Reducing Costs Across America: New Appliance Standards Save Consumers Money in Every State

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August 2024

Summary

National appliance standards save money for consumers and businesses by reducing utility bills. As of August 2024, the Department of Energy under the Biden administration has updated standards for about two dozen products. We estimate that these standards will save a typical US household $107 each year on average over the next two decades, with savings ranging from $67 to $285 depending on the state. Business owners across the United States will collectively save an average of more than $2 billion annually. These standards will also reduce harmful air pollution and water waste.

Overview

Standards for household appliances and other products reduce utility bills for consumers and businesses by ensuring that all new models available for sale meet a minimum level of efficiency. Products covered by national standards range from refrigerators and water heaters to commercial air conditioners and electric motors.

As of August 2024, the Department of Energy (DOE) under the Biden administration has set new and updated efficiency standards for about two dozen products. This policy analysis provides estimates of the state-by-state utility bill savings for households and businesses, air pollution reductions, and water savings from standards finalized between January 2021 and July 2024. Table 1 shows the final rule publication date and compliance date for each of the 20 products included in our analysis.[1]

The household and business utility bill savings are significant in every state. We estimate that average annual household utility bill savings over the next two decades will range from $67 in Utah to $285 in Hawaii; a typical American household will save $107 each year on average. Businesses across the country—including small businesses like restaurants and convenience stores and larger businesses owning bigger commercial buildings and industrial facilities—will collectively save more than $2 billion each year on average.

In addition to the significant cost savings for households and businesses, the new standards will also reduce air pollution that harms human health and protect scarce water supplies in drought-stricken areas. We estimate that standards completed under the Biden administration will reduce national

[1] DOE also finalized four rules consistent with efficiency levels in ASHRAE 90.1 for direct expansion-dedicated outdoor air systems, variable refrigerant flow air conditioners and heat pumps, small three-phase air-conditioners and heat pumps, and computer room air conditioners. We did not include these products in our analysis.

annual emissions of nitrogen oxides (NO_x) and sulfur dioxide (SO_2) by about 11,700 tons and 5,100 tons, respectively, and save about 50 billion gallons of water each year on average over the next two decades.

While we did not quantify climate emissions reductions or peak electricity demand reductions in this policy analysis, reduced energy use resulting from the new standards will meaningfully reduce greenhouse gas emissions and lessen the strain on the electrical grid, improving grid reliability and helping to moderate future energy prices.

Table 1. Final rule publication date and compliance date for efficiency standards finalized under the Biden administration

Product	Final Rule published	Compliance date
General service lamps - backstop	May 2022	July 2022
Air cleaners	April 2023	Tier 1: December 2023; Tier 2: December 2025
Room air conditioners	May 2023	May 2026
Pool heaters	May 2023	May 2028
Electric motors	June 2023	June 2027
Microwave ovens	June 2023	June 2026
Dedicated-purpose pool pump motors	September 2023	September 2025 or September 2027 (depending on the product category)
Commercial water heaters	October 2023	October 2026
Furnaces	December 2023	December 2028
Refrigerators/freezers	January 2024	January 2029 or January 2030 (depending on the product category)
Cooking products	February 2024	January 2028
Clothes dryers	March 2024	March 2028
Clothes washers	March 2024	March 2028
General service lamps	April 2024	July 2028
Distribution transformers	April 2024	April 2029
Dishwashers	April 2024	April 2027
Water heaters	May 2024	May 2029
Miscellaneous refrigeration products	May 2024	January 2029
Air-cooled unitary ACs/HPs	May 2024	January 2029
Circulator pumps	May 2024	May 2028

Below we provide our state-by-state estimates of household utility bill savings, bill savings for businesses, and reductions in air pollutant emissions and water waste due to standards completed under the Biden administration. Appendices A and B describe our methodology, and Appendix C lists the sources for the assumptions for each of the products in our analysis.

Consumer Pocketbook Savings Add Up

The savings from standards finalized under the Biden administration to date add up to significant bill savings for consumers in every state. Table 2 shows the annual household utility bill savings on average over the next two decades (2025 through 2044) for the 50 states plus the District of Columbia. Total household savings include electricity, gas, and water and wastewater bill savings. A typical US household will save $107 each year on average, with savings ranging from $67 in Utah to $285 in Hawaii. Cumulatively, this amounts to more than $2,000 in bill savings over the next two decades for a typical American household. Table 1 also shows the cumulative statewide bill savings for household products over the next two decades. While cumulative statewide savings are generally correlated with the size of the state, households in even the state with the lowest population, Wyoming, will collectively save over $300 million. Most of the bill savings come from reduced electricity use, but gas and water savings also contribute meaningfully to the total savings.

A typical US household will save $107 annually on average over the next two decades from recently finalized efficiency standards.

