

State-Level Benefits from Potential Federal Appliance Standards

Massachusetts															
Summary of Benefits by Product	Effective Date	Annual Savings in 2020						Annual Savings in 2030				Economics			
		Annual Savings per Unit	Incremental Cost per Unit ¹	Electricity	Primary Energy	Summer Peak Capacity	Value of Bill Savings ²	Electricity	Primary Energy	Summer Peak Capacity	Value of Bill Savings ²	Pay Back Period ³	Benefit / Cost Ratio ⁴	Net Present Value ⁵	Cumulative Energy Savings through 2030
Products	Year	kWh, (gal), or (therms)	\$	GWh	BBtu	MW	\$Million	GWh	BBtu	MW	\$Million	Years		\$Million (2009\$)	TBtu
Residential															
Battery chargers	2014	4	\$ 1	193.8	2,019.7	26.7	\$ 33.9	193.8	1,948.4	26.7	\$ 33.9	0.8	6.1	\$ 213	28.3
Central AC & HP	2016	545	\$ 255	65.8	685.8	47.6	\$ 11.5	212.0	2,131.7	153.4	\$ 37.1	2.7	2.5	\$ 130	17.1
Clothes dryers (total)	2014	-	\$ 50	76.9	875.8	11.4	\$ 14.7	195.1	2,151.4	29.0	\$ 37.4	-	3.4	\$ 169	19.5
(electricity)	2014	93	\$ 50	76.9	801.3	11.4	\$ 13.5	195.1	1,962.4	29.0	\$ 34.2	3.1	3.9	\$ 163	17.8
(gas)	2014	[3.5]	\$ 50	-	74.5	-	\$ 1.3	-	189.1	-	\$ 3.2	8.3	1.4	\$ 6	1.7
Clothes washers (total) ⁶	2015	244	\$ 96	80.5	1,264.3	12.0	\$ 21.4	161.1	2,469.4	24.0	\$ 42.7	-	5.1	\$ 411	26.6
(electricity - machine)	2015	22	\$ 9	15.8	164.6	2.3	\$ 2.8	31.6	317.6	4.7	\$ 5.5	1.6	9.1	\$ 25	3.5
(electricity - water heating)	2015	222	\$ 87	64.8	675.0	9.6	\$ 11.3	129.5	1,302.3	19.3	\$ 22.7	-	-	\$ 101	14.2
(gas)	2015	[10.1]	\$ 87	-	424.7	-	\$ 7.3	-	849.5	-	\$ 14.5	2.4	5.9	\$ 35	8.9
(water)	2015	[5233.5]	\$ -	Bil. Gal.-->	5.8	-	\$ -	Bil. Gal.-->	11.6	-	\$ -	-	-	\$ 250	-
Direct heaters	2013	48	\$ 326	-	227.1	-	\$ 3.9	-	457.3	-	\$ 7.9	3.3	3.1	\$ 36	4.8
(gas)	2013	[68]	\$ 326	-	271.3	-	\$ 4.6	-	542.6	-	\$ 9.3	2.8	3.7	\$ 46	5.7
External power supplies	2013	2	\$ 1	44.0	459.1	6.1	\$ 7.7	44.0	442.9	6.1	\$ 7.7	2.7	2.0	\$ 28	6.7
Furnaces (gas)	2013	[82.2]	\$ 520	-	831.2	-	\$ 14.2	-	1,939.4	-	\$ 33.2	3.7	3.1	\$ 144	18.0
Furnaces (oil)	2013	[33.9]	\$ 17	-	69.2	-	\$ 1.6	-	161.4	-	\$ 2.8	0.3	106.0	\$ 24	1.5
Furnace fans	2016	547	\$ 100	139.5	1,454.6	28.8	\$ 24.4	449.7	4,521.7	92.7	\$ 78.7	1.0	9.6	\$ 413	36.4
Microwave ovens	2012	16	\$ 2	37.6	391.6	5.6	\$ 6.6	39.8	400.0	5.9	\$ 7.0	0.8	8.7	\$ 51	6.0
Pool heaters	2013	[20]	\$ 44	-	62.6	-	\$ 1.1	-	62.6	-	\$ 1.1	1.3	4.0	\$ 7	0.9
Refrigerators	2014	130	\$ 52	141.0	1,469.7	21.2	\$ 24.7	357.9	3,599.0	53.8	\$ 62.6	2.3	5.3	\$ 325	32.7
Room AC	2014	86	\$ 35	36.1	376.0	50.8	\$ 6.3	69.4	697.6	97.7	\$ 12.1	2.3	4.0	\$ 59	7.8
Water heaters	2013	-	\$ -	164.0	2,721.0	22.6	\$ 46.0	306.2	4,696.9	42.2	\$ 81.3	-	6.3	\$ 475	54.5
(electricity)	2013	220	\$ 65	164.0	1,709.8	22.6	\$ 28.7	306.2	3,078.9	42.2	\$ 53.6	1.7	5.9	\$ 305	35.1
(gas)	2013	[14]	\$ 30	-	1,011.2	-	\$ 17.3	-	1,617.9	-	\$ 27.7	1.3	7.1	\$ 170	19.4
Commercial															
Beverage vending machines	2012	682	\$ 157	5.9	62.0	1.4	\$ 1.0	9.8	98.5	2.3	\$ 1.6	1.4	7.0	\$ 10	1.2
Commercial boilers	2013	[513.6]	\$ 2,968	-	96.6	-	\$ 1.5	-	225.4	-	\$ 3.5	3.7	4.1	\$ 22	2.1
Clothes washers (total) ⁶	2012	-	\$ 503	7.1	162.7	2.3	\$ 2.7	8.9	201.0	2.9	\$ 3.1	5.3	1.6	\$ 12	2.8
(electricity)	2012	208	\$ 446	7.1	74.2	2.3	\$ 1.1	8.9	89.8	2.9	\$ 1.4	-	-	\$ (7)	1.3
(gas)	2012	[26.8]	\$ 57	-	88.5	-	\$ 1.5	-	111.1	-	\$ 1.7	-	-	\$ 11	1.5
(water)	2012	[5827]	\$ -	Bil. Gal.-->	0.2	-	\$ -	Bil. Gal.-->	0.3	-	\$ -	-	-	\$ 8	-
Fluorescent ballasts	2014	18	\$ 2	41.9	436.3	13.7	\$ 6.7	103.3	1,038.5	33.8	\$ 18.1	0.7	15.1	\$ 93	9.7
Fluorescent lamps	2012	11	\$ 2	539.5	5,623.9	176.5	\$ 86.6	539.5	5,425.4	176.5	\$ 86.6	1.3	3.4	\$ 556	92.0
Incandescent reflector lamps	2012	62	\$ 3	159.5	1,662.1	39.3	\$ 25.6	159.5	1,603.4	39.3	\$ 25.6	0.3	5.0	\$ 223	30.6
BR \ exempted reflector lamps	2013	38	\$ 1	72.3	754.1	17.8	\$ 11.6	72.3	727.5	17.8	\$ 11.6	0.2	4.7	\$ 84	13.9
Liquid-immersed transformers	2016	2	\$ 2	14.2	148.3	2.0	\$ 2.3	45.8	461.0	6.3	\$ 7.4	5.9	2.6	\$ 35	3.7
Low-voltage dry type transformers	2016	25	\$ 5	54.1	563.6	7.5	\$ 9.5	174.2	1,752.0	24.0	\$ 28.0	1.3	11.4	\$ 198	14.1
Metal halide lamp fixtures	2015	360	\$ 35	96.9	1,010.2	31.7	\$ 17.0	273.1	2,746.3	89.4	\$ 43.8	0.6	20.7	\$ 268	23.5
Reach-in refrigerators and freezers	2016	1,658	\$ 199	16.7	174.2	3.9	\$ 2.9	44.6	448.3	10.4	\$ 7.2	0.7	11.8	\$ 36	4.2
Small electric motors	2015	132	\$ 20	79.0	823.5	12.5	\$ 13.8	100.5	1,011.0	15.9	\$ 16.1	0.9	6.2	\$ 91	13.1
Walk-in refrigerators and freezers	2015	2,128	\$ 273	12.5	129.8	2.9	\$ 2.2	27.2	273.3	6.3	\$ 4.4	0.8	11.1	\$ 24	2.8
Total				2,079	24,555	544	\$ 401	3,588	41,691	957	\$ 702			\$ 4,137	474

