Jobs Created by Appliance Standards

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Executive Summary

National appliance efficiency standards have proven to be one of the most effective policies for saving energy and water and thereby reducing utility bills. Standards now in place cover approximately 60 categories of products, ranging from home appliances such as refrigerators and microwave ovens to the cooling and heating equipment and lighting that account for much of the energy used in offices and other commercial buildings. According to the US Department of Energy, appliance standards will cumulatively save $2 trillion on energy bills by 2030. Savings on water and wastewater bills add to those savings.

The net economic savings from these standards drive new economic activity. When the money consumers and businesses save on their utility bills outweighs any increase in the price of more-efficient products, those net savings are spent on or invested in other goods and services. Further, because the utility sector has low labor intensity (i.e., relatively few jobs for a given amount of spending compared to the economy as a whole), shifting spending from utilities to other goods and services results in a net increase in employment.

This report uses an input–output model of the US economy to estimate the job creation impacts of existing national appliance standards. Our analysis separately reports on the impacts of general service lighting (light bulb) standards—a standard with one of the largest savings—because that standard is threatened with a regulatory rollback.

As table ES1 shows, annual net economic savings from all existing standards reached an estimated $58 billion in 2016 and will grow to $134 billion by 2030. Savings grow over time as new standards take effect and as more and more products that meet the latest standards are sold and installed. Light bulb standards account for a large portion of the total net savings; researchers estimate that they will generate nearly $25 billion of the total net economic benefits in 2030.

Table ES1. Net economic savings and jobs created or sustained in 2016, 2020, 2025, and 2030

Year	Annual net economic savings (billion 2017$)	Jobs
2016	58	299,000
2020	83	412,000
2025	120	547,000
2030	134	553,000

The net economic benefits from all existing standards resulted in nearly 300,000 net added jobs in 2016. As the net economic savings grow, the number of related jobs will grow as well, reaching more than 550,000 in 2030. Year-over-year growth in net economic savings and job creation are highest in the early years of the analysis period, and they begin to level out as the affected product stock becomes saturated with models meeting current standards.

The number of jobs created by appliance standards is significant in every state. Figure ES1 shows the estimated number of net jobs created in each state in 2030. Because jobs are

created by net economic savings, the states with the largest savings have the largest number of jobs created. Savings scale with population and commercial building energy use so, not surprisingly, the states with the biggest populations have the largest job growth; the number of added jobs as a percentage of population varies little by state.

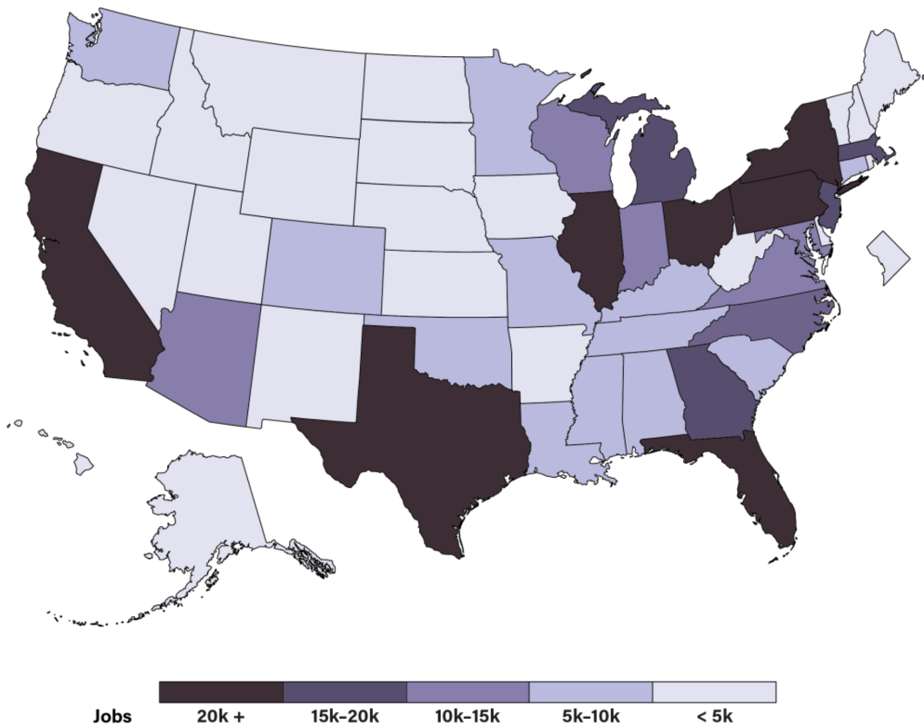

Figure ES1. Jobs created or sustained by all existing appliance standards in each state for 2030

As technologies improve, there will be new opportunities to update standards, resulting in additional cost-effective savings. Such updates should add to the savings and jobs created by standards in the years ahead. Conversely, weakening or eliminating current standards would harm the economy, reducing employment levels.

Introduction

Energy efficiency is a major source of employment in the United States. According to a study by the National Association of State Energy Officials and the Energy Futures Initiative, 2 million people in the United States provided energy-efficient products or services as part of their job in 2017 (NASEO EFI 2018). Such jobs include constructing energy-efficient buildings and technologies, manufacturing energy-efficient products, and providing professional finance, management, and legal services (DOE 2017b). However the macroeconomic impact of utility bill savings generated by energy efficiency improvements may be up to 50% larger, yet is often overlooked (Barrett and Baatz 2017). Indeed, appliance efficiency standards have done more to save energy in buildings than any other national policy (Nadel 2015). This paper analyzes the job creation impacts of national appliance standards.

Congress established the first national appliance standards in 1987 and expanded the program in 1988, 1992, 2005, and 2007. Standards now cover more than 60 categories of products used in the residential, commercial, and industrial sectors. For some products, such as faucets, unit heaters, and exit signs, the original standards have yet to be updated, while others have been strengthened multiple times (such as for refrigerators, clothes washers, central air conditioners and heat pumps). Standards for still other products such as battery chargers, furnace fans, and pumps have been established relatively recently.

Many of the products covered by several rounds of standards have improved remarkably. For example, a new refrigerator uses just one-quarter as much energy as a mid-1970s model despite being larger, having more features (such as auto-defrost), and costing half as much in inflation-adjusted dollars. Clothes washer energy use declined by 75% and real prices declined by 45% between 1987 and 2010, even as average washer tub capacity has grown; new clothes washers also typically provide better cleaning performance and are gentler on clothes than older ones (DOE 2017a; Mauer et al. 2013).