Table 2. Household bill savings by state: average annual and cumulative savings over the next two decades and cumulative statewide totals

	Average annual household bill savings (2022$)	Cumulative average household bill savings (2022$)	Cumulative statewide household bill savings (billion 2022$)
Alabama	**111**	2,230	4.3
Alaska	**114**	2,283	0.6
Arizona	**106**	2,113	5.8
Arkansas	**108**	2,165	2.5
California	**110**	2,198	29.3
Colorado	**78**	1,550	3.5
Connecticut	**167**	3,346	4.7
Delaware	**118**	2,353	0.9
District of Columbia	**94**	1,881	0.6
Florida	**113**	2,253	18.8
Georgia	**108**	2,161	8.5
Hawaii	**285**	5,690	2.8
Idaho	**84**	1,687	1.1

Illinois	**82**	1,639	8.1
Indiana	**97**	1,937	5.1
Iowa	**81**	1,623	2.1
Kansas	**82**	1,642	1.9
Kentucky	**101**	2,019	3.6
Louisiana	**114**	2,283	4.0
Maine	**147**	2,936	1.7
Maryland	**121**	2,414	5.6
Massachusetts	**163**	3,261	8.9
Michigan	**91**	1,822	7.3
Minnesota	**87**	1,738	3.9
Mississippi	**97**	1,940	2.2
Missouri	**77**	1,538	3.8
Montana	**68**	1,367	0.6
Nebraska	**76**	1,518	1.2
Nevada	**93**	1,858	2.2
New Hampshire	**178**	3,563	1.9
New Jersey	**113**	2,259	7.8
New Mexico	**79**	1,578	1.3
New York	**151**	3,014	22.9
North Carolina	**97**	1,947	8.0
North Dakota	**99**	1,979	0.6
Ohio	**85**	1,691	8.1
Oklahoma	**103**	2,069	3.2
Oregon	**83**	1,661	2.8
Pennsylvania	**128**	2,564	13.3
Rhode Island	**152**	3,035	1.3
South Carolina	**118**	2,368	4.8
South Dakota	**98**	1,960	0.7
Tennessee	**98**	1,970	5.3
Texas	**97**	1,945	20.4
Utah	**67**	1,341	1.4

Vermont	**135**	2,696	0.7
Virginia	**113**	2,258	7.4
Washington	**71**	1,425	4.2
West Virginia	**113**	2,267	1.6
Wisconsin	**89**	1,771	4.3
Wyoming	**74**	1,473	0.3

The annual bill savings vary by state primarily due to differences in energy prices (e.g., New England has electricity prices nearly twice the national average) but are also influenced by the types of appliances consumers tend to purchase (e.g., electric vs. gas water heaters), climate, and household size.

While all the recently finalized standards contribute to the bill savings, a handful of products have particularly significant impacts. The largest consumer savings come from water heaters, followed by light bulbs ("general service lamps"), clothes washers, refrigerators, clothes dryers, pool pump motors, and furnaces.

All the standards save consumers more money than they cost; we estimate that the total utility bill savings for household products outweigh any increases in purchase price by more than a factor of three.

Appliances Meeting the New Standards Can Also Provide Better Performance

For clothes washers and dryers, the new standards are equivalent to current ENERGY STAR levels. About three-quarters of ENERGY STAR top-loading washers tested by *Consumer Reports* received a washing performance score of 4 or 5 (out of 5), while only about one-quarter of non-ENERGY STAR models achieved such ratings. Similarly, more than 90% of ENERGY STAR electric dryers tested by *Consumer Reports* received drying performance ratings of 4 or 5, while only about two-thirds of non-ENERGY STAR models achieved such ratings. Additionally, more-efficient refrigerators and room ACs use variable-speed compressors, which help maintain more consistent temperatures and are generally quieter than single-speed compressors that cycle on and off frequently.

Businesses Also Save

Standards finalized under the Biden administration to date will also save business owners money in every state. Over the next two decades, we estimate that US businesses will collectively save more than $2 billion per year on average on utility bills. Table 3 shows the estimated average annual utility bill savings for businesses in each state from the standards for equipment used in the commercial and industrial sectors. On the low end, businesses in Vermont will collectively save nearly $5 million per year on average, while businesses in California will save nearly $250 million annually on average. Table 3 also shows the cumulative statewide bill savings for businesses over the next two decades. Businesses in even the least populated states will collectively save about $100 million or more cumulatively over the next two decades.

Table 3. Business bill savings by state: average annual and cumulative savings over the next two decades

	Average annual business bill savings (million 2022$)	Cumulative business bill savings (million 2022$)
Alabama	35.2	705
Alaska	5.6	112
Arizona	45.3	905
Arkansas	20.9	418
California	247.8	4,956
Colorado	31.4	628
Connecticut	32.5	650
Delaware	7.8	155
District of Columbia	15.9	318
Florida	145.4	2,908
Georgia	69.9	1,398
Hawaii	15.9	318
Idaho	7.5	150
Illinois	79.1	1,581
Indiana	43.7	873
Iowa	18.1	363
Kansas	20.3	406
Kentucky	28.0	560
Louisiana	43.5	870
Maine	9.5	190
Maryland	53.4	1,068
Massachusetts	64.1	1,282
Michigan	64.6	1,291
Minnesota	32.6	653
Mississippi	20.8	415
Missouri	30.2	604
Montana	6.4	128
Nebraska	12.9	258

Nevada	18.7	374
New Hampshire	11.6	232
New Jersey	76.0	1,520
New Mexico	13.5	271
New York	210.1	4,201
North Carolina	56.2	1,123
North Dakota	9.3	187
Ohio	65.8	1,315
Oklahoma	34.3	685
Oregon	13.7	274
Pennsylvania	68.2	1,364
Rhode Island	8.9	178
South Carolina	34.5	690
South Dakota	6.9	137
Tennessee	46.9	938
Texas	172.1	3,442
Utah	14.8	295
Vermont	4.8	96
Virginia	77.4	1,547
Washington	24.3	486
West Virginia	11.5	229
Wisconsin	39.5	790
Wyoming	5.2	104

These savings for businesses come from improving the efficiency of products such as commercial air conditioners, commercial water heaters, and electric motors; the savings will accrue to small businesses like convenience stores and restaurants as well as larger businesses owning bigger commercial buildings and industrial facilities.