Product	Emissions Reductions in 2020			Emissions Reductions in 2030 ⁷			
	CO2 1000 MT	NOx Tons	SO2 Tons	CO2 1000 MT	NOx Tons	SO2 Tons	
Residential							
Battery chargers	108.1	113.1	521.3	108.1	113.1	521.3	
Central AC & HP	0.04	66.2	305.3	118.3	123.7	570.4	
Clothes dryers	46.9	48.0	206.9	119.2	121.8	525.1	
	(electricity)	42.9	44.9	206.8	108.9	113.9	525.1
	(gas)	4.0	3.1	0.02	10.2	7.9	0.05
Clothes washers	68.0	64.8	216.8	135.9	129.5	433.7	
Direct heaters ⁸	12.3	8.9	-11.3	0.02	17.7	-22.7	
External power supplies	24.6	25.7	118.5	24.6	25.7	118.5	
Furnaces (gas)	45.0	34.7	0.2	105.1	81.1	0.5	
Furnaces (oil)	3.7	2.9	0.02	8.7	6.7	0.04	
Furnace fans	77.9	81.5	375.5	291.4	262.5	1209.9	
Microwave ovens	21.0	21.9	101.1	112.6	23.2	107.0	
Pool heaters	3.4	2.6	0.02	3.4	2.6	0.02	
Refrigerators	78.7	82.3	379.4	199.7	208.9	963.0	
Room AC	20.1	21.1	97.1	38.7	40.5	186.7	
Water heaters	146.3	138.4	441.6	258.5	246.3	824.3	
	(electricity)	91.5	95.7	441.3	170.9	178.7	823.8
	(gas)	54.8	42.3	0.3	87.7	67.6	0.4
Commercial							
Beverage vending machines	3.3	3.5	16.0	5.5	5.7	26.3	
Commercial boilers	5.2	4.0	0.03	12.2	9.4	0.1	
Clothes washers	8.8	7.9	19.2	11.0	9.9	24.1	
Fluorescent ballasts	23.4	24.4	112.6	57.6	60.3	277.9	
Fluorescent lamps	301.1	314.9	1451.7	301.1	314.9	1451.7	
Incandescent reflector lamps	89.0	93.1	429.0	89.0	93.1	429.0	
BR \ exempted reflector lamps	40.4	42.2	194.6	40.4	42.2	194.6	
Liquid-immersed transformers	7.9	8.3	38.3	25.6	26.8	123.3	
Low-voltage dry type transformers	30.2	31.6	145.5	97.2	101.7	468.8	
Metal halide lamp fixtures	54.1	56.6	260.7	152.4	159.4	734.8	
Reach-in refrigerators and freezers	9.3	9.8	45.0	24.9	26.0	119.9	
Small electric motors	44.1	46.1	212.6	56.1	58.7	270.5	
Walk-in refrigerators and freezers	7.0	7.3	33.5	15.2	15.9	73.1	
Total	1,280	1,362	5,711	2,413	2,327	9,632	

