

## Energy Efficient Appliances

### Summary:

This is an assessment of the anticipated benefits associated with the recently and proposed federal appliance and lighting standards to take effect between 2013 and 2020. With the exception of advocacy to keep the U.S. Department of Energy (DOE) on track with implementing the schedule established to ensure timely implementation no additional action is necessary. These standards are quantified and analyzed to help determine their relative contribution towards meeting the GHG reduction goal established in this action plan.

### Discussion and Background:

Appliance and lighting standards are a cost-effective way to reduce energy consumption, without requiring any lifestyle changes and to achieve GHG reductions. Appliances have a natural cycle of replacement and hence are excellent opportunities for innovation that achieves GHG reductions and consumer energy savings. In this analysis it is assumed that all new appliances and lighting replaced will remain in place throughout the time period or will be replaced with similar or more efficient units.

Federal standards can be established by Congress or by the U.S. DOE. The DOE process involves a public rulemaking similar to that used by DEP for environmental rulemaking. Congressionally established standards usually result from agreements reached between industry and efficiency advocates. In many cases individual states have developed standards for equipment for which the federal government does not plan to take action on. Although state-based standards are not considered in this analysis, examples of equipment for which other states have pursued developing standards include:

- commercial ice makers
- compact audio players
- distribution transformers
- DVD players and recorders
- hot food holding cabinets
- pool heaters
- portable electric spas
- water dispensers

### Analytical Process and Results:

Data specific for Pennsylvania was used in this analysis and was provided by the Appliance Standards Awareness Project (ASAP). Estimated annual sales of effected appliances or lighting equipment together with incremental costs per item and associated energy reductions were used to calculate total energy reductions, GHG reductions and savings. Table 1 illustrates the specific standards, date of implementation, energy savings and incremental costs per unit for all appliances and lighting equipment for which standards have been established and/or are expected be finalized.

**Table 1. Appliance & Lighting Standards Effective 2013 through 2020**

RESIDENTIAL	Effective Date	Annual Savings		Incremental Cost/Unit
		Amount	Unit	
Air handlers	2017	724	kWh	\$150.00
Heating	2017	426	kWh	
Cooling	2017	124	kWh	
Battery chargers	2014	12	kWh	\$3.72
Boilers (natural gas only)	2020	169	therms	\$900.00

Clothes washers	2015			\$57.00
Electricity - machine use & water heating	2015	77	kWh	
Natural gas - water heating	2015	4	therms	
Water	2015	3,048	gallons	
Computer equipment and components	2019			
Desktops	2019	87	kWh	\$ -
Laptops	2019	27	kWh	\$ -
Monitors	2019	58	kWh	\$ -
Dishwashers	2013			\$20.00
Electricity - machine use & water heating	2013	48	kWh	
Natural gas - water heating	2013	1	therm	
Water	2013	293	gallons	
External power supplies	2014	4	kWh	\$0.98
Faucets (residential lavatory)	2016			\$4.00
Water	2016	292	gallons	
Water heating - gas	2016	1	therms	
Water heating - electricity	2016	16	kWh	
Game consoles	2020	77	kWh	\$ -
Microwave ovens	2015	16	kWh	\$2.28
Set-top boxes	2018	83	kWh	\$ -
Televisions	2016	61	kWh	\$ -
Toilets	2016	795	gallons	-\$
Water heaters (electric only)	2020	997	kWh	\$814.00
<b>COMMERCIAL</b>				
Air conditioners, air cooled	2017	1,095	kWh	\$1,212.16
Automatic ice makers	2016			\$70.00
Electricity	2016	1,870	kWh	
Water	2016	5,957	gallons	
Clothes washers	2018			\$351.21
Electricity	2018	130	kWh	
Natural gas	2018	19	therms	
Water	2018	12,420	gallons	
Distribution transformers	2016			
Liquid-immersed transformers	2016	834	kWh	\$503.00
Low-voltage dry type transformers	2016	1,561	kWh	\$760.00
Medium-voltage dry type transformers	2016	8,473	kWh	\$6,642.00
Electric motors	2016	843	kWh	\$207.18
Fans, blowers & ventilation equipment	2020	9,474	kWh	\$1,410.00
Furnaces (warm-air)	2016	78	therms	\$300.00
Pre-rinse spray valve	2016			
Water	2016	11,026	gallons	

