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PUBLIC INTEREST COMMENT

ENERGY CONSERVATION STANDARDS FOR RESIDENTIAL DISHWASHERS

ROBERT J. MICHAELS

Professor of Economics, California State University, Fullerton

Rule Title: Energy Conservation Program: Energy Conservation Standards for Residential Dishwashers
Agency: Department of Energy (DOE)
Proposed: December 19, 2014
Comment Period Closes: February 17, 2015
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I. INTRODUCTION

A. The Proposed Rule

On December 19, 2014, the US Department of Energy (DOE) issued a Notice of Proposed Rulemaking (NOPR) on Energy Conservation Standards for Residential Dishwashers.[1] The proposed rule has been authorized under Title III, Part B, of the Energy Policy and Conservation Act of 1975 (EPCA), which authorized the "Energy Conservation Program for Consumer Products Other Than Automobiles."[2] These products include residential dishwashers. Any new or amended standard issued under the act must be designed to "achieve the maximum improvement in energy efficiency that is technologically feasible and economically justified" and must result in a "significant conservation" of energy.[3] The NOPR details energy conservation standards for dishwashers that will become effective in 2019. It also summarizes studies by the DOE and others that purportedly show that the NOPR satisfies EPCA's "maximum improvement" and "significant conservation" criteria. Current dishwasher standards were established in the DOE's 2012 direct final rule, based on submittals by manufacturers, energy and environmental groups, and consumer groups and effective for products

1. 79 Fed. Reg. 76,142, December 19, 2014, hereinafter cited as NOPR.
2. Public Law 94-163, codified in 42 U.S.C. 6291–6309.
3. 42 U.S.C. 6295(o)(2)(A) – (B). "Significant" is not defined in EPCA but has been defined by the appellate courts as not "genuinely trivial," a definition that the DOE claims is satisfied by the proposed rule. See NOPR, 76,144.

For more information, contact:
Robin Bowen, 703-993-8582 (o), 702-801-1344 (m), rbowen@mercatus.gmu.edu
Mercatus Center at George Mason University
3434 Washington Blvd., 4th Floor, Arlington, Virginia 22201

manufactured on or after May 30, 2013.[4] EPCA requires that, within 6 years of issuing a final rule, the DOE shall publish either (1) a notice of determination that amended standards are not needed or (2) a NOPR that includes a new proposed standard.

B. Purpose of this Comment

The Regulatory Studies Program of the Mercatus Center at George Mason University is dedicated to advancing knowledge about the effects of regulation on society. As part of its mission, the program conducts careful and independent analyses that employ contemporary economic scholarship to assess rulemaking proposals and their effects on the economic opportunities and the social well-being available to all members of American society.

This comment addresses the efficiency and efficacy of this proposed rule from an economic point of view. Specifically, it examines how the proposed rule may be improved by more closely examining the societal goals the rule intends to achieve and whether this proposed regulation will successfully achieve those goals. In many instances, regulations can be substantially improved by choosing more effective regulatory options or more carefully assessing the actual societal problem.

C. Summary of Comment

The NOPR provides, at best, a questionable rationale for the proposed rule. This comment concentrates on three aspects of the proposal:

1. *Treatment of so-called "market barriers" to energy and economic efficiency*. The NOPR's implied estimate of consumers' abilities to make rational decisions is significantly at variance with market reality. Markets for efficiency (in part through other DOE policies) have developed to a level at which we must rethink the presumption held by many economists: that market barriers still make governmental decisions more likely than private decisions to produce efficient outcomes.[5]

2. *Uncertainty about benefits and costs*. Uncertainty about magnitude of both benefits and costs is pervasive in the DOE's analysis of the proposed rule. These uncertainties mean that small errors can change the benefit-cost balance. Some of these errors are remediable though further research, but others are inherent in the research methodology used by the NOPR's authors.

3. *Overestimates of benefits*. The calculations exhibited in the NOPR are in important cases misleading, and important details are omitted or treated inadequately. In its analysis of the possible benefits of reduced US emissions under the rule, the NOPR arrives at estimates that are likely to be overestimates. Its treatment of benefits from the proposed rule to US residents being valued as benefits to the rest of the world is in violation of guidance from the Office of Budget and Management (OMB).

