) benefit/cost analyses of different regulations including appliance standards, and (2) market imperfection and market barriers as reasons for underinvestment in cost-effective energy efficiency products and equipment. This paper is available at: http://www.consumerfed.org/pdfs/Energy_Efficiency_Performance_Standards_Report.pdf

54 Supra footnote 4.

55 Supra footnote 44.

by ACEEE and ASAP found that the DOE predictions have overestimated product prices for recent federal standards for nine products, implying that the DOE's estimates of the benefits of appliance standards may be understated.

State-based appliance standards are also very cost-effective policies. As previously mentioned, the California Energy Commission estimated that the state's appliance standards saved consumers about $2.68 billion in 2010 and NEEP estimated that Connecticut's 2014 appliance standards will save residents and businesses more than $380 million in energy costs by 2020.[56,57]

Implementing standards typically costs significantly less than implementing energy efficiency programs. This is because states don't need to spend much money to promote the adoption of efficient appliances once standards become effective (unlike traditional energy efficiency programs, as described in Chapter 11, that provide rebates and technical support to participants).

Southern California Edison provides a good example of standards' low cost. The utility has spent about $4.7 million in the 2013–2014 program cycle on its Codes and Standards Program as of June 2014, and reported "gross" energy savings of approximately 380 GWh.[58] This program cost just one cent per kWh of savings in the first year. If we assume that the savings last for ten years on average from equipment installed to date in this program cycle, the cost would be about 0.1 cents per lifetime kWh of savings. If we also take into account the fact that the current standards will influence future consumer decisions to purchase new efficient equipment, the cost of implementation per kWh of lifetime savings would be even lower. Even after converting to "net" savings that utilities can claim from the new standards, the implementation cost is very small when compared with the cost of traditional energy efficiency programs.

Although these extremely low costs are impressive, other states will likely spend even less than California, because they can take advantage of California's learning when developing their own standards. Many states have already done so. In addition, as mentioned previously, ASAP has been providing assistance to various states and provides draft model legislation documents.[59] Therefore, the implementation cost of appliance standards could be substantially smaller for other states.

ACEEE and ASAP also describe how the long-term effects of appliance standards on product efficiency offer advantages that traditional ratepayer-funded efficiency programs (such as those described in Chapter 11) cannot:

> *By setting a minimum-efficiency level, standards ensure that efficiency improvements are incorporated into all new products and thus ensure all buyers a minimum level of efficiency performance. Without standards, in many cases, only premium products include efficiency improvements. Standards can help bring down costs for energy-efficient technologies due to economies of scale and because standards encourage manufacturers to focus on how to achieve efficiency improvements at minimum cost as manufacturers compete for the most price-sensitive portion of the market. As a result, higher-efficiency products become more affordable and widely available and all consumers enjoy the benefits from advances in product performance and design.*[60]

A good case in point is the price trend of household refrigerators since the 1970s. Figure 14-2 presents trends in refrigerator price, energy use per unit (kWh per year), and refrigerator size. It illustrates that the price of refrigerators has continued to decrease over time (although there are increases in certain years), and has experienced a 50- to 60-percent reduction over the past 35 years. This reduction is achieved despite the fact that average annual energy use was reduced by nearly 75 percent owing to the past California and federal appliance standards.

Refrigerators provide one of the most successful examples of appliance standards, but other products such as room air conditioners and clothes washers also saw decreasing price trends over many years according to a 2013 ACEEE/ASAP report.[61] The same report also compared the DOE's predicted manufacturer price increase with actual price increases associated with recent federal appliance standards for nine major products, and found that the actual price increase was less than the DOE predicted for all products, with substantial differences in many cases (Figure 14-3). The study observed price

