

CHAPTER 10. NATIONAL IMPACT ANALYSIS

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CHAPTER 10. NATIONAL IMPACT ANALYSIS

10.1 INTRODUCTION

This chapter describes the method the U.S. Department of Energy (DOE) used to estimate national impacts of proposed energy conservation standards for microwave oven standby mode and off mode power. To estimate these impacts, DOE calculated the quantity and net value to consumers of future national energy savings (NES) and the net present value (NPV) of consumer benefits resulting from trial standard levels (TSLs). Results described here include (1) national energy consumption and savings, (2) monetary value of national energy savings associated with each TSL, (3) increased total installed costs nationwide due to TSLs, and (4) the NPV of consumer benefits (difference between value of energy savings and increased total installed costs).

DOE determined both the NES and the NPV for all the TSLs considered for microwave oven standby mode and off mode power. All calculations were performed using a Microsoft Excel spreadsheet model, which is accessible on the Internet (www.eere.energy.gov/buildings/appliance_standards/). The spreadsheet model, referred to as the national impact analysis (NIA) model, incorporates the calculations of NES and NPV, along with input from the shipments model described in chapter 9. Details and instructions for using the NIA model are provided in appendix 10-A.

Chapter 9 provides a detailed description of the shipments models that DOE used to forecast future purchases of microwave ovens. Chapter 9 describes consumers' sensitivities (otherwise known as elasticities) related to total installed cost, operating costs, and household income, and how DOE captured them within the model.

10.2 TRIAL STANDARD LEVELS

DOE analyzed the benefits and burdens of a number of TSLs for microwave oven standby mode and off mode energy use. As shown in Table 10.2.1, DOE considered four TSLs. TSL 1 corresponds to the first candidate standard level (CSL) from each product class and represents the standby power level for each class with the least significant design change. TSL 4 corresponds to the max-tech CSL. TSLs 2 and 3 are intermediate CSLs between TSL 1 and TSL 4.

Table 10.2.1 Trial Standard Levels for Microwave Oven Standby Mode and Off Mode Energy Use

Trial Standard Level	Standby Power (W)	
	Product Class 1: Microwave-Only and Countertop Combination	Product Class 2: Built-In and Over-the-Range Combination
1	2.00	3.70
2	1.50	2.70
3	1.00	2.20
4	0.02	0.04

10.3 FORECASTED EFFICIENCY LEVELS

A key component of DOE’s estimates of NES and NPV is the standby power consumption forecasted over time for the base case (without new standards) and each potential standards case (with new standards). The forecasted values represent the annual shipment-weighted standby power consumption of microwave ovens throughout the forecast period (i.e., from the assumed compliance date of a new standard to 30 years after that date). For calculating NES, per-unit annual energy consumption is a direct function of product standby power consumption. For calculating NPV, two inputs that depend on the level of standby power consumption are needed: per-unit total installed cost and per-unit annual operating cost. The per-unit total installed cost is a direct function of the level of standby power consumption, because units with lower standby energy consumption tend to cost more. The per-unit annual operating cost is also a function of standby power consumption. The inputs to the calculation of NES and NPV are discussed in detail in sections 10.4 and 10.5.

DOE used base-case standby energy consumption levels from the previous microwave oven rulemaking to predict standby mode and off mode energy consumption for microwave ovens in the base case for all years in the forecast. For a complete discussion of the standby energy consumption values for microwave ovens in the base case, refer to section 8.2.5 of chapter 8. In forecasting base-case energy consumption for microwave ovens, DOE assumed there would be no increase in the shipment-weighted efficiency and no change in the distribution of product efficiencies until the end of the forecast period (2043). Although DOE recognizes that product efficiencies may change in the future, there are no historical data for microwave ovens to indicate how efficiencies have changed in the past or may change in the future.

To forecast standby energy consumption levels for the standards cases, DOE assumed a “roll-up” scenario that incorporates the shipment-weighted standby energy consumption levels for the compliance year (2014). DOE assumed that product standby energy consumption levels that did not meet the standard under consideration would “roll up” to meet the new standard. Also, DOE assumed that all products with standby energy consumption levels that exceeded the standard under consideration would not be affected. DOE made the same assumptions regarding increases in efficiency under the standards cases as under the base case, namely that forecasted efficiencies remain at the 2014 efficiency levels until the end of the forecast period. Although

frozen trends may not exactly predict efficiencies in the future, DOE considers that maintaining a frozen efficiency for the base and standards cases allows for a reasonable estimate of the effect of standards on product standby energy consumption.

Tables 10.3.1 and 10.3.2 show the distributions of product annual energy consumption levels and standby power in 2014 in the base and standards cases that DOE used for microwave ovens. DOE maintained the shipments-weighted standby power and annual energy use shown in the following tables throughout the forecast period, 2014–2043.