Further, the NOPR at numerous other junctures appears to depart from established methods of economic and policy analysis. Its treatment of the market responses and its consequent estimates

4. 77 Fed. Reg. 31918, May 30, 2012.
5. For some examples and more detail, see Ted Gayer and W. Kip Viscusi, "Overriding Consumer Preferences with Energy Regulations," *Journal of Regulatory Economics* 43 (2013): 248–64.

of the profitability of appliance producers is highly ad hoc. Limits of time and space do not allow a full analysis of these and other difficulties here, but should not be ignored.[6]

II. CONSUMER RATIONALITY AND THE NOPR

A. Market Barriers

The proposed rule attempts to justify mandatory efficiency standards by purporting to show that consumers have important problems in obtaining relevant information (e.g., power consumption by different appliance models) and in considering that information in order to arrive at rational decisions. If so, some believe that allowing consumers to choose efficiency levels can leave them worse off than if an authority with better information and computational abilities had made the choice for them. A mandatory efficiency standard that eliminates some choices at the outset might reduce this "market barrier" to rational choice. Broadly, we find that market barriers to such decisions are quite low for dishwashers; that behavior of consumers and producers—and the DOE—have all combined to lower them; and that in important ways the proposed rule would reduce the ability of markets to respond to change. It is important to note that our conclusions about dishwashers cannot be extended to other appliances without further research.

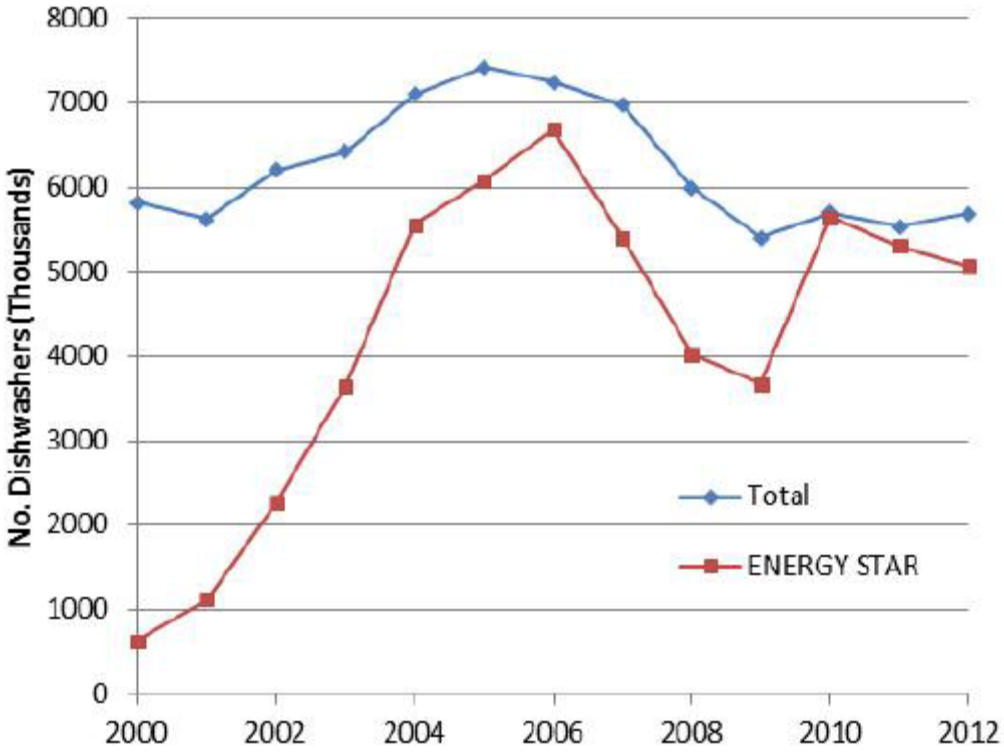
The proposed rule addresses the informational barrier by removing consumer choices that do not meet the DOE's standard. Implicitly it says that those who preferred dishwashers out of compliance with the standards would invariably make incorrect decisions and that there is no reason to allow them to make inferior choices. Here, however, we can show that consumers have accurate information about energy consumption at their disposal and are using it. We can further show that seeming violations of rationality may be no more than indications of heterogeneity among buyers, for some of whom the best choice may fall short of the standards.