Altogether, DOE estimates that appliance efficiency standards completed through 2016 will save 71 quadrillion Btus (quads) of energy by 2020 and 142 quads through 2030. For comparison, the entire US economy uses about 100 quads per year. Cumulative utility bill savings will reach $1 trillion by 2020 and more than $2 trillion by 2030 (DOE 2017a). These estimates of utility bill savings are conservative; they do not count water and wastewater bill savings, even though many standards save considerable amounts of water. National water savings in 2015 reached 1.5 trillion gallons—enough to meet the needs of all the households in Texas, Oklahoma, Arizona, and Colorado combined for one year (deLaski and Mauer 2017). Less energy and water waste leads to less pollution, helping us meet clean air standards and protect public health, ease pressure on overburdened water supplies, and reduce greenhouse gas emissions. The energy and water savings from standards can also improve electric system reliability and defer or reduce the need for new energy and water infrastructure, which lowers consumers' utility rates.

While researchers have thoroughly documented the energy, water, and utility bill savings from existing appliance standards, the macroeconomic impact of these standards has gotten less attention. A 2011 report published by ASAP and ACEEE evaluated the job creation impacts of standards completed as of that time, as well as the potential jobs that could be created by updating existing standards (Gold et al. 2011). Since 2011, many standards have been updated, new standards have been established for additional products, and the economy has evolved. This report updates our 2011 report, incorporating the impacts of all standards completed as of its publication in July 2018, including the expanded scope of national light bulb standards.

Energy and Water Efficiency and Jobs

In general, efficiency improvements create jobs in two phases: the implementation phase and the savings phase (Bell, Barrett, and McNerney 2015). The implementation phase (also known as the construction phase) includes the manufacturing, purchasing, and installation processes and employs workers who provide efficient products and services. These products and services deliver utility bill savings, triggering a savings phase of job creation. As consumers and businesses invest and spend the money they saved due to efficiency measures, that spending spurs economic activity, additional investments, and more jobs.

For appliance standards, a price impact or efficiency premium is typically captured in the savings phase as an initial cash outlay by the purchaser of a product subject to an efficiency standard. On a per-unit basis, the efficiency premium is a monetary transfer from the purchaser of the more-efficient product to the manufacturing sector (as well as distributors, retailers, and, for some products, installers). The overall impact of the standards-affected products on jobs manufacturing depends on several factors, including the total number of products sold (shipments), the labor required to make each product, and any changes in the mix of products sold that exceed the standard. The purchaser may pay more money upfront for the efficient, standard-conforming product but may in turn receive savings that exceed the additional purchase price over time. The net economic benefit of cost-effective appliance standards for the product purchasers—that is, the utility bill savings less the efficiency premium—is positive over time. Consumers and businesses that purchase products that meet efficiency standards spend or invest those net savings, driving job creation.

Scope and Methodology

To estimate the impact of appliance standards on jobs, we started with estimates of consumer and business net economic savings, taking into account both utility bill savings and the additional estimated cost of more-efficient products (the efficiency premium).[1] Then, using our Dynamic Energy Efficiency Policy Evaluation Routine (DEEPER) input–output model of the US economy, we determined how the purchase of and net savings from more-efficient products meeting minimum efficiency standards affects total employment.

SCOPE

For this paper, we analyzed all existing national appliance standards. We included the cumulative effects of all standards that Congress enacted, including those passed in 1987,

[1] When we discuss utility bill savings, the amount includes electricity, direct fossil fuel use, and water and wastewater bill savings.

1988, 1992, 2005, and 2007, as well as all DOE updates to the original legislated standards. We also included some standards originally established by DOE rather than Congress, including those for liquid-immersed distribution transformers and swimming pool pumps.

We pay particular attention to the national light bulb standards, both because the savings from this product category are especially large and because these standards are currently being threatened with a potential rollback attempt. Under the terms of a legal settlement, DOE has initiated a regulatory proceeding that might attempt to reduce the range of light bulbs affected by standards. In addition, some light bulb manufacturers dispute whether improved standards slated for 2020 will take effect without further action. Therefore we have separated out the benefits of this important but now-vulnerable standard.

NET ECONOMIC SAVINGS

We calculated annual net economic savings for each year from 2016 through 2030 by subtracting annual incremental costs from annual utility bill savings. Annual incremental costs represent the increased prices that consumers paid for more-efficient models that meet the standards. As Appendix A describes, in some cases product prices have actually declined as new standards have taken effect. For this analysis, however, we used estimates of product price increases based on analysis at the time that each standard was established. Annual utility bill savings are the savings from the more-efficient products meeting the standards, including bill savings for electricity, direct fossil fuel use, and water and wastewater.

For all existing standards other than light bulbs, we used estimates of state-by-state annual energy and water savings and the product price increases from ASAP and ACEEE's 2017 report, which includes a detailed methodology (deLaski and Mauer 2017). For this new report, we updated our analysis for light bulbs to incorporate more recent data on market trends and an expansion of the scope of light bulbs covered by the standards, which DOE finalized in 2017.[2] For all standards, we calculated energy bill savings using state-by-state data on electricity and natural gas prices for the residential, commercial, and industrial sectors for 2016 (EIA 2018a; EIA 2018b). We then used price projections from the Energy Information Administration's 2018 *Annual Energy Outlook* to calculate future energy prices relative to 2016 prices (EIA 2018c). For water and wastewater prices, we used regional prices and water price trends (DOE 2016).

CALCULATION OF JOBS CREATED

Overview

Using the net economic savings, we determined the impact of increased spending on job creation. Utility bill savings represent a loss of sales to utilities but a gain to consumers. So, while the loss of energy and water sales may result in job losses in the utilities sector, the consumer savings would create jobs when consumers and businesses spend and invest their

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[2] For more detail on our methodology for light bulbs, see appliance-standards.org/document/gsl-methodology.

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savings. Overall, more jobs are created than lost because the money flows from industries with low labor intensity to the rest of the economy, which has a higher labor intensity.

Similarly, the efficiency premium increases spending in manufacturing and trade services—which includes everything from cashiers and installers to nurses and financiers—and reduces spending in other sectors. For our modeling purposes, we assigned the entire efficiency premium to the manufacturing sector, which has relatively fewer jobs per million dollars in spending. Shifting spending from all other sectors to manufacturing reduces overall employment levels slightly, but is more than outweighed by the jobs created as a result of utility bill savings. Figure 1 shows an example.

