CHAPTER 17. REGULATORY IMPACT ANALYSIS

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CHAPTER 17. REGULATORY IMPACT ANALYSIS

17.1 INTRODUCTION

The U.S. Department of Energy (DOE) has determined that energy conservation standards for consumers of residential dishwashers constitute an "economically significant regulatory action" under Executive Order (E.O.) 12866, Regulatory Planning and Review. 58 FR 51735, Volume 58, No. 190, page 51735. (October 4, 1993). Under 10 CFR part 430, subpart C, appendix A, section III.12, DOE committed to evaluating non-regulatory alternatives to proposed standards by performing a regulatory impact analysis (RIA). 61 FR 36981, Volume 61, No. 136, page 36978. (November 15, 1996). This RIA, which DOE has prepared pursuant to E.O. 12866, evaluates potential non-regulatory alternatives, comparing the costs and benefits of each to those of the proposed standards. 58 FR 51735, page 51741. As noted in E.O. 12866, this RIA is subject to review by the Office of Management and Budget's Office of Information and Regulatory Affairs. 58 FR 51735, page 51740.

For this RIA, DOE used an integrated National Impact Analysis (NIA)-RIA model built on the NIA model discussed in chapter 10 for its analysis. DOE studied the impacts of the non-regulatory policies on the standard-sized product class.

DOE identified six non-regulatory policy alternatives that possibly could provide incentives for the same energy efficiency levels as the proposed standards for the products that are the subject of this rulemaking. The non-regulatory policy alternatives 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 to the effectiveness of the proposed standard.

Table 17.1.1 Non-Regulatory 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

Sections 17.2 and 17.3 discuss the analysis of the six policies listed above. Section 17.4 presents the results of the policy alternatives.

17.2 NON-REGULATORY POLICIES

This section describes the method DOE used to analyze the energy savings and cost effectiveness of the six non-regulatory policy alternatives (excluding the alternative of no new regulatory action) for the identified residential dishwashers. This section also describes the assumptions underlying the analysis.

17.2.1 Methodology

DOE used its integrated NIA-RIA spreadsheet model to calculate the national energy savings (NES) and net present value (NPV) associated with each non-regulatory policy alternative. Chapter 10 of the technical support document (TSD) describes the NIA spreadsheet model. Appendix 17-A, section 17-A.3, discusses the NIA-RIA integrated model approach.

DOE quantified the effect of each alternative on the purchase of products that meet target levels, which are defined as the efficiency levels in the proposed standards. After establishing the quantitative assumptions underlying each alternative, DOE appropriately revised inputs to the NIA-RIA spreadsheet model. The primary model inputs revised were market shares of products meeting target efficiency levels and product replacement rates. The shipments of products for any given year reflect a distribution of efficiency levels. DOE assumed that the proposed standards would affect 100 percent of the shipments of products that did not meet target levels in the base case,[a] whereas the non-regulatory policies would affect a smaller percentage of those shipments. DOE made certain assumptions about the percentage of shipments affected by each alternative policy. DOE used those percentages to calculate the shipment-weighted average energy consumption and costs of residential dishwashers attributable to each policy alternative.

Increasing the efficiency of a product often increases its average installed cost. However, operating costs generally decrease because energy consumption declines. DOE therefore calculated an NPV for each non-regulatory alternative in the same way it did for the proposed standards. In some scenarios, increases in total installed cost are mitigated by government rebates or tax credits. Because DOE assumed that consumers would re-pay credits and rebates in some way (such as additional taxes), DOE did not include rebates or tax credits as a consumer benefit when calculating national NPV. DOE's analysis also excluded any administrative costs for the non-regulatory policies; including such costs would decrease the NPVs slightly.

[a] The base case for the NIA is a market-weighted average of units at several efficiency levels.

The following are key measures for evaluating the impact of each alternative.

- National energy savings, given in quadrillion Btus (quads), describes the cumulative national primary energy savings for products bought during the period from the effective date of the policy (2013) through the end of the analysis period (2047).

- Net present value represents the value in 2010$ (discounted to 2010) of net monetary savings from products bought during the period from the effective date of the policy (2013) through the end of the analysis period (2047).

- DOE calculated the NPV as the difference between the present value of installed product cost and operating expenditures in the base case and the present value of those costs in each policy case. DOE calculated operating expenses (including energy costs) for the life of the product.

17.2.2 Assumptions Regarding Non-Regulatory Policies

The effects of non-regulatory policies are by nature uncertain, because they depend on program implementation, marketing efforts, and on consumers' responses to a program. Because the projected effects depend on assumptions regarding the rate of consumer participation, they are subject to more uncertainty than are the impacts of mandatory standards, which DOE assumes will meet with full compliance. To increase the robustness of the analysis, DOE conducted a literature review regarding each non-regulatory policy and consulted with recognized experts to gather information on similar incentive programs that have been implemented in the United States. By studying experiences with the various types of programs, DOE sought to make credible assumptions regarding potential market impacts. Section 17.3 presents the sources DOE relied on in developing assumptions about each alternative policy and reports DOE's conclusions as they affected the assumptions that underlie the modeling of each policy.

