

## CHAPTER 17. REGULATORY IMPACT ANALYSIS

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## CHAPTER 17. REGULATORY IMPACT ANALYSIS

### 17.1 INTRODUCTION

The Department of Energy (DOE) has determined that energy conservation standards for commercial clothes washers constitute an “economically significant regulatory action” under Executive Order (E.O.) 12866 “Regulatory Planning and Review.” 58 FR 51735 (October 4, 1993). Therefore, DOE’s proposed energy conservation standards require a regulatory impact analysis (RIA), which involves an evaluation of non-regulatory alternatives to the standards. This document evaluates several possible alternatives to the proposed standards, and compares the costs and benefits of each to the proposed standards. As described in section 17.2.2 of this report, the proposed standards for commercial clothes washers is trial standard level (TSL) 3.

Under the Process Rule (*Procedures for Consideration of New or Revised Energy Conservation Standards for Consumer Products*, 61 FR 36974 (July 15, 1996); 10 CFR Part 430, Subpart C, Appendix A), DOE is committed to continually explore non-regulatory alternatives to standards. This RIA, which DOE has prepared pursuant to E.O. 12866, is subject to review under the Executive Order by the Office of Management and Budget (OMB)’s Office of Information and Regulatory Affairs (OIRA). 58 FR 51735.

DOE identified six major non-regulatory alternatives to standards as representing feasible policy options to achieve consumer product energy efficiency for the appliance products that are the subject of this rulemaking. These are listed in Table 17.1.1. DOE evaluated each alternative in terms of its ability to achieve significant energy savings at a reasonable cost, and compared the effectiveness of each one to the effectiveness of the proposed standards.

**Table 17.1.1 Policy Alternatives to National Standards**

No New Regulatory Action
Consumer Rebates
Consumer Tax Credits
Manufacturer Tax Credits
Voluntary Energy Efficiency Targets
Early Replacement
Bulk Government Purchases

The technical support document (TSD) for DOE’s notice of proposed rulemaking (NOPR) covered conventional cooking products (i.e., cooktops and ovens), microwave oven energy factor (EF), microwave oven standby power consumption, and commercial clothes washers (CCW).<sup>1</sup> DOE has already completed its standards rulemaking for conventional cooking products and microwave oven EF and has published both a final rule<sup>2</sup> and corresponding TSD.<sup>3</sup> This chapter presents information and results pertaining solely to CCWs. The impact of more-efficient equipment on microwave oven standby power will be addressed in a subsequent TSD.

## 17.2 NON-REGULATORY POLICIES

### 17.2.1 Methodology

This section describes the approach DOE used to analyze non-regulatory policies for commercial clothes washers.

To calculate the national energy savings and the net present value (NPV) corresponding to each policy alternative, DOE used its national impact analysis (NIA) spreadsheet models. (See Chapter 11 of the technical support document (TSD) for a description of the NIA spreadsheet models.) To compare each alternative to the proposed standards, DOE quantified the effect of each alternative on the purchase of commercial clothes washers meeting the *target levels*, which are defined as the efficiency levels in the proposed standards. Once it had made the quantitative assumptions for each alternative policy, DOE made the appropriate revisions to the inputs in the NIA spreadsheet models. The main model inputs that DOE revised were market shares of equipment at target efficiencies, shipment-weighted average annual energy consumption and annual water consumption, and equipment replacement rates. The shipments for any given year are comprised of a distribution of efficiency levels. DOE assumed that standards would affect 100 percent of the shipments, while the non-regulatory policies would affect a smaller percentage of the shipments. In each policy case, DOE made particular assumptions about the percentage of shipments impacted by the policy under analysis. DOE then calculated the shipment-weighted average energy consumption and costs using these market shares.

A shift in the market share of higher efficiency units may increase the average installed cost of energy-consuming equipment. Operating costs will generally decrease due to a decline in energy consumption. Therefore, DOE calculated an NPV for non-regulatory alternatives in the same way as it did for the proposed standards. In some scenarios, total installed cost increases are partially mitigated by government rebates or tax credits. However, DOE assumed that credits and rebates would be paid for by consumers in another form (such as additional taxes), and therefore did not include them as a consumer benefit for the purposes of calculating the national NPV. DOE did not consider administrative costs for any of the non-regulatory policies in its analysis. Inclusion of such costs would decrease their NPVs by a small amount.

The key measures of the impact of each alternative are:

- National energy savings in quadrillion Btus (quads): Cumulative national primary energy savings for equipment bought in the period from the effective date of the policy case (2013) to the year 2043.
- Net present value: The value of net monetary savings from equipment bought in the period from the effective date of the policy case (2013) to the year 2043. DOE calculated the NPV as the difference between the present value of equipment and operating expenditures (including energy) in the base case and the present value of expenditures in

each alternative policy case. DOE calculated operating expenses (including energy) for the life of the equipment.

### 17.2.2 Policy Assumptions

The impacts of non-regulatory policies are by nature uncertain, since they depend on program implementation and marketing efforts and the subsequent consumer behavior response. The projected impacts depend on the assumptions regarding the consumer participation rate, and are therefore subject to more uncertainty than the impacts of mandatory standards, which DOE assumes will have full compliance. To increase the robustness of the analysis, DOE conducted a literature review on each non-regulatory policy and consulted with key experts to gather information on similar incentive programs that have already been implemented in the U.S. By studying field experience with sample programs of each type, DOE sought to make credible assumptions of their potential market impacts. Section 17.3 below reports the conclusions from this research as they apply to the policy modeling assumptions and includes the corresponding literature citations.

Each of the policy alternatives that DOE considered to the proposed standards would improve the average efficiency of new commercial clothes washer equipment relative to their base cases (no new regulatory action). The analysis considered that each alternative policy would induce commercial consumers to purchase units at the same efficiency levels as required by the proposed standards, or the *target levels*. In contrast to the proposed standards, however, their market penetration rate in the alternative policy cases may not be 100 percent.

The proposed standards for commercial clothes washers are those in TSL 3, as shown in Table 17.2.1.

**Table 17.2.1 Trial Standard Levels for Commercial Clothes Washers**

Product Class	Proposed Energy Conservation Standards
Top-Loading Washers	Minimum 1.60 Modified Energy Factor / Maximum 8.50 Water Factor
Front-Loading Washers	Minimum 2.00 Modified Energy Factor / Maximum 5.00 Water Factor

DOE assumed that the non-regulatory policy impacts would last from the effective date for proposed standards for commercial clothes washers—2013—through the end of the analysis period, 2043.