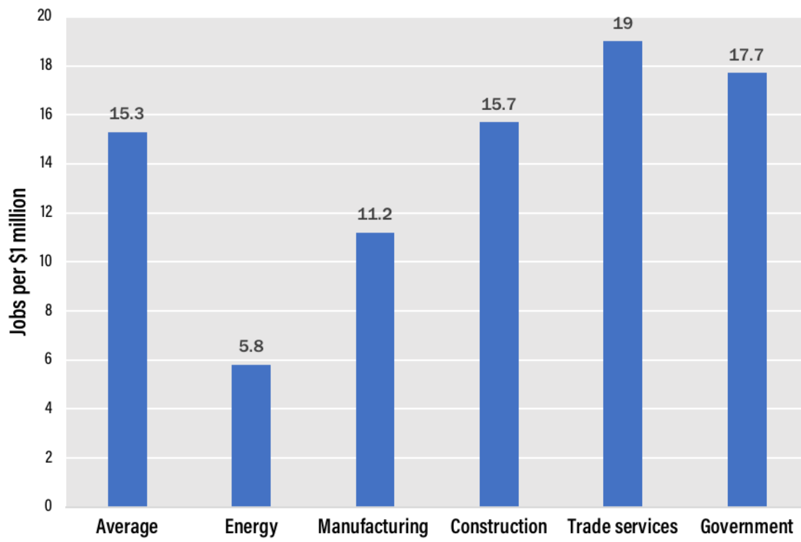

Figure 1. Jobs supported per $1 million in various sectors of the 2013 US economy. *Source:* Nadel 2017.

As figure 1 indicates, the energy sector has low labor intensity, while trade services is more labor intensive and therefore supports more jobs per $1 million of revenue. If the economy consisted of only the sectors in figure 1 and everything else was held constant, taking $1 million from the energy sector and putting it into the construction sector would create 15.7 construction jobs, result in a loss of 5.8 energy jobs, and create 9.9 (15.7 less 5.8) net jobs.[3] (This scenario is illustrative and not meant to be used to determine a jobs-to-investment ratio.)

In our analysis here, one job is equal to one full-time employee working for one full year. A job created in year 1 and then sustained through year 5 would yield one job-year for each of those years for a total of five job-years over the period. Likewise, two people working half time for one full year would equal one full-time employee, and any combination of persons

[3] When we interpret the jobs results in this paper, we are talking about net jobs, not gross jobs. Net jobs are jobs created or sustained compared to a business-as-usual baseline; gross jobs are the jobs in an entire industry or sector at a point in time.

and hours combining to one full-time job would equal one job-year. When we discuss jobs numbers (*jobs*), we are referring to job-years created or sustained in that year from appliance standards.

We have not attempted to estimate the impact of appliance standards on total product shipments. As we discuss in Appendix A, substantial evidence suggests that standards may have had little if any effect on total product shipments over time.

DEEPER

We calculated jobs created by national appliance standards using the DEEPER model, which is ACEEE's proprietary input–output model for evaluating the macroeconomic impacts of various energy efficiency initiatives at the local, state, and national levels.[4] In our analysis, we use a 14-sector approach to estimate the macroeconomic impacts of net economic savings. DEEPER models how changes in spending impact the US economy and compares that change to a baseline scenario. For a full description of DEEPER and its use in this type of analysis, see Appendix A in Barrett and Baatz (2017) or, for an expanded description, see Appendix B in Gold et al. (2011).

Allocating Jobs to States

We allocated our national jobs estimates to each of the 50 states and the District of Columbia using net economic savings by state. Specifically, for each state for each year, we divided net economic savings in that state by the total national net economic savings to calculate the percentage of national savings delivered to each state. We then allocated the national jobs to each state using these percentages. We did not include other factors that would affect jobs by state such as variations in the purchasing power of a dollar, wage differences, the net energy flow between states, the amount of equipment manufacturing in the state, or consumption habits. Thus, some state-level results may be less accurate than the national results, but they should nonetheless indicate the scale of economic impacts.

Results

NATIONAL

Annual net economic savings for consumers and businesses from appliance standards (accounting for both savings and costs) were $58 billion in 2016 and will be $134 billion by 2030. The savings from appliance standards created nearly 300,000 jobs in 2016, roughly 0.2% of the 145 million total US employees in December of 2016 (Census Bureau 2018a). As savings grow in the years ahead, the job creation benefits will also grow. Appliance standards will increase the number of jobs in the US economy by more than 550,000 in 2030. Table 1 shows annual net economic savings and jobs for the years 2016, 2020, 2025, and 2030.

[4] For more information on DEEPER, see ACEEE's factsheet: aceee.org/sites/default/files/pdf/fact-sheet/DEEPER_Methodology.pdf.

Table 1. Net economic savings and jobs created or sustained in 2016, 2020, 2025, and 2030

Year	Annual net economic savings (billion 2017$)	Jobs
2016	58	299,000
2020	83	412,000
2025	120	547,000
2030	134	553,000

Net Economic Savings

Figure 2 shows the annual utility bill savings and incremental costs associated with all existing appliance standards and the light bulb standards for 2016–2030.

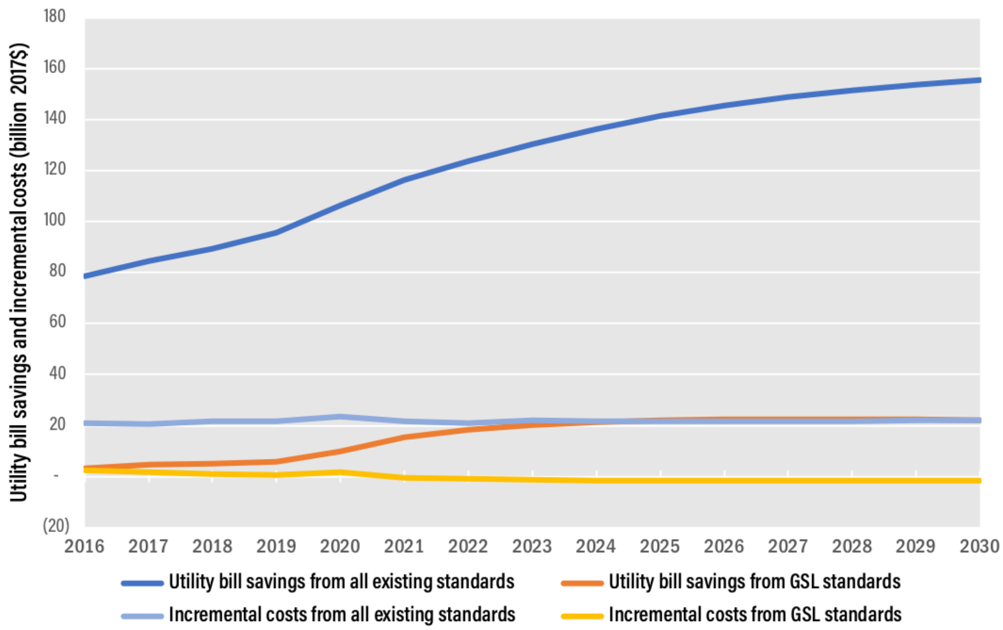

Figure 2. Annual utility bill savings and incremental costs resulting from appliance standards

As figure 2 shows, annual utility bill savings from all existing standards reach $156 billion by 2030, including roughly $22 billion from light bulb standards. Costs are relatively flat over the analysis period. The annual incremental cost of the light bulb standards declines and actually becomes negative due to LED bulbs' significantly longer lifetime (typically 20 years compared to approximately 1 year for traditional and halogen incandescent bulbs); this results in consumers purchasing far fewer bulbs. The negative incremental cost reflects the fact that over time, consumers will save money on light bulb purchases in addition to seeing substantial electricity bill savings from the light bulb standards.