B. Is the Lack of Information a Relevant Barrier?

The market failure in our case does not take the form of a desirable commodity that can be sold for more than its cost but for some reason does not exist. Dishwashers that meet the standards of the NOPR are currently available and were available at the time the TSD was produced. The bulk of dishwashers are compliant with existing regulations but not the proposed ones. Standard dishwashers meeting or exceeding the NOPR standard constituted 3.6 percent of shipments in 2013.[7] As of this writing (February 12, 2015), the DOE had certified 684 models as compliant with existing standards, 643 of which were "standard" (as opposed to compact, discussed in more detail below).[8] Of the standard models, 29 met the NOPR's proposed power use standards, 199 were compliant for

6. For additional details, see the DOE filing by James Broughel, "Energy Conservation Standards for Standby Mode and Off Mode for Microwave Ovens; Petition for Reconsideration," Public Interest Comment, Mercatus Center at George Mason University, September 16, 2013, and "Energy Conservation Standards for Residential Refrigerators," Regulatory Report Card, Mercatus Center at George Mason University, 2010.
7. NOPR at 76,160. Data on compliance with the new water standard were not presented. A histogram of dishwasher energy use appears in TSD, 3-36.
8. The DOE's Compliance Certification Database (accessed January 31, 2015) lists 684 models, 41 compact and 643 regular. See http://www.regulations.doe.gov/certification-data/CCMS-414316810 25.html.

FIGURE 1: ANNUAL SHIPMENTS OF RESIDENTIAL DISHWASHERS



Source: TSD at 3-16.

water use, and 20 were compliant for both. Limited data do not allow us to determine the premia on their prices. Since extremely efficient models are relatively new (and probably more costly), it is likely that evidence on their growth is sparse and difficult to generalize. The fact that matters is that they are already available and were not forced into existence by a regulation.

The historical development of dishwasher efficiency, however, leads to questions about the need for and benefits of standards such as those proposed in the NOPR. Initiated in 1992, the EPA's voluntary "Energy Star" certification programs set performance standards whose thresholds have risen over time (but are still below those proposed in the NOPR). The EPA currently lists 509 models deemed to meet Energy Star standards. Of them, 20 satisfy the NOPR's energy use criteria, 120 meet those for water use, and 10 are compliant with both.[9]

The EPA has claimed that Energy Star's growth over the past ten years has brought about a tripling of energy cost savings and carbon emissions reductions by participating products.[10] Figure 1 shows the growth of Energy Star unit sales and percentages of sales from 2000 through 2012.[11]

9. As of January 31, 2015, there were 509 records for regular models of Energy Star Certified Residential Dishwashers. See http://www.energystar.gov/productfinder/product/certified-residential-dishwashers.
10. EPA, Office of Atmospheric Programs, Climate Protection Partnerships 2013 Annual Report, 4-8.
11. See TSD, 3-13. Some of the gap in earlier years is occupied by compliant units that were in existence but not certified. In 2013 90 percent of total sales were Energy Star compliant. See EPA, "Energy Star Unit Shipment and Market Penetration Report," 2013 Summary, 5.

The figure and supporting data suggest that information-based market failure is now a minor issue. A relatively small percentage of buyers continue to choose uncertified dishwashers over Energy Star models, quite possibly for other, non-efficiency-related reasons that may still be regarded as equally rational (e.g., price, aesthetics, odd features of value to few consumers). The apparent trend is one of an increasing proportion of Energy Star buyers who benefit from the information implicit in the program.

We have also seen an increasing awareness of Energy Star as a guide to cost-effective purchases. The EPA found that between 2001 and 2013 individual buyers who recognized the Energy Star label before it was shown ("unaided consumers") rose from under 30 percent to over 70 percent of the public.[12] The DOE's case is largely a misapplication of "behavioral economics" to a situation where its relevance is doubtful, since its standard is in part founded upon assumptions that consumers are uninformed and incapable of making choices that are in their own best interests. Sources such as advertising, informed salespeople, and Energy Star labels provide consumers with sufficient information about the economically efficient decisions that many of them are in fact making.