Table 10.3.1 Microwave Ovens and Countertop Combination Ovens: Standby Energy Consumption Distributions in 2014 for Base and Standards Cases

TSL	Stand-by Power (W)	Annual Energy Use (kWh/yr)	Market Share %				
			Base Case	Trial Standard Level			
				1	2	3	4
Baseline	4.00	34.8	46%				
1	2.00	17.4	35%	81%			
2	1.50	13.0	19%	19%	100%		
3	1.00	8.69	0%	0%	0%	100%	
4	0.02	0.17	0%	0%	0%	0%	100%
Shipments Weighted Standby Power			2.83	1.90	1.50	1.00	0.02
Shipments Weighted Annual Energy Use			24.6	16.5	13.0	8.7	0.17

Table 10.3.2 Over the Range Combination Ovens: Standby Energy Consumption Distributions in 2014 for Base and Standards Cases

TSL	Stand-by Power (W)	Annual Energy Use (kWh/yr)	Market Share %				
			Base Case	Trial Standard Level			
				1	2	3	4
Baseline	4.50	39.1	100%				
1	3.70	32.1	0%	100%			
2	2.70	23.5	0%	0%	100%		
3	2.20	19.1	0%	0%	0%	100%	
4	0.04	0.35	0%	0%	0%	0%	100%
Shipments Weighted Standby Power			4.50	3.70	2.70	2.20	0.04
Shipments Weighted Annual Energy Use			39.1	32.1	23.5	19.1	0.35

10.4 NATIONAL ENERGY SAVINGS

DOE calculates annual NES and cumulative NES throughout the forecast period, which extends from 2014 to 2043. Positive values of NES represent energy savings, meaning national energy consumption with standards is lower than in the base case.

10.4.1 Definition

As the following equation indicates, DOE calculates annual NES as the difference between two projections: a base case (without new standards) and a standards case (with new standards).

$$NES_y = AEC_{BASE} - AEC_{STD}$$

Cumulative national energy savings are the sum of annual energy savings throughout the forecast period, which extends from the assumed compliance date of a new standard, 2012, to 30 years after the effective date (2042). This calculation is represented by the following equation.

$$NES_{cum} = \sum NES_y$$

DOE calculated national annual energy consumption by multiplying the number, or stock, of microwave ovens (by vintage) by the associated unit energy consumption (also by vintage). National annual energy consumption is calculated by the following equation.

$$AEC = \sum STOCK_V \times UEC_V$$

For the above expressions, DOE defined the various quantities as follows:

$AEC =$	national annual energy consumption each year summed over vintages of the product stock, $STOCK_V$ (quads);
$NES =$	annual national energy savings (quads);
$STOCK_V =$	stock of product (millions of units) of vintage V surviving in the year for which DOE is calculating annual energy consumption;
$UEC_V =$	annual energy consumption per product in kilowatt-hours (kWh);
$V =$	year in which the product was purchased as a new unit; and
$y =$	year in the forecast (2012–2042).

The stock of a product depends on annual shipments and the lifetime of the product. As described in chapter 9, DOE projected shipments under the base and standards cases. DOE determined that shipments under the standards cases would be slightly lower than under the base case, because more efficient products have slightly higher purchase prices. In other words, DOE believes that higher purchase prices would cause some consumers to forego purchasing new products, resulting in dropped, or displaced, shipments.

To avoid including savings attributable to shipments displaced because of standards, DOE used the projected standards-case shipments and, in turn, the standards-case stock, to calculate the annual energy consumption for the base case.

10.4.2 Inputs

The inputs to the calculation of national energy savings (NES) are:

- shipments;
- product stock ($STOCK_V$);
- annual energy consumption per unit (UEC);
- national annual energy consumption (AEC); and
- site-to-source conversion factor (src_conv).

10.4.2.1 Shipments and Equipment Stock

DOE forecasted shipments of each product class under the base case and all standards cases. Several factors affect forecasted shipments, including purchase cost, operating cost, and household income. As noted earlier, the increased cost of more efficient products causes some consumers to forego buying the products. Consequently, shipments forecasted under the standards cases are lower than under the base case. The method DOE used to calculate and generate the shipments forecasts for each considered product class is described in detail in chapter 9, Shipments Analysis.

The equipment stock in a given year is the number of products shipped from earlier years that survive in that year. The NIA shipments model tracks the number of units shipped each year. DOE assumes that products have an increasing probability of retiring as they age. The probability of survival as a function of years since purchase is the survival function. Chapter 9 provides additional details on the survival functions that DOE used for each product class.

