

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

Virginia															
Summary of Benefits by Product	Effective Date	Annual Savings in 2020						Annual Savings in 2030				Economics			
		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>	Cumulative Energy Savings through 2030
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	233.0	2,428.4	32.1	\$ 22.6	233.0	2,342.7	32.1	\$ 22.6	1.5	3.4	\$ 120	34.0
Central AC & HP	2016	545	\$ 255	121.2	1,263.6	132.8	\$ 11.8	390.6	3,927.9	428.1	\$ 37.9	5.1	2.1	\$ 117	31.6
Clothes dryers (total)	2014	-	\$ 50	92.4	1,053.1	13.7	\$ 10.4	234.6	2,586.8	34.9	\$ 26.4	-	2.0	\$ 85	23.4
(electricity)	2014	93	\$ 50	92.4	963.5	13.7	\$ 9.0	234.6	2,359.5	34.9	\$ 22.8	5.5	2.2	\$ 78	21.4
(gas)	2014	[3.5]	\$ 50	-	89.6	-	\$ 1.5	-	227.3	-	\$ 3.7	8.8	1.4	\$ 6	2.0
Clothes washers (total) <sup>6</sup>	2015	244	\$ 96	96.8	1,520.2	14.4	\$ 17.7	193.7	2,969.1	28.8	\$ 35.3	-	4.3	\$ 396	31.9
(electricity - machine)	2015	22	\$ 9	19.0	197.9	2.8	\$ 1.8	38.0	381.9	5.6	\$ 3.7	2.3	7.4	\$ 12	4.2
(electricity - water heating)	2015	222	\$ 87	77.9	811.6	11.6	\$ 7.6	155.7	1,565.8	23.2	\$ 15.1	-	-	\$ 48	17.0
(gas)	2015	[10.1]	\$ 87	-	510.7	-	\$ 8.3	-	1,021.3	-	\$ 16.5	2.6	5.6	\$ 37	10.7
(water)	2015	[5233.5]	\$ -	Bil. Gal.-->	7.0	-	\$ -	Bil. Gal.-->	14.0	-	\$ -	-	-	\$ 300	-
Direct heaters	2013	48	\$ 326	-	190.8	-	\$ 3.3	-	384.2	-	\$ 6.9	4.7	2.2	\$ 25	4.0
(gas)	2013	[47.5]	\$ 326	-	227.9	-	\$ 3.7	-	455.8	-	\$ 7.4	4.2	2.5	\$ 29	4.8
External power supplies	2013	2	\$ 1	53.0	552.0	7.3	\$ 5.1	53.0	532.5	7.3	\$ 5.1	4.8	0.9	\$ (3)	8.0
Furnaces (gas)	2013	[57.4]	\$ 520	-	1,258.2	-	\$ 20.4	-	2,935.9	-	\$ 47.6	5.6	2.1	\$ 156	27.2
Furnaces (oil)	2013	[23.7]	\$ 17	-	58.1	-	\$ 1.3	-	135.6	-	\$ 2.2	0.4	72.0	\$ 19	1.3
Furnace fans	2016	520	\$ 100	157.1	1,637.3	80.2	\$ 15.2	506.1	5,089.5	258.6	\$ 49.1	2.0	5.0	\$ 230	40.9
Microwave ovens	2012	16	\$ 2	45.2	470.9	6.7	\$ 4.4	47.8	481.0	7.1	\$ 4.6	1.5	4.8	\$ 31	7.2
Pool heaters	2013	[20]	\$ 44	-	75.2	-	\$ 1.2	-	75.2	-	\$ 1.2	1.4	3.8	\$ 7	1.1
Refrigerators	2014	130	\$ 52	169.5	1,767.1	25.5	\$ 16.4	430.3	4,327.3	64.7	\$ 41.7	4.1	2.9	\$ 176	39.3
Room AC	2014	86	\$ 35	43.4	452.1	61.1	\$ 4.2	83.4	838.8	117.4	\$ 8.1	4.2	2.2	\$ 29	9.4
Water heaters	2013	-	\$ -	197.2	3,271.6	27.2	\$ 38.8	368.1	5,647.3	50.8	\$ 67.2	-	4.3	\$ 362	65.6
(electricity)	2013	220	\$ 65	197.2	2,055.8	27.2	\$ 19.1	368.1	3,702.0	50.8	\$ 35.7	3.0	3.3	\$ 170	42.2
(gas)	2013	[14]	\$ 30	-	1,215.8	-	\$ 19.7	-	1,945.3	-	\$ 31.5	1.3	6.7	\$ 192	23.3
<b>Commercial</b>															
Beverage vending machines	2012	682	\$ 157	10.3	107.2	2.4	\$ 0.8	16.9	170.3	3.9	\$ 1.3	3.1	3.2	\$ 6	2.1
Commercial boilers	2013	[513.6]	\$ 2,968	-	167.2	-	\$ 2.1	-	390.1	-	\$ 5.0	4.5	3.4	\$ 29	3.6
Clothes washers (total) <sup>6</sup>	2012	-	\$ 503	12.3	228.8	4.0	\$ 2.5	15.5	281.5	5.1	\$ 2.7	7.2	1.0	\$ 0.1	3.9
(electricity)	2012	208	\$ 446	12.3	128.4	4.0	\$ 0.9	15.5	155.5	5.1	\$ 1.1	-	-	\$ (23)	2.2
(gas)	2012	[26.8]	\$ 57	-	100.4	-	\$ 1.6	-	126.1	-	\$ 1.6	-	-	\$ 10	1.7
(water)	2012	[5827]	\$ -	Bil. Gal.-->	0.4	-	\$ -	Bil. Gal.-->	0.5	-	\$ -	-	-	\$ 13	-