III. COSTS, BENEFITS, AND PRODUCT ATTRIBUTES

A. What Do Consumers Value?

If all persons have identical preferences, are in identical situations, and have no other goals than to maximize net benefits from their dishwashers (present outlay less discounted future costs), one design of dishwasher would suffice and competition would weed out inefficient designs. It should come as no surprise that the universe of dishwashers is far more heterogeneous than that, as are the attributes of their buyers and the choices they make about dishwasher use. Rather than acknowledge such differences in its rulemaking (which might lead to different optimal choices), the DOE chose to split all dishwashers into "standard" and "compact" designs based on their capacities.[13] Without stating the product characteristics that provide customers with "utility," the DOE likewise chose to assert that product modifications (which certain consumers clearly value at more than their costs) do not affect purchasers' well-being.[14] The DOE should provide additional information to justify its classification scheme, which appears overly broad.

The DOE acknowledges that its determination of benefits and costs will depend on certain data regarding users and use patterns. A dishwasher that is expected to have a short service life or be used infrequently is less likely to be the best choice if its design includes costly efficiency improvements. Higher costs mean that some users will choose not to purchase compliant models and go on using more energy than if a range of models were available. The DOE assumed, however, that "a consumer's decision to replace or repair their dishwasher was not impacted by an increase in

12. EPA, "Climate Protection Partnerships 2013," 10.
13. "Based on a survey of products available on the market, the DOE determined that compact residential dishwashers provide unique utility by means of their countertop or drawer configurations." NOPR at 76,149. The NOPR and TSD contain no additional data regarding the choice process or how they determined the uniqueness of utility.
14. NOPR at 76,150. "Based on data from internal testing and the availability of products on the market, the DOE has determined that the standards proposed in this NOPR would not reduce the utility or performance of the products under consideration in this rulemaking." It is not clear why one should expect that a consumer who was given the findings of the DOE's tests would draw the same conclusions as the DOE did.

efficiency." It also assumed that "replacement frequency was unaffected by the increased installed cost, the repair cost and energy cost savings" of newer models (NOPR at 76,159). The DOE does not reconcile these assumptions with its estimates of demand elasticities, which affect both replacement of older units and increases in energy-intensive hand-washing.

B. Lifespans and Savings

The DOE acknowledges that many possible statistical distributions have been used to analyze appliance lifespans. Nevertheless, it chose to analyze only one assumption and apply it to one of several data sources, its Residential Energy Consumption Survey (RECS, TSD, 8-21–8-23). The narrow benefit-cost margins it found (see below) would surely suggest analysis of other data sets and alternative probability distributions that might provide additional insight into the robustness of the DOE's conclusions. Further, it adjusted the RECS data before estimating the Weibull distribution (TSD at 8-22) using sources and methods it did not make available to readers of the TSD.[15] Appendix 8-D of the TSD estimates parameters of the lifespan distribution, again with no way the reader can use to link the data to the conclusions. For unexplained reasons, the DOE also chose to use a single distribution for lifetimes of all dishwashers rather than separate calculations for the standard and compact models whose differences both the NOPR and TSD acknowledged. The DOE disregarded alternative sources of lifespan data that could have resulted in important changes in its benefit-cost calculations. One commentator in this docket referenced external estimates that put average lifespans at between 9 and 12 years, both significantly lower than those chosen by the DOE.[16]

The DOE's research on lifespans itself yields conclusions that can call into question its benefit-cost calculations. The Weibull distribution it chose has a positive skew, with its mean larger than its median. Substituting in the parameter values from TSD Appendix 8-D-2 yields a mean (average) lifespan of 15.4 years. The median of that distribution can be calculated as 14.74 years—in other words, half of all new dishwashers reach the end of their lives before 14.74 years have elapsed.[17] The DOE finds a payback period of 9.0 years for standard models that meet its preferred TSL 2 specifications.[18] Using the Weibull cumulative distribution function we can calculate that 19.2 percent of dishwashers will be worthless or give their owners net losses by the end of the payback period. For those that last longer we require a present value for the benefits, which might be modeled in several ways and whose details cannot be reconstructed from the NOPR. The DOE admits that the results show that 39 percent of those who purchase a TSL 2 dishwasher will incur net costs (NOPR at 76,170).

15. "Data from the US Census's American Housing Survey (AHS), which surveys all housing including vacant and second homes, enabled the DOE to adjust the RECS data to reflect some appliance use outside of primary residences. By combining the results of both surveys with the known history of appliance shipments (collected from Appliance magazine or directly from manufacturer trade associations), the DOE estimated the percentage of appliances of a given age still in operation. This survival function, which the DOE assumed has the form of a cumulative Weibull distribution, provides an average and a median appliance lifetime. The DOE calculated the average lifetime for both product classes at 15.4 years" (TSD at 8-21).
16. DOE, Direct Final Rule, "Energy Conservation Standards for Residential Dishwashers," Docket EERE-2011-BT-STD-0060, Comment by Sofia Miller, September 14, 2012, 5.
17. All numerical computations used standard components of Mathematica 9.
18. TSL 2 refers to Trial Standard Level 2, one of three examined by the DOE and the one that it has recommended (NOPR at 76,170).