56 Supra footnote 27.

57 Supra footnote 38.

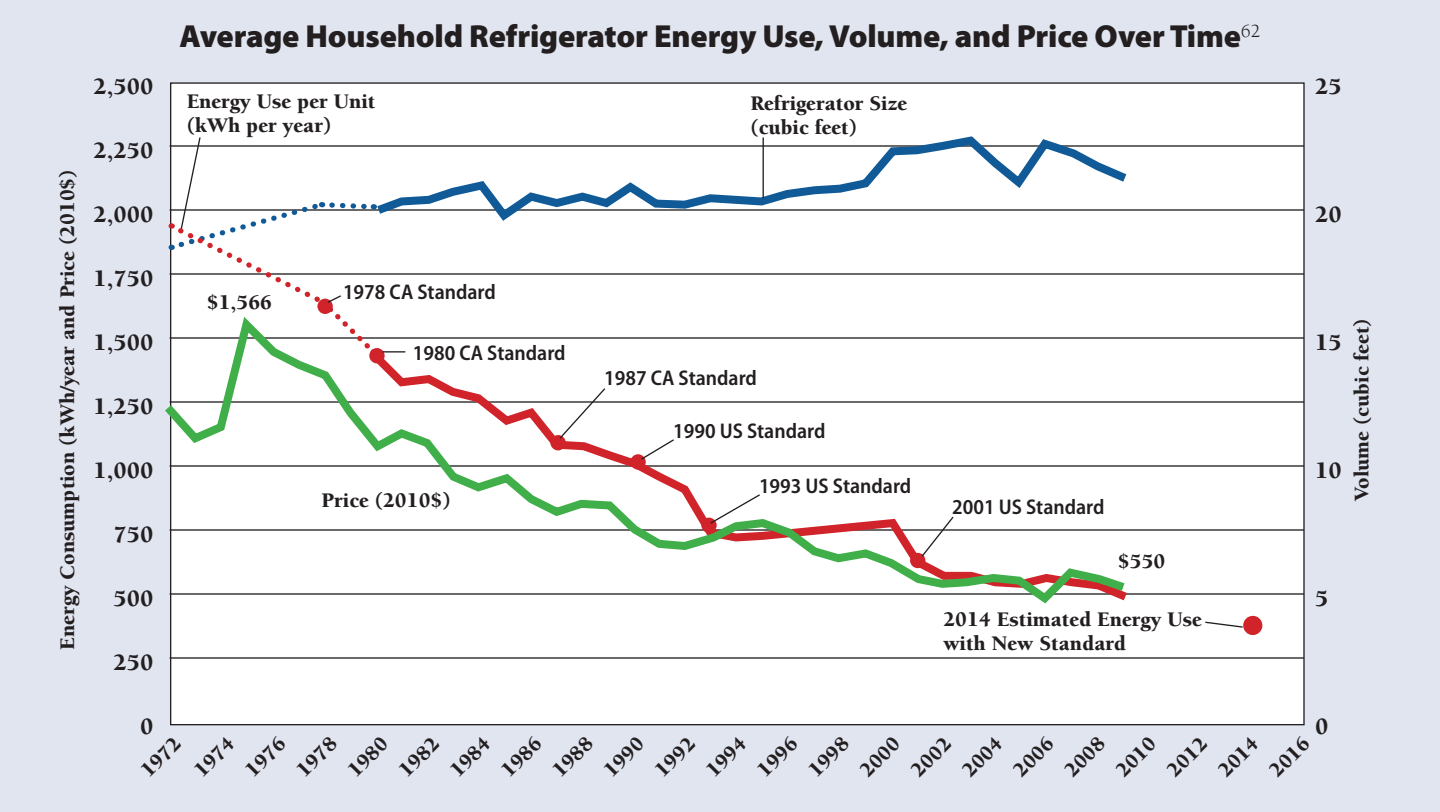
58 Southern California Edison. (2014, June). *2013–2014 Monthly Energy Efficiency Program Report – Report Month: June 2014.* Available at: http://eestats.cpuc.ca.gov/EEGA2010Files/SCE/monthlyReport/SCE.MN.201406.1.xlsx

59 Supra footnote 18.

60 Supra footnote 10.

61 Nadel, S., & deLaski, A. (2013, July). *Appliance Standards: Comparing Predicted and Observed Prices.* ACEEE and ASAP. Available at: http://www.aceee.org/research-report/e13d

Figure 14-2



declines for four out of the nine products, and the actual average price across all products decreased by $12. These are strong indications of price reduction effects owing to economies of scale, and manufacturers' efforts to minimize costs when producing new products that meet new minimum efficiency standards.