Each non-regulatory policy that DOE considered would improve the average efficiency of new residential dishwashers relative to their base case efficiency scenario (which involves no new regulatory action). The analysis considered that each alternative policy would induce consumers to purchase units having the same efficiency levels as required by the proposed standards (the target levels). As opposed to the standards case, however, the policy cases may not lead to 100 percent market penetration of units that meet target levels.

Table 17.2.1 shows the efficiency levels stipulated in the proposed standards for residential dishwashers.

Table 17.2.1 Efficiency Levels in Proposed Standard Level for Standard-Sized Residential Dishwashers

Level	Annual Energy Use kWh/year	Annual Water Use 1,000 gal/year
Baseline	355	1.40
2	307	1.08

DOE assumed that the effects of non-regulatory policies would last from the effective date of standards—2013—through the end of the analysis period, which is 2047.

17.2.3 Policy Interactions

DOE calculated the effects of each non-regulatory policy separately from those of the other policies. In practice, some policies are most effective when implemented in combination, such as early replacement implemented with consumer rebates, or early replacement implemented with bulk government purchases. However, DOE attempted to make conservative assumptions to avoid double-counting policy impacts. The resulting policy impacts are not additive; the combined effect of several or all policies cannot be inferred from summing their results.

Section 17.4 presents graphs that show the market penetration estimated under each non-regulatory policy for residential dishwashers.

17.3 NON-REGULATORY POLICY ASSUMPTIONS

The following subsections describe DOE's analysis of the impacts of the six non-regulatory policy alternatives to proposed standards for residential dishwashers. (Because the alternative of No New Regulatory Action has no energy or NPV impacts, essentially representing the NIA base case, DOE did not perform any additional analysis for that alternative.) DOE developed estimates of the market penetration of high-efficiency products both with and without each of the non-regulatory policy alternatives.

17.3.1 No New Regulatory Action

The case in which no new regulatory action is taken with regard to the energy efficiency of residential dishwashers constitutes the base case, as described in chapter 10, National Impact Analysis. The base case provides the basis of comparison for all other policies. By definition, no new regulatory action yields zero energy savings and an NPV of zero dollars.

17.3.2 Consumer Rebates

DOE considered the scenario in which the Federal government would provide financial incentives in the form of rebates to consumers for purchasing energy-efficient appliances. This policy provides a consumer rebate for purchasing residential dishwashers that operate at (or above) the same efficiencies as stipulated in proposed standards (target levels)

17.3.2.1 Methodology

To inform its estimate of the market impacts of consumer rebates, DOE performed a thorough search for existing rebate programs nationwide. It gathered data on utility or agency rebates for residential dishwashers throughout the country. DOE also reviewed the current State Energy Efficient Appliance Rebate Program (SEEARP) funded by the American Recovery and Reinvestment Act (ARRA).[1], [b] This program may be considered a combination of a consumer rebate and an early replacement program, with intention to induce appliance sales during the economic recession. DOE analyzed summary material from DOE on SEEARP rebates for residential dishwashers.[2]

DOE based its evaluation methodology for consumer rebates on a comprehensive study of California's potential for achieving energy efficiency. This study, performed by XENERGY, Inc.,[c] summarized experiences with various utility rebate programs.[3] XENERGY's analytical method utilized graphs, or penetration curves, that estimate the market penetration of a technology based on its benefit/cost (B/C) ratio. DOE consulted with experts and reviewed other methods of estimating the effect of consumer rebate programs on the market penetration of efficient technologies. The other methods, developed after the referenced XENERGY report was published,[4, 5, 6, 7, 8, 9] used different approaches: other economic parameters (e.g., payback period), expert surveys, or model calibration based on specific utility program data rather than multi-utility data. Some models in use by energy efficiency program evaluation experts were so client-specific that generic relationships between economic parameters and consumer response could not be established.[7] DOE decided that the most appropriate available method for this RIA analysis was the XENERGY approach of penetration curves based on B/C ratio, which incorporates lifetime operating cost savings.

XENERGY's model estimates market impacts induced by financial incentives based on the premise that two types of information diffusion drive the adoption of new technologies. *Internal sources* of information encourage consumers to purchase new products primarily through word-of-mouth from early adopters. *External sources* affect consumer purchase

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[b] DOE provided funding for State-run rebate programs for consumer purchases of new ENERGY STAR® qualified home appliances. The resulting SEEARP was implemented beginning in late 2009 by the 50 States and six U.S. territories, each selecting its own appliances, rebate levels, efficiency levels, appliance recycling requirements, and eligible populations.

[c] XENERGY is now owned by KEMA, Inc. (www.kema.com)

decisions through marketing efforts and information from outside the consumer group. Appendix 17-A, section 17-A.4.1, contains additional details on internal and external information diffusion.

XENERGY's model equation accounts for the influences of both internal and external sources of information by superimposing the two components. Combining the two mechanisms for information diffusion, XENERGY's model generates a set of penetration (or implementation) curves for a measure. XENERGY then calibrated the curves based on participation data from utility rebate programs. The curves illustrate the increased penetration (i.e., increased market share) of efficient products driven by consumer response to changes in B/C ratio induced by rebate programs. The penetration curves depict various diffusion patterns based on perceived barriers (from no barriers to extremely high barriers) to consumer purchase of high-efficiency products.