10.4.2.2 Annual Energy Consumption per Unit

DOE developed annual per-unit energy consumption as a function of product energy efficiency for each of the considered products (chapter 7, Energy Use Characterization, and chapter 8, Life-Cycle Cost and Payback Period Analyses). Because annual per-unit energy consumption is directly dependent on energy efficiency, DOE used the shipments-weighted energy efficiencies for the base and standards cases (presented in section 10.3), along with the annual energy use data presented in chapter 8, to estimate the shipments-weighted average annual per-unit energy consumption under the base and standards cases.

As noted in section 10.3, DOE assumed that forecasted energy efficiencies in the base and standards cases remain constant at 2014 levels. Because annual per-unit energy consumption is a function of energy efficiency, DOE held the values shown in Tables 10.4.1 and 10.4.2 constant throughout the forecast period.

Table 10.4.1 Microwave and Countertop Combination Ovens: Shipments-Weighted Average per-Unit Annual Energy Consumption in 2014

TSL	Standby Power (W)	Annual Energy Use (kWh/yr)
Baseline	4.00	34.8
1	2.00	17.4
2	1.50	13.0
3	1.00	8.69
4	0.02	0.17

Table 10.4.2 Over the Range Combination Ovens: Shipments-Weighted Average per-Unit Annual Energy Consumption in 2014

TSL	Standby Power (W)	Annual Energy Use (kWh/yr)
Baseline	4.50	39.1
1	3.70	32.1
2	2.70	23.5
3	2.20	19.1
4	0.04	0.35

10.4.2.3 National Annual Energy Consumption

The national annual energy consumption is the product of the annual energy consumption per unit and the number of units of each vintage. This calculation accounts for differences in unit energy consumption from year to year. The equation for determining annual energy consumption, shown in section 10.3, is repeated here.

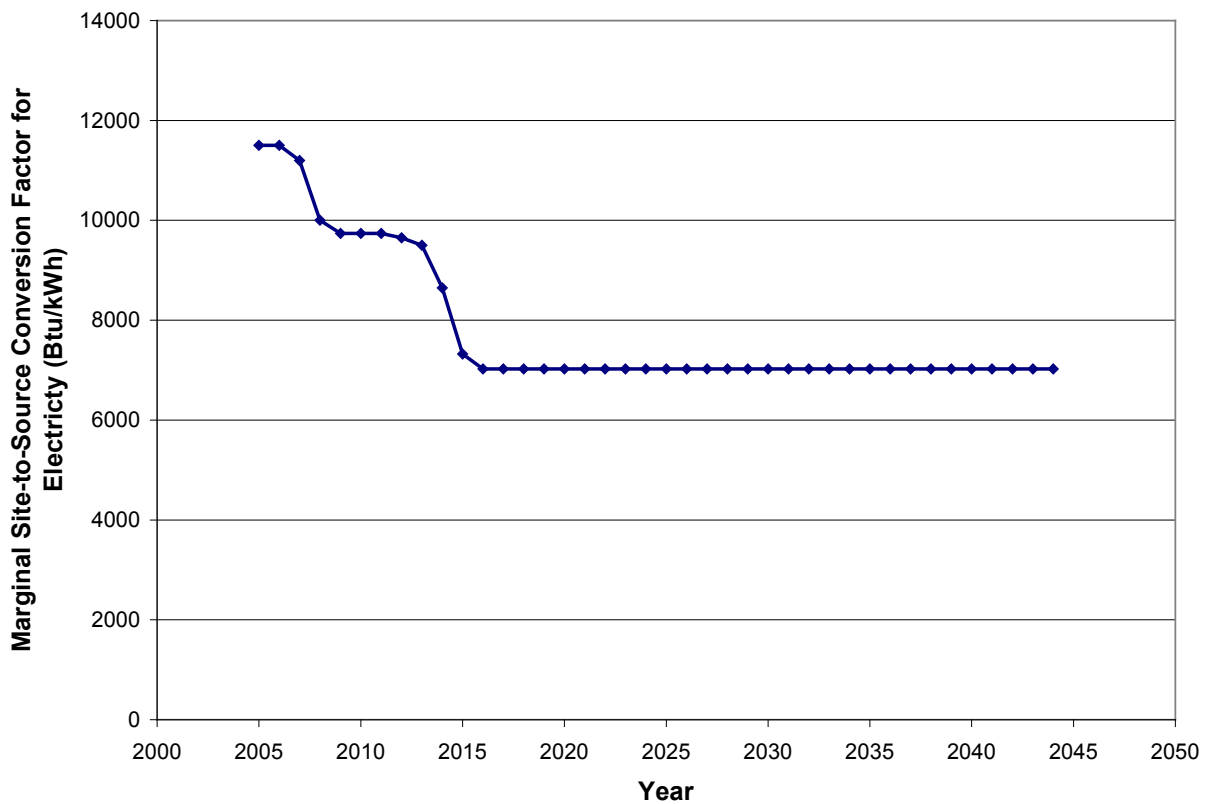
$$AEC = \sum STOCK_v \times UEC_v$$

In determining national annual energy consumption, DOE initially calculated the annual energy consumption at the site and then applied a conversion factor to calculate primary energy consumption (see section 10.4.2.4).