Figure 3 shows the annual net economic savings for consumers and businesses from existing standards (accounting for both savings and costs) for 2016–2030. (Table B1 in Appendix B shows the same results in tabular format.)

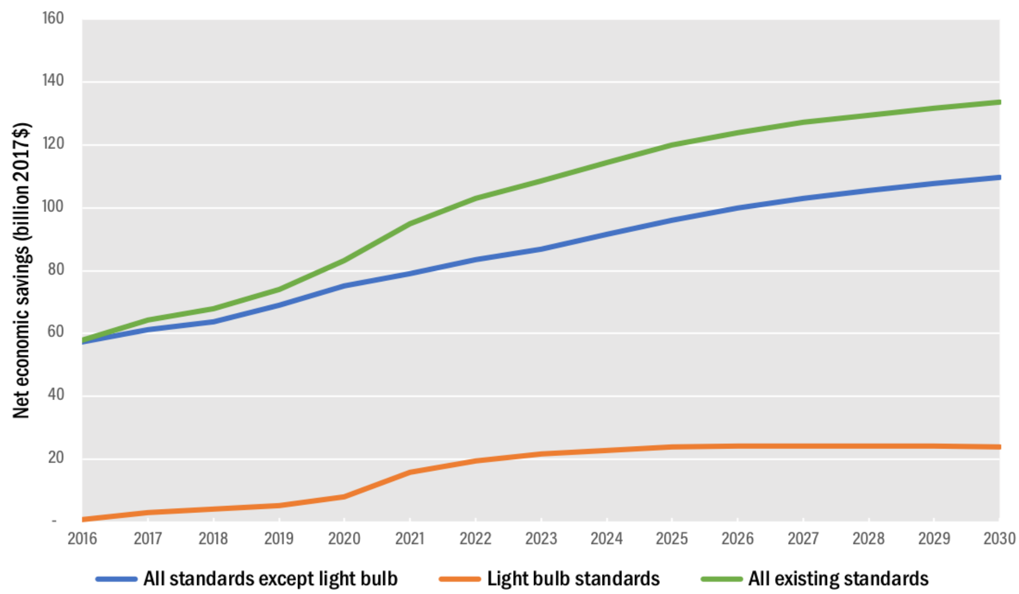

Figure 3. Annual net economic savings from appliance standards

Annual net economic savings from all existing standards grow from $58 billion in 2016 to almost $135 billion in 2030. For the light bulb standards, net economic savings reach nearly $25 billion in 2030. Savings increase as consumers and businesses replace existing products with new devices that meet the latest efficiency standards. Light bulb savings increase significantly in 2020–2021 due to a scheduled increase in standards that apply to a wider range of products in 2020. Light bulb savings flatten quickly after 2020 because traditional and halogen incandescent light bulbs have a short average lifetime, so stock turnover occurs more quickly than it does for other standards.

As we discuss in Appendix A, research shows that DOE has generally overestimated the cost to improve efficiency and that, for some products, prices have actually declined as new standards have taken effect. Given this, our estimated net economic savings are likely conservative.

Job Creation

In 2016, the net economic savings from existing appliance standards created or sustained close to 300,000 US jobs, and by 2030 that number will almost double to more than 550,000 jobs. For comparison, there are roughly 650,000 workers in the entire US mining, quarrying, and oil and gas extraction sector (BLS 2018). Figure 4 shows the number of jobs created or sustained each year for 2016–2030 as a result of existing appliance standards (see table B1 in Appendix B for the same results in tabular form).

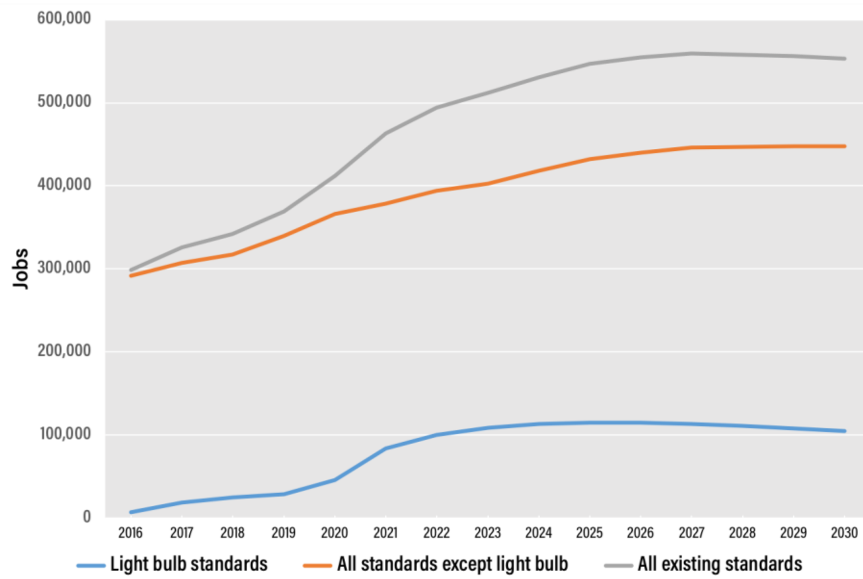

Figure 4. Jobs created or sustained from existing appliance standards for 2016–2030

As figure 4 shows, year-over-year growth is high in the early years, driven by implementation of standards issued in prior years and the increasing saturation of compliant products in the in-use stock. Growth slows over time as the stock becomes saturated with compliant products meeting existing standards. Light bulb standards account for a significant portion of jobs created by standards, contributing 105,000 jobs in 2030.

STATE BY STATE

The number of jobs in each state is significant. Because we allocate the jobs created or sustained proportionately to statewide net economic benefits, the states with the largest economic savings also have the largest number of jobs. Therefore states with large populations tend to have the most jobs. Figure 5 shows the 50 states and DC on a gradient for the respective jobs created by all existing standards in 2030. California gains roughly 75,000 jobs; New York, 50,000; and Texas, 45,000.