DOE adjusted the XENERGY penetration curves based on expert advice founded on more recent utility program experience.[7, 10] DOE also devised an interpolation method to create penetration curves based on relationships between the actual base case market penetrations and actual B/C ratios. Appendix 17-A, sections 17-A.4.2 and 17-A.4.3, contain discussion on DOE's methodology for adjusting and interpolating the curves.

DOE modeled the effects of a consumer rebate policy for residential dishwashers by determining the increase in market penetration of products meeting the target level relative to their market penetration in the base case. It did this using the interpolated penetration curve created for standard-sized dishwashers based on the XENERGY methodology to best reflect the market barrier level faced by this product class. Section 17.3.2.2 shows the interpolated curve used in the analysis.

17.3.2.2 Analysis

For the standard-sized product class, DOE estimated the effect of increasing its B/C ratio via a rebate that would pay part or all of the increased installed cost of a unit that met the target efficiency level compared to one meeting the baseline efficiency level.[d] DOE based the rebate amounts on a large sample of utility and agency rebate programs for residential dishwashers. DOE gathered data on 124 rebates for standard-sized dishwashers initiated by 104 utilities or agencies in various States. (Appendix 17-A, section 17-A.5, identifies the rebate programs.) To represent the rebate level, DOE used the simple average of the rebate amounts for units meeting the target level in these programs. DOE assumed that these average rebates amounts would apply to models at all efficiency levels at or above the target level for this product class.

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[d] The baseline technology for each product class is defined in the engineering analysis, chapter 5, as the technology that represents the basic characteristics of products in that class. A baseline unit typically is one that just meets current Federal energy conservation standards and provides basic consumer utility.

DOE assumed that rebates would remain in effect at the same levels throughout the forecast period (2013–2047).

For standard-sized dishwashers, DOE first calculated the B/C ratio without a rebate using the difference in total installed costs and lifetime operating cost savings between the unit meeting the target level and the baseline unit. It then calculated the B/C ratio given a rebate for the unit meeting the target efficiency level. Because the rebate reduced the incremental cost, the unit receiving the rebate had a larger B/C ratio. Table 17.3.1 shows the effect of consumer rebates on the B/C ratio. The B/C value for units given rebates represents a weighted average[e] of the values for the efficiency levels at or above the target level to which the rebate would apply.

Table 17.3.1 Benefit/Cost Ratios Without and With Rebates for Standard-Sized Dishwashers (2010$)

B/C Ratio Without Rebate	1.2
Rebate Amount	$37.23
B/C Ratio With Rebate	4.4
Calculated Market Barrier Curve	No

DOE used these B/C ratios along with the penetration curve shown in Figure 17.3.1 to estimate the percentage of consumers who would purchase dishwashers that meet the target levels both with and without a rebate incentive. The curve calculated by DOE to represent the market behavior for standard-sized dishwashers was the *no barriers* penetration curve.

[e] The weighting factor is the 2013 base-case market share of each corresponding efficiency level.