10.4.2.4 Energy Site-to-Source Conversion Factors

In determining national annual energy consumption, DOE initially calculated the annual energy consumption at the site (for electricity, the energy in kWh consumed at the household or establishment). To account for losses associated with the generation, transmission, and

distribution of electricity, DOE then applied a conversion factor to the site energy consumption to calculate primary (source) energy consumption. . The site-to-source conversion factor is a multiplicative factor used to convert site energy consumption into primary or source energy consumption, expressed in quads (quadrillion Btus). DOE used annual site-to-source conversion factors based on the version of the National Energy Modeling System (NEMS)^a that corresponds to EIA's *Annual Energy Outlook 2010* (AEO 2010).¹ The factors are marginal values, which represent the response of the system to an incremental decrease in consumption. For electricity, the conversion factors change over time in response to projected changes in generation sources (*i.e.*, the types of power plants projected to provide electricity to the Nation). Figure 10.4.1 shows the site-to-source conversion factors from 2005 to the end of the forecast period. DOE assumed that conversion factors remain at 2030 values throughout the rest of the forecast period.



^a For more information on NEMS, please refer to the U.S. Department of Energy, Energy Information Administration documentation. A useful summary is *National Energy Modeling System: An Overview 2000*, DOE/EIA-0581(2000), March 2000. EIA approves use of the name NEMS to describe only an official version of the model without any modification to code or data. Because this analysis entails some minor code modifications and the model is run under various policy scenarios that are variations on EIA assumptions, DOE refers to the model by the name NEMS-BT (BT is DOE's Building Technologies Program, under whose aegis this work has been performed). NEMS-BT was previously called NEMS-BRS.

Figure 10.4.1 Marginal Site-to-Source Conversion Factors for Electricity

10.5 NET PRESENT VALUE

DOE calculated the net present value (NPV) of the increased product cost and reduced operating cost associated with the difference between the base case and each potential standards case for the considered microwave oven standby mode and off mode energy use product classes.

10.5.1 Definition

The NPV is the value in the present of a time-series of costs and savings. The NPV is described by the equation:

$$NPV = PVS - PVC$$

Where:

PVS = present value of savings in operating cost, and
 PVC = present value of increased total product cost to consumers.

DOE determined the PVS and PVC according to the following expressions.

$$PVS = \sum OCS_y \times DF_y$$

$$PVC = \sum TIC_y \times DF_y$$

Where:

OCS = total annual savings in operating cost each year summed over vintages of the product stock, $STOCK_V$;
 TIC = total annual increases in product cost each year summed over years of the product shipments, $SHIP_y$;
 DF = discount factor in each year; and
 y = year in the forecast.

DOE calculated the total annual consumer savings in operating cost by multiplying the number or stock of a given product class (by vintage) by its per-unit operating cost savings (also by vintage). DOE calculated the total annual increases in consumer product cost by multiplying the number or shipments of the given product class (by vintage) by its per-unit increase in consumer product cost (also by vintage). The calculation of total annual operating cost savings and total annual product cost increases is represented by the following equations.

$$OCS_y = \sum STOCK_V \times UOCS_V$$

$$TIC_y = \sum SHIP_y \times UTIC_y$$

Where:

$STOCK_V$ = stock of products of vintage V that survive in the year for which DOE calculated annual energy consumption;
 $UOCS_V$ = annual per-unit savings in operating cost;
 V = year in which the product was purchased as a new unit;
 $SHIP_y$ = shipments of products in year y ; and
 $UTIC_y$ = annual per-unit increase in installed product cost in year y .

DOE determined the total increased product cost for each year from the compliance date of a potential standard to 2043. DOE determined the present value of operating cost savings for each year from the compliance date of the standard to the year when all units purchased by 2043 have been retired. DOE calculated costs and savings as the difference between a standards case and a base case without new standards.

DOE developed a discount factor from the national discount rate and the number of years between the present (*i.e.*, year to which the sum is being discounted) and the year in which the costs and savings occur. The NPV is the sum over time of the discounted net savings.

10.5.2 Inputs

The inputs to calculation of the net present value (NPV) are:

- Average annual product cost;
- average annual savings in operating cost;
- total annual increases in product cost;
- total annual savings in operating cost;
- discount factor;
- present value of costs; and
- present value of savings.