Notes:

- ¹ For purposes of the analyses, incremental costs for residential and commercial clothes washers are apportioned based on the individual components' contribution to overall energy consumption.
- ² Value of bill savings is based on energy savings in 2020 or 2030 and current average state energy prices. This value does not take account of the incremental cost of more efficient products.
- ³ Payback period is the length of time required to recoup any increase in product cost from advances in efficiency.
- ⁴ The benefit / cost ratio is a measure of the annual energy bill savings of an efficient product versus its incremental cost.
- ⁵ Net present value is the total monetary value of bill savings achieved by products sold under the standards between now and 2030 minus the total incremental product cost incurred by purchasers as a result of the standards over the same period expressed in current dollars. Both costs and savings are discounted using a 5% real discount rate.
- ⁶ The payback period and benefit / cost ratios for residential and commercial clothes washers take into account savings from the machine, water heating, and water consumption. For residential clothes washers, the two payback periods were calculated for a clothes washer utilizing electricity vs. natural gas for water heating. Benefit / cost ratios were calculated for total savings and costs (electric, natural gas, and water) as well as for clothes washers utilizing electricity vs. natural gas for water heating. For commercial clothes washers, we assume that only natural gas is used for water heating. Therefore only one payback period and benefit / cost ratio were calculated.
- ⁷ 2030 emissions reductions for NOx and SO2 are calculated using 2020 emission factors.
- ⁸ Negative savings for direct heaters represent the emissions generated from the incorporation of electronic ignition, a technology that is not included in the current federal standard.