### 17.2.3 Policy Interactions

DOE calculated the impacts of each regulatory policy separately from those of the other policies. In actual practice, certain policies are often most effective when implemented in combination to provide incentives, such as early replacement with consumer rebates, or early replacement with bulk government purchases. DOE attempted to make conservative assumptions to avoid double-counting policy impacts. Therefore, the policy impacts reported

below are not additive; the combined impact of several or all of the policies may not be inferred from adding the results together.

Section 17.3 presents graphs showing market penetration or shipment-weighted efficiency parameters for each of the non-regulatory policy cases for commercial clothes washers.

## **17.3 NON-REGULATORY POLICY ASSUMPTIONS**

### **17.3.1 No New Regulatory Action**

The case in which no new regulatory action is taken with regard to commercial clothes washer efficiency constitutes the base case scenario described in Chapter 11 on the national impact analysis. This case defines the basis of comparison for all other scenarios. By definition, no new regulatory action yields zero energy savings and an NPV of zero dollars.

### **17.3.2 Financial Incentives Policies**

DOE considered scenarios in which the Federal government would provide two types of financial incentives: rebates and tax credits. The government could provide consumers with a rebate for purchasing an energy efficient appliance meeting the target level for each product. Tax credits could be offered to consumers who purchased target-level commercial clothes washers. The government could also provide tax credits to manufacturers to offset costs associated with producing such equipment.

DOE's evaluation of consumer rebates used a comprehensive study of the potential for energy efficiency in California performed by Xenergy, Inc., which summarized experience with various utility rebate programs.<sup>4</sup> This analysis method is based on curves that estimate the market penetration of a technology based on its benefit/cost (B/C) ratio. DOE consulted with experts and reviewed several other methods of estimating market penetration of efficient technologies due to consumer rebate programs that were developed since the referenced Xenergy report was published.<sup>5,6,7,8</sup> However, these methods were based either on other economic parameters (payback period) or on expert surveys predicting penetration of a new technology over time. Therefore, DOE decided to use the penetration curve method based on B/C ratio, which incorporates lifetime operating cost savings, and was calibrated with utility rebate program participation results.

Xenergy's information diffusion model estimates market impacts induced by financial incentives for energy efficient appliances. The basic premise of this model is that information diffusion drives technology adoption. The model is formulated to characterize the influences of both internal and external sources of information on consumer behavior by superimposing two components in the equation, each capturing the effect of one of two different types of information source. The effects of these two types of information diffusion mechanisms are

different. *Internal* sources of information influence consumers to purchase new products due mainly to word-of-mouth from early adopters, while *external* information sources influence consumers to change their adoption decisions as a result of marketing efforts and information coming from outside the consumer group. (Appendix 17A of the TSD contains further details on modeling these influences.)

Xenergy's model combined these two information diffusion mechanisms and generated a set of measure "implementation curves" or *penetration curves*, which Xenergy calibrated using evaluation data from utility rebate programs. Consumer response to rebate incentives appears to be a combination of the two information source types. The penetration curves illustrate the increased penetration (i.e., increased market share) of efficient equipment as a result of consumer response to B/C ratio changes induced by a specific rebate program. The penetration curves are used to depict various diffusion patterns based on perceived barriers to consumer purchase of high-efficiency equipment. There are penetration curves for varying levels of market barriers, from "no barriers" to "extremely high barriers." These curves provide a means to study the impact of changing the B/C ratio, by reducing the initial equipment cost through financial incentives, on the consumer participation rate.

DOE based its estimates of the impacts of consumer tax credits on actual program experience with State tax credits in Oregon. DOE studied State tax credits in Montana as well. DOE also attempted to determine residential consumer participation due to the Federal appliance tax credits, which were mandated by the Energy Policy Act of 2005 (EPACT 2005). For the manufacturer tax credits policy, DOE attempted to investigate manufacturer participation due to the efficient equipment tax credits from EPACT 2005. Both the Federal consumer and manufacturer credits were in effect in 2006 and 2007. Unfortunately, the Internal Revenue Service (IRS) had not yet published data on taxpayer response to either of these tax credits.

DOE also incorporated previous research that had differentiated the impact of tax credits into the "direct price effect," which arises from the incremental equipment cost savings, and the "announcement effect," which is independent of the credit amount.<sup>9,10</sup> The announcement effect derives from the credibility that a particular technology receives from its inclusion in an incentive program, as well as changes in product marketing strategy, and the resulting modifications in markups and pricing. DOE assumed that the direct price effect and the announcement effect would apply to the consumer tax credit policy as well as the consumer rebate policy, and that half of the increases in market penetration associated with either policy would be due to the direct price effect and half to the announcement effect.

### **17.3.2.1 Consumer Rebates**

DOE modeled the impact of the consumer rebate policy by determining the increase in market penetration of target-level equipment relative to its market penetration in the base case.

For commercial clothes washers, DOE assumed that the rebate would cover a portion of the incremental cost between a washer meeting the baseline efficiency level and a unit meeting

the target efficiency level. It based this amount on the simple average of the rebate levels for efficient commercial clothes washers offered by 24 agencies across the country.<sup>a</sup> (See Appendix 17A for a listing of these rebate programs.) The average of these rebate levels was \$174, which was about 31 percent of the incremental installed cost between efficient and inefficient models of \$551. DOE assumed the rebates would remain in effect until they had transformed the markets so that the shift in market share of efficient units seen in the first year of the programs would be maintained throughout the forecast period (2013–2043).

For each type of commercial clothes washers (top-loading and front-loading), DOE first calculated the B/C ratio for the baseline unit without a rebate. It then calculated another B/C ratio for the unit meeting the target level, with a rebate, relative to the baseline unit. Because of the incremental cost reductions due to the rebates, the B/C ratios for the rebate policy unit were larger. Table 17.3.3 shows the benefits as lifetime operating cost savings, incremental installed costs without rebates and with rebates, and B/C ratios without rebates and with rebates. Note that in the case of front-loading washers, the rebate completely covers the price differential between the baseline and more-efficient unit. As a result, the B/C ratio is infinite.