The increase in total annual product cost is equal to the annual change in the average annual product cost (difference between base case and standards case) multiplied by the shipments forecasted in the standards case. As with the calculation of the NES, DOE did not calculate total annual product costs using base-case shipments. To avoid including savings due to displaced shipments (by consumers deciding not to buy higher-cost products), DOE used the

standards-case projection of shipments and, in turn, the standards-case stock, to calculate product costs.

The total annual savings in operating cost savings are equal to the change in annual operating cost (difference between base case and standards case) per unit multiplied by the shipments forecasted in the standards case.

10.5.2.1 Total Installed Cost per Unit

The per-unit total installed cost of each considered product is described in chapter 8 as a function of product energy efficiency. Because the per-unit total annual installed cost is directly dependent on energy efficiency, DOE used the shipments-weighted energy efficiencies of the base and standards cases described in section 10.3, in combination with the total installed costs developed in chapter 8, to estimate the shipments-weighted average annual per-unit total installed cost under the base and standards cases.

DOE based average microwave oven consumer product costs on average manufacturer costs plus average overall markup values. Using the relationship between microwave oven standby mode and off mode energy use and total installed cost presented in chapter 8, DOE derived the per-unit total installed cost based on the shipments-weighted energy efficiencies that correspond to the base case and each standards case for the representative product classes.

For the SNO PR, DOE applied the learning rate (LR) described in chapter 8 to forecast the prices of microwave ovens sold in each year in the forecast period (2014-2043). The price in each year is a function of the cumulative production of microwave ovens forecast in each year. DOE derived a price factor index, with 2010 equal to 1, to forecast prices in each future year. The default index value in a given year is a function of the LR and the cumulative production forecast through that year, which is based on the shipments forecast described in chapter 9. DOE applied the same value to forecast prices for each microwave oven product class at each considered efficiency level.

For electric cooking products, the estimated LR (defined as the fractional reduction in price expected from each doubling of cumulative production) is 28.9 percent. Table 10.5.1 shows the costs in 2014.

Table 10.5.1 Shipment-Weighted Average Product Costs in 2014 for Base and Trial Standard Levels

	Base Case	Trial Standards Levels			
		1	2	3	4
Microwave Ovens and Countertop Combination Ovens					
Shipment Weighted Annual Energy Use (<i>kWh</i>)	24.6	16.5	13.0	8.69	0.17
Avg. Product Cost (<i>2010\$</i>)	\$224	\$224	\$224	\$225	\$230
Over the Range Combination Ovens					
Shipment Weighted Annual Energy Use (<i>kWh</i>)	39.1	32.1	23.5	19.1	0.35
Avg. Product Cost (<i>2010\$</i>)	\$482	\$482	\$486	\$496	\$490

DOE recognizes that there is uncertainty in its estimates of equipment price trends. To provide a potential indication of long term changes in the trend, DOE performed price trend fits to two component periods in the historical data, equal to the first and second half of the total time period. For electric cooking equipment, the selected periods were 1969-1989 and 1990-2010. Appendix 8-E shows the estimated learning parameters for these periods. DOE also performed a sensitivity calculation using data specific for microwave ovens.

In addition to using the above learning parameters, DOE examined a constant real price sensitivity case. DOE also used a forecast based on the “chained price index--other consumer durable goods except ophthalmic” forecasted for *AEO2010*. This index is the most disaggregated category that includes appliances. To develop an inflation-adjusted index, DOE normalized the above index with the chained price index--gross domestic product forecasted for *AEO2010*.

Figure 10.5.1 shows the default price factor index and the indices corresponding to each of the sensitivities for microwave ovens. All indices are adjusted for inflation.

The NIA results reported in this chapter are based on the default LR. With cumulative shipments through 2043 projected to reach 1,280 million (compared with 522 million in 2010), the price is projected to drop to 0.64 times the 2010 value. Appendix 10-C presents annualized NPV results using the other price factor indices.