Fluorescent ballasts	2014	18	\$ 2	72.4	754.8	23.7	\$ 5.3	178.7	1,796.8	58.5	\$ 17.3	1.6	7.0	\$ 68	16.7
Fluorescent lamps	2012	11	\$ 2	648.7	6,762.0	212.3	\$ 47.9	648.7	6,523.3	212.3	\$ 47.9	2.9	1.6	\$ 159	110.6
Incandescent reflector lamps	2012	62	\$ 3	191.7	1,998.5	47.3	\$ 14.1	191.7	1,927.9	47.3	\$ 14.1	0.6	2.8	\$ 119	36.7
BR \ exempted reflector lamps	2013	38	\$ 1	87.0	906.7	21.5	\$ 6.4	87.0	874.7	21.5	\$ 6.4	0.5	2.2	\$ 32	16.7
Liquid-immersed transformers	2016	2	\$ 2	27.8	289.6	3.8	\$ 2.1	89.5	900.1	12.4	\$ 6.6	12.9	1.2	\$ 8	7.2
Low-voltage dry type transformers	2016	25	\$ 5	65.0	677.7	9.0	\$ 6.3	209.5	2,106.6	28.9	\$ 15.5	2.9	5.2	\$ 97	16.9
Metal halide lamp fixtures	2015	360	\$ 35	116.5	1,214.6	38.1	\$ 11.3	328.4	3,302.1	107.5	\$ 24.2	1.3	9.5	\$ 139	28.3
Reach-in refrigerators and freezers	2016	1,658	\$ 199	20.1	209.5	4.7	\$ 1.9	53.6	539.0	12.5	\$ 4.0	1.6	5.4	\$ 18	5.0
Small electric motors	2015	132	\$ 20	95.0	990.1	15.0	\$ 9.2	120.9	1,215.6	19.2	\$ 8.9	2.1	2.8	\$ 39	15.8
Walk-in refrigerators and freezers	2015	2,128	\$ 273	15.0	156.1	3.5	\$ 1.5	32.7	328.6	7.6	\$ 2.4	1.7	5.1	\$ 12	3.4
<b>Total</b>				<b>2,571</b>	<b>30,461</b>	<b>786</b>	<b>\$ 284</b>	<b>4,514</b>	<b>52,630</b>	<b>1,566</b>	<b>\$ 512</b>			<b>\$ 2,476</b>	<b>592</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	177.5	136.0	626.8	177.5	136.0	626.8
Central AC & HP	0.1	79.6	367.1	297.6	228.0	1051.0
Clothes dryers	75.3	57.7	248.7	191.1	146.5	631.4
	(electricity)	70.4	54.0	248.7	178.8	137.0
	(gas)	4.9	3.7	0.02	12.3	9.5
Clothes washers	101.5	77.9	260.7	202.9	155.7	521.4
Direct heaters <sup>8</sup>	9.6	7.4	-9.5	0.02	14.9	-19.0
External power supplies	40.3	30.9	142.5	40.3	30.9	142.5
Furnaces (gas)	68.2	52.6	0.3	159.1	122.7	0.8
Furnaces (oil)	3.1	2.4	0.02	7.3	5.7	0.04
Furnace fans	119.7	91.7	422.6	447.9	295.4	1361.8
Microwave ovens	34.4	26.4	121.5	184.9	27.9	128.7
Pool heaters	4.1	3.1	0.02	4.1	3.1	0.02
Refrigerators	129.2	98.9	456.1	327.9	251.2	1157.9
Room AC	33.1	25.3	116.7	63.6	48.7	224.4
Water heaters	216.2	166.4	531.0	385.9	296.2	991.1
	(electricity)	150.3	115.1	530.6	280.5	214.9
	(gas)	65.9	50.8	0.32	105.4	81.3
<b>Commercial</b>						
Beverage vending machines	7.8	6.0	27.7	12.9	9.9	45.6
Commercial boilers	9.1	7.0	0.04	21.1	16.3	0.1
Clothes washers	14.8	11.4	33.2	18.6	14.3	41.6
Fluorescent ballasts	55.2	42.3	194.8	136.2	104.3	480.8
Fluorescent lamps	494.3	378.6	1745.4	494.3	378.6	1745.4
Incandescent reflector lamps	146.1	111.9	515.8	146.1	111.9	515.8
BR \ exempted reflector lamps	66.3	50.8	234.0	66.3	50.8	234.0
Liquid-immersed transformers	21.2	16.2	74.7	68.2	52.2	240.8
Low-voltage dry type transformers	49.5	37.9	174.9	159.6	122.3	563.7
Metal halide lamp fixtures	88.8	68.0	313.5	250.2	191.7	883.5
Reach-in refrigerators and freezers	15.3	11.7	54.1	40.8	31.3	144.2
Small electric motors	72.4	55.4	255.6	92.1	70.6	325.3
Walk-in refrigerators and freezers	11.4	8.7	40.3	24.9	19.1	87.9
<b>Total</b>	<b>2,064</b>	<b>1,663</b>	<b>6,949</b>	<b>4,022</b>	<b>2,936</b>	<b>12,128</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.