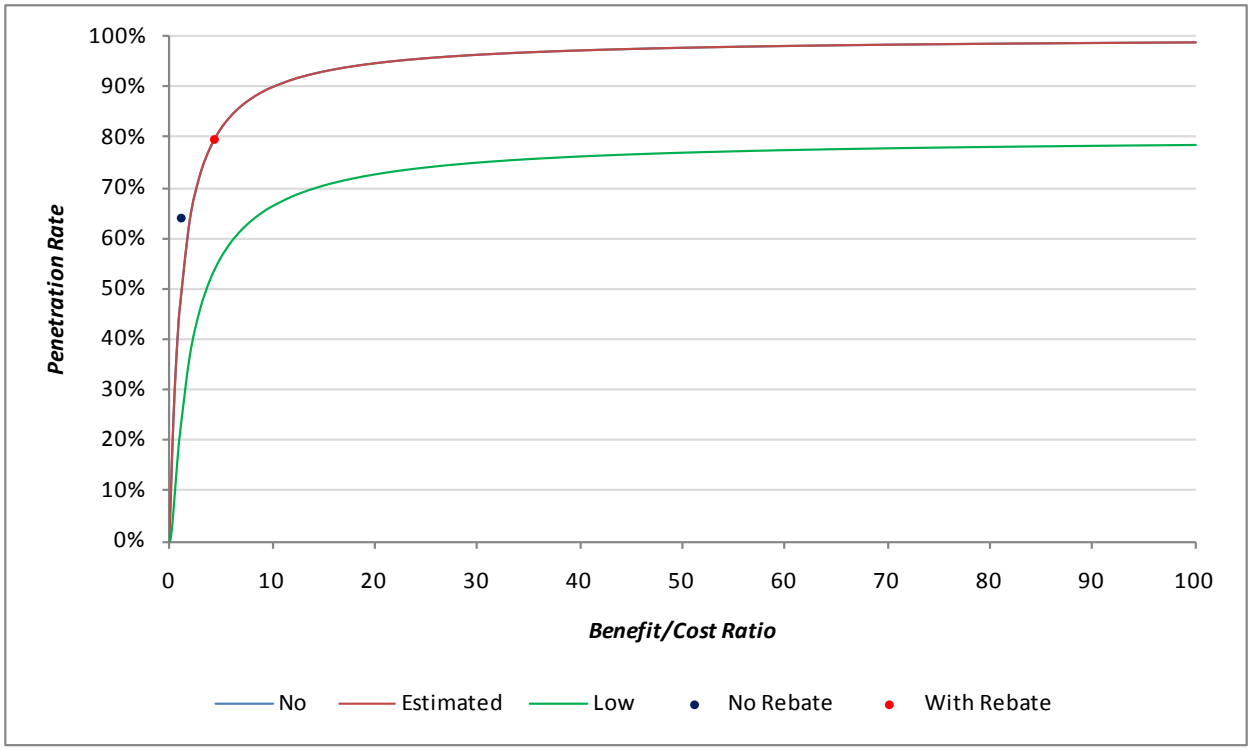

Figure 17.3.1 Market Penetration Curve for Standard-Sized Dishwashers

DOE next estimated the percent increase represented by the change in penetration rate shown on the penetration curve. It then added that percent increase to the market share of units that meet the target level in the base case to obtain the market share of units that meet the target level in the rebate case. Table 17.3.2 summarizes the market shares for standard-sized dishwashers in 2013. DOE used the resulting annual increases in market shares as inputs to represent the rebate policy case scenario in its NIA-RIA model. Appendix 17A, Table 17A.2.1, shows the annual market share increases due to this policy. Section 17.4 presents the resulting efficiency trends for the policy case of consumer rebates for standard-sized dishwashers.

Table 17.3.2 Market Penetrations in 2013 Without and With Rebates for Standard-Sized Dishwashers

Base-Case Market Share of Units that Meet Target Levels	63.9
Market Share of Units that Meet Target Levels With Rebates	85.2
Increased Market Share of Units that Meet Target Level With Rebates	21.3

17.3.3 Consumer Tax Credits

DOE estimated the effects of tax credits on consumer purchases based on its previous analysis of consumer participation in tax credits. DOE supported its approach using data from Oregon State's tax credit program for energy-efficient appliances. DOE also incorporated previous research that disaggregated the effect of rebates and tax credits into a *direct price effect*, which derives from the savings in purchase price, and an *announcement effect*, which is independent of the amount of the incentive.[11,12] The announcement effect derives from the credibility that a technology receives from being included in an incentive program, as well as changes in product marketing and modifications in markup and pricing. DOE assumed that the rebate and consumer tax credit policies would encompass both direct price effects and announcement effects, and that half the increase in market penetration associated with either policy would be due to the direct price effect and half to the announcement effect.

In estimating the effects of a tax credit on purchases of consumer products that meet new efficiency standards, DOE assumed the amount of the tax credit would be the same as the corresponding rebate amount discussed above.

DOE estimated that fewer consumers would participate in a tax credit program than would take advantage of a rebate. Research has shown that the delay required for a consumer to receive a tax credit, plus the added time and cost in preparing the tax return, make a tax credit incentive less effective than a rebate received at the time of purchase. Based on previous analyses, DOE assumed that only 60 percent of the consumers who would take advantage of a rebate would take advantage of a tax credit.[13]

In preparing its assumptions, DOE also reviewed other tax credit programs that have been offered at both the Federal and State levels for energy-efficient appliances.

The Energy Policy Act of 2005 (EPACT 2005) included Federal tax credits for consumers who purchase energy-efficient products, including home heating and cooling products for new or existing homes.[14] Those tax credits were in effect in 2006 and 2007, expired in 2008, reinstated for 2009–2010 by ARRA, and extended by Congress for 2011 with some modifications.[1, 15]DOE reviewed Internal Revenue Service data on the numbers of taxpayers who claimed the tax credits during tax years 2006 and 2007. DOE also reviewed data from an earlier Federal energy conservation tax credit program in place in the 1980s. However, DOE did not find data specific enough to dishwashers to warrant adjusting its analysis method for the Consumer Tax Credits policy case. Appendix 17-A, section 17-A.6.1, contains more information on Federal consumer tax credits.

DOE also reviewed its previous analysis on Oregon's tax credits for clothes washers to provide support for its assumptions.[16] In the previous analysis, DOE compared the market shares of ultra-high efficiency (UHE) residential clothes washers in Oregon, which offered both State tax credits and utility rebates, with those in Washington State, which offered only utility rebates during the same period. Based on this analysis, DOE estimated that in Oregon the impact of tax

credits was 62 percent of the impact of rebates for UHE clothes washers having equivalent efficiency. This finding supports its original assumption that participation in a tax credit program would be about 60 percent of participation in a rebate program. Additional discussion of State tax credits for Oregon and other states is in Appendix 17-A, section 17-A.6.3.

DOE applied the assumed 60 percent participation described above to the penetration rates estimated for the rebate policy to estimate penetration rates attributable to consumer tax credits. In doing so, DOE incorporated the assumptions for consumer response to financial incentives from the penetration curve selected for standard-sized dishwashers.

Table 17.3.3 summarizes DOE's assumptions for standard-sized dishwashers regarding the market penetration of units in 2013 that meet target efficiency levels given a consumer tax credit.