ASAP and ACEEE's state-by-state analysis of new state appliance standards explained previously provides projections of economic benefits for consumers using various metrics. Using the Florida case again, Table 14-5 presents economic benefits of the 10 product standards proposed by ASAP and ACEEE. Among all products that save electricity, battery chargers, room air cleaners, and faucets provide the highest economic benefits, ranging from $233 million net present value (NPV) for faucets to $590 million NPV for battery chargers. With all products included, the total consumer economic benefit would be expected to be about $1.8 billion NPV from the new appliance standards just for Florida alone, if these new standards are adopted and become effective in 2017.[63] Simple payback periods and benefit/cost ratios are preferable, and a few products do not have any payback period because meeting the new standards is expected to add no or little incremental costs. For the other products, simple payback periods range from about less than one year to eight years, and benefit/cost ratios range from 1.5 to 20.

Using a similar methodology, ACEEE also developed estimates of the potential impacts that would result if every state adopted the most ambitious appliance efficiency standards that already exist in at least one state for five specific consumer products including three products listed in Table 14-5 (i.e., double-ended quartz halogen lamps,

62 Obtained from ASAP on September 15, 2014. Figure 14-2 is a revised version of a 2011 ASAP graph available at: http://www.appliance-standards.org/sites/default/files/Refrigerator%20Graph_July_2011.PDF. The original data sources are the Association of Home Appliance Manufacturers for energy consumption and volume, and US Census Bureau for price. Although this figure only includes data for one appliance, it refutes one of the core arguments of critics who assert that appliance efficiency standards drive up the cost of appliances and thus harm consumers.

63 NPV is the total monetary value of bill savings achieved by products purchased between the effective date of the standards and 2035 minus the total incremental product cost incurred by purchasers as a result of the standards over the same period.

Figure 14-3

Comparison of Predicted Manufacture Price Increase for Standards With Actual Price Increase[64]

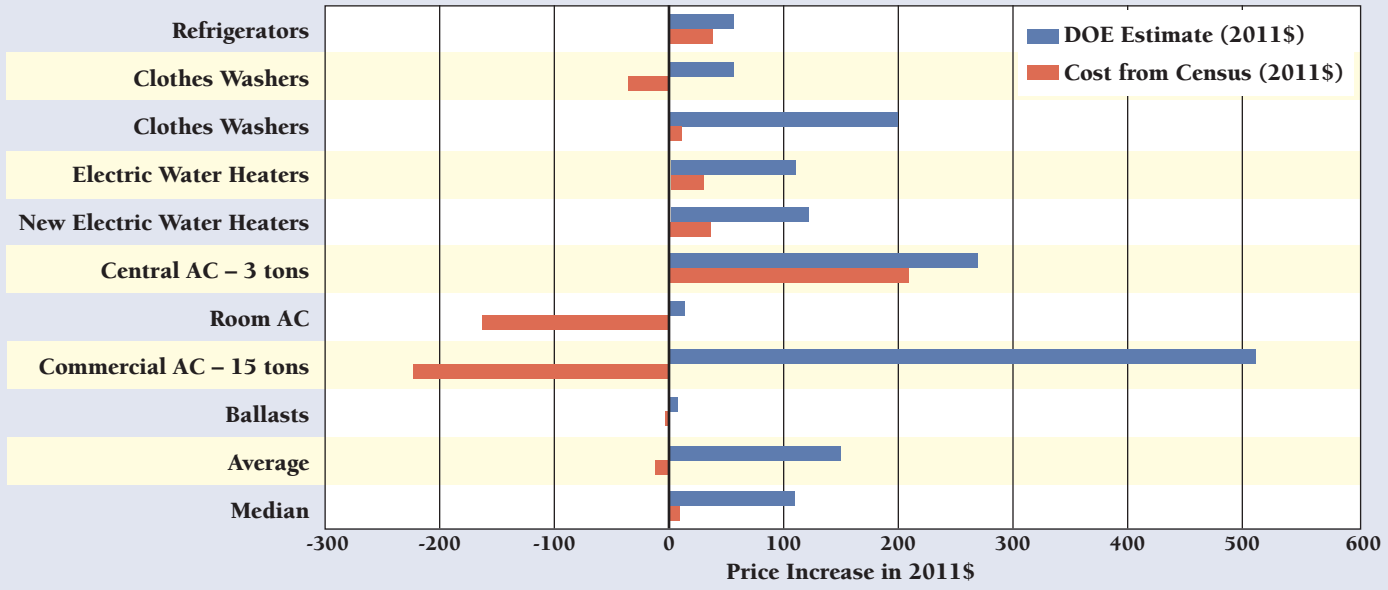


Table 14-5

Potential Economic Impacts of New State Appliance Standards Through 2035 for Florida[65]