Reducing Air Pollution, Saving Water, and Other Benefits

In addition to reducing utility bills, the standards finalized under the Biden administration will provide other significant benefits. Cutting needless energy waste reduces emissions, including air pollutants such as NO_x and SO_2 emitted at power plants or when operating a gas-fired appliance. NO_x and SO_2 are harmful to the human respiratory system and contribute to respiratory conditions, particularly in children, the elderly, and people with asthma. Table 4 shows the estimated state-by-state average

annual NO_x and SO_2 emissions reductions over the next two decades from standards completed under the Biden administration. Total nationwide average annual emissions reductions are about 11,700 tons and 5,100 tons for NOx and SO_2, respectively. While we did not analyze particulate matter (e.g., PM2.5) emissions directly, the new standards will also reduce emissions of PM2.5, which are correlated with NO_x emissions.

New standards for clothes washers and dishwashers will also reduce water waste, helping to reduce stresses on water supplies in drought-stricken areas. Table 4 also shows estimated state-by-state average annual and cumulative water savings over the next two decades. Even the least populated states will save about 100 million gallons of water annually while the states with the largest populations will save several billion gallons annually. Cumulatively, the new standards will save over 1 trillion gallons of water nationwide over the next two decades.

While this policy analysis does not include estimates of state-by-state reductions in climate emissions, the energy savings from the new standards will translate into significant greenhouse gas reductions. Additionally, cutting needless electricity waste lessens the strain on the electrical grid, which helps improve grid reliability by reducing peak demand and can help moderate future energy prices.

Table 4. Air pollution reductions and water savings by state: average annual NO_x and SO_2 emissions reductions and annual and cumulative water savings over the next two decades

	Average annual NO_x reductions (tons)	Average annual SO_2 reductions (tons)	Average annual water savings (million gallons)	Cumulative water savings (billion gallons)
Alabama	84	135	816	16.3
Alaska	164	10	118	2.4
Arizona	183	20	1,169	23.4
Arkansas	104	10	490	9.8
California	1,088	31	6,417	128.3
Colorado	340	30	942	18.8
Connecticut	150	9	583	11.7
Delaware	32	19	162	3.2
District of Columbia	26	15	107	2.1
Florida	1,388	431	3,524	70.5
Georgia	208	240	1,744	34.9
Hawaii	298	309	236	4.7
Idaho	76	6	301	6.0
Illinois	354	186	2,080	41.6
Indiana	302	354	1102	22.0
Iowa	168	42	516	10.3
Kansas	93	11	475	9.5

Kentucky	139	208	732	14.6
Louisiana	122	14	754	15.1
Maine	54	3	222	4.4
Maryland	196	129	1,005	20.1
Massachusetts	291	16	1,124	22.5
Michigan	407	299	1,638	32.8
Minnesota	310	78	926	18.5
Mississippi	67	55	477	9.5
Missouri	235	208	1,000	20.0
Montana	36	6	177	3.5
Nebraska	100	22	318	6.4
Nevada	151	10	512	10.2
New Hampshire	57	3	224	4.5
New Jersey	285	135	1,514	30.3
New Mexico	81	6	346	6.9
New York	634	32	3,234	64.7
North Carolina	210	122	1,698	34.0
North Dakota	53	15	125	2.5
Ohio	417	558	1,917	38.3
Oklahoma	174	19	642	12.8
Oregon	72	15	690	13.8
Pennsylvania	392	371	2,096	41.9
Rhode Island	48	3	175	3.5
South Carolina	100	67	833	16.7
South Dakota	50	12	143	2.9
Tennessee	182	306	1,131	22.6
Texas	805	133	4,776	95.5
Utah	128	8	539	10.8
Vermont	27	2	103	2.1
Virginia	247	142	1,399	28.0
Washington	129	25	1,257	25.1
West Virginia	70	119	290	5.8

Wisconsin	337	87	959	19.2
Wyoming	33	2	94	1.9

Conclusion

Efficiency standards finalized under the Biden administration will provide significant pocketbook savings for consumers, with annual household bill savings ranging from $67 in Utah to $285 in Hawaii on average over the next two decades. A typical US household will save $107 each year on average. The standards will also provide utility bill savings for both small and large businesses; businesses across the country will collectively save more than $2 billion per year on average. In addition to bill savings, the standards will also help protect public health by reducing harmful air pollution; reduce stresses on scarce water supplies; cut greenhouse gas emissions; and lessen strains on the electric grid.

Appendix A. Methodology and Assumptions

Our general methodology for estimating savings is based on product sales; the exception is for the general service lamps backstop standard (Appendix B describes our methodology for the general service lamps backstop). We estimated national annual electricity, natural gas, and water savings (where applicable) for each product based on estimated annual shipments in the year the standard takes effect; per-unit energy and (if applicable) water savings; and average product lifetime.[2] Our analysis inputs, summarized in Table A1, were based on DOE's final analysis for each of the standards; details and references for each of the product-specific inputs are shown in Appendix C.