Table 17.3.3 Market Penetrations in 2013 Attributable to Consumer Tax Credits for Standard-Sized Dishwashers

Base-Case Market Share of Units that Meet Target Levels	63.9
Market Share of Units that Meet Target Levels With Consumer Tax Credits	76.7
Increased Market Share of Units that Meet Target Level With Consumer Tax Credits	12.8

DOE assumed that this policy would transform the market permanently, so that the increase in market share seen in the first year of the program would be maintained throughout the forecast period. The increased market shares attributable to consumer tax credits shown in Table 17.3.3 were used as inputs in the NIA-RIA model. Appendix 17-A, Table 17-A.2.1, shows the annual market share increases due to this policy. Section 17.4 presents the resulting efficiency trends for the policy case of consumer tax credits for standard-sized dishwashers that meet target efficiency levels.

17.3.4 Manufacturer Tax Credits

To analyze the potential effects of a policy that offers tax credits to manufacturers that produce residential dishwashers that meet target efficiency levels, DOE assumed that a manufacturer tax credit would lower the consumer's purchase cost by an amount equivalent to that provided by the consumer rebates or tax credits described above. DOE further assumed that manufacturers would pass on some of their reduced costs to consumers, causing a direct price effect. DOE assumed that no announcement effect would occur, because the program would not

be visible to consumers.[f] Because the direct price effect is approximately equivalent to the announcement effect,[11] DOE estimated that a manufacturer tax credit would induce half the number of consumers assumed to take advantage of a consumer tax credit to purchase more efficient products. This assumed participation rate is equal to 30 percent of the number of consumers who would participate in a rebate program.

DOE attempted to investigate manufacturer response to the Energy Efficient Appliance Credits for manufacturers mandated by EPACT 2005.[17] Those manufacturer tax credits were in effect for dishwasher models produced in 2006 and 2007, reinstated for 2009 and 2010, and extended to 2011 with modifications in the eligibility requirements. DOE was unable to locate data from the Internal Revenue Service or other sources on manufacturer response to the Federal credits. Appendix 17-A, section 17-A.6.2, presents details on Federal manufacturer tax credits.

DOE applied the assumption of 30 percent participation to the penetration rates predicted for the rebate policy to estimate the effects of a manufacturer tax credit policy. In doing so, the Department incorporated the assumptions for consumer response to financial incentives from the penetration curve selected for standard-sized dishwashers.

Table 17.3.4 summarizes DOE's assumptions for standard-sized dishwashers regarding the market penetration of units in 2013 meeting target efficiency levels given a manufacturer tax credit.

Table 17.3.4 Market Penetrations in 2013 Attributable to Manufacturer Tax Credits for Standard-Sized Dishwashers

Base-Case Market Share of Units that Meet Target Levels	63.9
Market Share of Units that Meet Target Levels With Manufacturer Tax Credits	70.3
Increased Market Share of Units that Meet Target Level With Manufacturer Tax Credits	6.4

DOE assumed that this policy would transform the market permanently, so that the increases in market share seen in the first year of the program would be maintained throughout the forecast period. The increased market shares attributable to a manufacturer tax credit shown in Table 17.3.4 were used as inputs in the NIA-RIA model. Appendix 17-A, Table 17-A.2.1, shows the annual market share increases due to this policy. Section 17.4 presents the resulting efficiency trends for the policy case of manufacturer tax credits for standard-sized dishwashers.

[f] Note that this is a conservative assumption, since it is possible that manufacturers or utility/agency efficiency programs might promote the models for which manufacturers increase production due to the tax credits, which in turn might induce some announcement effect. However, DOE found no data on such programs on which to base an estimate of the magnitude of this possible announcement effect on consumer behavior.

17.3.5 Voluntary Energy Efficiency Targets

For each product, DOE assumed that voluntary energy efficiency targets would be achieved as manufacturers gradually stopped producing units that operated below the target efficiency levels. DOE assumed that the impetus for phasing out production of low-efficiency units would be a program similar to the ENERGY STAR labeling program conducted by the Environmental Protection Agency (EPA) and DOE. The ENERGY STAR program specifies the minimum energy efficiencies that various products, including residential dishwashers, must have to receive the ENERGY STAR label. ENERGY STAR encourages consumers to purchase efficient products via marketing that promotes consumer label recognition, various incentive programs that adopt the ENERGY STAR specifications, and manufacturers' promotion of their qualifying appliances. ENERGY STAR projects market penetration of compliant appliances and estimates the percentage of sales of compliant appliances that are attributable to the ENERGY STAR program.

Researchers have analyzed the ENERGY STAR program's effects on sales of several consumer products. Program efforts generally involve a combination of information dissemination and utility or agency rebates. The analyses have been based on State-specific data on percentages of shipments of various appliances that meet ENERGY STAR specifications. The analyses generally have concluded that the market penetration of ENERGY STAR-qualifying appliances is higher in regions or States where ancillary promotional programs have been active.[18, 19,20]

DOE based its estimates of market penetration on the ENERGY STAR program's estimates of historic shipments meeting the ENERGY STAR level for standard-sized residential dishwashers.[21] DOE estimated the percentage of market shares attributable to the existing ENERGY STAR program for each product. DOE then assumed that an enhanced ENERGY STAR program for each product would produce an additional 50 percent above the annual increases in market penetration shown by the existing programs, beginning in 2013. From this forecast DOE calculated the annual percent increases in market share for units represented by the shipments attributed to ENERGY STAR. DOE added those percent increases to the market shares of residential dishwashers that met the target levels in the RIA base case, starting in 2013, to obtain the annual market shares of units meeting the target efficiency level in the voluntary energy efficiency targets case.