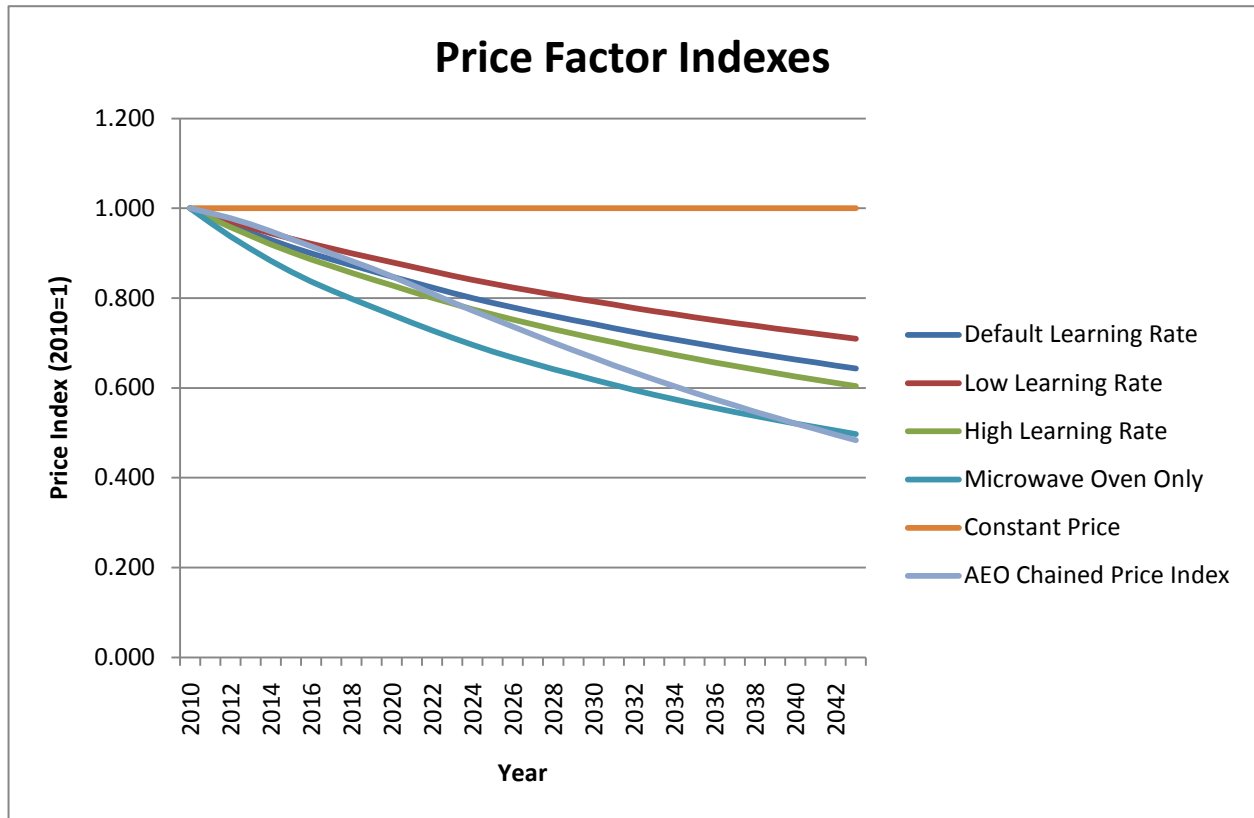


Figure 10.5.1 Equipment Price Factor Indices for the Default Case and Sensitivity Cases

10.5.2.2 Annual Operating Cost Savings per Unit

Per-unit annual operating cost represents the annual cost for energy for each unit. DOE determined the savings in per-unit annual energy cost for each product by multiplying the savings in per-unit annual energy consumption by the appropriate energy price.

Estimates of per-unit annual energy consumption for the base case and each standards case were presented in section 10.4.2.2. DOE forecasted energy prices based on EIA's *AEO2010*. The energy prices and price trends are described in chapter 8.

10.5.2.3 Total Increases in Product Cost

The total annual increase in product cost for any given standards case is the product of the average cost increase per unit due to the standard and the number of units of each vintage shipped. The equation for determining the total annual increase in product cost for a given standards case, which was shown in section 10.5.1, is repeated here.

$$TIC_y = \sum SHIP_y \times UTIC_y$$

10.5.2.4 Total Savings in Annual Operating Cost

The total annual savings in operating cost for any given standards case is the product of the annual savings in operating cost per unit attributable to the standard and the number of units of each vintage. This method accounts for differences in annual savings in operating cost from year to year. The equation for determining the total annual savings in operating cost for a given standards case, which was presented in section 10.5.1, is repeated here.

$$OCS = \sum STOCK_v \times UOCS_v$$

10.5.2.5 Discount Factors

DOE multiplies monetary values for future years by a discount factor to determine their present value. The discount factor (DF) is described by the equation:

$$DF = \frac{1}{(1+r)^{(y-y_p)}}$$

Where:

- r = discount rate,
- y = year of the monetary value, and
- y_p = year in which the present value is being determined.

Although DOE used consumer discount rates to determine the life-cycle cost (LCC) of microwave ovens, it used national discount rates to calculate national NPV. DOE estimated NPV using both a 3-percent and a 7-percent real discount rate, in accordance with the Office of Management and Budget's guidance to Federal agencies on the development of regulatory analysis, particularly section E therein: *Identifying and Measuring Benefits and Costs*.² DOE defined the present year as 2011.

10.5.2.6 Present Value of Costs

The present value of increased installed costs is the annual increase in installed cost for each year (*i.e.*, the difference between the standards case and base case), discounted to the present and summed over the period for which DOE is considering the installed products (from the compliance date of energy conservation standards through 30 years later).