C. Sensitivity to Assumptions

The distribution of benefits generated by the proposed standards is particularly interesting because of its smallness. Average life cycle savings, relative to the baseline for purchasers of TSL 2 dishwashers, are no more than $21 and, for many buyers, negative. Far from its three-year rebuttable presumption of savings (i.e., an improvement should pay for itself in three years of ownership), the DOE acknowledges that an analysis for dishwashers requires considerable other research for justification (NOPR at 76,172). The benefit-cost balance here is narrow. Dishwashers of efficiency level 2 will have installed costs increasing from $495 to $582, but lifecycle costs will fall from $987 to $970 (NOPR at 76,170).

As noted above, payback periods are long, particularly relative to the lifespans of dishwashers, and a substantial percentage of them will expire at ages too young to return any savings to their owners. Some figures carry burdens of arbitrariness that can wash out any seeming savings and on which the DOE might have performed additional research to reduce the zone of uncertainty. Particularly interesting is the sensitivity of benefit-cost computations to the number of cycles (i.e., the total number of dishwashing events) per year. In various years between 2001 and 2009, the DOE has assumed a range of annual cycles that includes 322, 264, 215, and 171. The survey on which the DOE currently relies was taken in 2001, in the midst of a long period of shrinking household sizes and declines in home food preparation (TSD at 3-3 and 7-2). The DOE attempts simulation analysis, but it is not clear how helpful doing so can be in light of increasingly old data and underlying heterogeneity of users.

D. Disproportionate Impact on Seniors and Low-Income Households

As required, the DOE performed analyses particularized to potential disparate impacts on certain consumer subgroups, here assumed to be low-income households and seniors. For senior-only households the payback period for a TSL 2 dishwasher is 11.6 years; 64 percent of them experience net costs and average life cycle savings are $1 (TSD at 11-2 and 11-3). For low-income households the payback period is 9 years, but 59 percent of those households experience net costs relative to the baseline. Low-income households who get net benefits enjoy discounted average life cycle savings of $15 (TSD at 11-4 and 11-5). The DOE summarizes the outcome by stating that "average [life-cycle cost] savings for low-income households and senior-only households at the considered efficiency levels are not substantially different from the average for all households" (NOPR at 76,171; substantiality was not defined). Stated in another way, a large fraction of the population, both the rich and the poor, receives extremely small benefits, and another large fraction takes losses that result from imposition of the standard.

IV. NET BENEFITS

NOPR Table 1.3 is entitled "Summary of National Economic Benefits and Costs" of the proposed rule. Rather than "national," however, the TSD makes clear that these benefits are estimates of world totals (TSD chapter 14 and appendix 14A). OMB Circular A-4 requires analysis from a domestic perspective. It allows discussion of international benefits and costs but notes that "these effects

should be reported separately."[19] Separating domestic from global effects requires determining the percentage of benefits to allocate to the United States.

There are additional difficulties in the discounting process. The NOPR (at 76,162) notes the OMB's rule that NPV be evaluated at discount rates of 3 and 7 percent, but there are no calculations of the benefits relying on the social cost of carbon (SCC) corresponding to 7 percent.[20] The lowest monetized value for carbon is $12.0 per ton, corresponding to a discount rate of 5 percent. There is no SCC calculation for 7 percent, but it is virtually certain that its present value would be well below the 5 percent present value and quite possibly close to zero. This observation may call into question numerous other rulemakings using SCC, which also cannot possibly have incorporated the 7 percent calculations that the OMB has long specified.

