

**State-Level Benefits from Potential Federal Appliance Standards**

Pennsylvania															
Summary of Benefits by Product	Effective Date	Annual Savings in 2020						Annual Savings in 2030				Economics			Cumulative Energy Savings through 2030
		Annual Savings per Unit	Incremental Cost per Unit <sup>1</sup>	Electricity	Primary Energy	Summer Peak Capacity	Value of Bill Savings <sup>2</sup>	Electricity	Primary Energy	Summer Peak Capacity	Value of Bill Savings <sup>2</sup>	Pay Back Period <sup>3</sup>	Benefit / Cost Ratio <sup>4</sup>	Net Present Value <sup>5</sup>	
Products	Year	kWh, (gal), or [therms]	\$	GWh	BBtu	MW	\$Million	GWh	BBtu	MW	\$Million	Years		\$Million (2009\$)	TBtu
<b>Residential</b>															
Battery chargers	2014	4	\$ 1	389.9	4,064.3	53.8	\$ 44.4	389.9	3,920.8	53.8	\$ 44.4	1.3	4.0	\$ 250	56.9
Central AC & HP	2016	545	\$ 255	158.9	1,656.1	140.1	\$ 18.1	511.9	5,147.9	451.4	\$ 58.3	4.2	2.0	\$ 166	41.4
Clothes dryers (total)	2014	-	\$ 50	154.7	1,762.4	23.0	\$ 20.1	392.7	4,329.3	58.4	\$ 50.9	-	2.3	\$ 184	39.2
(electricity)	2014	93	\$ 50	154.7	1,612.5	23.0	\$ 17.6	392.7	3,948.9	58.4	\$ 44.7	4.7	2.5	\$ 174	35.8
(gas)	2014	[3.5]	\$ 50	-	149.9	-	\$ 2.4	-	380.5	-	\$ 6.2	8.8	1.4	\$ 10	3.3
Clothes washers (total) <sup>6</sup>	2015	244	\$ 96	162.1	2,544.2	24.1	\$ 32.3	324.2	4,969.1	48.2	\$ 64.7	-	4.4	\$ 697	53.4
(electricity - machine)	2015	22	\$ 9	31.8	331.3	4.7	\$ 3.6	63.6	639.2	9.5	\$ 7.2	2.1	7.8	\$ 26	7.0
(electricity - water heating)	2015	222	\$ 87	130.3	1,358.3	19.4	\$ 14.8	260.6	2,620.6	38.7	\$ 29.7	-	-	\$ 107	28.5
(gas)	2015	[10.1]	\$ 87	-	854.7	-	\$ 13.9	-	1,709.4	-	\$ 27.8	2.6	5.7	\$ 62	17.9
(water)	2015	{5233.5}	\$ -	Bil. Gal.-->	11.7	-	\$ -	Bil. Gal.-->	23.4	-	\$ -	-	-	\$ 503	-
Direct heaters	2013	48	\$ 326	-	421.6	-	\$ 7.3	-	849.0	-	\$ 14.9	3.6	2.9	\$ 64	8.9
(gas)	2013	[62.7]	\$ 326	-	503.7	-	\$ 8.2	-	1,007.3	-	\$ 16.4	3.2	3.3	\$ 76	10.6
External power supplies	2013	2	\$ 1	88.6	923.8	12.2	\$ 10.1	88.6	891.2	12.2	\$ 10.1	4.1	1.2	\$ 10	13.4
Furnaces (gas)	2013	[75.8]	\$ 520	-	3,562.7	-	\$ 57.9	-	8,312.9	-	\$ 135.0	4.2	2.7	\$ 545	77.0
Furnaces (oil)	2013	[31.3]	\$ 17	-	128.4	-	\$ 2.9	-	299.6	-	\$ 4.9	0.3	96.4	\$ 43	2.8
Furnace fans	2016	550	\$ 100	281.3	2,931.9	84.6	\$ 32.0	906.3	9,113.8	272.7	\$ 103.2	1.6	6.3	\$ 508	73.3
Microwave ovens	2012	16	\$ 2	75.6	788.1	11.2	\$ 8.6	80.0	805.0	11.9	\$ 9.1	1.3	5.7	\$ 63	12.1