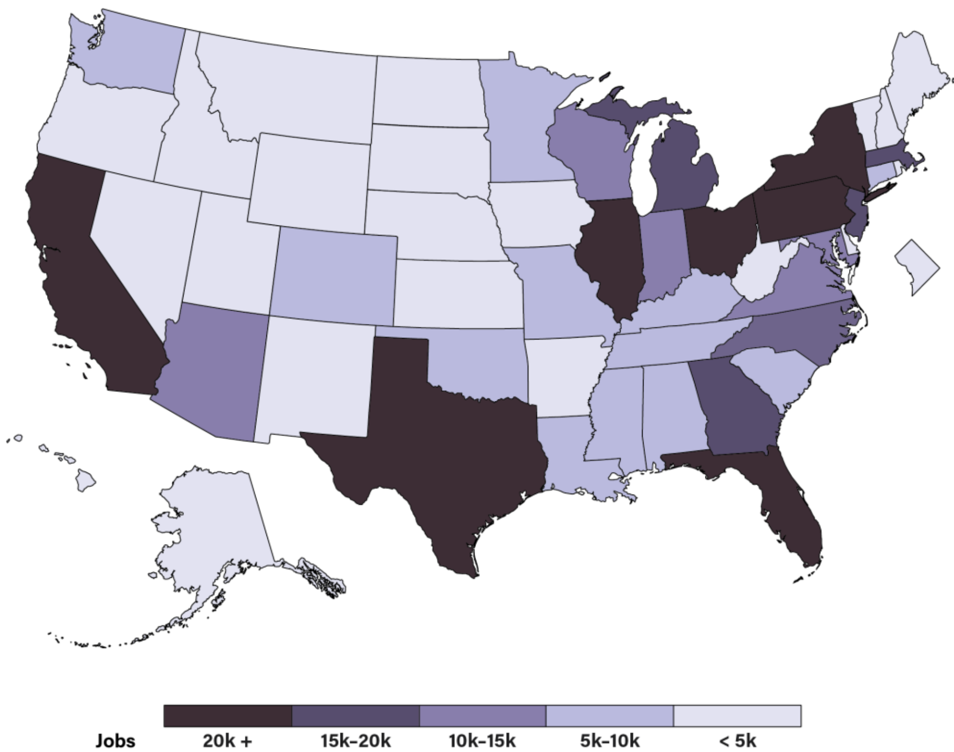

Figure 5. Jobs created or sustained by all existing appliance standards in each state for 2030

Table 2 shows annual net economic savings and jobs in 2020 and 2030 for all existing standards for each of the 50 states and DC.

Table 2. Net economic savings and jobs from all existing standards by state in 2020 and 2030

	Annual net economic savings (million 2017$)		Jobs	
State	2020	2030	2020	2030
Alabama	1,336	1,943	6,625	8,044
Alaska	270	403	1,337	1,669
Arizona	1,564	2,619	7,755	10,844
Arkansas	685	1,123	3,395	4,651
California	11,056	19,849	54,809	82,192
Colorado	936	1,578	4,641	6,534
Connecticut	1,274	2,018	6,314	8,354
Delaware	254	446	1,257	1,846
District of Columbia	260	454	1,289	1,881
Florida	5,057	7,891	25,067	32,676
Georgia	2,521	3,672	12,496	15,203
Hawaii	648	957	3,211	3,964
Idaho	242	405	1,198	1,676
Illinois	3,293	5,065	16,325	20,973
Indiana	1,727	2,668	8,559	11,049
Iowa	659	1,022	3,268	4,234
Kansas	735	1,108	3,646	4,589
Kentucky	870	1,352	4,314	5,597
Louisiana	1,130	1,864	5,602	7,717
Maine	391	627	1,937	2,597
Maryland	1,695	2,977	8,402	12,329
Massachusetts	2,382	3,762	11,806	15,576
Michigan	2,742	4,032	13,592	16,694
Minnesota	1,208	1,852	5,986	7,670
Mississippi	759	1,255	3,761	5,197
Missouri	1,479	2,114	7,334	8,755
Montana	181	302	897	1,251
Nebraska	381	592	1,891	2,450
Nevada	477	803	2,363	3,325
New Hampshire	445	707	2,204	2,926
New Jersey	2,762	4,658	13,692	19,287

	Annual net economic savings (million 2017$)		Jobs	
State	2020	2030	2020	2030
New Mexico	395	641	1,960	2,656
New York	7,372	11,998	36,542	49,681
North Carolina	2,422	3,573	12,004	14,793
North Dakota	180	277	893	1,147
Ohio	3,141	4,862	15,571	20,132
Oklahoma	882	1,407	4,374	5,826
Oregon	661	1,132	3,277	4,689
Pennsylvania	3,358	5,802	16,645	24,027
Rhode Island	356	565	1,765	2,339
South Carolina	1,425	2,078	7,066	8,604
South Dakota	183	281	905	1,164
Tennessee	1,334	2,040	6,611	8,448
Texas	5,747	9,135	28,489	37,825
Utah	463	753	2,296	3,116
Vermont	205	327	1,014	1,353
Virginia	2,075	3,083	10,288	12,765
Washington	1,049	1,819	5,201	7,530
West Virginia	472	749	2,337	3,102
Wisconsin	1,847	2,689	9,155	11,136
Wyoming	128	222	635	918
Total	**83,112**	**133,549**	**412,000**	**553,000**

Table B2 in Appendix B shows state-by-state annual net economic savings and jobs for 2020 and 2030 for the light bulb standards.

Future Additional Job Creation

Research by ASAP and ACEEE estimated that possible updates to existing national standards in 2022–2029 could boost annual consumer and business utility bill savings by $43 billion by 2030, growing to $65 billion annually by 2050 (deLaski et al. 2016). If state-level standards are adopted in a sufficient number of states to drive compliance at the national level, an additional $16 billion could be saved annually by 2035 (Mauer, deLaski, and DiMascio 2017). These estimates do not account for potential impacts on product prices; they do suggest, however, that very large additional job creation benefits are attainable by improving existing national standards and adopting new state standards.

Conclusion

Economic savings from appliance standards result in significant job creation as consumers and businesses spend and invest their savings. In 2016, annual net economic savings from existing national standards were $58 billion, and they will increase to $134 billion by 2030. These economic savings created or sustained nearly 300,000 US jobs in 2016; by 2030, there will be more than 550,000 jobs that would not otherwise exist. Updates to existing national standards and new state-level standards would provide additional future job creation benefits.

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Appendix A. How Do Appliance Standards Affect Sales?

Generally, higher prices for any given product translate to lower demand for that product. Therefore, if making a product more efficient to comply with a standard adds costs that are passed on to consumers in the form of higher prices (as generally assumed by DOE) then, everything else being equal, appliance standards would result in lower shipments, affecting manufacturing jobs. This prediction, however, ignores two important factors.