Evaluation of the proposed rule becomes more problematic after a look at NOPR Table 1.3 (at 76,144). Its bottom rows are called "Total Net Benefits Including Emissions Reduction Monetized Value." The table says that they were calculated at discount rates of 3 and 7 percent and that the NOPR contains no references to the lack of SCC calculations at 7 percent. The 3 percent benefits of $11.4 billion include $9.2 billion in operating cost savings, $2.0 billion in monetized carbon abatement, and $0.2 billion that is oddly unlabeled. Subtraction of $7.1 billion in costs yields a net of $4.3 billion. Absent SCC data the DOE cannot possibly calculate a net present value discounted at 7 percent. Nevertheless, the table shows a figure for it. At 7 percent there are $4.1 billion in operating cost savings, and the table contains no corresponding SCC figure. Despite that absence the table shows $6.2 billion of discounted net benefits at 7 percent, inexplicably greater than the $4.3 billion estimated for 3 percent. Any SCC calculated for a 7 percent discount factor would be considerably lower than its $2.0 billion counterpart at 3 percent. We conclude that the difference between them requires further explanation from the DOE. Further, the NOPR's use of consumer credit interest rates in its calculations suggests that a 7 percent discount rate would be more appropriate for a benefit-cost summary than a 3 percent rate.[21]

19. US Office of Management and Budget, Circular A-4 (September 2003), 15. The Interagency Working Group (IWG) that issues and revises estimates of SCC concluded on the basis of certain economic arguments that "a global measure of the benefits of reducing US emissions is preferable." Such a preference, however, has yet to be expressed as federal policy. See Interagency Working Group on Social Cost of Carbon, "Technical Support Document: Technical Update of the Social Cost of Carbon for Regulatory Impact Analysis under Executive Order 12866," May 2013, 15.

20. The domestic and global tables are at TSD, 14-6 and 14-7. TSD summary table 1-2-1 also contains no calculation for CO2 at a 7 percent discount rate.

21. There are two other loose ends regarding the table. As noted in the text, the IWG did not estimate a carbon reduction value for a 7 percent discount factor. The NOPR table does, however, contain a modest ($0.1 billion) entry for the monetized benefits of NOx reduction with a 7 percent discount factor, but inexplicably does not do so for a 3 percent factor (where its value would be higher). Finally, at four locations the NOPR and TSD state, "The SCC time series used by the DOE incorporate an escalation factor" (TSD 1-3 and 1-6 and NOPR 76,145 and 76,146). This operation is not mentioned anywhere else. Possibly it means that SCC data increase over time, which hardly bears repeating. If instead "escalation" refers to some other adjustment, there are no relevant data in the NOPR or the TSD.

V. CONCLUSIONS

These comments do not address all economically relevant material in the NOPR, but taken as a group they suggest numerous difficulties that should be addressed before issuance of a final rule. They can be summarized:

- The NOPR's treatment of "market barriers" is inconsistent with evidence that consumers are informed about efficiency issues and that this information allows them to make economically efficient choices of dishwashers.
- The proposed rule may yield economic inefficiencies because it treats dissimilar consumers as similar. Manufacturers respond to the heterogeneity of consumers by offering a wide variety of products. Forcing all dishwashers to include energy-saving technology can generate an excess of costs over benefits (e.g., for buyers who only use their dishwashers a few times a month). Energy efficiency is not the same as economic efficiency, which acknowledges the existence of costs beyond those of energy.
- Important aspects of the DOE's benefit-cost analysis are highly sensitive to seemingly minor differences in assumptions about consumer use patterns and dishwasher lifespans. Calculations in the NOPR show that these differences are substantial and that large percentages of dishwasher purchasers (including lower-income and elderly ones) can expect to receive no net benefits from the proposed rule.
- Estimates of SCC are best described as experimental and tentative. In many of the NOPR's calculations they are the difference between positive and negative benefit-cost figures, but there is no reason to assume that SCC is a valid guide for policy decisions. Additionally, the NOPR's calculations overstate the net benefits for Americans by treating worldwide benefits as captured only by Americans.

The NOPR's analysis of dishwashers is superficially detailed and modern in its research methods. In the areas discussed above and numerous others, the research embodied in it appears to be inadequate as a foundation for a rule that will apply to every dishwasher sold in the United States after 2019. Whatever errors and uncertainties are in the document, it is ultimately just an assertion that the DOE is better than consumers at choosing the energy efficiency and other attributes of dishwashers. There may be efficiency losses from maintaining the old standard, but those are inefficiencies that markets already appear to be correcting. Upon closer examination, the NOPR presents, at best, a very weak case for a new standard and, at worst, will impose costs on the majority of future purchasers of dishwashers in return for few, if any, discernible benefits.