Products	Payback Period Years	Benefit/ Cost Ratio	NPV Economic Impact $ Million
Battery Chargers	-	-	592.3
Small Consumer Chargers	1.3	2.7	566.6
Small Non-Consumer Chargers	3.5	2.3	5.2
Large Chargers	1.1	9.9	20.5
Commercial Dishwashers	0.5	20.1	75.1
electricity	-	-	-
natural gas	-	-	-
water	-	-	-
Double-Ended Quartz Halogen Lamps	1.1	1.7	26.4
Faucets (lavatory)	no cost	no cost	233.1
electricity	-	-	-
natural gas	-	-	-
water	-	-	-
Hot Food Holding Cabinets	2.9	3.2	12.6
Portable Electric Spas	7.9	1.5	3.7
Room Air Cleaners	no cost	no cost	415.5
Toilets	no cost	no cost	306.1
Urinals	no cost	no cost	127
Water Dispensers	0.5	15.3	29.1
TOTAL	**-**	**-**	**1,821**

residential lavatory faucets, portable electric spas), and two new products (i.e., commercial hot food holding cabinets and bottle-type water dispensers). ACEEE found that such standards could save more than 112 million MWh of electricity (cumulatively) by 2030, while the ratio of benefits to costs would be somewhere between 1.8 and 9.4. Although the potential MWh savings from appliance standards were not as great as for other energy efficiency policies studied by ACEEE, the benefit/cost ratio was higher than for any other option analyzed.[66]

64 Developed based on Table 1 from: Supra footnote 61.

65 Refer to ASAP analysis for Florida, available at: http://www.appliance-standards.org/states

66 Hayes, S., Herndon, G., Barrett, J. P., Mauer, J., Molina, M., Neubauer, M., Trombley, D., & Ungar, L. (2014, April). *Change Is in the Air: How States Can Harness Energy Efficiency to Strengthen the Economy and Reduce Pollution.* ACEEE. Available at: http://aceee.org/research-report/e1401

7. Other Considerations

Utility's Involvement in Appliance Standard Adoption

As mentioned previously, a growing number of stakeholders including utilities and third-party efficiency administrators are exploring the role of C&S in existing electric and gas energy efficiency programs such as those described in Chapter 11. Typically adoption of new C&S poses challenges for efficiency program administrators, because such new policies make programmatic savings harder to achieve by raising the minimum efficiency levels of certain products, and by reducing the amount of savings that program administrators can claim result from their own efforts. This is an important challenge to address. However, utilities and third parties can turn this challenge into an opportunity by proactively getting involved in the support of new codes and appliances, and seeking potentially substantial savings from their code and standard efforts.

States may find it advantageous to allow or direct energy efficiency program administrators to support C&S for the following reasons: (1) program administrators in many states already have significant knowledge and expertise about energy efficient products, some of which are suitable candidates for new appliance standards; (2) program administrators have experience assessing feasibility, potential, and benefits and costs of energy efficient products; (3) program administrators have experience in conducting evaluation, measurement, and verification (EM&V) studies; and (4) program administrators have access to funding to support adoption of C&S in various ways.

Specific examples of the role program administrators can play with regard to new C&S include the following:

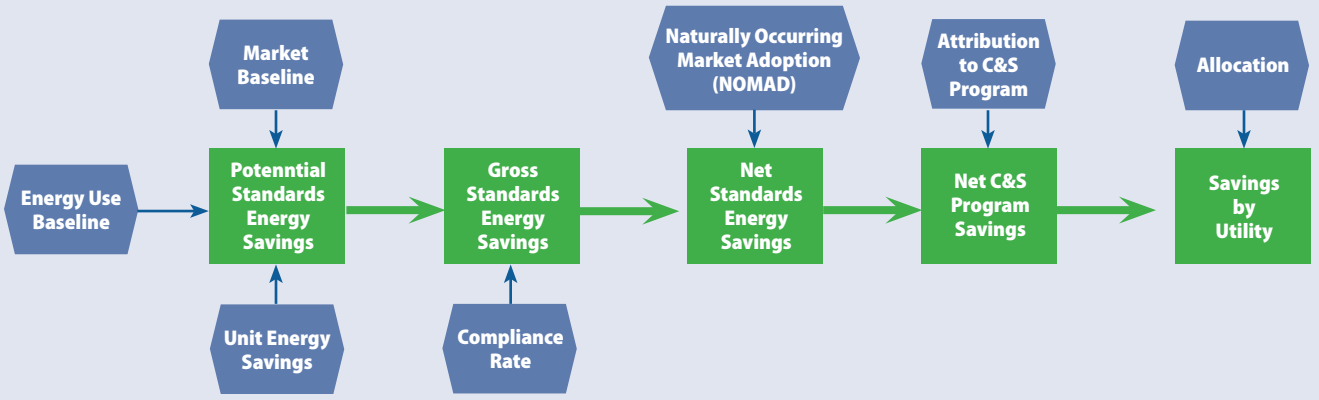
- Holding meetings and working groups to target products ripe for new standards;
- Developing technical reports on the feasibility and potential costs and benefits of candidate products for standards consideration (e.g., CASE reports by California utilities);
- Developing standard testing practices and evaluation tools;
- Conducting EM&V analyses on new standards (e.g., impact evaluation and process evaluation studies); and
- Providing expert witness testimony in regulatory hearings and assisting with consumer and regulator education efforts.[67]

Energy Impact Evaluation

New challenges for policy impact evaluation may arise if C&S are included as part of a state's plan for compliance with the Clean Power Plan emissions guidelines for existing power plants (i.e., the "111(d) rule"). This is partly because

Figure 14-4

California Codes and Standards Evaluation Methodology[68]



67 California utilities are providing these technical support activities for code and standard development. Also refer to: Cooper, A., & Wood, L. (2011, August). *Integrating Codes and Standards Into Electric Utility Energy Efficiency Portfolios.* Institute for Electric Efficiency. Available at: http://www.edisonfoundation.net/iei/Documents/IEE_IntegratingCSintoEEPortfolios_final.pdf

68 KEMA, Inc., The Cadmus Group, Inc., Itron, Inc., Nexus Market Research, Inc., & ENRG, Inc. (2010, April). *Volume III – Codes & Standards (C&S) Programs Impact Evaluation – California Investor Owned Utilities' Codes and Standards Program Evaluation for Program Years 2006–2008.* CALMAC Study ID: CPU0030.06. Available at: http://www.calmac.org/publications/codes_standards_vol_iii_finalevaluationreport-updated_04122010.pdf

no state except California has done EM&V studies to verify energy savings from C&S, and such EM&V studies could potentially be more complex than conventional EM&V studies for energy efficiency programs owing to the complexity of assessing attribution of program efforts to standard adoption.[69] Fortunately states can learn from California's approach to conducting EM&V studies for appliance standards.

California's C&S evaluation methodology has five core steps, as presented in Figure 14-4, and is explained briefly below:[70]

1) **Potential Savings Analysis.** A per-unit energy savings is calculated for the incremental benefit of adopting a new or more stringent C&S at the statewide level.
2) **Gross Energy Savings and Compliance Rate.** Realized energy savings from C&S are estimated by identifying compliance rates of new C&S, and applying them to potential energy savings estimates. For appliance standards, a priority is placed on high-impact energy savings appliances, and surveys are conducted with vendors regarding those appliances. Lastly, individual vendor data are extrapolated to the statewide level.
3) **Net Energy Savings and Normally Occurring Market Adoption.** Net energy savings are estimated by adjusting gross energy savings for the naturally occurring market adoption (NOMAD) of more efficient appliances, equipment, and building techniques in the marketplace. NOMAD rates are developed based on industry expert opinions on market diffusion curves obtained from a Web-based tool and direct interviews.
4) **Net Program Savings and Program Attribution.** Net program savings that the state's IOUs can claim toward their programmatic energy savings goals are estimated by adjusting net energy savings for program attribution factors. Independent third parties assess attribution by collecting data and documentation on the utilities' activities in three areas: (1) the development of compliance methods and other analytic techniques; (2) the development of C&S language and technical, scientific, and economic information in support of the C&S; and (3) demonstrating the feasibly of C&S adoption.[71]
5) **Savings Allocation Among Utilities.** Final statewide energy savings are assigned to each utility based on the IOU's percentage of statewide electricity sales.