**Table 17.3.1 Benefit/Cost Ratios for Commercial Clothes Washer Proposed Standard and Rebate Policy Case**

	<b>Top-Loading</b>	<b>Front-Loading</b>
Benefit (Lifetime Operating Cost Savings)	\$455	\$601
Incremental Installed Cost (Increased Installed Cost)	\$2315	\$23
<b>B/C Ratio with No Rebate</b>	<b>2.1</b>	<b>26.6</b>
Rebate Amount	\$174	\$23
Adjusted Incremental Installed Cost (Increased Installed Cost after Rebate)	\$41	\$0
<b>B/C Ratio for Rebate Policy Case</b>	<b>11.2</b>	<b>Infinite</b>

DOE then used the B/C ratios with the penetration curves shown in Figures 17.3.1 and 17.3.2 to estimate the increased percentage of consumers who would purchase the units that meet the policy target levels if given a rebate incentive. For top-loading commercial clothes washers, DOE chose the “moderate barriers” curve. In the case of top-loading washers, the incremental cost between the baseline and the TSL is substantial, yet the savings are also substantial and the target-level units have significant market share. Figure 17.3.1 shows the increase in penetration rates of target-level top-loading units as a function of their higher B/C ratios. Using the method discussed above, DOE estimated that the market share of equipment meeting the policy target due to a rebate policy would increase by 45.6 percent. For front-loading commercial clothes washers, DOE chose the “no barriers” curve, because the incremental cost between the baseline and the TSL is small and the savings are substantial. Figure 17.3.2 shows the increase in

<sup>a</sup> Some rebates for commercial clothes washers are offered by electric and/or gas utilities, some by water utilities, and in some service territories by both energy and water utilities. DOE calculated the average rebate amount from the total (combined) rebate amount available to the consumer.

penetration rates of target-level front-loading units as a function of their higher B/C ratios. Using the method discussed above, DOE estimated that the market share of equipment meeting the policy target due to a rebate policy would increase by 3.6 percent.

To calculate the impacts of this policy, DOE adjusted the market shares of commercial clothes washers at the target efficiencies in its NIA model to represent the policy case scenarios.

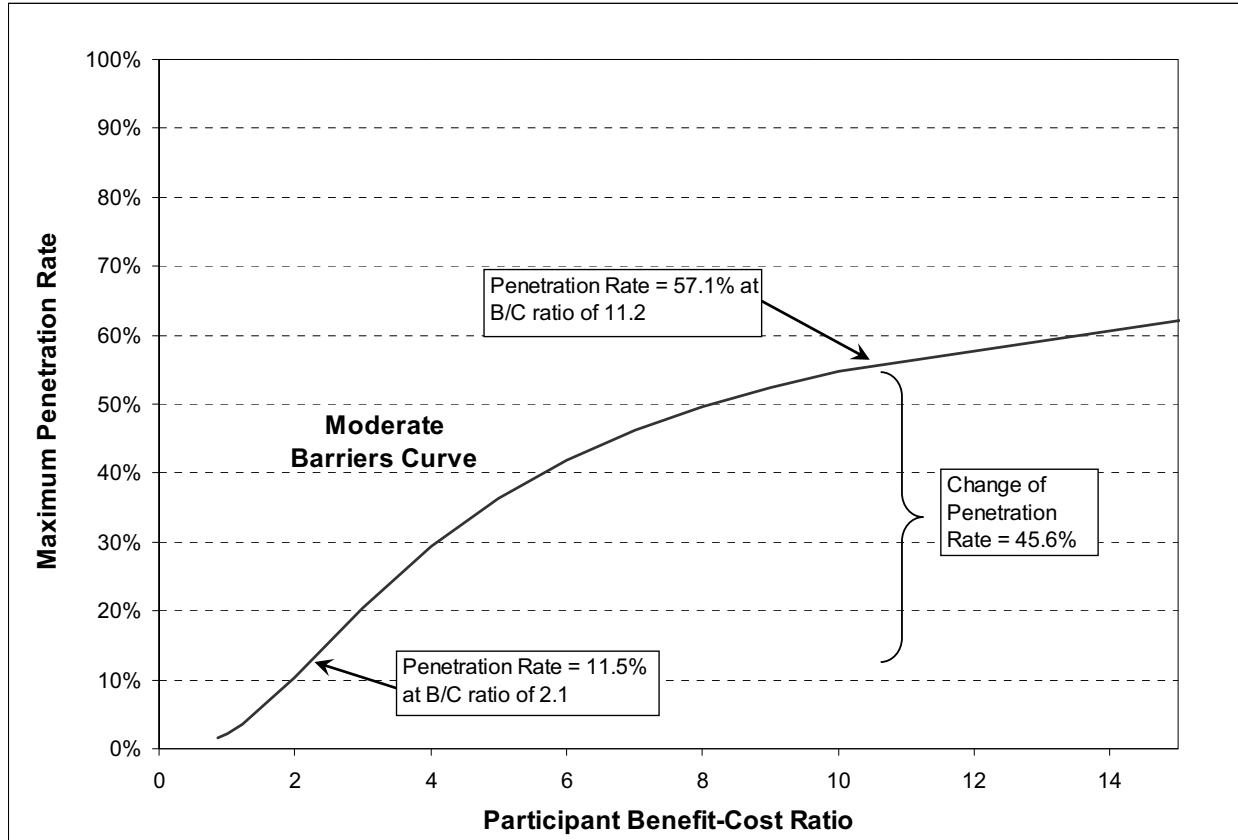
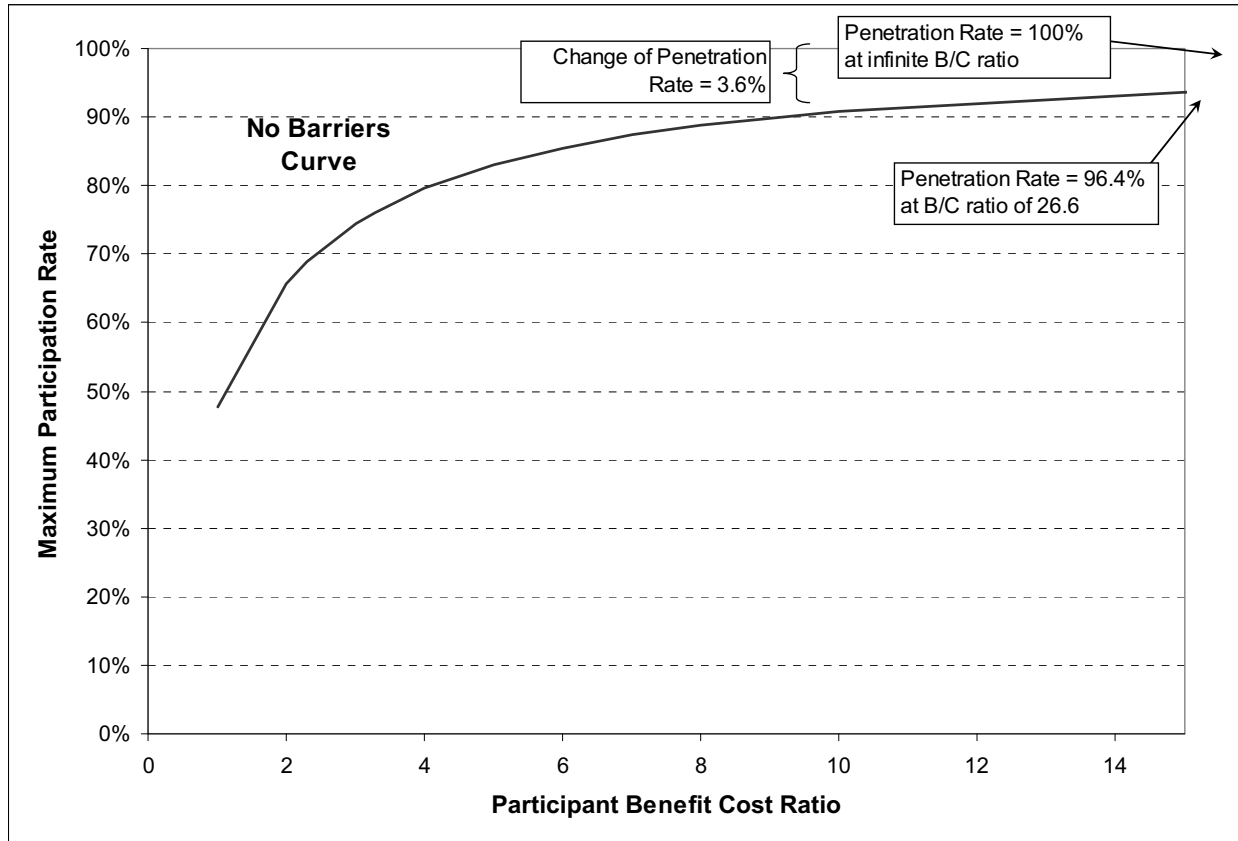