First, DOE has generally overestimated the cost to improve efficiency and, for several products at least, prices have actually declined as new standards have taken effect. Second, all else being equal, a more-efficient product is more desirable to consumers than a lower-efficiency product. These two observations help explain why appliance standards do not appear to have resulted in declines in shipments.

ACEEE and ASAP found that for eight newly standardized products in 2000–2010, DOE overestimated the increase in manufacturer selling price by a factor of 10 on average (Nadel and deLaski 2013). ACEEE and ASAP also found that for refrigerators, clothes washers, and dishwashers, real prices declined by 30–45% between 1987 and 2010, while average energy use decreased by 50–75% (Mauer et al. 2013). Further, additional research found that appliance prices declined over time and that the rate of decline accelerated around the time that new standards took effect, while at the same time, product quality improved (Brucal and Roberts 2017). If prices do not increase with new standards or increase by less than what DOE estimated, the impact of higher prices on shipments is either zero or reduced.

Further, even in cases where a new standard might lead to an increase in price, the new product's improved efficiency typically makes it more desirable to consumers, which somewhat counteracts the impact of higher prices. Lawrence Berkeley National Laboratory (LBNL) has estimated a short-run price elasticity for appliances of –0.45 (i.e., a 10% increase in price would yield a 4.5% decrease in units sold) (Fujita 2015). However LBNL has also estimated an efficiency elasticity for appliances of 0.16–0.24 (i.e., a 10% increase in efficiency will yield a 1.6–2.4% increase in units sold) (Fujita 2015). Thus, the impact of a 10% increase in efficiency would counteract the impact of a price increase of 4–5%. Therefore, even in cases where prices increase as a result of new standards, the efficiency elasticity would offset at least some of the price elasticity's impact and, in some cases, it may actually outweigh that impact.

Historical shipment data show that there is apparently little correlation between shipment trends and new standards taking effect. Figure A1 shows historical annual shipments for refrigerators and freezers and annual housing units completed for 1987–2008 (the most-recent years for which shipment data were available); it also shows when new standards took effect. (In Appendix C, figures C2–C5 show similar data for clothes washers, water heaters, central air conditioners and heat pumps, and commercial unitary air conditioners and heat pumps.)

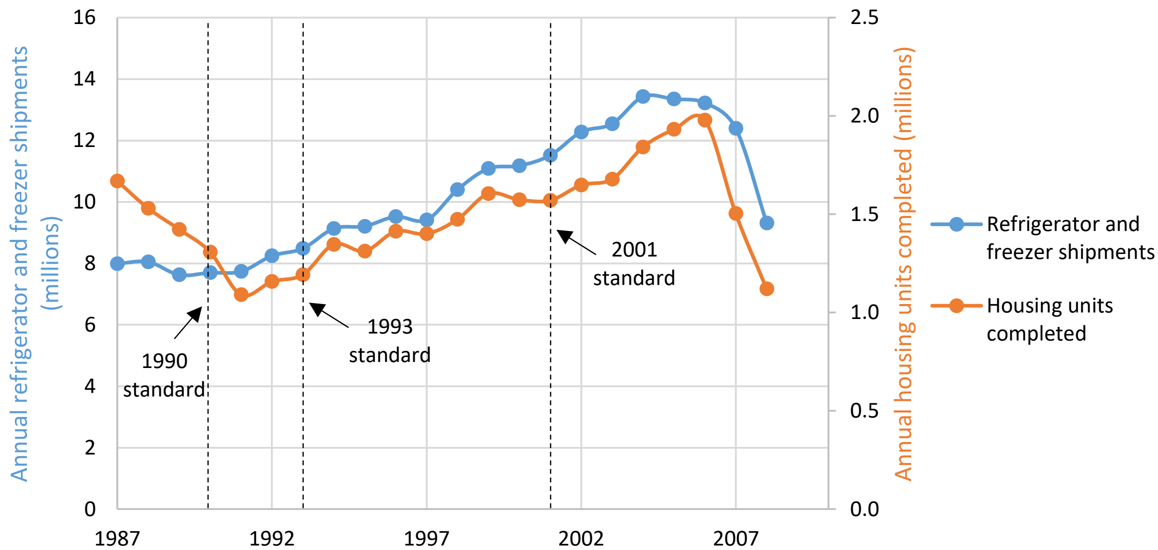

Figure A1. Refrigerator and freezer shipments and housing units completed 1987–2008

Although there appears to be little correlation between shipment trends and new standards, a fairly strong correlation seems to exist between shipments and housing units completed. This makes sense because housing units completed are a strong indicator of the general health of the economy, which in turn affects consumer purchases. In addition, for many products, a significant portion of shipments goes to new construction.

In sum, research has found that prices have either declined with new standards or have increased by much less than what DOE predicted. Further, even in cases where prices may increase due to a new standard, the general consumer preference for more-efficient products counteracts the impact of higher prices on shipments. These findings help explain why appliance standards do not appear to have any significant impact on shipments.

Appendix B. Net Economic Savings and Jobs

Table B1. Annual net economic savings and jobs for all existing standards and for light bulb standards

	Annual net economic savings (million 2017$)		Jobs	
Year	Light bulb standards	All existing standards	Light bulb standards	All existing standards
2016	685	57,911	7,000	299,000
2017	2,905	64,161	19,000	326,000
2018	4,165	67,785	25,000	342,000
2019	5,099	74,009	29,000	369,000
2020	8,065	83,112	46,000	412,000
2021	15,838	94,811	84,000	463,000
2022	19,400	102,951	100,000	494,000
2023	21,540	108,450	109,000	512,000
2024	22,843	114,363	113,000	531,000
2025	23,742	119,870	115,000	547,000
2026	24,137	123,972	115,000	555,000
2027	24,246	127,166	113,000	559,000
2028	24,182	129,567	111,000	558,000
2029	24,024	131,713	108,000	556,000
2030	23,858	133,549	105,000	553,000

Table B2. Net economic savings and jobs from light bulb standards by state in 2020 and 2030

	Annual net economic savings (million 2017$)		Jobs	
State	2020	2030	2020	2030
Alabama	111	299	632	1,315
Alaska	27	70	156	310
Arizona	126	404	721	1,779
Arkansas	59	184	334	811
California	1,198	3,783	6,832	16,648
Colorado	93	326	529	1,437
Connecticut	132	372	751	1,636
Delaware	24	76	136	333
District of Columbia	19	58	107	254