Although determining attribution makes the impact assessment more complex, it is thought to be worthwhile because program administrators' support of C&S adoption is expected to increase the gross savings from adoption of state appliance standards. Furthermore, it is important to note that estimating attribution accurately is a secondary concern from the state's perspective, because a state's main concern is how accurately and reasonably the statewide impact of standards can be estimated.

Coordination With Traditional Energy Efficiency Programs

C&S raise the baseline for energy efficiency programs and make it harder for them to achieve savings. Thus, when C&S are included in program administrators' energy efficiency programs, it is essential that the impacts of such policies are properly and consistently incorporated in the energy savings goals for an entire program portfolio for a given program administrator, as well as in program administrators' program plans. Furthermore, program administrators need to be strategic about which measures and technologies are suitable for code and standard programs, and strategically determine the appropriate program mix.[72]

Addressing Manufacturers' Concerns

An increase in the adoption of state appliance standards across regions owing to the Clean Power Plan regulation for existing power plants may create a new challenge for manufacturers. From the manufacturers' standpoint, federal standards provide more certainty than state standards. If one or only a handful of states in a region adopt new standards or if states adopt standards that vary from one state to another, it would make it harder for manufacturers to produce and deliver their products. Thus, it would be preferable for states to coordinate their efforts and establish similar standards across the same region.[73] Furthermore,

69 "Attribution" in this context refers to the extent to which the utilities' efforts in support of an appliance standard can be credited for the adoption of that standard by the state.

70 Supra footnote 68.

71 The relevant information can be collected from California Energy Commission hearing transcripts, workshop meeting notes, CASE reports, and interviews of various stakeholders involved in the C&S process.

72 Supra footnote 20.

73 Supra footnote 18.

states should make sure that voices of manufacturers are heard in an open public forum, similar to the stakeholder processes in California and other states.

State Plans for 111(d) Compliance

When the time comes for states to prepare plans for compliance with a final 111(d) rule, some states may be interested in including state appliance standards in their plans. However, it is possible that many states will not be able to complete an entire standard development process before the deadline for submitting their plans to the EPA. Thus, states need to be creative in developing their plans if they decide to use standards as a policy option to reduce emissions.

States would need to include at least the following pieces of information in the plans they submit to the EPA for approval:

- Description of the ongoing or expected process to adopt new standards, such as the stakeholder process, including the expected date of each activity and standard implementation;
- Definition of covered products in the new standards;
- Estimates of potential energy and CO_2 emissions savings and costs from the standards;
- Impact and process evaluation plans (as required by the EPA for a 111(d) plan);[74] and
- Discussion of any uncertainty associated with savings and cost estimates (as required by the EPA for a 111(d) plan), as well as the feasibility of adopting and implementing the proposed new standards.[75]

One of the challenges of preparing a state compliance plan appears to be estimating potential savings. However, to the extent states intend to follow what other states have recently implemented, they may be able to rely on ASAP's preliminary estimates of savings from new state standards for each state across the nation.[76] Although states could modify ASAP's analyses based on state-specific sales data (if such data exist), it is conceivable that ASAP's analysis would be sufficient for the purpose of preparing a compliance plan. However, when verifying energy savings, states need to conduct a detailed impact evaluation based on appropriate state-specific data.

Gaining sufficient consensus among stakeholders as to what new standards can and should be adopted would be another challenge of including appliance standards in a 111(d) compliance plan. States may need to assess stakeholder consensus or hear stakeholder views well before the plan submission deadline if they anticipate any reservations from stakeholders, or if they think stakeholder input would be helpful to improve the design of new standards.

8. For More Information

Interested readers may wish to consult the following reference documents for more information on appliance standards.