Figure 17.3.1 Market Penetration Curve for Top-Loading Commercial Clothes Washers



**Figure 17.3.2 Market Penetration Curve for Front-Loading Commercial Clothes Washers**

### 17.3.2.2 Consumer Tax Credits

To analyze this policy, DOE studied taxpayer participation in tax credit programs for energy efficient appliances, which were available at both the Federal and the State levels. DOE analyzed a consumer tax credit program whose credit amounts would be similar to the percentage of equipment costs covered by existing State tax credits.

EPACT 2005 included Federal tax credits for consumers who installed efficient air conditioners or heat pumps, gas or oil furnaces, furnace fans, and gas, oil, or electric heat pump water heaters in new or existing homes.<sup>11</sup> While these credits were available during tax years 2006 and 2007, as mentioned above, the IRS had not published data on the numbers of taxpayers taking these credits. Appendix 17A gives details of the equipment covered and the Federal tax credit amounts for residential appliances.

The States of Oregon and Montana have had consumer tax credits for efficient appliances for several years.<sup>b</sup> DOE based most of its estimates on Oregon's experience with this policy. Oregon's Residential Energy Tax Credit (RETC) was created in 1977. The Oregon legislature expanded the RETC program in 1997 to include home appliances and participation in the program increased significantly after they became eligible.<sup>c</sup> In response to changes in the appliance market, the RETC program updates its lists of eligible model numbers monthly, and makes occasional adjustments to the maximum tax credit dollar amount for each appliance. Oregon offers tax credits on residential refrigerators, clothes washers, and dishwashers.<sup>12</sup> The tax credit is either an amount noted on the list of qualifying appliances<sup>d</sup> or 25 percent of the purchase price of the appliance, whichever is less.

Montana has had an Energy Conservation Installation Credit for residential energy conservation measures since 1998.<sup>13</sup> The tax credit covers a variety of residential energy and water efficiency installations, including Energy Star heating/cooling equipment, water heaters, low-flow showerheads and faucets, and light fixtures and controls. The amount of the credit increased in 2002 from 5 percent of equipment costs (up to \$150) to 25 percent (up to \$500). DOE obtained data from the Montana Department of Revenue (DER) on the numbers of tax credits claimed from 1998 through 2006.<sup>14</sup> However the DER did not have data disaggregated by appliance, so the number of tax credits claimed for large household appliances could not be distinguished from those for plumbing products. DOE analyzed the available data and noted that the number of tax credits claimed increased steadily from 1998 through 2006, which contributed to its assumptions for this policy scenario.

Because tax credits have not been available for commercial clothes washers, DOE analyzed the Oregon residential tax credit data for residential clothes washers to inform the analysis of the tax credit policy for commercial clothes washers.

DOE obtained data from the Oregon Department of Energy (ODOE) on the number of efficient appliance tax credits claimed by Oregon residential taxpayers for the years 1998 through 2006, as well as the credits claimed by appliance type for the years 2000 to 2006.<sup>15</sup> DOE also obtained Oregon appliance shipments data for clothes washers and dishwashers for 2006.<sup>16,17</sup> The number of credits claimed generally increased each year, although there were some fluctuations that ODOE attributed to changes in qualifying models. DOE assumed that a tax credit program would be designed to provide consistent consumer information and slightly adjusted the ODOE data for the years 2003 and 2004 to provide a steady trend line. DOE calculated that the number of clothes washer tax credits claimed comprised 24 percent of the total number of Oregon clothes washer shipments in 2006. However, not all of these high-efficiency clothes washers were likely purchased due to the tax credit program alone. Some

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<sup>b</sup> The District of Columbia (Washington D.C.) passed legislation entitled the "Residential Energy Conservation Tax Credit Act Of 2005" for consumer tax credits, but did not appropriate the necessary funding and so the credits did not go into effect.

<sup>c</sup> The program added fuel cells in 1999 and high-efficiency heat pump systems, furnaces, and boilers in 2002.

<sup>d</sup> These lists change frequently, and generally require units that exceed ENERGY STAR specifications -- for example units that meet Consortium for Energy Efficiency (CEE) specifications.

taxpayers would have been motivated by utility rebate incentives, and others would be "free riders" who would have purchased efficient appliances without a tax credit or rebate incentive but still claimed the tax credit. To better understand this interaction between tax credits, rebates, and free riders/market impacts, DOE reviewed a report prepared by KEMA on efficient clothes washers in the Northwest. KEMA compared the penetration of "ultra high efficiency" (UHE)<sup>e</sup> clothes washers in Oregon and Washington, two neighboring States that have similar utility rebate programs for residential clothes washers.<sup>18</sup> The study attributed the difference in market share of these UHE units (50 percent for Oregon versus 15 percent for Washington) to the Oregon tax credits. DOE estimated that 38 percent of the tax credits claimed (9 percent of total shipments) were actually due to rebates. To estimate the free riders, DOE used the market penetration of the baseline commercial clothes washer units on the penetration curve presented above (Figure 17.3.6), which was 9.2 percent of total shipments (38 percent of the number of tax credit claims). DOE then estimated that the remaining 24 percent of the Oregon clothes washer tax credits claimed for the years 1998–2005 (or 5.8 percent of total shipments) were attributable to tax credits alone.