DOE estimated that the programs developed in support of the voluntary energy efficiency targets policy would increase market shares of efficient units. Appendix 17-A, Table 17-A.2.2, shows the annual market share increases due to this policy used as inputs to the NIA-RIA model. Section 17.4 presents the resulting efficiency trends for the policy case of voluntary energy efficiency targets for residential dishwashers that meet target efficiency levels.

17.3.6 Early Replacement

The non-regulatory policy of early replacement refers to a program to replace residential appliances before the ends of their useful lives. The purpose of such a policy is to replace old, inefficient units with higher efficiency units. The economic feasibility of early replacement depends on the vintage of the unit being replaced, the installed cost of the new unit, and the energy cost savings. DOE examined several resources to inform its analysis of the policy. One report detailed the Connecticut Appliance Retirement Program (ARP), which was conducted in 2004.[22] Another was a 2006 study of the potentials for electric energy efficiency performed for the State of Vermont.[23]

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 purpose of the ARP was to help Connecticut utility customers 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 operating older appliances. In addition, the program provided consumers with financial incentives to replace inefficient RACs with ENERGY STAR-qualified units. DOE considers the RAC program to most closely resemble the early replacement policy scenario for residential clothes washers, because consumers replaced primary units rather than retiring second units. Nexus/RLW used program data and surveys to estimate the number of RACs retired by ARP participants, the percentage of retired units that were replaced with an ENERGY STAR model, and the number of RACs replaced by non-participants during the program. According to the Nexus/RLW analysis, about 7 percent of all RACs retired during the program were retired through the ARP, and 63 percent of those were replaced with ENERGY STAR models. Thus the program resulted directly in about 4 percent of total eligible RAC consumers deciding on early replacement of inefficient units.

In 2006, GDS Associates, Inc., conducted a study for the State of Vermont of the potential for reducing electricity use and peak demand through energy efficiency and fuel conversion measures. The study took an aggressive, multi-program approach, one aspect of which was early replacement of appliances. GDS considered that under the program residential appliances, including RACs, would be replaced during 4 years (2006–2009). GDS estimated achievable market penetrations assuming that consumers would receive a financial incentive equal to 50 percent of the incremental cost of each program measure. GDS assumed a maximum 80-percent penetration. For early replacement of RACs, GDS estimated a maximum achievable participation of 5 percent of eligible single-family or multi-family homes in the year before the program began (2005).

DOE also reviewed a study it had conducted in the 1990s, under EPACT 1992, which analyzed the effectiveness of Federal programs that supported early retirement of appliances.[24] The study identified policy options for early replacement that included a direct national program;

replacement of Federally owned appliances; and promotion through product manufacturers, consumer incentives, incentives to utilities, and building regulations.[g]

For this RIA analysis, DOE analyzed a program to target installed units having efficiency levels lower than target levels and encourage their early replacement with products that perform at target levels. DOE modeled the effects of the early replacement policy by increasing by 4 percent per year the retirement rate of units that were in the stock in the first year of the analysis period (2013). DOE used the 4-percent rate from the Connecticut study, because it was based on actual program experience. DOE assumed that the early replacement program would continue until it had facilitated the replacement of all eligible residential standard-sized dishwashers in the stock in the year the program began (2013). Shipments of new units in 2013 and beyond were not affected by the program, but remained at base-case efficiency levels. After the stock of inefficient units was replaced completely, the policy would produce no additional impacts.

An early replacement policy would create a fairly immediate jump in shipments of products that meet target efficiency levels relative to the base case, as shown in Figure 17.3.2. High-efficiency units would be brought quickly into the stock, leading to an immediate gain in the market share of efficient units compared to the base case. As opposed to the policy cases discussed previously, however, an early replacement policy results in market shares of efficient units returning to base-case percentages as the eligible market is depleted. In addition, because units removed early from the stock would have been replaced later (at the ends of their useful lives) without the program, as the figure illustrates the number of shipments in later years drops slightly below the base-case shipments forecast.

The shipments shown in Figure 17.3.2 represent units that replace existing units (replacement shipments). Appendix 17-A, Table 17-A.2.2, shows the projected market shares due to the early replacement policy. Section 17.4 presents the resulting efficiency trends for the policy case of early replacement for dishwashers.

[g] The analysis concluded that, although cost-effective opportunities for early replacement exist, a widespread Federal program was not justified economically. Because early retirement means that a unit may be replaced by an appliance less efficient than the eventual replacement would have been, energy savings would be less than anticipated. Early replacement programs also could increase long-term sales volatility by encouraging a temporary increase in production, followed by a lull in demand. Early replacement could be economical in localities subject to high energy costs or environmental constraints; when replacement appliances are much more efficient than existing stock; or when a major technology breakthrough has occurred, creating the need for a ready market.