To calculate the per-unit energy and water savings, we subtracted the average per-unit consumption in the standards case from that in the base case (i.e., absent amended standards). Both the base-case and standards-case values take into account the distribution of efficiency levels (e.g., the base-case per-unit consumption reflects that some portion of sales exceed the current minimum efficiency levels).

We assumed that both annual shipments and the distribution of efficiency levels in the base case remain constant over time. In reality, both shipments and base case efficiency tend to increase over time. Thus, we implicitly assumed that these two factors cancel each other out.

We used the equation below to calculate savings in each year of the analysis:

Annual savings = Number of installed units x Per-unit savings

where the number of installed units is:

Before full stock turnover: Annual shipments x (Number of years after compliance date + 0.5)

After full stock turnover: Annual shipments x Average product lifetime

In calculating the number of installed units meeting the new standard prior to full stock turnover, we accounted for products being purchased throughout the year. Thus, in any given year we counted only one-half year of savings from products purchased in that year. For products with compliance dates in the first half of the year (i.e., before July 1), we assumed that year for the compliance date; for products with compliance dates in the second half of the year, we used the following year as the assumed compliance date.

We calculated state-by-state electricity, natural gas, and water savings by allocating national product sales to each state and, where appropriate, making state-by-state adjustments to sales allocations and per-unit savings. For certain products,[3] data were available that allowed us to estimate different per-unit energy savings values for a specific state(s) or region. For products for which per-household consumption is correlated with household size (dishwashers, clothes washers, clothes dryers, cooking products, and microwaves), we adjusted per-unit savings based on average household size.[4]

[2] For product types with more than one product class, we calculated shipment-weighted per-unit savings and average lifetimes.

[3] We calculated state or region-specific per-unit savings based on DOE rulemaking analyses for gas furnaces, gas and electric pool heaters, and pool pump motors. We used the 2020 Residential Energy Consumption Survey (RECS) to estimate state-specific per-unit savings adjustments for gas furnaces, gas storage water heaters, and electric storage water heaters.

[4] www.census.gov/quickfacts/.

For products used in multiple sectors (e.g., air cleaners used in both residential and commercial applications), we allocated total sales to each sector based on available data on the breakdown of sales by sector. We then allocated sales in each sector to each of the states.

For residential products for which product saturation does not vary significantly by region (e.g., clothes washers, dishwashers, refrigerators), we used the number of households in each state to allocate product sales.[5] For residential products for which saturation varies significantly by state or region (e.g., gas-fired products, pool products), we used data on equipment saturation from the Residential Energy Consumption Survey (RECS) 2020 to allocate sales by state.[6]

For commercial and industrial products, we generally allocated sales based on state-by-state sector energy usage.[7] For products where saturation and/or usage differs more significantly by state or region (e.g., commercial gas water heaters, commercial air conditioners), we used regional data on end-use consumption from the Commercial Buildings Energy Consumption Survey (CBECS) 2018.[8] For these products, we first allocated product sales to the nine US Census divisions based on end-use consumption in CBECS 2018 (e.g., for commercial cooling) and then allocated regional sales to individual states based on overall commercial electricity or gas use.

Table A1. Analysis inputs for each of the products

Product	Compliance date	Annual shipments (millions)	Shipment-weighted per-unit annual savings	Units	Average lifetime (years)
Air cleaners	--	--	--	--	--
Residential - Tier 1	2024	4.9	10	kWh	9.0
Residential - Tier 2	2026	5.4	13	kWh	9.0
Commercial - Tier 1	2024	3.3	22	kWh	9.0
Commercial - Tier 2	2026	3.6	28	kWh	9.0
Air-cooled unitary ACs/HPs	2029	0.37	1,669	kWh	22.2
Circulator pumps	2028	2.00	111	kWh	10.5
Clothes dryers	2028	8.9	--	--	--
Electric	2028	7.4	103	kWh	14.0
Gas-fired	2028	1.4	--	--	14.0
electricity	--	--	6	kWh	--
gas	--	--	0.4	MMBtu	--

[5] *Ibid*.

[6] www.eia.gov/consumption/residential/data/2020/.

[7] EIA-861 Annual Electric Power Industry Report. www.eia.gov/electricity/data/state/.

[8] www.eia.gov/consumption/commercial/data/2018/.

Clothes washers	2028	11.0	--	--	13.4
electricity	--	--	25	kWh	--
gas	--	--	0.02	MMBtu	--
water	--	--	659	gallons	--
Commercial water heaters	--	--	--	--	--
Residential - gas-fired	2027	0.02	--	--	12.0
electricity	--	--	-130	kWh	--
gas	--	--	21	MMBtu	--
Commercial - gas-fired	2027	0.13	--	--	12.3
electricity	--	--	-42	kWh	--
gas	--	--	12	MMBtu	--
Cooking Products	2028	--	--	--	--
Electric	2028	8.8	4	kWh	16.8
Gas-fired	2028	6.4	--	--	14.5
electricity	--	--	0.2	kWh	--
gas	--	--	0.001	MMBtu	--
Dedicated-purpose pool pump motors	--	--	--	--	--
Extra-small & standard size - National	2026	1.28	1,123	kWh	4.7
Extra-small & standard size - CA	2026	0.17	255	kWh	4.7
Small size - National	2028	0.80	637	kWh	3.9
Small size - CA	2028	0.11	503	kWh	3.9
Distribution transformers	2029	1.5	275	kWh	32.0
Dishwashers	2027	8.9	--	--	15.2
electricity	--	--	6	kWh	--
gas	--	--	0.02	MMBtu	--
water	--	--	55	gallons	--
Electric motors	--	--	--	--	--
Medium electric motors	2027	0.18	933	kWh	33.4
Air-over motors	2027	0.21	196	kWh	13.3
Furnaces	--	--	--	--	--
Residential - South/rest of country	2029	1.31	--	--	21.5
electricity	--	--	-11	kWh	--