DOE also reviewed Oregon's business energy tax credit (BETC) for commercial clothes washers. Oregon's BETC is 35–50 percent of the incremental cost of the efficient equipment.<sup>f</sup> The majority of these credits were claimed for laundries and rental dwellings, and included commercial clothes washers as well as other appliances. However, ODOE did not track the types of appliances involved nor the number of machines per project; the annual counts are the total number of projects, with each project involving one or more appliances. DOE was therefore unable to use the data to estimate market percentages for specific appliances, i.e. commercial clothes washers. However, DOE did note the trend of increasing numbers of credits claimed from 1998 through 2006, which contributed to its assumptions regarding the trend line for this policy scenario.

Table 17.3.2 shows the number of Oregon residential tax credits claimed for clothes washers as percentages of total annual shipments these claims represent for the years 1998–2006. It also shows the percentages of total shipments attributed to the tax credits themselves, to utility rebates, and to other market influences/free riders for 2006. The table also shows the percentage attributed to tax credits for the prior years of 1998–2005.

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<sup>e</sup> Units meeting specifications of minimum modified energy factor (MEF) of 2.20 and maximum water factor (WF) of 6.5.

<sup>f</sup> The business tax credit is taken over five years: 10 percent in the first and second years and 5 percent each year thereafter; the taxpayer may carry the unused credit forward up to eight years. Those with eligible project costs of \$20,000 or less may take the tax credit in one year.

**Table 17.3.2 Oregon Tax Credits Claimed for Residential Clothes Washers from 1998 to 2006 and their Attribution for 2006**

	1998	1999	2000	2001	2002	2003	2004	2005	2006
Tax Credits Claimed	5.5%	11%	13%	15%	19%	21%	18%	22%	24%
Tax Credits Claimed, Adjusted	5.5%	11%	13%	15%	19%	20%	21%	22%	24%
<b>Due to Tax Credits</b>	1.3%	2.7%	3.1%	3.6%	4.6%	4.8%	5.1%	5.3%	<b>5.8%</b>
Due to Rebates	NA	NA	NA	NA	NA	NA	NA	NA	9.0%
Due to Market	NA	NA	NA	NA	NA	NA	NA	NA	9.2%

DOE estimated that the market share of both top-loading and front-loading commercial clothes washers at the target efficiency level would increase by the percentages experienced by residential clothes washers in the first nine years of the tax credit program. As shown in Table 17.3.3, their market share would increase from 2013 to 2020 and would remain constant at the 2021 level of 5.8 percent for the remainder of the forecast period.

**Table 17.3.3 Annual Increased Market Shares of Commercial Clothes Washers at Target Efficiency Level from Consumer Tax Credits**

Year of Program	Commercial Clothes Washers
2013	1.3%
2014	2.7%
2015	3.1%
2016	3.6%
2017	4.6%
2018	4.8%
2019	5.1%
2020	5.3%
2021–2043	5.8%

### 17.3.2.3 Manufacturer Tax Credits

EPACT 2005 provides Energy Efficient Appliance Credits to manufacturers for production of high-efficiency refrigerators, clothes washers, and dishwashers at the Federal level through the IRS.<sup>19</sup> Manufacturers receive these credits only for the increase in production of qualifying appliances over a three-year rolling baseline. Each manufacturer is limited to a certain amount for all credits under this provision. The credits were available for models produced in 2006 and 2007. Legislation pending in Congress would extend the manufacturer tax credits in modified form through 2010.<sup>20</sup> Appendix 17A gives details of the equipment covered and the Federal tax credit amounts for appliance manufacturers.

DOE assumed that a manufacturer tax credit program would effectively result in a lower price to the consumer by an amount equivalent to that provided by consumer tax credits as described above. Because these tax credits would go directly to manufacturers, DOE assumed that manufacturers would pass on the reduced costs to consumers, causing the direct price effect. However, DOE assumed that the announcement effect would not occur because the program

would not be visible to consumers. Since the direct price effect is approximately equivalent to the announcement effect,<sup>9</sup> DOE estimated that half of the consumers assumed to take advantage of consumer tax credits would purchase more-efficient products due to a manufacturer tax credit program. DOE thus applied 50 percent to the market penetrations attributed to Oregon's consumer tax credits in the year 2006 for dishwashers and clothes washers and used the resulting market penetrations to represent the impact of manufacturer tax credits for all years of the analysis period. DOE assumed the impact of this policy would be to permanently transform the market so that the market share increase seen in the first year of the program would be maintained throughout the forecast period.

DOE estimated that, due to this policy, the market share of efficient commercial clothes washers for both top-loading and front-loading units would annually increase by 2.9 percent over the base case at the TSL.

### **17.3.3 Voluntary Energy Efficiency Targets**

DOE assumed that voluntary targets would be achieved through manufacturer participation in a gradual phaseout of production of units below their respective TSLs. DOE assumed that this would be achieved by a program similar to the Energy Star endorsement labeling program conducted by the Environmental Protection Agency (EPA) and DOE. The Energy Star program sets minimum energy efficiency specifications for various products, including commercial clothes washers. Energy Star encourages consumer adoption of these products through marketing to promote consumer label recognition, adoption of the specifications by various efficiency incentive programs, and manufacturer production and promotion of Energy Star-compliant appliances. Energy Star prepares projections of market penetration of compliant appliances, and estimates the percentage of the sales of those compliant appliances that are attributed to the Energy Star program.