	Annual net economic savings (million 2017$)		Jobs	
State	2020	2030	2020	2030
Florida	404	1,177	2,305	5,178
Georgia	206	562	1,174	2,475
Hawaii	68	168	388	740
Idaho	21	79	118	348
Illinois	328	930	1,869	4,094
Indiana	159	461	909	2,027
Iowa	62	191	353	842
Kansas	65	188	373	829
Kentucky	73	226	418	996
Louisiana	84	267	482	1,177
Maine	40	121	228	531
Maryland	161	502	921	2,211
Massachusetts	236	670	1,344	2,950
Michigan	297	789	1,695	3,473
Minnesota	116	348	659	1,531
Mississippi	61	187	347	822
Missouri	134	371	766	1,632
Montana	17	60	95	264
Nebraska	33	105	188	464
Nevada	43	154	245	679
New Hampshire	46	132	260	580
New Jersey	270	813	1,538	3,577
New Mexico	39	125	221	548
New York	993	2,712	5,665	11,937
North Carolina	226	620	1,288	2,729
North Dakota	13	42	75	183
Ohio	313	888	1,785	3,908
Oklahoma	76	232	435	1,021
Oregon	61	220	346	969
Pennsylvania	351	1,111	2,005	4,888
Rhode Island	37	105	209	462
South Carolina	129	339	735	1,490

	Annual net economic savings (million 2017$)		Jobs	
State	2020	2030	2020	2030
South Dakota	16	50	92	220
Tennessee	108	332	618	1,462
Texas	406	1,290	2,316	5,678
Utah	37	134	212	590
Vermont	21	62	120	271
Virginia	191	517	1,090	2,277
Washington	90	347	514	1,526
West Virginia	45	131	256	578
Wisconsin	191	493	1,091	2,171
Wyoming	10	34	54	150
Total	**8,065**	**23,858**	**46,000**	**105,000**

Appendix C. Annual Shipments for Five Products and Annual Housing Units Completed

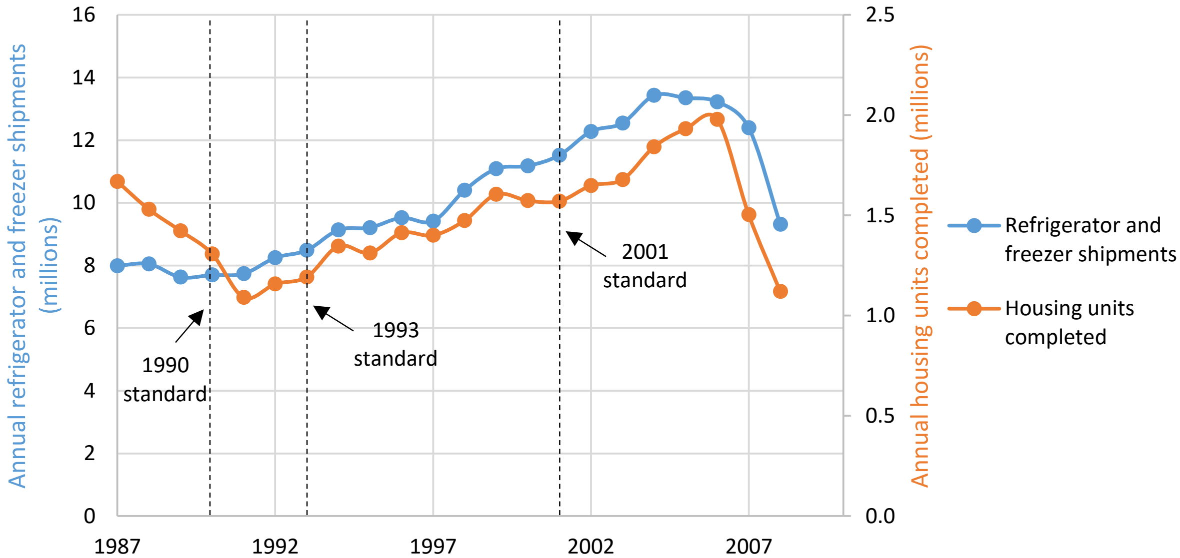

Figure C1. Annual refrigerator and freezer shipments and housing units completed 1987–2008. ***Sources:*** **DOE 2011; Census Bureau 2018b.**

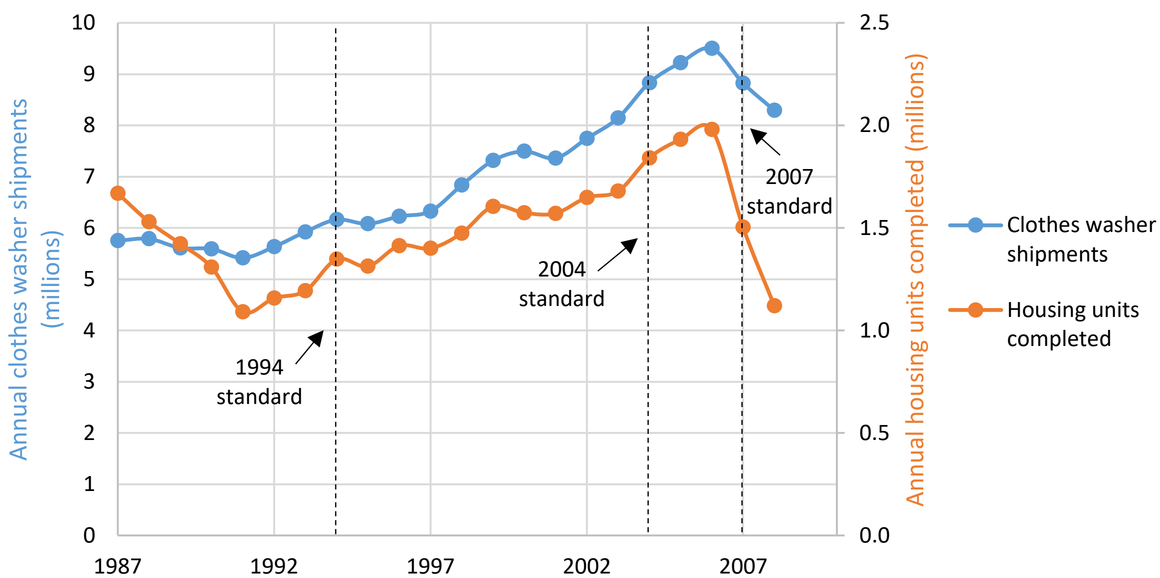

Figure C2. Annual clothes washer shipments and housing units completed 1987–2008. ***Sources:*** **DOE 2012; Census Bureau 2018b.**