- Cooper, A., & Wood, L. (2011, August). *Integrating Codes and Standards into Electric Utility Energy Efficiency Portfolios.* Institute for Electric Efficiency. Available at: http://www.edisonfoundation.net/iei/Documents/IEE_IntegratingCSintoEEPortfolios_final.pdf
- Hayes, S., Herndon, G., Barrett, J. P., Mauer, J., Molina, M., Neubauer, M., Trombley, D., & Ungar, L. (2014, April). *Change Is in the Air: How States Can Harness Energy Efficiency to Strengthen the Economy and Reduce Pollution.* ACEEE. Available at: http://aceee.org/research-report/e1401
- KEMA, Inc., The Cadmus Group, Inc., Itron, Inc., Nexus Market Research, Inc., & ENRG, Inc. (2010, April). *Volume III – Codes & Standards (C&S) Programs Impact Evaluation – California Investor Owned Utilities' Codes and Standards Program Evaluation for Program Years 2006–2008.* CALMAC Study ID: CPU0030.06. Available at: http://www.calmac.org/publications/codes_standards_vol_iii_finalevaluationreportupdated_04122010.pdf

74 Supra footnote 23.

75 US EPA. (2014, June). *State Plan Considerations – Technical Support Document (TSD) for Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units.* Docket ID No. EPA-HQ-OAR-2013-0602. Available at: http://www2.epa.gov/sites/production/files/2014-06/documents/20140602tsd-state-plan-considerations.pdf. States may also need to include contingencies in their plans to address the possibility that appliance standards are not ultimately adopted or do not save as much energy as anticipated when the plan was submitted to the EPA.

76 Refer to ASAP website at: http://www.appliance-standards.org/map/benefits-from-state

- Lee, A., Dethman, L., Gurin, C., Burns, D., Filerman (Phi), S., Thomley, D., & Collins, S. (2012, May). *2010–2012 California Statewide Codes and Standards Program Process Evaluation Final Report.* CALMAC Study ID SCE0319.01. Prepared by the Cadmus Group for Southern California Edison and Pacific Gas and Electric. Available at: http://www.calmac.org/publications/SCE-PG%26E_C%26S_Process_Evaluation_FINAL_5-28-12.pdf
- Lee, A., Groshans, D., Gurin, C., Cook, R., & Walker, T. (2012, August). *Raising the Bar – Getting Large Energy Savings Through Programs That Support Energy-Efficiency Codes and Standards.* Proceedings of the 2012 ACEEE Summer Study on Energy Efficiency in Buildings. Available at: http://www.cadmusgroup.com/wp-content/uploads/2012/12/590-ACE3-Codes-Standards-Paper-Final.pdf
- Lowenberger, A., Mauer, J., deLaski, A., DiMascio, M., Amann, J., & Nadel, S. (2012, March). *The Efficiency Boom: Cashing in on the Savings From Appliance Standards.* ACEEE and ASAP. Available at: http://www.aceee.org/research-report/a123
- Nadel, S., deLaski, A., Eldridge, M., & Kliesch, J. (2006, March). *Leading the Way: Continued Opportunities for New State Appliance and Equipment Efficiency Standards.* ACEEE and ASAP. Available at: http://www.aceee.org/research-report/a062
- US EPA. (2006, April). *Clean Energy-Environment Guide to Action: Policies, Best Practices, and Action Steps for States,* chapter 4. Available at: http://epa.gov/statelocalclimate/resources/action-guide.html

9. Summary

Appliance standards can be an effective policy option to reduce CO_2 at the lowest possible cost. The implementation cost is significantly lower than the cost of utility energy efficiency programs. There is also the potential to reduce the actual cost of efficient products that are subject to new standards owing to economies of scale and manufacturer competition.

One option available to states is to accelerate or enhance standard adoption by allowing or directing utilities and third-party program administrators to support standard adoption and to take credit from the standards toward their programmatic energy savings goals.

The primary challenge to implementing standards is political feasibility. Some state legislatures have granted state agencies authority to adopt new standards, but many others need to pass new legislation to establish new standards. Thus, states must consider the political feasibility of adopting state appliance standards. Another major challenge is to measure and verify energy and CO_2 emissions savings from appliance standards given states' limited experience in this area. However, states can learn from California's example in this regard. Addressing these barriers will allow states to access a highly advantageous, cost-effective policy option to reduce energy and CO_2 emissions.