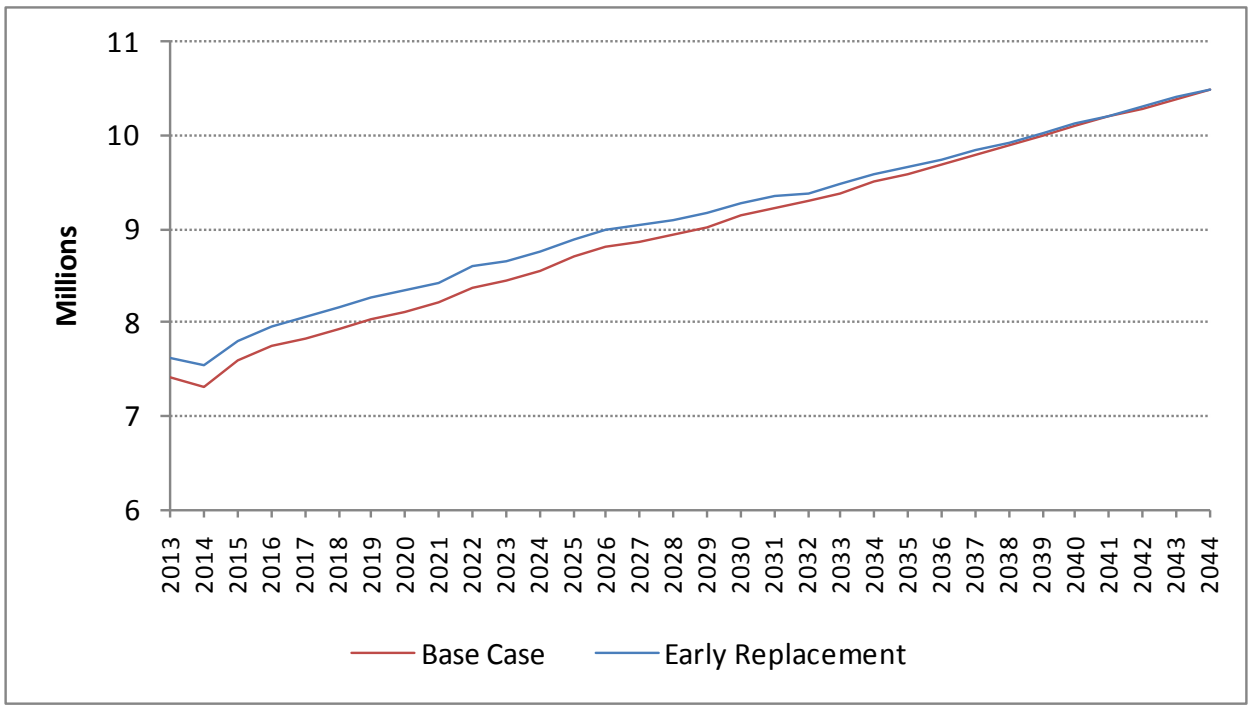

Figure 17.3.2 Estimated Replacement Shipments of Standard-Sized Dishwashers With and Without an Early Replacement Program

17.3.7 Bulk Government Purchases

DOE assumed that a policy requiring bulk government purchases would lead to Federal, State, and local governments purchasing products that meet target efficiency levels. Combining the market demands of multiple public sectors also would provide a market signal to manufacturers and vendors that some of their largest customers seek products that meet an efficiency target at favorable prices. Such a program also could induce "market pull," whereby manufacturers and vendors would achieve economies of scale for high efficiency products.

Most of the previous bulk government purchase (procurement) initiatives at the Federal, State, and municipal levels 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. DOE based its assumptions regarding the effects of a policy calling for bulk government purchases on studies the Federal Energy Management Program (FEMP) performed regarding the savings potential of its procurement specifications for appliances and other products. FEMP, however, does not track purchasing data, because of the complex range of purchasing systems, number of vendors, etc. States, counties, and municipalities have demonstrated increasing interest and activity in "green purchasing." Although many of the programs target office equipment, the growing infrastructure for developing and applying efficient purchasing specifications indicates that bulk government purchase programs are feasible.[25, 26]

DOE assumed that government agencies, such as the Department of Housing and Urban Development, would administer a bulk purchasing program for residential dishwashers. The bulk purchasing policy also could be incorporated at the Federal level into the FEMP program, which has established procurement guidelines. Federal construction requirements include the FEMP guidelines for installing or replacing equipment. The FEMP program currently has procurement specifications in place for residential dishwashers.[27]

DOE also reviewed its own previous research on the potential for market transformation through bulk government purchases. Its major study analyzed several scenarios based on the assumption that 20 percent of Federal equipment purchases in the year 2000 already incorporated energy efficiency requirements based on FEMP guidelines. One scenario in the DOE report showed energy-efficient Federal purchasing ramping up during 10 years from 20 percent to 80 percent of all Federal purchases.[28]

Based on its study described above, DOE estimated that a bulk government purchase program instituted within a 10-year period would result in at least 80 percent of government-purchased residential dishwashers meeting target efficiency levels.

DOE assumed that bulk government purchases would affect a subset of housing units for which government agencies purchased or influenced the purchase of dishwashers. This subset would consist primarily of public housing and housing on military bases. DOE defined this subset based on publicly owned housing identified in the American Housing Survey (AHS) for 2009, which was 1.8 million households, or about 1.4 percent of all U.S. households.[29] (The AHS reports 130.0 million U.S. households.[30]) According to the 2005 Residential Energy Consumption Survey (RECS 2005), 15 percent of publicly owned households had dishwashers.[31] DOE therefore estimated that 0.2 percent of U.S. housing units represent publicly owned households using dishwashers; this constitutes the population to which this policy would apply.