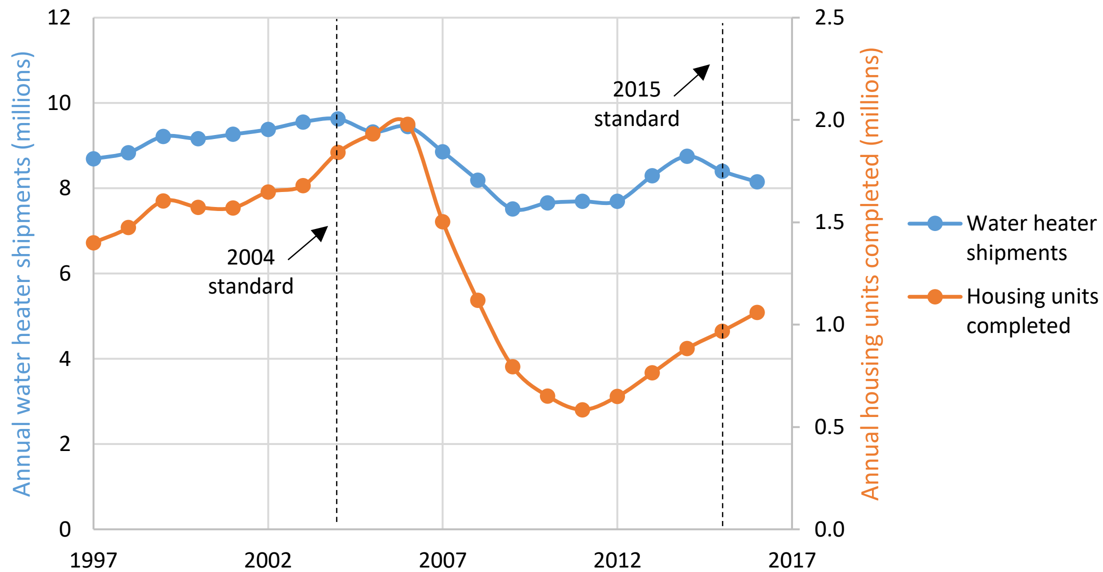

Figure C3. Annual water heater shipments and housing units completed 1997–2016. *Sources:* AHRI 2018b; Census Bureau 2018b.

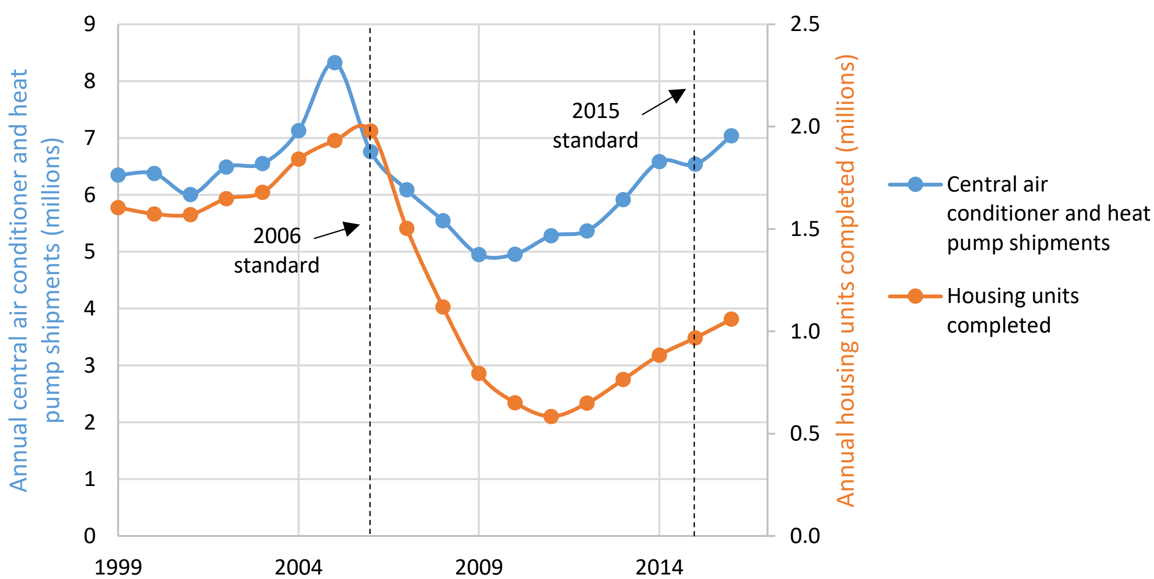

Figure C4. Annual central air conditioner and heat pump shipments and housing units completed 1999–2016. *Sources:* AHRI 2018a; Census Bureau 2018b.

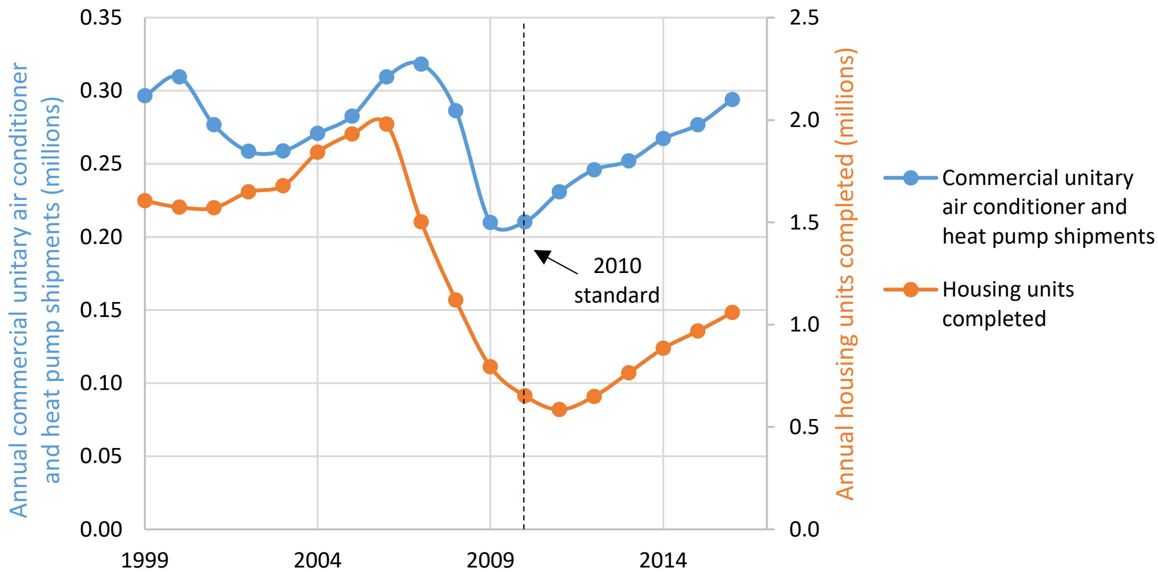

Figure C5. Annual commercial unitary air conditioner and heat pump shipments and housing units completed 1999–2016. ***Sources:*** **AHRI 2018a; Census Bureau 2018b.**