gas	--	--	2.4	MMBtu	--
Residential - North	2029	1.72	--	--	21.5
electricity	--	--	-7	kWh	--
gas	--	--	2.4	MMBtu	--
Commercial - South/rest of country	2029	0.05	--	--	21.5
electricity	--	--	-23	kWh	--
gas	--	--	5.2	MMBtu	--
Commercial - North	2029	0.10	--	--	21.5
electricity	--	--	-13	kWh	--
gas	--	--	4.4	MMBtu	--
General service lamps	--	--	--	--	--
Residential	2029	322.1	2	kWh	12.1
Commercial	2029	83.2	8	kWh	8.5
Microwaves	2026	12.4	1.3	kWh	10.8
Miscellaneous refrigeration products	2029	1.7	49	kWh	11.2
Pool heaters	--	--	--	--	--
Electric	--	--	--	--	--
Residential - Rest of country	2028	0.05	1,375	kWh	11.0
Residential - Pacific	2028	0.01	778	kWh	11.0
Residential - South Atlantic	2028	0.05	500	kWh	11.0
Commercial - Rest of country	2028	0.004	16,834	kWh	11.0
Commercial - Pacific	2028	0.0005	14,695	kWh	11.0
Commercial - South Atlantic	2028	0.004	13,755	kWh	11.0
Gas-fired	--	--	--	--	--
Residential - Rest of country	2028	0.17	--	--	11.0
electricity	--	--	-3	kWh	--
gas	--	--	1.0	MMBtu	--
Residential - CA, CT, FL, NY	2028	0.08	--	--	11.0
electricity	--	--	-2	kWh	--
gas	--	--	0.4	MMBtu	--
Commercial - Rest of Country	2028	0.03	--	--	11.0
electricity	--	--	-48	kWh	--

gas	--	--	15.1	MMBtu	--
Commercial - CA, CT, FL, NY	2028	0.01	--	--	11.0
electricity	--	--	-36	kWh	--
gas	--	--	13.5	MMBtu	--
Refrigerators	--	--	--	--	--
Standard refrigerators/freezers	2030	16.4	72	kWh	15.0
Compact refrigerators	2029	2.2	11	kWh	8.9
Residential water heaters	--	--	--	--	--
Residential - electric	2029	4.2	--	--	15.1
electricity	--	--	1,117	kWh	--
gas	--	--	-0.6	MMBtu	--
Residential - gas-fired	2029	4.3	--	--	14.5
electricity	--	--	-2	kWh	--
gas	--	--	1.2	MMBtu	--
Commercial - electric	2029	0.5	--	--	15.1
electricity	--	--	1,319	kWh	--
gas	--	--	-0.6	MMBtu	--
Commercial - gas-fired	2029	0.1	--	--	14.5
electricity	--	--	-6	kWh	--
natural gas	--	--	1.2	MMBtu	--
Room air conditioners	--	--	--	--	--
Residential	2026	6.4	118	kWh	9.3
Commercial	2026	1.0	166	kWh	9.3

We calculated energy bill savings using state-by-state electricity and natural gas prices for the residential, commercial, and industrial sectors. We used price projections from the US Energy Information Administration's (EIA's) Annual Energy Outlook (AEO) 2023 to calculate electricity prices for each of the NERC regions for each year of the analysis period relative to 2022 prices.[9] We then applied these projections for the NERC regions to 2022 state-by-state electricity prices.[10] For states that span more than one NERC region, we calculated weighted-average projected changes in electricity prices based on electricity sales.[11] Alaska and Hawaii are not included in the NERC region data; for these states

[9] www.eia.gov/outlooks/aeo/.

[10] EIA-861 Annual Electric Power Industry Report. www.eia.gov/electricity/data/state/.

[11] www.aceee.org/sites/default/files/publications/researchreports/e1601.pdf.

we assumed the rate of change of electricity prices would be equivalent to the US average. Table A2 shows the projected residential, commercial, and industrial electricity prices in 2025 for each state.

Table A2. State-by-state 2025 electricity prices (2022 cents/kWh) for the residential, commercial, and industrial sectors

State	Residential	Commercial	Industrial
Alabama	12.62	11.27	6.03
Alaska	21.30	17.98	15.82
Arizona	12.04	9.49	6.48
Arkansas	11.73	9.95	7.04
California	21.25	17.24	12.61
Colorado	13.99	10.98	8.07
Connecticut	23.66	17.90	13.76
Delaware	13.69	10.81	8.22
District of Columbia	14.16	15.36	7.24
Florida	12.54	9.76	7.42
Georgia	12.34	10.46	6.82
Hawaii	39.67	36.02	31.50
Idaho	9.51	7.23	5.55
Illinois	14.67	10.36	7.51
Indiana	13.70	11.96	7.76
Iowa	12.66	9.91	6.40
Kansas	13.30	10.81	7.59
Kentucky	11.04	9.72	5.67
Louisiana	12.47	11.44	7.08
Maine	21.58	14.87	10.07
Maryland	14.32	12.34	9.27
Massachusetts	24.97	18.02	15.57
Michigan	16.78	11.39	7.31
Minnesota	13.44	11.30	8.20
Mississippi	11.08	10.27	5.53
Missouri	11.10	8.96	6.97
Montana	8.88	7.99	5.00
Nebraska	10.99	8.76	6.97