Pool heaters	2013	[20]	\$ 44	-	125.9	-	\$ 2.0	-	125.9	-	\$ 2.0	1.4	3.8	\$ 12	1.9
Refrigerators	2014	130	\$ 52	283.7	2,957.5	42.7	\$ 32.3	720.2	7,242.4	108.3	\$ 82.0	3.5	3.4	\$ 372	65.7
Room AC	2014	86	\$ 35	72.6	756.7	102.2	\$ 8.3	139.6	1,403.8	196.5	\$ 15.9	3.6	2.6	\$ 63	15.7
Water heaters	2013	-	\$ -	330.1	5,475.5	45.5	\$ 70.6	616.1	9,451.6	85.0	\$ 123.1	-	4.7	\$ 678	109.7
(electricity)	2013	220	\$ 65	330.1	3,440.6	45.5	\$ 37.6	616.1	6,195.8	85.0	\$ 70.2	2.6	3.8	\$ 356	70.6
(gas)	2013	[14]	\$ 30	-	2,034.9	-	\$ 33.0	-	3,255.8	-	\$ 52.9	1.3	6.8	\$ 322	39.1
<b>Commercial</b>															
Beverage vending machines	2012	682	\$ 157	10.4	108.5	2.4	\$ 1.0	17.1	172.4	4.0	\$ 1.6	2.4	4.1	\$ 9	2.1
Commercial boilers	2013	[513.6]	\$ 2,968	-	169.2	-	\$ 2.4	-	394.7	-	\$ 5.6	4.1	3.8	\$ 35	3.7
Clothes washers (total) <sup>6</sup>	2012	-	\$ 503	12.5	347.7	4.1	\$ 4.7	15.6	430.7	5.1	\$ 5.3	6.5	1.5	\$ 18	6.0
(electricity)	2012	208	\$ 446	12.5	129.9	4.1	\$ 1.2	15.6	157.3	5.1	\$ 1.5	-	-	\$ (21)	2.2
(gas)	2012	[26.8]	\$ 57	-	217.8	-	\$ 3.5	-	273.4	-	\$ 3.9	-	-	\$ 25	3.7
(water)	2012	{5827}	\$ -	Bil. Gal.-->	0.4	-	\$ -	Bil. Gal.-->	0.5	-	\$ -	-	-	\$ 13	-
Fluorescent ballasts	2014	18	\$ 2	73.3	763.8	24.0	\$ 6.9	180.8	1,818.2	59.2	\$ 20.6	1.2	8.9	\$ 91	16.9
Fluorescent lamps	2012	11	\$ 2	1,085.7	11,317.1	355.3	\$ 102.3	1,085.7	10,917.6	355.3	\$ 102.3	2.3	2.0	\$ 467	185.1
Incandescent reflector lamps	2012	62	\$ 3	320.9	3,344.7	79.2	\$ 30.2	320.9	3,226.6	79.2	\$ 30.2	0.5	3.2	\$ 253	61.5
BR \ exempted reflector lamps	2013	38	\$ 1	145.6	1,517.5	35.9	\$ 13.7	145.6	1,463.9	35.9	\$ 13.7	0.4	2.8	\$ 81	27.9
Liquid-immersed transformers	2016	2	\$ 2	37.7	393.4	5.2	\$ 3.6	121.6	1,222.8	16.8	\$ 11.5	10.1	1.5	\$ 30	9.8
Low-voltage dry type transformers	2016	25	\$ 5	108.8	1,134.2	15.0	\$ 12.4	350.6	3,525.6	48.4	\$ 33.0	2.3	6.7	\$ 219	28.4
Metal halide lamp fixtures	2015	360	\$ 35	195.0	2,032.8	63.8	\$ 22.2	549.6	5,526.5	179.8	\$ 51.8	1.0	12.1	\$ 306	47.3
Reach-in refrigerators and freezers	2016	1,658	\$ 199	33.6	350.6	7.8	\$ 3.8	89.7	902.0	20.9	\$ 8.4	1.3	6.9	\$ 39	8.4
Small electric motors	2015	132	\$ 20	159.0	1,657.1	25.2	\$ 18.1	202.3	2,034.5	32.1	\$ 19.1	1.6	3.6	\$ 92	26.4
Walk-in refrigerators and freezers	2015	2,128	\$ 273	25.1	261.3	5.8	\$ 2.9	54.7	549.9	12.7	\$ 5.2	1.4	6.5	\$ 26	5.7
<b>Total</b>				<b>4,205</b>	<b>51,497</b>	<b>1,163</b>	<b>\$ 571</b>	<b>7,304</b>	<b>89,048</b>	<b>2,148</b>	<b>\$ 1,027</b>			<b>\$ 5,321</b>	<b>1,000</b>