DOE estimated that each year of a bulk government purchase policy (2013) an increasing percent of shipments of government-purchased units beyond the base case would meet target efficiency levels. DOE estimated that within 10 years (by 2022) bulk government purchasing programs would result in 80 percent of the dishwasher market for publicly owned housing meeting target levels. DOE modeled the bulk government purchase program assuming that the market share for each product achieved in 2022 would be maintained throughout the rest of the forecast period. Appendix 17-A, Table 17-A.2.2, shows the annual market share increases due to this policy used as inputs to the NIA-RIA model. Section 17.4 presents the resulting efficiency trends for the policy case of bulk government purchase of residential dishwashers.

17.4 IMPACTS OF NON-REGULATORY ALTERNATIVES

Figure 17.4.1 shows the effects of each non-regulatory policy on market penetration for residential dishwashers. The market share of products that meet the target level in the base case is forecasted to be constant after 2015. Relative to the base case, the policy cases increase the market shares that meet the target level. Note that the proposed standards (not shown in the figures) would result in a 100-percent market penetration of products that meet the target efficiency level.

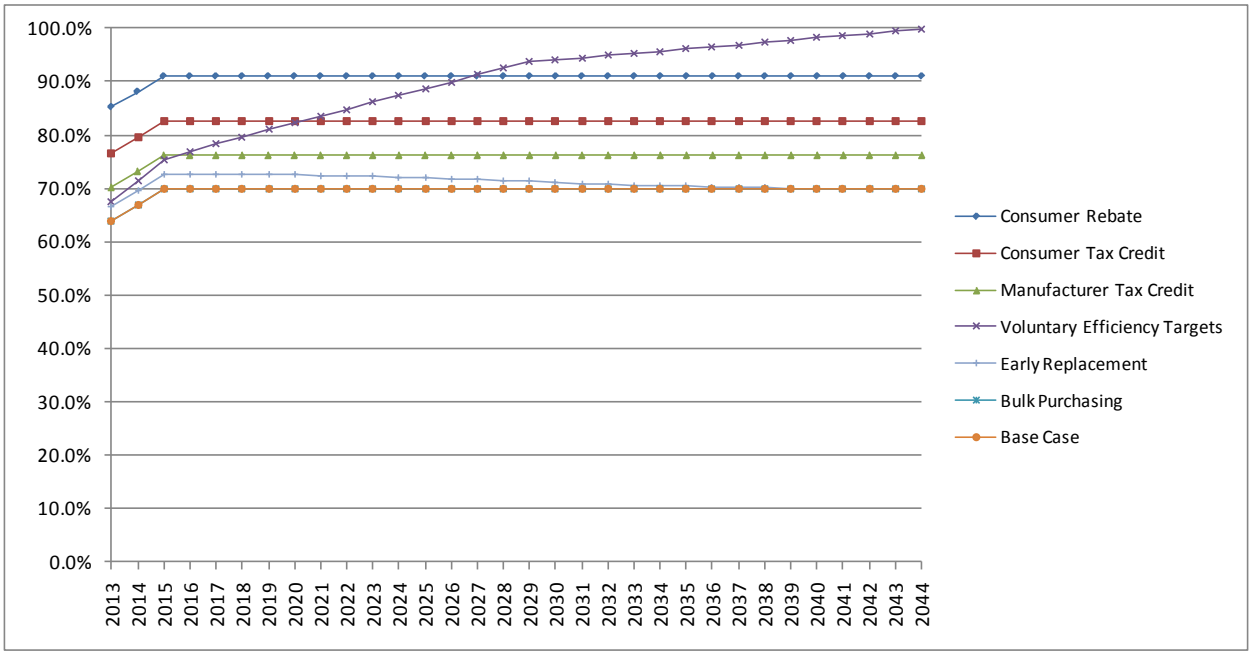

Figure 17.4.1 Market Penetration of Standard-Sized Dishwashers Meeting the Target Level in Policy Cases

Table 17.4.1 shows the national energy savings and net present value (NPV) for six non-regulatory policies analyzed in detail for residential dishwashers. The target level for each policy equals the efficiency level in the corresponding proposed standard.

The case in which no regulatory action is taken with regard to residential dishwashers constitutes the base case (or "No New Regulatory Action" scenarios), in which energy savings and NPV are zero by definition. For comparison, the tables include the impacts of the proposed standards. Energy savings are given in quadrillion British thermal units (quads). The NPVs shown in Table 17.4.1 are based on two discount rates, 7 percent and 3 percent.

The consumer rebates policy provides the most national energy savings of the non-regulatory policies, while the bulk government purchases policy provides the least savings.

Table 17.4.1 Impacts of Non-Regulatory Alternatives for Residential Dishwashers, Standard-Sized (TSL 2)

Policy Alternative	Primary Energy Savings quads	Net Present Value* billion 2010$	
		7% Discount Rate	3% Discount Rate
Consumer Rebates	0.059	0.142	0.566
Consumer Tax Credits	0.035	0.085	0.339
Manufacturer Tax Credits	0.018	0.043	0.170
Voluntary Energy Efficiency Targets	0.053	0.159	0.614
Early Replacement	0.005	0.008	0.032
Bulk Government Purchases	0.001	0.001	0.007
Proposed Standards	0.085	0.201	0.805

* For products shipped in 2013─ 2047

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