Water heating - gas	2016	71	therms	
Water heating - electricity	2016	595	kWh	
Pumps	2016	1,424	kWh	\$791.00
Refrigeration equipment	2016	1,493	kWh	\$483.00
Walk-in coolers and freezers	2015	4,312	kWh	\$725.00
Unit heaters	2016	374	therms	\$2,640.00
Urinals	2016	2,340	gallons	\$ -
<b>LIGHTING</b>				
Candelabra & intermediate base incandescent lamps	2020			
Candelabra	2020	34	kWh	\$0.30
Intermediate base	2020	17	kWh	\$0.30
General service fluorescent lamps	2017	3	kWh	\$0.76
High intensity discharge lamps	2017	467	kWh	\$18.05
Incandescent reflector lamps	2017			
Incandescent reflector lamps - covered (including previously exempt)	2017	30	kWh	\$3.00
Incandescent reflector lamps - not covered	2015	52	kWh	\$2.70
Luminaires (portable light fixtures)	2019	22	kWh	\$1.50
Metal halide lamp fixtures	2015	54	kWh	\$17.36
Outdoor lighting fixtures	2019	241	kWh	\$40.00

Using the data above the following annual and cumulative results were calculated and summarized in Table 2:

- Megawatt hours (MWh) saved per appliance/lighting equipment
- Thousand cubic feet (MCF) of natural gas saved per appliance
- Costs and net savings, expressed in 2010 dollars (\$ million)
- Cumulative net present value expressed in 2010 dollars (\$ million) at 5% discount rate

To estimate GHG emission reductions that are expected to displace conventional grid-supplied electricity (i.e., energy efficiency and conservation), a simple, straightforward approach is used. We assume that these policy recommendations would avoid generation from an “average thermal” mix of fuel-based electricity sources of coal and natural gas. This mix is assumed to be a mix of 50% natural gas and 50% coal from 2013 through 2020 and reflects the latest trend in Pennsylvania shifting towards a greater percentage of natural gas and less coal. This methodology is consistent with all other initiatives analyzed in this action plan report. The resultant emissions factor is 0.69 metric tons per MWh. The applied emission factor for natural used in this analysis is a standard 0.0536 metric tons per million Btu. GHG reductions are expressed in million metric tons of CO<sub>2</sub> equivalent (MMtCO<sub>2</sub>e) and together with the above referenced calculated data annual and cumulative cost-effectiveness results were quantified, expressed as dollars per metric tons per ton of CO<sub>2</sub>e reduced (\$/ton). Table 3 illustrates these final results.

**Table 2. Summary of Pennsylvania Benefits from National Appliance Standards**

	<b>Electricity (MWh)</b>	<b>Natural Gas (MCF)</b>	<b>Dollars (\$Million)</b>
Annual Savings in 2020	9,850,190	4,387,514	1,170
Cumulative Savings in 2020	27,772,850	13,679,151	2,767
Net Present Value (\$Million)			\$ (2,636)

**Table 3. Estimated GHG Reductions, Costs and Cost-effectiveness**

<b>Annual Results (2020)</b>			<b>Cumulative Results (2013-2020)</b>		
<b>GHG Reductions (MMtCO<sub>2</sub>e)</b>	<b>Costs (Million \$)</b>	<b>Cost- Effectiveness (\$/tCO<sub>2</sub>e)</b>	<b>GHG Reductions (MMtCO<sub>2</sub>e)</b>	<b>Costs (NPV, Million \$)</b>	<b>Cost- Effectiveness (\$/tCO<sub>2</sub>e)</b>
6.9	-\$1,170	-\$169	18.7	-\$2,636	-\$141

**Possible Overlap:**

Overlap with the High Performance Buildings initiative exists and will be addressed in the overlap analysis to avoid any double-counting.

**Subcommittee/Committee Comments:**