Several reports have analyzed the impacts of Energy Star programs for specific products, which are generally based on a combination of information dissemination and utility or agency rebates. These studies base their analysis on the Energy Star statewide data on percentages of shipments by appliance that meet the Energy Star specifications. These analyses have generally concluded that the market penetration of Energy Star-qualifying appliances is higher in regions or States where such promotional programs have been active.<sup>18,21,22,23,24</sup>

For top-loading commercial clothes washers, DOE modeled the voluntary efficiency targets policy assuming an expansion of existing Energy Star program efforts for this product. In the absence of Energy Star forecast data on commercial clothes washer shipments, DOE based its assumptions for increased market penetration on EPA experience with residential clothes washers. While there are more incentive programs using the Energy Star specification for residential clothes washers than there are for commercial clothes washers, the savings from commercial clothes washers are higher related to the costs, so DOE assumed that the market impacts for the two programs would be similar. The most recent specification change for which Energy Star had available projections was 2007. (Its next scheduled specification change occurs

in 2009.) Hence, DOE based its estimates for commercial clothes washers on the Energy Star program’s projections for increased residential clothes washer market penetration due to the Energy Star program from 2007 through 2025.<sup>25</sup> DOE estimated that an enhanced Energy Star program would provide an additional 50 percent market share increase beyond that caused by the existing Energy Star program, whose impacts are implicit in the base case. It assumed that the same pattern of annual market penetration increases would apply to top-loading commercial clothes washer markets beginning in 2013. DOE assumed the programs resulting from this expanded voluntary efficiency targets policy would increase projected market share of the targeted units by the percentages shown in Table 17.3.4. The Energy Star projections run for 19 years, through 2025; DOE assumed that the increased market penetration achieved after 19 years, by 2030, would remain constant through 2043.

**Table 17.3.4 Annual Increased Market Shares of Top-Loading Commercial Clothes Washers at Target Efficiency Level from Voluntary Efficiency Targets**

<b>Year of Program</b>	<b>Top-Loading Commercial Clothes Washers*</b>
2013	0%
2014	5%
2015	8%
2016	10%
2017	10%
2018	11%
2019	11%
2020	11%
2021	12%
2022	12%
2023	12%
2024	12%
2025	13%
2026	13%
2027	13%
2028	14%
2029	14%
2030	14%
2031-2043	14%

\* Percentages in each column refer to shares of the eligible market.

DOE did not analyze the potential impacts of voluntary energy efficiency targets for front-loading commercial clothes washers because over 88 percent of the front-loading washer market in the base case already meets TSL 3. The Energy Star program typically targets products where a maximum of approximately 25 percent of the existing market meets the target efficiency level.<sup>23</sup> Since the market for front-loading washers is well above the 25 percent threshold, DOE did not consider this policy for front-loading commercial clothes washers

#### 17.3.4 Early Replacement

Early replacement refers to the replacement of commercial clothes washers before the ends of their useful lives. The purpose of this policy is to replace old, inefficient equipment with higher-efficiency units. The economic feasibility of early replacement depends on the vintage of the unit being replaced, the cost for the new equipment, and the energy cost savings.

There has been limited experience with early replacement programs for appliances in the U.S. However, DOE studied several reports to inform its analysis of this policy. One report detailed the Connecticut Appliance Retirement Program (ARP) conducted in 2004.<sup>26</sup> Another was an electric energy efficiency potentials study performed for the State of Vermont in 2006.<sup>27</sup> DOE had also performed an earlier study on Federal potential for early retirement of appliances under EPACK 1992.

The Connecticut ARP was conducted from June through December 2004 by Nexus Market Research, Inc. and RLW Analytics, Inc. for Northeast Utilities–Connecticut Light and Power and the United Illuminating Company’s State programs. The ARP intended to assist utility customers in Connecticut to overcome barriers to recycling room air conditioners (RACs), secondary refrigerators, and freezers. The program picked up used appliances at customers’ homes or at turn-in events, paid participants to retire their units, and educated customers about the costs of running older appliances. In addition, the program paid incentives to consumers to replace their RACs with Energy Star-qualified units. DOE considered the RAC program to most closely resemble the early replacement policy scenario, since these consumers were replacing primary units rather than retiring second units. Nexus’ report on ARP results estimated the number of RACs retired by program participants, the percentage of those replaced with an Energy Star model, and the number of RACs replaced by non-participants during the program duration, using program data and surveys. According to their analysis, about seven percent of all RACs retired during the program were retired through the ARP, and 63 percent of those were replaced with an Energy Star model. This meant that the program directly resulted in early replacement with a more efficient unit of about four percent of the total eligible RAC population. DOE assumed that this type of program most likely eliminates second ownership of the RAC, thus shortening its useful service life.

In 2006, GDS Associates, Inc. conducted an electricity and peak demand potentials study for energy efficiency and fuel conversion measures for the State of Vermont. GDS developed a special “early retirement” scenario with all residential appliances replaced during the four-year period from 2006 to 2009, and analyzed similar early replacements in the commercial sector. They estimated achievable market penetrations assuming that consumers would receive a financial incentive equal to 50 percent of the incremental cost of the measure in most programs. GDS assumed an 80 percent penetration limit for the program. It estimated a maximum achievable annual program participant level of two percent of applicable single-family or multifamily homes in 2005.

DOE also reviewed a study it conducted in the 1990s, under EPACK 1992, which analyzed the feasibility of a Federal program to promote early replacement of appliances.<sup>28</sup> This

study identified policy options for early replacement that included a direct national early replacement program, replacement of Federally owned appliances, promotion through equipment manufacturers, consumer incentives, incentives to utilities, and building regulations.<sup>g</sup>

For this analysis, DOE considered a program that targets the units in the stock that have efficiency levels lower than the policy target efficiency level and encourages their early replacement with products at the target level. The program affects a portion of units in the stock in 2013 that would be replaced at the end of their useful or service life (at the “natural” replacement rate) without the effects of this policy, under which they would be replaced sooner. Shipments in 2013 and beyond are not affected by this program and remain at base case efficiency levels.

Based on their average service lives, 9 percent of commercial clothes washers in multifamily buildings, and 14 percent of commercial clothes washers in laundromats are replaced annually; these are their natural replacement rates. For this policy study, DOE assumed that an additional percentage of commercial clothes washers in the existing stock in 2013, the first year of the analysis period, would be replaced by models meeting the target levels. For each product, DOE modeled this policy by replacing four percent per year of the units in the stock in addition to those being replaced at the end of their service lives (using the estimated percentage from the Connecticut study since it was based on actual program experience). DOE assumed that these early replacement programs would last as long as it took to completely replace all of the eligible commercial clothes washers that were in the stock in the year that the program began (2013). After the 2013 stock had been completely replaced, there would be no additional impacts from this policy.