The increase in total installed cost refers to both product and installation costs associated with the more energy-efficient products purchased in the standards case compared to the base case. DOE calculated annual increases in installed cost as the difference in total cost of new products installed each year, multiplied by the shipments in the standards case.

10.5.2.7 Present Value of Savings

The present value of savings in operating cost is the annual savings in operating cost (*i.e.*, the difference between the base case and standards case), discounted to the present and summed over the period that begins with the compliance date of standards and ends when the last installed unit is retired from service.

Savings represent decreases in operating cost (including costs for energy, repair, and maintenance) associated with the more energy-efficient products purchased in a standards case compared to the base case. Total annual savings in operating cost are the savings per unit multiplied by the number of units of each vintage that survive in a particular year. Because equipment consumes energy throughout its lifetime, the energy consumption for units installed in the past year includes energy consumed until the unit is retired from service.

10.6 NES AND NPV RESULTS

The NIA model provides estimates of the NES and NPV that would result from standards at various efficiency levels. The inputs to the NIA model were discussed in sections 10.4.2 (NES Inputs) and 10.5.2 (NPV Inputs). DOE generated the NES and NPV results using a Microsoft Excel spreadsheet, which is accessible on the Internet (www.eere.energy.gov/buildings/appliance_standards/). Details and instructions for using the spreadsheet are provided in appendix 10-A, User Instructions for Shipments and National Energy Savings Spreadsheet Model, in the section titled, “NES and NPV Input Summary.”

Table 10.6.1 summarizes the inputs to the NIA model. The data source for each input also is noted.

Table 10.6.1 Inputs to National Energy Savings and Net Present Value Calculations

Input	Data Description
Shipments	Annual shipments from shipments model (see chapter 9).
Compliance Date of Standard	2014
Energy Efficiency in Base Case	Shipments-weighted unit energy consumption (UEC) determined for each year.
Energy Efficiency in Standards Cases	“Roll-up” scenario assumed for determining shipments-weighted UEC for each standards case.
Annual Energy Consumption per Unit	Annual weighted-average values are a function of shipments-weighted UEC.
Learning Rates	See chapter 8 and appendix 8-E.
Total Installed Cost per Unit	Annual weighted-average values are a function of efficiency level.
Energy Cost per Unit	Annual weighted-average values are a function of the annual UEC and energy prices (see chapter 8 for energy prices).
Escalation of Energy Prices	Based on EIA <i>AEO2010</i> forecasts (to 2035) and on extrapolation after 2035 (see chapter 8).
Energy Site-to-Source Conversion Factor	Conversion, which differs yearly, is generated by DOE/EIA’s NEMS program (a time-series conversion factor that includes electric generation, transmission, and distribution losses).
Discount Rate	3 percent and 7 percent real.
Present Year	2011.

10.6.1 National Energy Savings Results

This section provides results of NES calculations for standards at each of the efficiency levels analyzed for the considered products. NES results, which are cumulative through 2043, are shown as primary energy savings. Because DOE based the inputs to the NIA model on weighted-average values, results are discrete point values, rather than a distribution of values as produced by the LCC and payback period (PBP) analyses. DOE reports both undiscounted and discounted values of energy savings. Discounted energy savings represent a policy perspective in which energy savings in the future are less significant than energy savings in the present.

Table 10.6.2 Microwave Ovens and Countertop Combination Ovens: Cumulative National Energy Savings in 2014-2043

Trial Standard Level	Standby Power (watts)	National Energy Savings (quads)	Discounted Values (quads)	
			7%	3%
1	2.00	0.21	0.07	0.12
2	1.50	0.30	0.09	0.17
3	1.00	0.41	0.13	0.24
4	0.02	0.62	0.20	0.36

Table 10.6.3 Over the Range Combination Ovens: Cumulative National Energy Savings in 2014-2043

Trial Standard Level	Standby Power (watts)	National Energy Savings (quads)	Discounted Values (quads)	
			7%	3%
1	3.70	0.002	0.001	0.001
2	2.70	0.004	0.001	0.002
3	2.20	0.005	0.002	0.003
4	0.04	0.010	0.003	0.006

10.6.2 Net Present Value Results

This section provides the results of calculating the NPV of consumer benefits for standards at each of the considered efficiency levels for the considered products. Results, which are cumulative, are shown as the discounted value of the net savings in dollar terms.

The present value of increased total installed cost is the total annual increase in installed cost (the difference between the standards case and base case), discounted to the present and summed throughout the period for which DOE evaluated the impact of standards.

Savings are decreases in operating cost associated with the more energy-efficient products purchased in the standards case compared to the base case. Total savings in operating cost are the savings per unit multiplied by the number of units of each vintage (*i.e.*, year of manufacture) that survive in a particular year. The operating cost includes expenditures until the last unit purchased during the forecast period is retired from service.