Product	Emissions Reductions in 2020			Emissions Reductions in 2030 <sup>7</sup>		
	CO2 1000 MT	NOx Tons	SO2 Tons	CO2 1000 MT	NOx Tons	SO2 Tons
<b>Residential</b>						
Battery chargers	281.1	227.6	1049.1	281.1	227.6	1049.1
Central AC & HP	0.1	133.3	614.4	369.1	298.8	1377.4
Clothes dryers	119.7	96.6	416.3	303.8	245.1	1056.7
	(electricity)	111.5	90.3	416.2	283.2	229.2
	(gas)	8.1	6.3	0.04	20.6	15.9
Clothes washers	163.2	130.3	436.3	326.4	260.7	872.7
Direct heaters <sup>8</sup>	21.6	16.5	-21.0	0.05	32.9	-42.1
External power supplies	63.9	51.7	238.5	63.9	51.7	238.5
Furnaces (gas)	193.0	148.9	1.0	450.4	347.5	2.2
Furnaces (oil)	7.0	5.4	0.03	16.2	12.5	0.08
Furnace fans	202.8	164.2	756.8	758.9	529.0	2438.6
Microwave ovens	54.5	44.1	203.4	292.8	46.7	215.4
Pool heaters	6.8	5.3	0.03	6.8	5.3	0.03
Refrigerators	204.6	165.6	763.4	519.3	420.4	1937.9
Room AC	52.3	42.4	195.3	100.7	81.5	375.6
Water heaters	348.3	278.6	888.7	620.7	495.7	1658.7
	(electricity)	238.0	192.7	888.1	444.3	359.6
	(gas)	110.3	85.1	0.5	176.4	136.1
<b>Commercial</b>						
Beverage vending machines	7.5	6.1	28.0	12.4	10.0	46.1
Commercial boilers	9.2	7.1	0.05	21.4	16.5	0.11
Clothes washers	20.8	16.4	33.6	26.1	20.6	42.2
Fluorescent ballasts	52.8	42.8	197.2	130.4	105.5	486.5
Fluorescent lamps	782.8	633.7	2921.2	782.8	633.7	2921.2
Incandescent reflector lamps	231.4	187.3	863.3	231.4	187.3	863.3
BR \ exempted reflector lamps	105.0	85.0	391.7	105.0	85.0	391.7
Liquid-immersed transformers	27.2	22.0	101.5	87.7	71.0	327.2
Low-voltage dry type transformers	78.5	63.5	292.8	252.8	204.6	943.4
Metal halide lamp fixtures	140.6	113.8	524.7	396.3	320.8	1478.7
Reach-in refrigerators and freezers	24.3	19.6	90.5	64.7	52.4	241.4
Small electric motors	114.6	92.8	427.7	145.9	118.1	544.4
Walk-in refrigerators and freezers	18.1	14.6	67.4	39.4	31.9	147.1
<b>Total</b>	<b>3,332</b>	<b>2,815</b>	<b>11,482</b>	<b>6,406</b>	<b>4,913</b>	<b>19,614</b>

**Notes:**

- <sup>1</sup> 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.
- <sup>2</sup> 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.
- <sup>3</sup> Payback period is the length of time required to recoup any increase in product cost from advances in efficiency.
- <sup>4</sup> The benefit / cost ratio is a measure of the annual energy bill savings of an efficient product versus its incremental cost.
- <sup>5</sup> 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.
- <sup>6</sup> 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.
- <sup>7</sup> 2030 emissions reductions for NOx and SO2 are calculated using 2020 emission factors.
- <sup>8</sup> 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.