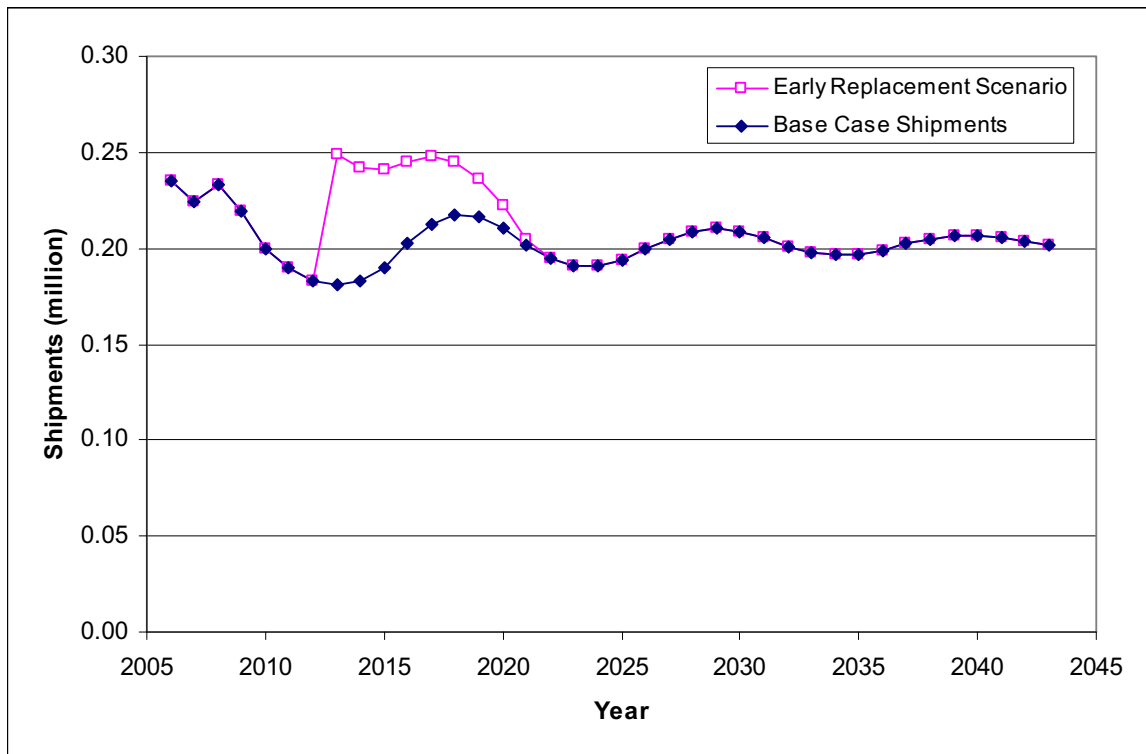
The policy would create a jump in shipments of equipment meeting target efficiency levels relative to the base case in the early years of the program as shown in Figures 17.3.3. As a result, more high efficiency units meeting the policy targets would be quickly brought into the equipment stock, leading to an immediate gain in the market share of efficient units compared to the base case. However, unlike the other policy cases discussed, the efficient unit market share would drop back down to the levels in the base case as the eligible market is depleted.

Figure 17.3.10 indicates the increase in shipments for the entire clothes washer market including both top-loading and front-loading units. As described in Chapter 8, section 8.2.6, DOE estimated that 70 percent of the market is comprised of top-loading washers and 30 percent is comprised of front-loading washers. DOE estimated that the market share of top-loading and front-loading washers would remain fixed at 70 percent and 30 percent, respectively, through the

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<sup>g</sup> The analysis concluded that, while cost-effective opportunities for early replacement exist, a widespread Federal early replacement program was not economically justified. Because premature retirement means that a unit may be replaced by an appliance less efficient than the eventual replacement would probably have been, energy savings would be smaller than anticipated. Early replacement programs could increase sales volatility in the long run by encouraging a temporary increase in production followed by a lull in demand. Early replacement could be economical in localities with high energy cost conditions or environmental constraints, when replacement appliances are much more efficient than existing stock, or when a major technology breakthrough has recently occurred, creating the need for a ready market.

forecast period. Therefore, the increase in shipments due to the early replacement program is distributed based on the existing market shares of top-loading and front-loading washers.



**Figure 17.3.3 Early Replacement Shipments Projections for Commercial Clothes Washers**

### 17.3.5 Bulk Government Purchases

DOE assumed that a bulk government purchase policy would encourage Federal, State, and local governments to purchase equipment meeting the target efficiency levels. Aggregating public sector demand could provide a market signal to manufacturers and vendors that some of their largest customers sought suppliers with products that met an efficiency target at favorable prices. This program also could induce “market pull” impacts through manufacturers and vendors achieving economies of scale for high-efficiency products.

While there have been several bulk government purchasing initiatives at the Federal, State, and municipal levels, most of these programs have not tracked data on number of purchases or degree of compliance with procurement specifications. In many cases, procurement programs are decentralized, being part of larger State or regional initiatives. At the Federal level, the Federal Energy Management Program (FEMP) has performed studies of savings potential for its procurement specifications for appliances and other equipment on which DOE based its assumptions for this policy. Yet FEMP does not track purchasing data, due to the complexity of the purchasing systems, number of vendors, etc. There is evidence of increasing interest and activity in “green purchasing” on the State, county, and municipal levels. While many of these

programs target office equipment, the existence of a growing infrastructure for efficient purchasing specifications indicates that such impacts that DOE attributed to bulk government purchasing programs are feasible.<sup>29,30</sup>

For top-loading commercial clothes washers, DOE assumed that government agencies, such as the U.S. General Services Administration (GSA), would administer such a program. At the Federal level, this program could modify the current FEMP procurement guidelines for “family-sized” commercial clothes washers. At FEMP’s required level, the current specifications (which are identical to those for residential clothes washers) are minimum MEF of 1.42 and maximum water factor of 10.5.

To estimate the impact of a bulk government purchase program for this product, DOE first determined the shipments of commercial clothes washers that go to government-owned housing. A technology review prepared for FEMP by Pacific Northwest National Laboratory (PNNL) in 2000 estimated that 6000–7000 commercial clothes washers were purchased annually for Federal buildings.<sup>31</sup> DOE assumed that, by 2013, this policy would apply to the upper end of this shipments range, or about 3.3 percent of the market. Although a portion (15 percent) of the commercial clothes washer market consists of laundromats, since it is not likely that the government owns laundromats, DOE assumed that this policy would affect only commercial clothes washers in multifamily buildings. Hence the eligible population of commercial clothes washers to which this policy would apply is 3.3 percent of total shipments.