As an example, Figure 10.6.2 illustrates the net costs and benefits under TSL 3. Figures similar to the one presented below can be produced from analysis data for each of the proposed standard levels. The annual product cost is the sum of the increase in the total installed cost for products purchased each year during the forecast period. The annual savings in operating cost is the savings for products operating in each year. The NPV is the difference between the cumulative annual discounted savings and the cumulative annual discounted costs.

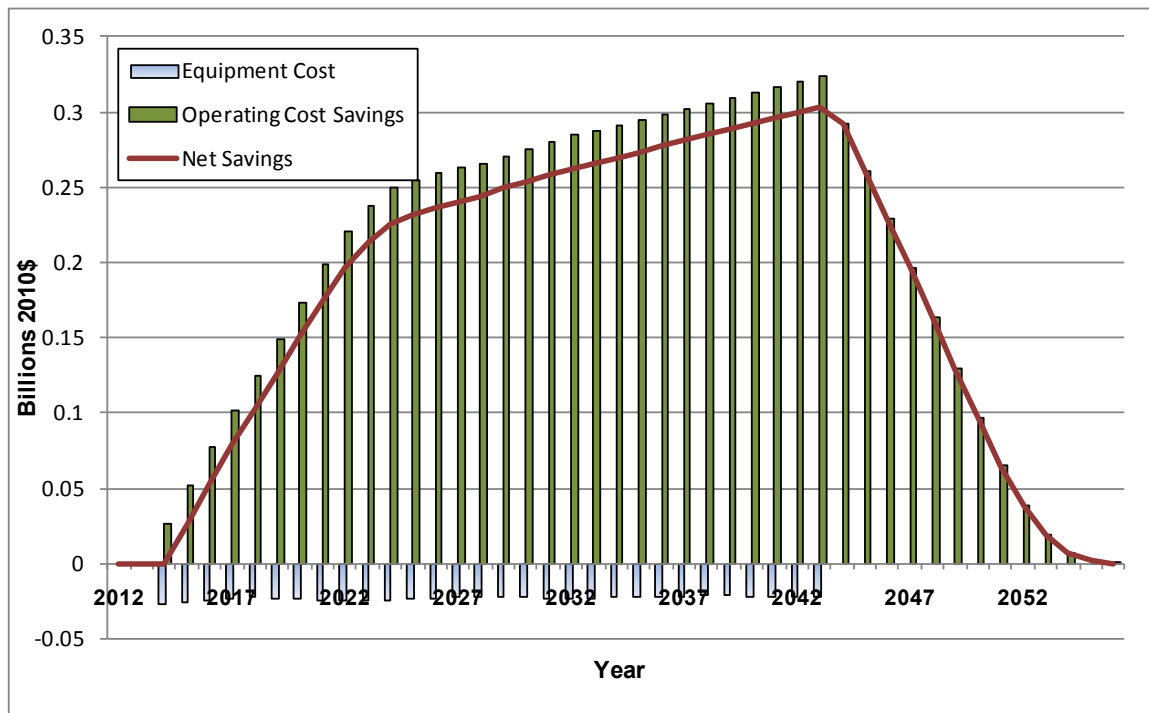


Figure 10.6.1 Annual Costs and Savings for TSL 3

Table 10.6.4 Microwave Ovens and Countertop Combination Ovens: Cumulative Net Present Value of Consumer Benefit

Trial Standard Level	Standby Power (watts)	Net Present Value	
		7% Discount Rate (billion 2010\$)	3% Discount Rate (billion 2010\$)
1	2.00	1.01	1.97
2	1.50	1.41	2.75
3	1.00	1.81	3.58
4	0.02	2.21	4.53

Table 10.6.5 Over the Range Combination Ovens: Cumulative Net Present Value of Consumer Benefit

Trial Standard Level	Standby Power (watts)	Net Present Value	
		7% Discount Rate (billion 2010\$)	3% Discount Rate (billion 2010\$)
1	3.70	0.009	0.018
2	2.70	0.015	0.031
3	2.20	0.006	0.017
4	0.04	0.039	0.079

The NPV results presented in this chapter are based on use of the medium learning rate to forecast product prices: 28.9% (the “default” learning rate). DOE considered five sensitivities: (1) a “low learning” rate; (2) a “high learning” rate; (3) a “Microwave only” learning rate, (4) an “AEO 2010 chained price index forecast”, and (5) a “no learning” rate, which assumes constant real prices over the entire forecast period.

Appendix 10-C presents NPV results for the default case and each sensitivity case. The results in the appendix are annualized and combine the NPV of the consumer savings, calculated for each TSL using 3 and 7 percent discount rates, with the present value of the estimated economic benefits resulting from reduced CO₂ and NO_x emissions.

REFERENCES

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