Nevada	13.41	9.41	7.60
New Hampshire	24.48	18.04	13.83
New Jersey	16.71	13.54	11.33
New Mexico	13.30	10.33	5.93
New York	22.48	18.31	7.18
North Carolina	11.51	8.38	6.13
North Dakota	10.99	8.31	6.94
Ohio	12.72	9.27	6.33
Oklahoma	12.69	10.60	7.19
Oregon	8.42	6.54	4.13
Pennsylvania	15.54	10.28	7.47
Rhode Island	22.32	15.67	16.39
South Carolina	13.47	10.40	6.69
South Dakota	12.29	10.11	7.76
Tennessee	10.18	9.61	4.80
Texas	12.89	8.28	6.65
Utah	10.59	7.82	6.16
Vermont	19.16	16.69	10.84
Virginia	12.83	9.01	7.14
Washington	7.57	6.63	3.74
West Virginia	12.15	9.30	5.73
Wisconsin	14.59	10.78	7.44
Wyoming	10.85	8.93	6.25

We used price projections from EIA's AEO 2023 to calculate natural gas prices for each of the nine US Census divisions for each year of the analysis period relative to 2022 prices. We then applied these regional price projections to 2022 state-by-state natural gas prices.[12] For water and wastewater prices, we used regional prices derived from a 2020 American Water Works Association/Raftelis survey and water price trends for each year of the analysis period from DOE's recent clothes washer final rule analysis.[13] Table A3 shows the projected residential and commercial natural gas prices and water/wastewater prices for 2025.

[12] www.eia.gov/dnav/ng/ng_pri_sum_a_EPG0_PRS_DMcf_a.htm.

[13] "Energy_Water Price Trends" sheet of LCC spreadsheet. www.regulations.gov/document/EERE-2017-BT-STD-0014-0513.

Table A3. State-by-state 2025 residential and commercial natural gas prices and water/wastewater prices

State	Residential natural gas (2022$/MMBtu)	Commercial natural gas (2022$/MMBtu)	Water/wastewater (2022$/thousand gallons)
Alabama	14.46	11.19	13.81
Alaska	9.80	7.30	16.34
Arizona	14.82	8.91	16.34
Arkansas	13.67	8.86	13.81
California	17.82	11.62	16.34
Colorado	10.59	9.38	16.34
Connecticut	15.08	10.73	17.36
Delaware	13.30	10.50	13.81
District of Columbia	14.79	12.78	13.81
Florida	23.25	12.04	13.81
Georgia	16.02	9.67	13.81
Hawaii	50.82	31.78	16.34
Idaho	6.63	5.85	16.34
Illinois	10.62	9.55	15.33
Indiana	8.93	7.44	15.33
Iowa	10.06	8.22	15.33
Kansas	11.09	9.14	15.33
Kentucky	12.14	10.07	13.81
Louisiana	12.91	9.01	13.81
Maine	17.03	13.84	17.36
Maryland	15.05	11.99	13.81
Massachusetts	16.80	13.00	17.36
Michigan	8.71	7.83	15.33
Minnesota	9.35	7.85	15.33
Mississippi	12.15	10.10	13.81
Missouri	11.03	8.34	15.33
Montana	8.67	8.43	16.34
Nebraska	9.90	7.64	15.33

Nevada	10.59	7.74	16.34
New Hampshire	16.85	13.57	17.36
New Jersey	9.87	9.90	17.36
New Mexico	10.41	8.53	16.34
New York	12.87	7.81	17.36
North Carolina	15.25	10.49	13.81
North Dakota	8.41	7.13	15.33
Ohio	10.06	6.57	15.33
Oklahoma	12.03	8.07	13.81
Oregon	11.35	7.44	16.34
Pennsylvania	11.77	9.29	17.36
Rhode Island	14.93	12.77	17.36
South Carolina	13.90	10.32	13.81
South Dakota	8.48	6.86	15.33
Tennessee	10.38	9.54	13.81
Texas	13.46	8.00	13.81
Utah	8.72	7.35	16.34
Vermont	12.74	7.29	17.36
Virginia	14.28	9.80	13.81
Washington	11.35	7.66	16.34
West Virginia	10.71	8.23	13.81
Wisconsin	8.73	7.48	15.33
Wyoming	11.15	9.13	16.34

We calculated state-by-state NOx and SO_2 emissions reductions from electricity savings by multiplying annual electricity savings by respective state-by-state average emissions factors. We calculated emissions factors for each year of the analysis period for each of the NERC regions by dividing projected electric power sector emissions by projected electric power sector generation using EIA's 2023 AEO and assuming transmission and distribution losses of 5.2%[14]. For states that span more than one NERC region, we calculated weighted-average emissions factors based on electricity sales.[15] Alaska and Hawaii are not included in the NERC emissions projections; for these states we used emissions factors from

[14] www.eia.gov/electricity/state/unitedstates/state_tables.php.