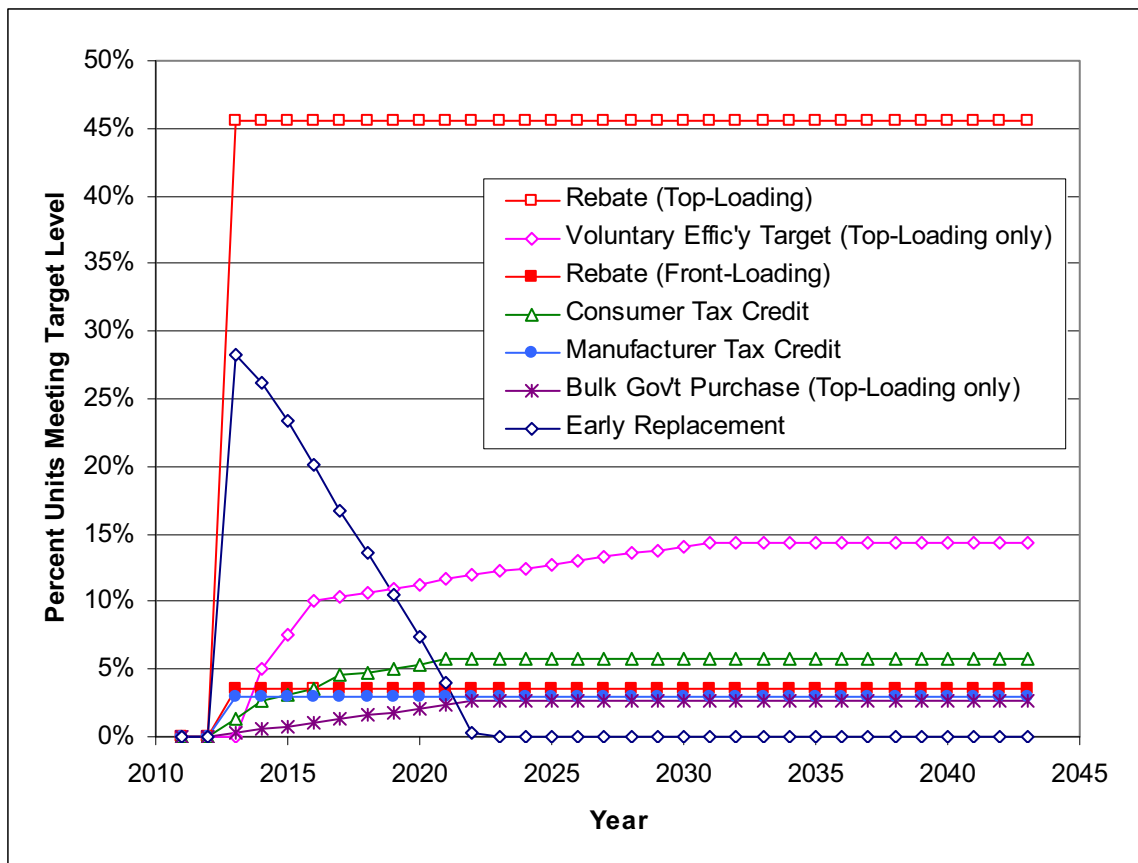
DOE also reviewed its own research on the potential for market transformation through bulk government purchasing.<sup>32</sup> This study analyzed several scenarios that started from the assumption that 20 percent of Federal equipment purchasing in the year 2000 already incorporated energy efficiency, following the FEMP guidelines. One scenario in the DOE report showed energy efficient Federal purchasing ramping up from 20 percent to 80 percent of all Federal purchases over 10 years. Of government-owned residential buildings, DOE’s life-cycle cost and payback period analysis estimated that, by the start year of 2013, none had top-loading commercial clothes washers at efficiency levels meeting the amended energy conservation standards. DOE estimated that a bulk government purchasing program instituted over a 10-year time period would eventually result in an 80-percentage-point increase (from 0 percent to 80 percent) in the number of government-purchased commercial clothes washers meeting the target efficiency levels.

Based on the above percentages, DOE estimated that, by the end of the first year of the policy case (2013), eight percent of shipments of government-purchased top-loading commercial clothes washers would be equipment meeting the target levels for these products due to existing bulk government purchase programs. By 2022, DOE estimated that bulk government purchase programs would increase their market share to 80 percent. Thus, DOE modeled the enhanced bulk government purchase program assuming that an annual eight percent market share increase would be maintained over 10 years starting in 2013. Section 17.4 below presents the resulting efficiency trends for the bulk government purchase policy case for top-loading commercial clothes washers.

DOE did not analyze the potential impacts of bulk government purchases for front-loading commercial clothes washers because over 88 percent of the front-loading washer market already meets TSL 3. FEMP procurement specifications typically promote products in the top 25 percent of the existing market in terms of efficiency. Since most of the front-loading washers sold in the base case would already comply with such specifications, DOE did not consider this program for front-loading commercial clothes washers.<sup>33</sup>

## 17.4 NON-REGULATORY POLICY IMPACTS

Figure 17.4.1 shows the market share (penetration rate) impacts for each of the non-regulatory policy cases for commercial clothes washers. All policy cases increase the market share of products meeting the target level, with voluntary energy efficiency targets being the most effective over the entire forecast period. As a reminder, the proposed standards (not shown in Figure 17.4.1) would result in a 100 percent penetration of products meeting the target level.



**Figure 17.4.1 Penetration Rates of Units Meeting the Target Level for Commercial Clothes Washers**

## 17.5 RESULTS SUMMARY FOR NON-REGULATORY ALTERNATIVES

Table 17.5.1 shows the national energy savings and NPV resulting from the various non-regulatory alternative policy cases, when the efficiency target levels are equal to the proposed standard levels for each product. The cases in which no regulatory action is taken with regard to commercial clothes washers constitute the base case (or "No Action") scenarios, in which energy savings and NPV are zero by definition. For comparison, the tables include the impacts of the proposed energy conservation standards. The NPV amounts shown in Table 17.5.1 are based on two discount rates (seven percent and three percent real).

**Table 17.5.1 Non-Regulatory Alternatives for Commercial Clothes Washers with Target Levels at TSL 3**

Policy Alternatives	Primary Energy Savings (quads)	Water savings (trillion gallons)	Net Present Value* (billion 2008\$)	
			7% discount rate	3% discount rate
No New Regulatory Action	0.0	0.0	0.0	0.0
Consumer Rebates	0.06	0.07	0.18	0.47
Consumer Tax Credits	0.01	0.01	0.03	0.08
Manufacturer Tax Credits	0.005	0.01	0.02	0.06
Voluntary Energy Efficiency Targets**	0.02	0.02	0.06	0.15
Early Replacement	0.01	0.01	0.11	0.17
Bulk Government Purchases**	0.003	0.01	0.02	0.04
Proposed Standards at TSL 3	0.10	0.14	0.36	0.89

\* Net present value (NPV) is the value of a time series of costs and savings. DOE determined the NPV from 2013 to 2043 in billions of 2008\$.

\*\* Voluntary energy efficiency target and bulk government purchase alternatives are not considered for front-loading washers because the percentage of the market at TSL 3 is well over the market adoption target level that each alternative strives to attain.

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