[15] www.aceee.org/sites/default/files/publications/researchreports/e1601.pdf.

2021 and assumed the rate of change of emissions factors would be equivalent to the US average. The 2025 state-by-state emissions factors are shown in Table A4.

Table A4. State-by-state 2025 NO_x and SO_2 emissions factors

State	NO_x (tons/GWh)	SO_2 (tons/GWh)
Alabama	0.087	0.144
Alaska	2.369	0.190
Arizona	0.271	0.067
Arkansas	0.198	0.093
California	0.095	0.006
Colorado	0.594	0.100
Connecticut	0.170	0.015
Delaware	0.063	0.119
District of Columbia	0.063	0.119
Florida	0.225	0.091
Georgia	0.079	0.127
Hawaii	1.892	2.314
Idaho	0.321	0.057
Illinois	0.139	0.257
Indiana	0.328	0.659
Iowa	0.332	0.139
Kansas	0.118	0.043
Kentucky	0.136	0.283
Louisiana	0.186	0.086
Maine	0.170	0.015
Maryland	0.069	0.142
Massachusetts	0.170	0.015
Michigan	0.216	0.271
Minnesota	0.324	0.133
Mississippi	0.140	0.146
Missouri	0.281	0.483
Montana	0.110	0.042

Nebraska	0.391	0.150
Nevada	0.398	0.070
New Hampshire	0.170	0.015
New Jersey	0.063	0.119
New Mexico	0.283	0.090
New York	0.120	0.011
North Carolina	0.099	0.213
North Dakota	0.348	0.153
Ohio	0.125	0.349
Oklahoma	0.260	0.128
Oregon	0.054	0.018
Pennsylvania	0.081	0.186
Rhode Island	0.170	0.015
South Carolina	0.099	0.216
South Dakota	0.403	0.147
Tennessee	0.140	0.258
Texas	0.168	0.078
Utah	0.410	0.071
Vermont	0.170	0.015
Virginia	0.113	0.166
Washington	0.054	0.018
West Virginia	0.125	0.349
Wisconsin	0.321	0.130
Wyoming	0.443	0.076

We calculated state-by-state NOx emissions reductions from natural gas savings by multiplying annual natural gas savings by a natural gas emissions factor of 94 lb/million cu. ft.[16]

[16] www3.epa.gov/ttn/chief/ap42/ch01/final/c01s04.pdf. Emissions factor for residential furnaces.

Appendix B. Methodology for General Service Lamps Backstop

For the general service lamps backstop standard, we estimated savings for three lamp categories: A-type medium screw base lamps, reflector lamps, and decorative lamps. We assumed that 100% of sales in the commercial sector as of 2020 were LEDs, and therefore we only estimated savings for the residential sector.

To calculate the stock of each lamp type in each year, we started with estimates of the 2020 stock for A-type lamps (table B1) and reflector and decorative lamps (table B2).[17]

Table B1. 2020 residential stock of A-type lamps by lamp type[18]

Lamp type	Lamps (million)	% of total
Conventional incandescent	161	4%
Halogen	291	8%
CFL	1,454	39%
LED	1,778	48%

Table B2. 2020 residential stock of reflector and decorative lamps by lamp type[19]

Lamp category	Incandescent		LED		Total lamps (million)
	Lamps (million)	% of total	Lamps (million)	% of total	
Reflector	418	38%	690	62%	1,108
Decorative	307	31%	690	69%	944

For the base case, we assumed that, as of 2020, 25% of sales of A-type and reflector lamps were incandescents,[20] and 75% were LEDs. For decorative lamps, we assumed an even split of sales between incandescents and LEDs. (Because the average lifetime of LEDs is much longer than that of incandescents, these splits in market share result in stock penetrations of incandescents that are much lower than their market share.) For the standards case, we assumed a 100% market share for LEDs beginning in July 2022.

We calculated the number of lamps of each lamp type being replaced each year based on the stock in the previous year and the average lamp lifetime. We also accounted for lamp shipments going to new construction based on EIA's 2020 projections of the average annual growth in residential and

[17] For simplicity, we excluded CFLs from our analysis for reflector and decorative lamps.

[18] www.energy.gov/sites/default/files/2024-08/ssl-lmc2020_apr24.pdf.

[19] *Ibid*.

[20] We use *incandescent* here to refer to both conventional incandescent lamps and halogen lamps.

commercial floor space.[21] We calculated the stock of each lamp type in each future year as the sum of replacement shipments, shipments to new construction, and lamps not being replaced (i.e., installed lamps that did not burn out in the previous year). We calculated total annual energy use in each year based on the stock of each lamp type and the per-unit energy use.

Table B3 shows our assumptions for each lamp category and lamp type, including average wattage, lifetime, and per-unit annual energy use.

Table B3. Assumed average wattage, lifetime, and per-unit annual energy use by lamp category and lamp type[22]

Lamp category and lamp type	Average wattage (W)	Average lifetime (years)	Average per-unit annual energy use (kWh)
A-type			
Halogen	43	1.9	35.0
CFL	13	11.0	10.6
LED	10	18.2	8.1
Reflector			
Incandescent	60	3.2	61.2
LED	12.5	18.7	12.7
Decorative			
Incandescent	60	2.1	54.3
LED	7	17.8	6.3

Finally, we calculated annual energy savings in each year based on the difference in total annual energy use in the base case and the standards case.

[21] www.eia.gov/outlooks/aeo/.

[22] eta-publications.lbl.gov/sites/default/files/impact_of_eisa_2007_on_gsls_2021_12_03_kk.pdf.

Appendix C. Sources for Product Assumptions

Product	Sources
Air cleaners	DOE Final Rule Technical Support Document: www.regulations.gov/document/EERE-2021-BT-STD-0035-0024 DOE Final Rule National Impact Analysis: www.regulations.gov/document/EERE-2021-BT-STD-0035-0022
Air-cooled unitary ACs/HPs	DOE Final Rule Technical Support Document: www.regulations.gov/document/EERE-2022-BT-STD-0015-0096
Circulator pumps	DOE Final Rule Technical Support Document: www.regulations.gov/document/EERE-2020-BT-STD-0007-0040 DOE Final Rule National Impact Analysis: www.regulations.gov/document/EERE-2016-BT-STD-0004-0139 DOE Final Rule: www.regulations.gov/document/EERE-2016-BT-STD-0004-0142
Clothes dryers	DOE Final Rule Technical Support Document: www.regulations.gov/document/EERE-2014-BT-STD-0058-0059 DOE Final Rule National Impact Analysis: www.regulations.gov/document/EERE-2014-BT-STD-0058-0061
Clothes washers	DOE Final Rule Technical Support Document: www.regulations.gov/document/EERE-2017-BT-STD-0014-0510
Commercial water heaters	DOE Final Rule Technical Support Document: www.regulations.gov/document/EERE-2021-BT-STD-0027-0038 DOE Final Rule National Impact Analysis: www.regulations.gov/document/EERE-2021-BT-STD-0027-0041
Cooking products	DOE Final Rule Technical Support Document: www.regulations.gov/document/EERE-2014-BT-STD-0005-12819 DOE Final Rule National Impact Analysis: www.regulations.gov/document/EERE-2014-BT-STD-0005-12821
Dedicated-purpose pool pump motors	DOE Final Rule Technical Support Document: www.regulations.gov/document/EERE-2017-BT-STD-0048-0102

	DOE Final Rule National Impact Analysis: www.regulations.gov/document/EERE-2017-BT-STD-0048-0103
Dishwashers	DOE Final Rule Technical Support Document: www.regulations.gov/document/EERE-2019-BT-STD-0039-0061 DOE Final Rule National Impact Analysis: www.regulations.gov/document/EERE-2019-BT-STD-0039-0064
Distribution transformers	DOE Final Rule Technical Support Document: www.regulations.gov/document/EERE-2019-BT-STD-0018-0165 DOE Final Rule National Impact Analysis: www.regulations.gov/document/EERE-2019-BT-STD-0018-0166 www.regulations.gov/document/EERE-2019-BT-STD-0018-0167 www.regulations.gov/document/EERE-2019-BT-STD-0018-0168
Electric motors	DOE Final Rule Technical Support Document: www.regulations.gov/document/EERE-2020-BT-STD-0007-0040
Furnaces	DOE Final Rule: www.regulations.gov/document/EERE-2014-BT-STD-0031-4107 DOE Final Rule Technical Support Document: www.regulations.gov/document/EERE-2014-BT-STD-0031-4100 DOE Final Rule National Impact Analysis: www.regulations.gov/document/EERE-2014-BT-STD-0031-4101
General service lamps	DOE Final Rule Technical Support Document: www.regulations.gov/document/EERE-2022-BT-STD-0022-0201 DOE Final Rule National Impact Analysis: www.regulations.gov/document/EERE-2022-BT-STD-0022-0203
Microwave ovens	DOE Final Rule Technical Support Document: www.regulations.gov/document/EERE-2017-BT-STD-0023-0032 DOE Final Rule National Impact Analysis: www.regulations.gov/document/EERE-2017-BT-STD-0023-0033
Miscellaneous refrigeration products	DOE Final Rule Technical Support Document: www.regulations.gov/document/EERE-2020-BT-STD-0039-0037

	DOE Final Rule National Impact Analysis: www.regulations.gov/document/EERE-2020-BT-STD-0039-0040
Pool heaters	DOE Final Rule Technical Support Document: www.regulations.gov/document/EERE-2021-BT-STD-0020-0025 DOE Final Rule National Impact Analysis: www.regulations.gov/document/EERE-2021-BT-STD-0020-0021
Refrigerators/freezers	DOE Final Rule Technical Support Document: www.regulations.gov/document/EERE-2017-BT-STD-0003-0108 DOE Final Rule National Impact Analysis: www.regulations.gov/document/EERE-2017-BT-STD-0003-0111 www.regulations.gov/document/EERE-2017-BT-STD-0003-0112 www.regulations.gov/document/EERE-2017-BT-STD-0003-0113
Room air conditioners	DOE Final Rule Technical Support Document: www.regulations.gov/document/EERE-2014-BT-STD-0059-0053 DOE Final Rule National Impact Analysis: www.regulations.gov/document/EERE-2014-BT-STD-0059-0054
Water heaters	DOE Final Rule Technical Support Document: www.regulations.gov/document/EERE-2017-BT-STD-0019-1416 DOE Final Rule National Impact Analysis: www.regulations.gov/document/EERE-2017-BT-STD-0019-1425